



**Macedon
Ranges**
Shire Council

Draft Kyneton Movement Network Study 2018

Engineering and Projects Department

Assets and Operations Directorate



Acronyms and Abbreviations

Council/MRSC	Macedon Ranges Shire Council
PTV	Public Transport Victoria
CAIP	Community Access and Inclusion Plan
vph	Vehicles Per Hour
CAPEX	Capital Expenditure
DDA	Disability Discrimination Act
BSMR	Bike Safe Macedon Ranges
PBS	Performance-Based Standards
LATM	Local Area Traffic Management
GHG	Greenhouse Gas
KBG	Kyneton Botanical Gardens
SSC	State Suburbs
UCL	Urban Centres and Localities

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1. Introduction

1.1 About the Plan

Kyneton has been identified as an important township within the Loddon Mallee South region given its strategic location, current service provision and access to both Melbourne and Bendigo.

Plan Melbourne, the Victorian Government's long term planning strategy, identifies Kyneton as a Regional Town, with the capacity to provide more housing and employment, generating development whilst not impacting on the surrounding environmental qualities and local town character.

The Macedon Ranges Settlement Strategy and Kyneton Structure Plan aims to manage the growth of Kyneton Township to a population of generally between 6,000 to 10,000 people.

The 2018 draft Kyneton Movement Network Study (KMNS) is a long term plan that will help guide the planning and provision of Kyneton's transport system now and into the future to respond to this growth and change. The plan sets a vision for the transport movement network which will aim to provide a sustainable, integrated and responsive transport network to service both existing and future community needs of the township.

The 2018 Kyneton Movement Network Plan provides guidance on the provision and upgrade of existing movement network infrastructure required to support both the existing and potential future communities of Kyneton. This study will be used to inform future movement network infrastructure planning and provide direction to guide transport infrastructure and service planning provided by Council and other levels of government. The study also identifies future transport infrastructure projects to guide capital works and resourcing priorities.

1.2 Building on our previous study

The draft Kyneton Movement Network Study builds on and supersedes the 2010 Kyneton Movement Network Infrastructure Study. Since 2010, when the first KMNS was adopted by Council there have been a number of changes which have influenced the planning of the Kyneton transport network both locally and at a state level.

These include:

- **Loddon Mallee Regional Growth Plan (2014)** - The LMRGP identifies Kyneton as a district hub to support smaller settlements. Kyneton is identified as having capacity for growth and will act as a sub-regional

employment centre. The town is identified as having significant - infrastructure being located on the Calder Highway, Bendigo rail corridor with ease of access to both Melbourne and Bendigo;

- **Ministerial approval of Kyneton Structure Plan (2016)** - amendment to the Macedon Ranges Planning Scheme, to include a framework plan for Kyneton which identifies a proposed settlement expansion area to the south of the township;
- **Plan Melbourne Refresh (2017)** – identifies Kyneton as a regional centre with capacity to accommodate residential and employment growth; and
- **Regional Rail Network Revival – Bendigo & Echuca Rail Upgrade (2018)** – State government investment in upgrade works to the Bendigo and Echuca Line to enable faster services to Echuca and more frequent services between Epsom, Eaglehawk and Bendigo. This includes station upgrades to Gisborne, Kyneton, Macedon and Woodend to respond to anticipated greater usage of passengers on the upgraded line.

1.3 Vision

The vision of the draft Kyneton Movement Network Study is to plan for a transport network which is integrated, safe, responsive, inclusive and sustainable. This will be achieved by:

- Integrating land use and transport planning;
- Improving connectivity in and between new and established neighbourhoods;
- Improving and extending pedestrian and cycle networks to key destinations and improving the Campaspe River trail network;
- Improving access to and frequency of public transport network (bus and rail) which connects more people to public transport services during peak and off peak times;
- Developing stronger commuter connections to and from Kyneton to major services and employment centres;
- Facilitating tourism opportunities through greater connection with rail and the towns cycling network; and
- Making the road network safer by reducing congestion, improving intersections and addressing missing links in both road, footpath and public transport services.

2. Background

2.1 Need for the study

The resilience of township communities relies heavily on the ability to access local jobs, education, services and surrounding regions. Residents need to live in connected communities which are well planned, sustainable and liveable. For this to occur communities need integrated and reliable transport networks which connect communities to where they need to go.

Council is striving to ensure that both the existing and future Kyneton community is planned as an integrated and connected community. It is imperative that the social and economic impacts of isolation and disadvantage created by disconnection is avoided.

As the community of Kyneton grows so too does the need to plan for a safe and efficient transport network that responds to community and business needs. Population and employment growth will have an impact on the demand for transport services – increasing needs will have an impact on the existing network. This presents both challenges and opportunities to upgrade the existing network and respond to the community and business needs.

The study is needed to address many of the following transport planning challenges:

- Congestion on the road network;
- Linkages and connections – the need to provide an integrated road, pedestrian and cycle network;
- Integrating future settlement area with the existing township;
- Maximising local access and patronage of the Kyneton Railway station through advocating for better town bus connection to services and upgrades to station infrastructure;
- Safety of the network; and
- Health and wellbeing for all residents through the implementation of a movement network which benefits all residents, no matter where they live in Kyneton.

2.2 Study tasks

Preparation of the draft Kyneton Movement Network Study involved the following transport analysis and assessment tasks:

1. Review of the previous movement network study requirements to determine areas within the study area that require improvements to the transport network, addressing both current and anticipated impacts on the transport network in Kyneton.
2. Model the potential impact of population growth by 2036 and the potential challenges and opportunities on the current transport network, Identify potential transport network upgrades to address future changed conditions and bring benefits to both the existing and future Kyneton community.
3. Understand and develop the existing and potential movement networks which integrates both established and new settlements, through a connected network of pedestrian cycle, road and public transport systems.
4. Review the existing road hierarchy in the Kyneton Township having regard to both established and proposed future settlement areas, categorising the potential road hierarchy and its ability to accommodate both vehicle, public transport, cycle and bicycle movements. For example:
 - a. Arterial Roads – through traffic movement across town; primary connection between major use areas; primary freight routes; regional-local cycle movements, access to public transport, pedestrian and bus movements;
 - b. Collector Streets – local area trip end traffic; direct property access; local bus movements, pedestrian movements; local cycle movements; and
 - c. Local Streets – direct property access; pedestrian movement; local cycle movement.
5. Understand the existing network deficiencies and identify connectivity options and/or maintenance works.
6. Assess the connectivity options and infrastructure requirements in terms of economic, legal and environmental aspects and ultimately preparing a prioritised list of potential road infrastructure recommendations.
7. Understand current and future public transport service network expectations of government and private service providers and implications for future transport network planning in Kyneton.

8. Provide guidance and justification for the provision and upgrade of existing movement network infrastructure to support the existing and proposed communities of Kyneton.
9. Integrate relevant external stakeholder planning studies and requirements.
10. Consultation with residents, businesses, stakeholders and servicing agencies.

DRAFT

2.4 Project approach

The current document whilst loosely structured on the previous 2010 study content has been widened to respond to key movement network impacts which will influence the planning of Kyneton over the next 20 years.

Council has approached the study by understanding factors which will influence the direction of planning the movement network. This includes a better appreciation of:

- Latest population and development data projections and consideration of movement network needs and impacts of potential settlements (namely Kyneton South);
- Comparison and linkage between the existing and potential future movement networks;
- Integration of the network – focussing on all types of movement – not just road/vehicle based;
- Analysis of potential issues and opportunities generated by the extension and upgrade of the movement network needed to respond to population and employment growth changes;
- Community, stakeholder and agency feedback; and
- Current developments with transport infrastructure works which will impact on the future movement network (namely the Kyneton Development Plan area).

The main objective of conducting a movement network study is to gain an understanding of the interim and future infrastructure requirements that will need to be planned for / in place to respond to the changing demands of both existing and future communities of Kyneton.

Key matters addressed by the study in adopting this approach are the identification of:

- New and upgraded road infrastructure with shared capacity for pedestrians and cycle paths;
- New connections for pedestrians and cyclists – on and off road;
- Public Transport improvements based on future capabilities (frequency of service, infrastructure, linking town bus connections with rail, station upgrades etc); and
- Increased parking provisions for forecast parking needs.

2.5 Population change

The Settlement Hierarchy vision introduced into the Macedon Ranges Planning Scheme (Clause 21.04) forecasts Kyneton evolving from a District town (with a typical population of 2,000-6,000) to a Large District Town (with a typical population of 6,000-10,000).

The latest 2016 census data from the Australian Bureau of Statistics (SSC) states that the Kyneton District (Kyneton and surrounds) has a population of 6,951 whereas the Township (UCL) has a population of 4,866.

Most of the growth anticipated for Kyneton will be within the established areas of the town (infill development) and Greenfield locations both within the township area and proposed south in the Kyneton investigation area.

Based on an assessment of the draft Kyneton South Framework Plan and the potential for a range of housing types, a broad assessment indicates that this area may generate around 4000 people.

This population combined with expected infill and development of existing zoned Greenfield locations, and the ABS census data indicates that forecasts for Kyneton township may reach between 6,000-10,000 residents by 2036.

2.6 Policy considerations

2.6.1 Plan Melbourne

Plan Melbourne is the Victorian Government's long-term planning strategy, guiding the way the city and state will grow and change to 2050. Plan Melbourne has identified Kyneton as a Regional Town and included it in the following policy direction.

Policy 7.1.2 Support planning for growing towns in peri-urban areas

“A number of towns in peri-urban areas have capacity for more housing and employment-generating development without impacting on the economic and environmental roles that surrounding non-urban areas serve. Those towns include Warragul–Drouin, Bacchus Marsh, Torquay–Jan Juc, Gisborne and Kyneton. Peri-urban towns can provide an affordable and attractive alternative to metropolitan living. However, strategies need to be developed for the timely delivery of state and local infrastructure to support growth and protect their significant amenity. Most importantly, development in peri-urban areas must also be in keeping with local character, attractiveness and amenity. Growth boundaries should be established for

each town to avoid urban sprawl and protect agricultural land and environmental assets Regional Growth Plan.”

2.6.2 Loddon Mallee South Regional Growth Plan (LMSRGP)

The Loddon Mallee South region encompasses the municipalities of Central Goldfields, Bendigo, Loddon, Macedon Ranges and Mount Alexander.

Specific to Kyneton, the LMSRGP says:

- *Larger centres such as Gisborne, Kyneton, Castlemaine and Maryborough act as district hubs to smaller surrounding settlements and rural areas, both inside and beyond the regional boundaries. These larger centres offer a diversity of retail and community services and recreational and cultural opportunities that complement those on offer in Bendigo and Melbourne; and*
- *Regional centres and towns identified as having capacity for growth in the Loddon Mallee South region are Maryborough, Gisborne, Castlemaine and Kyneton. These centres and towns will be the focus of future population growth and act as sub-regional employment centres.*

2.6.3 Regional Network Development Plan

The Department of Economic Development, Jobs Transport and Resources released the Regional Network Development Plan in May 2016.

The Plan primarily guides the short, medium and long term priorities needed to modernise the network with more track, more train, better facilities and more services, see Section 4.1 for detail on the deliverables expected for Kyneton. (Department of Economic Development, Jobs Transport and Resources, 2016).

2.6.4 Macedon Ranges Localised Planning Statement

The peri-urban areas surrounding metropolitan Melbourne and Victoria's major regional cities and towns comprise distinctive areas and landscapes of outstanding natural beauty and environmental, economic and cultural heritage significance.

The Statement of Planning Policy provides a framework to ensure the outstanding landscapes, layers of settlement history, impressive landforms, and diverse natural environment of the Macedon Ranges are protected and conserved and continue to be of special significance to the people of Victoria. It celebrates the inexorable links between Country and Aboriginal Victorians.

In this statement, the declared area is the municipal district of the Macedon Ranges Shire Council.

The statement aims to support efforts to:

- Recognise the connection and stewardship of the Traditional Owners in relation to land in the declared area;
- Identify and protect significant landscapes and environmental and cultural heritage features within the declared area;
- Enhance conservation of the area's unique habitats, ecosystems and biodiversity;
- Provide greater certainty about the landscape values and rural land to be conserved for current and future generations;
- Guide the sustainable use of natural resources in keeping with the declared area's significant landscapes, environmental and cultural values;
- Reinforce the role and function of settlements in guiding future land use change and development to accommodate housing, employment and services to meet community needs and promote jobs, investment and infrastructure delivery;
- Ensure consideration of the area's significant landscapes in the management of land and the planning and provision of public infrastructure; and
- Reinforce the importance of building community resilience to environmental risks associated with climate change, including the potential increased impact of natural hazards (such as bushfire and flooding).

2.6.5 Macedon Ranges Planning Scheme

The Macedon Ranges Planning Scheme (Clause 21.13-2) identifies the following key strategies to guide future planning for Kyneton. These objectives have been considered in the development of this study:

- Plan for future Greenfield growth to maintain a 15 year residential land supply by investigating areas south of the township, focusing initially on the southeast (east of the railway line and towards the Campaspe River);
- Support infill development within existing residential zoned land;
- Facilitate and reserve land for a new bridge connection south from Edgecombe Street across the Campaspe River to support future residential development to the southeast;
- Maintain and expand existing pedestrian and cycling routes along the Campaspe River;
- Maintain the role of the Town Centre as the retail, commercial and civic core; and
- Support a grid-based layout in new residential subdivisions to echo the Link and Place concept of good urban design.

The Macedon Ranges Planning scheme provides a planning framework to strategically manage the future planning of Kyneton.

One of the key objectives of these documents is to facilitate the sustainable growth of Kyneton to a population of a Large District Town.

To accommodate this growth, an area south of the railway line was identified to accommodate medium to long term growth to enable the provision of adequate land supply and diversity of housing to accommodate the towns changing demographics

2.6.6 Draft Kyneton South Framework Plan – August 2017

A draft Framework Plan for the Kyneton South area was prepared by Council to provide direction on the potential future medium to longer term growth that may occur south of the township. This framework plan aims to ensure that growth is coordinated, planned, and integrated with the existing Kyneton Township. The draft Kyneton South Framework Plan enables Council and other service agencies to consider/ anticipate likely infrastructure and service upgrades that may be required to service this new community within Kyneton.

The draft Framework Plan for Kyneton South (see Figure 2-2) was prepared with extensive community consultation and participation of key servicing agencies including Vic Roads, PTV, and Transport for Victoria and local bicycle network groups. The draft framework plan aims to guide any future medium to longer term growth by:

- Setting out key objectives to be achieved by any future growth;
- Outlining a plan to guide more detailed planning to guide any future growth by looking specifically at land use, open space, heritage, character, public transport, and street and cycle networks; and

- Identifying major infrastructure required to support any future growth of the area in the medium to longer term.

Key directions of the draft Kyneton South Framework Plan include:

- That any growth in the Framework Plan can only occur if Edgecombe Street Bridge is delivered;
- Identifying alternate access roads around Kyneton to alleviate existing traffic issues;
- Providing green links for walking and cycling along Campaspe River and Ritchie's Creek and throughout the Framework Plan area identifying sensitive interface areas;
- Identifying potential retail/commercial and residential uses around the train station;
- Emphasising the importance an integrated and permeable transport network to encourage walking, cycling and maximise safety for all users; and
- Identifying land for future community uses.

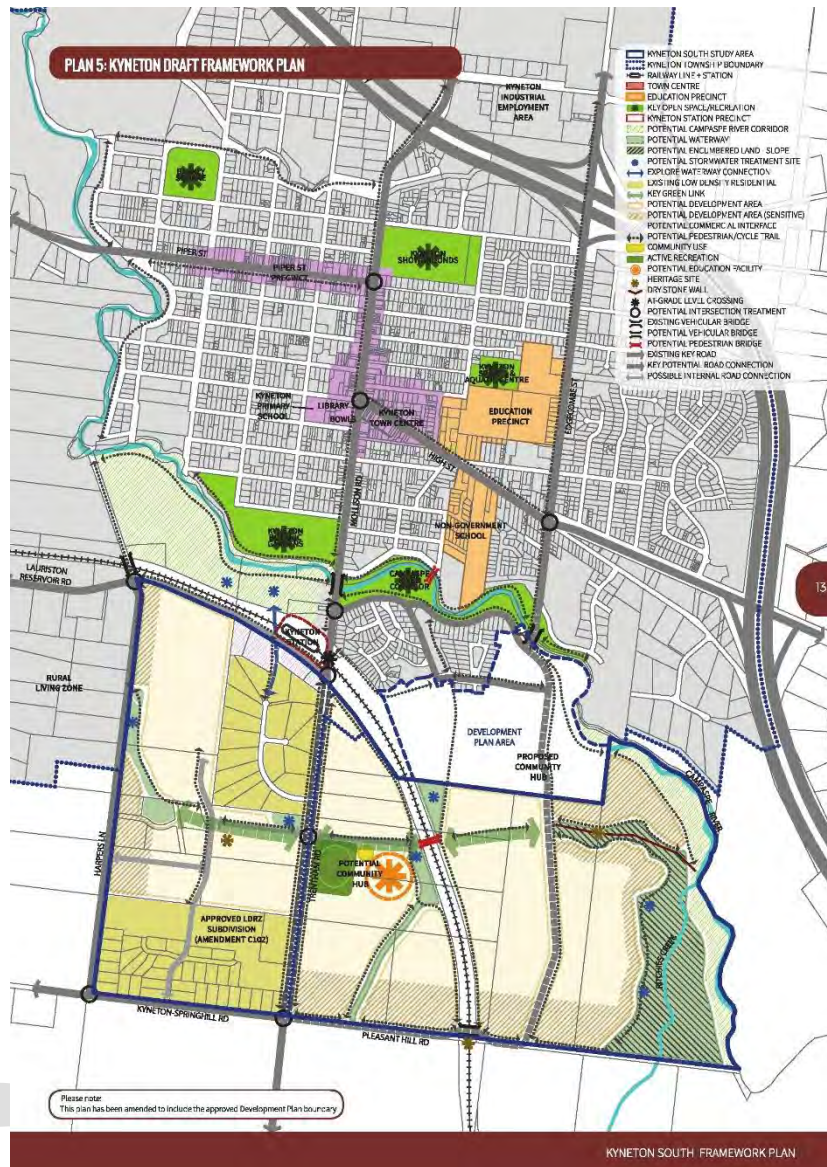


Figure 2-2: Kyneton Draft Framework Plan

Recognising the need for infrastructure and land use planning to be aligned, the draft Kyneton Movement Network Study has been developed alongside this strategic work to help develop an understanding of the future transport network needs of this area and impacts on the existing movement network. The draft Framework Infrastructure Plan provides high level guidance on potential movement network infrastructure deemed necessary to support any future medium to longer term growth in this area of Kyneton. This study supports the direction of the framework plan.

It should be noted that the draft Kyneton South framework plan is yet to be adopted by Council, pending the outcomes of the Localised Planning Statement.

2.6.7 The Loddon Campaspe Integrated Transport Strategy

In 2013 six municipalities including Macedon Ranges Shire Council, agreed to form a regional working group due to the absence of a transportation plan or strategy for the region.

Macedon Ranges Shire Council are supportive of the Loddon Campaspe Integrated Transport Strategy and the six key goals derived from the strategy as listed below:

Goal 1: Protect and enhance a transport system that supports regional economic development and population growth.

Goal 2: Improve the capacity and function of the transport network, and integrate it with land use.

Goal 3: Manage the transport system so that it is maintained to a safe and affordable level of service.

Goal 4: Provide equitable community access and connectivity for large and small communities.

Goal 5: Support efficient and sustainable transport of products between producers, markets and nodes within the region and with other regions.

Goal 6: Support improved community health and environmental outcomes.

The Loddon Campaspe Integrated Transport Strategy states that the Macedon Ranges is in the top three regional growth areas exhibiting strong tourism output, employment numbers and correspondingly low unemployment figures comparatively within the region. Figure 2-3 below shows the future economic growth directions in the Loddon Campaspe Region.

The combination of the abovementioned policy documents, the draft Kyneton South Framework Plan and the detailed analysis of the transport network in this study look at working towards addressing the six key goals of the Loddon Campaspe Integrated Transport Strategy.

Integration between the draft Kyneton South Framework Plan and the draft Kyneton Movement Network Study will align future land use and infrastructure provisions and allude to the potential items needed to support future development of the area.

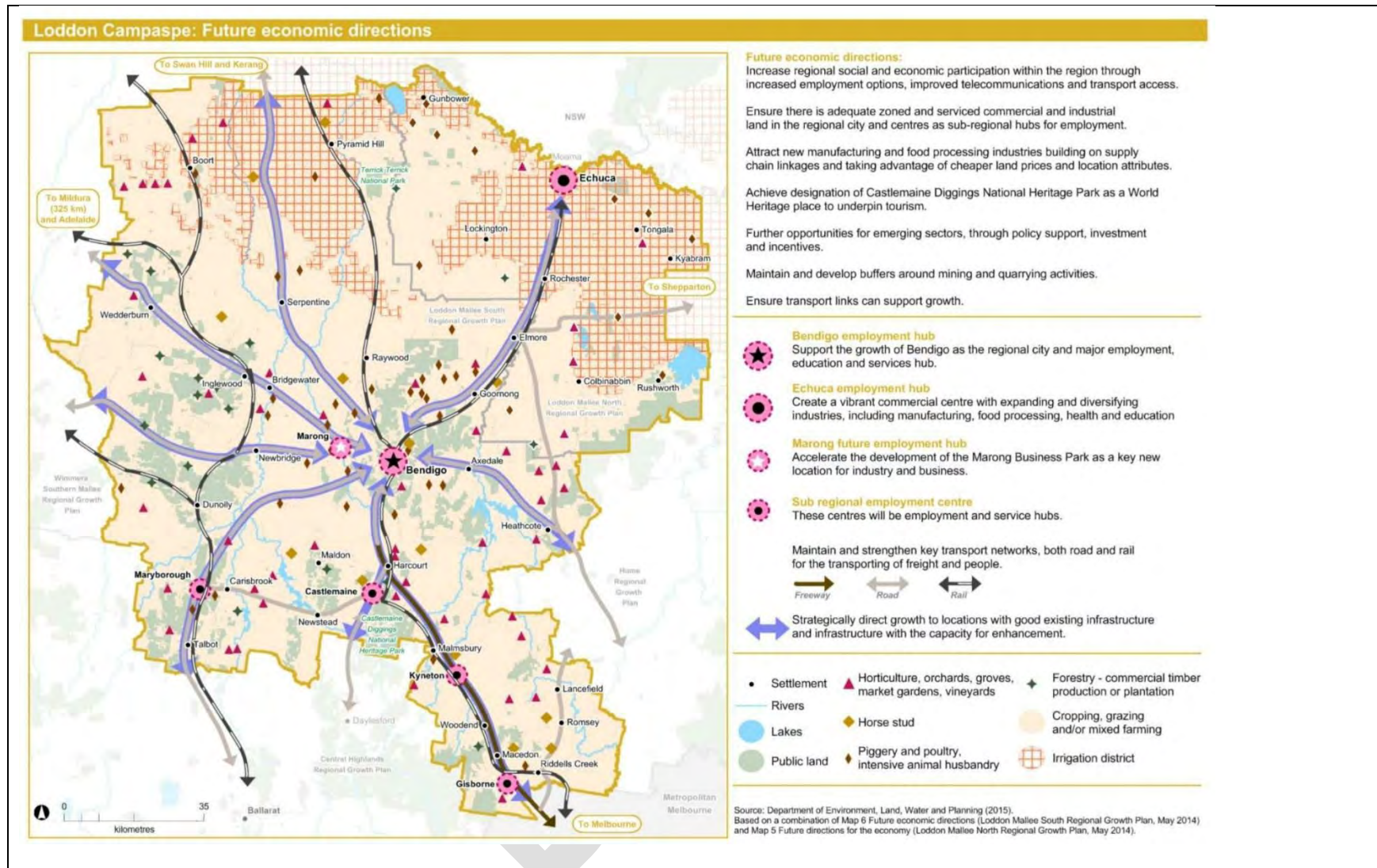


Figure 2-3: Future economic growth directions for the Macedon Ranges

2.6.8 Climate Change Action Plan 2017

Our changing climate presents significant challenges for the present and the future, and everyone has a role to play in addressing climate change.

The Climate Change Action Plan is about the present, with a focus on how Council will reduce emissions from its own activities to minimise its impact on climate change. It also outlines how Council will influence key stakeholders and support the community in reducing emissions

Council's Climate Change Action Plan lists a number of actions that are relevant to this study and they include:

- Replace 12 of Council's existing fossil fuel vehicles with hybrid vehicles from 2017-2021;
- During this timeframe trial electric vehicles and install the necessary infrastructure to support them;
- Advocate to public bus operators and state government to investigate a move towards more sustainable non fossil fuel forms of public transport. Currently (2018) the Andrews Labor Government is introducing Hybrid technology on 50 new buses across Melbourne; and
- Encourage walking and cycling instead of car travel.

The sustainable transport action plan in this study supports the shift to reductions in car travel.

3. Community and stakeholder consultation

To inform the early development of the draft movement network study it was recognised early in the process that there were interconnections between the preparation of a draft Kyneton Movement Network Study and the preparation of the draft Kyneton South Framework Plan. Given both projects had commenced essentially at the same time, it was considered beneficial to both Council, the community and stakeholders to combine the consultative processes.

The engagement process began with a facilitated workshop with state government servicing agencies and relevant council officers in October 2016. This workshop highlighted some of the important issues and opportunities in Kyneton having regard to managing population change and infrastructure provision.

In May-June 2017 Council engaged Metropolis Research to undertake both an interview survey (door knock survey) and to set up an online survey. The survey involved a number of questions related to reasons for living in Kyneton, what needs to be improved and specific questions on how people use transport, open space, community facilities, and their housing and employment needs. Importantly the survey asked questions regarding what transport movement network improvements are needed now and into the future as the town grows.

Residents completed 105 face to face surveys and 36 online surveys.

The draft Kyneton South Framework Plan included a number of directions on the future planning of Kyneton and in particular potential directions on road, pedestrian, cycling and public transport networks. A summary brochure was sent to all households in Kyneton (over 3000 households) seeking comments/submissions and attendance at a number of both drop in sessions and two community workshop which were held in August 2017. In addition officers attended a stall promoting the draft plan and seeking comments on the potential transport network ideas at the Kyneton Farmers Market in July 2017.

As part of this consultative process, a total of approximately 300 people (residents, businesses, stakeholders and government agencies) participated in the discussions, with 120 attending the scheduled meetings/drop in sessions/consultation workshops and 141 people completing the door to door and online survey.

The conversations with the community, stakeholders and agencies on transport matters, acquired through this extensive consultative process helped inform the strategic directions of the draft Kyneton Movement Network Study.

3.1 What the community informed us

3.1.1 Resident Surveys

Residents were asked in the survey to rate the importance of eighteen issues in Kyneton, including issues relating to transport infrastructure.

All of the eighteen issues residents rated were from least to somewhat important, to average to high importance. The rating was out of 10 with 10 being of highest importance.

The rated issues of most to highest importance by Kyneton residents were the frequency of the train service (8.35 by interview and 8.27 by online survey respondents), footpath connections (8.33 and 7.41), and local road maintenance (8.16 and 7.47).

The survey also asked respondents to identify what needed to be improved. The four most common raised improvements that respondents felt were important in Kyneton (related to the movement network) were included footpaths (21.6% of interview and 3.1% of online survey respondents), and roads and traffic (11.8% and 15.6%).

A diverse range of other issues were also raised by a small number of respondents including, parking, bike and walking paths, and safety.

In summary the main issues raised included:

Footpaths/Paths

- *Better quality surfaces – maintenance, DDA compliance*
- *Importance of having footpaths in all our streets to reduce reliance on cars*
- *Better pedestrian access to the train station*
- *Better access to the Campaspe River Trail*
- *An overwhelming majority stated that they use or may require walking trails in the next 5 years; and*

Roads/Traffic/Transport

- *Improved safety and amenity of the existing rail crossing for pedestrians, cyclists and motor vehicles*
- *Transport networks should connect new estates within the township*
- *Improved level of service for local road maintenance*
- *Cycling and pedestrian networks need to be in place to avoid reliance on cars*
- *Develop local area traffic management schemes in problem areas*

- *To improve access, the Edgecombe Street bridge should be constructed if new development is permitted south of the Campaspe River*
- *Bus connections should be extended to new areas and to be improved in existing areas*
- *Parking shortfall/requirements for the Edgecombe Street education precinct*
- *More parking spaces at train station.*

More specific responses from the community in relation to the aforementioned transport related issues are covered under the Issues and Opportunities for that specific section.

The resident surveys included a section related to what was considered important if Kyneton Township was to grow, having regard to transport improvements needed to support any proposed growth in the Kyneton south area.

Both the interview and online survey respondents considered of very high importance the need for transport networks to connect new estates to the township, and better pedestrian and cycling access to the train station. Cycling and pedestrian networks were rated highly to avoid reliance on cars. The Edgecombe Street bridge connection was also identified as important if new development is permitted south of the Campaspe River. Safety and amenity of the existing rail crossing on Trentham Road, and railway crossings for pedestrians, cyclists, and motor vehicles was also considered of very high importance.

Of very high importance was the need have bus connections extended to new areas and improve networks within existing areas.

The following table highlights the aspects rating of high importance (out of 10) for the following transport related aspects (two scores being one for the interview and the other for the online surveys).

Transport related aspects

❖ Pedestrian and cycling access to the train station	(9.03 and 8.74)
❖ Transport networks should connect new estates within the town	(8.92 and 8.55)
❖ The Edgecombe St Bridge should be constructed if new development is permitted south of the Campaspe River	(8.85 and 8.35)
❖ Cycling and pedestrian networks need to be in place to avoid reliance on cars	(8.76 and 8.31)
❖ Bus connections should be extended to new areas and to be improved in existing areas	(8.75 and 7.61)

Importance of transport aspects when assessing the long-term growth potential of the Kyneton South investigation area

Macedon Ranges Shire Council - 2017 Kyneton Framework Plan Survey

(Percent of respondents providing a response)

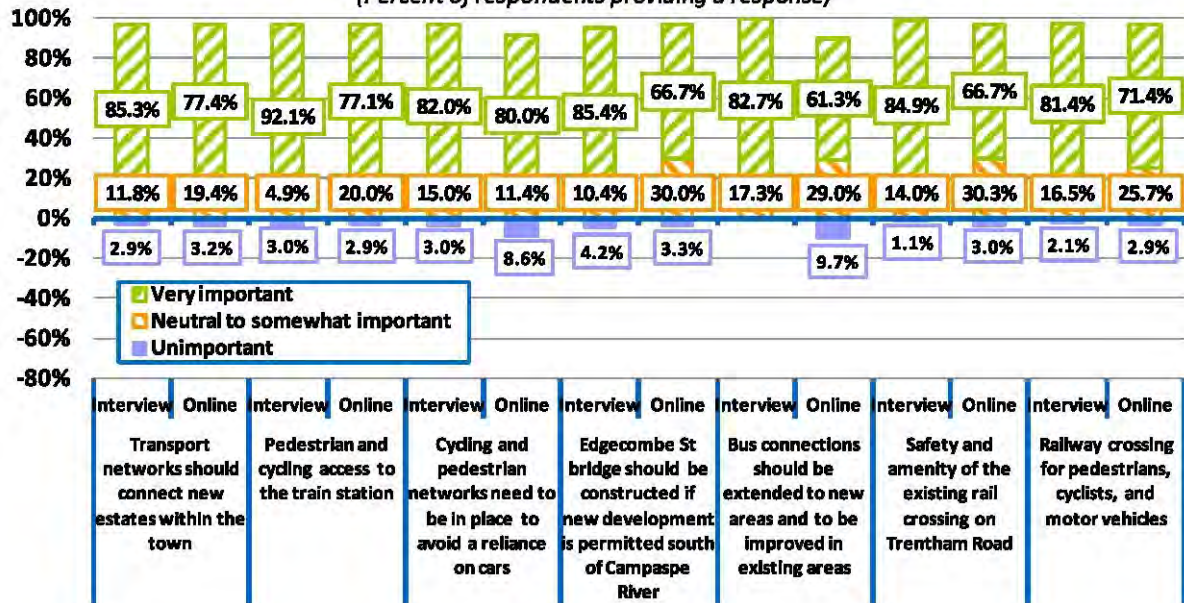


Table 3-1: Transport related survey results from community consultation

Further survey information results concerning the current importance of infrastructure related issues and community statements regarding the Kyneton environment / built form can be viewed under Appendix C.

3.1.2 Community workshops and submissions

Through the community consultation workshops/ drop in sessions a number of key themes emerged, which essentially supported the results gained from the surveys.

Essentially residents identified that they wanted an improved and more integrated movement network to enable residents to have choices regarding their mobility and access. Better connections in established and new areas of Kyneton was very important to avoid pockets of isolation created by disconnected pedestrian, cycle, road and public transport networks. Fundamental was the extension of footpath connections to enable more walkable and connected communities.

Transport planning in the Kyneton Township needed to focus on the following:

- Connectivity between neighbourhoods and to collector and arterial road networks;
- An integrated and permeable transport network to encourage walking, cycling, reduce car dependency and maximise safety and connectivity for all road uses;
- Support a grid based layout incorporating substantial street planting and avoid cul-de-sacs;

- Footpath linkages, extension of the bus network to all neighbourhoods, alleviation of congestion on main roads and better walking and cycling paths;
- Improvements to frequency, service and infrastructure of the Kyneton Train Station;
- Safety and amenity in relation to the existing railway crossing on Trentham Road;
- Edgecombe St connection to the south if development is encouraged in this location;
- Cycling and pedestrian connectivity between neighbourhoods and to collector and arterial roads;
- Campaspe river trail networks;
- Footpaths, shared paths or bike paths in the road network; and
- A master plan for the Kyneton Train Station should be prepared by State Government in partnership with Macedon Ranges Shire to address issues and opportunities for improvements.

3.2 Community Access and Inclusion Plan 2014-2018 community feedback

The Community Access and Inclusion Plan (CAIP) document recognises that public and community transport is an issue across regional areas, Kyneton is therefore not immune to this effect. The local community advised Council that there is a requirement for improved accessible transport options, where an increase in supply of taxi services will help to address this concern.

Kyneton has the highest proportion of residents with a profound disability (7.5%) strengthening the need for capable transport services. The action plans in this study look to address some of the accessibility issues in moving around Kyneton.

4. Existing and future transport movement networks

For the purpose of this study, a movement network comprises multiple forms of movements including vehicular, bicycle and pedestrian traffic. This section outlines the public transport services provisions of state government authorities and private operators.

4.1 Public transport

The Regional Network Development Plan lists initiatives that are currently being incorporated into the transport network with future directions for improvements to the network that incorporates enhancements to the services in Kyneton.

Key initiatives funded in the 2016-17 State Budget are:

- Two additional off-peak return services from Melbourne to Bendigo each day;
- Upgrade Woodend station car park with lighting and additional car parks;
- Improve station car parks at Gisborne and Kyneton; and
- Planning work to increase capacity on the Bendigo line and improve reliability and facilitate 20 minute frequency during the peak and 40 minutes during the day and evenings.

Future potential improvements are:

- Deliver capacity improvements on the Bendigo line;
- Upgrade tracks on the Bendigo line to allow for higher speeds of up to 160km/h;
- Increased track capacity between Kyneton and Bendigo; and
Improve safety at regional level crossings.

4.1.1 Public rail

Current service

The railway line from Melbourne to Bendigo has this year has had two additional off-peak return services from Melbourne to Bendigo on a daily basis. This includes better coordination of Kyneton bus service timetable.

The current increase in services sees the Bendigo to Melbourne line operate 21 services per day. The return journey, Melbourne to Bendigo sees 24 services per day.

Potential service

Council approached Public Transport Victoria (PTV) with regards to the future provision for public transport in Kyneton. The assumptive based public transport provisions heading towards 2036 in Kyneton may typically include:

- 20 minute peak and 40 minute off peak train frequency on the Bendigo line; and
- Kyneton town bus service to coordinate with train times.

Station upgrade

For the financial year 2016-17 the state budget allowed for improved station car parking and amenities at the Kyneton Train Station, see Section 4.2 Potential public transport action plan for actual deliverables.

Future directions

Potential initiatives listed in the development plan that improve services to Kyneton are:

- Upgrade to the Bendigo line to allow for higher speed trains;
- Increase to track capacity between Kyneton and Bendigo;
- Improvements to safety at regional level crossings; and
- Implement bus service improvements as demand for services change.

4.1.2 Public bus routes

Current Kyneton Town service

The Kyneton town bus service prior to 2014 was a trial service to gauge the actual patronage and its effectiveness in the community. The service was made permanent by PTV late in 2014 with four routes that are now run by Dysons Group, that connect all the residential zones (apart from Zone 11) contained within the study area – see Figure 2-1: Draft Kyneton Movement Network Study area.

The town service vehicle is a standard 12.5m bus which caters for the current and future patronage. The bus service currently runs from Wednesday to Friday only with frequency of services typically every hour from 9am to 3pm with an additional morning service on Route 1 (Train Station to Town Centre).

Potential service

Council will continue to advocate to PTV for improvements on the existing service ensuring that bus and train times in the peak demand are coordinated sufficiently. Service improvements will be directly related to population growth within Kyneton and discussions with PTV regarding the Kyneton South Developments are underway

to ensure they are catering for future development as guided by the Regional Network Development Plan.

Kyneton to Bendigo

Kyneton Bus Lines operates a morning and afternoon return service to and from Bendigo Monday to Friday.

Melbourne – Bendigo (night service)

Vline buses run a Friday and weekend night service from Melbourne to Bendigo and return stopping in Kyneton.

Woodend – Kyneton

This service is run by Organ's coaches and operates a morning run every day during the school term only with a return run in the afternoon.

Malmsbury – Kyneton

This service is run by Organ's coaches and operates a singular run every Thursday prior to midday with a return run in the afternoon.

4.1.3 School bus routes

The school bus routes in Kyneton are serviced by Organ's Coaches Kyneton. School bus routes predominantly remain static, although historically variations in bus routes and stops have occurred without Council knowledge. Up to date service timetables can be viewed on the Organ's website where indicative routes through Kyneton are depicted in Figure 4-1.

4.1.4 Taxi services

Kyneton Taxi Service operates within Kyneton, trading from Monday to Saturday with some after-hours bookings available.

More recently an Uber service has been operating in Kyneton over the past year, the service is called Kyuber Reagle.

4.1.5 Kyneton Township public transport network

Illustrated below in Figure 4-1 is the existing and potential public transport movement network encompassed by the Kyneton study area.

Potential future service expansion would ideally see the Kyneton South Investigation Area serviced by the town bus service.

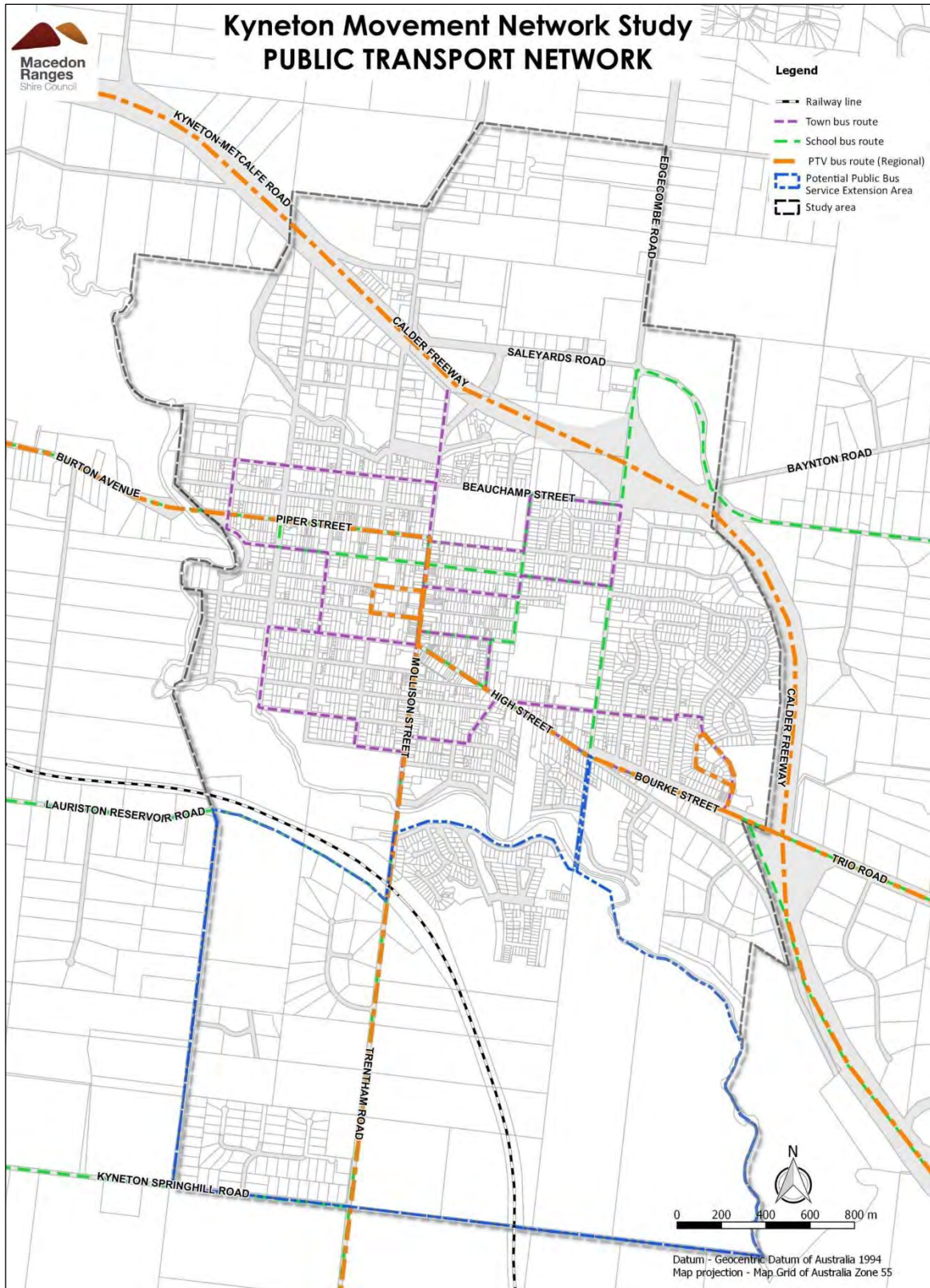
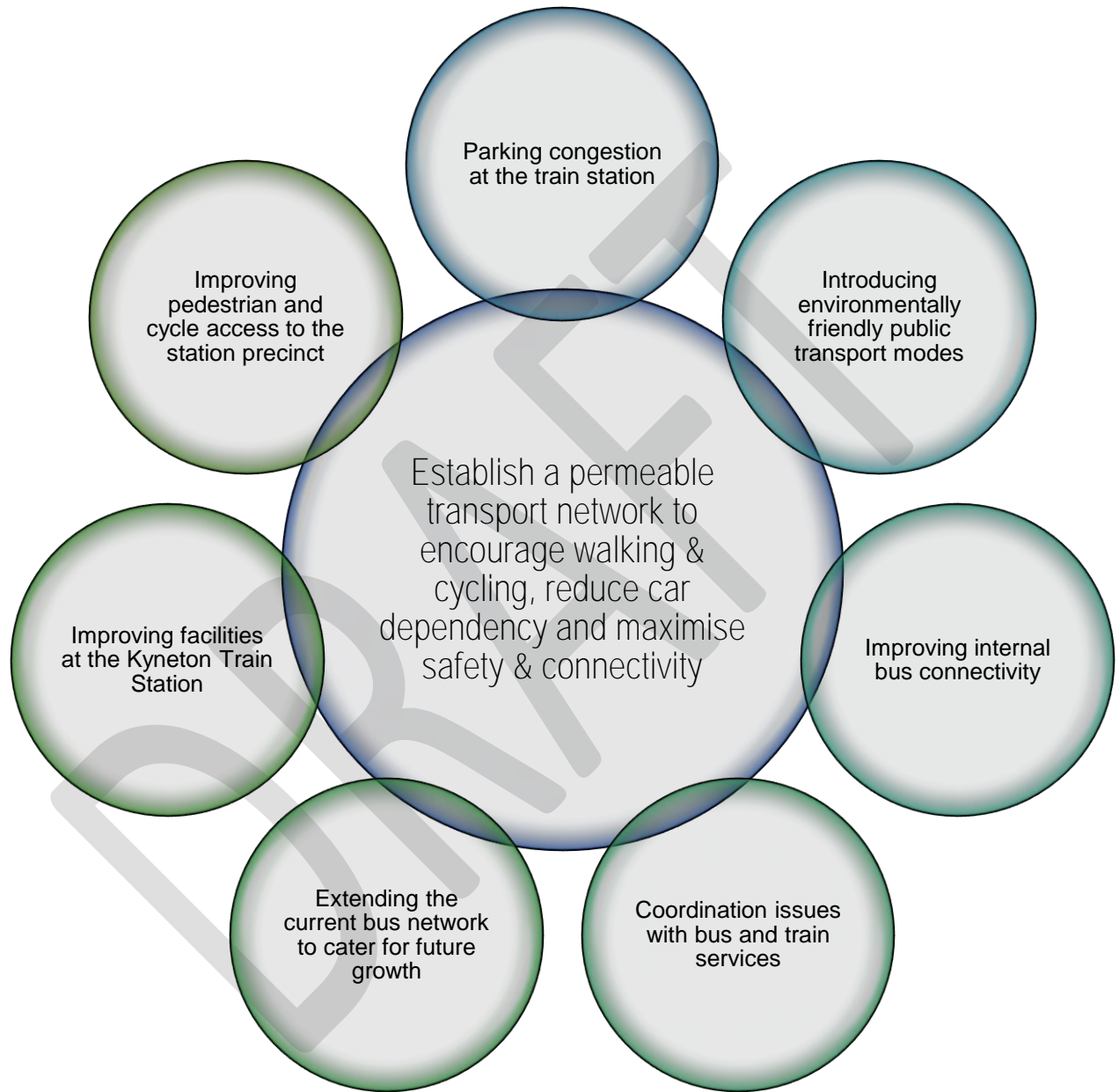


Figure 4-1: Kyneton township existing and potential public transport network

4.1.6 Public Transport issues and opportunities

The issues and opportunities identified through the development of the early draft Kyneton Movement Network Study include:



4.2 Potential public transport action plan

In response to the issues and opportunities information and the Transport Modelling Report, the following transport action plan has been prepared.

	Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Improved station amenity, including parking, lighting, drainage, security and comms.	Victorian Government funded, VicTrack managed Kyneton Train Station upgrade was completed in late 2017.	VicTrack	<ul style="list-style-type: none"> 100 extra sealed commuter car parks Improved safety via new car park lighting, CCTV and signage New site drainage with on-site Bioretention.
2.0	Transition to sustainable transport.	Advocate to public bus operators and state government to investigate a move towards more sustainable non fossil fuel forms of public transport. Currently the Andrews Labour Government is introducing Hybrid technology on 50 new buses across Melbourne.	MRSC Engineering	Reduction in greenhouse gas emissions. The Transport Sectors equates to 25% of all GHG emissions where bus operators contribute at least 2% of that (King & Hensher, 2006). Hybrid technology trials reduced fuel consumption by 30% with significant noise reduction during idling and departure.
3.0	Improve bus connectivity/services to key activity/service areas.	Work with PTV to advocate for periodic review of the public transport network in Kyneton to improve services and coordination of trains and buses. Engineering/Strategic Planning to ensure all new development areas are well serviced by public transport.	MRSC Engineering, Strategic Planning, PTV	Potential service to be circular in operation via clockwise and counter clockwise with peak time intervals of 10 to 20 minutes and to coordinate with train frequency.
4.0	Improved accessible transport options.	The CAIP 2014-2018 highlighted a requirement for an increase in taxi services. Council to advocate to PTV for suitable solutions.	MRSC, PTV	Potential adaption of the current bus network to a Flexi-Ride service or improved taxi services given enough demand. This later should include disability services being offered.
5.0	Improved safety and amenity of the existing rail crossing for pedestrians, cyclists and motor vehicles.	Advocate for investigation works into removing the level crossing.	MRSC Engineering, VicRoads VicTrack, PTV, DELWP, LXRA	Improved traffic flow given future expected volumes coupled with potential frequency increases in Vline services to 20 minutes peak and 40 minutes off-peak.

4.3 Existing and future cycle and footpath network

Council's Walking and Cycling Strategy was adopted in 2014. This strategy looks at developing an integrated network to increase participation by the community in using more sustainable modes of transport to get around. This in turn attempts at fostering a healthier community and reducing the dependency on single-occupancy vehicles.

The 2014 strategy studied key issues: priorities; progression and future requirements.

The Walking and Cycling Strategy was developed from the high value placed on walking and cycling opportunities by the community and looks to provide clear priorities and guidelines for future action. Creating walking and cycle friendly environments within Macedon Ranges is seen as critical to achieving Council's stated vision for the shire.

The key objective of the strategy is to provide Council with strategic direction on ways to increase participation and improve the supportive infrastructure and resourcing for walking and cycling in the shire over the next ten years.

Community feedback saw the majority of respondents (89.4%) consider the provision of walking and cycling paths, tracks and trails as extremely important or important. Key recommendations to support community expectation and work to achieve Council's vision for the shire that are of importance to the draft Kyneton Movement Network Study are:

- Guidelines and standards;
- Connections between towns;
- Connections within towns;
- Tourism trails; and
- Supportive infrastructure.

The Walking and Cycling Strategy network map can be seen in Appendix A.

4.3.1 Victorian Cycling Strategy 2018-28

Council has been advised that planning is underway to assess the Strategic Cycling Corridors (SCC) in the Macedon Ranges as part of the Victorian Cycling Strategy 2018-28, starting with Kyneton. The SCC are the cycling superhighways providing safer cycling opportunities, where a key focus of the strategy is on growing the urban commuting potential, be it commuting from the suburbs to the Town Centre or railway station for more distant commuting. In Kyneton the cycling corridor may typically incorporate following:

- The Municipal Bicycle Network (MBN) – refers to cycling on local roads that connects into;
- The Principal Bicycle Network (PBN) – which incorporates arterial road cycling and connects into;

- The SCC – sometimes this may be referred to as ‘The last mile’ where safety for cyclists is the key emphasis.

In-line with working at promoting healthier and better connected neighbourhoods in Kyneton, Council is currently working with Transport for Victoria in the forward planning of what the potential cycle networks might look like. The figure below provides a map of the existing and potential cycle routes in and around Kyneton.



Figure 4-2: Existing and potential cycle network

4.3.2 Existing path network maintenance schedule

Council’s adopted Road Management Plan 2017 sets out the maintenance frequency of all footpaths and shared paths in the shire. The figure below shows the existing path network and the associated maintenance level assigned to each segment. This figure is supplemented by a frequency table for inspections.

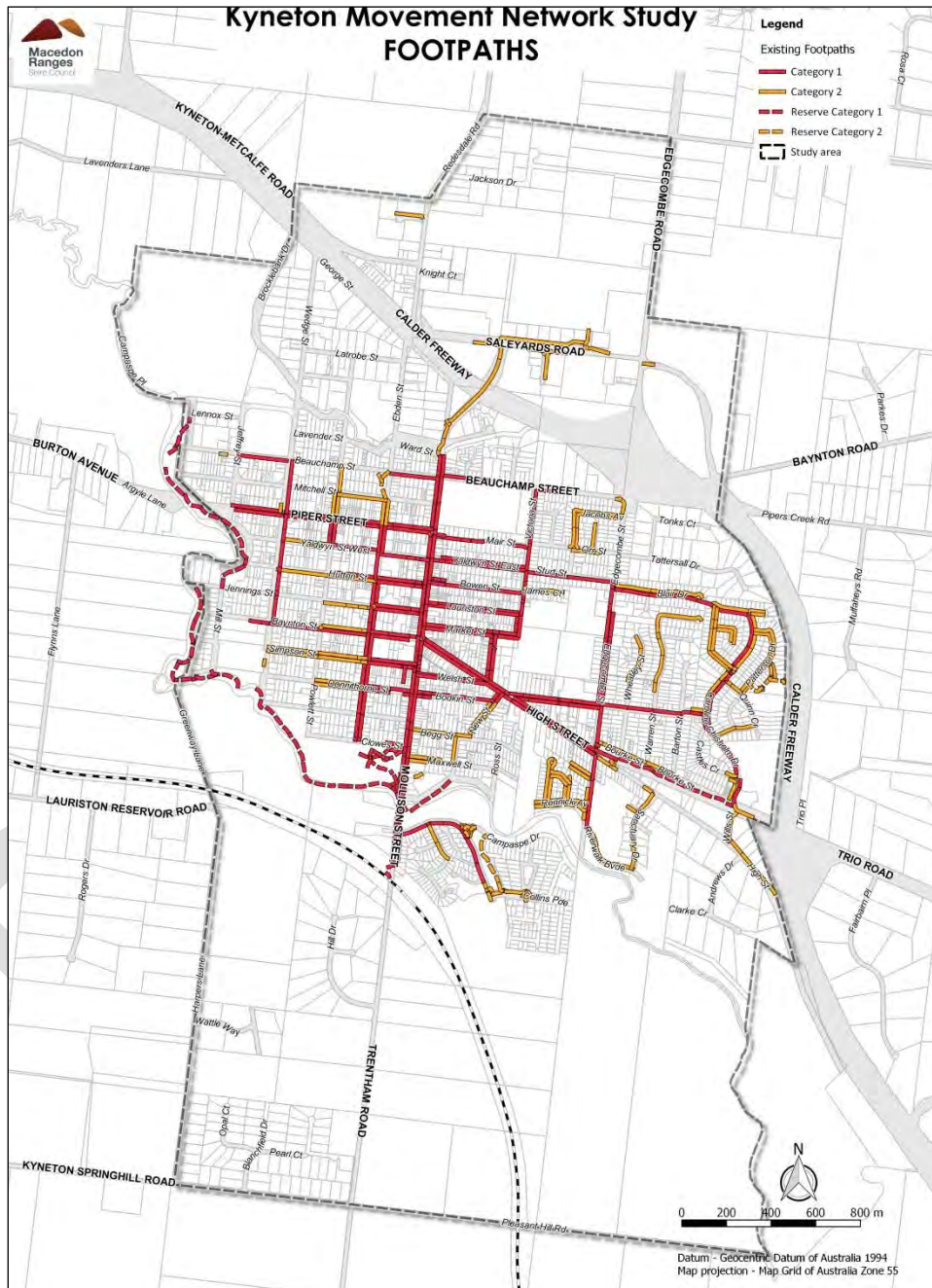


Figure 4-3: Existing path network

Table 4-1: Path inspection frequency

Pathway Category	Inspection frequency (per annum)
1	2
2	1

4.3.4 Investing into a healthier community

Council’s focus on footpaths, shared paths and designated cycle lanes and connectivity within the shire is improving year on year. This improvement reflects Council’s recognition of the community focus on the importance of providing a well-connected footpath network by gradually improving existing footpath infrastructure to meet current standards to continue to provide health and social benefits, participation in exercise and sustainable travel choices within the community.

Year one of the Council Plan focuses on promoting health and wellbeing and is a key driver for investing into a healthier community.

The table below compares Council’s shire wide expenditure on footpath and shared footpath infrastructure for the 2018/19 and previous three financial years. Council understands the need to invest in more sustainable transport journeys and that we have an aging population that will ultimately not be driving in the future. The key focus will be enabling the community to move around more easily and participate in short journeys from home to local amenities.

Table 4-2: Capital expenditure comparison – Footpaths

Financial year	Asset Expenditure Type			Total
	New	Renewal	Upgrade	
2015/16	\$50,000	\$270,000	\$256,000	\$576,000
2016/17	\$245,000	\$300,000	\$50,000	\$595,000
2017/18	\$750,000	\$320,000	\$73,000	\$1,143,000
2018/19	\$715,000	\$300,000	\$50,000	\$1,065,000
Total	\$1,760,000	\$1,190,000	\$429,000	

Table 4-2 incorporates previous and current works on the Campaspe River Trail that is a desirable action of the draft Kyneton Framework Plan. In addition to the Campaspe River Trail works, an additional \$50,000 was allocated in the 2017/18 and 2018/19 budgets for implementation of actions proposed in the 2014 Walking and Cycling Strategy.

4.3.5 Macedon Ranges Shared Trails Feasibility Studies

In light of Macedon Ranges not having an official well-defined bicycle network, Council is undertaking steps to develop a shared trails study that includes cross-border connections with neighboring municipalities.

The purpose of the study is to, provide realistic components that are “project ready” and meet the criteria for funding by State and/or Federal Governments (MRSC, Dec 2017). When completed this infrastructure will work towards fostering healthier communities by providing more opportunities to get out and be active whilst increasing exposure in attracting tourism throughout the region.

Figure 4-4 below outlines the individual components that the study will examine.

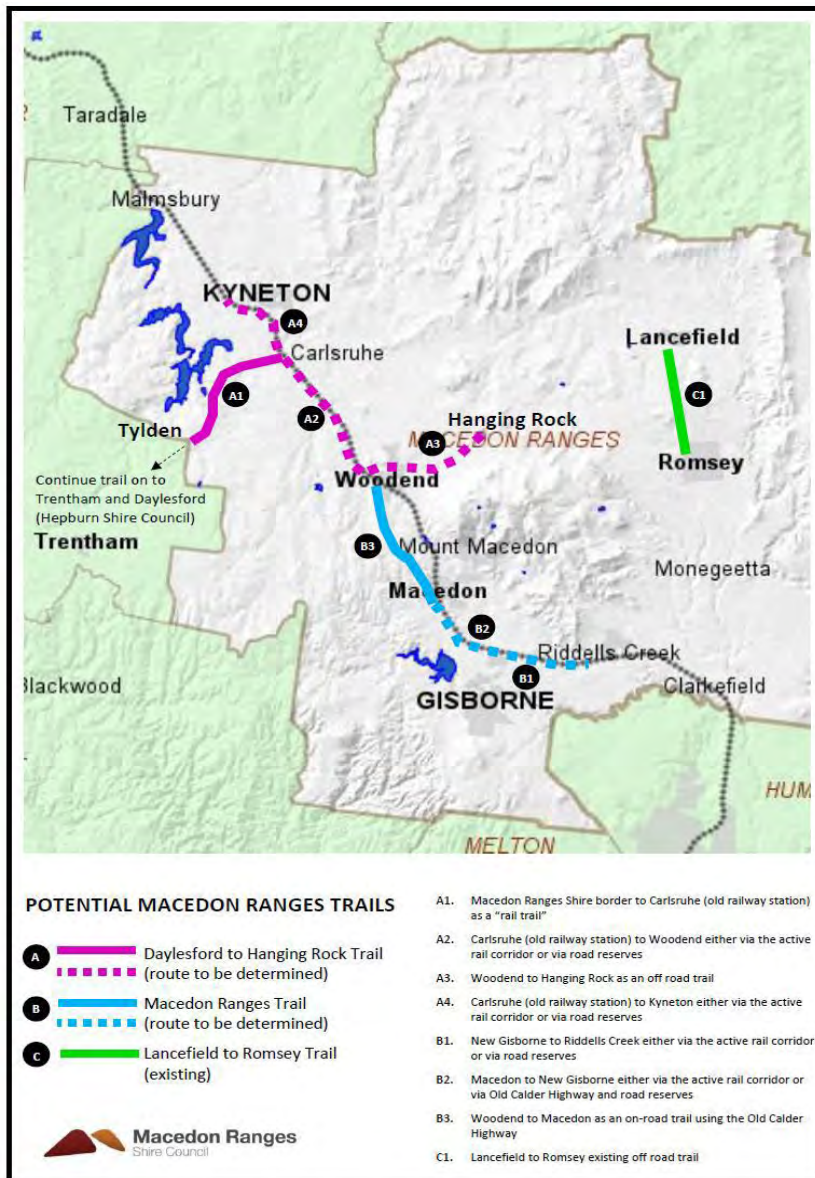


Figure 4-4: Potential shared trails locality plan

A strategic document produced by RMCG Consultancy in September 2017 to develop the Loddon Campaspe Trails Network, contains reference to the Daylesford to Macedon Ranges Rail Trail via Tylden, Woodend and Carlsruhe.

The status indicated for this document is at the planning stage, where only the feasibility study has been completed. Council intends on collaborating with Hepburn Shire Council who is responsible for delivering the project from the Macedon Ranges Shire boundary.

4.3.6 Potential cycle and pedestrian network

Figure 4-5 below from the draft Kyneton South Framework Plan is derived from the walking and cycling strategy and depicts the existing and potential pedestrian and bicycle network within the Kyneton study area.

