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NWGGA Road and Rail Planning Investigations

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Client: City of Greater Geelong

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Executive summary

The Northern and Western Geelong Growth Areas (NGGA and WGGA) are projected to accommodate a combined population of 110,000 residents as well as approximately 100,000 square metres of activity centre development.

In preparing an updated Road Network Operating Plan (RNOP) for Geelong, City of Greater Geelong identified a number of additional investigations to maximise transport opportunities for the growth areas, specifically around public transport. These investigations are the focus of this study and include:

1. An outer orbital traffic route, beyond the two growth areas
2. A large scale commuter railway station for the northern suburbs of Geelong
3. Use of the western rail corridor for public transport, to service the two growth areas and the broader western growth corridor (including Golden Plains Shire Council).

The intent of these investigations was to develop a baseline of information required to inform the feasibility and further development of the projects, identify the transport needs of the growth area and how these drive the need for the projects, and consider the options for implementing each project.

Outer orbital traffic route: The outer orbital traffic route investigation considered three options: an external route, an internal route, and provision of multiple routes between the two growth areas. Whilst the external route was not recommended due to its limited expected usage by growth area residents – owing to its peripheral location and replication of the function of the nearer Geelong Ring Road – the use of Evans Road as an internal route or provision of multiple local roads were considered worthy of further investigation. These corridors should be considered in subsequent strategic modelling of the growth areas to understand their potential effectiveness in managing congestion.

Commuter railway station: The commuter railway station investigation considered three options: a new Corio Railway Station, an expanded Lara Railway Station, and a station in Avalon at the interchange between the proposed Avalon Airport rail link and the Melbourne-Geelong main rail line. Due to its close proximity to the NGGA and absence of significant development constraints, the new Corio Railway Station was identified as the most attractive alternative. This site should be considered in the Geelong Commuter Car Parking Strategy, which is currently underway and will confirm the long term demand for commuter parking along the Melbourne-Geelong rail corridor. Alternative access arrangements to the commuter railway station – such as upgraded bus services and active transport connections – should be considered and encouraged to better support the long-term sustainability goals of the region.

Western rail corridor: The potential use of the western rail corridor for public transport (light rail or heavy rail) was explored for its suitability toward meeting the transport needs of the two growth areas. These concepts were also compared with several on-road transport options (bus rapid transit and conventional buses) that could alternatively be configured for the same purpose. The provision of a high quality public transport service – in conjunction with supporting land use patterns – has the potential to reduce the need for significant capacity upgrades along the arterial road network in several critical locations.