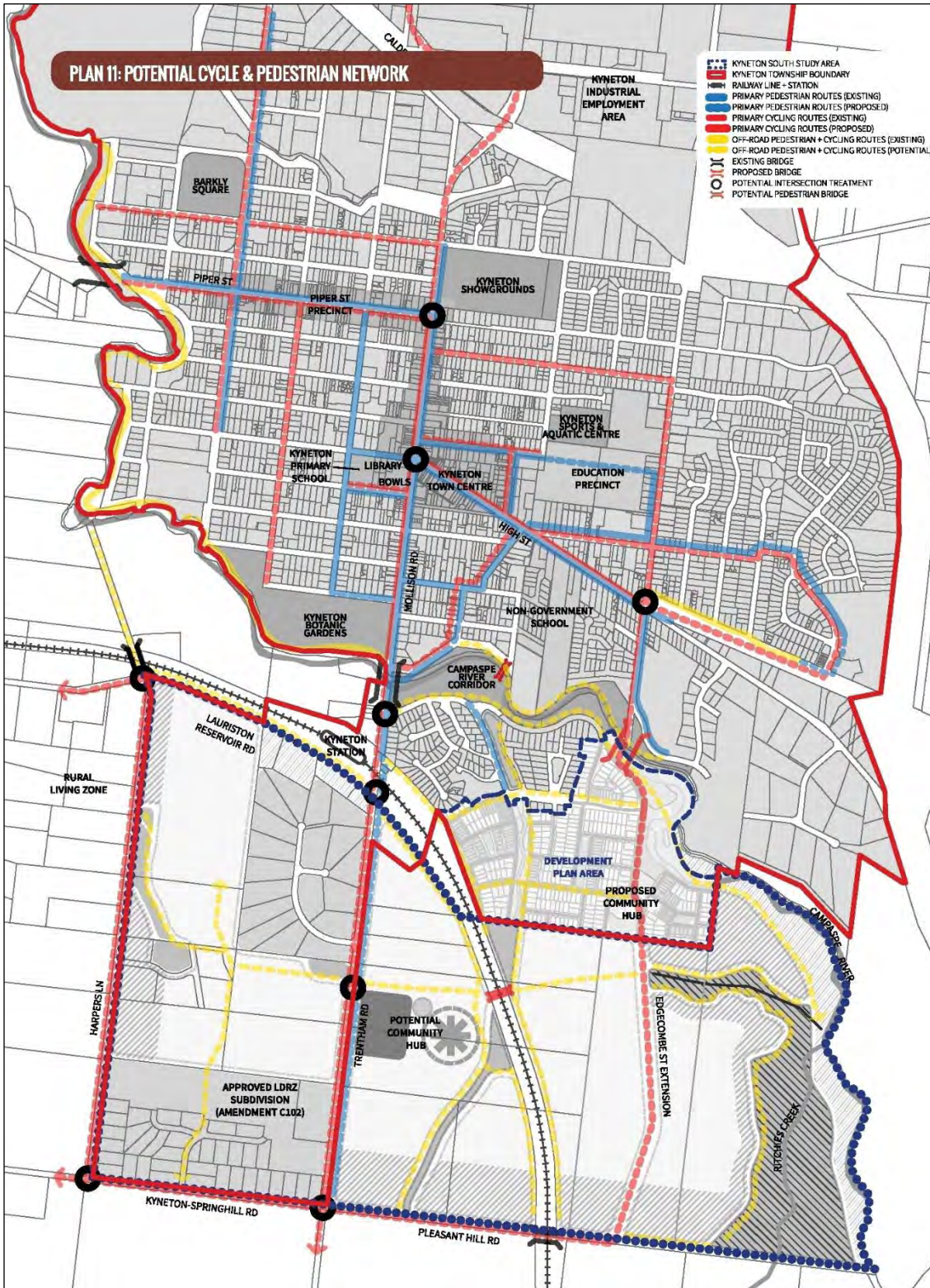


Figure 4-5: Potential pedestrian and cycle network

4.3.7 Macedon Ranges Shire Council Shire Wide Footpath Program

Council develops and maintains a shire wide footpath program. This program highlights new footpath/shared path linkages forecast for a 10 year period. Individual projects are prioritised by being evaluated against a select set of criteria. The criteria include improving access to education, business, recreation and transport nodes. Catchment population and links to other strategies/plans are also considered. The priorities are then evaluated against community input from our internal request system, community consultation and internal and external studies.

Council adopted the current shire wide footpath plan in December 2018, where community feedback was obtained during December 2017 for input into prioritisation of projects scheduled for each township and again in July 2018.

The endorsed plan for Kyneton is split into a priority list of High, Medium and Low as shown in Figure 4-6.

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Shire-Wide Footpath Plan 2018 - Kyneton

Figure 4-6: Shire Wide Footpath Plan 2018

4.3.8 Bicycle and footpath issues and opportunities

The issues and opportunities identified through the development of the early draft Kyneton Movement Network Study include:



4.4 Potential sustainable transport action plan

	Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Improved amenity for sustainable transport modes (cycling).	Council initiative to provide on-street short-term storage facilities for cyclists accessing the Town Centre services in various locations. To be completed in FY 18/19.	Sports & Recreation, MRSC Engineering, Operations	Increased cycle use can only be measured as part of “an integrated package of many different, complementary interventions, including infrastructure provision and pro-bicycle programs, supportive land use planning...” (Pucher, Dill, & Handy, 2010).
2.0	Growing urban commuting.	Work with Transport for Victoria (TFV) to review the SCC in Kyneton as part of the Victorian Cycling Strategy 2018-28.	MRSC, TFV, VicRoads	A safer interconnected cycling corridor from residential Kyneton to the Town Centre and Railway Station.
3.0	Reduce reliance of Council Fleet on fossil fuels.	See Actions 3.1 – 3.7 in Council’s Climate Change Action Plan June 2017.	MRSC	Zero net emissions by 2030-2031.
4.0	Improve pedestrian & cycling connectivity.	Review against the 10 year shire wide footpath CAPEX program, the 2014 Walking and Cycling Strategy and outcomes from the Macedon Ranges Shire Council Shared Trails Feasibility Study.	MRSC Engineering, Operations, Sports & Recreation	Footpath asset expenditure of \$750k in FY 17/18. \$50k assigned to the Walking and Cycling Strategy in FY 18/19. The Shared Trails Feasibility Study is in the research phase.
5.0	Pedestrian/cycling connectivity from Kyneton South.	Advocate for the delivery of the Edgecombe Street Bridge from Campaspe Dr to Riverwalk Blvd.	MRSC Engineering, Strategic Planning	Preferred bridge cross section consists of an 11.8m formation width that includes a 1.8m footpath/3.5m traffic lane/3.5m traffic lane/3m shared path.
6.0	Campaspe River Walk access improvements.	Council has completed three sections of the Campaspe River Walk that were endorsed by Council.	MRSC Engineering, Operations	Key deliverables are: <ol style="list-style-type: none"> 1. Improved connection from Piper Street to the river walk. 2. New section from the south end of Mill Street to the existing path at Wedge Street. 3. New links and upgrade to the walkway from Campaspe Cr to the south end of Mill Street.

4.5 Existing and potential road network

4.5.1 Existing road hierarchy

The existing road network hierarchy depicted below is categorised in accordance with Macedon Ranges Shire Council Road Management Plan 2017 for road maintenance purposes. The hierarchy of VicRoads arterials and Council maintained local roads within Kyneton are depicted in Figure 4-7 below.

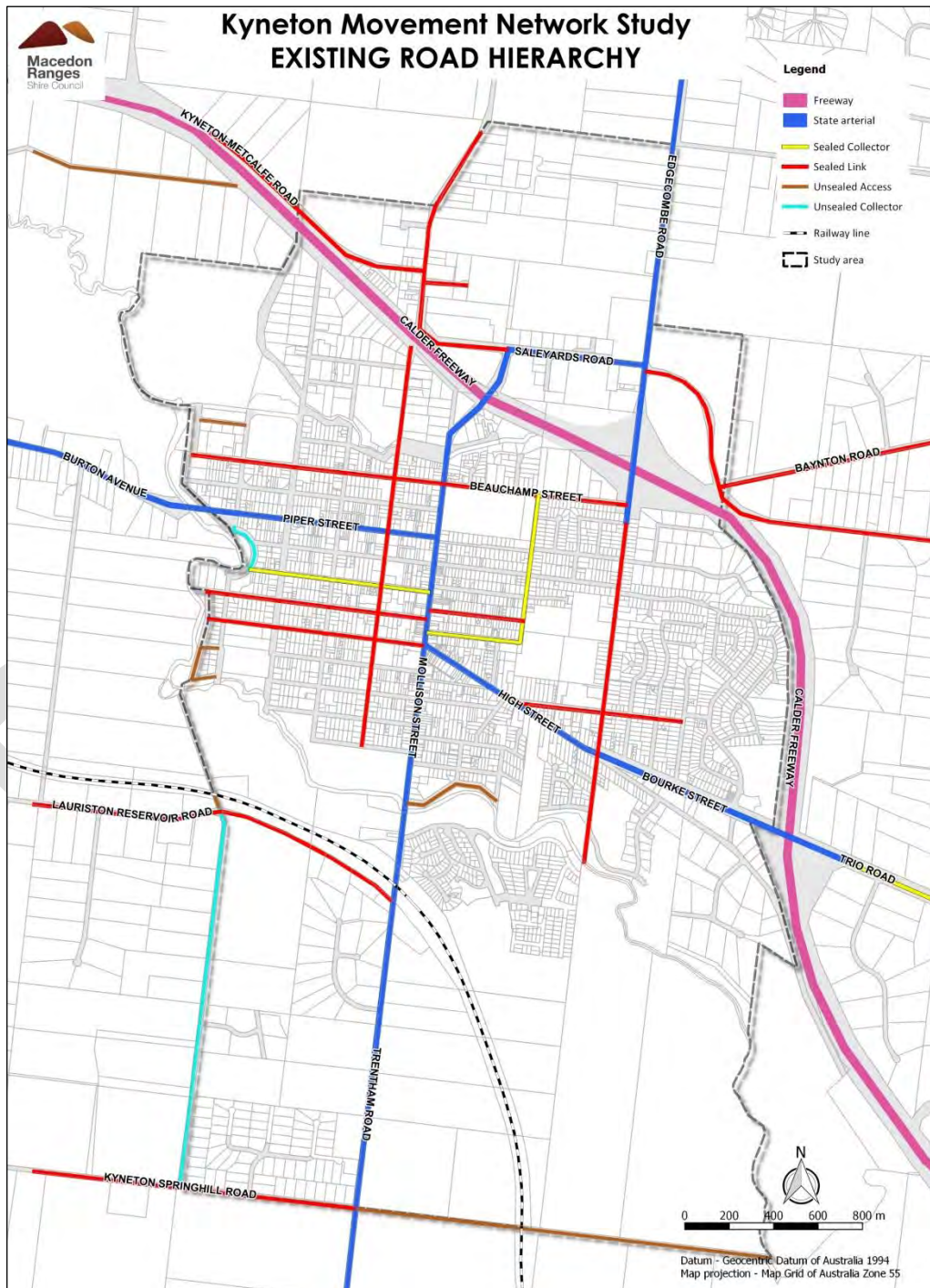


Figure 4-7: Existing road categories

4.5.2 Potential road network

The draft Kyneton South Framework Plan highlights possible future additions to the existing road network. The proposal considers an additional Campaspe River crossing as an extension of Edgecombe Street. This will provide an alternate access to the arterial road network for the residents in the Campaspe Views Estate and the Development Plan Area, see Figure 4-8. The framework plan identifies that any further development beyond the existing Development Plan Area can only be considered once an additional Campaspe River crossing has been provided.

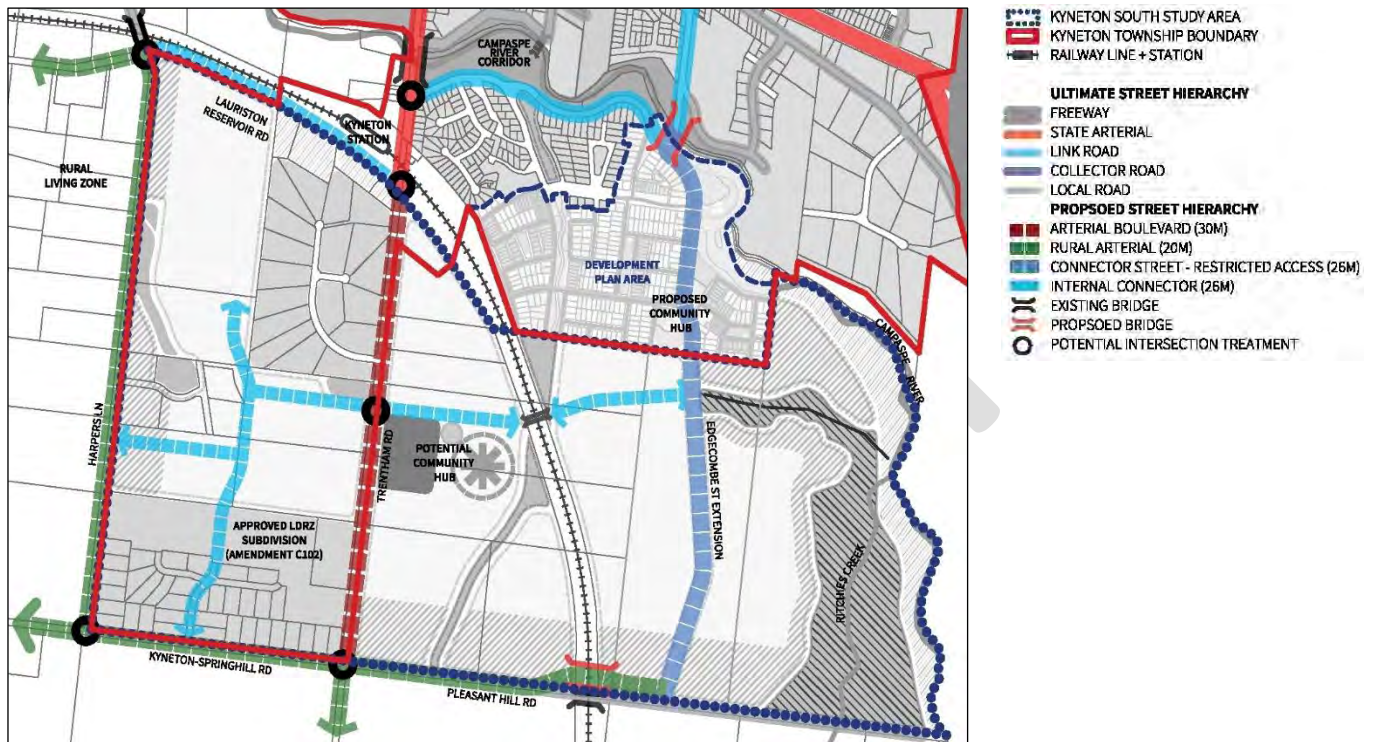


Figure 4-8: Potential street network in the investigation area

A potential western township/northern rural arterial access route to service development south of the Campaspe River could follow a number of routes. Typical route options include:

1. Kyneton-Springhill Road and/or Lauriston-Reservoir Road → Harpers Lane → Lauriston-Reservoir Road → Flynn's Lane → Burton Avenue (arterial);
2. Kyneton-Springhill Road → Harpers Lane → Lauriston-Reservoir Road → Harts Lane → Burton Avenue (arterial); and
3. Kyneton-Springhill Road → Harts Lane → Burton Avenue (arterial).

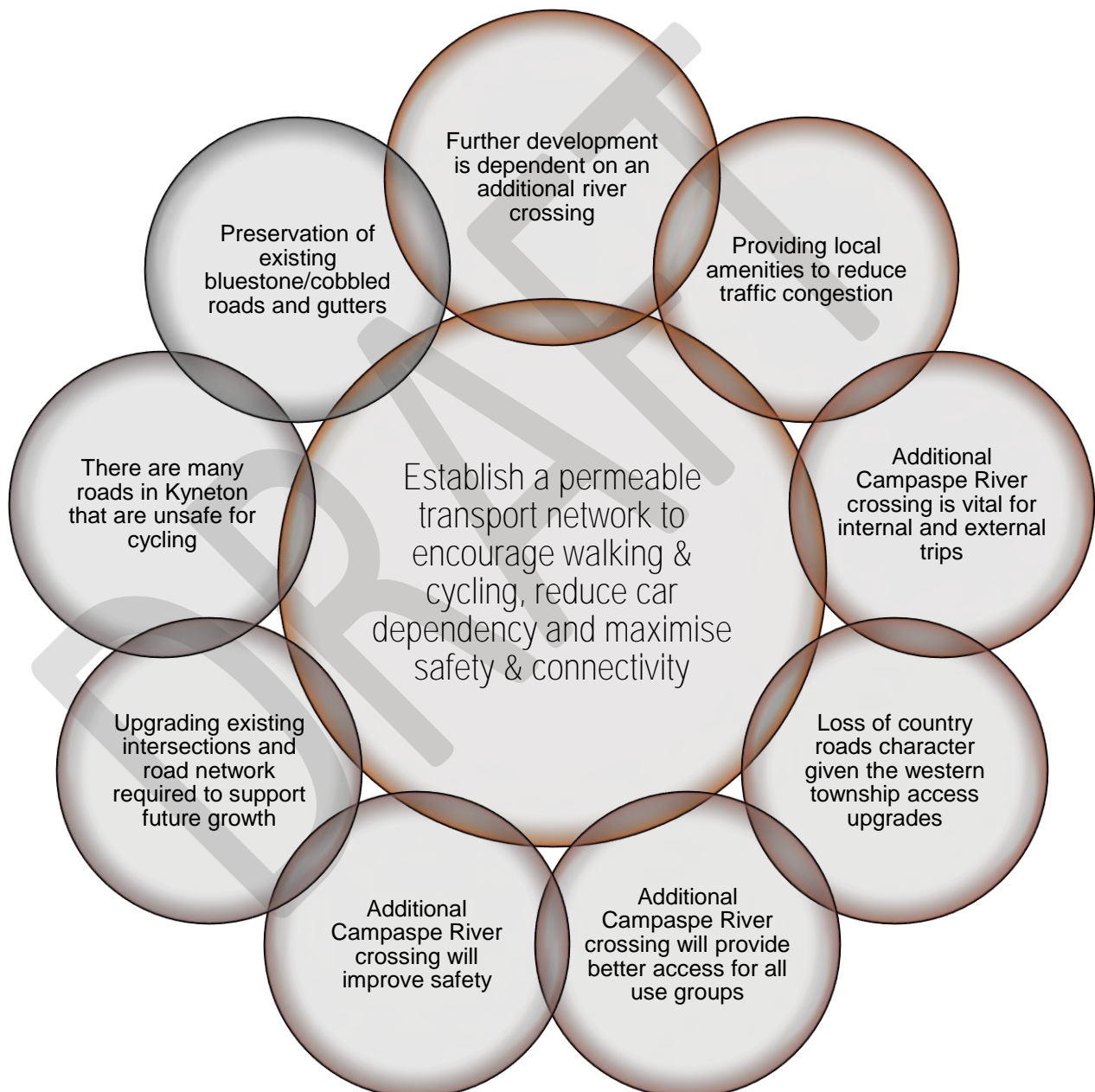
The western access route would require road upgrades to one of the route options listed above, but an upgrade is only activated once development in the investigation area reaches the required density. In Section 6, the Kyneton Transport Model will determine the preferred route option given the most likely traffic distribution.

In order to deliver a functional road network to cater for development for all types of road users, potential road cross sections for the rural arterial, boulevard and

connector street have been derived – see cross section extracts from the draft Framework Plan in Appendix B.

4.5.3 Issues and opportunities with the potential road network

Issues and opportunities identified through the development of the early draft Kyneton Movement Network Study include:



The action plan for this particular aspect of the transport network is covered under Section 6 Potential road infrastructure plan.

4.6 Existing freight movement network

The existing freight network in Kyneton remains unchanged from the previous movement network study. Some industrial areas have been further developed however no rezoning of new land has occurred. Predominantly most of the heavy vehicle movements bypass Kyneton via the Calder Freeway, however internal freight in Kyneton is unavoidable and integral to the local economy. The existing freight movements are depicted in Figure 4-9.

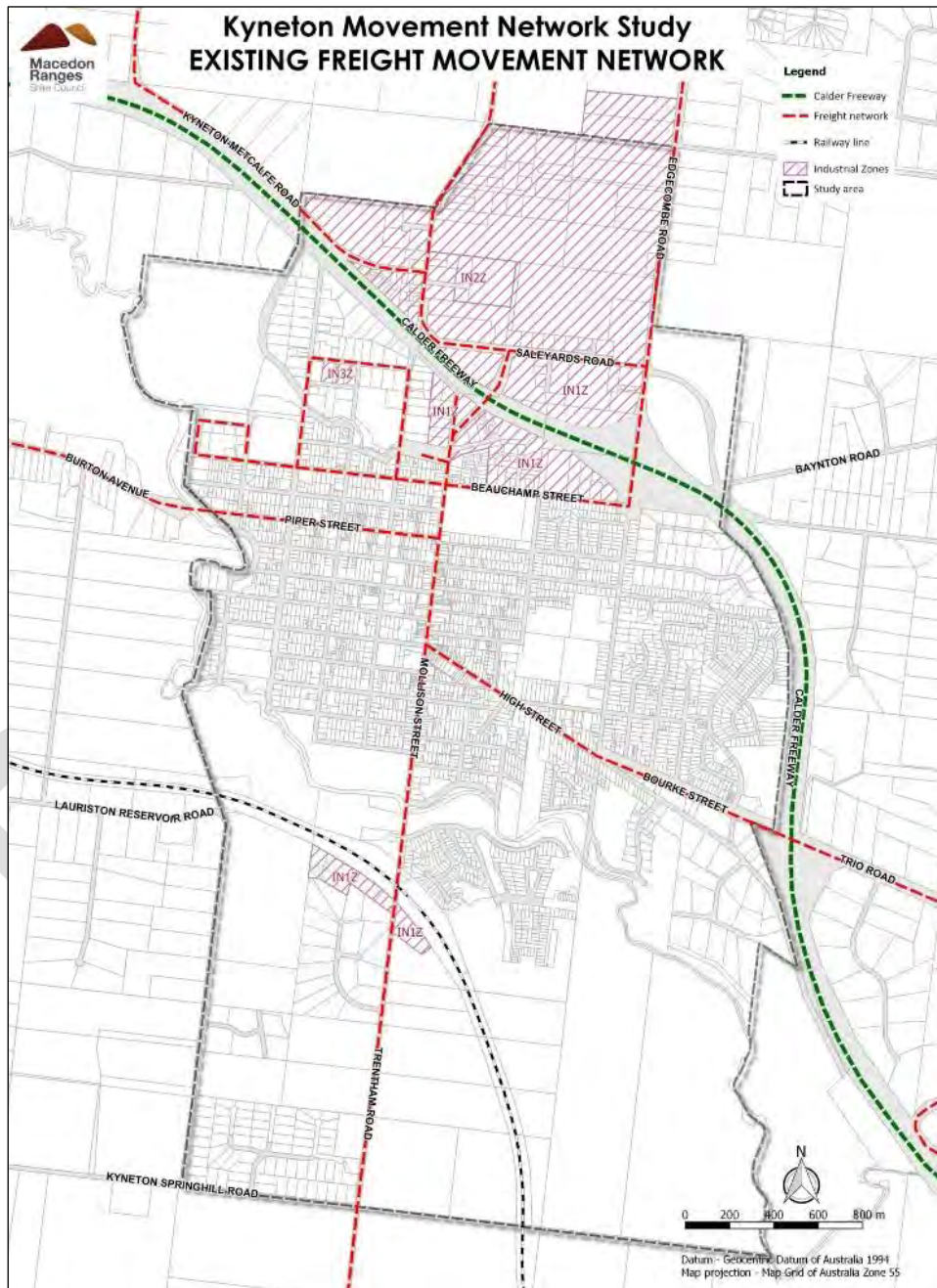


Figure 4-9: Existing freight movement network (Aurecon Australia Pty Ltd, Apr 2010)

Typical freight movements within Kyneton consist of:

- Delivery vehicles accessing the Town Centre to retail outlets; and
- Freight movements destined for the industrial areas.

The freight network dependent on size and classification of vehicle is restricted to the arterials roads unless special permit access is granted to local level roads. The National Heavy Vehicle Regulator (established in July 2009) sets out laws on where heavy vehicles are allowed to access the road network. VicRoads plays a supporting role and holds the online heavy vehicle network map that designates what roads are approved for particular types of heavy vehicles. Companies requiring the use of roads that are restricted on the map need to apply for permission to access, where the local authority is consulted.

For example the PBS Level 1 vehicle (defined as 3 or 4 axle rigid trucks towing a 3 or 4 axle dog trailer) has access to most local roads except under certain conditions imposed by the road authority. With regard to other common heavy vehicles on our roads, B-Double trucks are restricted to the arterial roads with some exceptions in accessing industrial estates. Figure 4-10 illustrates the applicable network access for a typical PBS Level 1 vehicle in the Kyneton area.

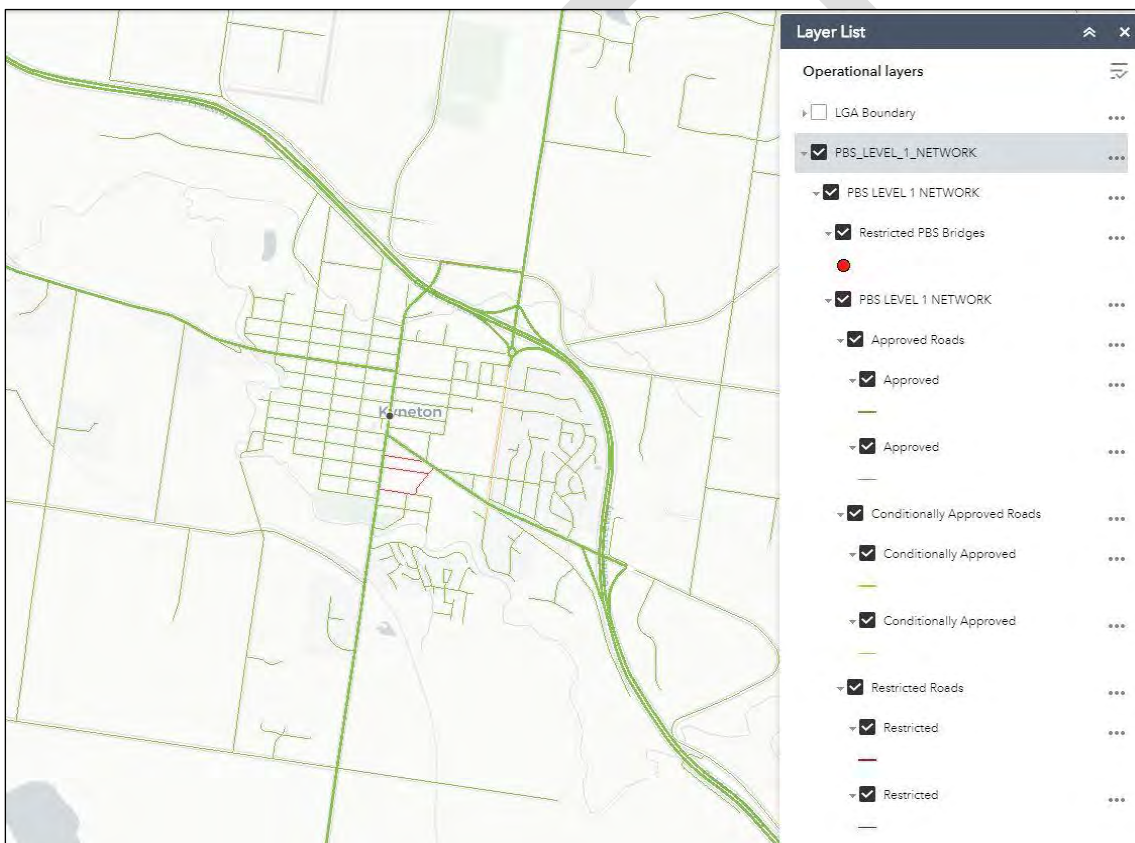


Figure 4-10: PBS Level 1 Network Map (Vic Roads, 2018)

4.7 Crash statistics and road safety

4.7.1 Road Safety Strategy

In absence of a Road Safety Strategy, Council Officers are guided towards the principles set out in Victoria's Road Safety Strategy and Action Plan – Towards Zero 2016-2020. This strategy is directly related to the rural environment and therefore feeds directly into Council's own direction into reducing the road toll in the rural environment.



Figure 4-11: The safe system approach

The safe system approach acknowledges that people will make mistakes but no one should die because of it (Victoria State Government, 2016-2020).

The action plan involves highlighting the most serious trauma challenges derived from expert research and statistical data. The safe system approach looks to apportion funds directly to addressing these most serious trauma challenges on the road network to ensure that when we make a mistake we do not pay for it with our lives.

4.7.2 Analysis of crash statistical data

The current period used for reviewing crashes and in conjunction with the Transport Modelling Report is from 01-07-2013 to 30-06-2018. The table below simplifies the crash history on all roads in the Kyneton postcode area 3444 during this period

Table 4-1: Crashes by year and severity – all vehicle types

Year	Fatal	Serious Injury	Other Injury	Total Crashes
2013	0	0	5	5
2014	0	3	8	11
2015	2	4	9	15
2016	0	3	11	14
2017	0	6	3	9
2018	0	0	4	4
Total	2	16	40	58

During the five-year crash period two fatal crashes were recorded on the Arterial network in 2015. One crash was within the study area and involved a pedestrian just south of the level rail crossing on Mollison Street in Kyneton at night. The second was on Heathcote-Kyneton Road outside the study area that involved a loss of control on a straight high speed road alignment into a roadside object. See crash map in Figure 4-12 for the crash locations contained within the study area.

Of the 16 serious injury crashes only two occurred within the study area and both were on the arterial network. The two crashes were related to:

- Head on collision between two vehicles
- Loss of control off of carriageway

None of the other serious injury crashes recorded, occurred on local roads and all of the serious injury crashes occurred on high speed rural roads that in turn highlights the crash trend across Victoria.

In summary, the casualty crash statistic data confirms that there are no serious safety concerns with the existing road network within the study area due to there being no evidence of similar crash types occurring at the same location on a regular basis and with the majority of crashes (70%) resulting in other injury.

One significant initiative employed to address crashes on our rural roads is the Nation Building Black Spot Program. This is a federally funded initiative running on a yearly basis. The program looks at directly addressing crash trends at specific black spot areas like intersections or lengths of road that meet the criteria. This is done by implementing road safety measures to these crash areas with the ultimate aim of removing the risk and/or reducing the severity of a crash. The following section outlines the successful projects Council has undertaken on the local rural road network and the focus of the Towards Zero campaign.

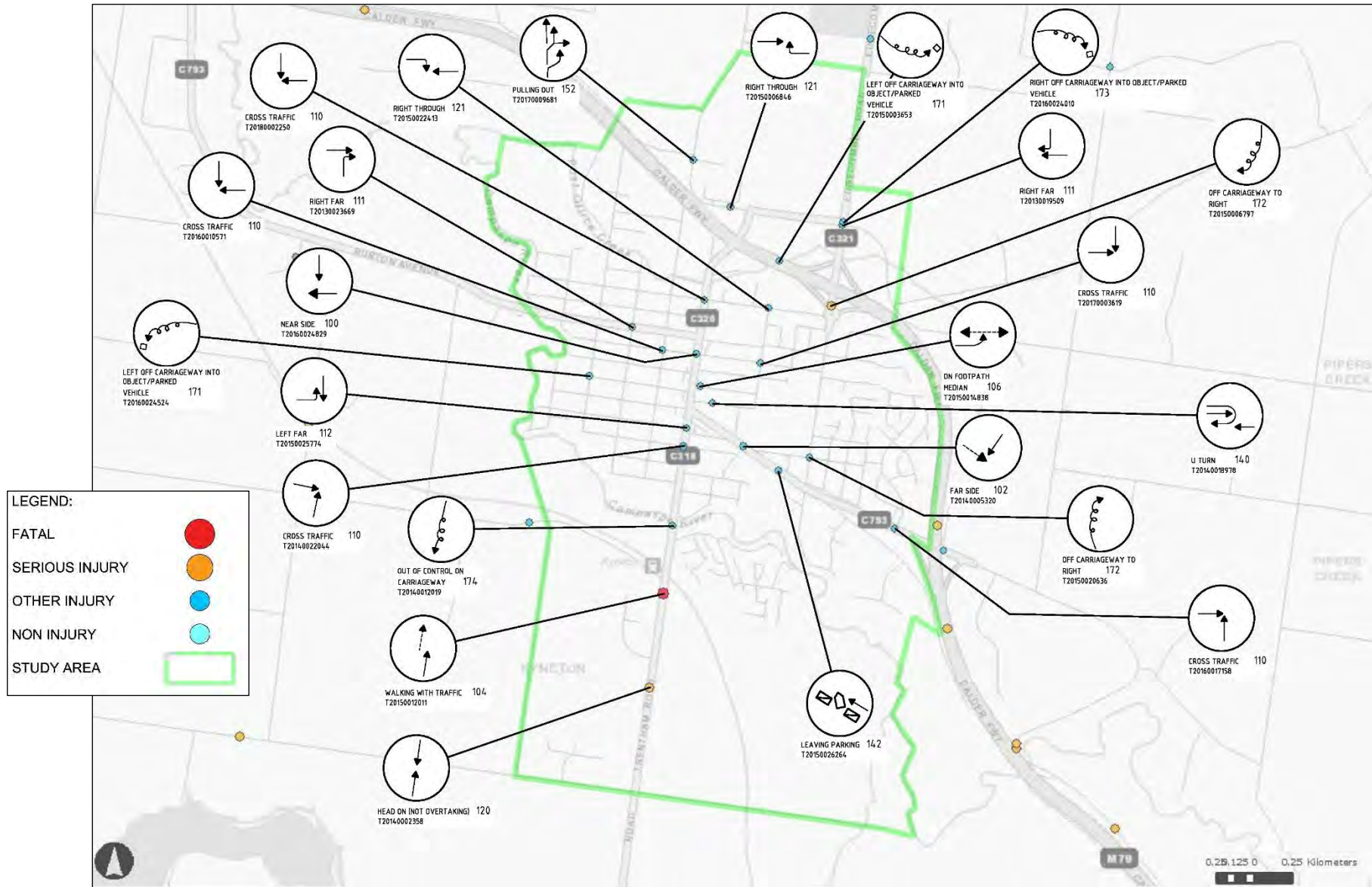


Figure 4-12: Study area crash location map (VicRoads RCIS Production, 2018)

4.7.3 Council approach to crash reduction

In applying the safe system approach, Council's road safety team conducts the following initiatives in the advent of continuously working towards reducing the road toll on our roads:

- Applying for funding through the TAC Local Government Grants for Small-Scale Infrastructure. This process allows Council the opportunity to apply for funding to address pedestrian and cyclist safety as part of the Towards Zero 2016-2020 Road Safety Strategy and Action Plan;
- Annual review of the recorded crash history on our roads under the Nation Building Black Spot Program resulting in funding for sites meeting the required crash criteria. Historical project success under this scheme for financial years 13/14 to 16/17 are as follows:
 - Ashbourne Road, Woodend – Black Length, \$1.08M;
 - Cobb & Co Road, Kyneton – Black Length, \$148k;
 - Couangalt Road, Gisborne South – Black Spot, \$213k
 - Romsey Road, Springfield – Black Length, \$378k
 - Three Chain Road, Newham – Black Length, \$806k
 - Burke & Wills Track, Lancefield – Black Length, \$98k; and
 - Romsey Road, Newham – Black Length, \$186k.
- Applying for funding under the Building Better Regions Fund. This is a federally funded scheme that involves the construction of new infrastructure or the upgrade or extension of existing infrastructure that provides economic and social benefit to the region;
- Investigating, justification and formulation of road safety initiatives generated by queries from the Macedon Ranges community;
- Participation in annual road safety campaigns with Bike Safe Macedon Ranges (BSMR) to foster safer roads for cyclists;
- Training our team on the most up to date crash analysis techniques and treatment options;
- Safety reviews of the road network on routine road, drainage and traffic investigations throughout the shire;
- Speed reviews of our roads from data collected from Council's annual MetroCount traffic data collection program;
- Monitoring the local road use application framework to ensure certain heavy vehicles are not using roads in sensitive built up areas;
- Collaborating with neighboring municipalities and Vic Roads to establish working groups to achieve greater results in project development, financing, delivery and beneficial outcomes for all road users; and

- Purchase of two mobile Variable Message Boards to be used on our road network for multiple purposes including, major road works, fire management exercises by the CFA, and Community/Council run events.

4.7.4 Other road safety initiatives

Council actively works on initiatives with BSMR with the installation of 'Share the Road' warning signage on key high speed rural roads that are often frequented by cycle groups for training or recreational purposes. Key cycling routes identified and treated within the Kyneton District are as follows:

- Trio Road
- Edgecombe Road
- Cobb & Co Road
- Three Chain Road

Council also assists Bike Safe Macedon Ranges with their 'Pass with care' campaign annually (see Figure 4-13) by installing a large message board at key locations in accordance with VicRoads road safety requirements.



Figure 4-13: 'Pass with care' campaign - location: Centennial Park, Macedon

5. Kyneton transport model - summary

5.1 Traffic consultant modelling using Public Transport Victoria Vissim Model

Council is working with an external traffic consultant to prepare a holistic overview of the existing and future traffic network by conducting detailed modelling using the PTV Vissim Model. This model is a state of the art microscopic multi-modal traffic flow simulation software package.

Appendix G in this study contains the Transport Modelling Report that provides more detailed information on traffic modelling of the Kyneton study and surrounding area. Council will use this model to determine and cost the potential future infrastructure requirements for key intersections on the existing road network within Kyneton, taking into consideration new connector roads in the Kyneton South Investigation Area, an alternate north-west connector to Burton Avenue and a possible northern entry/exit point from the Kyneton Development Plan Area.

The model looks at two scenarios; the existing or base case (2016) and the future scenario (2036) that incorporates full development of the Kyneton South Investigation Area. These models consider traffic generated internally, along with that external to the Kyneton study area.

5.2 Transport model development

Considering the base case and future scenario, the transport model is based on the assessment of traffic generated from the number of residential dwellings; employment and gross floor area for industry, retail, office and commercial uses; employment and education enrollments within the Kyneton study area. It should also be noted that the assumptions from the previous 2010 study, made with regards to traffic trip types, splits and land and floor areas are carried forward into this model as they are still considered to be valid. The difference in this model is that up to date statistical data from *.id Consulting Pty Ltd and ABS data* has been incorporated to assist in developing figures for the base case and scenario for the 20 year analysis period initiating from 2016 to 2036.

5.2.1 Land use summary

For initial analysis and in conjunction with the previous movement network study land use zones, the 11 Zone System was re-deployed to distribute the internal and external trips generated by these zones. For detailed modelling purposes using the PTV Vissim Model, a more detailed system has been established incorporating 40 zones being based on the 11 zone system boundary. A graphical comparison of these can be seen in Figure 5-1 below:

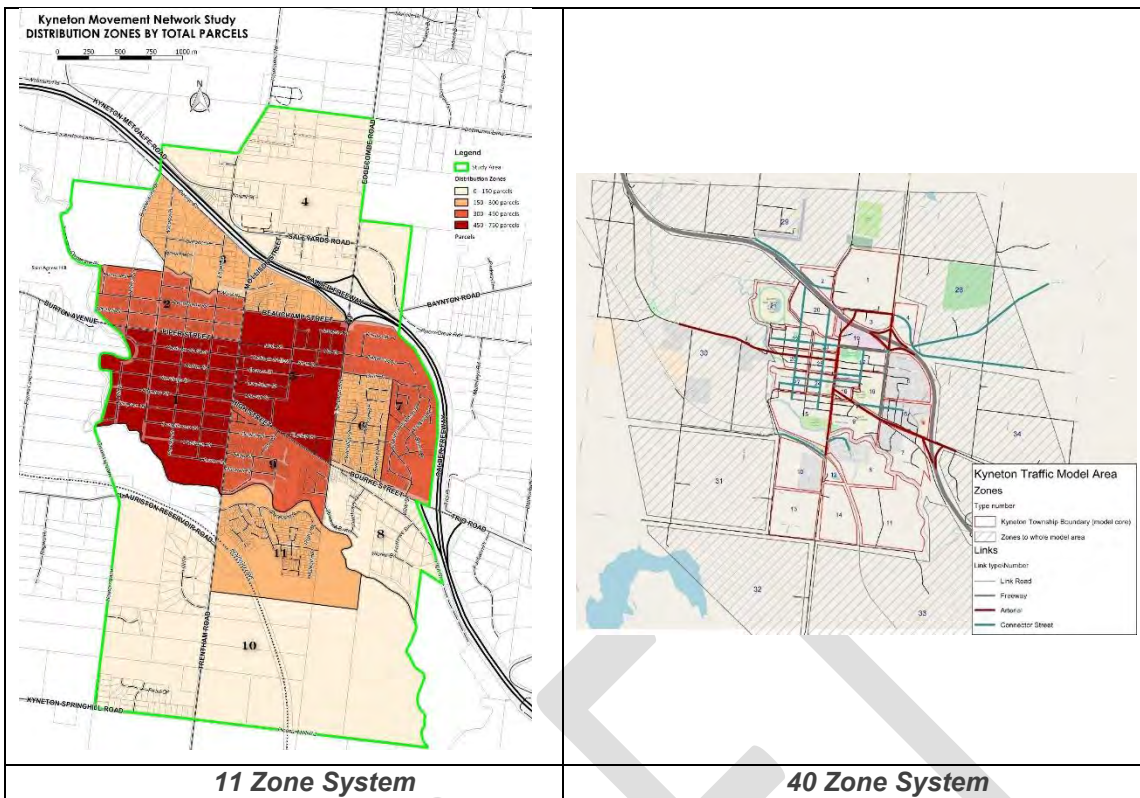


Figure 5-1: Kyneton Distribution Zones

Traffic generated within these zones is directly attributed to the number of active parcels for the Base/Active lots and Future Proposed lots detailed in Table 5-1 and Table 5-2 below.

Table 5-1: Base/Active lot distribution by planning zone

Traffic Zone	C1Z	C2Z	FZ	GRZ1	IN1Z	IN2Z	LDRZ	Total Parcels
1	106			569				675
2	48			283				331
3				95	63			158
4		1			74	8		83
5	129			451				580
6				274				274
7	9			325				334
8				40	16		18	74
9	43			249				292
10			24		4		55	83
11			1	136	1			138
Grand Total	335	1	25	2422	158	8	73	3022

Table 5-2: Future/Potential lot distribution by planning zone

Traffic Zone	C1Z	C2Z	FZ	GRZ1	IN1Z	IN2Z	LDRZ	Total Parcels
1	106			571				677
2	50			291				341
3				97	63			160
4		1			92	9		102
5	132			453				585
6				286				286
7	9			325				334
8				44	16		18	78
9	45			281				326
10			24	1800	4		55	1883
11			1	493	1			495
Grand Total	342	1	25	4641	176	9	73	5267

Key: Planning Zones

C1Z	Commercial Zone 1	IN1Z	Industrial Zone 1
C2Z	Commercial Zone 2	IN2Z	Industrial Zone 2
FZ	Farming	LDRZ	Low Density Residential
GRZ1	General Residential Zone 1		

Utilising the planning zone data, a refined land use table was prepared populating each of the 40 zones with the number of dwellings; employment and gross floor area for industry, retail, office and commercial uses; employment, enrolments for education uses; and other employment (hospital, aged care, sports facilities etc), for the base year 2016 and future year 2036 Transport Model.

5.2.2 Trip generation summary

This section gives a brief trip generation summary where the methodology of the trip generation process is detailed in the Transport Modelling Report in Appendix F. The table below illustrates the global model results for the AM peak hourly volumes per dwelling for Base Year (2016) and Future Year (2036) Transport Models.

Table 5-3: Base & Future Year Model Result Comparison

YEAR	1	2	3	4	5	6	7=(4+5)	8=(6+7)	9=(7/1)
	DWELLINGS	EMPLOYMENT INDUSTRY	TOTAL EMPLOYMENT	INTERNAL TRIPS	INTERNAL- EXTERNAL TRIPS	EXTERNAL- INTERNAL TRIPS	KYNETON RESIDENTS TRIPS	TOTAL KYNETON RELATED TRIPS	TRIPS/DWELL
2016	2265	1835	4084	1463	602	825	2064	2889	0.91
2036	3965	2982	5527	3026	841	1180	3868	5047	0.98
Ratio 36/16	1.75	1.63	1.35	2.07	1.40	1.43	1.87	1.75	1.07

The tabulated results are based on a 3-step model developed for Kyneton as follows:

- Step 1 – The Trip Generation Model calculates the amount of movement for basic travel purposes (work, shopping, education and other);
- Step 2 - The Trip Distribution model distributes these trips to zones in the model, depending on the dwellings and employment zone distribution; and
- Step 3 - The Trip Assignment model, distributes these trips to the road network.

5.3 Edgecombe Street Bridge background

In 2016 Council sought advice on preliminary investigations with regard to the optimal alignment and river crossing location for a second bridge over the Campaspe River. It is expected that where the river crossing connects back in to the Kyneton South Development Area road network, a suitably designed intersection treatment would be incorporated to best suit the traffic flow characteristics.

Funding avenues at this stage are still emerging and may consist of an infrastructure contribution plan, Council input, and assistance from the state government.

Investigative works are still currently underway to determine the preferred alignment/s and cost to deliver the second bridge over the Campaspe River.

5.4 Base case scenario 2016

The base case model was developed for the purpose of calibrating the transport model. The most up to date data has been incorporated to build the 2016 base case model. This scenario considers a pre-determined road network used within Kyneton to reach the main activity and service centers. The base model uses current land use figures, traffic count (peak hour) data, Industrial/Retail and Commercial employment figures plus school enrollments to create a representative, existing conditions transport model. The validity of the model is calculated based on the GEH statistic. For a more detailed explanation of the GEH statistic and model comparison results see Appendix G – Section 4.2.

5.5 Future scenario 2036

The transport model for the future scenario will forecast traffic growth up until 2036. It is envisaged that this forecast will coincide closely with the current 2013 Kyneton Structure Plan. Previous commercial and industrial land use studies to support the structure plan are still considered current due to marginal growth in these areas.

The number of dwellings are expected to grow by 2036, where the major development areas currently under investigation other than localised minor infill areas are; the Kyneton Development Plan Area (Zone 11); and the Kyneton South Investigation Area (Zone 10) see Figure 2-1: Draft Kyneton Movement Network Study area.

The future model will be based on residential growth of the Kyneton study area including the major developments mentioned above along with the associated demand for employment and education.

Council considered multiple land use scenarios and options to be tested in the future model to take into account partial and full development of the investigation area - along with the corresponding impact on the road network with or without the Edgecombe Street Bridge crossing.

These scenarios inform the Study of the most likely road network used, given increases in traffic volumes and the most realistic scenario to undertake detailed modeling and analysis.

5.5.1 Land Use Scenario 2

This scenario looks at testing the full growth of the Eastern and Western Neighborhoods which includes the Kyneton South Development Plan Area.

5.5.1.1 Option 3 – With Edgecombe Street Bridge: select model option for this study – Year 2036

Option 3 is the preferred model as it incorporates 78% of full development of the investigation area by 2036 and highlights the most likely road network used given the characteristics of the forecast traffic volumes. This option considers the existing and potential road network, as indicated in the draft Kyneton South Framework Plan (see Figure 4-8) with the inclusion of the Edgecombe Street Bridge crossing and an upgrade of the existing north-western link via Kyneton-Springhill/Harpers Lane and/or Lauriston-Reservoir Road and Flynn's Lane to Burton Avenue. The model also takes into account that Council could (prior to the 2036 development level) implement Local Area Traffic Management (LATM) schemes in local access streets on the south-west side of High Street and to the west of Mollison Street.

Findings

- The two-way traffic volume over the Mollison Street Bridge is 1,029 vph (777 vehicles northbound and 252 vehicles southbound).
- The two-way traffic volume on the introduced Edgecombe Street Bridge is expected to carry 1,003 vph (655 vehicles northbound and 348 vehicles southbound).
- Flynn's Lane is expected to carry 267 vph two-way (220 vehicles northbound and 47 vehicles southbound).
- Mollison Street and Edgecombe Street (south of High Street) are approaching capacity with a volume to capacity ratio (V/C) of 0.81 and 0.89 respectively.
- Mollison Street between Saleyards Road and Beauchamp Street, Saleyards Road west of Edgecombe Street, and Edgecombe Road between Saleyards Road and Beauchamp Street are experiencing high traffic volumes with a V/C Ratio of 0.68, 0.62, and 0.77 respectively.

- These modelled traffic volumes will result in delays and queues at all major intersections within the Town Centre. This will also exacerbate the use of known rat-runs on local streets to avoid congestion in the Town Centre.
- Upgrades will be necessary for many existing intersections within the Town Centre to safely cater for the forecast traffic volume, however the existing road network is land constrained – see Section 6 Potential road infrastructure plan.

The transport model plot for this scenario showing the directional volumes on the road network can be viewed in Appendix C of the Transport Modelling report.

5.5.1.2 Option 5 – Without Edgecombe Street Bridge – Year 2031

This option considers the existing and proposed road network, as indicated in the draft Kyneton South Framework Plan (see Figure 4-8) without the Edgecombe Street Bridge crossing and an upgrade of the existing north-western link via Kyneton-Springhill Road/Harpers Lane and/or Lauriston-Reservoir Road and Flynn’s Lane to Burton Avenue.

Findings

- The northbound one-way AM peak traffic volume of the Mollison Street Bridge is 1,150 vph (2031 volume), this is approximately 280 vph more than Option 3 analysis of 777 vph (2036). This volume of traffic is in excess of the one-way mid-block capacity of a standard traffic lane (900 vph adjacent to a parking lane).
- The northbound peak hour volume on Flynn’s Lane is 100 vph. It should be noted that at this point in time, development of the eastern neighborhood has not begun hence congestion on Mollison Street has not peaked which will in turn trigger increased usage of the alternate access route to the Town Centre via the north-western link.
- These modelled traffic volumes will result in longer delays and queues at an earlier stage at major intersections within the Town Centre. This will exacerbate the use of known rat-runs on local streets to avoid congestion in the Town Centre.
- Upgrades will be necessary for many existing intersections within the Town Centre to cater for the forecast traffic volume however the existing road network is land constrained – see Section 6 Potential road infrastructure plan.

The transport model plot for this scenario showing the directional volumes on the road network can be viewed in Appendix E of the Transport Modelling report.

5.5.2 Additional option: Land Use Scenario 2 – Option 3 Edgecombe Street Bridge trigger point determination

Holistically Council recognises that the need for the Edgecombe Street Bridge is integral to the Kyneton road network functioning with the predicted potential development. The bridge on its own will not however alleviate the over saturation on Mollison Street and major intersections within the Town Centre. Intersection upgrades in conjunction with the bridge crossing will be necessary to cope with full development and traffic generation thereof.

The purpose of this option is simply to determine the point in time at which lot numbers and annual traffic generation increases, oversaturate the existing road network and would trigger certain infrastructure requirements.

Table 5-4 below shows the volume to capacity (V/C) ratio on key roads in the study area. A V/C Ratio of (1) refers to a road that is at capacity.

Table 5-4: One-way AM peak Hour Volume to Capacity Ratio

Road Name	Future Year 2021 V/C Ratio		Future Year 2026 V/C Ratio		Future Year 2031 V/C Ratio	
	North/ Eastbound	South/ Westbound	North/ Eastbound	South/ Westbound	North/ Eastbound	South/ Westbound
Bourke St west of Caroline Chisholm Dr	0.20	0.27	0.20	0.26	0.18	0.25
High St West of Ferguson St	0.45	0.43	0.50	0.43	0.55	0.42
Campaspe Dr east of Mollison St	0.15	0.63	0.24	0.97	0.32	1.15
Trentham Rd south of Railway Line	0.30	0.28	0.32	0.26	0.57	0.21
Mollison St north of Railway Line	0.21	0.18	0.23	0.17	0.36	0.14
Mollison St north of Campaspe Dr	0.72	0.29	1.01	0.36	1.28	0.39
Mollison St south of Piper St	0.35	0.33	0.42	0.36	0.56	0.38
Mollison St north of Piper St	0.39	0.28	0.49	0.30	0.60	0.31
Mollison St south of Saleyards Rd	0.40	0.20	0.54	0.23	0.69	0.26

Findings

Future Year 2021:

- All key arterial roads in Table 5-4 apart from Campaspe Drive and Mollison Street north of Campaspe Drive have a V/C Ratio less than 0.45; and
- Campaspe Drive westbound lane and Mollison Street northbound lane as described above have a V/C Ratio of 0.63 and 0.72 respectively.

Future Year 2026:

- All key arterial roads in Table 5-4 apart from Campaspe Drive and Mollison Street north of Campaspe Drive have a V/C Ratio less than 0.55; and

- Campaspe Drive westbound lane and Mollison Street northbound lane as described above have a V/C Ratio of 0.97 (close to capacity) and 1.01 (over capacity) respectively.

Future year 2031:

- All key arterial roads in Table 5-4 apart from Campaspe Drive, Mollison Street north of Campaspe Drive and Mollison Street between Piper Street and Saleyards Road have a V/C Ratio less than 0.60; and
- Campaspe Drive westbound lane and Mollison Street northbound lane as described above are over capacity with a v/c ratio of 1.15 and 1.28 respectively. Mollison Street has a V/C Ratio between 0.60 and 0.69.

In conclusion of the findings, it is recommended that the Edgecombe Street Bridge, be constructed well before year 2026 or in conjunction with the construction of the 850th residential lot within the investigation area. This is to avoid any of the key roads exceeding their capacity.

5.5.3 Additional Option: Land Use Scenario 2 – Option 3a Calder Freeway northbound entry ramp

Further analysis was undertaken in order to protect Edgecombe Street from congestion, speeding and general rat-running. This road provides access to businesses, private residences and a school precinct.

The analysis involved modelling the network effect utilising the Option 3 scenario with the addition of a northbound entry ramp at the Bourke Road Interchange – Option 3a.

In summary the analysis determined that the northbound ramp to the Calder Freeway would carry around 95 vph during the AM Peak hour period. The addition of the ramp, works in reducing the peak hour volumes expected on Edgecombe Street from 366 to 317 vph. These figures don't build a strong business case for the inclusion of an additional ramp.

An additional option, 3b looked to implement an LATM treatment along Edgecombe Street with the aim of reducing the average travel speed to between 20 and 25 km/h. This combination works at reducing the traffic volume on Edgecombe Street to 79 vph while increasing the utilisation of the northbound on-ramp to the Calder to 268 vph.

This combination is considered the preferred option given further investigation and planning to determine feasibility. Figures 5.2 and 5.3 below compare the 2036 one-way AM Peak Hour network traffic volumes for Option 3a and 3b.

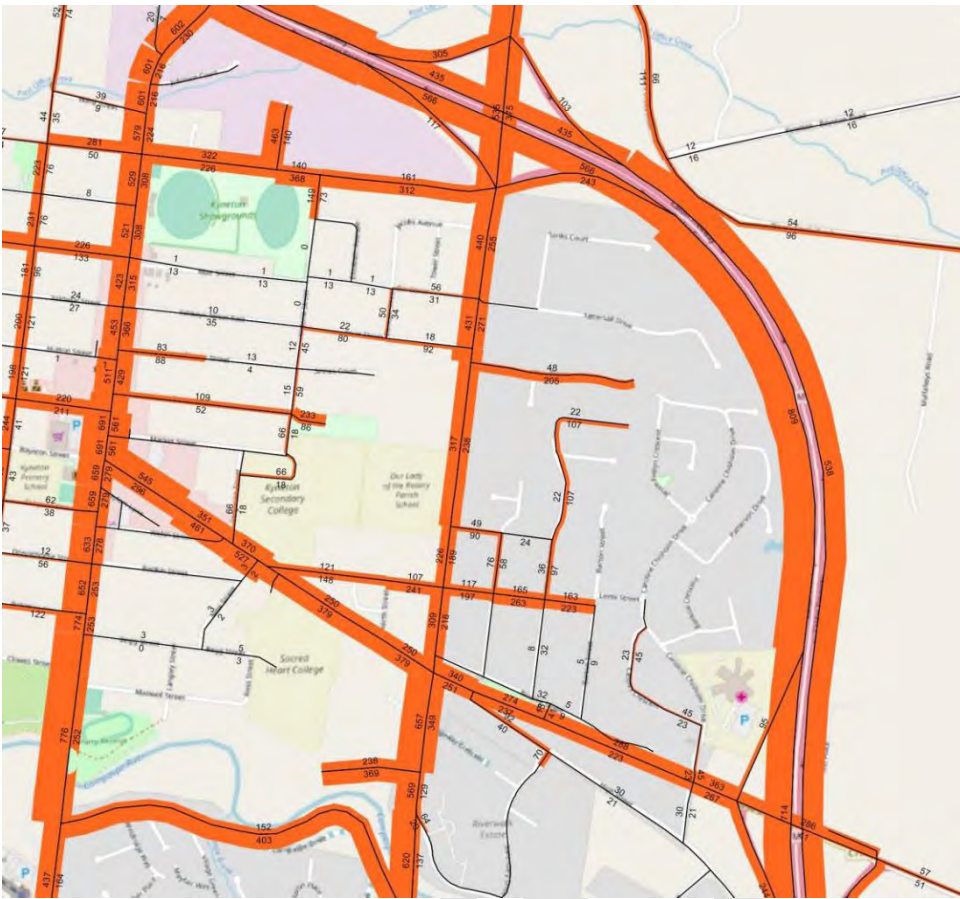


Figure 5-2: Option 3a one-way traffic volumes 2036

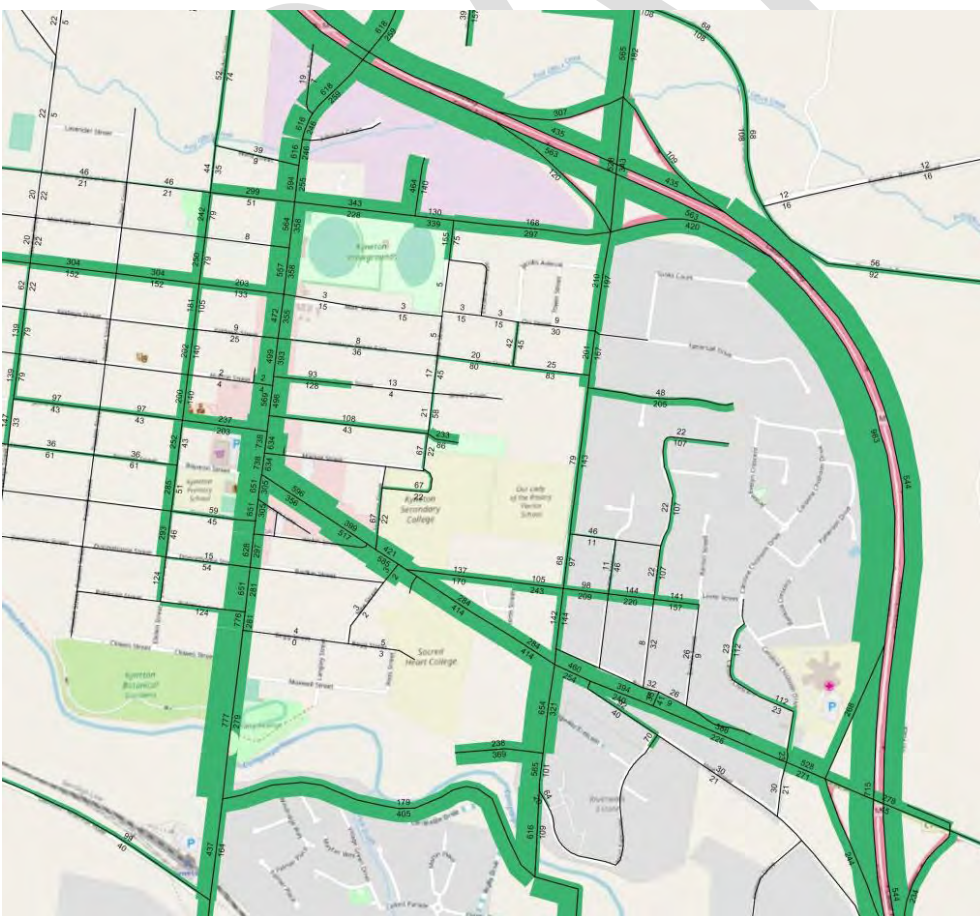


Figure 5-3: Option 3b one-way traffic volumes 2036

5.6 Existing 2016 and future 2036 traffic volume comparison

The following tables are extracted from the Kyneton Transport Modelling report and compare the Base Case and potential Future Scenario – Option 3 traffic volumes that may be experienced in the Kyneton Study Area and the new internal road network in the investigation area. Further detail can be read in Appendix G

Table 5-5: Existing 2016 and future 2036 traffic volume comparison

Road Name	Two-way AM Peak Hour Traffic Volume		Ratio 2036 to 2016	Future Year 2036 Traffic Volume (vehicle s/ day)	Expected Road Capacity (vehicles/ day)	Capacity Exceeded (Yes/ No)
	Base Year 2016	Future Year 2036				
Beauchamp St west of Edgecombe St	272	421	1.55	4,680	3,000 - 7,000	N
Beauchamp St west of Mollison St	77	333	4.32	3,700	3,000 - 7,000	N
Bourke St west of Caroline Chisholm Dr	588	477	0.81	5,300	7,000 – 18,000	N
Burton Av south of Calder Freeway*	207	299	1.44	3,330	7,000 – 18,000	N
Campaspe Dr east of Mollison St	84	558	6.64	6,200	3,000 - 7,000	N
Edgecombe St north of Epping St	394	603	1.53	6,700	3,000 - 7,000	N
Epping St	201	347	1.73	3,860	3,000 - 7,000	N
High St East of Mollison St	602	886	1.47	9,850	7,000 – 18,000	N
Trentham Road south of Railway Line	268	481	1.79	5,350	7,000 – 18,000	N
Mollison St north of Campaspe Dr	281	1029	3.66	11,440	7,000 – 18,000	N
Mollison St north of High St	650	1293	1.99	14,370	7,000 – 18,000	N
Mollison St South of High St	336	943	2.81	10,480	7,000 – 18,000	N
Mollison St north of Piper St	418	825	1.97	9,170	7,000 – 18,000	N
Mollison St south of Saleyards Rd	284	851	3.00	9,460	7,000 – 18,000	N
Piper St west of Mollison St	288	496	1.72	5,520	7,000 – 18,000	N
Saleyards Rd west of Mollison St	201	490	2.44	5,450	3,000 - 7,000	N
Saleyards Rd west of Edgecombe Rd	244	755	3.09	8,390	7,000 – 18,000	N
Edgecombe Rd south or Saleyards Rd	331	795	2.40	8,840	7,000 – 18,000	N
Flynn's Lane	11	267	24.27	2,970	500 – 1,000	Y
Lauriston Reservoir Rd East of Flynn's Lane	80	247	3.09	2,750	500 - 1,000	Y
Lauriston Reservoir Rd west of Trentham Rd	87	140	1.61	1,560	500 - 1,000	Y
Harpers Lane	43	327	7.60	3,640	50 - 200	Y
Kyneton-Springhill Road	43	228	5.30	2,540	500 - 1,000	Y
Pleasant Hill Road	8	142	17.75	1,580	50 - 200	Y

Road Name	Two-way AM Peak Hour Traffic Volume		Ratio 2036 to 2016	Future Year 2036 Traffic Volume (vehicle s/ day)	Expected Road Capacity (vehicles/ day)	Capacity Exceeded (Yes/ No)
	Base Year 2016	Future Year 2036				
Edgecombe St south of High St	19	1,003	52.79	11,150	3,000 - 7,000	Y
Trentham Rd south of Kyneton-Springhill Rd	173	219	26.59	2,435	7,000 – 18,000	N
Calder Freeway south-east of Edgecombe St.	927	1,243	1.34	13,820	< 44,000	N
Calder Freeway south-east of Bourke St.	1,232	1,734	1.41	19,270	< 44,000	N

*VicRoads have advised Council that land has been set aside for a full diamond interchange of the Calder Freeway / Burton Avenue intersection.

Table 5-6: Kyneton South Investigation Area - internal road network classification

Road Name	Future Year 2036 Two-way AM Peak Hour Traffic Volume	Future Year 2036 Traffic Volume (vehicles/ day)	Expected Road Capacity (vehicles/ day)	Road Classification
Edgecombe St Extension between Campaspe River and Pleasant Hill Rd	715	7,950	6,000 – 12,000	Connector Street Level 2
East West Connector Street within the Kyneton South Investigation Area	450	5,000	2,500 - 6,000	Connector Street Level 1

6. Potential road infrastructure plan

This section highlights the infrastructure works required to assist in catering for the future 2036 traffic volumes on Kyneton’s road network. Any new infrastructure works that are initiated by Council are subject to implementation processes consisting of but not limited to: Environmental, and Urban Design assessments. Note that Appendix D contains a concise recommendations list from all areas of this study.

6.1 Potential recommendations

The cross referenced potential road infrastructure projects are listed in Table 6-1 below and diagrammatically represented in Figure 6-1. Refer to the Kyneton Transport Modelling Report Section 8 and the draft Kyneton South Framework Plan typical cross sections in Appendix B for more information on the potential recommendations.

Table 6-1: Potential road infrastructure and indicative costs

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
Existing road infrastructure upgrades						
2	Edgecombe Street upgrade btw High Street and Campaspe River	MRSC	Access for vehicular and pedestrian traffic and congestion	2 x 3.5m traffic lanes with additional 1.5m bicycle lanes	Prior to 2026 or the 850 th lot	\$840,000
4	Pleasant Hill Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2025-2032	\$525,000
5	Flynn’s Lane upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$1,235,000
6	Lauriston-Reservoir Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$1,270,000

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
7	Harpers Lane upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2032	\$1,310,000
8	Kyneton-Springhill Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$660,000
9	Trentham Road upgrade (C318)	VicRoads	Upgrade to safely cater for forecast traffic volumes	Subject to further investigation and planning to determine feasibility		
New road infrastructure						
1	Edgecombe Street Bridge over the Campaspe River	MRSC	Access for vehicular and pedestrian traffic and congestion	Subject to further investigation and planning to determine feasibility		
3	Edgecombe Street extension	MRSC	New road network	Combination of Figure 4 and consultant recommendation: 2 x 3.5m traffic lanes with additional 1.5m bicycle lanes separated by a 6.0m median for channelization at intersections and localised indented parking	2025	\$6,420,000
4	Pleasant Hill Road extension and overpass	MRSC	New road network	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2023-2032	\$3,320,000
10	East-West connector street	MRSC	New road network	Based on Figure 4 in Appendix B	2025	\$3,350,000
11	New/Bodkin and Begg Streets	MRSC	Rat-run and speeding issues	Road humps	2019-2020	\$35,000
11	Pohlman and Ebdon Streets	MRSC	Rat-run and speeding issues	Road humps	2036	\$60,000

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
11	McKenna Drive (KBG)	MRSC	Rat-run and speeding issues	Road humps	2019-2020	\$25,000
11	Edgecombe Street	MRSC	Combination treatment with Ref # 13 to reduce average travel speed and therefore increase utilisation of potential Calder on-ramp.	Road humps	Subject to further investigation and planning to determine feasibility	
13	Calder Interchange – Bourke Street	VicRoads	Congestion on Edgecombe Street	Northbound entry ramp	Subject to further investigation and planning to determine feasibility	
Intersection treatments						
N/A	Lauriston-Reservoir Road / Harpers Lane	MRSC	For safe and efficient operation of the intersection	Roundabout	2036-2041	\$150,000
12.a	High Street / Edgecombe Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.b	High Street / Epping Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.c	Saleyards Road / Edgecombe Road / Pipers Creek Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.d	Mollison Street / Saleyards Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.e	Mollison Street / Beauchamp Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.f	Mollison Street / Piper Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.g	Mollison Street / High Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
12.h	Mollison Street / Campaspe Drive	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.i	Trentham Road / Lauriston-Reservoir Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.j	Trentham road / East West Connector Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.k	Trentham Road / Pleasant Hill Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.l	Burton Avenue / Flynn's Lane	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.m	Piper Street / Ebdon Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
14	Mollison Street and Fergusson Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		

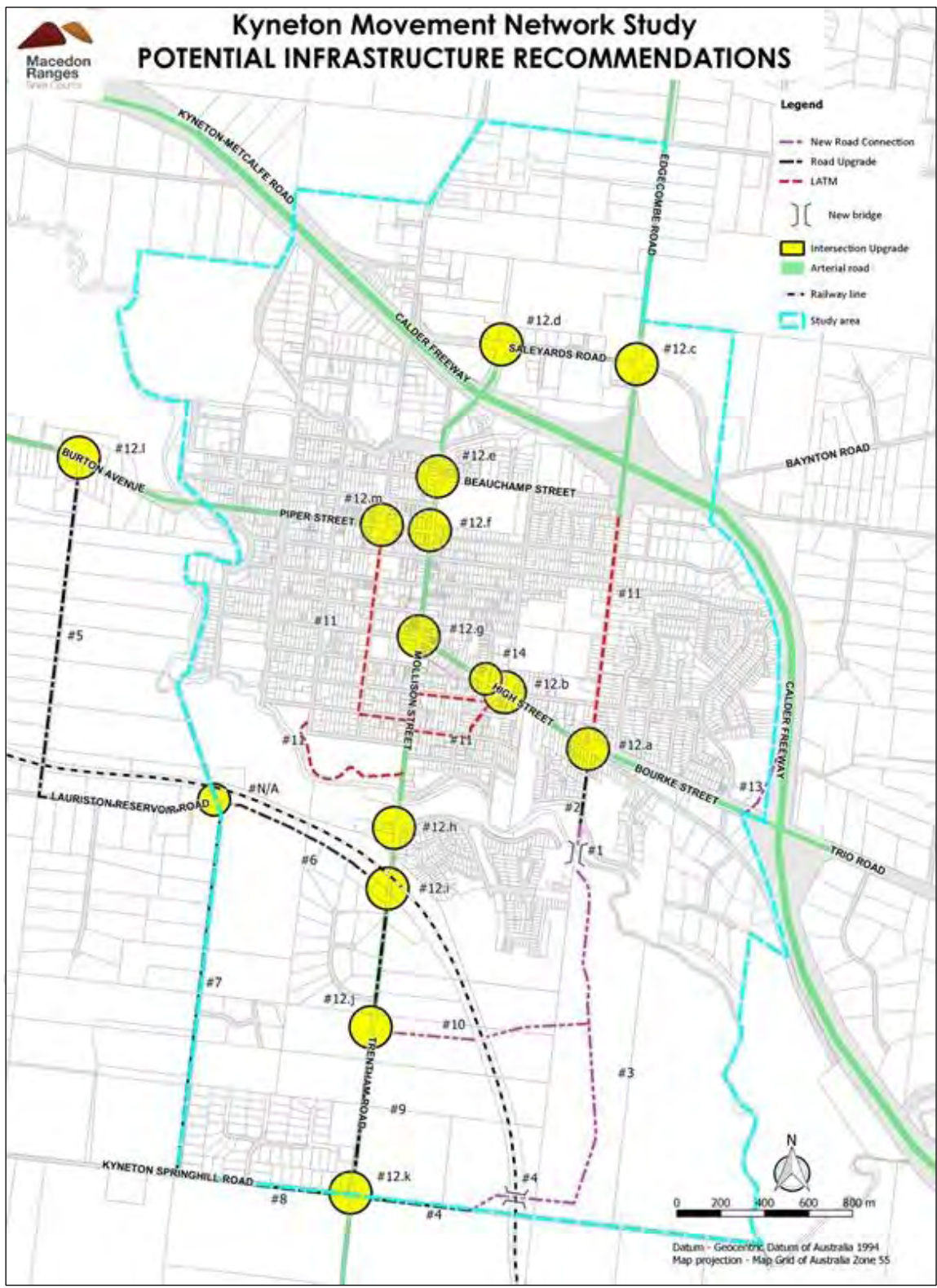


Figure 6-1: Potential infrastructure recommendations plan

7. Town Centre car parking

7.1 Summary of existing conditions

In January 2015 Council conducted a peak occupancy survey of on and off-street Council managed parking spaces in the Town Centre of Kyneton. Detailed tabulated results can be viewed in Table 7-1. In summary the survey yielded the following results:

Peak occupancy of on-street and off-street parking spaces.

- There are a total of 1251 car spaces.
- 725 of these spaces are located on-street (58%).
- 526 spaces are located off-street (42%)
- A variety of restrictions apply to the parking within the survey area, however there is no paid parking.

In order to identify typical peak conditions, detailed parking demand surveys were conducted in Kyneton on:

- Thursday 15th of January 2015 and Friday 16th of January 2015 between 9:00am and 5:00pm.
- Saturday 17th of January 2015 between 9:00am and 2:00pm.
- The surveys were conducted during school holidays.
- Thursday's and Saturday's weather condition was clear.
- Friday's weather condition was wet.

The average occupancy rate for Kyneton over the three consecutive days surveyed was found to be 52%. The overall peak time was observed to occur between 1.00pm and 2.00pm on Thursday/Friday and between 12.00pm and 1.00pm on Saturday (including both on-street and off-street parking).

The most critical areas surveyed for on-street parking with an average occupancy rate above 80% were observed to be:

- Bowen Street (A12) on Thursday, Friday and Saturday.
- Mollison Street (A20) on Thursday, Friday and Saturday.

The most critical area surveyed for off-street parking with an average occupancy rate above 80% was observed to be:

- Council Car Park 1 (A31) on Thursday and Friday.

The detailed Kyneton parking survey map below in Figure 7-1 depicts the area surveyed for on and off-street parking, the type of parking and restrictions applicable at the time of survey.

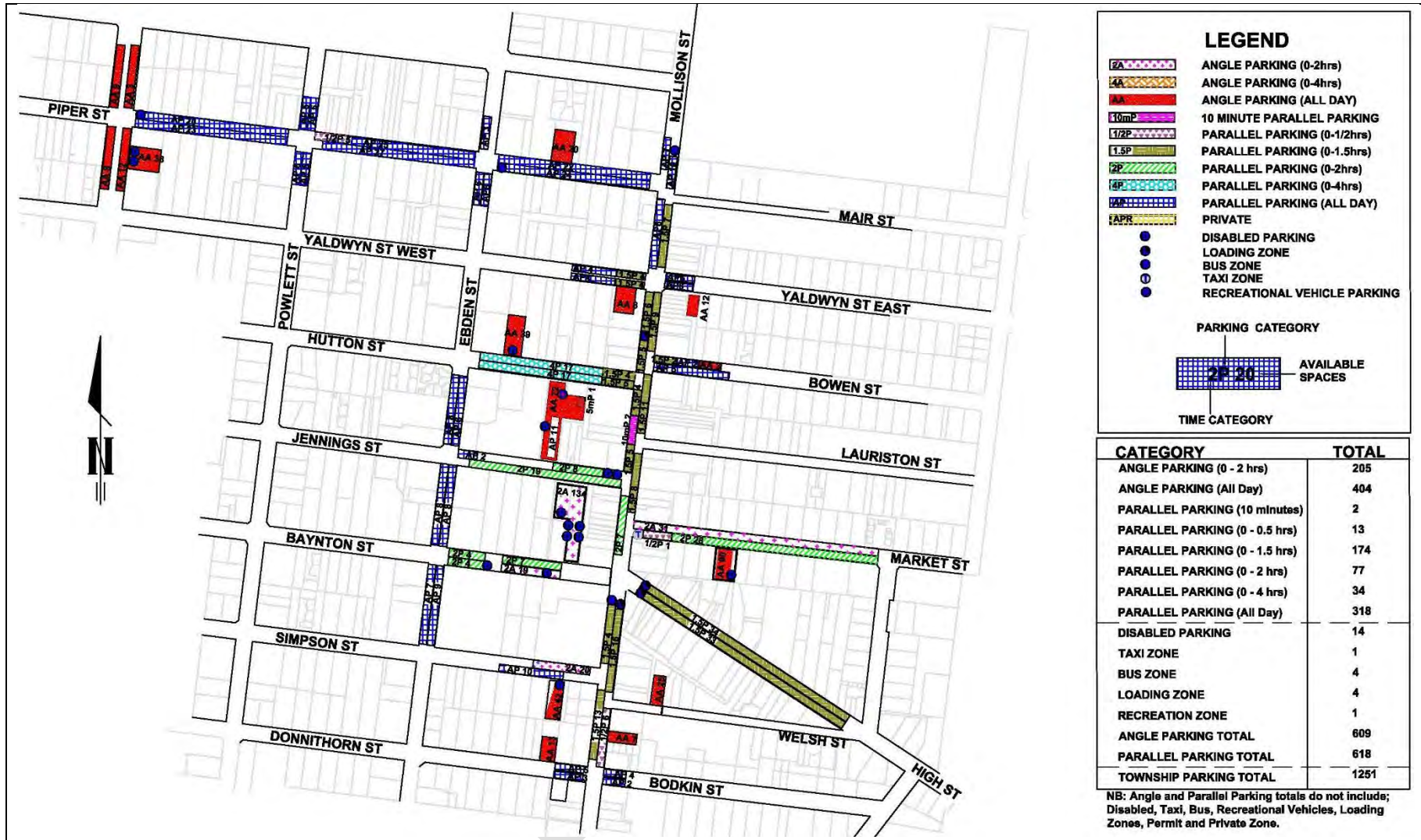


Figure 7-1: Kyneton parking survey map

Table 7-1: Kyneton parking survey demand table

STREET		THURSDAY			FRIDAY		SATURDAY	
ON-STREET	Total Capacity	Allocated Disabled Spaces	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate
A1 - WEDGE STREET	32		23%	47%	27%	38%	46%	72%
A2 - PIPER STREET	44		26%	39%	27%	39%	45%	52%
A3 - POWLETT STREET	21		57%	71%	52%	39%	75%	90%
A4 - PIPER STREET	57		59%	81%	55%	68%	67%	79%
A5 - EBDEN STREET	15		48%	67%	50%	80%	71%	87%
A6 - PIPER STREET	47		42%	55%	39%	45%	28%	45%
A7 - MOLLISON STREET	18		1%	6%	1%	6%	1%	6%
A8 - MOLLISON STREET	13		39%	62%	55%	77%	26%	46%
A9 - YALDWYN STREET WEST	16		16%	38%	15%	25%	6%	13%
A10 - YALDWYN STREET EAST	12		44%	58%	41%	75%	20%	50%
A11 - MOLLISON STREET	21		69%	81%	68%	76%	55%	71%
A12 - BOWEN STREET	12		96%	100%	94%	100%	87%	100%
A13 - HUTTON STREET	43		72%	93%	64%	81%	28%	33%
A14 - EBDEN STREET	14		35%	50%	34%	43%	16%	29%
A15 - MOLLISON STREET	22		69%	86%	73%	86%	74%	86%
A16 - JENNINGS STREET	31	1	71%	87%	67%	84%	65%	77%
A17 - EBDEN STREET	16		26%	50%	44%	50%	6%	6%

STREET			THURSDAY		FRIDAY		SATURDAY	
ON-STREET	Total Capacity	Allocated Disabled Spaces	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate
A18 - EBDEN STREET	16		25%	50%	8%	13%	18%	25%
A19 - BAYNTON STREET	36	2	60%	72%	57%	72%	69%	89%
A20 - MOLLISON STREET	15		85%	100%	88%	100%	95%	100%
A21 - MARKET STREET	62		69%	81%	63%	77%	50%	63%
A22 - HIGH STREET	69		59%	70%	66%	83%	53%	74%
A23 - MOLLISON STREET	22		51%	73%	59%	77%	55%	68%
A24 - SIMPSON STREET	30		32%	53%	13%	20%	16%	23%
A25 - MOLLISON STREET	19		39%	74%	51%	74%	49%	63%
A26 - DONNITHORN STREET	8		67%	100%	47%	63%	53%	88%
A27 - BODKIN STREET	14		69%	79%	75%	86%	27%	36%
A28 - EMPORIUM	40	2	14%	18%	12%	15%	9%	13%
A29 - ART GALLERY	20		21%	25%	16%	25%	9%	10%
A30 - REAL ESTATE AGENT	8		77%	88%	56%	75%	25%	38%
A31 - COUNCIL CAR PARK 1	86	2	94%	99%	90%	98%	39%	45%
A32 - COUNCIL CAR PARK 2	40	1	64%	73%	54%	63%	0%	0%

STREET		THURSDAY			FRIDAY		SATURDAY	
ON-STREET	Total Capacity	Allocated Disabled Spaces	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate	Average Occupancy Rate	Peak Occupancy Rate
A33 - VET CAR PARK	12		58%	75%	58%	75%	33%	50%
A34 - WOOLWORTHS CAR PARK	139	5	76%	89%	78%	85%	71%	86%
A35 - SHOP CAR PARK	90		59%	63%	58%	67%	22%	32%
A36 - SHOP CAR PARK	43	1	61%	70%	37%	47%	38%	53%
A37 - SHOP CAR PARK	28		33%	50%	51%	79%	23%	29%
A38 - PUB CAR PARK	13		33%	77%	28%	62%	15%	15%
A39 - SHOP CAR PARK	7		36%	43%	45%	57%	46%	71%

DRAFT

7.2 Car parking issues and opportunities

7.2.1 Parking for people with disabilities

Kyneton is expected to see population growth in all age groups (see Figure 7-2), reinforcing the need for compliant disability parking spaces.

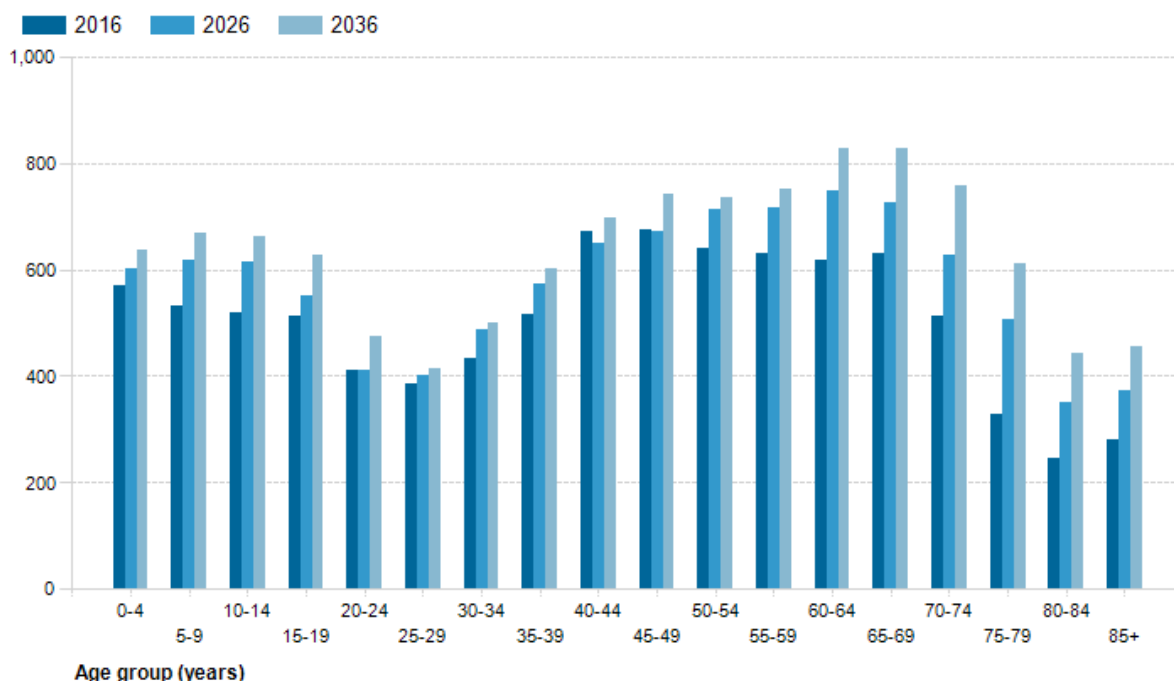


Figure 7-2: Kyneton District - forecast age structure (.id the population experts, 2017)

In 2016 Council undertook a survey of all on and off-street disability parking spaces in Kyneton. The results from this survey highlighted 22 disability parking spaces (4 on-street, 18 off-street), where all were non-compliant with today's standards. Typical shortfalls in compliance were missing signage, no pavement markings, adverse crossfall and inadequate dimensions of parking bays.

7.2.2 Kyneton Community Park

South of the Town Centre is the Kyneton Community Park. This is a nature-based play space contained within the Kyneton Botanical Gardens on Mollison Street. The park provides activities and spaces for people of all ages to picnic, celebrate, exercise and play and was officially opened in June 2017.

The botanical gardens site is covered by an Environmental Significance Overlay which creates difficulties in modifying existing road infrastructure to provide formalised onsite parking. With the anticipated numbers of visitors to the area expected to increase there may be a requirement for improvements in accessibility for pedestrians, cyclists and vehicles.

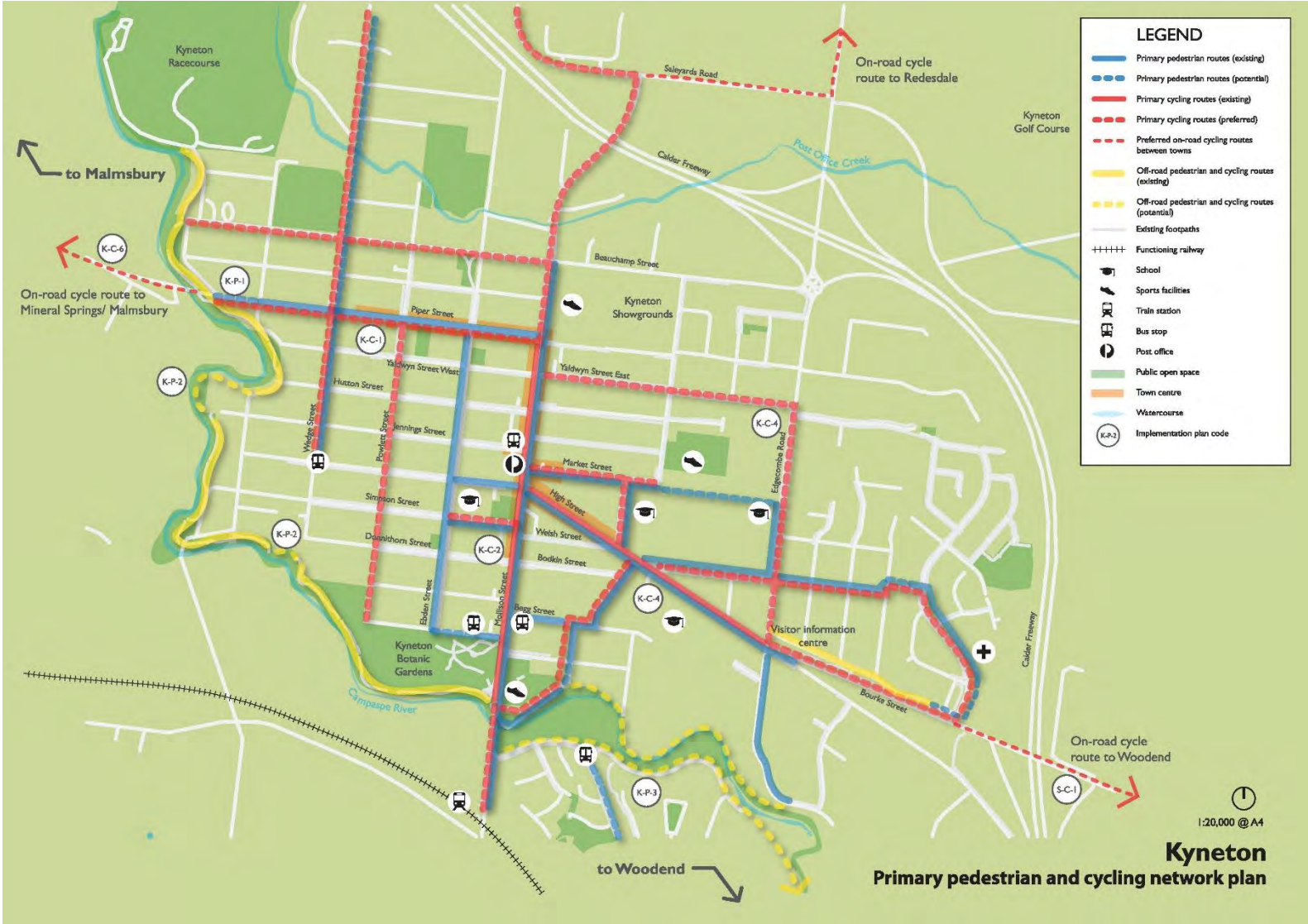
7.3 Potential Kyneton parking action plan

Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Ensure DDA compliance of disability parking spaces in Town Centre.	MRSC Engineering, Operations	22 DDA compliant disability parking spaces.
2.0	Look at opportunities to increase and formalise on-road parking and access surrounding the Botanical gardens.	<ul style="list-style-type: none"> Advocate for a shared path to be high priority. Prepare business case for formalised parking and road widening for FY 19/20. 	<ul style="list-style-type: none"> Constructed shared path on south side of Clowes Street from Mollison to Ebden Street Potential to develop formalised on-street parking on south side of Clowes Street.
3.0	Kyneton township site specific parking restrictions.	MRSC Engineering, Operations	Uniformity of parking restrictions with the intention of creating desirable vehicle turnover to meet business demand.
4.0	Improved parking in Edgecombe Street education precinct.	MRSC Engineering, Operations	Outcome dependent on conducting a parking review of the precinct.
5.0	Improved station amenity, including parking, lighting, drainage, security and comms.	VicTrack	<ul style="list-style-type: none"> 100 extra sealed commuter car parks Improved safety via new car park lighting, CCTV and signage New site drainage with on-site Bioretention.

8. Works Cited

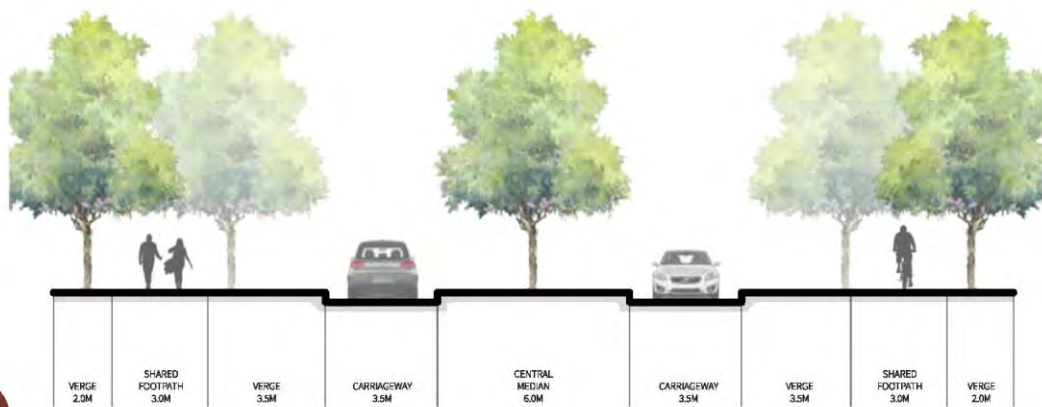
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Appendix A – Walking and Cycling Strategy 2014 network map



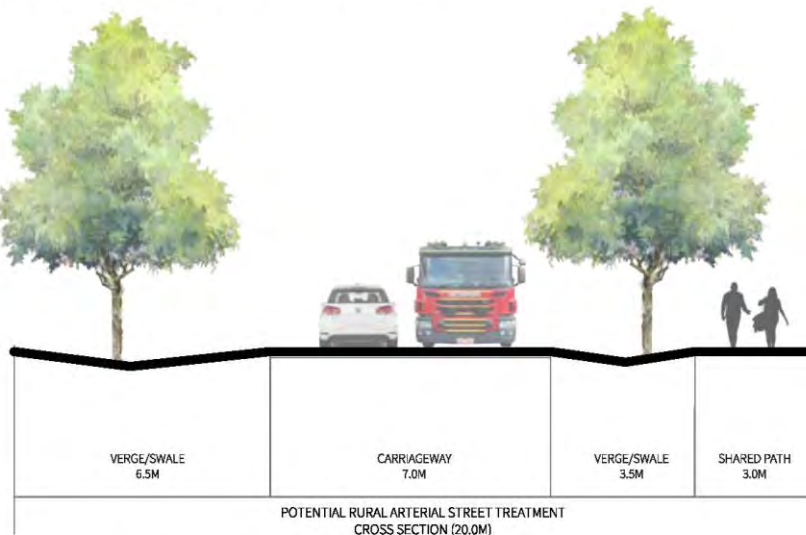
Appendix B – Draft Kyneton South Framework Plan - potential road cross sections

FIGURE 2: POTENTIAL TRENTHAM ROAD BOULEVARD ARTERIAL CROSS SECTION



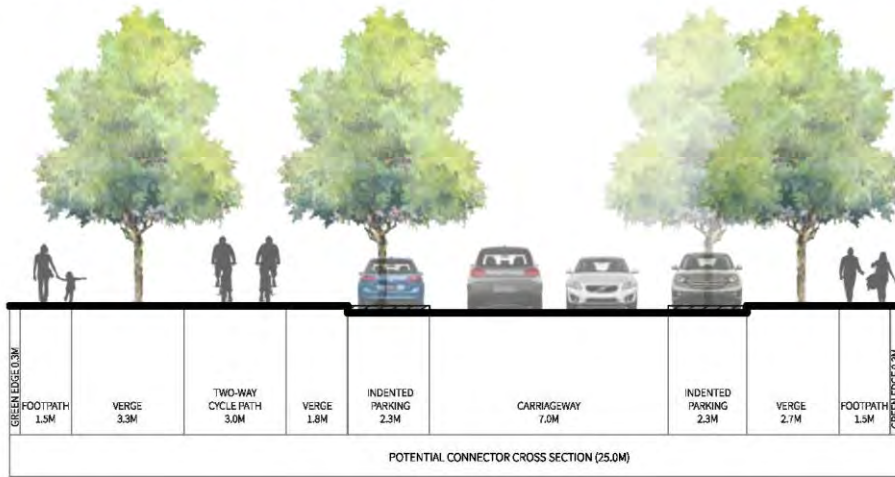
26

FIGURE 3: POTENTIAL RURAL ARTERIAL ROAD CROSS SECTION



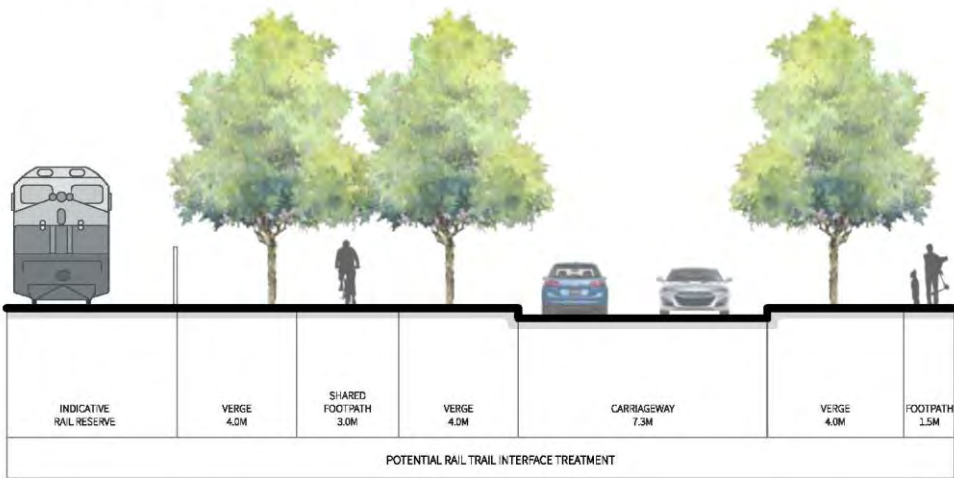
MACEDON RANGES SHIRE COUNCIL

FIGURE 4: POTENTIAL CONNECTOR STREET CROSS SECTION

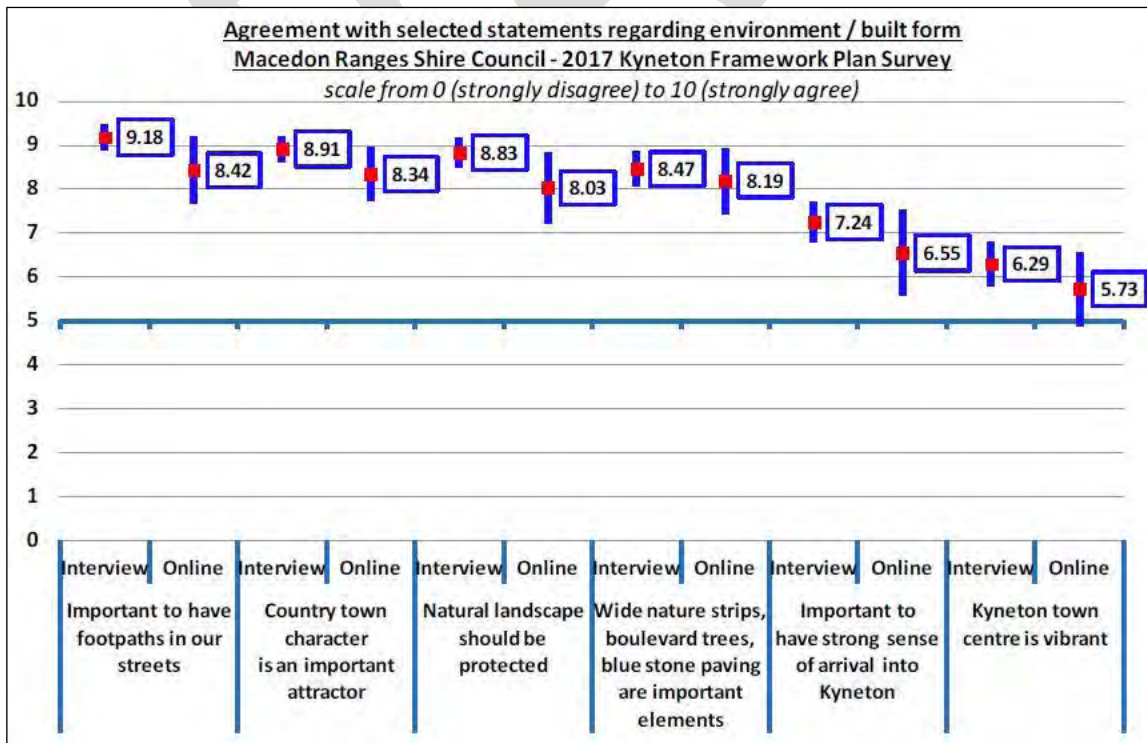
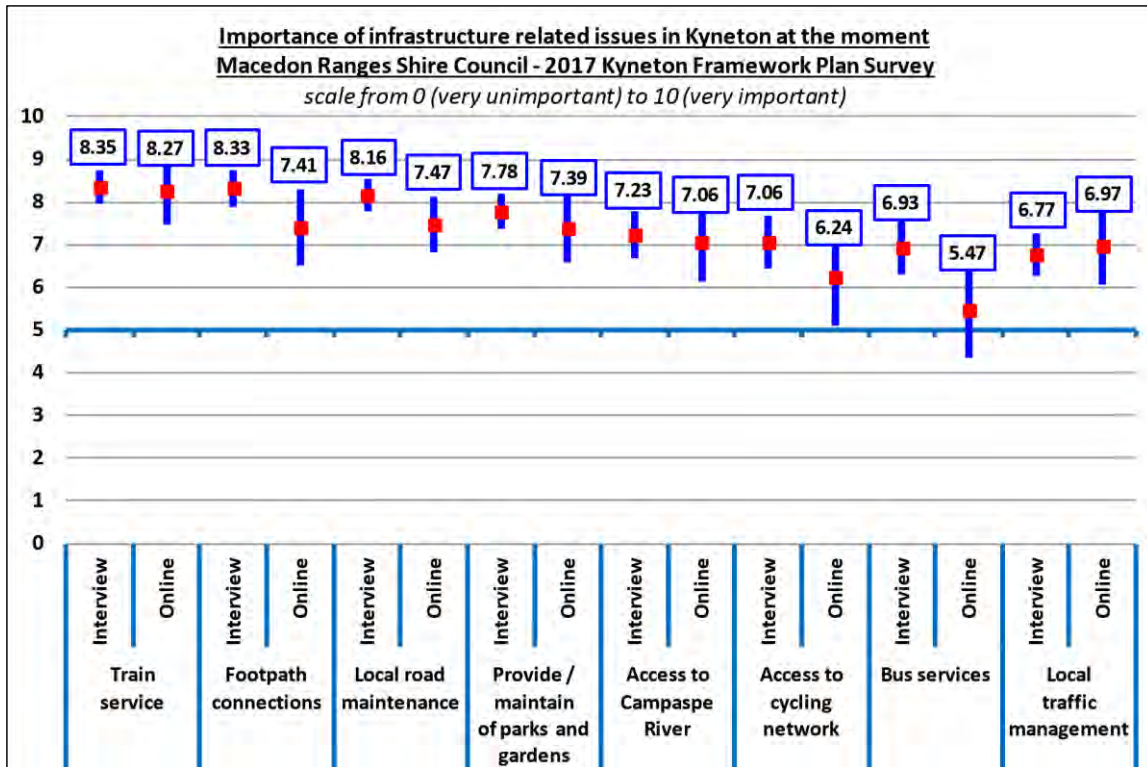


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FIGURE 5: POTENTIAL RAIL TRAIL INTERFACE STREET



Appendix C – Draft Kyneton South Framework Plan - survey tables



Appendix D – Summary of recommendations

D.1 Potential public transport action plan

	Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Improved station amenity, including parking, lighting, drainage, security and comms.	Victorian Government funded, VicTrack managed Kyneton Train Station upgrade was completed in late 2017.	VicTrack	<ul style="list-style-type: none"> • 100 extra sealed commuter car parks • Improved safety via new car park lighting, CCTV and signage • New site drainage with on-site Bioretention.
2.0	Transition to sustainable transport.	Advocate to public bus operators and state government to investigate a move towards more sustainable non fossil fuel forms of public transport. Currently the Andrews Labor Government is introducing Hybrid technology on 50 new buses across Melbourne.	MRSC Engineering	Reduction in greenhouse gas emissions. The Transport Sectors equates to 25% of all GHG emissions where bus operators contribute at least 2% of that (King & Hensher, 2006). Hybrid technology trials reduced fuel consumption by 30% with significant noise reduction during idling and departure.
3.0	Improve bus connectivity/services to key activity/service areas.	Work with PTV to advocate for periodic review of the public transport network in Kyneton to improve services and coordination of trains and buses. Engineering/Strategic Planning to ensure all new development areas are well serviced by public transport.	MRSC Engineering, Strategic Planning, PTV	Potential service to be circular in operation via clockwise and counter clockwise with peak time intervals of 10 to 20 minutes and to coordinate with train frequency.
4.0	Improved accessible transport options.	The CAIP 2014-2018 highlighted a requirement for an increase in taxi services. Council to advocate to PTV for suitable solutions.	MRSC, PTV	Potential adaption of the current bus network to a Flexi-Ride service or improved taxi services given enough demand. This later should include disability services being offered.
5.0	Improved safety and amenity of the existing rail crossing for pedestrians, cyclists and motor vehicles.	Advocate for investigation works into removing the level crossing.	MRSC Engineering, VicTrack, PTV, DELWP, LXRA	Improved traffic flow given future expected volumes coupled with potential frequency increases in Vline services to 20 minutes peak and 40 minutes off-peak.

D.2 Potential sustainable transport action plan

Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Improved amenity for sustainable transport modes (cycling).	Council initiative to provide on-street short-term storage facilities for cyclists accessing the Town Centre services in various locations. To be completed in FY 18/19.	Sports & Recreation, MRSC Engineering, Operations Increased cycle use can only be measured as part of “an integrated package of many different, complementary interventions, including infrastructure provision and pro-bicycle programs, supportive land use planning...” (Pucher, Dill, & Handy, 2010).
2.0	Growing urban commuting.	Work with Transport for Victoria (TFV) to review the SCC in Kyneton as part of the Victorian Cycling Strategy 2018-28.	MRSC, TFV, VicRoads A safer interconnected cycling corridor from residential Kyneton to the Town Centre and Railway Station.
3.0	Reduce reliance of Council Fleet on fossil fuels.	See Actions 3.1 – 3.7 in Council’s Climate Change Action Plan June 2017.	MRSC Zero net emissions by 2030-2031.
4.0	Improve pedestrian & cycling connectivity.	Review against the 10 year shire wide footpath CAPEX program, the 2014 Walking and Cycling Strategy and outcomes from the Macedon Ranges Shire Council Shared Trails Feasibility Study.	MRSC Engineering, Operations, Sports & Recreation Footpath asset expenditure of \$750k in FY 17/18. \$50k assigned to the Walking and Cycling Strategy in FY 18/19. The Shared Trails Feasibility Study is in the research phase.
5.0	Pedestrian/cycling connectivity from Kyneton South.	Advocate for the delivery of the Edgecombe Street Bridge from Campaspe Dr to Riverwalk Blvd.	MRSC Engineering, Strategic Planning Preferred bridge cross section consists of an 11.8m formation width that includes a 1.8m footpath/3.5m traffic lane/3.5m traffic lane/3m shared path.
6.0	Campaspe River Walk access improvements.	Council has completed three sections of the Campaspe River Walk that were endorsed by Council.	MRSC Engineering, Operations Key deliverables are: 1. Improved connection from Piper Street to the river walk 2. New section from the south end of Mill Street to the existing path at Wedge Street 3. New links and upgrade to the walkway from Campaspe Cr to the south end of Mill Street.

D.3 Potential road infrastructure plan

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
Existing road infrastructure upgrades						
2	Edgecombe Street upgrade btw High Street and Campaspe River	MRSC	Access for vehicular and pedestrian traffic and congestion	2 x 3.5m traffic lanes with additional 1.5m bicycle lanes	Prior to 2026 or the 850 th lot	\$840,000
4	Pleasant Hill Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2025-2032	\$525,000
5	Flynn's Lane upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$1,235,000
6	Lauriston-Reservoir Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$1,270,000
7	Harpers Lane upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2032	\$1,310,000
8	Kyneton-Springhill Road upgrade	MRSC	Upgrade to safely cater for forecast traffic volumes	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2036-2041	\$660,000
9	Trentham Road upgrade (C318)	VicRoads	Upgrade to safely cater for forecast traffic volumes	Subject to further investigation and planning to determine feasibility		
New road infrastructure						
1	Edgecombe Street Bridge over the Campaspe River	MRSC	Access for vehicular and pedestrian traffic and congestion	Subject to further investigation and planning to determine feasibility		

Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
3	Edgecombe Street extension	MRSC	New road network	Combination of Figure 4 and consultant recommendation: 2 x 3.5m traffic lanes with additional 1.5m bicycle lanes separated by a 6.0m median for channelization at intersections and localised indented parking	2025	\$6,420,000
4	Pleasant Hill Road extension and overpass	MRSC	New road network	Combination of Figure 3 in Appendix B and MRSC standard rural road cross section (7.6m carriageway)	2023-2032	\$3,320,000
10	East-West connector street	MRSC	New road network	Based on Figure 4 in Appendix B	2025	\$3,350,000
11	New/Bodkin and Begg Streets	MRSC	Rat-run and speeding issues	Road humps	2019-2020	\$35,000
11	Pohlman and Ebdon Streets	MRSC	Rat-run and speeding issues	Road humps	2036	\$60,000
11	McKenna Drive (KBG)	MRSC	Rat-run and speeding issues	Road humps	2019-2020	\$25,000
11	Edgecombe Street	MRSC	Combination treatment with Ref # 13 to reduce average travel speed and therefore increase utilisation of potential Calder on-ramp.	Road humps	Subject to further investigation and planning to determine feasibility	
13	Calder Interchange – Bourke Street	VicRoads	Congestion on Edgecombe Street	Northbound entry ramp	Subject to further investigation and planning to determine feasibility	
Intersection treatments						
N/A	Lauriston-Reservoir Road / Harpers Lane	MRSC	For safe and efficient operation of the intersection	Roundabout	2036-2041	\$150,000
12.a	High Street / Edgecombe Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.b	High Street / Epping Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		

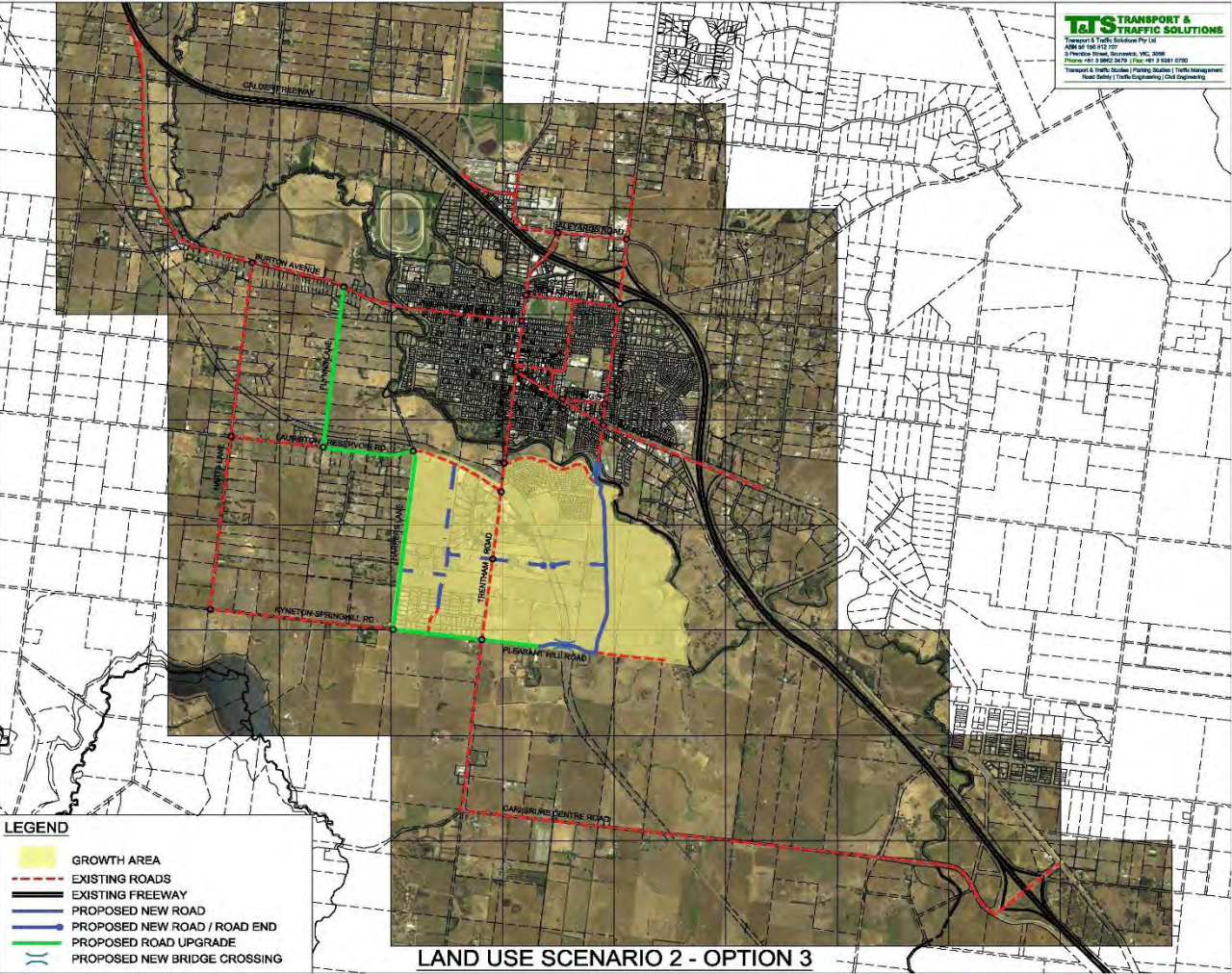
Ref #	Location	Authority	Identified issues and trigger	Potential treatment	Timeframe	Est. Cost
12.c	Saleyards Road / Edgecombe Road / Pipers Creek Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.d	Mollison Street / Saleyards Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.e	Mollison Street / Beauchamp Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.f	Mollison Street / Piper Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.g	Mollison Street / High Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.h	Mollison Street / Campaspe Drive	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.i	Trentham Road / Lauriston-Reservoir Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.j	Trentham road / East West Connector Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.k	Trentham Road / Pleasant Hill Road	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.l	Burton Avenue / Flynn's Lane	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
12.m	Piper Street / Ebdon Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		
14	Mollison Street and Fergusson Street	VicRoads	For safe and efficient operation of the intersection	Subject to further investigation and planning to determine feasibility		



D.4 Potential Kyneton parking action plan







	Focus	Actions	Responsibility	Potential measurable outcomes
1.0	Ensure DDA compliance of disability parking spaces in Town Centre.	Prepare capital works delivery plan from 2015 survey and determine funding opportunities.	MRSC Engineering, Operations	22 DDA compliant disability parking spaces.
2.0	Look at opportunities to increase and formalise on-road parking and access surrounding the Botanical gardens.	<ul style="list-style-type: none"> Advocate for a shared path to be high priority. Prepare business case for formalised parking and road widening for FY 19/20. 	MRSC Engineering, Operations	<ul style="list-style-type: none"> Constructed shared path on south side of Clowes Street from Mollison to Ebden Street Potential to develop formalised on-street parking on south side of Clowes Street.
3.0	Kyneton township site specific parking restrictions.	Conduct a review of the existing restrictions (Figure 7-1) in relation to concentration of business and the inherent parking use characteristics.	MRSC Engineering, Operations	Uniformity of parking restrictions with the intention of creating desirable vehicle turnover to meet business demand.
4.0	Improved parking in Edgecombe Street education precinct.	Review current parking trends and forecast potential parking issues/requirements.	MRSC Engineering, Operations	Outcome dependent on conducting a parking review of the precinct.
5.0	Improved station amenity, including parking, lighting, drainage, security and comms.	Victorian Government funded, VicTrack managed Train Station upgrade completed late 2017.	VicTrack	<ul style="list-style-type: none"> 100 extra sealed commuter car parks Improved safety via new car park lighting, CCTV and signage New site drainage with on-site Bioretention.

Appendix E – Land Use Scenario 2 - Option 3 road network









Appendix F – Turning Movement Survey Data October 2017

Date: 9/10/2017

		Movement						Total
		Saleyards Road West Leg		Mollison Street South Leg		Saleyards Road East Leg		
								
Time Period	1	2	3	4	5	6		
8:00 - 9:00am	Car	29	66	43	53	21	90	302
	Commercial*	7	6	6	2	5	8	34
	Total	36	72	49	55	26	98	336
	%CV	10.7%	21.4%	14.6%	16.4%	7.7%	29.2%	
3:00 - 4:00pm	Car	45	90	92	66	30	65	388
	Commercial*	6	3	4	2	5	18	38
	Total	51	93	96	68	35	83	426
	%CV	12.0%	21.8%	22.5%	16.0%	8.2%	19.5%	







* ≥ Class 3, AustRoads 94

Date: 12/10/2017

		Movement						Total
		Mollison Street North Leg		Mollison Street South Leg		High Street East Leg		
								
Time Period	1	2	3	4	5	6		
8:00 - 9:00am	Car	168	111	100	139	222	72	812
	Commercial*	10	10	6	13	18	5	62
	Total	178	121	106	152	240	77	874
	%CV	20.4%	13.8%	12.1%	17.4%	27.5%	8.8%	
3:00 - 4:00pm	Car	196	165	121	169	269	64	984
	Commercial*	10	7	1	5	9	2	34
	Total	206	172	122	174	278	66	1018
	%CV	20.2%	16.9%	12.0%	17.1%	27.3%	6.5%	







* ≥ Class 3, AustRoads 94

Date: 12/10/2017














		Movement						
		Mollison Street North Leg		Mollison Street South Leg		Campaspe Dr East Leg		
		 1	 2	 3	 4	 5	 6	
Time Period								Total
8:00 - 9:00am	Car	14	152	2	191	44	5	408
	Commercial*	0	11	1	14	0	0	26
	Total	14	163	3	205	44	5	434
	%CV	3.2%	37.6%	0.7%	47.2%	10.1%	1.2%	
3:00 - 4:00pm	Car	49	163	7	159	39	7	424
	Commercial*	0	11	0	6	0	0	17
	Total	49	174	7	165	39	7	441
	%CV	11.1%	39.5%	1.6%	37.4%	8.8%	1.6%	

* ≥ Class 3, AustRoads 94














Date: 9/10/2017

		Movement						
		High Street West Leg		Mollison Street East Leg		Epping Street East Leg		
		 1	 2	 3	 4	 5	 6	
Time Period								Total
8:00 - 9:00am	Car	67	235	13	349	64	13	741
	Commercial*	3	19	0	20	0	0	42
	Total	70	254	13	369	64	13	783
	%CV	8.9%	32.4%	1.7%	47.1%	8.2%	1.7%	
3:00 - 4:00pm	Car	126	281	6	376	67	18	874
	Commercial*	2	28	0	14	0	0	44
	Total	128	309	6	390	67	18	918
	%CV	13.9%	33.7%	0.7%	42.5%	7.3%	2.0%	


















* ≥ Class 3, AustRoads 94

Date		10/10/2017												Movement	
		Piper Street West Leg			Mollison Street South Leg			Mair Street East Leg			Mollison Street North Leg				
															
Time Period		1	2	3	4	5	6	7	8	9	10	11	12	Total	
8:00 - 9:00am	Car	46	6	152	102	119	16	30	6	2	1	201	45	726	
	Commercial*	2	0	8	5	7	0	1	0	0	1	17	5	46	
	Total	48	6	160	107	126	16	31	6	2	2	218	50	772	
	%CV	6.2%	0.8%	20.7%	13.9%	16.3%	2.1%	4.0%	0.8%	0.3%	0.3%	28.2%	6.5%		
3:00 - 4:00pm	Car	53	3	95	114	171	18	11	2	2	4	165	71	709	
	Commercial*	4	0	3	1	5	0	0	0	0	0	9	10	32	
	Total	57	3	98	115	176	18	11	2	2	4	174	81	741	
	%CV	7.7%	0.4%	13.2%	15.5%	23.8%	2.4%	1.5%	0.3%	0.3%	0.5%	23.5%	10.9%		














* ≥ Class 3, AustRoads 94

Date		13/10/2017												Movement	
		Beauchamp Street West Leg			Mollison Street South Leg			Beauchamp Street East Leg			Mollison Street North Leg				
															
Time Period		1	2	3	4	5	6	7	8	9	10	11	12	Total	
8:00 - 9:00am	Car	3	8	30	7	68	78	9	80	24	1	19	149	476	
	Commercial*	0	1	0	0	3	9	2	3	4	1	0	9	32	
	Total	3	9	30	7	71	87	11	83	28	2	19	158	508	
	%CV	0.6%	1.8%	5.9%	1.4%	14.0%	17.1%	2.2%	16.3%	5.5%	0.4%	3.7%	31.1%		
3:00 - 4:00pm	Car	12	7	28	11	100	152	27	114	36	5	21	156	669	
	Commercial*	1	0	0	0	8	8	3	3	2	1	1	9	36	
	Total	13	7	28	11	108	160	30	117	38	6	22	165	705	
	%CV	1.8%	1.0%	4.0%	1.6%	15.3%	22.7%	4.3%	16.6%	5.4%	0.9%	3.1%	23.4%		














* ≥ Class 3, AustRoads 94

Date		11/10/2017																Movement	
		Beauchamp Street West Leg				Edgecombe Street South Leg				Calder off-ramp East Leg				Edgecombe Road North Leg					
																			
Time Period		1 [Ⓞ]	2	3	4	5	6 [Ⓞ]	7	8	9	10 [#]	11 [Ⓞ]	12	13	14 [#]	15 [Ⓞ]	16	Total	
8:00 - 9:00am	Car	16	65	26	2	37	11	48	0	5	43	0	36	116	68	11	0	484	
	Commercial*	0	9	1	0	3	3	3	1	0	4	1	13	7	13	4	0	62	
	Total	16	74	27	2	40	14	51	1	5	47	1	49	123	81	15	0	546	
	%CV	2.9%	13.6%	4.9%	0.4%	7.3%	2.6%	9.3%	0.2%	0.9%	8.6%	0.2%	9.0%	22.5%	14.8%	2.7%	0.0%		
3:00 - 4:00pm	Car	20	103	29	2	31	26	63	2	2	39	1	41	85	50	16	3	511	
	Commercial*	1	5	0	0	0	1	1	0	0	4	0	10	3	2	1	0	28	
	Total	21	108	29	2	31	27	64	2	2	43	1	51	88	52	17	3	539	
	%CV	3.9%	20.0%	5.4%	0.4%	5.8%	5.0%	11.9%	0.0%	0.4%	8.0%	0.2%	9.5%	16.3%	9.6%	3.2%	0.6%		













* ≥ Class 3, AustRoads 94
[Ⓞ] To/from Calder Freeway
[#] To Beauchamp Street

Date		10/10/2017												Movement	
		Epping Street West Leg			Edgecombe Street South Leg			Epping Street East Leg			Edgecombe Street North Leg				
															
Time Period		1	2	3	4	5	6	7	8	9	10	11	12	Total	
8:00 - 9:00am	Car	54	7	16	14	3	57	58	4	44	34	30	65	386	
	Commercial*	2	2	0	1	0	6	2	1	1	0	0	4	19	
	Total	56	9	16	15	3	63	60	5	45	34	30	69	405	
	%CV	13.8%	2.2%	4.0%	3.7%	0.7%	15.6%	14.8%	1.2%	11.1%	8.4%	7.4%	17.0%		
3:00 - 4:00pm	Car	51	21	45	11	5	56	40	1	24	40	45	79	418	
	Commercial*	1	0	0	0	1	6	0	0	0	1	1	6	16	
	Total	52	21	45	11	6	62	40	1	24	41	46	85	434	
	%CV	12.0%	4.8%	10.4%	2.5%	1.4%	14.3%	9.2%	0.2%	5.5%	9.4%	10.6%	19.6%		

* ≥ Class 3, AustRoads 94

Date		10/10/2017												Movement	
		Saleyards Road West Leg			Edgecombe Road South Leg			Pipers Creek Road East Leg			Edgecombe Road North Leg				
															Total
Time Period		1	2	3	4	5	6	7	8	9	10	11	12		
8:00 - 9:00am	Car	15	20	33	17	52	26	54	40	2	4	98	42	403	
	Commercial*	4	1	12	10	13	2	4	1	1	0	9	6	63	
	Total	19	21	45	27	65	28	58	41	3	4	107	48	466	
	%CV	4.1%	4.5%	9.7%	5.8%	13.9%	6.0%	12.4%	8.8%	0.6%	0.9%	23.0%	10.3%		
3:00 - 4:00pm	Car	56	19	40	39	74	46	46	24	2	5	71	42	464	
	Commercial*	6	0	2	10	15	4	2	1	0	0	13	5	58	
	Total	62	19	42	49	89	50	48	25	2	5	84	47	522	
	%CV	11.9%	3.6%	8.0%	9.4%	17.0%	9.6%	9.2%	4.8%	0.4%	1.0%	16.1%	9.0%		

* ≥ Class 3, AustRoads 94

Date		9/10/2017												Movement
		High Street West Leg			Edgecombe Street South Leg			High Street East Leg			Edgecombe Street North Leg			
														Total
Time Period		1	2	3	4	5	6	7	8	9	10	11	12	
8:00 - 9:00am	Car	14	8	187	4	3	0	55	5	360	58	48	1	743
	Commercial*	0	0	11	0	0	0	1	0	21	1	3	0	37
	Total	14	8	198	4	3	0	56	5	381	59	51	1	780
	%CV	1.8%	1.0%	25.4%	0.5%	0.4%	0.0%	7.2%	0.6%	48.8%	7.6%	6.5%	0.1%	
3:00 - 4:00pm	Car	23	13	234	13	6	5	52	2	263	35	57	5	708
	Commercial*	0	0	19	1	0	0	4	0	10	1	2	0	37
	Total	23	13	253	14	6	5	56	2	273	36	59	5	745
	%CV	3.1%	1.7%	34.0%	1.9%	0.8%	0.7%	7.5%	0.3%	36.6%	4.8%	7.9%	0.7%	

* ≥ Class 3, AustRoads 94

Appendix G – Kyneton Transport Modelling Report

DRAFT

Kyneton Movement Network Study 2018

Transport Modelling Report



Macedon Ranges Shire Council

March 2018

Document Issue Record

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Client:		Macedon Ranges Shire Council		
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1 INTRODUCTION

1.1 Background

Transport & Traffic Solutions Pty Ltd (T&TS) has been engaged by Macedon Ranges Shire Council (MRSC) to complete a Transport Model of the Kyneton Township over a 20 year time period from 2016 to 2036. During this time period the population within the Kyneton Township is projected to grow by approximately 4,000 people, with the majority of the population growth occurring south of the Campaspe River within the Kyneton South Investigation area, refer Figure 2.1.

The purpose of the Transport Model is to predict the future year road network traffic volumes within the Kyneton Township, so as to determine what impact the projected population growth will have on the existing transport network within the Township. Where impacts are identified, mitigation measures such as new transport infrastructure and/ or upgrades to existing transport infrastructure will be proposed with the view of reducing and where possible eliminating these impacts.

The results of the Transport Model and the recommendations in this report will be used by MRSC whom are preparing the Kyneton Movement Network Study 2018 (KMNS18), a plan of Kyneton's movement network over the next 20 years.

1.2 Project Scope

T&TS was required to develop a comprehensive Transport Model of the Kyneton Township for both the Base Year 2016 and the Future Year 2036. For the Future Year 2036 Model various land use scenarios of the Kyneton South Investigation Area and multiple road network options of each scenario were tested to determine what new transport infrastructure and/ or upgrades to existing transport infrastructure is required to support the projected population growth within the Kyneton Township.

T&TS was also required to complete intersection modelling of the key intersections along the Arterial Road network to determine what impact the future year traffic volumes will have on the key existing intersections and where impacts are identified determine what intersection upgrades are required to mitigate these impacts.

1.3 References

The following references were used to assist in the preparation of this report:

- Kyneton Structure Plan, AECOM, July 2013
- Draft Kyneton South Framework Plan, Kyneton South Investigation Area, Macedon Ranges Shire Council, August 2017 (yet to be adopted by Council;
- Kyneton Movement Network Infrastructure Study, For Macedon Ranges Shire Council, Aurecon, 9 April 2010;
- Macedon Ranges Shire Council Planning Scheme, Clause 21.13-2 Kyneton, and Clause 56.06 Access and Mobility Management;
- Kyneton Movement Network Transport Plan, For Macedon Ranges Shire Council, Aurecon, 1 April 2010;
- Kyneton Commercial Assessment, For Macedon Ranges Shire Council, Tim Nott, 6 May 2009;
- Australian Bureau of Statistics, 2011 and 2016 Data and Forecast ID Data;
- Austroads Guidelines, Australian Standards, and VicRoads Supplements to these Guidelines and Standards; and
- Infrastructure Design Manual, Ver 5.10, Local Government Infrastructure Design Association, 11 January 2018.

2 STUDY AREA

2.1 Kyneton Township

Kyneton is located on the Calder Freeway approximately 85 kilometres north-west of Melbourne, and 65 kilometres south of Bendigo. The Campaspe River which runs along the western and southern boundary of the town centre forms a natural boundary to the town centre which restricts development and road access to the west and south of the river.

Kyneton Railway Station which is on the Melbourne-Bendigo regional railway line is located to the south of the Town Centre and the Campaspe River, on Mollison Street immediately north of the Mollison Street/ Lauriston Reservoir Road intersection.

Both the Calder Freeway and the Melbourne-Bendigo regional railway line provides easy access to Bendigo and Melbourne, both an approximate one hour commute from Kyneton.

An extensive arterial road network managed by VicRoads runs in a north-south (Mollison Street/ Trentham Road and Edgecombe Road) and east-west (Burton Avenue/ Piper Street, High Street/ Bourke Street, and Saleyards Road) direction through the Town Centre connecting Heathcote to the north-east and Kyneton to Ballarat to the south-west.

Refer Figure 2.1 below for a plan of the Kyneton Township.

Kyneton is the second largest town in the shire and performs an important retail and service role to the surrounding agricultural district and townships¹.

The facilities in Kyneton include a:

- New modern hospital
- Library;
- Maternal and Child Health Centre;
- Kindergarten – Lady Brooks;
- Sports & Recreation Reserves – Barkley Square and Kyneton Showgrounds;
- Sports & Aquatic Centre;
- Kyneton District Health – Hospital & Community Care;
- Education Precinct – Kyneton Secondary College, Sacred Heart College & Our Lady of the Rosary Parish Primary School;
- Kyneton Primary School (to be relocated to the Education Precinct); and
- Kyneton Botanic Gardens.

The Loddon Mallee South Regional Growth Plan provides a regional approach to land use planning and Plan Melbourne identifies that Kyneton as a centre to be the focus of future population growth and act as sub regional employment centre.

The Macedon Ranges Planning Scheme and the Kyneton Structure Plan aims to facilitate the sustainable growth of Kyneton to a large district town, with a population of between 6,000 and 10,000 people.

¹ Draft Kyneton South Framework Plan, Kyneton South Investigation Area, Macedon Ranges Shire Council, August 2017.

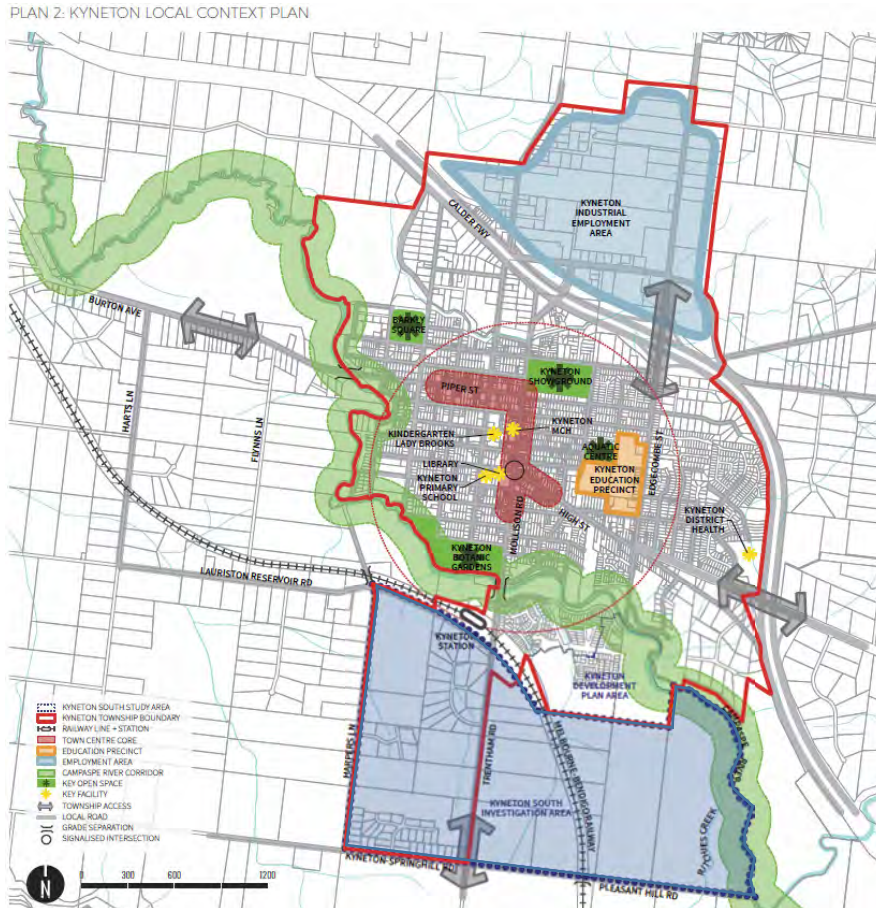


Figure 2.1: Kyneton Township²

2.2 Kyneton South Investigation Area

Macedon Ranges Shire Council is currently developing a Framework Plan for the Kyneton South Investigation Area to provide direction and to guide any future medium to long term growth within this Area. The Area is located to the south and west of the Campaspe River and is bounded by the Melbourne-Bendigo Railway line and Campaspe Views Estate to the north, Campaspe River to the east, Pleasant Hill Road and Kyneton-Springhill Road to the south, and Harpers Lane to the west. Trentham Road and the Melbourne-Bendigo Railway line run in a north-south direction through the site. Refer Figure 2.1 above for the Kyneton South Investigation Area.

MRSC has confirmed that an additional 1,800 residential dwellings can be accommodated within this area.

The Draft Kyneton South Framework Plan also identifies a potential street network within this area refer Figure 2.2 below, and potential transport infrastructure upgrades required to sustain this development as detailed below:

1. Edgecombe Street Bridge – Connection between High Street/ Bourke Street to Campaspe Drive over the Campaspe River.
2. Edgecombe Street Extension – The extension and upgrade of Edgecombe Street to have a minimum two-lane carriageway 7.0 metres wide, no parking and no direct access to lots.
3. Upgrade of Trentham Road – Create a boulevard street to define the southern township as a gateway entry. Trentham Road will be upgraded to a two-lane divided arterial road with 3 metre wide shared paths either side of the traffic lanes. The upgraded profile will terminate at the

² Plan 1: Kyneton Local Context Plan, Draft Kyneton South Framework Plan, Kyneton South Investigation Area, Macedon Ranges Shire Council, August 2017.

level crossing due to the heritage constraints of the existing bridge crossing of the Campaspe River and bluestone kerb along Mollison Street.

4. Intersection Treatments/ Upgrades – To be determined by traffic modelling however identifies the following key intersections:
 - Mollison Street/ Piper Street
 - Lauriston Reservoir Road/ Trentham Road
 - Lauriston Reservoir Road/ Harpers Lane
 - Kyneton Springhill Road/ Harpers Lane
 - Edgecombe Street/ High Street Intersection
 - Pleasant Hill Road/ Trentham Road
 - Campaspe Road/ Mollison Street
5. Pleasant Hill Road Upgrade (East-west Connection) – An east-west connection between Trentham Road and the Edgecombe Street Extension to include a new overpass over the Melbourne-Bendigo Railway line. The aim of this connection is to provide an alternate access to the Framework Plan Area east side of the Railway line and an alternative route to the existing Kyneton Town Centre, Industrial Precinct and Freeway.
6. Western Township Alternate Route – An alternative route for traffic trying to access the Calder Freeway heading towards Bendigo is proposed via Harpers Lane, Lauriston Reservoir Road, Flynn’s Lane and/ or Harts Lane. All roads apart from Lauriston Reservoir Road are sealed two-lane two-way local roads for part of their length.

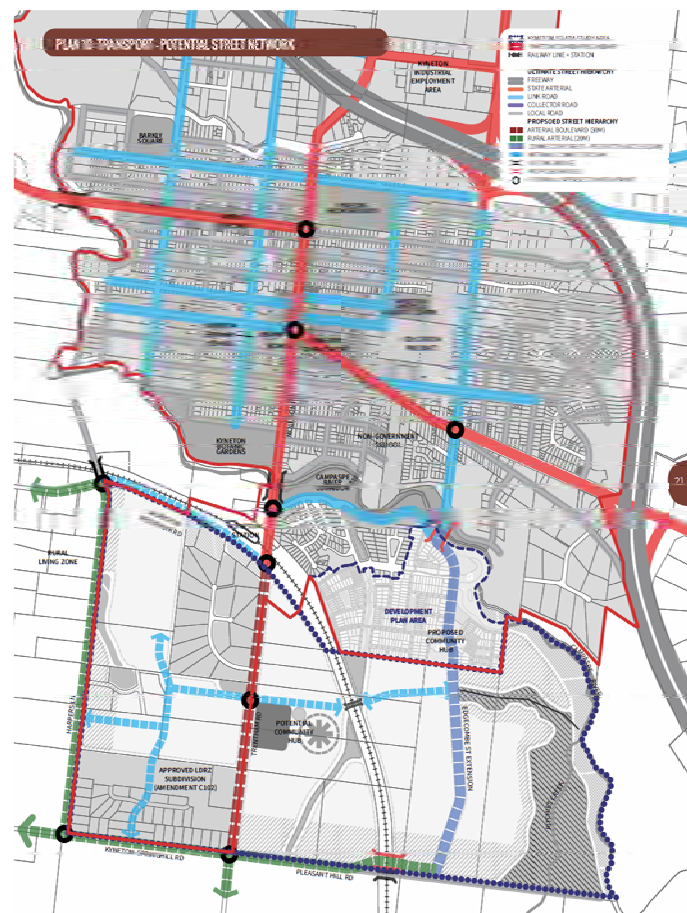


Figure 2.2: Potential Street Network³

³ Plan 10: Transport – Potential Street Network, Draft Kyneton South Framework Plan, Kyneton South Investigation Area, Macedon Ranges Shire Council, August 2017.

3 EXISTING TRANSPORT NETWORK

3.1 Road Network

The main arterial and local road network within the study area are detailed below. Details are based on a site inspection carried out on the 4 October 2017 and measurements taken from aerial photography.

3.1.1 Calder Freeway (M79)

The Calder Freeway is a four-lane divided freeway under the management of VicRoads. It is aligned in a generally south-east to north-west direction, providing a freeway connection between Melbourne and Bendigo.

The freeway runs through the Kyneton Township, separating the residential and commercial (Town Centre) zoned areas to the south, from most of the industrial zoned area to the north of the freeway. A connection between the zoned areas is provided over the freeway via two arterial road links, Mollison Street and Edgecombe Road.

Three access points to the Calder Freeway from Kyneton are provided as follows:

1. Bourke Street / Trio Road – A half diamond Interchange (Melbourne side) located to the south east of the Kyneton Township.
2. Edgecombe Road – A full diamond interchange located to the north-east of the Kyneton Township.
3. Burton Avenue – An at-grade intersection to the north-west of the Kyneton Township which allows all movements to and from the freeway.

The Freeway has a 110km/h posted speed limit in the vicinity of Kyneton.

3.1.2 Mollison Street / Kyneton-Trentham Road (C326/ C793/ C318)

Mollison Street (C326/ C793/ C318) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs in a north-south direction through the town centre and provides a main road connection between the industrial zoned area located to the north of the town centre and Kyneton railway station located to the south of the town centre. South of Lauriston Reservoir Road, Mollison Street becomes Kyneton-Trentham Road (C318).

Mollison Street has a road reservation width of approximately 20 metres and primarily comprises a single carriageway, with one traffic lane and parallel kerbside parking in each direction. On-road bicycle lanes are also provided on both sides of the carriageway, between Beauchamp Street and Franklin Place. The pavement width along this section of Mollison Street is approximately 13.5 metres wide.

The section of Mollison Street to the north of Beauchamp Street comprises a single carriageway with one traffic lane in each direction. The pavement width narrows to approximately 7.0 metres wide.

Kyneton-Trentham Road (C318) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs south from Mollison Street at Lauriston Reservoir Road and provides a main road connection to the neighbouring town of Trentham, to the south of Kyneton.

Kyneton-Trentham Road has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane in each direction and unsealed shoulders provided on both sides of the carriageway. The sealed pavement width is approximately 7.5 metres wide.

3.1.3 High Street / Bourke Street (C793)

High Street (C793) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs in a north-west to south-east direction between Mollison Street (signalised intersection) and Edgecombe Street. East of Edgecombe Street, High Street diverges to the south and forms a local access road under the management of Council. Bourke Street forms the continuation of the arterial road section of High Street, connecting Route C793 to the Calder Freeway.

The section of High Street to the west of Edgecombe Street has a road reservation width of approximately 20 metres and comprises a single carriageway, with one traffic lane and parallel kerbside parking in each direction. On-road bicycle lanes are also provided on both sides of the carriageway. The pavement width is approximately 13.5 metres wide.

Bourke Street forms the continuation of Route C793 to the east of Edgecombe Street. The carriageway primarily comprises one traffic lane in each direction with a turning lane provided along the centre of the carriageway. Parallel kerbside parking and an on-road bicycle lane are also provided on the south side of the carriageway only, between Edgecombe Street and Caroline Chisholm Drive. The pavement width along this section of Bourke Street is approximately 15 metres wide.

The section of Bourke Street to the east of Caroline Chisholm Drive comprises a single carriageway with one traffic lane in each direction. The pavement width narrows to approximately 7.5 metres wide.

A service road is located to the north of the Bourke Street carriageway (Bourke Street Service Road) within the road reservation, from Edgecombe Street to a court-bowl located at its eastern end. The service road provides direct access to adjacent residential properties on the north side of the road.

3.1.4 Piper Street / Burton Avenue (C793)

Piper Street (C793) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs in an east-west direction between Mollison Street and Campaspe Place within a commercial zone mostly related to tourism and is considered the 'Heritage Street' of Kyneton.

Piper Street has a road reservation width of approximately 20 metres and primarily comprises a single carriageway, with one traffic lane and a wide parallel kerbside parking lane shared with cyclists in each direction. The pavement width is approximately 13.5 metres wide.

West of the Campaspe River, Burton Avenue forms the continuation of Piper Street and Route C793 running in an east-west direction to Lauriston Road. From Lauriston Road, the orientation of Burton Avenue turns north and it runs in a north-south direction to the Calder Freeway.

Burton Avenue primarily comprises one traffic lane in each direction with unsealed shoulders provided on both sides of the carriageway. The sealed pavement width is approximately 7.0 metres wide.

3.1.5 Saleyards Road (C326)

Saleyards Road (C326) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs in an east-west direction between Mollison Street and Edgecombe Road through the industrial area located to the north of the town centre. West of Mollison Street, Saleyards Road forms a local access road under the management of Council. It continues to run in an east-west direction before turning north where it becomes Redesdale Road at Kyneton-Metcalf Road.

The arterial road section of Saleyards Road (C326) primarily comprises one traffic lane in each direction. The pavement width is approximately 7.5 metres wide. Channelised right and auxiliary left turn lane treatments are provided at the side road intersections on this section of Saleyards Road.

The local road section of Saleyards Road also comprises one traffic lane in each direction. The east-west section provides an additional turning lane along the centre of the carriageway and has a sealed pavement width of approximately 13.5 metres wide. The north-south section has a sealed pavement width of approximately 9.0 metres wide.

3.1.6 Edgecombe Road / Kyneton-Heathcote Road (C326)

Edgecombe Road/ Kyneton-Heathcote Road (C326) is a sealed two-lane, two-way arterial road under the management of VicRoads. It runs north from the Calder Freeway in Kyneton and provides a main road connection to the neighbouring towns of Redesdale and Heathcote, to the north of Kyneton.

Edgecombe Road/ Kyneton-Heathcote Road has a road reservation width of approximately 25 metres and comprises a single carriageway with one traffic lane in each direction and a painted median that allows turning lanes to be provided between the Calder Freeway and Saleyards Road. The pavement width along this section of the road is approximately 10 metres wide.

North of Saleyards Road, Edgecombe Road/ Kyneton-Heathcote Road comprises one traffic lane in each direction with unsealed shoulders provided on both sides of the carriageway. The sealed pavement width narrows to approximately 6.0 metres wide.

3.1.7 Edgecombe Street

Edgecombe Street is a sealed two-lane, two-way local access road under the management of Council. It runs in a north-south direction between the Calder Freeway/ Beauchamp Street and the Campaspe River to the east of the Kyneton town centre. Edgecombe Street forms the eastern frontage of Our Lady of the Rosary Primary School and provides a main road link through Kyneton.

Edgecombe Street has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane and parallel kerbside parking in each direction. The pavement width ranges from approximately 7.0 metres to 10.3 metres wide along the length of Edgecombe Street.

3.1.8 Beauchamp Street

Beauchamp Street is a sealed two-lane, two-way local access road under the management of Council. It runs in an east-west direction between Campaspe Place and Edgecombe Street to the north of the Kyneton town centre. Beauchamp Street forms the northern frontage of the Kyneton Showgrounds and provides the main road link to the Kyneton Racecourse Reserve located to the north-west of the town centre, and the Calder Freeway.

Beauchamp Street has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane and parallel kerbside parking in each direction. A section of 90 degree angle parking is also provided on the south side of the road adjacent to the showgrounds to the west of Victoria Street. The pavement width ranges from approximately 6.5 metres to 15.5 metres wide along the length of Beauchamp Street.

3.1.9 Epping Street

Epping Street is a sealed two-lane, two-way local access road under the management of Council. It runs in an east-west direction between High Street and Barton Street to the east of the Kyneton town centre, and forms the southern frontage of Kyneton Secondary College and RM Begg Aged Care.

Epping Street has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane and parallel kerbside parking in each direction. The sealed pavement width ranges from approximately 6.2 metres to 12.2 metres wide along the length of Epping Street.

3.1.10 Lauriston Reservoir Road

Lauriston Reservoir Road is a sealed two-lane, two-way local access road under the management of Council. It runs in an east-west direction between Kyneton-Trentham Road and Keegan Road, to the south-west of the Kyneton town centre.

Lauriston Reservoir Road has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane in each direction and unsealed shoulders provided on both sides of the carriageway.

3.1.11 Kyneton-Springhill Road

Kyneton-Springhill Road is a sealed two-lane, two-way local access road under the management of Council. It runs west from Kyneton-Trentham Road and provides a main road connection to the neighbouring town of Spring Hill, to the south-west of Kyneton.

Kyneton-Springhill Road has a road reservation width of approximately 20 metres and primarily comprises a single carriageway with one traffic lane in each direction and unsealed shoulders provided on both sides of the carriageway.

3.1.12 Pleasant Hill Road

Pleasant Hill Road is an unsealed two-way local access road under the management of Council. It runs east from Kyneton-Trentham Road at its intersection with Kyneton-Springhill Road to the south of Kyneton, and provides direct access to several rural properties.

Pleasant Hill Road has a road reservation width of approximately 20 metres.

3.1.13 Flynn's Lane

Flynn's Lane is a two-way local access road under the management of Council. It runs in a north-south direction between Burton Avenue and Lauriston Reservoir Road to the west of Kyneton, and provides direct access to several rural properties. Flynn's Lane has a sealed surface up to approximately 1km south of Burton Avenue. At this point Flynn's Lane is unsealed.

Flynn's Lane has a road reservation width of approximately 20 metres.

3.1.14 Harts Lane

Harts Lane is a two-way local access road under the management of Council. It runs in a north-south direction between Burton Avenue and Kyneton-Springhill Road to the west of Kyneton, and provides direct access to several rural properties. Harts Lane has a sealed surface between Burton Avenue and the Railway Line crossing, approximately 1km. South of the Railway Line, Harts Lane has an unsealed surface.

Harts Lane has a road reservation width of approximately 20 metres.

3.2 Existing Key Intersections

The following key Intersections within the Kyneton Township are identified by Macedon Ranges Shire Council as potentially being impacted by the projected population growth within the Kyneton Township.

1. High Street / Edgecombe Street – The High Street/ Edgecombe Street intersection forms an unsignalised cross intersection. High Street is the major east-west road leg where-as Edgecombe Street is the minor north-south road leg controlled by a Give Way sign on the southern leg and a Stop sign on the northern leg. A channelised right turn lane is provided on both High Street approaches to the intersection.
2. Epping Street / Edgecombe Street – The Epping Street/ Edgecombe Street intersection forms an unsignalised cross intersection controlled by a roundabout. Edgecombe Street forms the northern and southern legs of the intersection and Epping Street forms the eastern and western legs of the intersection.

The roundabout has a single circulating traffic lane and a central island diameter of approximately 6.5 metres.

3. Beauchamp Street / Edgecombe Street / Calder Freeway Interchange – The Beauchamp Street/ Edgecombe Street/ Calder Freeway Interchange forms an unsignalised five leg intersection controlled by a roundabout. Edgecombe Street forms the northern and southern legs of the intersection and Beauchamp Street forms the western leg of the intersection. The Calder Freeway off-ramp forms the eastern leg of the intersection and the Calder Freeway on-ramp forms the north-western leg of the intersection.

The roundabout has a single circulating traffic lane and a central island diameter of approximately 50 metres.

4. Saleyards Road / Edgecombe Road / Pipers Creek Road – The Saleyards Road/ Edgecombe Road/ Pipers Creek Road intersection forms an unsignalised staggered-T intersection. Edgecombe Road is the major north-south road leg where-as Saleyards Road is the minor western road leg and Pipers Creek Road is the minor eastern road leg. Both minor road leg approaches are controlled by a Give Way sign.

A channelised right turn lane is provided on both Edgecombe Road approaches to the intersection and an auxiliary left turn lane is provided on the south approach to the Saleyards Road leg.

5. Mollison Street / Saleyards Road – The Mollison Street/ Saleyards Road intersection forms an unsignalised T-intersection. Saleyards Road is the major east-west road leg where-as Mollison Street is the minor southern road leg controlled by a Give Way sign. A channelised right turn lane is provided on the Saleyards Road western approach to the intersection.
6. Mollison Street / Beauchamp Street – The Mollison Street/ Beauchamp Street intersection forms an unsignalised cross intersection. Mollison Street is the major north-south road leg where-as Beauchamp Street is the minor east-west road leg controlled by a Stop sign on both approaches. Basic left and right turn lanes are provided on the Mollison Street approaches to the intersection.
7. Mollison Street / Piper Street – The Mollison Street/ Piper Street intersection forms an unsignalised T-intersection. Mollison Street is the major north-south road leg where-as Piper Street is the minor western road leg controlled by a Give Way sign. Basic left and right turn lanes are provided on the Mollison Street approaches to the intersection, and a large radius kerb is provided on the south-western corner of the intersection to facilitate access by heavy vehicles turning left from Mollison Street into Piper Street.
8. Mollison Street / High Street – The Mollison Street/ High Street intersection is a signalised T-intersection. Mollison Street forms the northern and southern road legs where-as High Street forms the south-eastern road leg. Dedicated left and right turn lanes are provided on the Mollison Street approaches to the intersection. Pedestrian crossing facilities are provided on all three legs of the signalised intersection.
9. Mollison Street / Campaspe Drive – The Mollison Street/ Campaspe Drive intersection forms an unsignalised T-intersection. Mollison Street is the major north-south road leg where-as Campaspe Drive is the minor eastern road leg controlled by a Give Way sign.
10. High Street / Epping Street – The High Street/ Epping Street intersection forms an unsignalised T-intersection. High Street is the major north-west to south-east orientated road leg where-as Epping Street is the minor eastern road leg controlled by a Give Way sign.

The angle of the intersection of Epping Street on High Street means that the left turn movement from Epping Street into High Street and the right turn movement from High Street into Epping Street are quite tight. Further, the left turn movement from High Street into Epping Street and the right turn movement from Epping Street into High Street may be undertaken at speed due to the large radius available.

3.3 Existing Road & Intersection Traffic Volumes

MRSC provided 2016 average annual daily traffic volume data and intersection turning movement count data (collected between the 9th to 13th October 2017) for the key road network and intersections within the study area. Traffic volumes on the Calder Freeway were taken from the VicRoads Open Data website.

The recorded traffic volumes are illustrated in Figure 3.1 below. Refer also Appendix A, drawing no's. 17022KM-00-101 to 103 for a detailed copy of the existing traffic volume data.

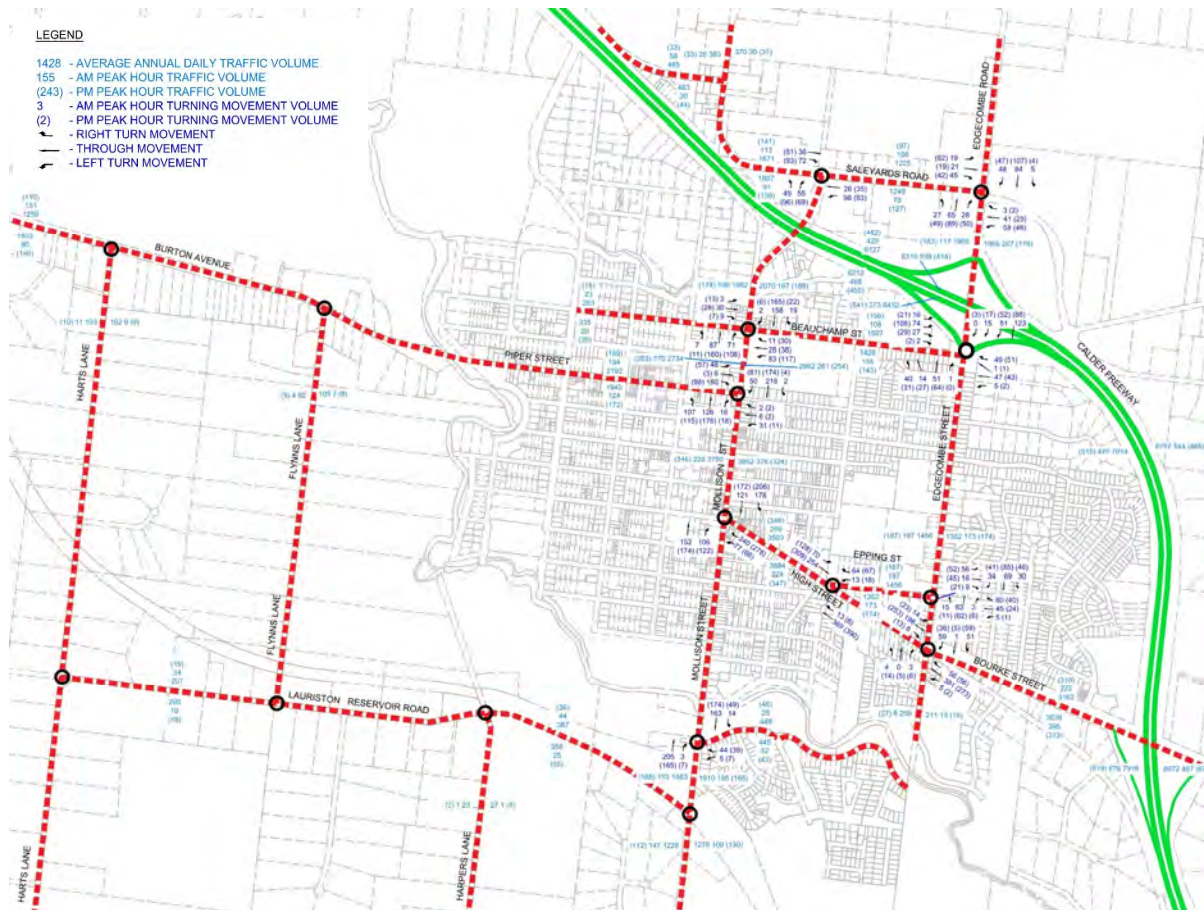


Figure 3.1: Existing Road & Intersection Traffic Volume Data

As illustrated in Figure 3.1 above the traffic volumes on the existing road network are well below the expected capacity of 18,000 vpd for a two-way two lane arterial road and 7,000 vpd for a local two-way two lane connector road.

The traffic volumes on the Freeway Network range from 13,800 vpd north of Burton Avenue to 16,000 vpd south of Bourke Street.

3.4 Casualty Accident Statistics

The casualty accident history within the study area was sourced from the VicRoads' Crashstats database. The database indicates that over a 5 Year period between 1 May 2012 and 30 April 2017⁴, 11 casualty crashes were recorded within the study area.

Details of the crashes are provided in Table 3.1 below.

⁴ The causality crash statistics data available on the VicRoads website is incomplete for the period after 30 April 2017.

Table 3.1: Casualty Crash Details, 1 May 2012 – 30 April 2017

No	Date	Location	Severity	DCA	Description
1	Monday 20 May 2013, 3:35pm	Intersection of Beauchamp Street & Edgecombe Street	Other	173	Right off carriageway into guardrail, day, one vehicle.
2	Monday 16 September 2013, 4:30pm	Intersection of Edgecombe Street & Epping Street	Other	110	Cross traffic, day, two vehicles.
3	Sunday 22 Sept 2013, 10:30am	Intersection of Edgecombe Road & Pipers Creek Road	Other	111	Right far (through vehicle hits right turning vehicle), three vehicles.
4	Tuesday 4 February 2014, 3:40am	Trentham Road, 200m south of Hill Drive	Serious/ Other	120	Head-on, not overtaking, dark no streetlights, two vehicles.
5	Tuesday 1 April 2014, 9:58am	Intersection of Mollison Street & Beauchamp Street	Other	110	Cross traffic, day, two vehicles.
6	Wednesday 11 June 2014, 7:45am	Mollison St, 60m south of Franklin Place (at bridge)	Other	174	Cyclist out of control on carriageway, dawn, icy road.
7	Tuesday 31 March 2015, 8:30am	Intersection of Beauchamp Street & Edgecombe Street	Serious	172	Off carriageway to right, day, two vehicles and a motorcycle.
8	Friday 5 June 2015, 5:52pm	Trentham Road, 89m south of Lauriston-Reservoir Rd	Fatal	104	Hit pedestrian walking with traffic, dark, no streetlights, one vehicle.
9	Monday 13 July 2015, 9:30pm	Intersection of Edgecombe Street & Epping Street	Other	172	Off carriageway to right, dark street lights on, Motorcycle
10	Sunday 26 July 2015, 11:25am	Intersection of Mollison Street & Beauchamp Street	Other	110	Cross traffic, day, two vehicles.
11	Monday 7 November 2016, 9:20am	Intersection of Edgecombe Road & Saleyards Road	Other	173	Right off carriageway into object/ parked vehicle, day, two vehicles.
12	Thursday, 8 September 2016, 2:10pm	Intersection of Mollison Street & Beauchamp Street	Other	130	Rear end (Vehicles in same lane), day, vehicle & motorcycle.

As detailed in Table 3.1 above, approximately nine of the twelve recorded crashes resulted in an other injury, two crashes resulted in a serious injury, and one crash resulted in a fatal injury.

One of the serious injury accidents occurred on Trentham Road south of the Melbourne-Bendigo Railway line during night time conditions, whilst the other occurred at the intersection of Beauchamp Street & Edgecombe Street during daylight conditions.

The fatal injury accident occurred on Trentham Road south of Lauriston Reservoir Road during night time conditions. In this location the Trentham Road cross section is of a rural characteristic i.e. grass shoulder/ verge and no footpath provided on either side of the carriageway.

Three accidents occurred over a three year period at the intersection of Mollison Street and Beauchamp Street, all resulting in other injury.

In summary, the casualty crash statistics data confirms that there are no serious safety concerns with the existing road network within the study area due to there being no evidence of the recorded accidents occurring on a regular basis and the majority of accidents (75%) resulting in other injury.

4 TRANSPORT MODEL

4.1 Background

The Transport Model is designed to be a tool to assist in determining what impact the proposed land use changes within the Kyneton Township will have on the existing road network and help determine what road network changes/ upgrades are required to meet the expected growth in traffic.

PTV Visum modelling software was used to create and model both the Base Year 2016 and Future Year 2036 Transport Model for the Kyneton Township as detailed in Section 4.1.1 to 4.1.3 below.

4.1.1 Network Creation

The Base Year 2016 Transport Model was first created by importing MRSC’s GIS shape file of the road network within the Kyneton Township into the Visum Transport Model. Links (roads) and nodes (intersections) were then created to define the existing transportation network. All links were defined with a length, number of lanes, capacity, and posted speed limit as per existing conditions. Refer Figure 4.1 below for the existing transportation network that was created in the Transport Model.

The existing road and intersection traffic volumes (refer Section 3.3 and Figure 3.1) were then added to the network model (links and nodes).

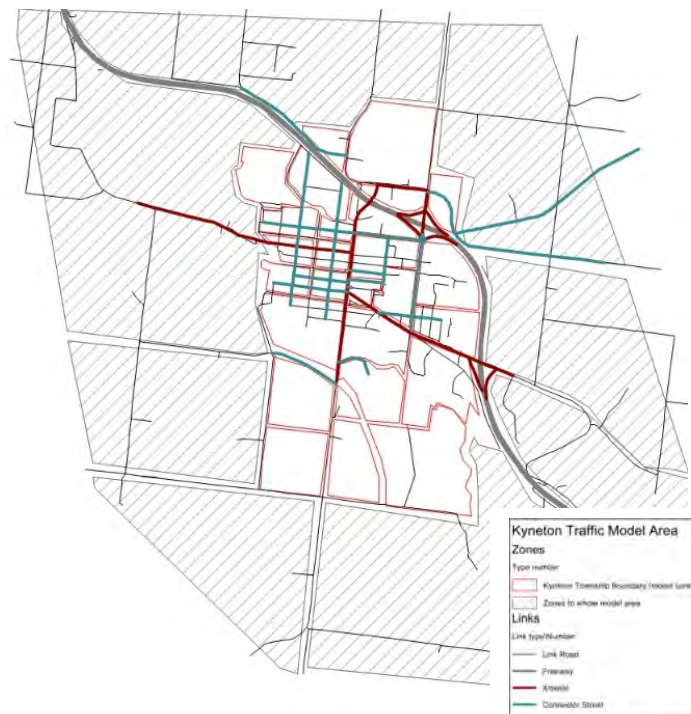


Figure 4.1: Base Year 2016 Transportation Network

4.1.2 Traffic Zones & Land Use

4.1.2.1 Traffic Zones

Traffic “zones” representing homogeneous land use areas, where trips start and end were then created for the Kyneton Township. The proposed Kyneton traffic zone system of eleven (11) Zones and the active and proposed land use parcels within the 11 Zone system was provided by MRSC for use in the Transport Model. Refer Figure 4.2 below for a copy of the 11 Zone system and Table 4.1 and Table 4.2 below for the Base/ Active Data and the Future Proposed Data respectively.

Due to the size of the study area and to ensure a more realistic Transport Model which in turn provides better trip assignment results, the Kyneton traffic zone system of 11 Zones was refined into a total of forty (40) traffic zones (internal and external in relation to the study area). Refer Figure 4.3 below for a copy of the 40 Zone system.

In this refinement, the connection with the previously created 11 zone system was maintained.

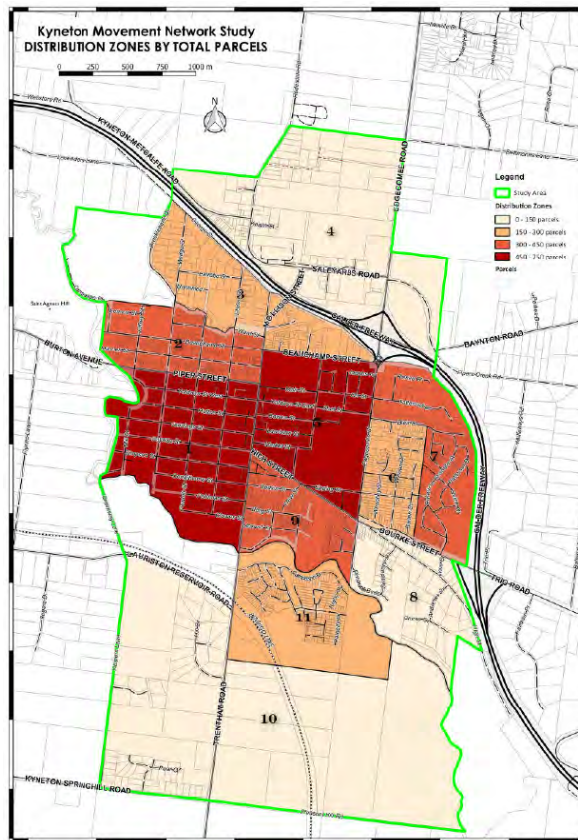


Figure 4.2: Kyneton 11 Zone System

Table 4.1: Base/Active lot distribution by planning zone

Traffic Zone	C1Z	C2Z	FZ	GRZ1	IN1Z	IN2Z	LDRZ	Total Parcels
1	106			569				675
2	48			283				331
3				95	63			158
4			1		74	8		83
5	129			451				580
6				274				274
7	9			325				334
8				40	16		18	74
9	43			249				292
10				24		4	55	83
11				1	136	1		138
Grand Total	335	1	25	2422	158	8	73	3022

Table 4.2: Future/ Proposed lot distribution by planning zone

Traffic Zone	C1Z	C2Z	FZ	GRZ1	IN1Z	IN2Z	LDRZ	Total Parcels
1	106			571				677
2	50			291				341
3				97	63			160
4			1		92	9		102
5	132			453				585
6				286				286
7	9			325				334
8				44	16		18	78
9	45			281				326
10				24	1800	4	55	1883
11				1	493	1		495
Grand Total	342	1	25	4641	176	9	73	5267

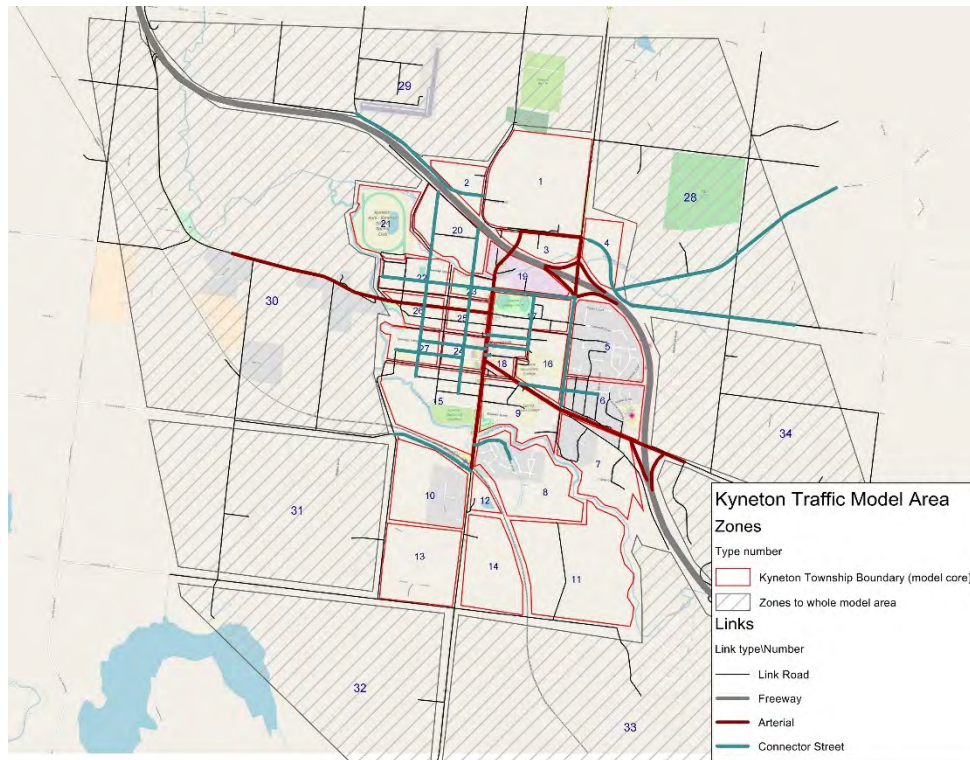


Figure 4.3: Kyneton 40 Zone System

The 40 Zone system model as detailed in Figure 4.3 above has been established as follows:

- Kyneton Township Boundary (27 Zones – Model Core),
- Wider Kyneton Area (8 Zones), and
- External to Kyneton (5 Zones)

A land use table was then produced populating the Kyneton Township Boundary (27 zones), with the number of dwellings; employment and gross floor area for industry, retail, office and commercial uses; employment and enrolments for education uses; and employment other (hospital, aged care, sports facilities etc.), for both the base year 2016 and future year 2036 Transport Models. For the Wider Kyneton Area (8 zones), as there was no available data on the existing land use within these zones, the total number of dwellings (120) was estimated based on aerial photography.

The zones External to Kyneton (5 zones) were connected to the in and out roads that intercept the study area of the model as follows:

- Two zones are connected to the Calder Freeway, north-west and south-east of the study area; and
- The remaining three zones are connected to the north Edgecombe Road (Heathcote-Kyneton Road), to the East Pipers Creek Road, and to the south Trentham Road.

This proposed zone system now covers all movements within the Kyneton Township (internal trips), to and from the Kyneton Township (external trips), and those that only pass through the Kyneton township (transit trips).

The traffic “zones” were then connected to the network model by creating links (zone connectors) between the zone centre of activity (centroid) and the network model. The zone connectors which are straight lines, simulate the intrazonal road network which have a travel speed set at 10km/h.

This connection of zones via centroids to the network model finalises the process of network creation, and therefore the network is ready for demand modelling and forms the base for both, land use and transport infrastructure changes.

4.1.2.2 Base Year 2016 Land Use

The number of residential parcels within each zone system was calculated by overlaying the proposed new 40 zone structure over a current aerial photo of the Kyneton Township, and manually counting the number of active and empty residential parcels within the Kyneton Township Boundary and Wider Kyneton Area zones.

Where floor areas within each zone was required, they were obtained by measuring the roof area from aerial photography within each zone. As roof area is greater than gross floor area, the measured areas were then adjusted in each zone to suit the total existing areas (occupied & vacant) as provided in Table 1 of the "Kyneton Commercial Assessment - For Macedon Ranges Shire Council", prepared by Tim Knott, which states that in the year 2008, there was a total of 47,364 square metres of retail floor space and 8,099 square metres of office floor space within the Town Centre.

The Tim Knott report also estimates that growth in retail and office floor space between 2008 and 2021 is expected to be around 2,700 square metres, where-as between 2021 and 2031 it is expected to be around 2,500 square metres. However, referring to the Australian Bureau of Statistics (ABS) employment data for the Kyneton area for the year 2011 and 2016, the retail industry group recorded a drop in employment. Therefore, for modelling purposes it is assumed that there has been no growth in retail space between 2008 and 2016.

The Tim Knott report also estimated that in 2008 there was approximately 1 retail/ office job for every 37 square metres of floor area. Refer Section 2.4 of the Tim Knott report. Therefore, the number of jobs in each zone was estimated by proportioning the total floor area calculated within that zone.

With regard to jobs/ employment in industry, education and other (hospital, aged care, sports facilities etc) areas, data was taken from the 2016 ABS employment data.

With regard to total enrolments for the education use, data was obtained from the *My School*⁵ website for each school located in the Kyneton township for the year 2016.

4.1.2.3 Future Year 2036 Land Use

For the future year MRSC advised that the demand for housing will grow at a rate of 85 dwellings per annum, with 80% (70 dwellings) delivered in greenfield areas and 20% (15 dwellings) delivered in infill locations.

The total floor area and number of jobs/ employment within the retail and office area were then grown in accordance with the recommendations in the Tim Knott report, i.e. 5,200 square metres.

Jobs/ employment in the industrial areas was grown at a rate of 2.46% per annum⁶. Where-as growth in Education employment and enrolments was grown in accordance with historical data as provided on the *My School* website for each school located in the Kyneton township.

4.1.2.4 Comparison Base Year 2016 Land Use vs Future Year 2036 Land Use

A summary of the Base Year 2016 and Future Year 2036 land use data used in the Transport Model is detailed in Table 4.3 below. Refer also Figure 4.4 & Figure 4.5 below for a breakdown of the Base Year 2016 & Future Year 2036 existing dwellings and employment in each zone respectively and Figure 4.6 & Figure 4.7 for the Base Year 2016 & Future Year 2036 existing employment types in each zone respectively.

⁵ My School, Australian Curriculum, Assessment and Reporting Authority, <https://www.myschool.edu.au/>

⁶ 2011 & 2016 ABS Employment Data, Growth in employment (industry in Kyneton between 2011 to 2016).

Table 4.3: Comparison Base Year 2016 vs Future Year 2036 Land Use Summary (Total)

Land Use	Measure	Base Year 2016	Future Year 2036	Difference
Dwellings	No.	2,265	3,965	+1,700
Industry	No. of Jobs	1,835	2,982	+1,147
	Floor Area (sq.m)	102,625	166,747	+64,122
Retail	No. of Jobs	1,290	1,396	+107
	Floor Area (sq.m)	47,364	51,279	+3,915
Office	No. of Jobs	221	277	+57
	Floor Area (sq.m)	8,099	10,184	+2,085
Education	No. of Jobs	340	474	+134
	No. of Enrolments	1,907	2,755	+848
Other	No. of Jobs	398	398	0 ⁷

Based on a ratio of 2.4 people per dwelling⁸ it is estimated that in the year 2036, Kyneton will have a population equivalent to 9,516 people, approximately 4,080 people more when compared to 2016. Therefore, between the year 2016 to 2036, the population in Kyneton is estimated to grow at a rate equivalent to 2.84% per annum.

Further in 2036 it is estimated that a total of 5,527 people will be employed in the Kyneton area. Therefore, between the year 2016 to 2036, employment in Kyneton is estimated to grow at a rate equivalent to 1.5% per annum.

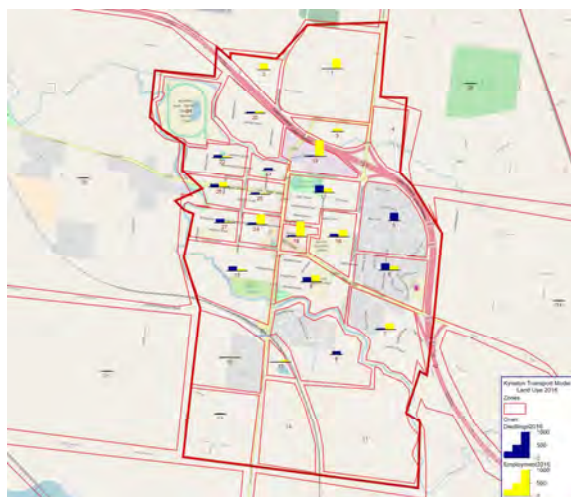


Figure 4.4: Base Year 2016 Dwellings and Employment per Zone

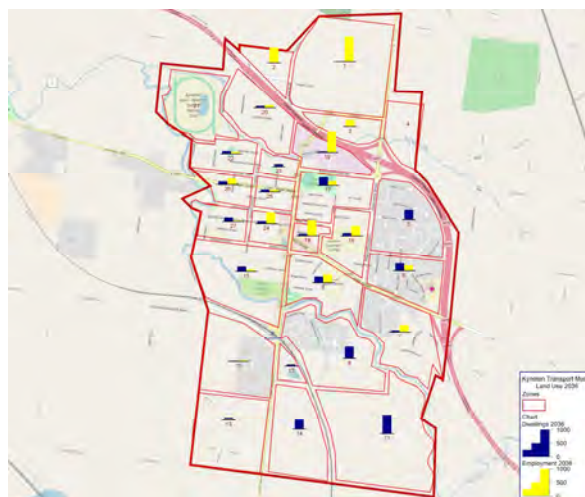


Figure 4.5: Future Year 2036 Dwellings and Employment per Zone

⁷ Jobs in other areas have not grown to maintain the total employment growth rate within the Kyneton Township equivalent to 1.5% per annum.

⁸ 2016 ABS Census Data – Number of Persons Usually Resident in Dwelling for the Kyneton Statistical Area (SA2), Accessed on 8 February 2018.

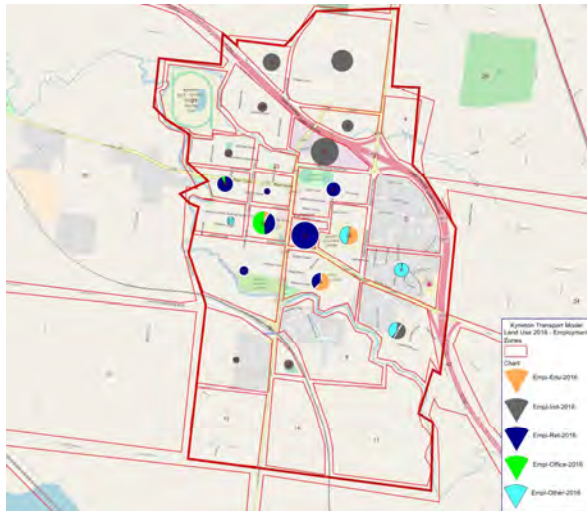


Figure 4.6: Base Year 2016 Employment Type per Zone

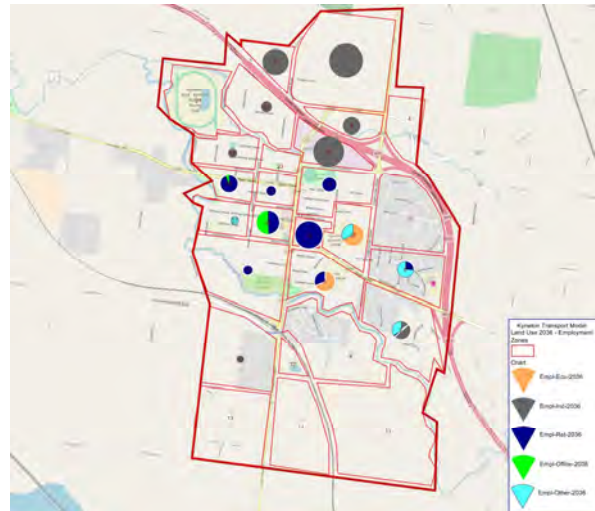


Figure 4.7: Future Year 2036 Employment Type per Zone

As illustrated in Figure 4.4 to Figure 4.7 above, the majority of growth in dwellings in the Future Year 2036 occurs within zones 8, 11, 12, and 14 east of Trentham Road (1,400 dwellings⁹), with some minimal growth occurring in zones 10 and 13 west of Trentham Road within the existing LDRZ. Further the majority of growth in employment occurs within zones 1, 2, and 3 north of the Calder Freeway.

It is noted that after this time period (Beyond 2036) growth in dwellings will continue occur in zone 14 east of Trentham Road and zones 10 and 13 west of Trentham Road (extra 400 dwellings). Refer Table 4.2, traffic zone 10.

4.1.3 Demand Modelling

The Kyneton traffic demand model was completed in three steps as follows:

4.1.3.1 Step 1 – Trip Generation Model: Calculates the amount of movement (trips) for basic travel purposes

The Trip Generation Model assumes that trip rates (number of trips) depend on the type and intensity of land use. The basic assumption of trip generation models is that number of trips in each zone can be estimated by analysing specific transportation modelling data.

To create a trip generation model, it is necessary to collect data that explains complex human behaviour and the relationship of this behaviour with land use. This is usually collected by performing specific surveys created to suit the needs of transportation modelling. The data needs to be statistically reliable, and explain basic trip characteristics, mode, purpose, duration, start/end time of trips as well as relevant socio-economic data of trip makers (car ownership, income, employment status, education etc).

As specific trip generation surveys were not completed for this study, assumptions about trip generation rates were taken from; Section 3.3 – Traffic Model of the Kyneton Movement Network Transport Plan dated 1 April 2010 prepared by Aurecon; guidelines for trip generation rates; and an expert assessment of the model parameters.

For the Kyneton Township, a theoretical trip generation model was created based on modelling four major trip purposes; Home-Work, Home-Shopping, Home-Education, and Non-Home based trips. The trip generation rates for the Base Year 2016 and Future Year 2036 were based on calculating a Trip Production (origin) and Trip Generation (destination) depending on the land value data (e.g. Home-Work Production = 0.65 per Dwelling, and Attraction = 0.9 per Total Employment). This trip generation rate was applied to both the Base Year and Future Year Land Use Model.

This approach was chosen with aim of modeling only the trip purposes that can be most accurately modeled. In the early stages of Model simulation, a traffic model was created that only covered the

⁹ 70 dwellings per annum. Refer Section 4.1.2.3 .

travel to work purpose trips as they strongly depend on the number of inhabitants (dwellings) and the number of employees. In the later stages of Model simulation, more travel purposes were introduced (education, shopping etc.) to the travel demand modelling. It is important to note that most of these trips are home-based (work-home, work-education) and that they mostly occur in AM peak hour. In PM peak hour most of the trips are not home-based and in their characteristics are more difficult to model.

4.1.3.2 Step 2 - The Trip Distribution Model: Distributes trips to zones in the model, depending on the dwelling and employment zone distribution

The Trip Distribution Model is based on the simple logic assuming, the greater the separation between an origin and destination, the lower the propensity to make the trip. This means that travellers are trying to minimise distance, time or cost when travelling from point A to point B with a specific purpose.

The Trip Distribution model connects trip production and attractions estimated in the Trip Generation Model to determine trip interchanges between each zonal pair. This model considers the effects of impedance or accessibility on destination choice.

For Kyneton, the distribution model used was a Gravity Model resulting in trip matrices for 2016 and 2036. The increase in traffic (Productions and Attractions) is in accordance with the growth of the basic land use changes i.e. increase in dwellings, employment (industrial, retail, education).

4.1.3.3 Step 3 - The Trip Assignment Model: Distributes trips to the road network

The Trip Assignment Model is relatively simple and depends on the system characteristics (network connection, capacity, speed etc). After finalising the Trip Distribution Model, produced trip matrices were distributed via connectors from zone to zone via the modelled road network.

Base Year and Future Year traffic was allocated to the network model (Trip Assignment) showing the impact of the land use changes on the road network. Further depending on the options (i.e. bridge - no bridge) different scenarios of what impact this traffic will have on the road network are established.

4.2 Base Year 2016 Transport Model

The Base Year 2016 Transport Model was created for the purpose of calibrating the model with the existing traffic volumes and the land use data as detailed in Section 3.3 and Section 4.1.2.2 above respectively.

For the Kyneton study area, a synthetic model was created based on the land use data provided for the Base Year 2016 and the demand model then applied. A created matrix (prior matrix) was assigned to the network, and link (mid-block) volumes were calculated.

A comparison of the model volume results with the traffic count volumes was then completed to assess how the Transport Model is reflecting the actual situation. It is hard to expect that the results of the transport model will completely match the results of traffic counts. The reasons for this are multiple:

- The model is based on a limited number of travel purposes, while the counting of traffic includes all possible trip purposes.
- Model network is simplified and does not contain all the roads that exist.
- Trips from the zones are linked to one point in the network, which is not the case

The validity of the model is then calculated based on the GEH statistic. The GEH Statistic is a formula used in traffic engineering, traffic forecasting, and traffic modeling to compare two sets of traffic volumes. The formula for the "GEH Statistic" is:

$$GEH = \sqrt{\frac{2(M - C)^2}{M + C}}$$

Where M is the hourly traffic volume from the traffic model and C is the real-world hourly traffic count.

Model calibration was then completed to eliminate the above reasons and to give the model the same results as realistic counting. Model calibration uses a procedure called matrix estimation to adjust the model results so that they fit the real time data (traffic counts).

The following Table 4.4 shows GEH results from prior matrix and calibrated matrix. Refer also Figure 4.8 below for a plot of the statistical error results.

Table 4.4: Base Year AM GEH Results – Prior and Final Matrix

Category	Prior matrix				Final matrix			
	Number of observations	Correlation Coefficient	GEH < 5	Standard Deviation	Number of observations	Correlation Coefficient	GEH < 5	Standard Deviation
LINK ROAD	26	0.655	42%	42.1	26	0.838	88%	18.6
FREEWAY	8	0.734	61%	60.9	8	0.692	100%	47.1
ARTERIAL	21	0.435	68%	77.9	21	0.849	100%	34.1
CONNECTOR ROAD	10	1.025	59%	32.9	10	0.971	90%	11.2

Referring to Table 4.4 above, the prior matrix has produced around 60% of compliance with traffic counts where GEH is less than 5, where-as after matrix estimation (final matrix) results are satisfactory, i.e. closer to 100%.

This procedure ensures that the modelled demand and the network model (defined with network density, speed and capacity) is acceptable for future year network option testing and comparison.

The Base Year 2016 PM peak matrix was obtained by transposing the AM Peak matrix, so that the trips are now in the opposite direction. GEH statistics were extrapolated for the PM results and a comparison with the existing PM traffic survey counts showed a smaller correlation with the PM count, however still with satisfactory statistical acceptability. Refer Figure 4.9 below.

The average annual daily traffic (AADT) was also modelled for comparison with the existing daily traffic volume data as collected on the road network in 2016 and determined to be satisfactory statistical acceptability.

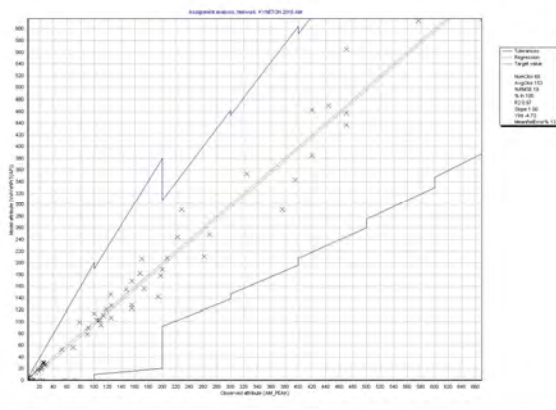


Figure 4.8: Base Year 2016 AM Statistical Error Results

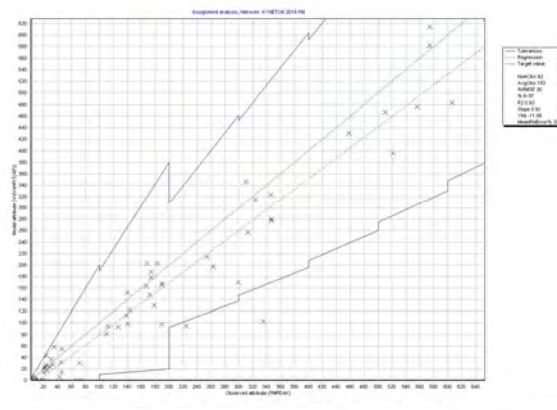


Figure 4.9: Base Year 2016 PM Statistical Error Results

Refer Appendix B for a copy of the Base Year 2016 Daily traffic volume, and the AM Peak and PM Peak traffic volumes including volume / capacity ratio plots

4.3 Future Year 2036 Transport Model

The Future Year 2036 Transport Model was created by utilising the AM Peak Base Year 2016 Transport Model and updating the existing land uses with the 2036 Land Use Summary as detailed in Section 4.1.2.3 above, and upgrading the existing road network as per the Kyneton South proposed street network plan, refer Figure 2.2 above.

As detailed above, the AM Peak Period Transport Model was selected over the PM Peak period for the following reasons:

- The AM Peak was determined to be a more stable model as vehicle trips in the AM are more specific i.e. home to work, home to school and last over a shorter period i.e. 7am – 9am. Where-as for the PM Peak, trips are more general i.e. some may be work or education to shop or leisure then to home, (which are difficult to replicate in a transport model) and may occur over a longer period i.e. 3pm – 6pm.
- The existing traffic volumes as surveyed showed that the AM Peak and PM Peak traffic volumes are very similar with some road and intersections experiencing a marginally higher traffic volume in the AM Peak and others experiencing a marginally higher traffic volume in the PM Peak. Therefore, it is expected that the Transport Model results for both peak periods would be very similar.
- The SIDRA analysis of the existing intersections showed that the AM and PM peak results are very similar.

The western township alternative route which involves the upgrade of Kyneton Spring Hill Road, Harpers Lane, Lauriston-Reservoir Road and Flynns Lane to Burton Avenue to a connector street standard was also included in this Transport Model. Refer Figure 4.10 below for the proposed Future Year 2036 Transport Model Road Network Layout.

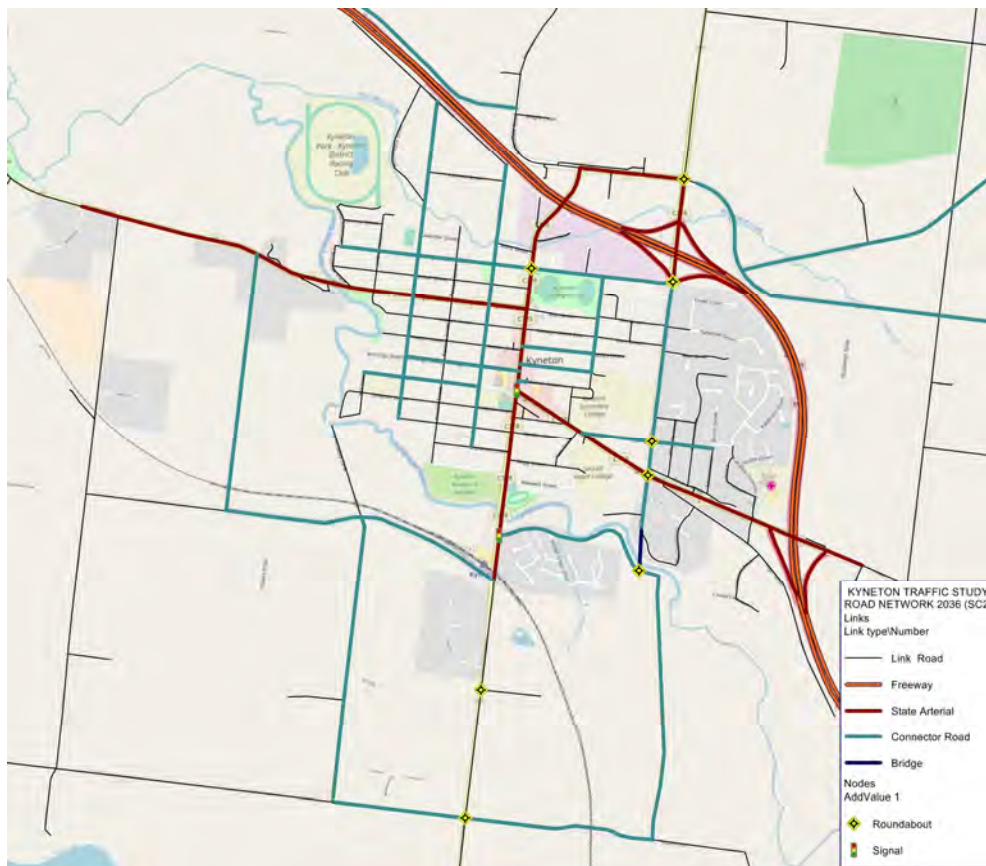


Figure 4.10: Future Year 2036 Transport Model - Road Network Layout

Based on a delivery rate of 70 dwellings per annum within greenfield areas (refer Section 4.1.2.3), it is estimated that by the year 2036, approximately 1,400 (78%) dwellings of the proposed 1,800 dwellings will be delivered within the Kyneton South area. As detailed in Section 4.1.2.4 above, the majority of these dwellings (1,400) will be delivered within zones 8, 11, 12 and 14 on the east side of Trentham Road.

It is noted that other road network options of the western township alternative route were tested, however determined to be a non-viable alternative due to the higher costs associated with upgrading the routes, combined with less vehicles using these routes due to the longer associated travel times.

An option without the new Edgcombe Street Bridge over the Campaspe River was also tested, however determined not to be a suitable road network option as the one-way AM Peak traffic volume on the Mollison Street northbound lane exceeds 1,200 vehicles per hour. This future year traffic volume is well in excess of the one-way mid-block capacity of a standard traffic lane (900 vehicles per hour adjacent to a parking lane)¹⁰ and will therefore have a significant impact on Mollison Street and the existing Mollison Street/ High Street signalised intersection, resulting in very long delays and queues for all vehicles travelling along Mollison Street and through the signalised intersection. Also, as development in the Kyneton South area, exceeds 1,400 dwellings beyond 2036, the traffic volume on Mollison Street will increase further, resulting in a severely congested road network, which in-turn will encourage drivers to seek an alternative route through the local adjacent access streets.

Refer Figure 4.11 for the Future Year 2036 AM Peak Traffic Volumes on the Road Network, and Figure 4.12 for the Future Year 2036 AM Peak Volume/ Capacity (V/C) Ratio. Refer also Appendix C for a detailed copy of these plots.



Figure 4.11: Future Year 2036 Transport Model – One-way Traffic Volumes

¹⁰ Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis

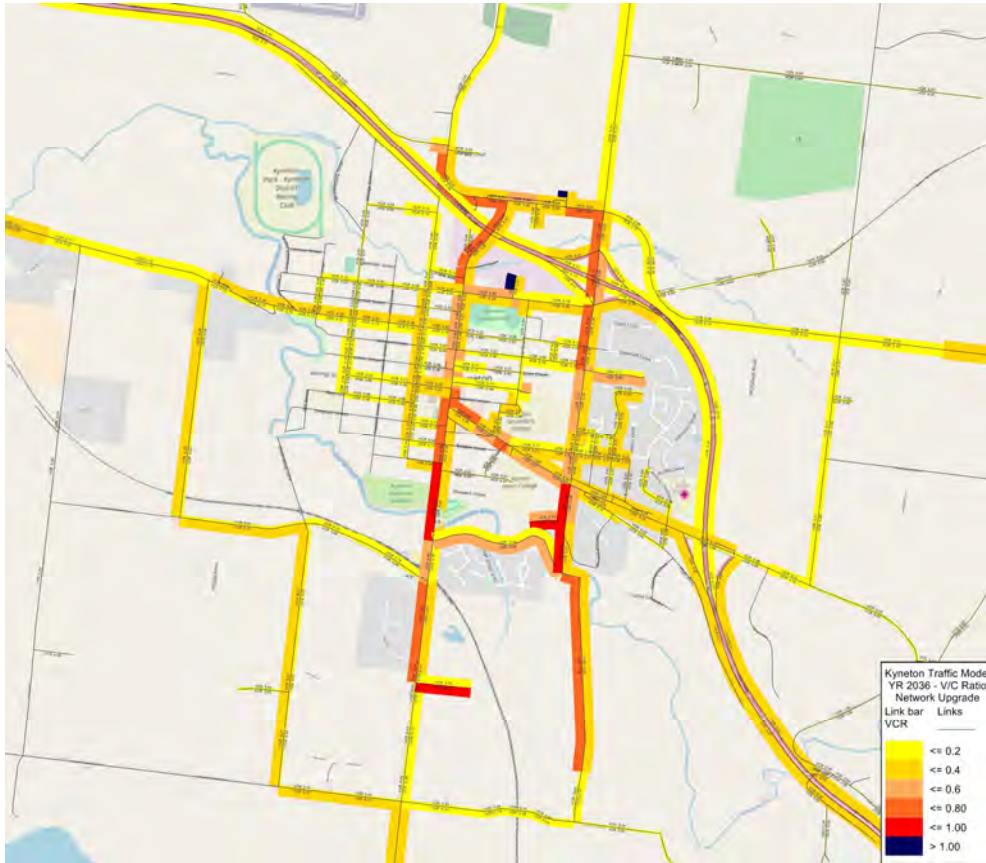


Figure 4.12: Future Year 2036 Transport Model – One-way Volume/ Capacity Ratio

As illustrated in Figure 4.11 and Figure 4.12 above, the Future Year 2036 AM Peak traffic volume on both Mollison Street and Edgecombe Street south of High Street are approaching capacity and have a V/C Ratio equivalent to 0.81 and 0.89 respectively. Further Mollison Street between Saleyards Road and Beauchamp Street, Saleyards Road west of Edgecombe Road, and Edgecombe Road between Saleyards Road and Beauchamp Street are experiencing high traffic volumes and have a V/C Ratio equivalent to 0.68, 0.62, and 0.77 respectively.

Due to the congested road network on Mollison Street and in particular at the Mollison Street/ High Street signalised intersection, it is expected that in the Future Year 2036, drivers on all approaches to the signalised intersection will try and seek an alternative route through the local street network to avoid the long delays and queues associated with the congested intersection. Therefore, it is recommended that traffic management measures be implemented within the local street network adjacent to the signalised intersection approaches to avoid this occurring. However, due to the heavy traffic movement from the south of the township to the north of the township during the AM Peak period and the expected reverse of this movement during the PM Peak period it is recommended that traffic management measures not be implemented along both Polhman Street and Ebden Street to ensure an alternative north-south route for drivers wanting to bypass the Town Centre. This will also ensure that the Future Year 2036 traffic volume on Mollison Street within the Town Centre does not exceed its capacity. Further if this recommendation is accepted by MRSC, then the intersection of Piper Street with Ebden Street should be upgraded to a roundabout to ensure the safe movement of traffic at this intersection.

The Transport Model has been calibrated to take into account the above road network changes.

4.4 Comparison Base Year 2016 & Future Year 2036 Transport Model

4.4.1 Trip Distribution

Analysis of the so-called desire lines show the expected changes in trip distribution. These changes occur due to the increase in the number of trips (associated with the growth of the township) and the different distribution of activity compared to the base year. Figure 4.13 and Figure 4.14 below illustrate these expected changes. It is noted for clarity external and transit trips have been removed from these figures.

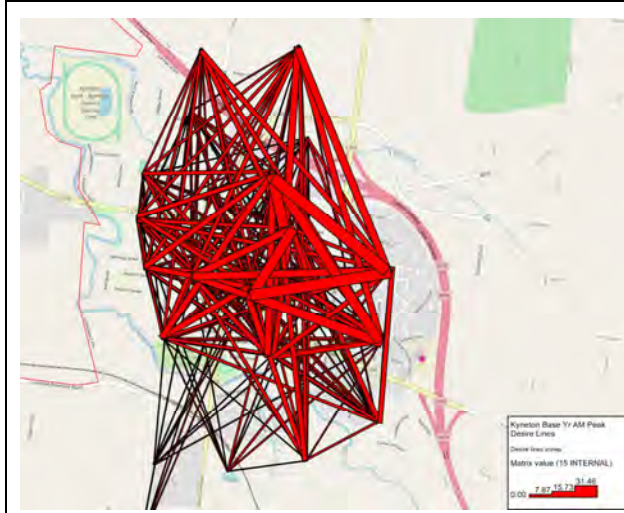


Figure 4.13: Base Year 2016 Desire Lines

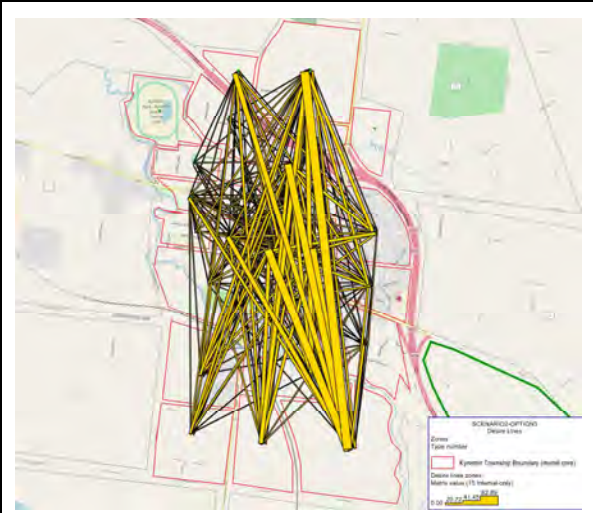


Figure 4.14: Future Year 2036 Desire Lines

As illustrated in Figure 4.13, during the Base Year 2016, all internal trips are concentrated in the existing continuously built up area (north of the Campaspe River), with the majority of trips attracted to the core center of the model (education, office, retail areas). Some internal trips are also attracted towards the northern industrial zones.

As illustrated in Figure 4.14, in the Future Year 2036, due to the proposed new development within the Kyneton South Investigation area combined with an increase in employment in the industrial areas north of the Calder Freeway, the majority of internal trips will now have a more north-south aligned travel pattern, whilst overlapping the existing travel patterns within the central zones of Kyneton.

4.4.2 Trip Generation

Table 4.5 below illustrates the global model results for the Base Year 2016 and Future Year 2036 Transport Model.

Table 4.5: Base & Future Year Model Result Comparison

YEAR	1	2	3	4	5	6	7=(4+5)	8=(4-6)	9=(7/1)
	DWELLINGS	EMPLOYMENT INDUSTRY	TOTAL EMPLOYMENT	INTERNAL TRIPS	INTERNAL-EXTERNAL TRIPS	EXTERNAL-INTERNAL TRIPS	KYNETON RESIDENTS TRIPS	TOTAL KYNETON RELATED TRIPS	TRIPS/DWELL
2016	2265	1835	4084	1463	602	825	2064	2889	0.91
2036	3965	2982	5527	3026	841	1180	3868	5047	0.98
Ratio 36/16	1.75	1.63	1.35	2.07	1.40	1.43	1.87	1.75	1.07

As illustrated in Table 4.5 above, in the base year the total peak hour trips generated per dwelling is 0.91 trips, where as in the future year it is approximately 0.98 trips.

The growth in trips generated per dwelling is mainly attributed to the expected growth in relative income i.e. mobility is strongly dependent on income. Therefore, as income is expected to grow over the forecast 20-year time period, growth factors in the trip generation model were refined/ adjusted accordingly to allow for future income changes.

Further the growth in trips per dwelling from the base year is also attributed to car ownership rates and the percentage of people expected to use their motor vehicle to travel to work. As such, the number of motor vehicles per dwelling, number of people per dwelling, and the main method of travel to work was sourced from the 2016 ABS Census data for both the Kyneton and Melbourne area for comparison purposes. The ABS data shows that there is approximately 1.9 vehicles and 2.43 people per dwelling in the Kyneton area and that approximately 87% of all people employed in Kyneton use a motor vehicle to travel to work. Where-as in Melbourne area there is approximately 1.68 vehicles and 2.67 people per dwelling and that approximately 76% of all people use a motor vehicle to travel to work.

The ABS data shows that residents of Kyneton have more vehicles per dwelling (almost two per dwelling) when compared to Melbourne, even though it has fewer people per dwelling, and 11% more people use their motor vehicle to travel to work.

Therefore, it can be concluded that due to the lack of alternative transport options in Kyneton, combined with the longer distances required to travel from a person's residence to employment/ education/ and essential services, residents of Kyneton require more motor vehicles per dwelling when compared to Melbourne, and predominately use their motor vehicle when travelling to work.

As such the trip generation rate per dwelling has been increased accordingly in the future year, to take into account that as future growth in residential development occurs south of the Campaspe River (which will double the existing Kyneton population) which is quite removed/ isolated from employment, education and essential services, and may potentially lack alternative transport options, car ownership rates per dwelling over the forecast period are expected to increase, therefore resulting in more vehicle trips per dwelling.

Table 4.5 also illustrates travel from the external zones to the internal zones and internal zones to internal zones which are distributed depending on the attractiveness of the zones (i.e. employment by categories, industry, retail etc.).

Transit trips (which do not gravitate to the internal zones in the model) are calculated on the basis of traffic counts and are forecasted with a growth rate of 2% per annum up to the year 2036.

4.4.3 Base Year 2016 & Future Year 2036 Traffic Volume Comparison

A comparison of the Base Year 2016 Traffic Volumes with the Future Year 2036 Traffic Volumes is provided in Table 4.6 below.

Referring to Table 4.6, the following existing roads will require upgrading to an Connector Street Level 1 standard (2,500vpd to 6,000 vehicles per day¹¹) to increase capacity:

1. Flynns Lane
2. Lauriston Reservoir Road between Flynn's Lane and Trentham Road
3. Harpers Lane
4. Kyneton Springhill Road between Harpers Land and Trentham Road
5. Pleasant Hill Road between Trentham Road and the Edgecombe Street Extension.

Edgecombe Street between High Street and the Campaspe River will also require upgrading as it is expected to experience traffic volumes in excess of 7,000 vpd, similar to a Secondary Arterial (Local) Road. However, any proposed road upgrade will be limited by the existing width of the road reserve which is currently 20m wide. Therefore, any proposed road upgrade should allow the following as a minimum:

- Two dedicated 3.5 metre wide through traffic lanes;

¹¹ Proposed new roads and upgrades to existing roads are to comply with Table 2: Urban Road/ Street Characteristics, Infrastructure Design Manual, Ver 5.10, 11 January 2018.

- Two 1.5 metre wide bike lanes;
- Restriction to on-street parking for the entire road length; and
- Restricted Access to adjoining allotments.

Table 4.6: Comparison Base Year 2016 Traffic Volume vs Future Year 2036 Traffic Volume

Road Name	Two-way AM Peak Hour Traffic Volume		Ratio 2036 to 2016	Future Year 2036 Traffic Volume (vehicles/day) ¹²	Expected Road Capacity ¹³ (vehicles/day)	Capacity Exceeded (Yes/ No)
	Base Year 2016	Future Year 2036				
Beauchamp St west of Edgecombe St	272	421	1.55	4,680	3,000 - 7,000	N
Beauchamp St west of Mollison St	77	333	4.32	3,700	3,000 - 7,000	N
Bourke St west of Caroline Chisholm Dr.	588	477	0.81	5,300	7,000 – 18,000 ¹⁴	N
Burton Av south of Calder Freeway	207	299	1.44	3,330	7,000 – 18,000	N
Campaspe Dr east of Mollison St	84	558	6.64	6,200	3,000 - 7,000	N
Edgecombe St north of Epping St	394	603	1.53	6,700	3,000 - 7,000	N
Epping St	201	347	1.73	3,860	3,000 - 7,000	N
High St East of Mollison St	602	886	1.47	9,850	7,000 – 18,000	N
Trentham Road south of Railway Line	268	481	1.79	5,350	7,000 – 18,000	N
Mollison St north of Campaspe Dr	281	1029	3.66	11,440	7,000 – 18,000	N
Mollison St north of High St	650	1293	1.99	14,370	7,000 – 18,000	N
Mollison St South of High St	336	943	2.81	10,480	7,000 – 18,000	N
Mollison St north of Piper St	418	825	1.97	9,170	7,000 – 18,000	N
Mollison St south of Saleyards Rd	284	851	3.00	9,460	7,000 – 18,000	N
Piper St west of Mollison St	288	496	1.72	5,520	7,000 – 18,000	N
Saleyards Rd west of Mollison St	201	490	2.44	5,450	3,000 - 7,000	N
Saleyards Rd west of Edgecombe Rd	244	755	3.09	8,390	7,000 – 18,000	N
Edgecombe Rd south or Saleyards Rd	331	795	2.40	8,840	7,000 – 18,000	N
Flynns Lane	11	267	24.27	2,970	500 – 1,000 ¹⁵	Y
Lauriston Reservoir Rd East of Flynns Lane	80	247	3.09	2,750	500 - 1,000	Y
Lauriston Reservoir Rd west of Trentham Rd	87	140	1.61	1,560	500 - 1,000	Y
Harpers Lane	43	327	7.60	3,640	50 - 200 ¹⁶	Y
Kyneton-Springhill Road	43	228	5.30	2,540	500 - 1,000	Y
Pleasant Hill Road	8	142	17.75	1,580	50 - 200	Y
Edgecombe St south of High St	19	1,003	52.79	11,150	3,000 - 7,000	Y
Trentham Rd south of Kyneton Spring Hill Rd	173	219	26.59	2,435	7,000 – 18,000	N

¹² Based on a peak hour to daily volume ratio equivalent to 0.09. This has been calculated from the existing traffic volume survey data.

¹³ Clause 56.06-8 Lot Access Objectives of the Macedon Ranges Planning Scheme, unless noted otherwise.

¹⁴ Clause 56.06-8 of the Planning Scheme states that Arterial Roads carry more than 7,000 vpd. Further based on the Austroads Guide to Traffic Management, Part 3 – Traffic Studies and Analysis, a two-lane undivided road has a theoretical daily capacity equivalent to 18,000 vpd.

¹⁵ Table 1.1 - Council's Local Road Network, Draft Road Management Plan 2017, Macedon Ranges Shire Council.

¹⁶ Table 1.1 - Council's Local Road Network, Draft Road Management Plan 2017, Macedon Ranges Shire Council.

Road Name	Two-way AM Peak Hour Traffic Volume		Ratio 2036 to 2016	Future Year 2036 Traffic Volume (vehicles/day) ¹⁷	Expected Road Capacity ¹⁸ (vehicles/day)	Capacity Exceeded (Yes/ No)
	Base Year 2016	Future Year 2036				
Calder Freeway south-east of Edgcombe St.	927	1,243	1.34	13,820	< 44,000 ¹⁹	N
Calder Freeway south-east of Bourke St.	1,232	1,734	1.41	19,270	< 44,000	N

It is noted that the traffic volume on Bourke Street west of the Calder Freeway Interchange is expected to drop in the future year. This expected drop in traffic volume may be attributed to the new employment proposed within industrial zone north of Saleyards Road, and therefore there is less of a requirement for people to leave Kyneton to find other employment. It also may be attributed to vehicles travelling northbound along the Calder Freeway to access the Kyneton Town Centre, avoiding the congested Mollison Street/ High Street Signalised intersection and travelling further north to the Edgcombe Road Interchange and the approaching the Town Centre via Beauchamp Street.

4.5 Kyneton South Investigation Area Internal Road Network Review

The proposed road classification of the key internal roads within the Kyneton South Area are detailed in Table 4.7 below.

Table 4.7: Kyneton South Investigation Area - Internal Road Network Classification

Road Name	Future Year 2036 Two-way AM Peak Hour Traffic Volume	Future Year 2036 Traffic Volume (vehicles/day)	Expected Road Capacity (vehicles/day) ²⁰	Road Classification
Edgcombe St Extension between Campaspe River and Pleasant Hill Rd	715	7,950	6,000 – 12,000	Connector Street Level 2
East West Connector Street within the Kyneton South Investigation Area	450	5,000	2,500 - 6,000	Connector Street Level 1

With regard to the proposed Edgcombe Street Extension, the Infrastructure Design Manual recommends that a road with this type of classification has a minimum of 2 No. 7.0 metre wide carriageway's that are separated by a 6.0 metre wide median, i.e. a four lane divided road.

However due to the restriction in upgrading the existing section of Edgcombe Street north of the Campaspe River to have only two dedicated 3.5 metre wide through traffic lanes, and the high cost associated with providing a four lane divided bridge, it is recommended that the Edgcombe Street Extension south of the river, maintain a similar proposed cross sectional profile to avoid the complexity and operational issues associated with the transition of a four-lane divided road into a two lane undivided road.

Therefore, to ensure that the Edgcombe Street Extension can maintain a daily traffic volume equivalent to 7,950 vehicles per day, it is recommended that the proposed cross-sectional profile consist of 2 No. 3.5 metre wide through traffic lanes, with a 1.5 metre wide bike lane provided either side of the traffic lane that are separated by a 6.0 metre wide median. Further turning lanes should be provided within the median at all adjoining local street intersections, and direct access to allotments including on-street parking should be restricted for the full road length.

¹⁷ Based on a peak hour to daily volume ratio equivalent to 0.09. This has been calculated from the existing traffic volume survey data.

¹⁸ Clause 56.06-8 Lot Access Objectives of the Macedon Ranges Planning Scheme, unless noted otherwise.

¹⁹ Table 4.5 - LOS Criteria for Basic Freeway Segments, Austroads Guide to Traffic Management, Part 3: Traffic Studies and Analysis. Assumes FFS = 100km/h & LOS = B.

²⁰ Table 2: Urban Road/ Street Characteristics, Infrastructure Design Manual, Ver 5.10, 11 January 2018.

5 INTERSECTION ASSESSEMENT

An analysis of the following major intersections within the study area was completed to determine what impact the Future Year 2036 peak hour traffic volume will have on the intersection. Where impacts are identified, recommendations to mitigate the impact via intersection upgrades have been made.

An assessment of both the Future Year 2036 AM Peak and PM Peak hour traffic volumes was completed. The PM Peak traffic volumes, are a reverse of the AM Peak volumes, and where required factored up to take into account the difference in traffic volumes between both peak events as recorded during the existing intersection turning movement surveys.

Refer Section 5.1.1 to 5.1.14 below for a summary of the proposed intersection upgrades where required to increase the capacity and/ or improve operational efficiency of the intersection. All proposed upgrades at unsignalised T-intersections and Cross Intersections are in accordance with Figure 2.23: Warrants for turn treatments on the major road at unsignalised intersections of the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings.

Refer Appendix D for a detailed summary of the SIDRA Analysis results.

5.1.1 High Street / Edgecombe Street

The existing intersection is to be upgraded to a roundabout to improve capacity and safety.

5.1.2 Epping Street / Edgecombe Street

The existing roundabout operates satisfactorily. Therefore, no upgrade is required.

5.1.3 High Street / Epping Street

The existing T-intersection is to be upgraded to include a channelised right turn lane and an auxiliary left turn lane on the High Street western and eastern approaches respectively to Epping Street by removing the existing parking lanes.

5.1.4 Beauchamp Street / Edgecombe Street / Calder Freeway Interchange

The existing roundabout operates satisfactorily. Therefore, no upgrade is required.

5.1.5 Saleyards Road / Edgecombe Road/ Pipers Creek Road

The existing intersection is to be upgraded to a roundabout to improve capacity and safety. It is noted that the proposed upgrade will present some design issues due to the stagger of Pipers Creek Road from Saleyards Road. Consideration should be given to acquiring land to the north of Pipers Creek Road to align its approach with Saleyards Road.

5.1.6 Mollison Street / Saleyards Road

Provide a short Auxiliary Left Turn Lane on the Mollison Street approach to Saleyards Road. This is required to improve capacity of the intersection.

5.1.7 Mollison Street / Beauchamp Street

The existing intersection is to be upgraded to a roundabout to improve capacity and safety.

5.1.8 Mollison Street / Piper Street

Provide an Auxiliary Left Turn Lane on the Piper Street approach to Mollison Street and formalise a channelised right turn lane on the Mollison Street northern and southern approaches respectively to Piper Street by removing the existing parking lanes. This is required to improve capacity and safety of the intersection.

5.1.9 Mollison Street / High Street

The existing Mollison Street/ High Street intersection requires the following upgrade to cater for the Future Year 2036 development traffic.

- High Street Leg - Provide an additional lane by widening the existing carriageway on the approach to the intersection and ban parking within 80 metres of the intersection stop line during peak times. Make this additional lane a dedicated left turn lane and convert the existing lane to a dedicated right turn lane.
- Mollison Street South Leg - Increase the channelised right turn lane length to obtain a total 60 metre storage length.
- Mollison Street South Leg – Provide additional storage to the left turn lane by banning parking within 130 metres of the intersection stop line during peak times.

5.1.10 Mollison Street / Campaspe Drive

The existing intersection is to be upgraded to a signalised intersection by others. Refer to the existing planning permit condition requirement for Campaspe Views Estate.

5.1.11 Trentham Road / Lauriston Reservoir Road

Provide a Short Channelised Right Turn Lane with a minimum of 10 metres storage length on the Trentham Road northern leg of the intersection. It is noted that the addition of the right turn lane may present some design issues due to the proximity of the existing railway crossing located to the north of this intersection. Therefore, consideration should be given to relocating the Lauriston Reservoir Road approach further south by acquiring land to the south of Lauriston Reservoir Road.

5.1.12 Trentham Road / East-West Access Road

From a safety perspective, the proposed Intersection is to be controlled by a roundabout.

5.1.13 Trentham Road / Pleasant Hill Road

The existing Intersection is to be upgraded to a roundabout to improve safety.

5.1.14 Burton Avenue / Flynn's Lane

Provide a Short Channelised Right Turn Lane on the Burton Avenue western leg of the intersection.

6 EDGECOMBE STREET BRIDGE REQUIREMENT

Three extra Transport Models for the Future Year 2021, 2026, and 2031 were created with and without the Edgcombe Street Bridge to assist in determining the trigger point for the bridge. In order to determine the trigger point for the bridge, an analysis of the volume to capacity ratio (degree of saturation) on a few selected key arterial roads within the study area was completed at the future year time lines to determine if and when the key arterial roads will exceed their capacity.

The Future Year 2036 land use summary as detailed in Table 4.3 was proportioned accordingly for each of the future year timelines.

Refer Table 6.1 for the Future Year 2021, 2026, and 2031 volume to capacity (v/c) ratio. Refer also Appendix E for a copy of the Future Year 2021, 2026, and 2031 traffic volume and volume/ capacity ratio plots.

Table 6.1: One-way AM Peak Hour Volume to Capacity Ratio

Road Name	Future Year 2021 V/C Ratio		Future Year 2026 V/C Ratio		Future Year 2031 V/C Ratio	
	North/ Eastbound	South/ Westbound	North/ Eastbound	South/ Westbound	North/ Eastbound	South/ Westbound
Bourke St west of Caroline Chisholm Dr.	0.20	0.27	0.20	0.26	0.18	0.25
High St West of Ferguson St	0.45	0.43	0.50	0.43	0.55	0.42
Campaspe Dr east of Mollison St	0.15	0.63	0.24	0.97	0.32	1.15
Trentham Rd south of Railway Line	0.30	0.28	0.32	0.26	0.57	0.21
Mollison St north of Railway Line	0.21	0.18	0.23	0.17	0.36	0.14
Mollison St north of Campaspe Dr	0.72	0.29	1.01	0.36	1.28	0.39
Mollison St south of Piper St	0.35	0.33	0.42	0.36	0.56	0.38
Mollison St north of Piper St	0.39	0.28	0.49	0.30	0.60	0.31
Mollison St south of Saleyards Rd	0.40	0.20	0.54	0.23	0.69	0.26

As illustrated in Table 6.1 above in the Future Year 2021 all key arterial roads apart from Campaspe Drive and Mollison Street north of Campaspe Drive have a v/c ratio less than 0.45. Both Campaspe Drive westbound lane and Mollison Street northbound lane have a v/c ratio equivalent to 0.63 and 0.72 respectively.

In the Future Year 2026, all key arterial roads apart from Campaspe Drive and Mollison Street north of Campaspe Drive have a v/c ratio less than 0.55. Both Campaspe Drive westbound lane and Mollison Street northbound lane have a v/c ratio equivalent to 0.97 (close to capacity) and 1.01 (over capacity) respectively.

In the Future Year 2031, all key arterial roads apart from Campaspe Drive, Mollison Street north of Campaspe Drive, and Mollison Street between Piper Street and Saleyards Road have a v/c ratio less than 0.60. Both Campaspe Drive westbound lane and Mollison Street northbound lane are over capacity with a v/c ratio equivalent to 1.15 and 1.28 respectively, where-as Mollison Street has a v/c ratio between 0.60 and 0.69.

Therefore, it is recommended that the Edgcombe Street Bridge, be constructed well prior to year 2026 or the construction of the 850th residential lot within the Kyneton South Area. This will ensure that Mollison Street between Campaspe Drive and High Street and in particular the intersection of Mollison Street with High Street and Campaspe Drive east of Mollison Street does not exceed their expected capacity.

7 PUBLIC TRANSPORT

The 2016 ABS Main method of Travel to Work Data for the Kyneton area indicates that 7% (3% Bus and 4% Train) of Kyneton residents use public transport to travel to and from work, where-as 87% of residents use the motor vehicle. The high motor vehicle usage is attributed to the longer distances people are required to travel to work, combined with a lack of public transport options/ availability.

As employment grows within the industrial zone to the north of the Calder Freeway and the new dwellings are developed within the southern part of Kyneton, it is expected that in the Future Year 2036 the percentage of people using a motor vehicle as their main method of travel to work will be similar to the 2016 ABS data, if not slightly higher.

Therefore, to encourage the use of public transport as an alternative mode of transport to the motor vehicle and help reduce the number of motor vehicle trips within the Kyneton Township, it is recommended that a new public transport service (bus) that is aligned in a north south direction (refer Figure 4.14 Future Year 2036 Desire Line) be introduced in Kyneton.

The bus service should be planned to have a circular route (both clockwise and anti-clockwise) around the township and include the new Edgecombe Street bridge crossing, Edgecombe Street, Saleyards Road, Mollison Street, Kyneton Railway Station, Trentham Road, Pleasant Hill Road, and the Edgecombe Street Extension in the route. Further, for the bus service to be a viable and efficient alternative to the motor vehicle, buses should run at intervals of around 10 to 20 minutes during peak times.

8 RECOMMENDATIONS

A Transport Model of the Kyneton Township over a 20 year time period from 2016 to 2036 has been created to assist in determining what impact proposed land use changes within the Kyneton Township will have on the existing road network and help determine what road network changes/ upgrades are required to meet the expected growth in traffic.

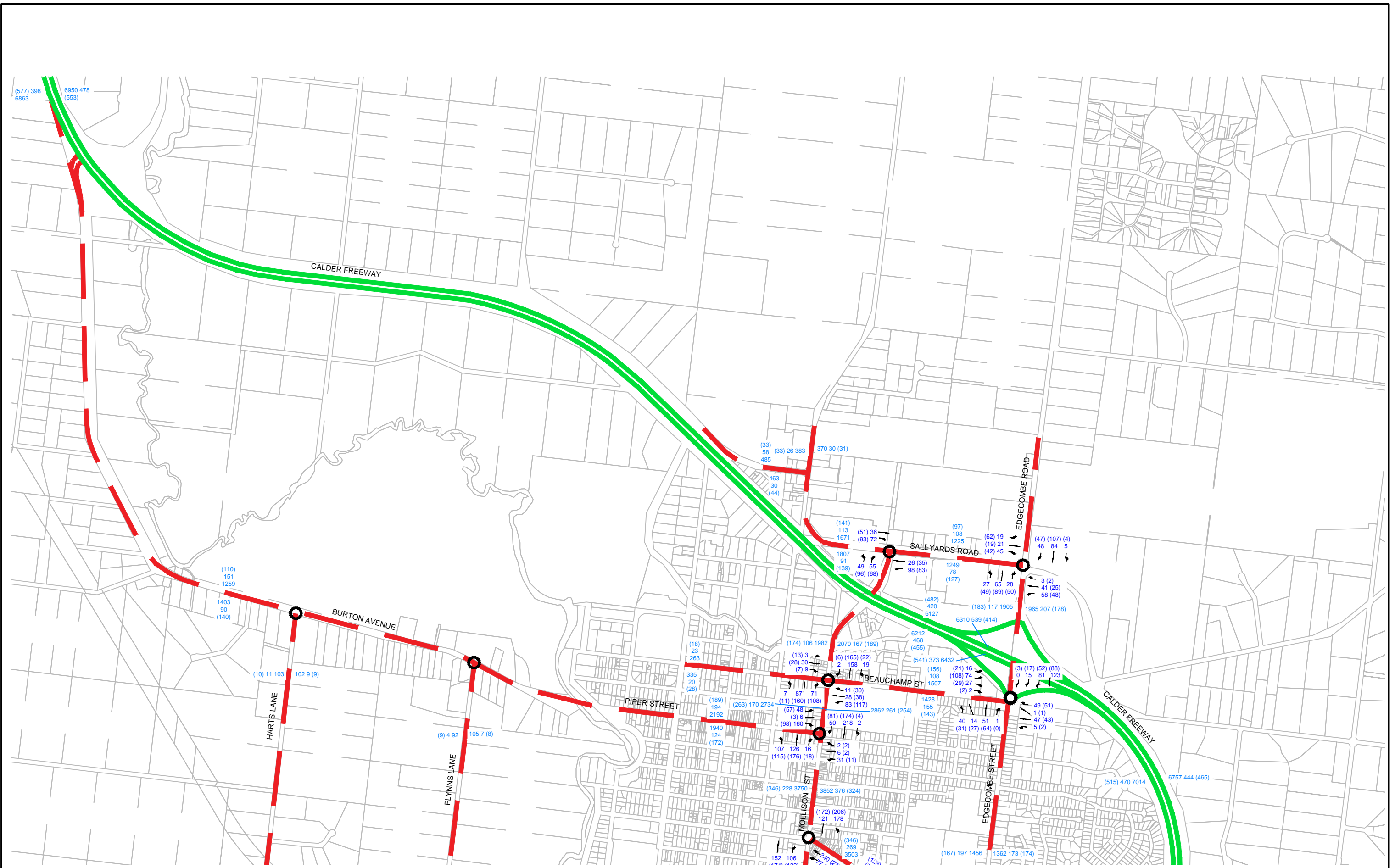
During this 20 year time period the population within the Kyneton Township is projected to grow by approximately 4,080 people (2.84% p.a.), with the majority of the population growth occurring south of the Campaspe River within the Kyneton South area. Employment is also expected to grow in the township by 1,443 jobs (1.5% p.a.) with the majority of jobs located in the industrial zoned land located north of the Calder Freeway. Further by the year 2036, approximately 1,400 (78%) dwellings of the proposed 1,800 dwellings will be delivered within the Kyneton South area.

Based on the 2036 Transport Model results, it is recommended that the following new transport infrastructure and/ or upgrades to existing transport infrastructure be implemented within the Kyneton Township, to support the projected population growth between 2016 and 2036 and ensures that the transport network operates below capacity:

1. Edgecombe Street Bridge over Campaspe River – A new two-lane two-way bridge with bike lanes or a shared path on both sides of the carriageway be constructed over the Campaspe River prior to year 2026 or the construction of the 850th residential lot within the Kyneton South Area.
2. Edgecombe Street Upgrade – The upgrade of Edgecombe Street between High Street and the Campaspe River is to have 2 No. 3.5 metre wide through traffic lanes, and a 1.5 metre wide bike lane provided on either side of the traffic lane. Restriction to on-street parking and access to adjoining allotments for the entire road length should also be implemented.
3. Edgecombe Street Extension – The proposed cross-sectional profile of the Edgecombe Street Extension south of Campaspe River should consist of 2 No. 3.5 metre wide through traffic lanes, with a 1.5 metre wide bike lane provided either side of the traffic lane. The thorough traffic lanes are to be separated by a 6.0 metre wide median. Turning lanes should be provided within the median at all adjoining local street intersections, and direct access to allotments including on-street parking should be restricted for the full road length.
4. Pleasant Hill Road Upgrade – Pleasant Hill Road between Trentham Road and the Edgecombe Street Extension be upgraded to a Connector Street Level 1 standard. This is to include a new overpass over the Melbourne-Bendigo Railway line.
5. Flynns Lane Upgrade – Flynns Lane between Burton Avenue and Lauriston Reservoir Road be upgraded to a Connector Street Level 1 standard. The carriageway width at the existing Melbourne-Bendigo Railway line overpass is to be narrowed to 6.0 metres wide.
6. Lauriston Reservoir Road Upgrade - Lauriston Reservoir Road between Flynn's Lane and Trentham Road be upgraded to a Connector Street Level 1 standard.
7. Harpers Lane Upgrade – Harpers Lane between Lauriston Reservoir Road and Kyneton Springhill Road be upgraded to a Connector Street Level 1 standard.
8. Kyneton Springhill Road Upgrade – Kyneton Springhill Road between Trentham Road and Harpers Lane be upgraded to a Connector Street Level 1 standard.
9. Trentham Road Upgrade – Upgrade Trentham Road between Lauriston Reservoir Road and Pleasant Hill Road to a Connector Boulevard Street standard. The cross sectional profile of Trentham Road is to consist of 2 No. 5.0 metre wide traffic lanes separated by a wide median strip. A 3.0 metre wide shared path is also to be provided on either side of the traffic lanes.
10. East West Connector Street – The East West Connector Street within the Kyneton South Area is to be constructed to a Connector Street Level 1 standard.
11. Traffic Management Scheme - Implement traffic management measures within the local street network adjacent to the signalised intersection approaches to prevent rat running within the local street network. However, due to the heavy traffic movement from the south of the township to the north of the township during the AM Peak period and the expected reverse of this movement during the PM Peak period it is recommended that traffic management measures not be implemented along both Polhman Street and Ebdon Street.

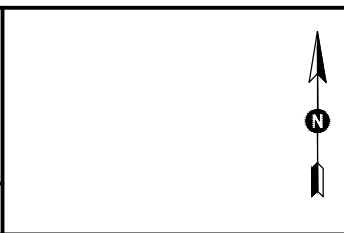
12. Intersection Upgrades – The following Intersections will require upgrading to ensure safe and efficient operation of the intersection:
- a. High Street / Edgecombe Street - Upgrade to a roundabout.
 - b. High Street / Epping Street - Upgrade to include a channelised right turn lane and an auxiliary left turn lane on the High Street western and eastern approaches respectively to Epping Street by removing the existing parking lanes.
 - c. Saleyards Road / Edgecombe Road/ Pipers Creek Road - Upgrade to a roundabout. Consideration should be given to acquiring land to the north of Pipers Creek Road to align its approach with Saleyards Road.
 - d. Mollison Street / Saleyards Road – Upgrade to include a short Auxiliary Left Turn Lane on the Mollison Street approach to Saleyards Road
 - e. Mollison Street / Beauchamp Street - Upgrade to a roundabout.
 - f. Mollison Street / Piper Street – Upgrade to include an Auxiliary Left Turn Lane on the Piper Street approach to Mollison Street and formalise a channelised right turn lane on the Mollison Street northern and southern approaches respectively to Piper Street by removing the existing parking lanes.
 - g. Mollison Street / High Street – Upgrade as follows:
 - High Street Leg - Provide an additional lane by widening the existing carriageway on the approach to the intersection and ban parking within 80 metres of the intersection stop line during peak times. Make this additional lane a dedicated left turn lane and convert the existing lane to a dedicated right turn lane.
 - Mollison Street South Leg - Increase the channelised right turn lane length to obtain a total 60 metre storage length.
 - Mollison Street South Leg – Provide additional storage to the left turn lane by banning parking within 130 metres of the intersection stop line during peak times.
 - h. Mollison Street / Campaspe Drive - The existing intersection is to be upgraded to a signalised intersection as per the existing planning permit condition requirement for the Campaspe Views Estate.
 - i. Trentham Road / Lauriston Reservoir Road – Upgrade to include a Short Channelised Right Turn Lane with a minimum of 10 metres storage length on the Trentham Road northern leg of the intersection. Consideration should be given to relocating the Lauriston Reservoir Road approach south by acquiring land to the south of Lauriston Reservoir Road so that the turn lane including transition avoids the Railway crossing.
 - j. Trentham Road / East-West Access Road - To be controlled by a roundabout.
 - k. Trentham Road / Pleasant Hill Road - Upgrade to a roundabout.
 - l. Burton Avenue / Flynns Lane – Upgrade to include a Short Channelised Right Turn Lane on the Burton Avenue western leg of the intersection.
 - m. Piper Street/ Ebden Street - Upgrade to a roundabout if traffic management measures are not implemented in both Polhman Street and Ebden Street.
 - n. Public Transport - New bus service with a circular route (both clockwise and anti-clockwise) around the Kyneton Township be introduced into the Township. The proposed bus route is to include the new Edgecombe Street bridge crossing, Edgecombe Street, Saleyards Road, Mollison Street, Kyneton Railway Station, Trentham Road, Pleasant Hill Road, and the Edgecombe Street Extension as a minimum and run at intervals of around 10 to 20 minutes during peak times.

APPENDIX A – EXISTING ROAD NETWORK TRAFFIC VOLUMES



No	REVISION	DATE	DES/DFT	APPRD

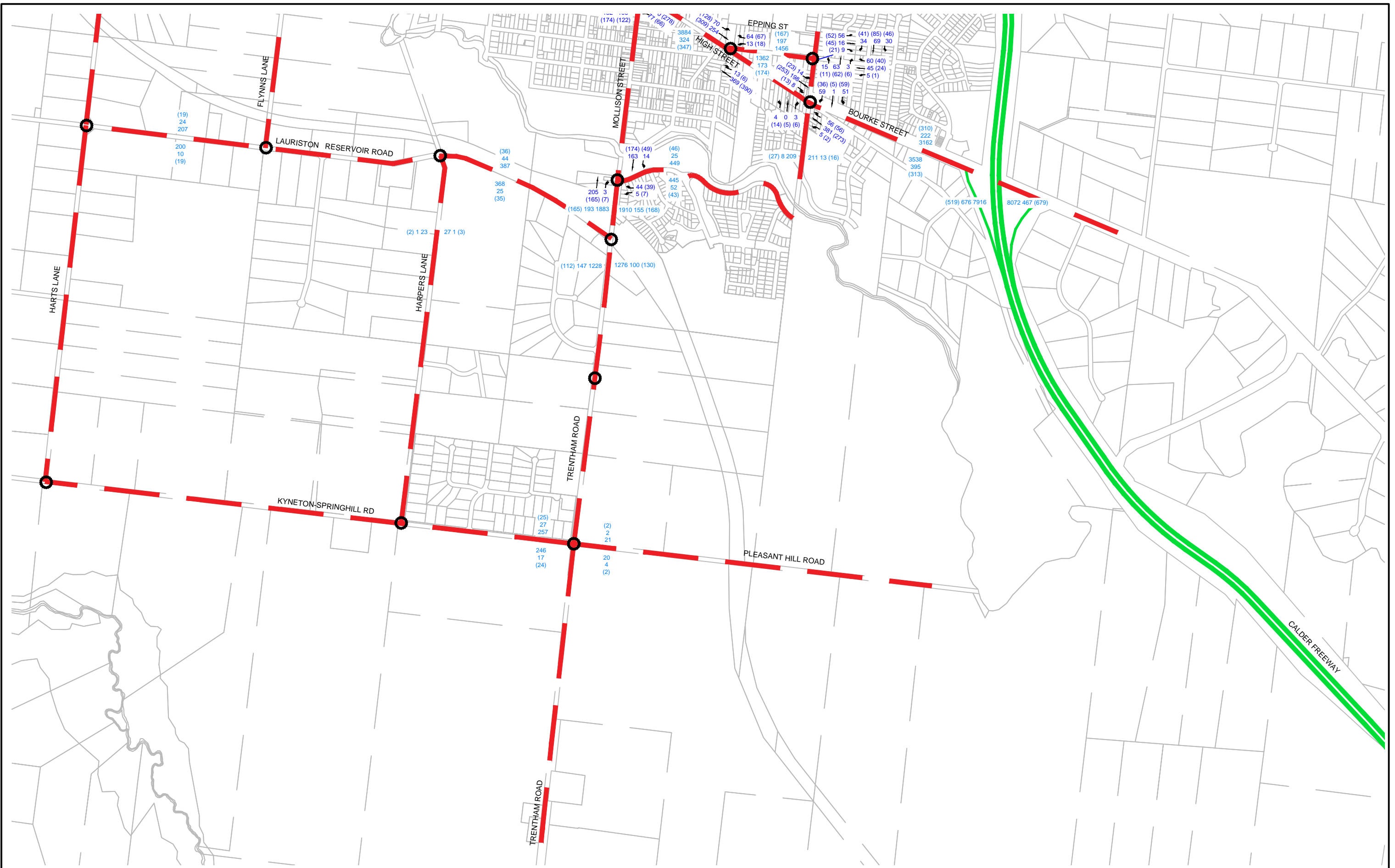
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155	- AM PEAK HOUR TRAFFIC VOLUME
243	- PM PEAK HOUR TRAFFIC VOLUME
3	- AM PEAK HOUR TURNING MOVEMENT VOLUME
(2)	- PM PEAK HOUR TURNING MOVEMENT VOLUME
→	- THROUGH MOVEMENT
↘	- RIGHT TURN MOVEMENT
↙	- LEFT TURN MOVEMENT



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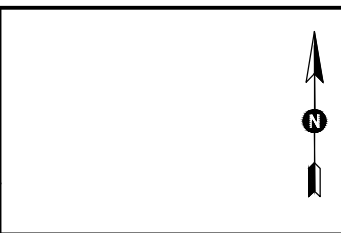
Drawn C. Emmitt	Project KMNS 2018
Designed C. Emmitt	Title Keynton Movement Network Study 2018 Existing Daily and Peak Hour Traffic Volumes Road & Intersections
Checked M. Marsicovetere	Client Macedon Ranges Shire Council PO Box 151 Kyneton VIC 3444
Approved M. Marsicovetere	© Transport & Traffic Solutions Pty Ltd

Drawing No. 17022KM-00-101	Revision
Drawing Status	
Sheet 1 of 3	Date 08.11.17
Scale NTS	Size A3



No	REVISION	DATE	DES/DFT	APPRD

LEGEND	
1428	- AVERAGE ANNUAL DAILY TRAFFIC VOLUME
155	- AM PEAK HOUR TRAFFIC VOLUME
243	- PM PEAK HOUR TRAFFIC VOLUME
3	- AM PEAK HOUR TURNING MOVEMENT VOLUME
2	- PM PEAK HOUR TURNING MOVEMENT VOLUME
(2)	- RIGHT TURN MOVEMENT
↑	- THROUGH MOVEMENT
↓	- LEFT TURN MOVEMENT

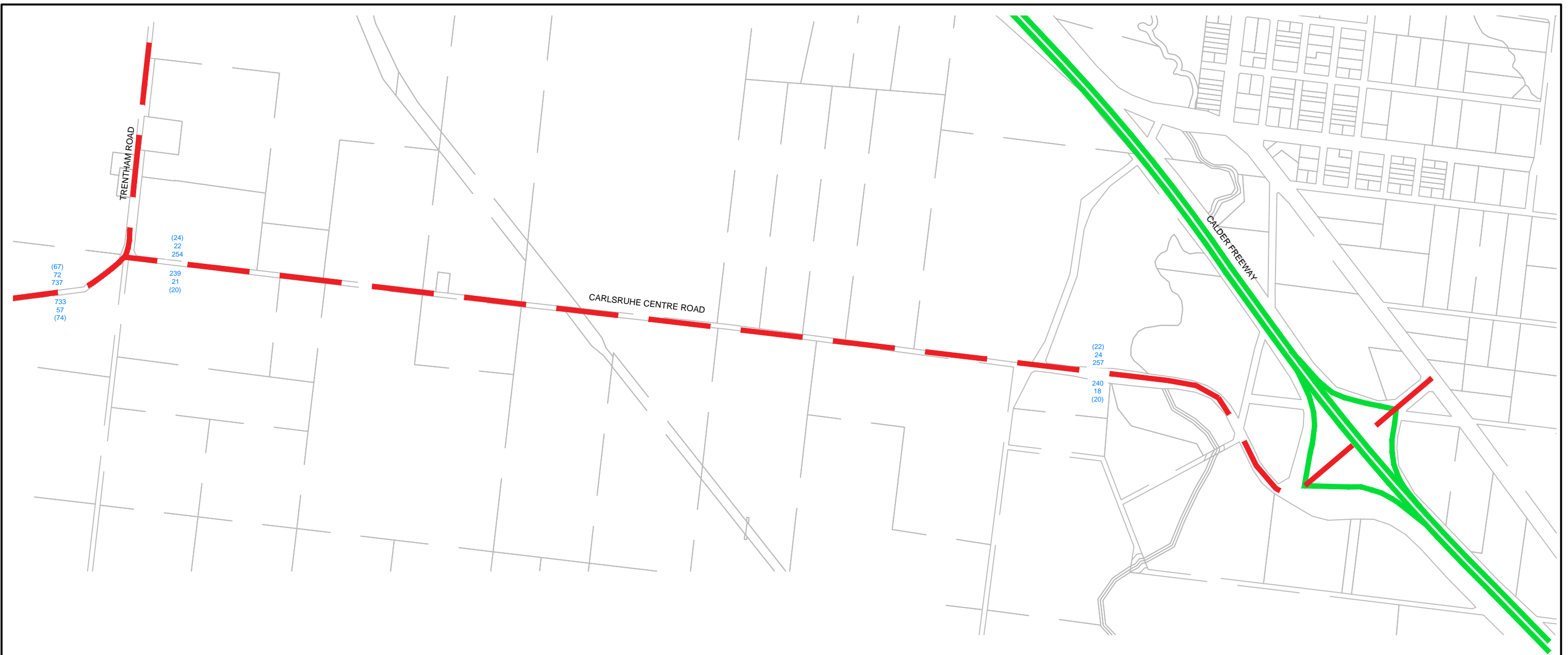


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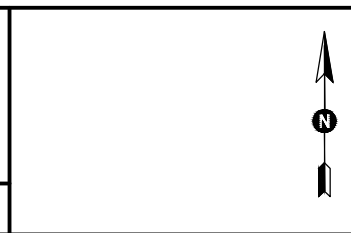
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Title Keynton Movement Network Study 2018 Existing Daily and Peak Hour Traffic Volumes Road & Intersections	Drawing Status

Drawing No. 17022KM-00-102	Revision
Sheet 2 of 3	Date 08.11.17
Scale NTS	Size A3



No	REVISION	DATE	DES/DFT	APPRD

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3	- AM PEAK HOUR TURNING MOVEMENT VOLUME
(2)	- PM PEAK HOUR TURNING MOVEMENT VOLUME
→	- RIGHT TURN MOVEMENT
→	- THROUGH MOVEMENT
←	- LEFT TURN MOVEMENT



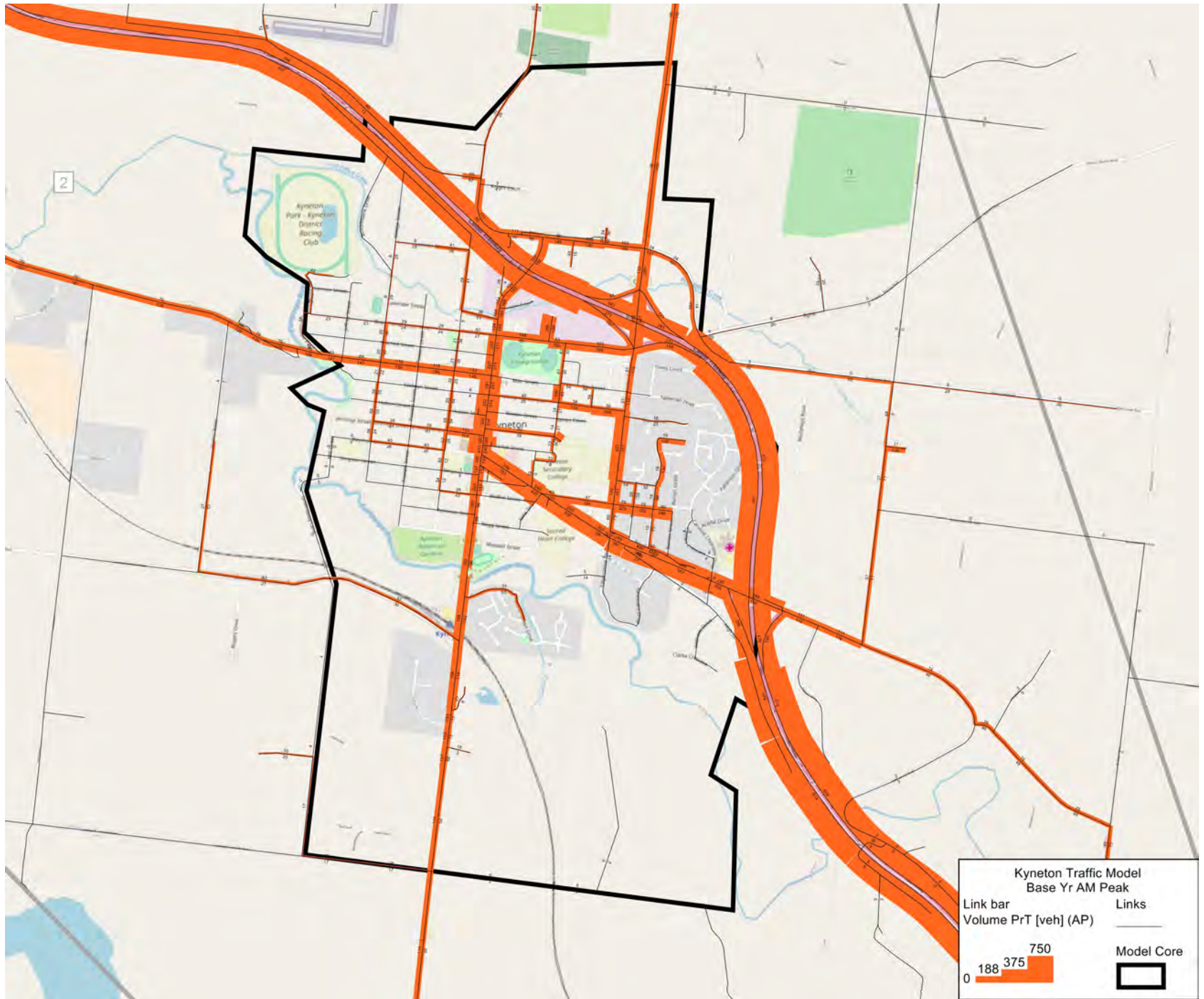
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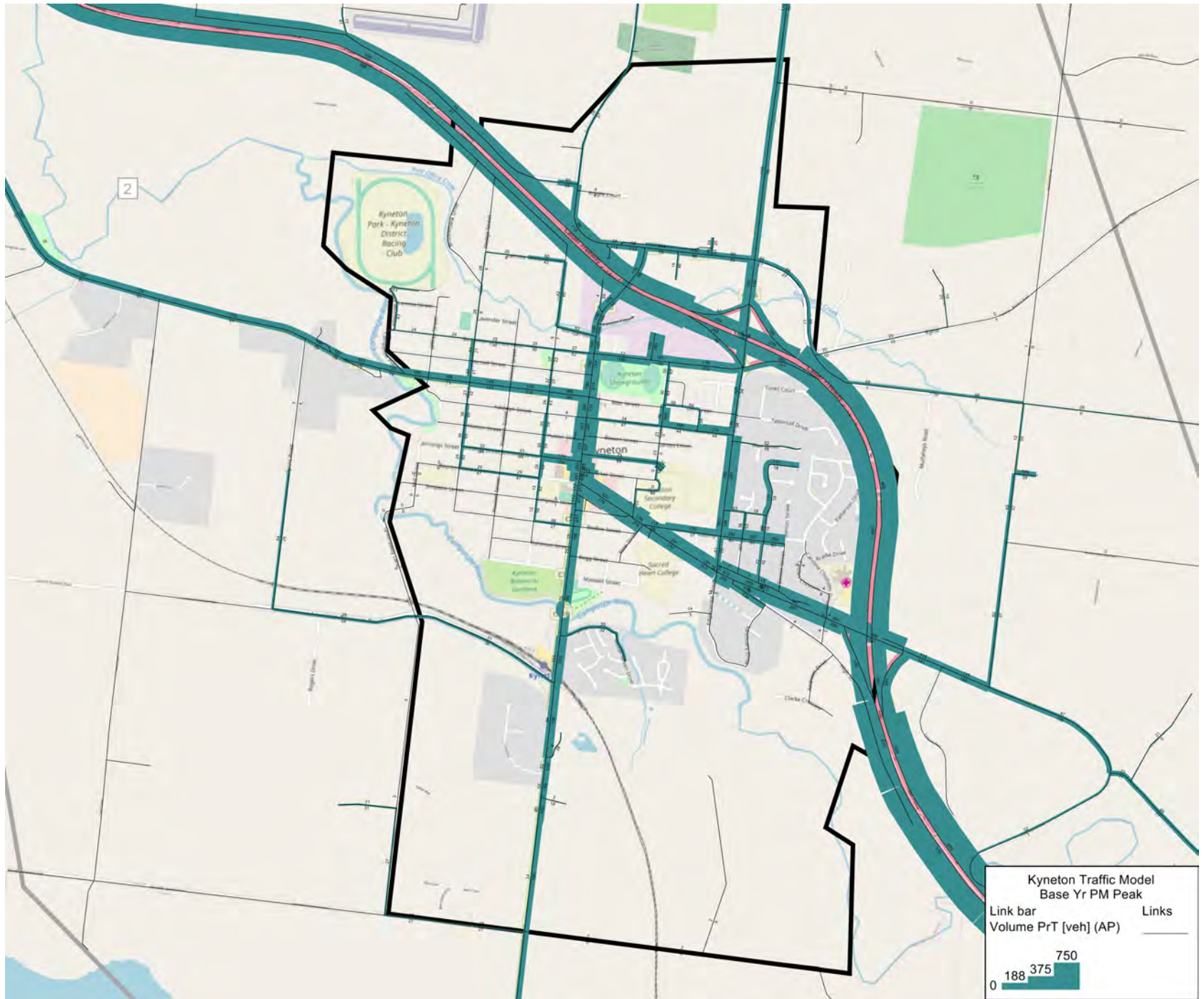
Drawn C. Emmitt
Designed C. Emmitt
Checked M. Marsicovetere
Approved M. Marsicovetere
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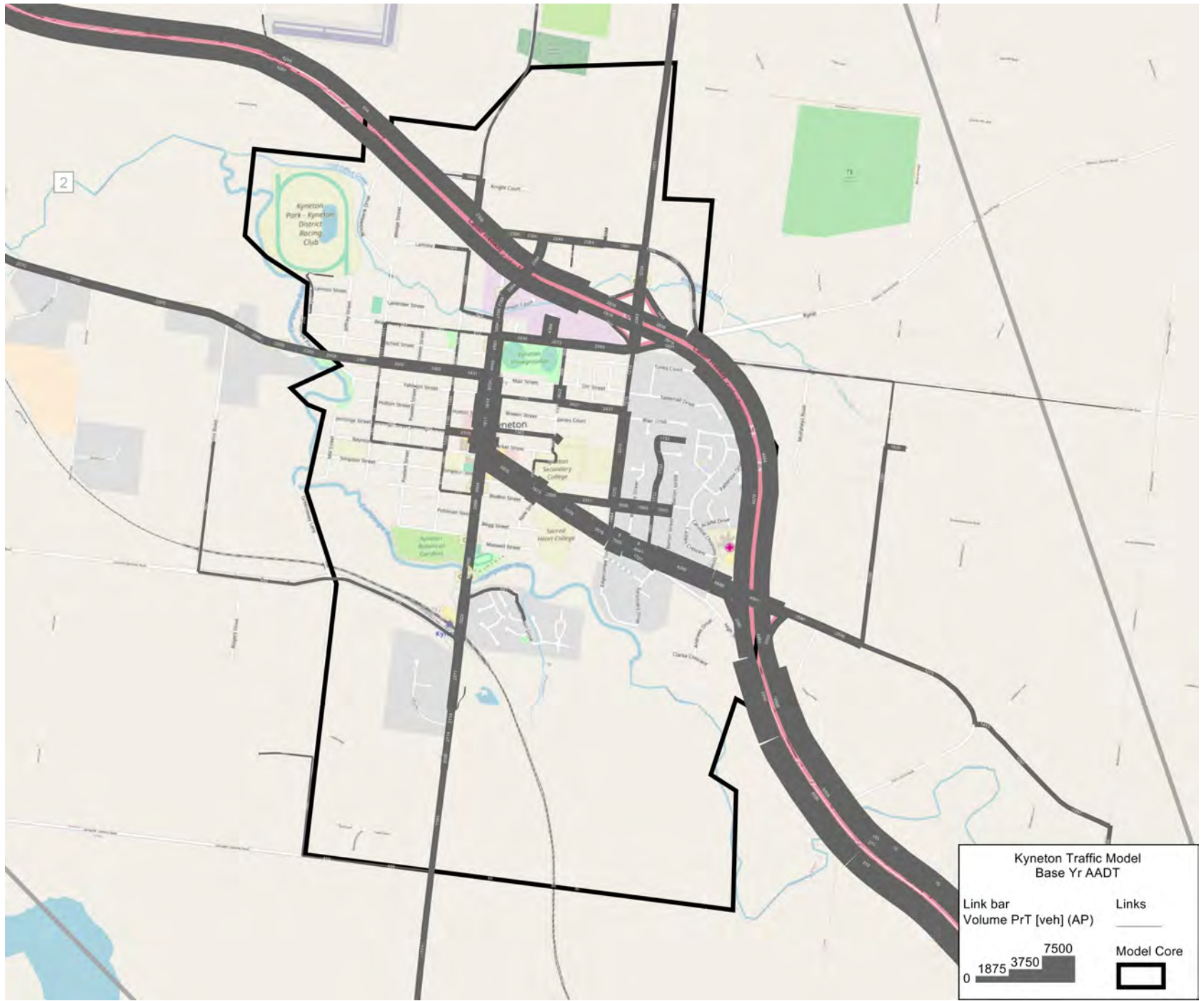
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Title Keynton Movement Network Study 2018 Existing Daily and Peak Hour Traffic Volumes Road & Intresections
Client Macedon Ranges Shire Council PO Box 151 Kyneton VIC 3444

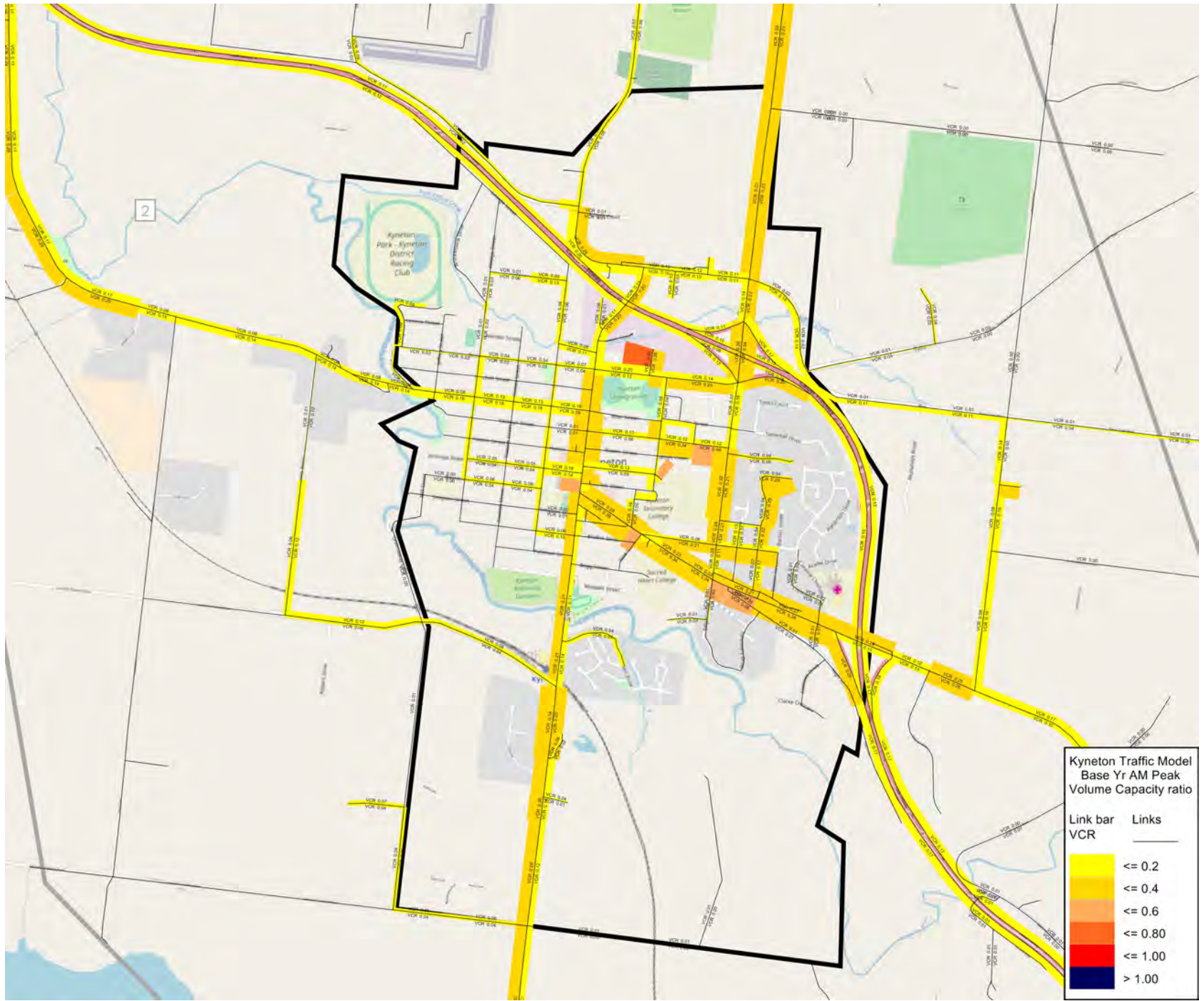
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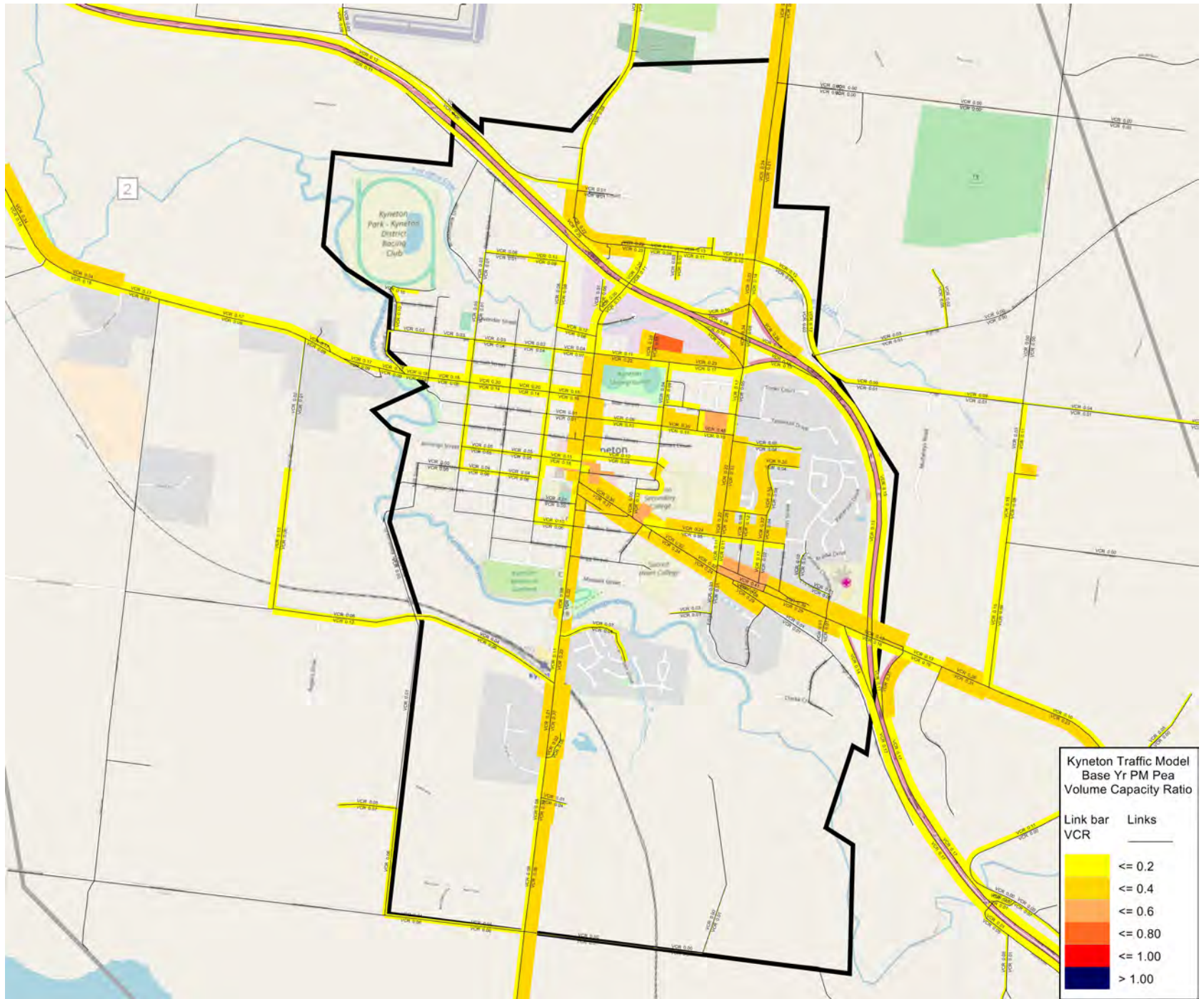
APPENDIX B – BASE YEAR 2016 TRANSPORT MODEL PLOTS



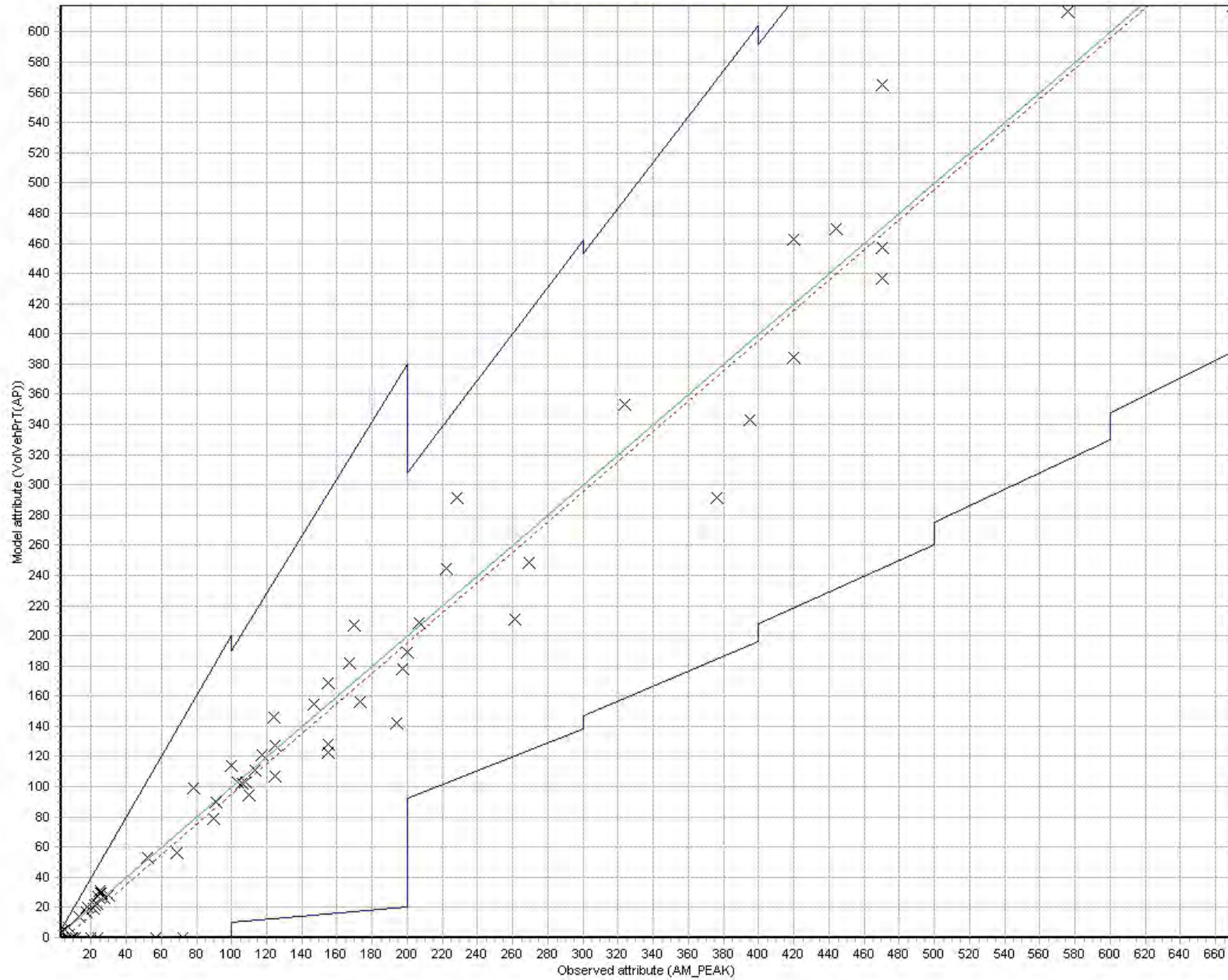








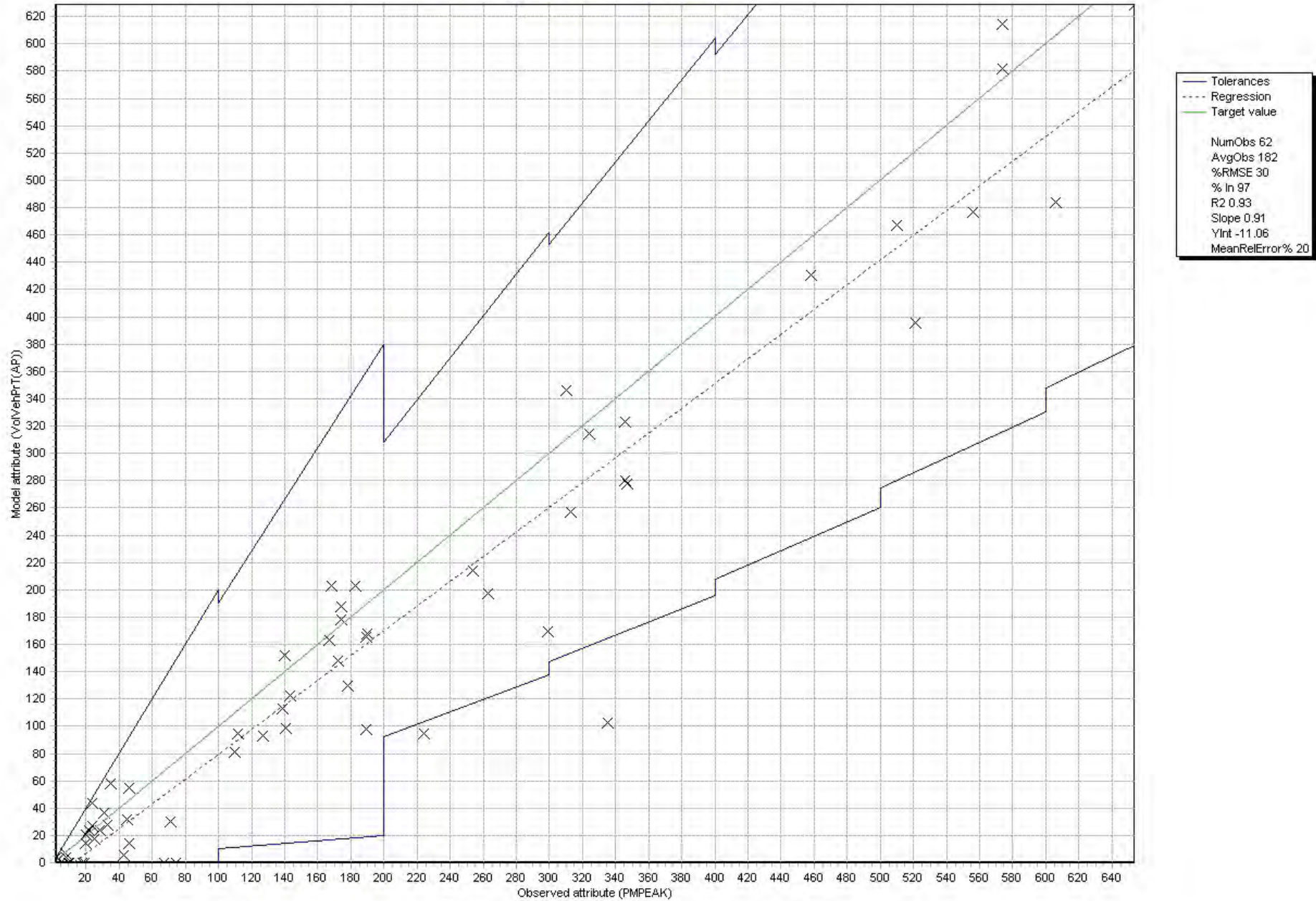
Assignment analysis, Network: KYNETON 2016 AM



— Tolerances
- - - Regression
— Target value

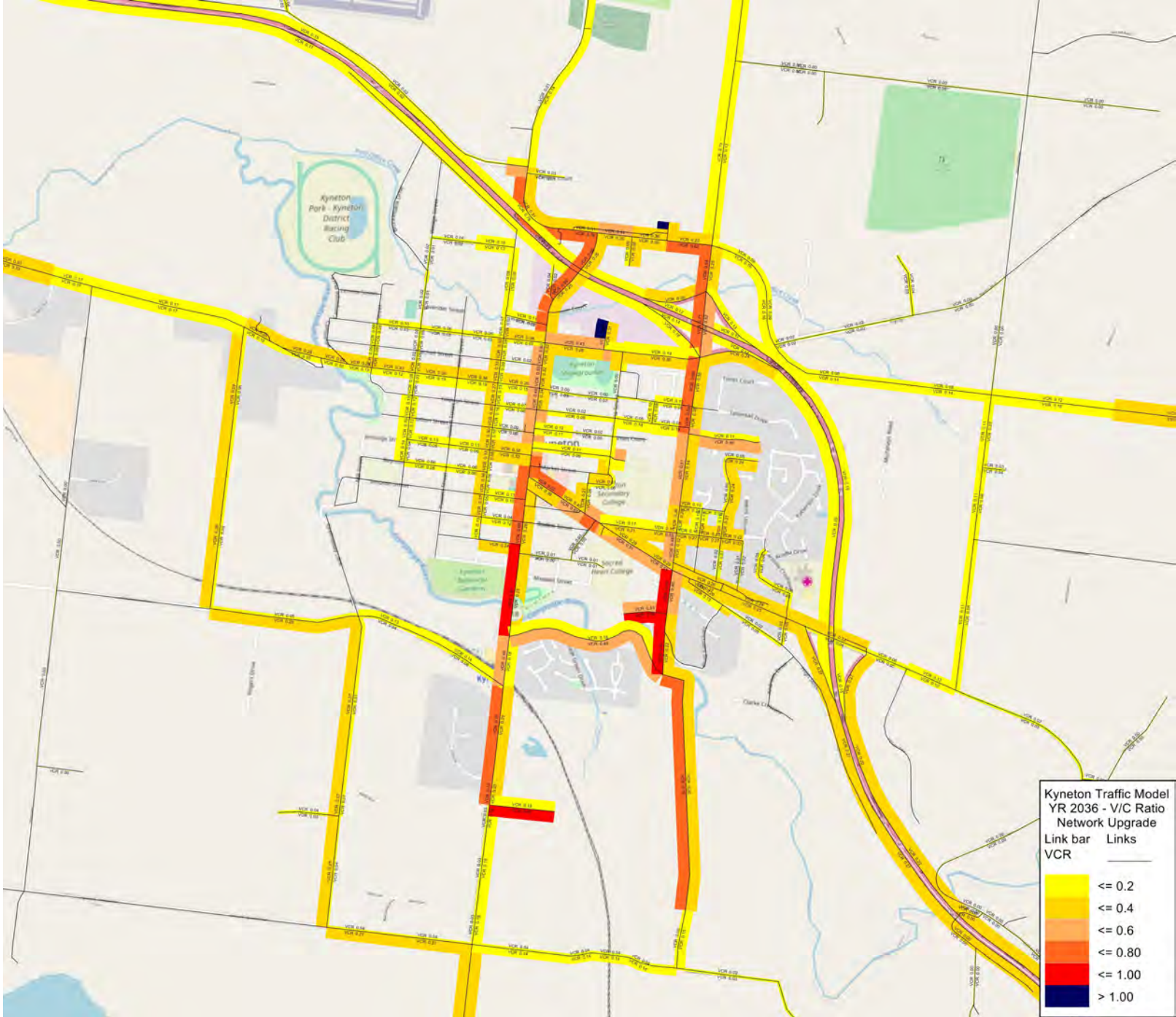
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AvgObs 153
%RMSE 19
% In 100
R2 0.97
Slope 1.00
YInt -4.73
MeanRelError% 13

Assignment analysis, Network: KYNETON 2016 PM



APPENDIX C – FUTURE YEAR 2036 TRANSPORT MODEL PLOTS



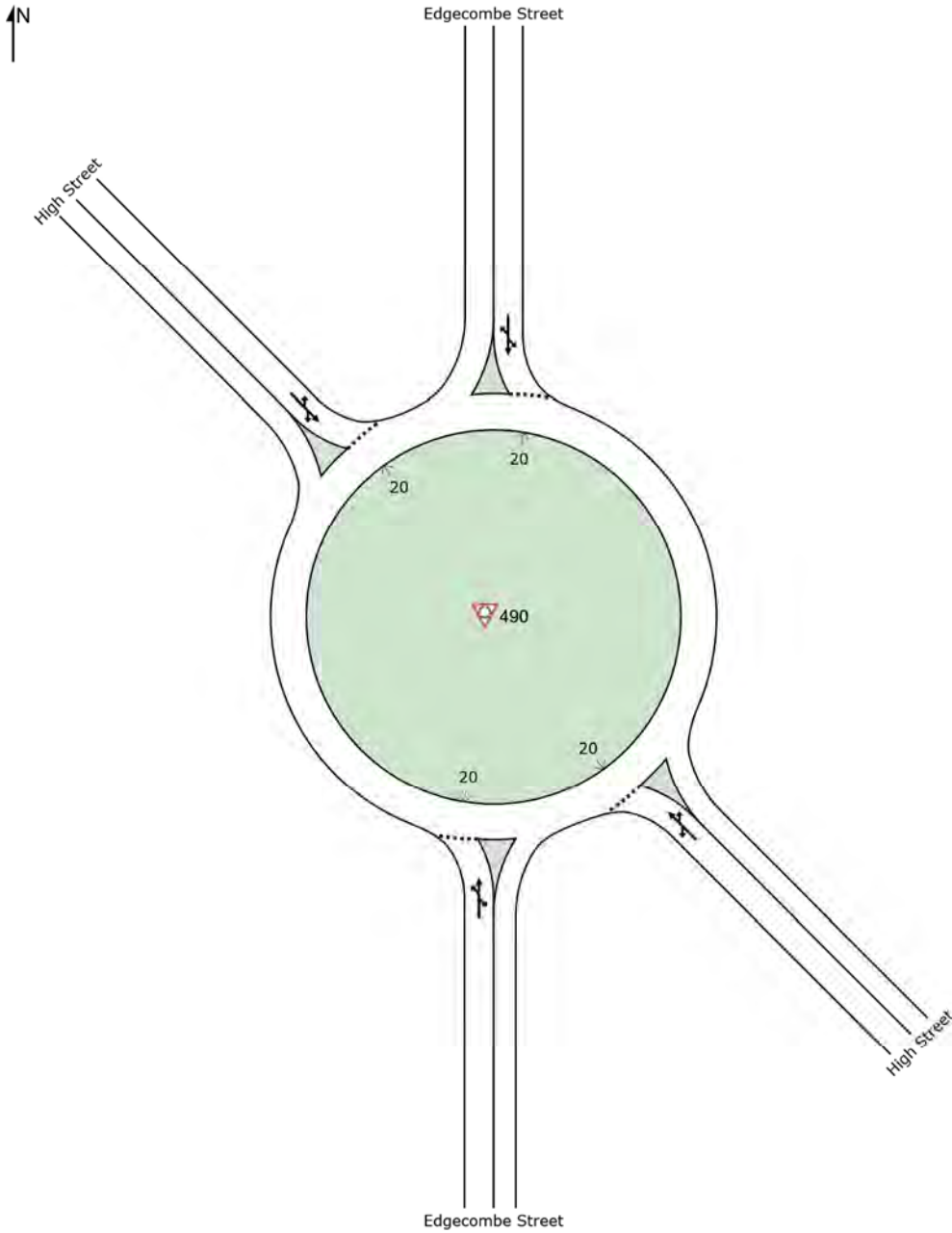


APPENDIX D – SIDRA ANALYSIS SUMMARY RESULTS

SITE LAYOUT

 Site: 490 [High St/ Edgecombe St - 2036 AM peak]

High St/ Edgecombe St - AM Peak
Roundabout



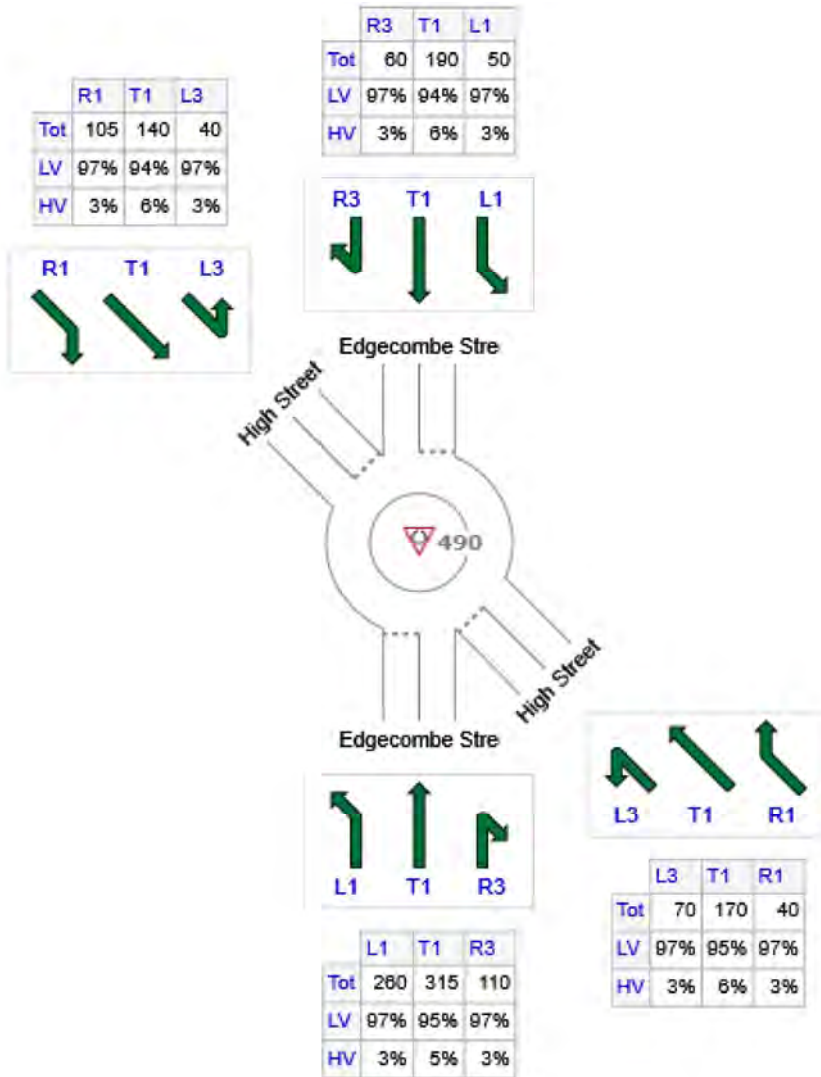
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 490 [High St/ Edgecombe St - 2036 AM peak]

High St/ Edgecombe St - AM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Street	685	658	27
SE: High Street	280	267	13
N: Edgecombe Street	300	285	15
NW: High Street	285	273	12
Total	1550	1484	66

LANE SUMMARY

 Site: 490 [High St/ Edgecombe St - 2036 AM peak]

High St/ Edgecombe St - AM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Street													
Lane 1 ^d	704	3.9	1179	0.597	100	6.3	LOS A	4.6	33.0	Full	500	0.0	0.0
Approach	704	3.9		0.597		6.3	LOS A	4.6	33.0				
SouthEast: High Street													
Lane 1 ^d	295	4.5	1078	0.274	100	6.2	LOS A	1.4	10.3	Full	500	0.0	0.0
Approach	295	4.5		0.274		6.2	LOS A	1.4	10.3				
North: Edgecombe Street													
Lane 1 ^d	306	4.8	1063	0.288	100	6.9	LOS A	1.5	11.2	Full	500	0.0	0.0
Approach	306	4.8		0.288		6.9	LOS A	1.5	11.2				
NorthWest: High Street													
Lane 1 ^d	300	4.3	975	0.308	100	7.7	LOS A	1.8	12.9	Full	500	0.0	0.0
Approach	300	4.3		0.308		7.7	LOS A	1.8	12.9				
Intersection	1605	4.3		0.597		6.7	LOS A	4.6	33.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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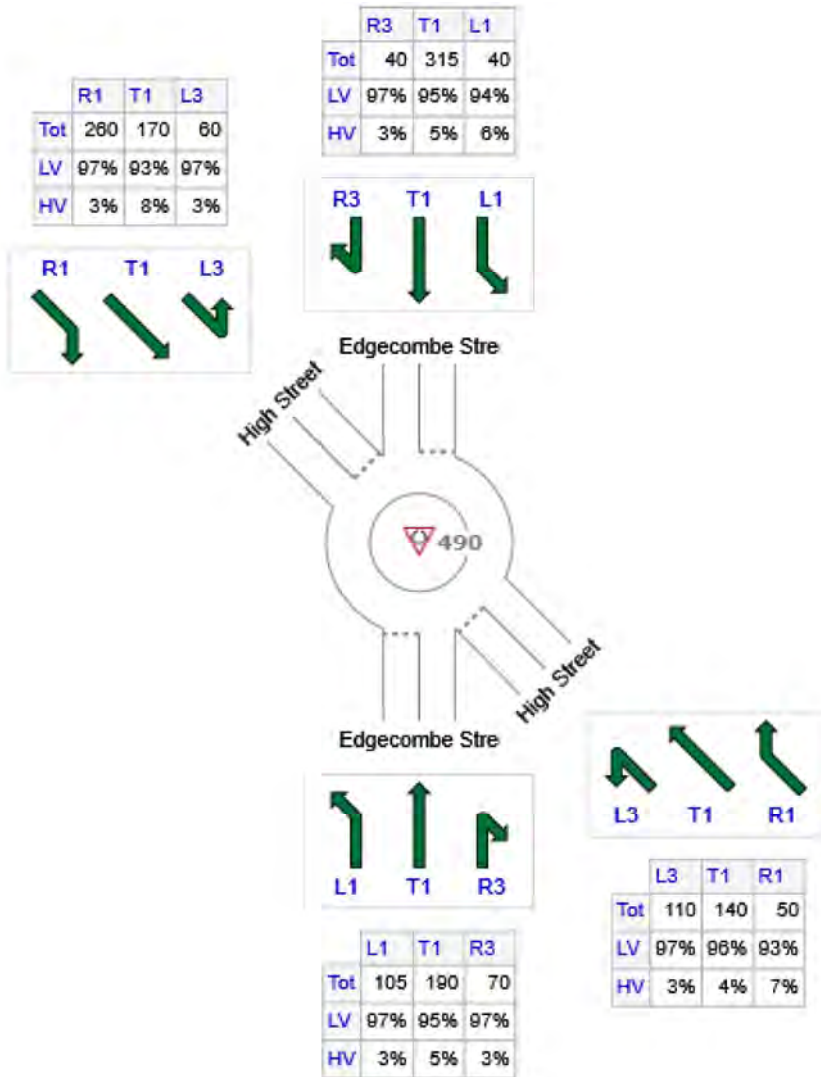
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 490 [High St/ Edgecombe St - 2036 PM peak]

High St/ Edgecombe St - PM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Street	365	350	15
SE: High Street	300	288	12
N: Edgecombe Street	395	376	19
NW: High Street	490	468	22
Total	1550	1482	68

LANE SUMMARY

 Site: 490 [High St/ Edgecombe St - 2036 PM peak]

High St/ Edgecombe St - PM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Street													
Lane 1 ^d	374	4.0	1170	0.320	100	5.5	LOS A	1.8	13.0	Full	500	0.0	0.0
Approach	374	4.0		0.320		5.5	LOS A	1.8	13.0				
SouthEast: High Street													
Lane 1 ^d	316	4.0	885	0.357	100	8.1	LOS A	2.2	15.6	Full	500	0.0	0.0
Approach	316	4.0		0.357		8.1	LOS A	2.2	15.6				
North: Edgecombe Street													
Lane 1 ^d	399	4.9	943	0.423	100	7.5	LOS A	2.6	19.3	Full	500	0.0	0.0
Approach	399	4.9		0.423		7.5	LOS A	2.6	19.3				
NorthWest: High Street													
Lane 1 ^d	516	4.6	1127	0.458	100	7.7	LOS A	2.8	20.4	Full	500	0.0	0.0
Approach	516	4.6		0.458		7.7	LOS A	2.8	20.4				
Intersection	1605	4.4		0.458		7.2	LOS A	2.8	20.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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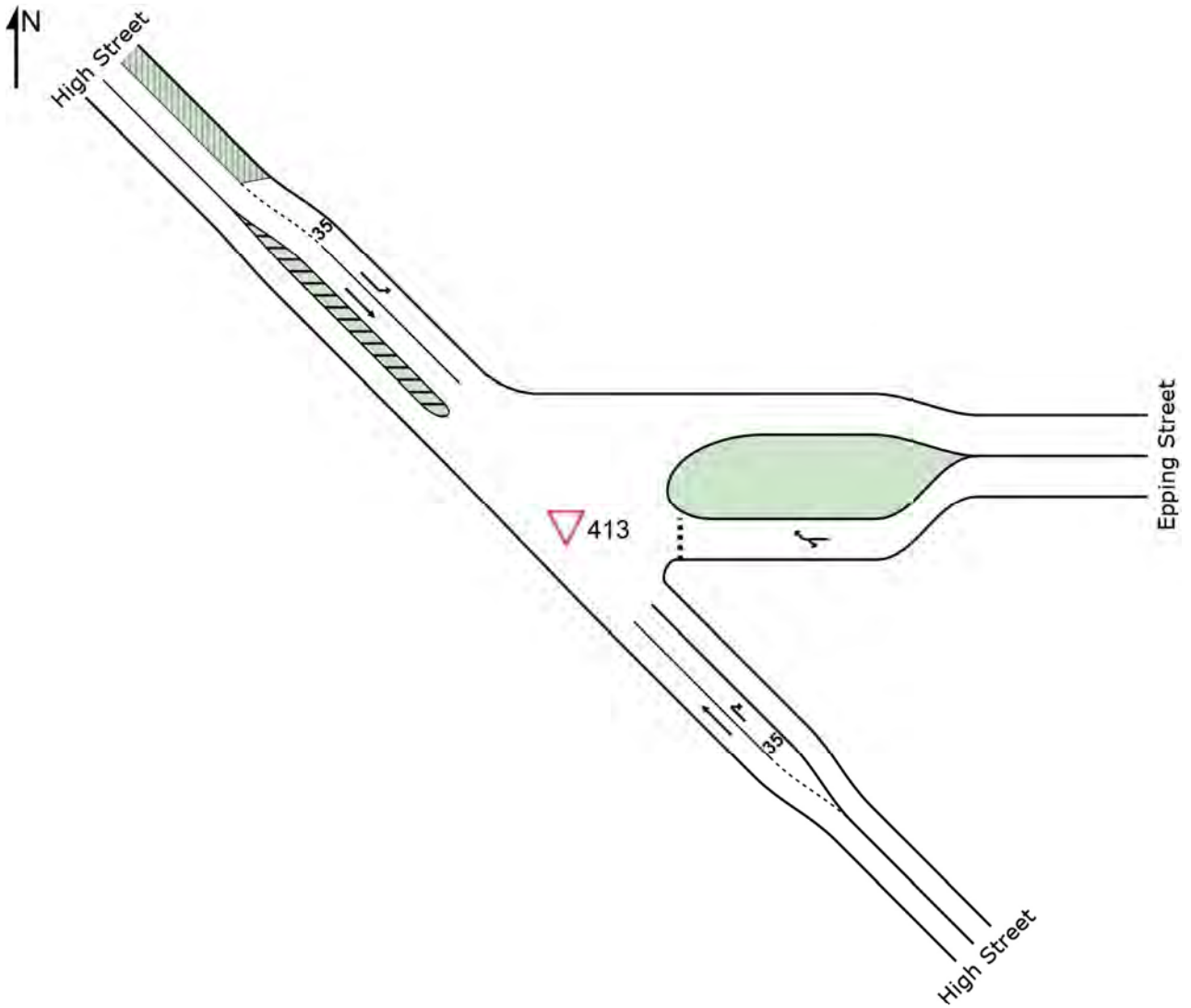
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SITE LAYOUT

▽ Site: 413 [High St/ Epping St - 2036 AM peak]

High St/ Epping St - AM Peak
Giveaway / Yield (Two-Way)



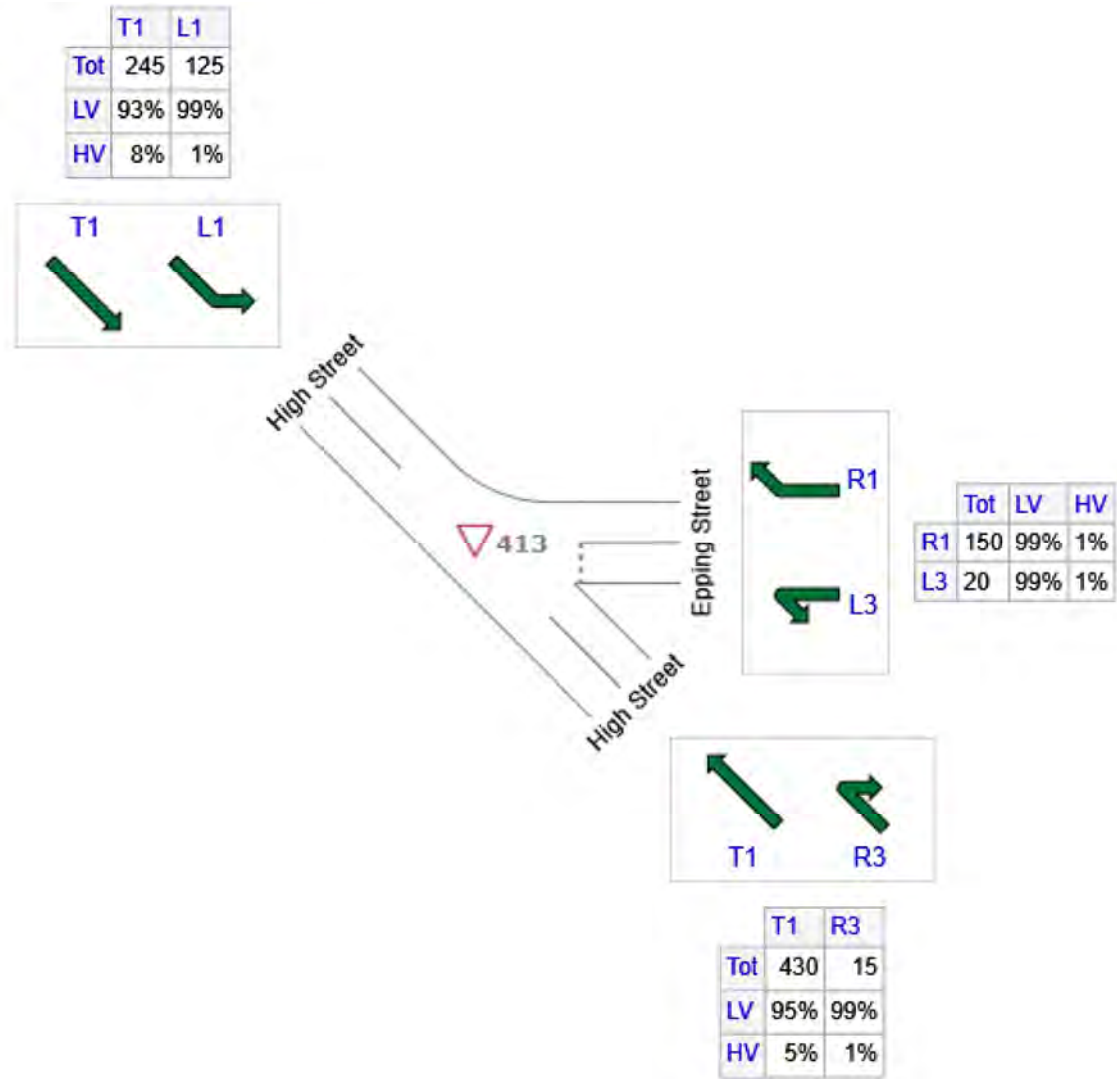
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 413 [High St/ Epping St - 2036 AM peak]

High St/ Epping St - AM Peak
 Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
SE: High Street	445	422	23
E: Epping Street	170	168	2
NW: High Street	370	350	20
Total	985	940	45

LANE SUMMARY

Site: 413 [High St/ Epping St - 2036 AM peak]

High St/ Epping St - AM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
SouthEast: High Street													
Lane 1	430	5.4	1845	0.233	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	15	1.0	974	0.015	100	6.8	LOS A	0.1	0.4	Short	35	0.0	NA
Approach	445	5.3		0.233		0.3	NA	0.1	0.4				
East: Epping Street													
Lane 1	170	1.0	389	0.437	100	14.7	LOS B	2.2	15.3	Full	500	0.0	0.0
Approach	170	1.0		0.437		14.7	LOS B	2.2	15.3				
NorthWest: High Street													
Lane 1	125	1.0	1859	0.067	100	4.1	LOS A	0.0	0.0	Short (P)	35	0.0	NA
Lane 2	245	7.5	1821	0.135	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	370	5.3		0.135		1.4	NA	0.0	0.0				
Intersection	985	4.5		0.437		3.2	NA	2.2	15.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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Organisation: TRANSPORT & TRAFFIC SOLUTIONS PTY LTD | Processed: Monday, 12 March 2018 9:15:27 AM

Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\High St Intersections.sip7

INPUT VOLUMES

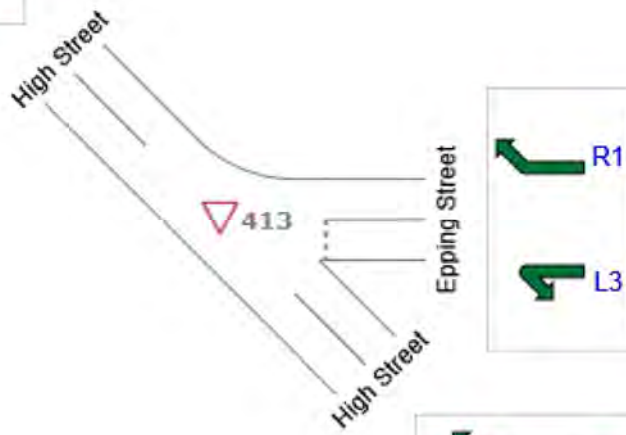
Vehicles and pedestrians per 60 minutes

▽ Site: 413 [High St/ Epping St - 2036 PM peak]

High St/ Epping St - PM Peak
 Giveaway / Yield (Two-Way)

Volume Display Method: Total and %

	T1	L1
Tot	515	180
LV	91%	99%
HV	9%	1%



	Tot	LV	HV
R1	150	99%	1%
L3	20	99%	1%



	T1	R3
Tot	295	25
LV	96%	99%
HV	4%	1%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
SE: High Street	320	309	11
E: Epping Street	170	168	2
NW: High Street	695	646	49
Total	1185	1124	61

LANE SUMMARY

Site: 413 [High St/ Epping St - 2036 PM peak]

High St/ Epping St - PM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
SouthEast: High Street													
Lane 1	295	3.6	1866	0.158	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	25	1.0	626	0.040	100	9.4	LOS A	0.1	1.0	Short	35	0.0	NA
Approach	320	3.4		0.158		0.8	NA	0.1	1.0				
East: Epping Street													
Lane 1	170	1.0	280	0.606	100	24.2	LOS C	3.2	22.5	Full	500	0.0	0.0
Approach	170	1.0		0.606		24.2	LOS C	3.2	22.5				
NorthWest: High Street													
Lane 1	180	1.0	1859	0.097	100	4.2	LOS A	0.0	0.0	Short (P)	35	0.0	NA
Lane 2	515	9.1	1803	0.286	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	695	7.0		0.286		1.1	NA	0.0	0.0				
Intersection	1185	5.2		0.606		4.3	NA	3.2	22.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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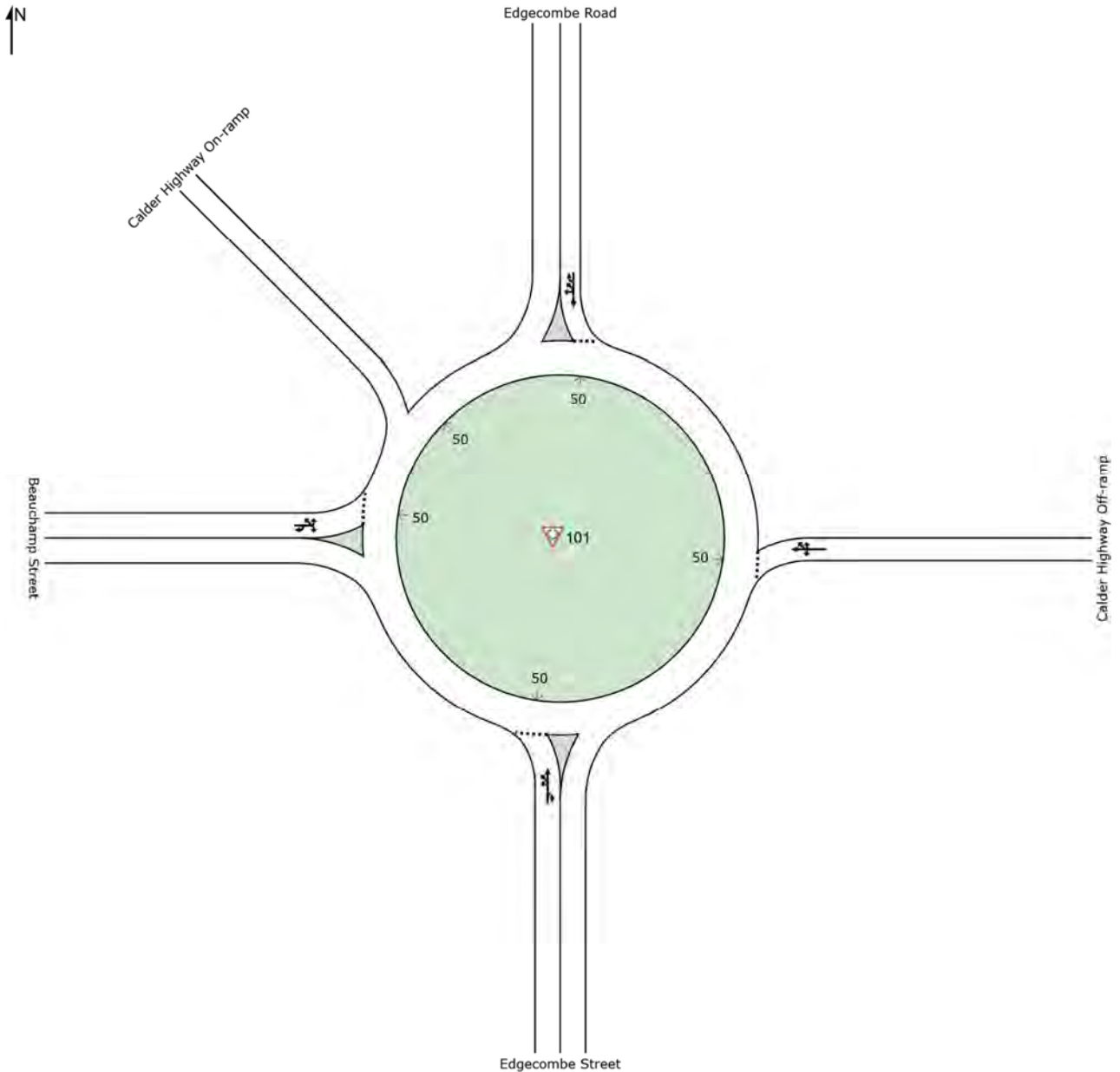
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SITE LAYOUT

 Site: 101 [Edgecombe St/ Beauchamp St - 2036 AM Peak]

Edgecombe St/ Beauchamp St - AM Peak
Roundabout



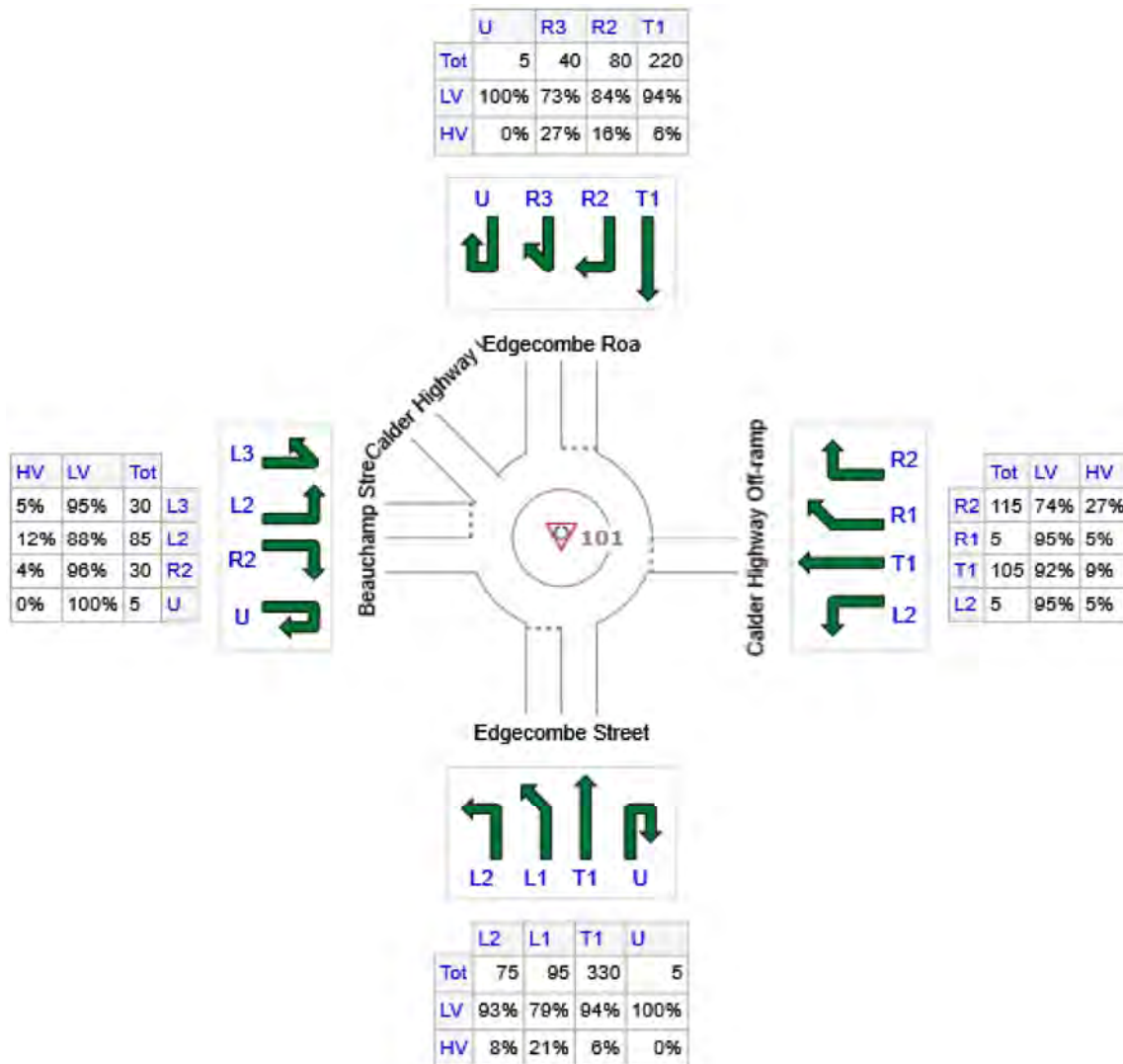
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 101 [Edgecombe St/ Beauchamp St - 2036 AM Peak]

Edgecombe St/ Beauchamp St - AM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Street	505	460	45
E: Calder Highway Off-ramp	230	190	40
N: Edgecombe Road	345	309	36
W: Beauchamp Street	150	137	13
Total	1230	1096	134

LANE SUMMARY

 Site: 101 [Edgecombe St/ Beauchamp St - 2036 AM Peak]

Edgecombe St/ Beauchamp St - AM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Street													
Lane 1 ^d	505	9.0	1202	0.420	100	3.9	LOS A	2.5	19.2	Full	500	0.0	0.0
Approach	505	9.0		0.420		3.9	LOS A	2.5	19.2				
East: Calder Highway Off-ramp													
Lane 1 ^d	230	17.3	1112	0.207	100	7.8	LOS A	1.1	8.7	Full	500	0.0	0.0
Approach	230	17.3		0.207		7.8	LOS A	1.1	8.7				
North: Edgecombe Road													
Lane 1 ^d	345	10.5	1550	0.223	100	5.2	LOS A	1.4	11.0	Full	500	0.0	0.0
Approach	345	10.5		0.223		5.2	LOS A	1.4	11.0				
West: Beauchamp Street													
Lane 1 ^d	150	8.7	1007	0.149	100	6.9	LOS A	0.8	6.3	Full	500	0.0	0.0
Approach	150	8.7		0.149		6.9	LOS A	0.8	6.3				
Intersection	1230	10.9		0.420		5.3	LOS A	2.5	19.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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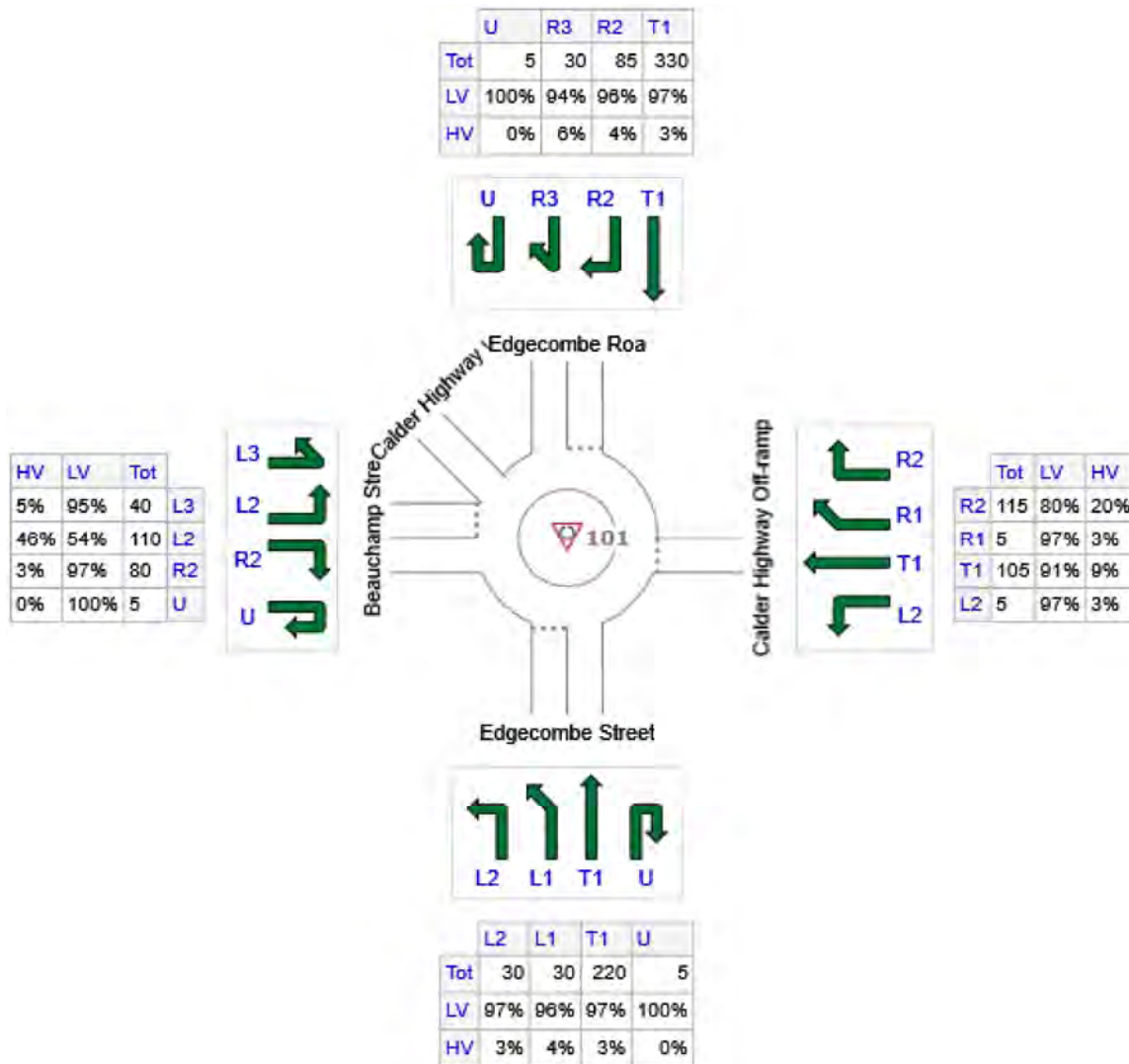
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [Edgecombe St/ Beauchamp St - 2036 PM Peak]

Edgecombe St/ Beauchamp St - PM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Street	285	276	9
E: Calder Highway Off-ramp	230	197	33
N: Edgecombe Road	450	434	16
W: Beauchamp Street	235	180	55
Total	1200	1088	112

LANE SUMMARY

 Site: 101 [Edgecombe St/ Beauchamp St - 2036 PM Peak]

Edgecombe St/ Beauchamp St - PM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Street													
Lane 1 ^d	285	3.0	1246	0.229	100	3.5	LOS A	1.2	8.7	Full	500	0.0	0.0
Approach	285	3.0		0.229		3.5	LOS A	1.2	8.7				
East: Calder Highway Off-ramp													
Lane 1 ^d	230	14.2	1019	0.226	100	8.6	LOS A	1.3	10.1	Full	500	0.0	0.0
Approach	230	14.2		0.226		8.6	LOS A	1.3	10.1				
North: Edgecombe Road													
Lane 1 ^d	450	3.6	1505	0.299	100	4.6	LOS A	2.0	14.6	Full	500	0.0	0.0
Approach	450	3.6		0.299		4.6	LOS A	2.0	14.6				
West: Beauchamp Street													
Lane 1 ^d	235	23.4	1082	0.217	100	7.1	LOS A	1.1	9.1	Full	500	0.0	0.0
Approach	235	23.4		0.217		7.1	LOS A	1.1	9.1				
Intersection	1200	9.4		0.299		5.6	LOS A	2.0	14.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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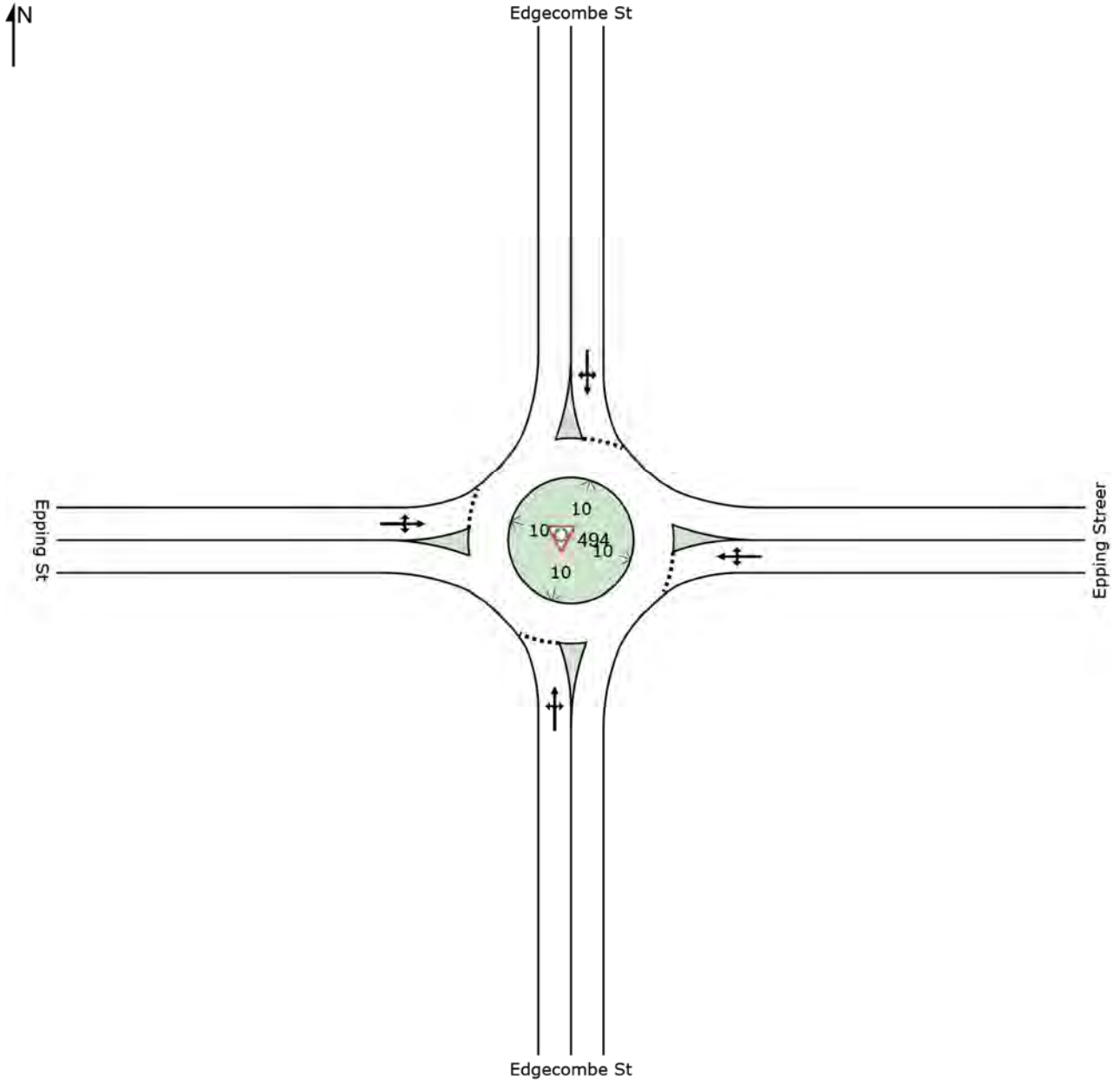
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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Edgecombe St Roundabouts.sip7

SITE LAYOUT

 Site: 494 [Edgecombe St/ Epping St - 2036 AM Peak]

Edgecombe St/ Epping Street - AM Peak
Roundabout



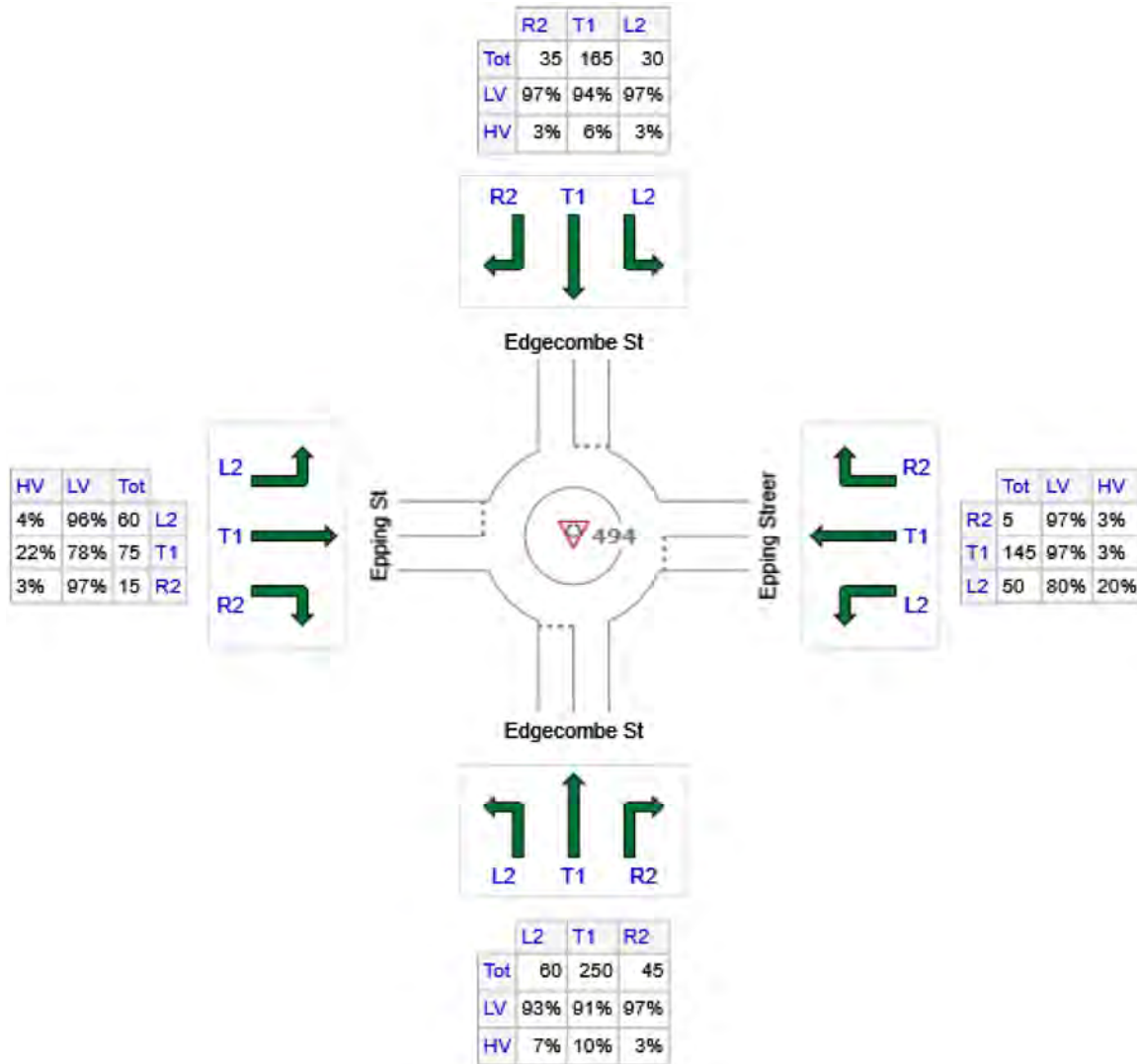
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 494 [Edgecombe St/ Epping St - 2036 AM Peak]

Edgecombe St/ Epping Street - AM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe St	355	326	29
E: Epping Street	200	185	15
N: Edgecombe St	230	218	12
W: Epping St	150	131	19
Total	935	861	74

LANE SUMMARY

 Site: 494 [Edgecombe St/ Epping St - 2036 AM Peak]

Edgecombe St/ Epping Street - AM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe St													
Lane 1 ^d	374	8.2	1132	0.330	100	6.2	LOS A	1.7	12.8	Full	190	0.0	0.0
Approach	374	8.2		0.330		6.2	LOS A	1.7	12.8				
East: Epping Street													
Lane 1 ^d	211	7.3	1078	0.195	100	5.9	LOS A	0.9	6.6	Full	500	0.0	0.0
Approach	211	7.3		0.195		5.9	LOS A	0.9	6.6				
North: Edgecombe St													
Lane 1 ^d	242	5.0	1175	0.206	100	5.9	LOS A	0.9	6.9	Full	500	0.0	0.0
Approach	242	5.0		0.206		5.9	LOS A	0.9	6.9				
West: Epping St													
Lane 1 ^d	158	12.8	969	0.163	100	6.6	LOS A	0.7	5.8	Full	400	0.0	0.0
Approach	158	12.8		0.163		6.6	LOS A	0.7	5.8				
Intersection	984	8.0		0.330		6.1	LOS A	1.7	12.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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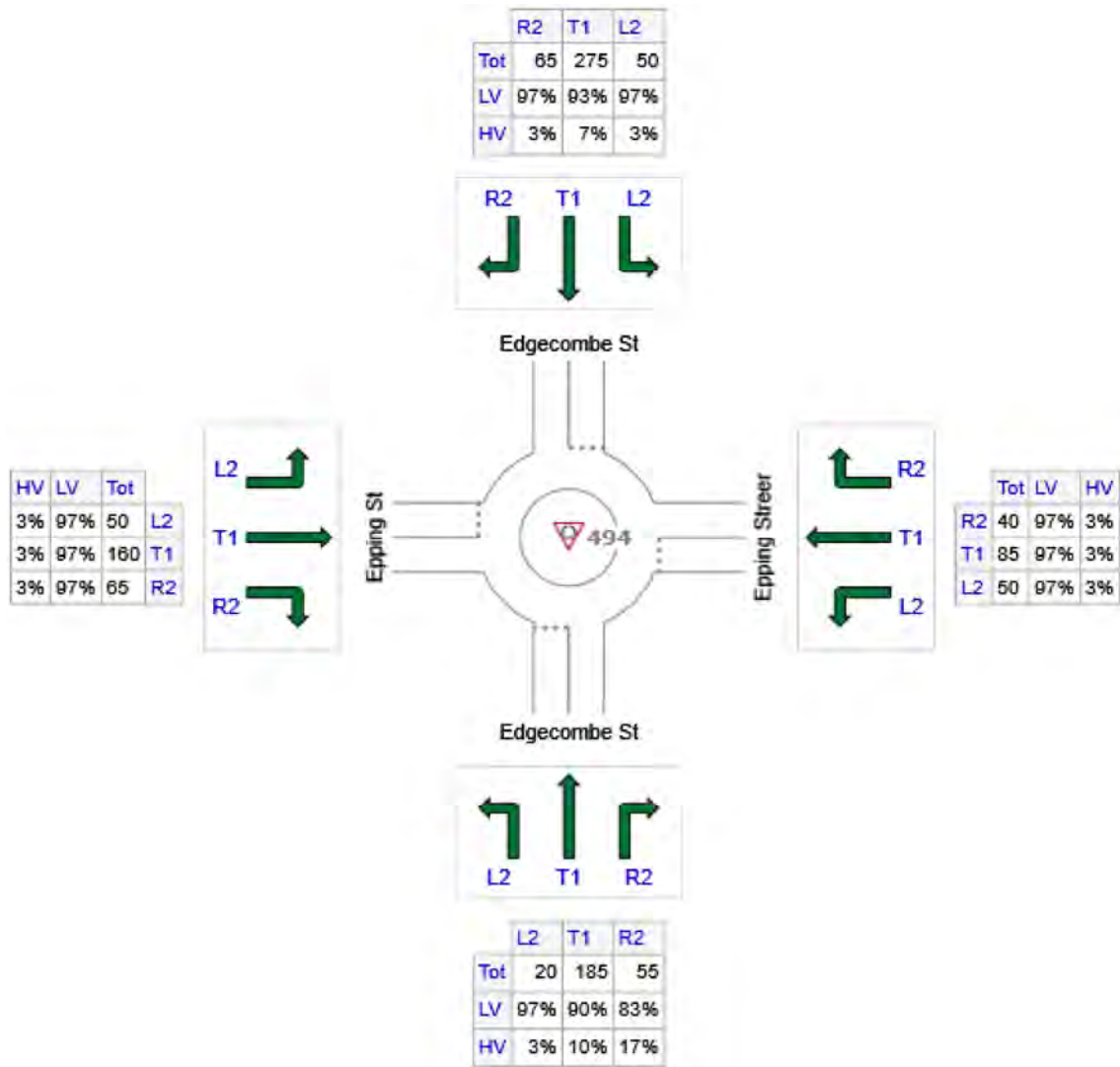
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 494 [Edgecombe St/ Epping St - 2036 PM Peak]

Edgecombe St/ Epping Street - PM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe St	260	232	28
E: Epping Streer	175	170	5
N: Edgecombe St	390	367	23
W: Epping St	275	267	8
Total	1100	1036	64

LANE SUMMARY

 Site: 494 [Edgecombe St/ Epping St - 2036 PM Peak]

Edgecombe St/ Epping Street - PM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe St													
Lane 1 ^d	274	10.7	1088	0.252	100	6.5	LOS A	1.2	9.3	Full	190	0.0	0.0
Approach	274	10.7		0.252		6.5	LOS A	1.2	9.3				
East: Epping Street													
Lane 1 ^d	184	3.0	946	0.195	100	7.4	LOS A	1.0	6.9	Full	500	0.0	0.0
Approach	184	3.0		0.195		7.4	LOS A	1.0	6.9				
North: Edgecombe St													
Lane 1 ^d	411	5.9	1039	0.395	100	7.0	LOS A	2.2	16.3	Full	500	0.0	0.0
Approach	411	5.9		0.395		7.0	LOS A	2.2	16.3				
West: Epping St													
Lane 1 ^d	289	3.0	1046	0.277	100	7.0	LOS A	1.4	9.9	Full	400	0.0	0.0
Approach	289	3.0		0.277		7.0	LOS A	1.4	9.9				
Intersection	1158	5.8		0.395		6.9	LOS A	2.2	16.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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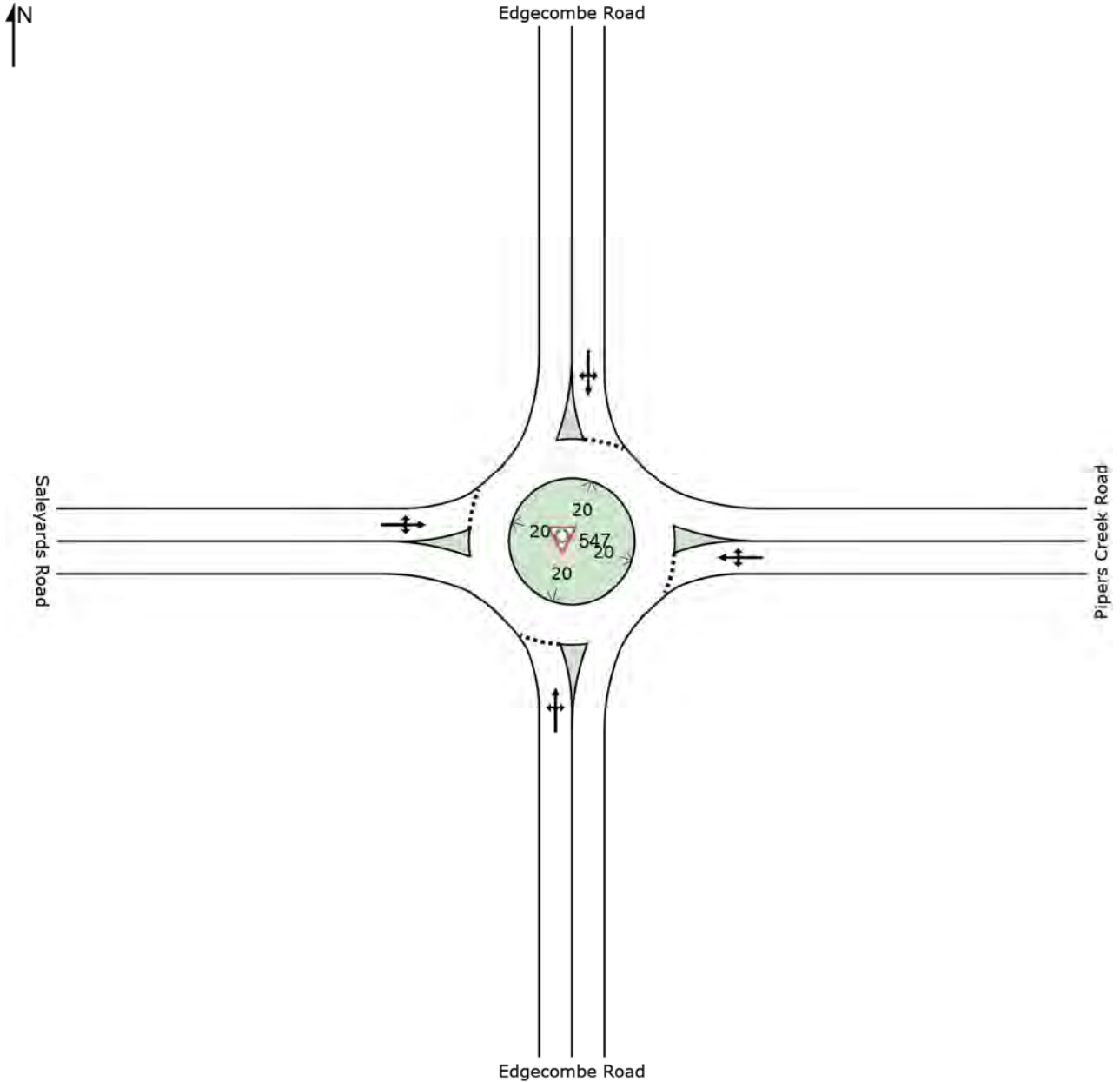
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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Edgecombe St Roundabouts.sip7

SITE LAYOUT

 **Site: 547 [Saleyards Rd/ Edgecombe Rd - 2036 AM Peak]**

Saleyards Rd/ Edgecombe Rd - Existing AM Peak
Roundabout



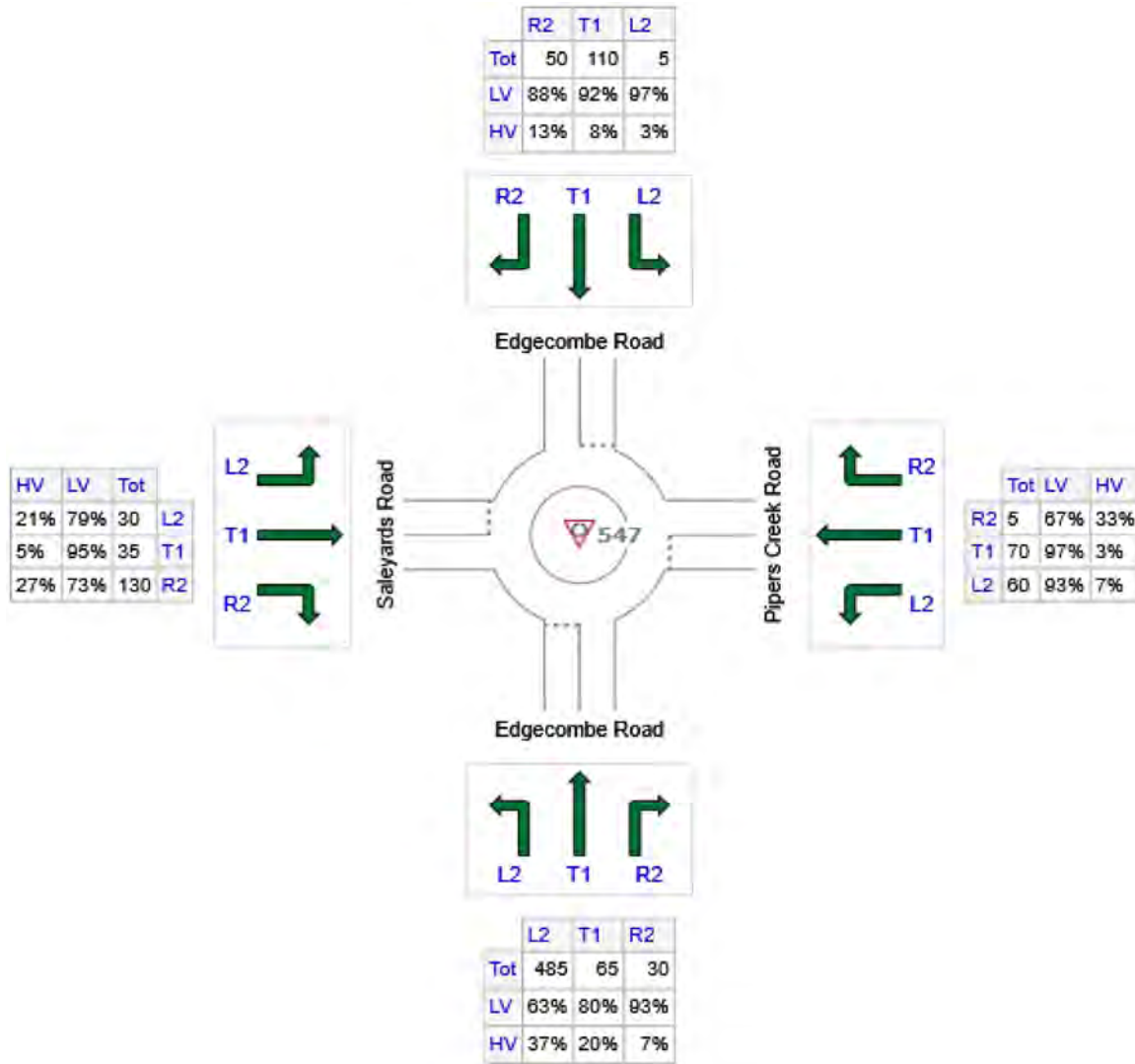
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 547 [Saleyards Rd/ Edgecombe Rd - 2036 AM Peak]

Saleyards Rd/ Edgecombe Rd - Existing AM Peak Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Road	580	385	195
E: Pipers Creek Road	135	127	8
N: Edgecombe Road	165	149	16
W: Saleyards Road	195	152	43
Total	1075	814	261

LANE SUMMARY

 Site: 547 [Saleyards Rd/ Edgecombe Rd - 2036 AM Peak]

Saleyards Rd/ Edgecombe Rd - Existing AM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Road													
Lane 1 ^d	580	33.6	1180	0.491	100	5.4	LOS A	3.1	27.7	Full	500	0.0	0.0
Approach	580	33.6		0.491		5.4	LOS A	3.1	27.7				
East: Pipers Creek Road													
Lane 1 ^d	135	5.9	1125	0.120	100	7.4	LOS A	0.5	3.8	Full	500	0.0	0.0
Approach	135	5.9		0.120		7.4	LOS A	0.5	3.8				
North: Edgecombe Road													
Lane 1 ^d	165	9.5	1169	0.141	100	6.4	LOS A	0.6	4.6	Full	500	0.0	0.0
Approach	165	9.5		0.141		6.4	LOS A	0.6	4.6				
West: Saleyards Road													
Lane 1 ^d	195	21.9	1203	0.162	100	7.8	LOS A	0.7	6.0	Full	500	0.0	0.0
Approach	195	21.9		0.162		7.8	LOS A	0.7	6.0				
Intersection	1075	24.3		0.491		6.2	LOS A	3.1	27.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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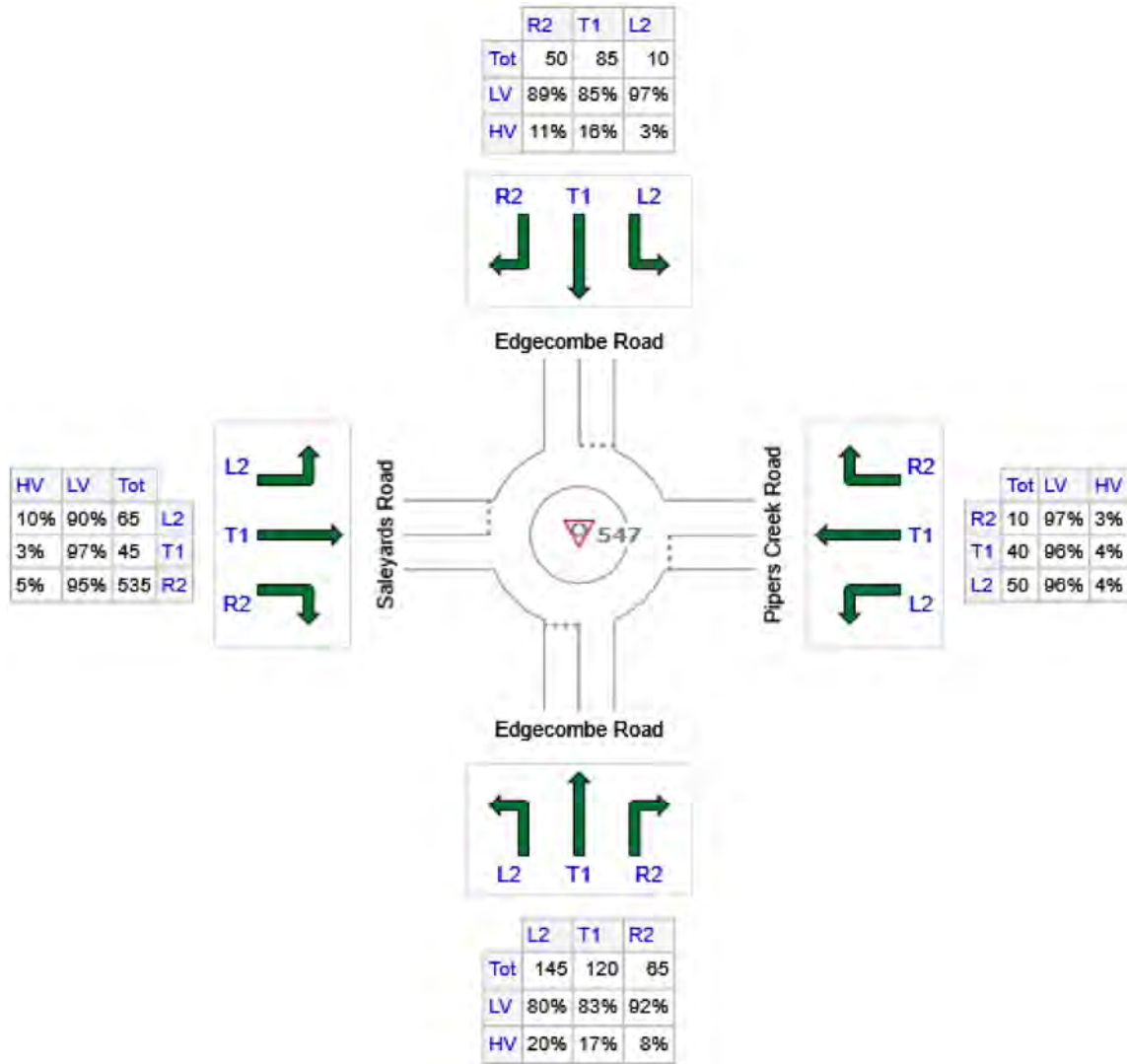
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 547 [Saleyards Rd/ Edgecombe Rd - 2036 PM Peak]

Saleyards Rd/ Edgecombe Rd - PM Peak Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Edgecombe Road	330	275	55
E: Pipers Creek Road	100	96	4
N: Edgecombe Road	145	126	19
W: Saleyards Road	645	612	33
Total	1220	1109	111

LANE SUMMARY

 **Site: 547 [Saleyards Rd/ Edgecombe Rd - 2036 PM Peak]**

Saleyards Rd/ Edgecombe Rd - PM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %						Veh	Dist m				
South: Edgecombe Road													
Lane 1 ^d	330	16.7	1275	0.259	100	5.5	LOS A	1.3	10.2	Full	500	0.0	0.0
Approach	330	16.7		0.259		5.5	LOS A	1.3	10.2				
East: Pipers Creek Road													
Lane 1 ^d	100	4.0	854	0.117	100	9.5	LOS A	0.6	4.5	Full	500	0.0	0.0
Approach	100	4.0		0.117		9.5	LOS A	0.6	4.5				
North: Edgecombe Road													
Lane 1 ^d	145	12.9	820	0.177	100	9.0	LOS A	1.0	7.4	Full	500	0.0	0.0
Approach	145	12.9		0.177		9.0	LOS A	1.0	7.4				
West: Saleyards Road													
Lane 1 ^d	645	5.2	1262	0.511	100	9.1	LOS A	3.3	24.0	Full	500	0.0	0.0
Approach	645	5.2		0.511		9.1	LOS A	3.3	24.0				
Intersection	1220	9.1		0.511		8.2	LOS A	3.3	24.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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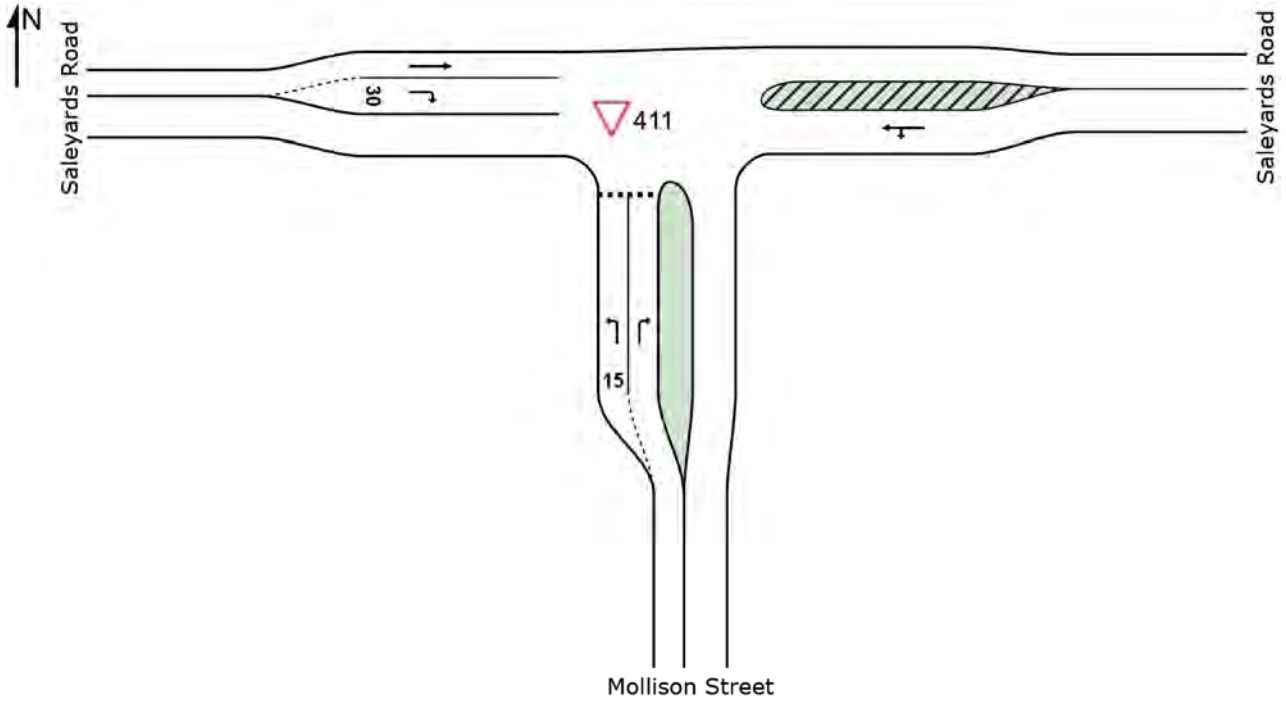
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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Saleyards Rd Intersections.sip7

SITE LAYOUT

▽ Site: 411 [Saleyards Rd/ Mollison St - 2036 AM Peak]

Saleyards Rd/ Mollison St - AM Peak
Giveaway / Yield (Two-Way)



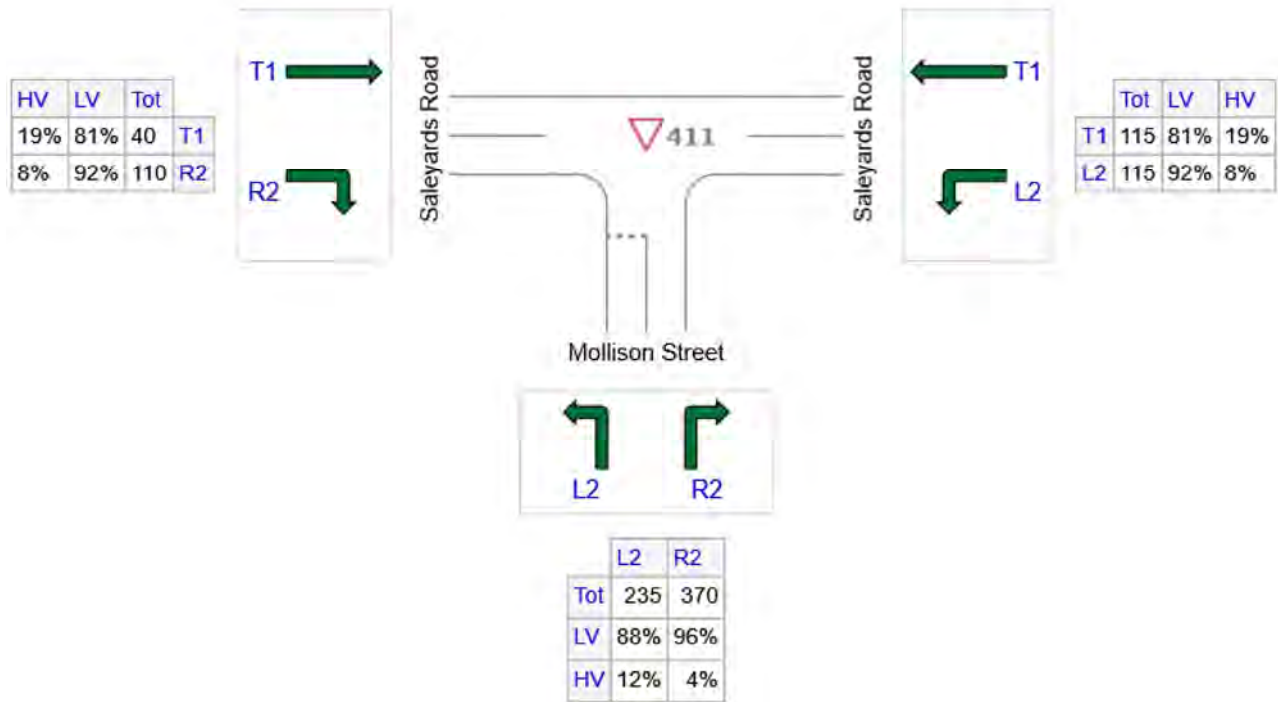
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 411 [Saleyards Rd/ Mollison St - 2036 AM Peak]

Saleyards Rd/ Mollison St - AM Peak
 Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	605	563	42
E: Saleyards Road	230	198	32
W: Saleyards Road	150	133	17
Total	985	894	91

LANE SUMMARY

Site: 411 [Saleyards Rd/ Mollison St - 2036 AM Peak]

Saleyards Rd/ Mollison St - AM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	235	12.4	1376	0.171	100	6.2	LOS A	0.8	5.9	Short	15	0.0	NA
Lane 2	370	3.6	788	0.470	100	9.8	LOS A	3.3	23.6	Full	500	0.0	0.0
Approach	605	7.0		0.470		8.4	LOS A	3.3	23.6				
East: Saleyards Road													
Lane 1	230	13.7	1898	0.121	100	2.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	230	13.7		0.121		2.8	NA	0.0	0.0				
West: Saleyards Road													
Lane 1	40	19.4	1705	0.023	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	110	8.3	1367	0.080	100	6.5	LOS A	0.4	2.7	Short	30	0.0	NA
Approach	150	11.3		0.080		4.8	NA	0.4	2.7				
Intersection	985	9.2		0.470		6.5	NA	3.3	23.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Saleyards Rd Intersections.sip7

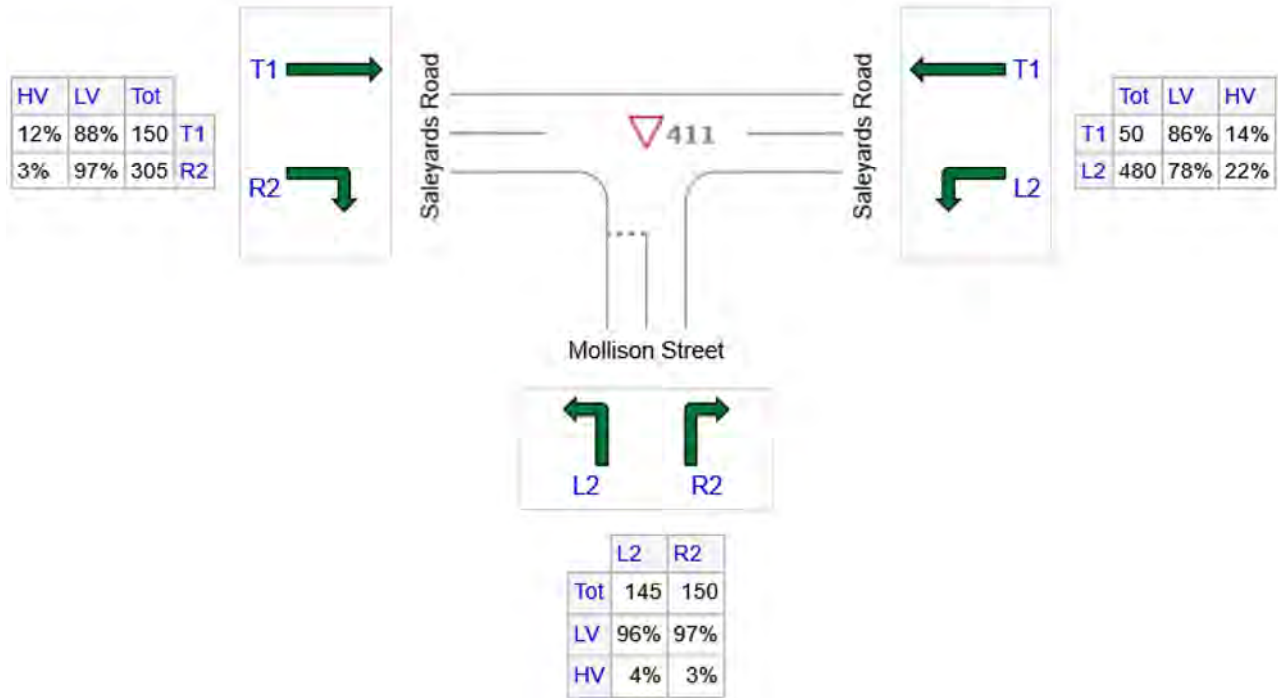
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 411 [Saleyards Rd/ Mollison St - 2036 PM Peak]

Saleyards Rd/ Mollison St - PM Peak
Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	295	284	11
E: Saleyards Road	530	417	113
W: Saleyards Road	455	428	27
Total	1280	1129	151

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Project: C:\Users\Michael\MyBox Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Saleyards Rd Intersections.sip7

LANE SUMMARY

Site: 411 [Saleyards Rd/ Mollison St - 2036 PM Peak]

Saleyards Rd/ Mollison St - PM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	145	4.2	1532	0.095	100	5.8	LOS A	0.4	2.9	Short	15	0.0	NA
Lane 2	150	3.0	435	0.345	100	14.7	LOS B	1.6	11.2	Full	500	0.0	0.0
Approach	295	3.6		0.345		10.3	LOS B	1.6	11.2				
East: Saleyards Road													
Lane 1	530	21.3	1764	0.300	100	5.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	530	21.3		0.300		5.3	NA	0.0	0.0				
West: Saleyards Road													
Lane 1	150	11.8	1783	0.084	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	305	3.2	941	0.324	100	9.1	LOS A	1.7	12.2	Short	30	0.0	NA
Approach	455	6.0		0.324		6.1	NA	1.7	12.2				
Intersection	1280	11.8		0.345		6.7	NA	1.7	12.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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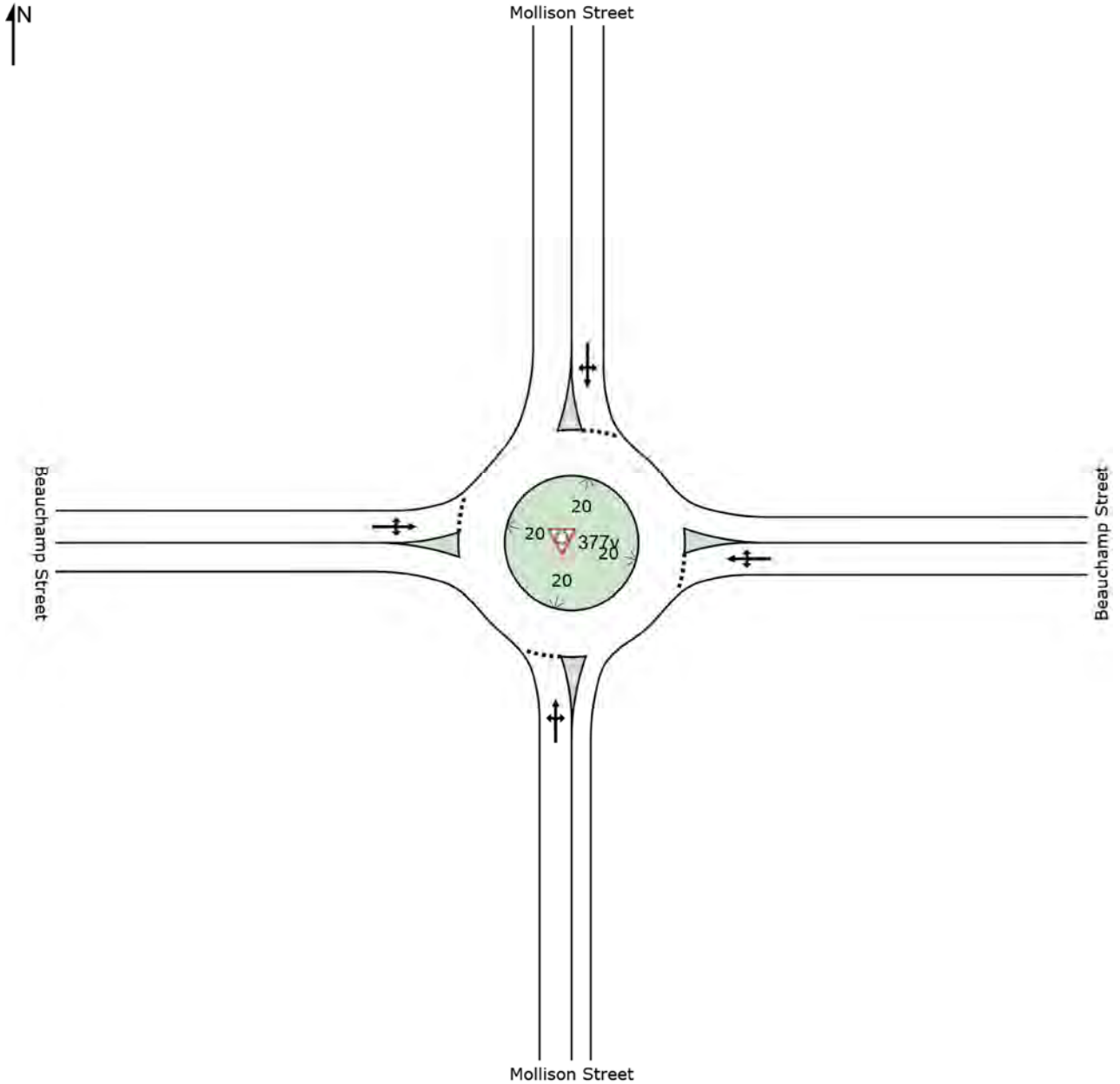
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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Saleyards Rd Intersections.sip7

SITE LAYOUT

 Site: 377v [Mollison St/ Beauchamp St - 2036 AM Peak]

Mollison St/ Beauchamp St - AM Peak
Roundabout



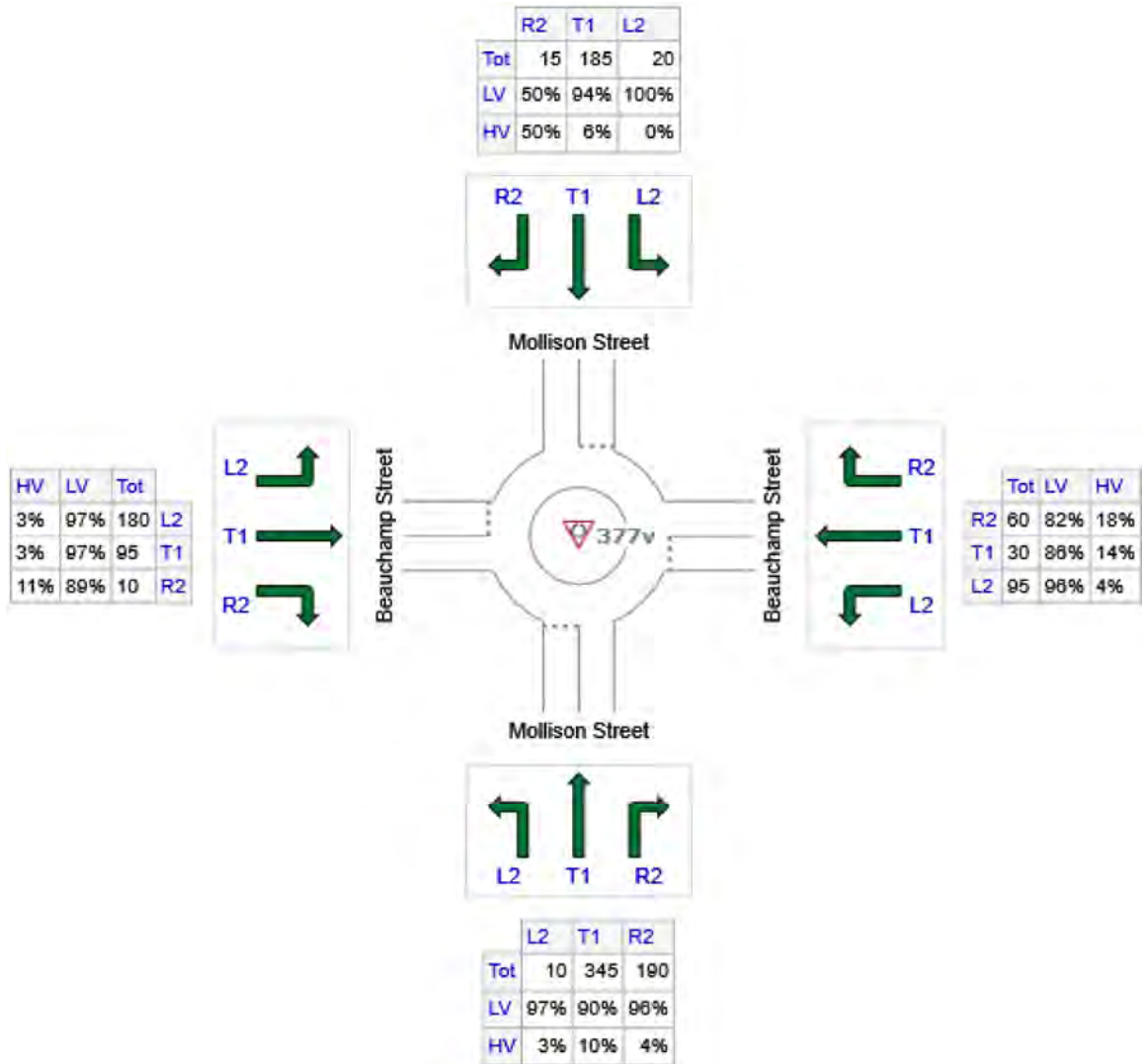
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 377v [Mollison St/ Beauchamp St - 2036 AM Peak]

Mollison St/ Beauchamp St - AM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	545	501	44
E: Beauchamp Street	185	166	19
N: Mollison Street	220	202	18
W: Beauchamp Street	285	276	9
Total	1235	1145	90

LANE SUMMARY

 Site: 377v [Mollison St/ Beauchamp St - 2036 AM Peak]

Mollison St/ Beauchamp St - AM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1 ^d	545	8.0	1344	0.405	100	6.3	LOS A	2.3	17.6	Full	500	0.0	0.0
Approach	545	8.0		0.405		6.3	LOS A	2.3	17.6				
East: Beauchamp Street													
Lane 1 ^d	185	10.1	1150	0.161	100	6.5	LOS A	0.7	5.6	Full	500	0.0	0.0
Approach	185	10.1		0.161		6.5	LOS A	0.7	5.6				
North: Mollison Street													
Lane 1 ^d	220	8.2	1114	0.197	100	5.7	LOS A	0.9	6.8	Full	500	0.0	0.0
Approach	220	8.2		0.197		5.7	LOS A	0.9	6.8				
West: Beauchamp Street													
Lane 1 ^d	285	3.3	924	0.308	100	6.1	LOS A	1.7	12.5	Full	500	0.0	0.0
Approach	285	3.3		0.308		6.1	LOS A	1.7	12.5				
Intersection	1235	7.3		0.405		6.2	LOS A	2.3	17.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

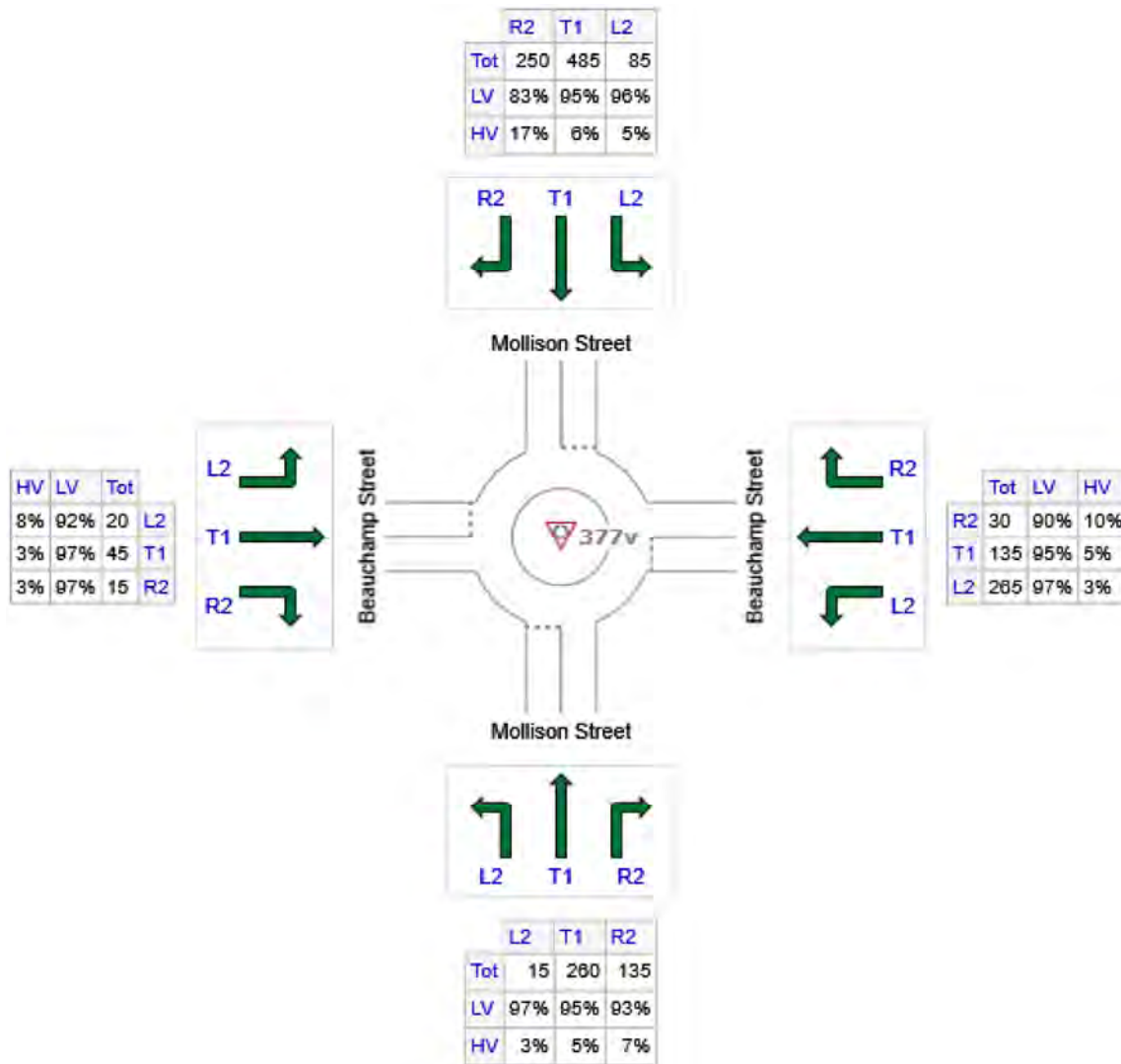
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 377v [Mollison St/ Beauchamp St - 2036 PM Peak]

Mollison St/ Beauchamp St - PM Peak
Roundabout

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	410	387	23
E: Beauchamp Street	430	412	18
N: Mollison Street	820	748	72
W: Beauchamp Street	80	77	3
Total	1740	1623	117

LANE SUMMARY

 Site: 377v [Mollison St/ Beauchamp St - 2036 PM Peak]

Mollison St/ Beauchamp St - PM Peak
Roundabout

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1 ^d	410	5.7	1022	0.401	100	7.9	LOS A	2.3	17.2	Full	500	0.0	0.0
Approach	410	5.7		0.401		7.9	LOS A	2.3	17.2				
East: Beauchamp Street													
Lane 1 ^d	430	4.2	738	0.583	100	11.8	LOS B	5.3	38.2	Full	500	0.0	0.0
Approach	430	4.2		0.583		11.8	LOS B	5.3	38.2				
North: Mollison Street													
Lane 1 ^d	820	8.8	1248	0.657	100	7.0	LOS A	5.5	41.0	Full	500	0.0	0.0
Approach	820	8.8		0.657		7.0	LOS A	5.5	41.0				
West: Beauchamp Street													
Lane 1 ^d	80	4.2	1009	0.079	100	5.2	LOS A	0.4	2.8	Full	500	0.0	0.0
Approach	80	4.2		0.079		5.2	LOS A	0.4	2.8				
Intersection	1740	6.7		0.657		8.3	LOS A	5.5	41.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

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

Roundabout Capacity Model: SIDRA Standard.

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

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

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

^d Dominant lane on roundabout approach

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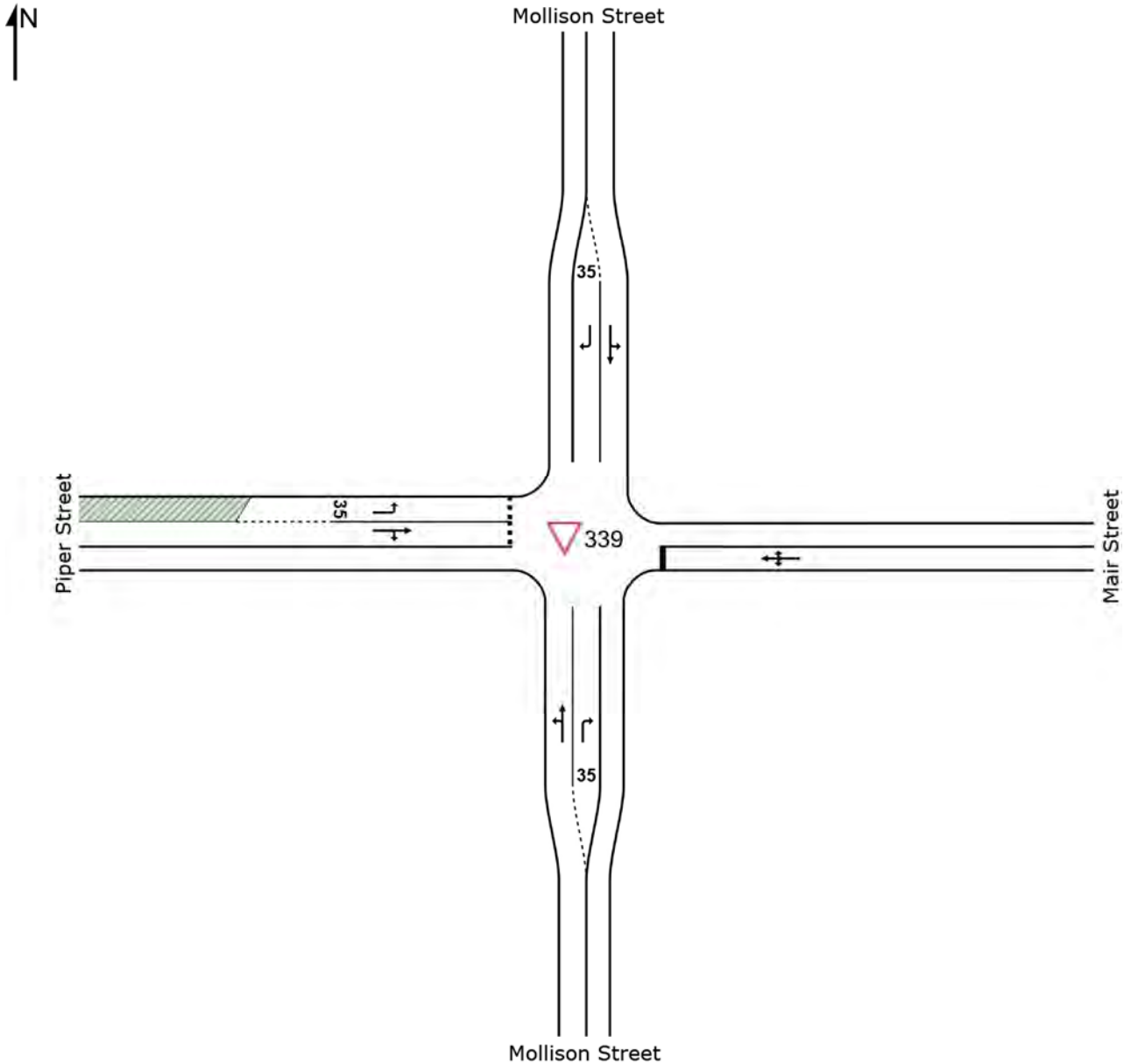
Organisation: TRANSPORT & TRAFFIC SOLUTIONS PTY LTD | Processed: Monday, 12 March 2018 9:58:35 AM

Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

SITE LAYOUT

▽ Site: 339 [Mollison St/ Piper St - 2036 AM Peak]

Mollison St/ Piper St - AM Peak
Giveaway / Yield (Two-Way)



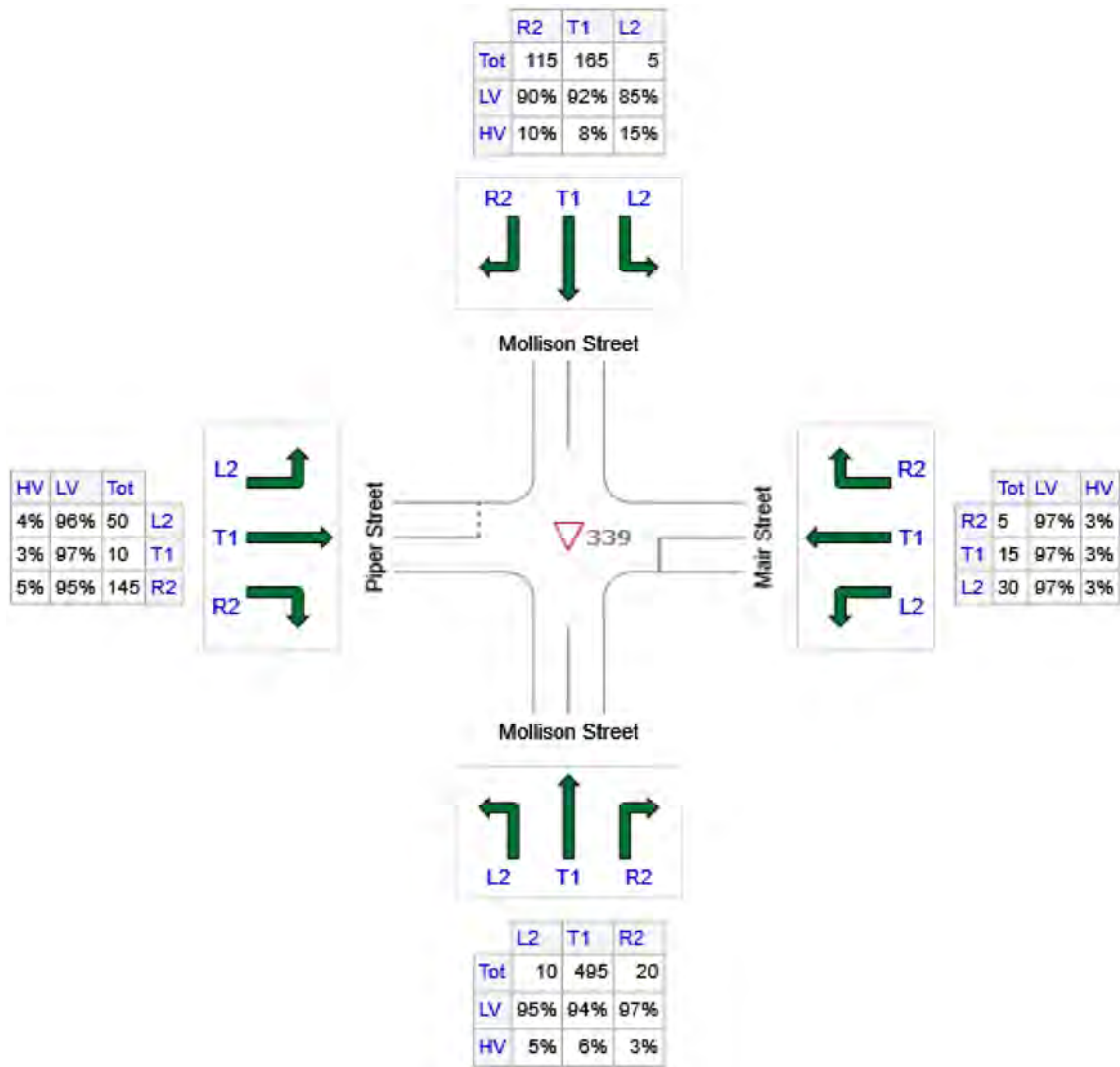
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 339 [Mollison St/ Piper St - 2036 AM Peak]

Mollison St/ Piper St - AM Peak
 Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	525	496	29
E: Mair Street	50	48	2
N: Mollison Street	285	260	25
W: Piper Street	205	195	10
Total	1065	1000	65

LANE SUMMARY

Site: 339 [Mollison St/ Piper St - 2036 AM Peak]

Mollison St/ Piper St - AM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	505	5.6	1899	0.266	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	20	3.0	1304	0.015	100	5.7	LOS A	0.1	0.5	Short	35	0.0	NA
Approach	525	5.5		0.266		0.3	NA	0.1	0.5				
East: Mair Street													
Lane 1	50	3.1	368	0.136	100	15.8	LOS C	0.5	3.4	Full	500	0.0	0.0
Approach	50	3.1		0.136		15.8	LOS C	0.5	3.4				
North: Mollison Street													
Lane 1	170	8.0	1869	0.091	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	115	10.0	964	0.119	100	7.2	LOS A	0.5	3.9	Short	35	0.0	NA
Approach	285	8.8		0.119		3.0	NA	0.5	3.9				
West: Piper Street													
Lane 1	50	4.2	733	0.068	100	7.4	LOS A	0.2	1.7	Short (P)	35	0.0	NA
Lane 2	155	4.9	235	0.660	100	32.0	LOS D	3.7	26.8	Full	500	0.0	0.0
Approach	205	4.7		0.660		26.0	LOS D	3.7	26.8				
Intersection	1065	6.1		0.660		6.7	NA	3.7	26.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

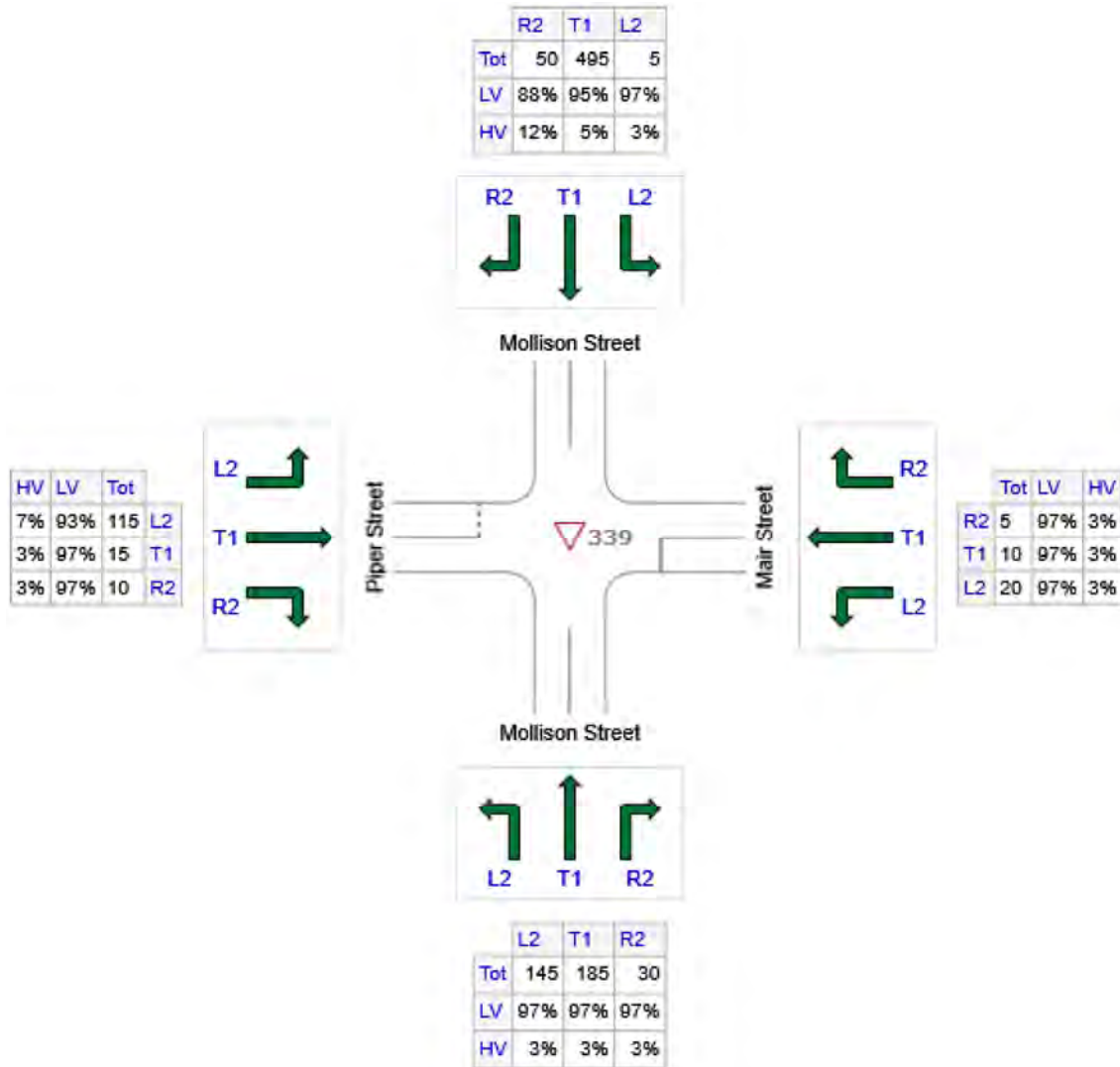
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 339 [Mollison St/ Piper St - 2036 PM Peak]

Mollison St/ Piper St - PM Peak
 Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	360	349	11
E: Mair Street	35	34	1
N: Mollison Street	550	518	32
W: Piper Street	140	131	9
Total	1085	1032	53

LANE SUMMARY

Site: 339 [Mollison St/ Piper St - 2036 PM Peak]

Mollison St/ Piper St - PM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	330	3.0	1889	0.175	100	2.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	30	3.0	1021	0.029	100	6.8	LOS A	0.1	0.9	Short	35	0.0	NA
Approach	360	3.0		0.175		2.4	NA	0.1	0.9				
East: Mair Street													
Lane 1	35	3.0	306	0.114	100	18.0	LOS C	0.4	2.8	Full	500	0.0	0.0
Approach	35	3.0		0.114		18.0	LOS C	0.4	2.8				
North: Mollison Street													
Lane 1	500	5.2	1905	0.262	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	50	12.3	1194	0.042	100	6.0	LOS A	0.2	1.4	Short	35	0.0	NA
Approach	550	5.8		0.262		0.6	NA	0.2	1.4				
West: Piper Street													
Lane 1	115	7.0	1066	0.108	100	5.5	LOS A	0.4	3.0	Short (P)	35	0.0	NA
Lane 2	25	3.0	257	0.097	100	17.2	LOS C	0.3	2.4	Full	500	0.0	0.0
Approach	140	6.3		0.108		7.6	LOS A	0.4	3.0				
Intersection	1085	4.9		0.262		2.7	NA	0.4	3.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

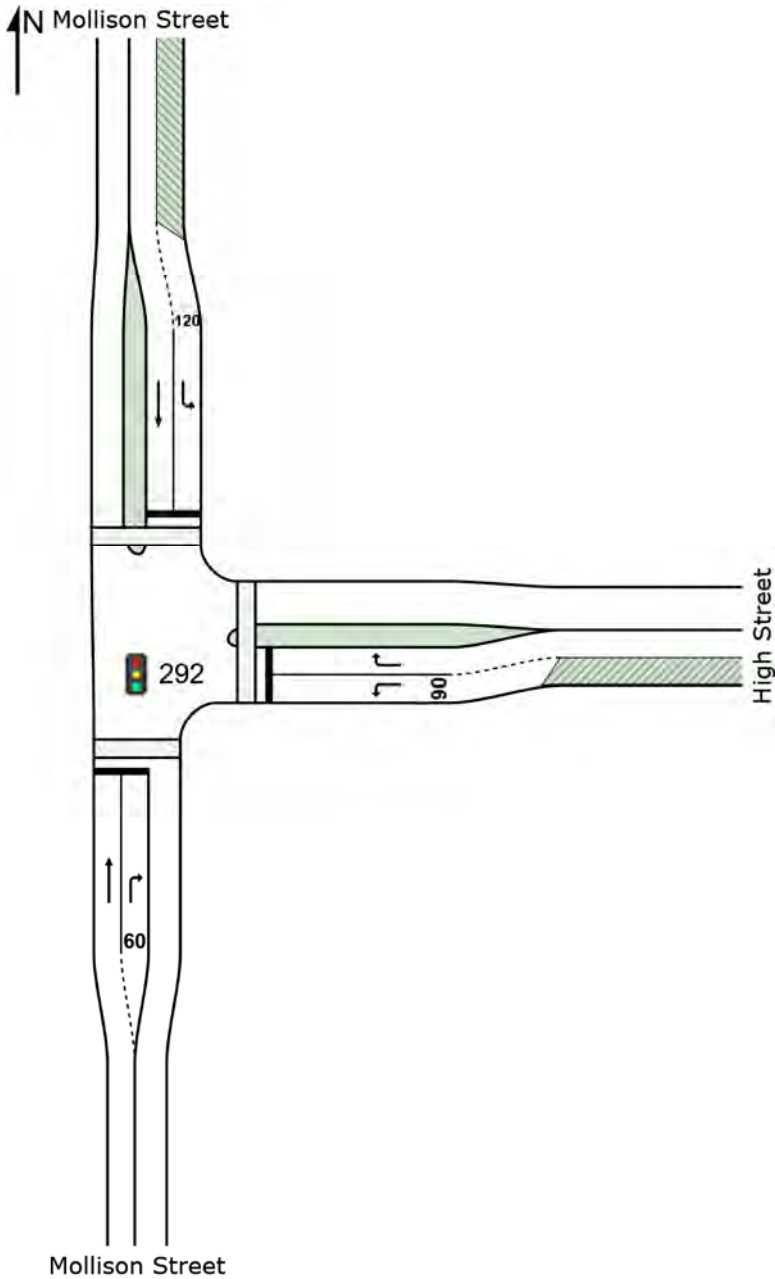
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

SITE LAYOUT

 Site: 292 [Mollison St/ High St - 2036 AM Peak]

Mollison St/ High St - AM Peak
Signals - Fixed Time Isolated



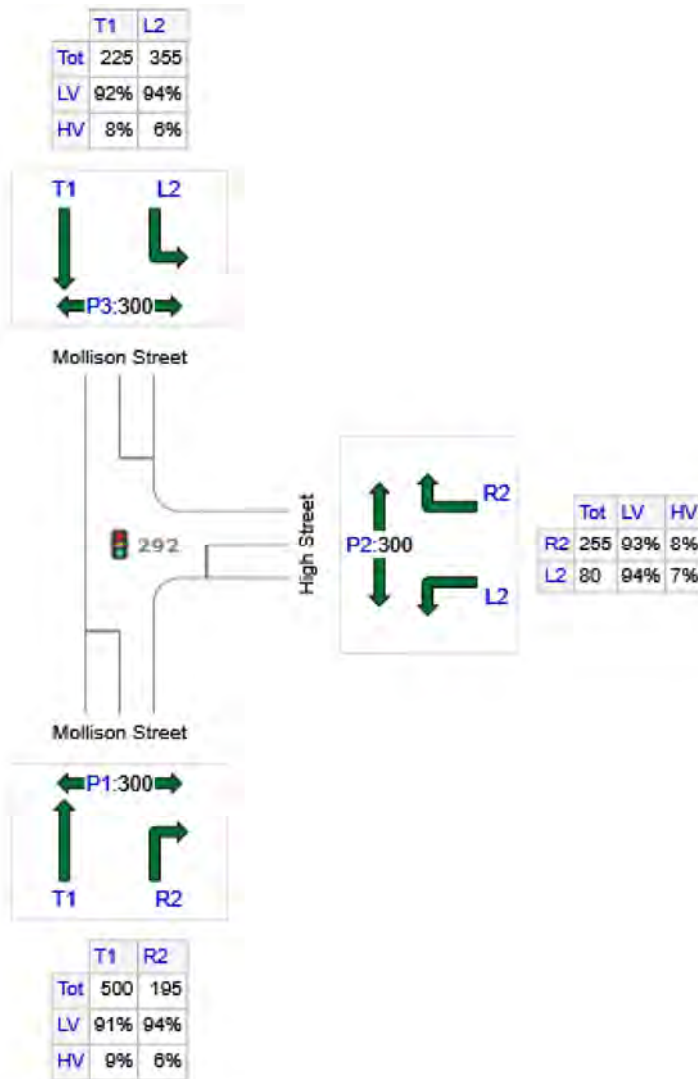
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 292 [Mollison St/ High St - 2036 AM Peak]

Mollison St/ High St - AM Peak
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	695	641	54
E: High Street	335	311	24
N: Mollison Street	580	541	39
Total	1610	1493	117

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

LANE SUMMARY

 **Site: 292 [Mollison St/ High St - 2036 AM Peak]**

Mollison St/ High St - AM Peak
 Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	500	8.6	624 ¹	0.801	100	27.6	LOS C	19.8	148.5	Full	500	0.0	0.0
Lane 2	195	5.7	380	0.513	100	26.7	LOS C	5.9	43.3	Short	60	0.0	NA
Approach	695	7.8		0.801		27.4	LOS C	19.8	148.5				
East: High Street													
Lane 1	80	6.5	330	0.242	100	38.8	LOS D	3.1	22.6	Short (P)	90	0.0	NA
Lane 2	255	7.5	328	0.778	100	46.6	LOS D	11.7	87.0	Full	500	0.0	0.0
Approach	335	7.3		0.778		44.7	LOS D	11.7	87.0				
North: Mollison Street													
Lane 1	355	5.6	762	0.466	100	24.1	LOS C	11.1	81.3	Short (P)	120	0.0	NA
Lane 2	225	8.3	324	0.695	100	39.7	LOS D	9.8	73.5	Full	500	0.0	0.0
Approach	580	6.6		0.695		30.2	LOS C	11.1	81.3				
Intersection	1610	7.3		0.801		32.0	LOS C	19.8	148.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

¹ Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

PHASING SUMMARY

 **Site: 292 [Mollison St/ High St - 2036 AM Peak]**

Mollison St/ High St - AM Peak
 Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program

Phase Sequence: Four Phase

Reference Phase: Phase A

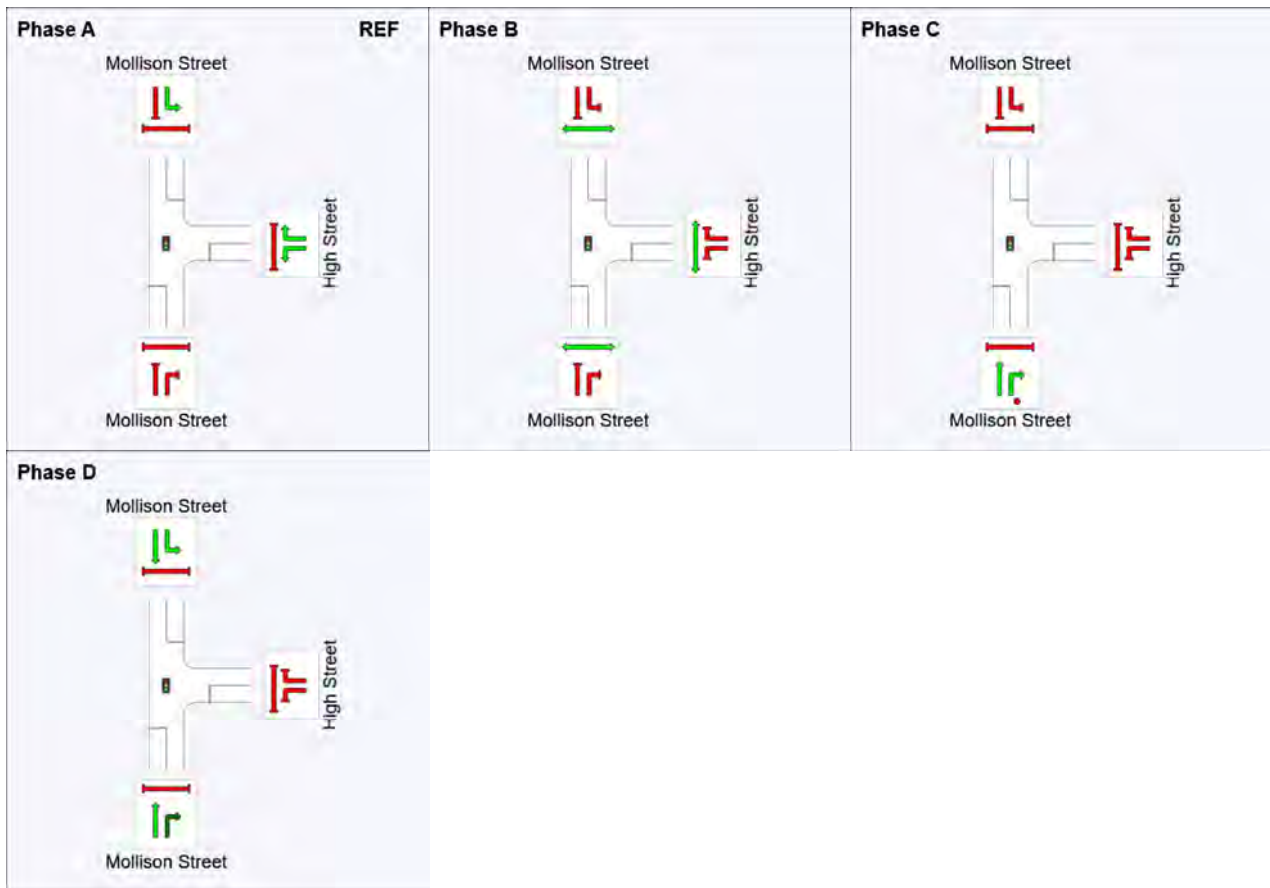
Input Phase Sequence: A, B, C, D

Output Phase Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	0	23	50	68
Green Time (sec)	17	21	15	16
Phase Time (sec)	23	24	21	22
Phase Split	26%	27%	23%	24%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase

VAR: Variable Phase



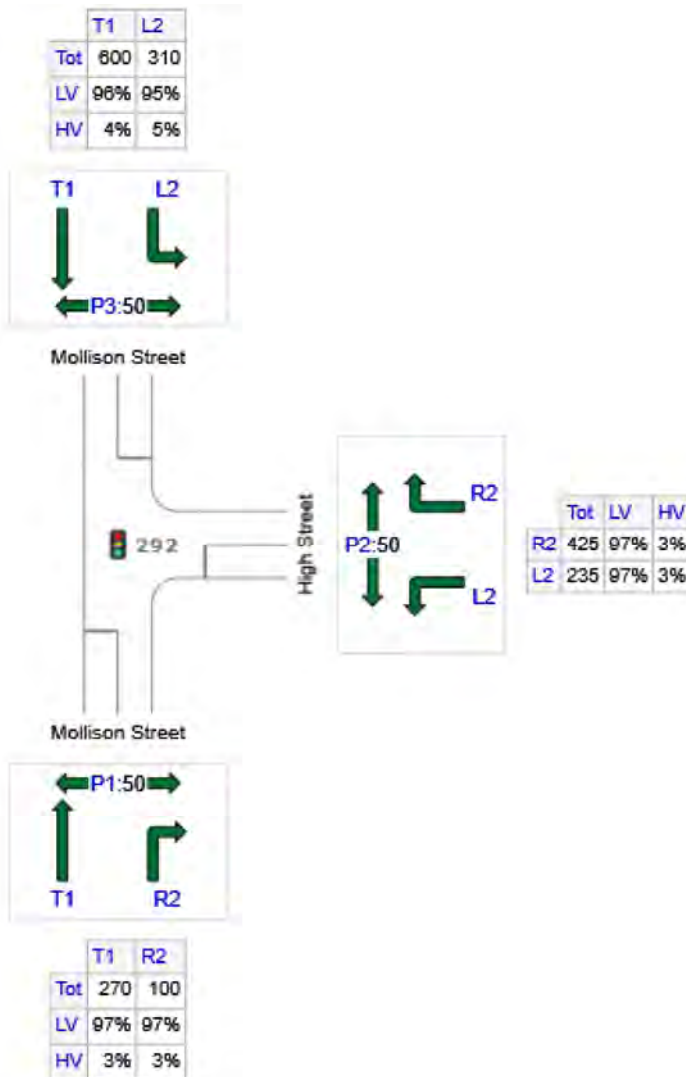
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 292 [Mollison St/ High St - 2036 PM Peak]

Mollison St/ High St - PM Peak
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	370	359	11
E: High Street	660	639	21
N: Mollison Street	910	870	40
Total	1940	1868	72

LANE SUMMARY

 **Site: 292 [Mollison St/ High St - 2036 PM Peak]**

Mollison St/ High St - PM Peak
 Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	270	3.0	866	0.312	100	18.2	LOS B	8.2	59.1	Full	500	0.0	0.0
Lane 2	100	3.0	185	0.541	100	31.2	LOS C	3.0	21.8	Short	60	0.0	NA
Approach	370	3.0		0.541		21.7	LOS C	8.2	59.1				
East: High Street													
Lane 1	235	3.0	555	0.424	100	21.5	LOS C	6.2	44.3	Short (P)	90	0.0	NA
Lane 2	425	3.2	447	0.951	100	71.0	LOS E	27.7	199.2	Full	500	0.0	0.0
Approach	660	3.1		0.951		53.4	LOS D	27.7	199.2				
North: Mollison Street													
Lane 1	310	4.9	1148	0.270	100	12.5	LOS B	6.3	46.1	Short (P)	120	0.0	NA
Lane 2	600	4.1	636	0.944	100	59.0	LOS E	38.3	277.2	Full	500	0.0	0.0
Approach	910	4.4		0.944		43.1	LOS D	38.3	277.2				
Intersection	1940	3.7		0.951		42.5	LOS D	38.3	277.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Lane LOS values are based on average delay per lane.
 Intersection and Approach LOS values are based on average delay for all lanes.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

PHASING SUMMARY

 **Site: 292 [Mollison St/ High St - 2036 PM Peak]**

Mollison St/ High St - PM Peak
 Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Phase Times determined by the program

Phase Sequence: Four Phase

Reference Phase: Phase A

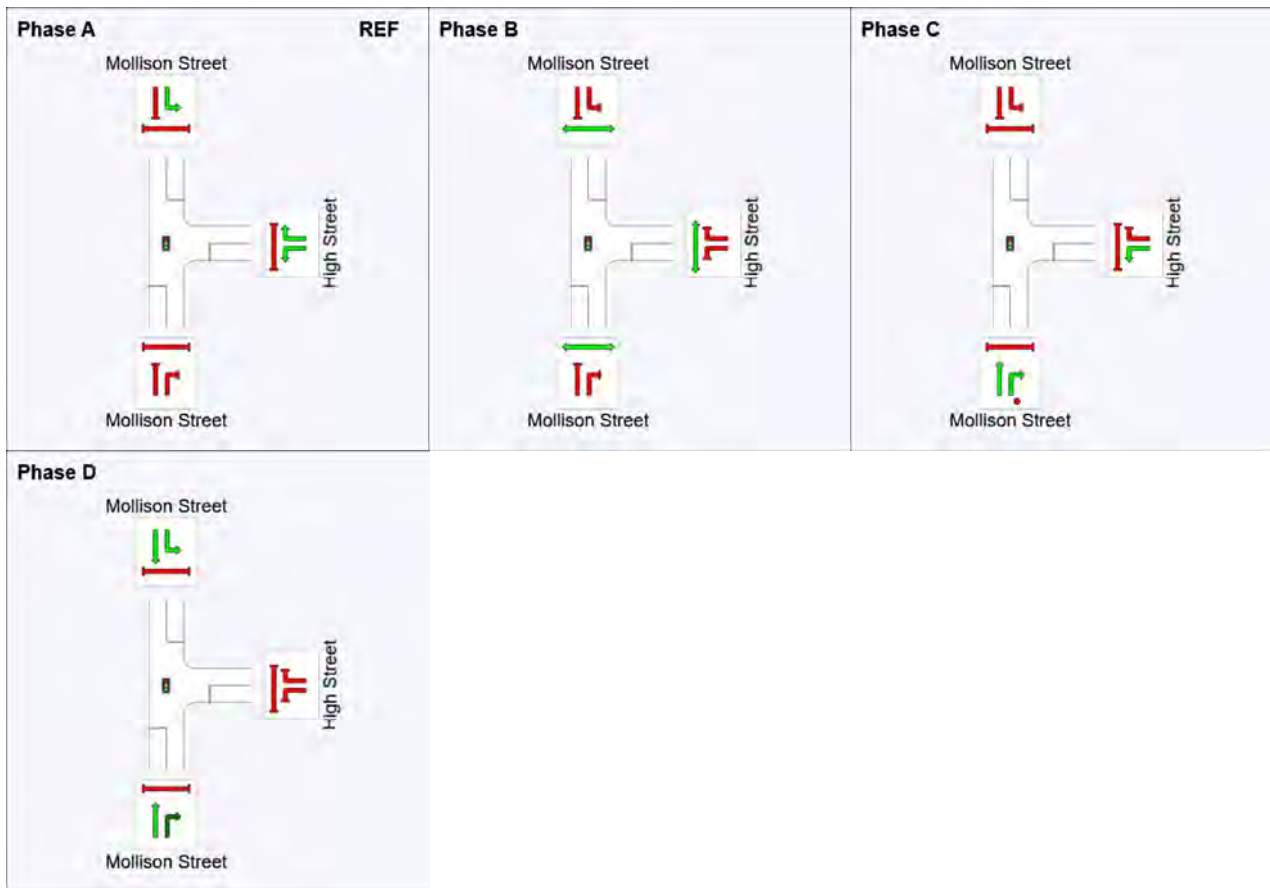
Input Phase Sequence: A, B, C, D

Output Phase Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	0	31	51	60
Green Time (sec)	25	15	6	34
Phase Time (sec)	30	18	12	40
Phase Split	30%	18%	12%	40%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase

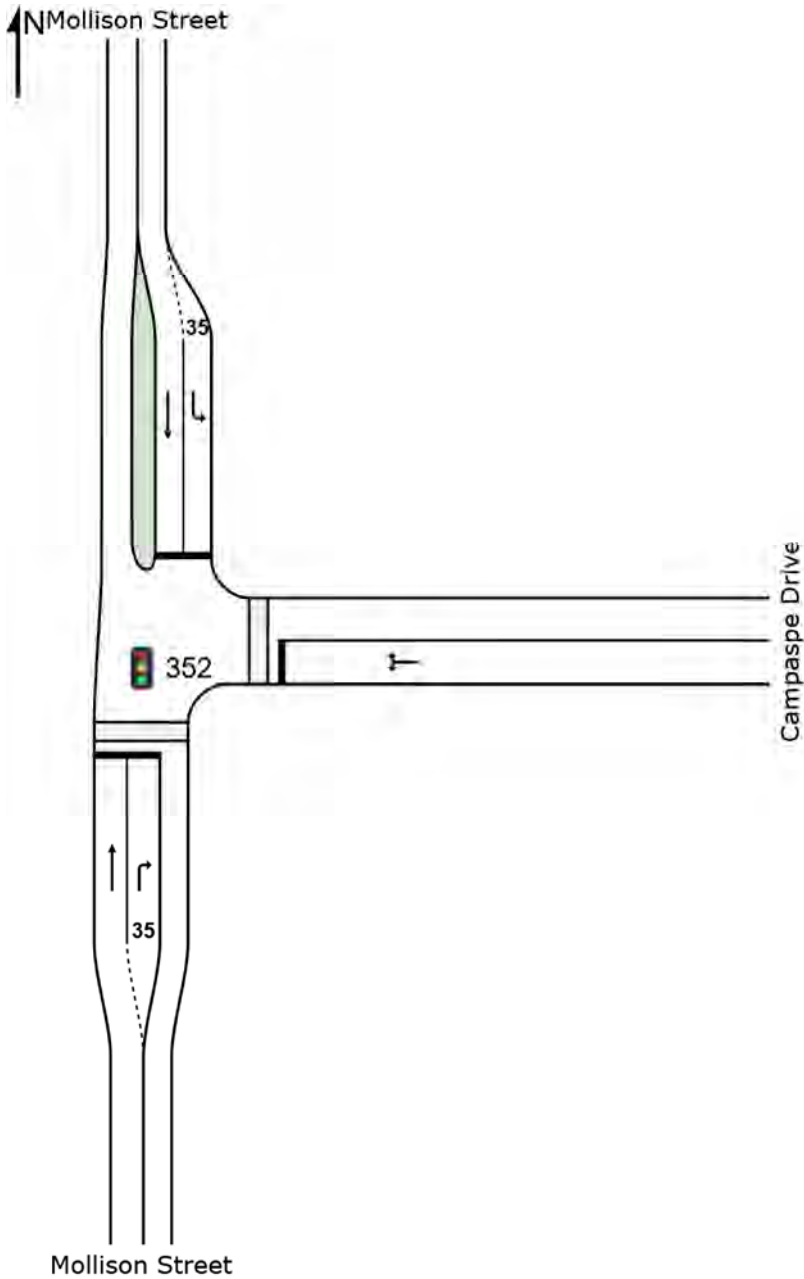
VAR: Variable Phase



SITE LAYOUT

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 AM Peak]**

Mollison St/ Campaspe Dr - AM Peak
Signals - Fixed Time Isolated



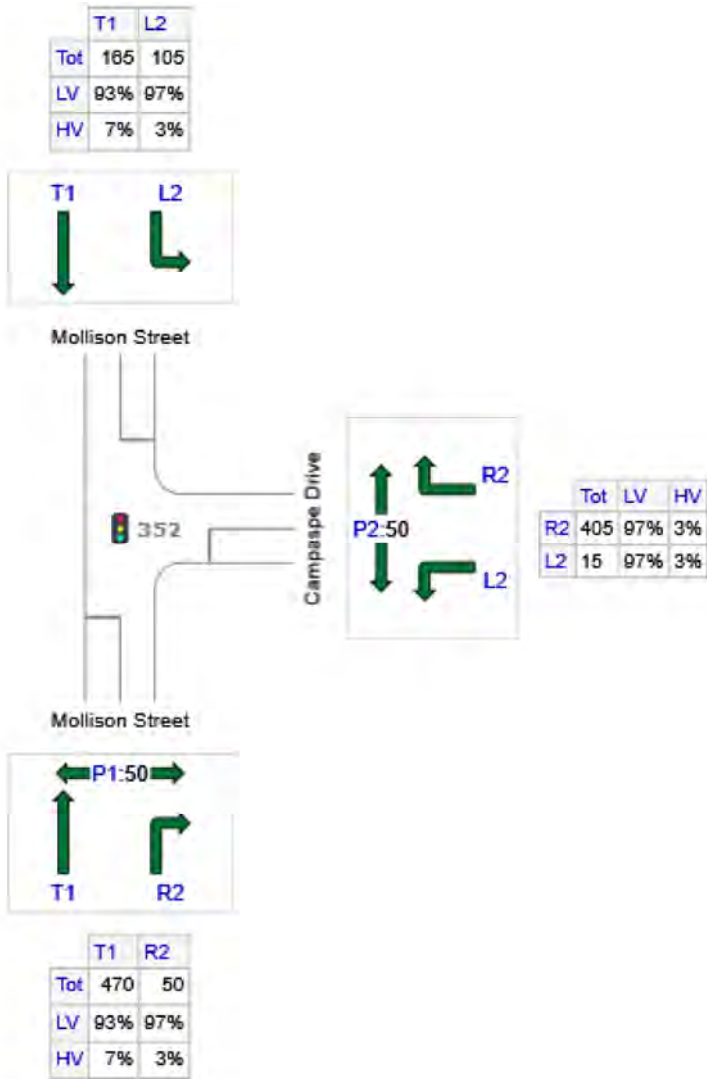
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 Site: 352 [Trentham Rd/ Campaspe Dr - 2036 AM Peak]

Mollison St/ Campaspe Dr - AM Peak
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	520	487	33
E: Campaspe Drive	420	407	13
N: Mollison Street	270	256	14
Total	1210	1150	60

LANE SUMMARY

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 AM Peak]**

Mollison St/ Campaspe Dr - AM Peak

Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	470	6.8	829 ¹	0.567	100	15.8	LOS B	12.8	95.2	Full	500	0.0	0.0
Lane 2	50	3.0	474	0.105	100	19.4	LOS B	1.1	8.1	Short	35	0.0	NA
Approach	520	6.4		0.567		16.2	LOS B	12.8	95.2				
East: Campaspe Drive													
Lane 1	420	3.0	726	0.578	100	26.3	LOS C	13.2	94.7	Full	500	0.0	0.0
Approach	420	3.0		0.578		26.3	LOS C	13.2	94.7				
North: Mollison Street													
Lane 1	105	3.0	1320	0.080	100	8.7	LOS A	1.1	8.0	Short	35	0.0	NA
Lane 2	165	6.7	575	0.287	100	22.6	LOS C	4.9	36.4	Full	500	0.0	0.0
Approach	270	5.3		0.287		17.2	LOS B	4.9	36.4				
Intersection	1210	5.0		0.578		19.9	LOS B	13.2	95.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

¹ Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

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PHASING SUMMARY

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 AM Peak]**

Mollison St/ Campaspe Dr - AM Peak
 Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Phase Times determined by the program

Phase Sequence: Opposed Turns

Reference Phase: Phase B

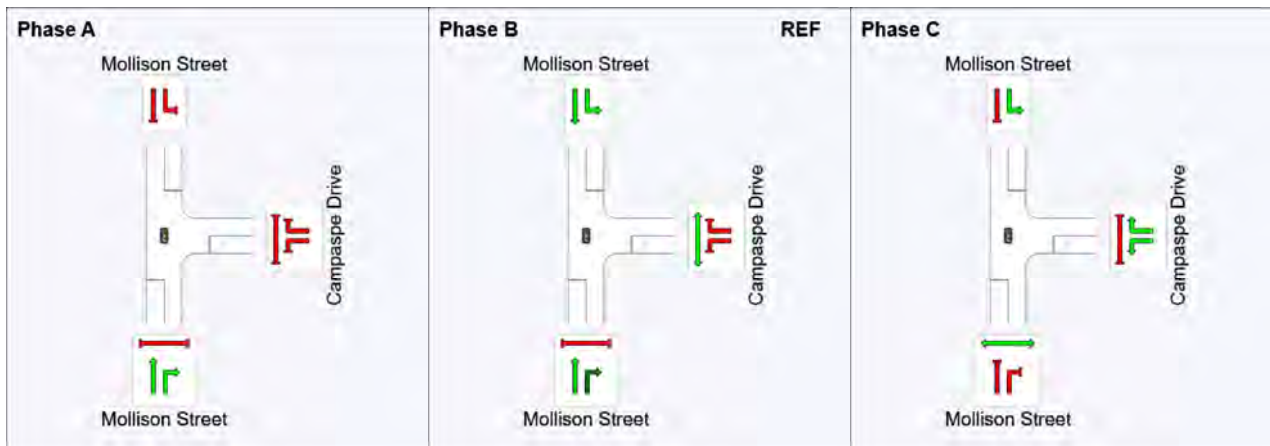
Input Phase Sequence: A, B, C

Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	67	0	31
Green Time (sec)	7	25	30
Phase Time (sec)	13	31	36
Phase Split	16%	39%	45%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase

VAR: Variable Phase



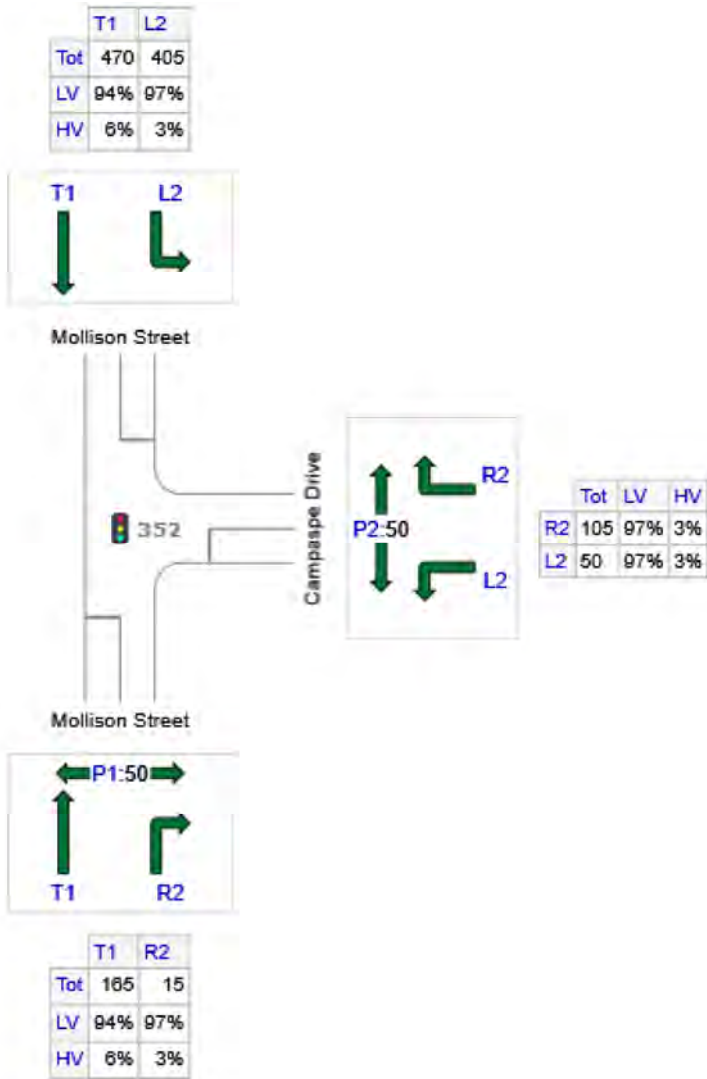
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 PM Peak]**

Mollison St/ Campaspe Dr - PM Peak
 Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Mollison Street	180	169	11
E: Campaspe Drive	155	150	5
N: Mollison Street	875	833	42
Total	1210	1153	57

LANE SUMMARY

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 PM Peak]**

Mollison St/ Campaspe Dr - PM Peak

Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mollison Street													
Lane 1	165	6.3	1349	0.122	100	3.8	LOS A	2.0	14.7	Full	500	0.0	0.0
Lane 2	15	3.0	416	0.036	100	11.4	LOS B	0.2	1.3	Short	35	0.0	NA
Approach	180	6.0		0.122		4.5	LOS A	2.0	14.7				
East: Campaspe Drive													
Lane 1	155	3.0	272	0.569	100	40.2	LOS D	5.9	42.3	Full	500	0.0	0.0
Approach	155	3.0		0.569		40.2	LOS D	5.9	42.3				
North: Mollison Street													
Lane 1	405	3.0	1342	0.302	100	9.0	LOS A	5.0	36.2	Short	35	0.0	NA
Lane 2	470	6.3	785 ¹	0.599	100	11.0	LOS B	10.7	79.2	Full	500	0.0	0.0
Approach	875	4.8		0.599		10.1	LOS B	10.7	79.2				
Intersection	1210	4.7		0.599		13.1	LOS B	10.7	79.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

¹ Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

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PHASING SUMMARY

 **Site: 352 [Trentham Rd/ Campaspe Dr - 2036 PM Peak]**

Mollison St/ Campaspe Dr - PM Peak
 Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Phase Times determined by the program

Phase Sequence: Opposed Turns

Reference Phase: Phase B

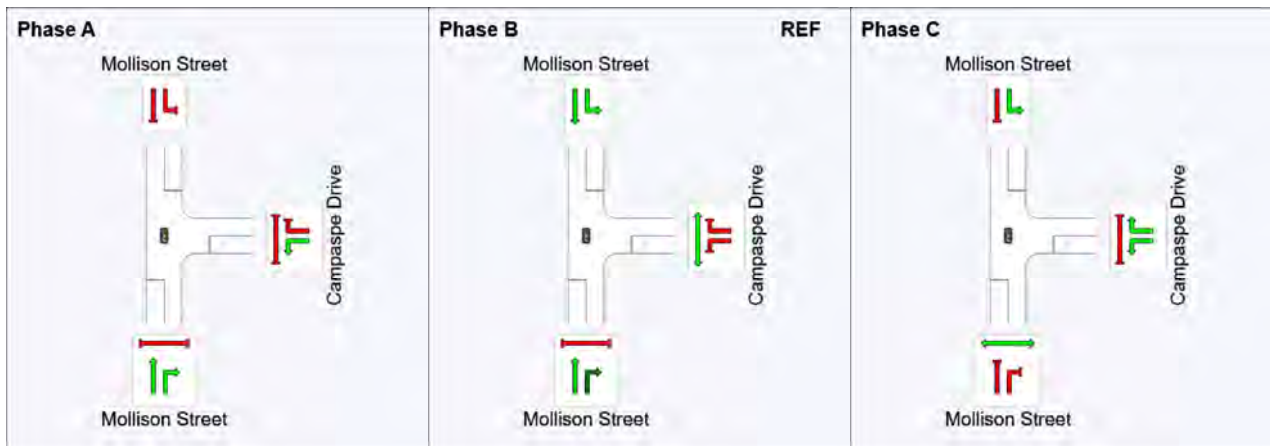
Input Phase Sequence: A, B, C

Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	68	0	51
Green Time (sec)	6	45	11
Phase Time (sec)	12	51	17
Phase Split	15%	64%	21%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase

VAR: Variable Phase



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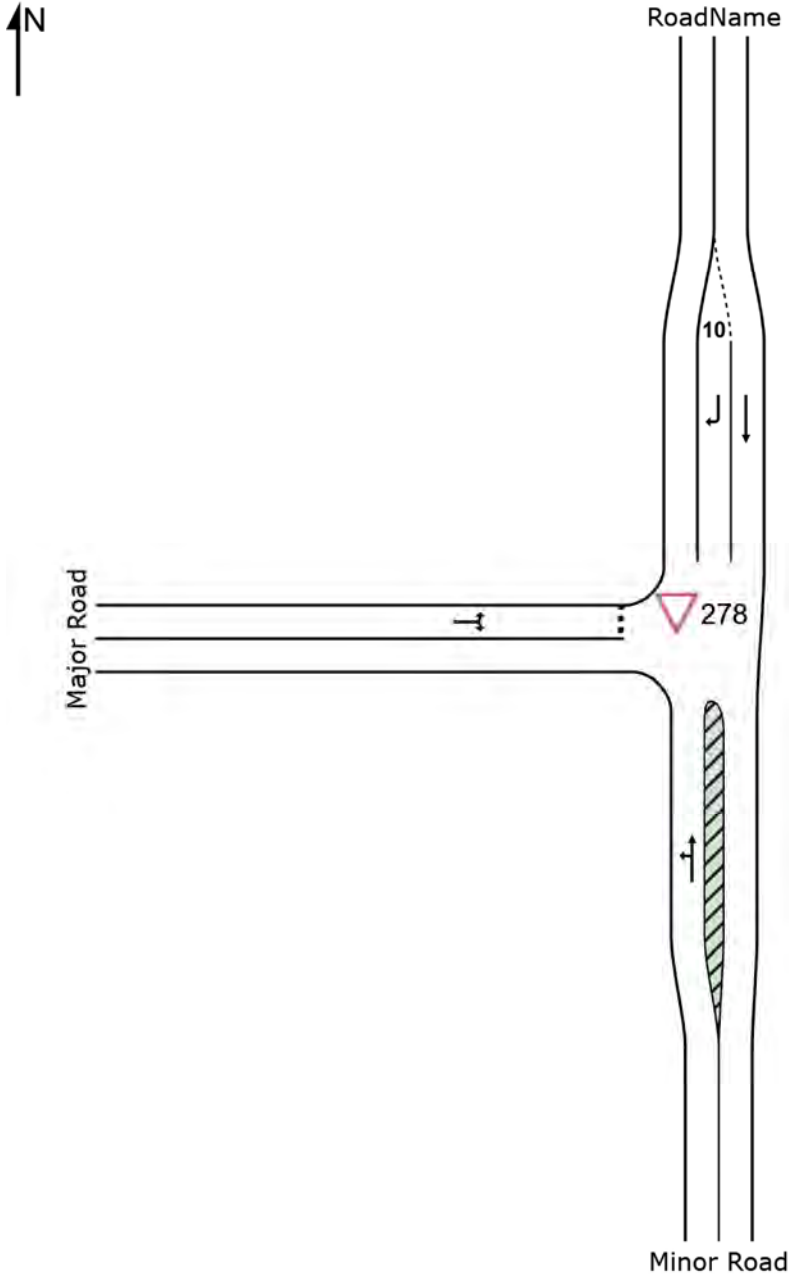
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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

SITE LAYOUT

▽ Site: 278 [Trentham Rd/ Lauriston-Reservoir Rd - 2036 AM Peak]

Trentham Rd/ Lauriston-Reservoir Rd - AM Peak
GiveWay / Yield (Two-Way)



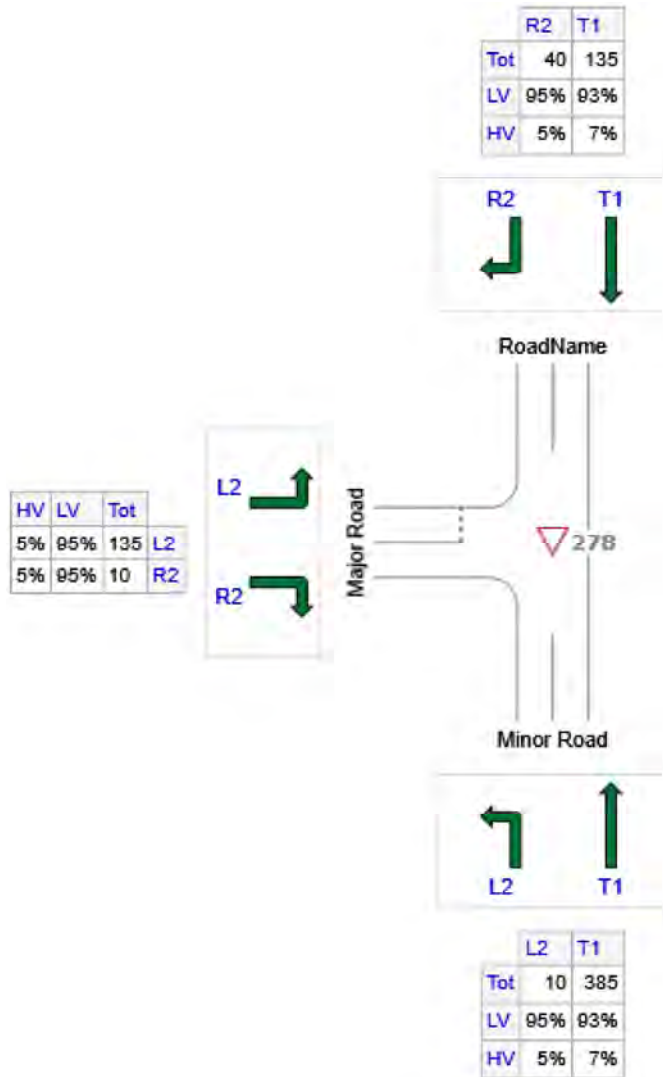
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 278 [Trentham Rd/ Lauriston-Reservoir Rd - 2036 AM Peak]

Trentham Rd/ Lauriston-Reservoir Rd - AM Peak
Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Minor Road	395	368	27
N: RoadName	175	164	11
W: Major Road	145	138	7
Total	715	670	45

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LANE SUMMARY

Site: 278 [Trentham Rd/ Lauriston-Reservoir Rd - 2036 AM Peak]

Trentham Rd/ Lauriston-Reservoir Rd - AM Peak
 Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Minor Road													
Lane 1	416	6.8	1885	0.221	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	416	6.8		0.221		0.2	NA	0.0	0.0				
North: RoadName													
Lane 1	142	6.8	1887	0.075	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	42	5.0	1136	0.037	100	7.1	LOS A	0.2	1.1	Short	10	0.0	NA
Approach	184	6.4		0.075		1.6	NA	0.2	1.1				
West: Major Road													
Lane 1	153	5.0	991	0.154	100	7.6	LOS A	0.6	4.5	Full	500	0.0	0.0
Approach	153	5.0		0.154		7.6	LOS A	0.6	4.5				
Intersection	753	6.3		0.221		2.0	NA	0.6	4.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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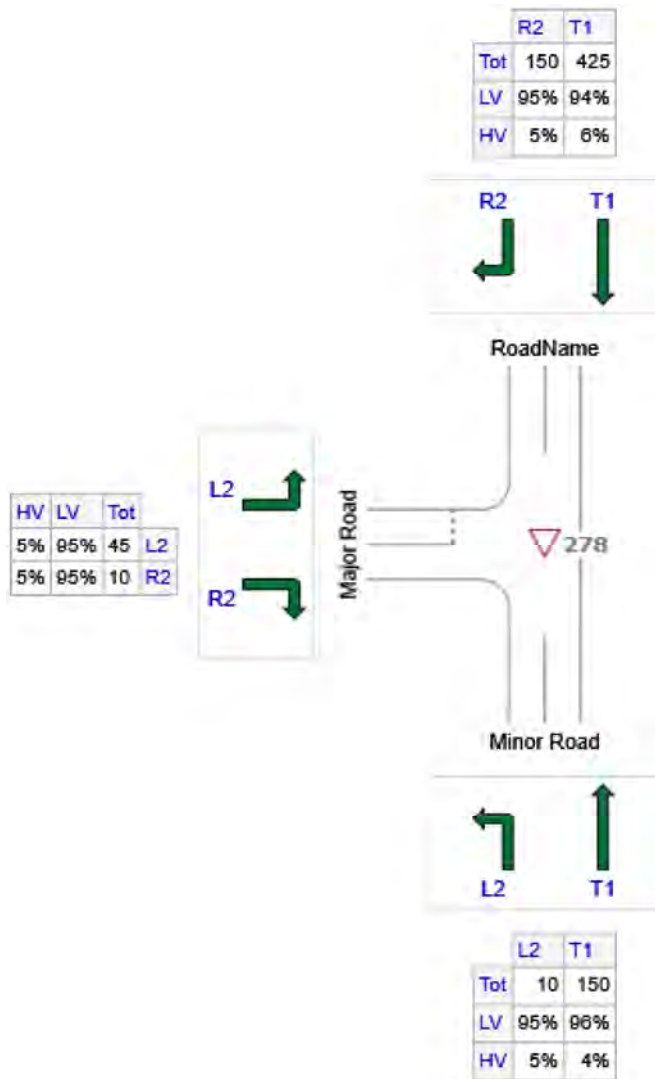
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 278 [Trentham Rd/ Lauriston-Reservoir Rd - 2036 PM Peak]

Trentham Rd/ Lauriston-Reservoir Rd - PM Peak
Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Minor Road	160	154	6
N: RoadName	575	541	34
W: Major Road	55	52	3
Total	790	747	43

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Mollison St Intersections.sip7

LANE SUMMARY

Site: 278 [Trentham Rd/ Lauriston-Reservoir Rd - 2036 PM Peak]

Trentham Rd/ Lauriston-Reservoir Rd - PM Peak
 Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Minor Road													
Lane 1	168	3.7	1918	0.088	100	0.4	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	168	3.7		0.088		0.4	NA	0.0	0.0				
North: RoadName													
Lane 1	447	6.3	1893	0.236	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	158	5.0	1502	0.105	100	6.1	LOS A	0.5	3.6	Short	10	0.0	NA
Approach	605	6.0		0.236		1.6	NA	0.5	3.6				
West: Major Road													
Lane 1	58	5.0	969	0.060	100	7.4	LOS A	0.2	1.7	Full	500	0.0	0.0
Approach	58	5.0		0.060		7.4	LOS A	0.2	1.7				
Intersection	832	5.4		0.236		1.8	NA	0.5	3.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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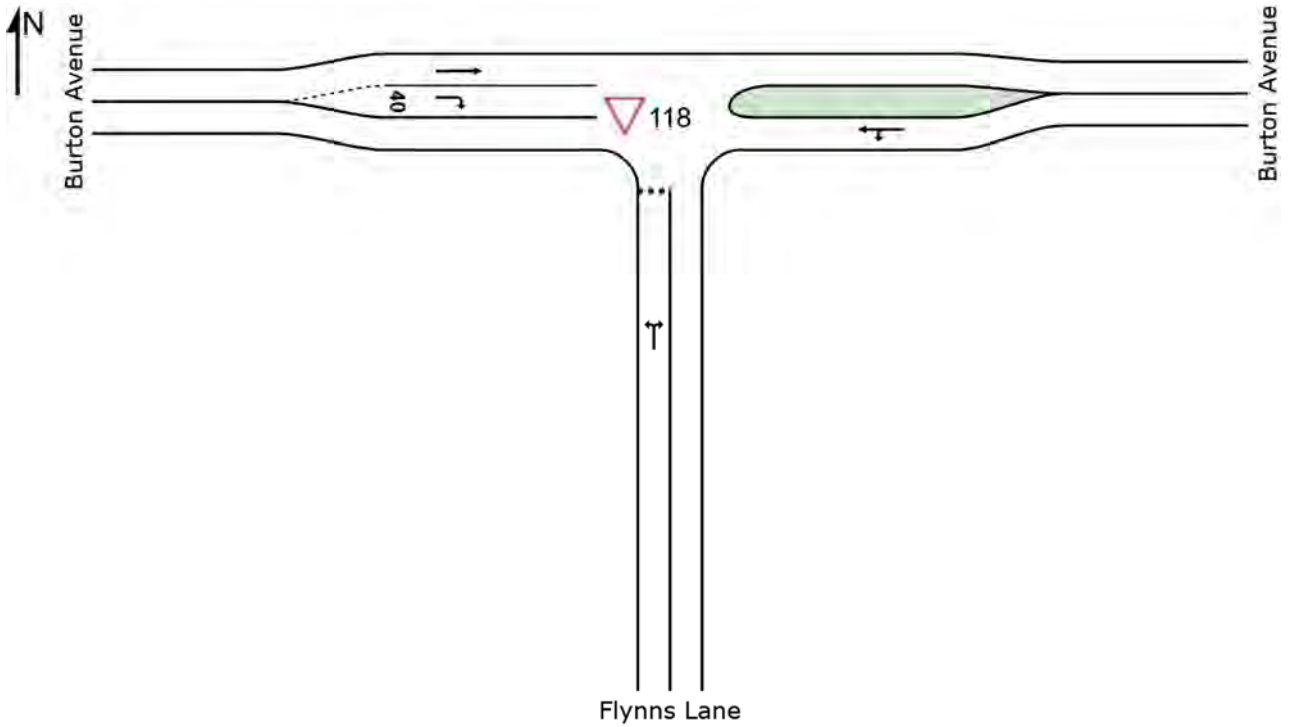
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SITE LAYOUT

▽ Site: 118 [Burton Ave/ Flynnns Lane - 2036 AM Peak]

Burton Ave/ Flynnns Lane - AM Peak
Giveaway / Yield (Two-Way)



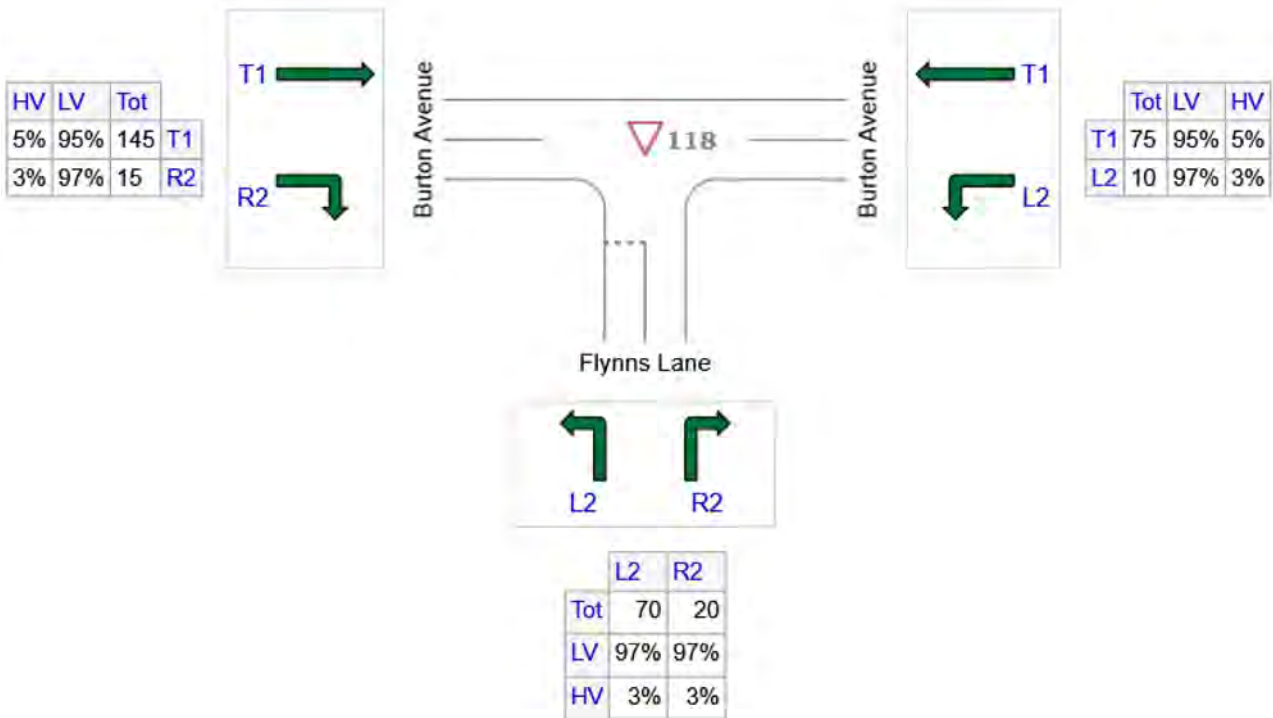
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 118 [Burton Ave/ Flynns Lane - 2036 AM Peak]

Burton Ave/ Flynns Lane - AM Peak
Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Flynns Lane	90	87	3
E: Burton Avenue	85	81	4
W: Burton Avenue	160	152	8
Total	335	321	14

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Burton Ave Intersection.sip7

LANE SUMMARY

Site: 118 [Burton Ave/ Flynnns Lane - 2036 AM Peak]

Burton Ave/ Flynnns Lane - AM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Flynnns Lane													
Lane 1	95	3.0	1300	0.073	100	6.1	LOS A	0.3	2.1	Full	500	0.0	0.0
Approach	95	3.0		0.073		6.1	LOS A	0.3	2.1				
East: Burton Avenue													
Lane 1	89	4.8	1900	0.047	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	89	4.8		0.047		0.7	NA	0.0	0.0				
West: Burton Avenue													
Lane 1	153	5.0	1908	0.080	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	16	3.0	1637	0.010	100	5.7	LOS A	0.0	0.3	Short	40	0.0	NA
Approach	168	4.8		0.080		0.5	NA	0.0	0.3				
Intersection	353	4.3		0.080		2.1	NA	0.3	2.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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Project: C:\Users\MichaelM\Box Sync\Projects\17022_Kyneton MNS\Modelling\SIDRA\Future volumes\Burton Ave Intersection.sip7

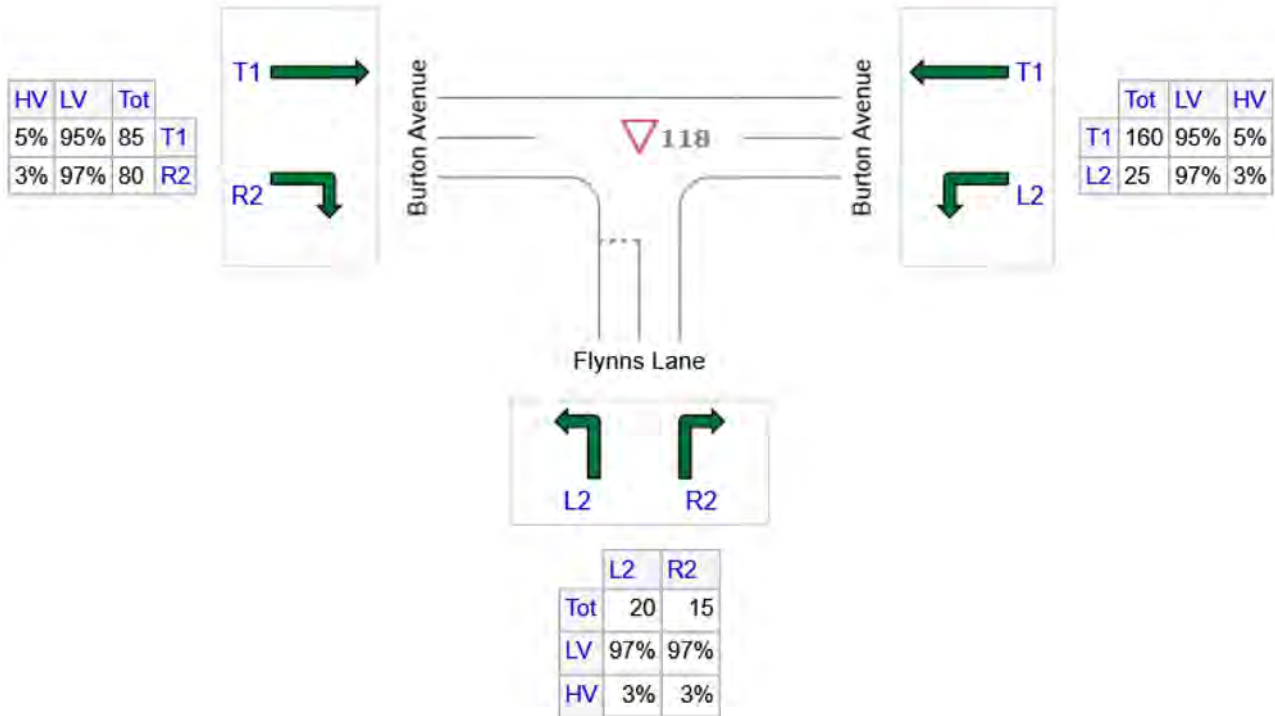
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

▽ Site: 118 [Burton Ave/ Flynnns Lane - 2036 PM Peak]

Burton Ave/ Flynnns Lane - AM Peak
 Giveaway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Flynnns Lane	35	34	1
E: Burton Avenue	185	176	9
W: Burton Avenue	165	158	7
Total	385	369	16

LANE SUMMARY

Site: 118 [Burton Ave/ Flynnns Lane - 2036 PM Peak]

Burton Ave/ Flynnns Lane - AM Peak
 Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Flynnns Lane													
Lane 1	37	3.0	1035	0.036	100	6.8	LOS A	0.1	1.0	Full	500	0.0	0.0
Approach	37	3.0		0.036		6.8	LOS A	0.1	1.0				
East: Burton Avenue													
Lane 1	195	4.7	1898	0.103	100	0.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	195	4.7		0.103		0.8	NA	0.0	0.0				
West: Burton Avenue													
Lane 1	89	5.0	1908	0.047	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	84	3.0	1479	0.057	100	6.1	LOS A	0.3	1.8	Short	40	0.0	NA
Approach	174	4.0		0.057		3.0	NA	0.3	1.8				
Intersection	405	4.3		0.103		2.3	NA	0.3	1.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

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

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

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

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

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

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APPENDIX E - FUTURE YEAR 2021, 2026, AND 2031 TRANSPORT MODEL PLOTS