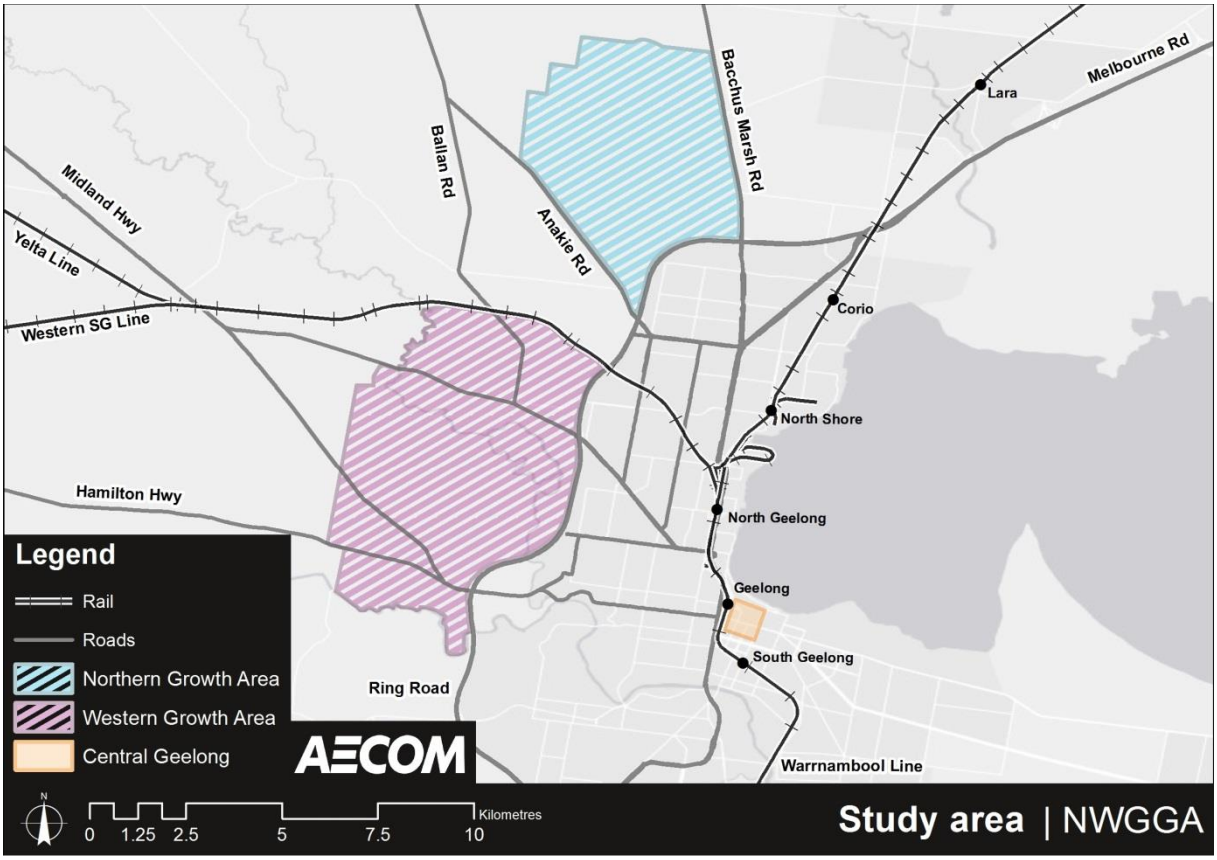
The conclusion of these investigations is that — in order to help preserve the valued natural qualities that currently define the areas designated for the NGGA and WGGA — aggressive public transport measures should be explored to enable a less car-centric design future for these areas.

In conjunction with the strategic connections as represented by the outer orbital route — any variation of which would need to be designed to be consistent with the desired community character — as well as the development of a well-designed and well-located strategic commuter rail facility on the main line to Melbourne, the introduction of enhanced public transport could help ensure a more sustainable and inclusive future for existing and new outer Geelong residents.

1.0 Introduction

The Northern and Western Geelong Growth Areas (NWGGA) are projected to accommodate a combined population of approximately 110,000 residents and approximately 100,000 square metres of activity centre development. These growth areas are shown in Figure 1. This growth will generate high levels of travel demand, likely to be concentrated on several key transport corridors.

Figure 1 Project study area



In support of the proposed growth areas, City of Greater Geelong (CoGG) has resolved to prepare an integrated infrastructure delivery plan. The task of preparing this plan is referred to as the NWGGA project. Much of this work is already underway, with CoGG commissioning a number of technical reports in late 2016 across a range of disciplines. One of these technical studies comprises a transport movement and access strategy.

In late 2016 CoGG began to prepare an updated Road Network Operating Plan (RNOP) for Geelong, including these growth areas. This plan is currently undergoing finalisation. From this process, three additional investigations were identified to maximise transport opportunities for the growth areas, specifically around public transport. These project investigations include:

1. An outer orbital traffic route, beyond the two growth areas
2. A large scale commuter railway station for the northern suburbs of Geelong
3. A rail corridor that services the two growth areas and the broader western growth corridor (including Golden Plains Shire Council).

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These investigations fall into the feasibility stage of the project life cycle. The intent of these are the identification of projects worthy of further development, or identification of projects that are not feasible. The objectives of this study are to:

- Develop a baseline of information required to inform the feasibility and further development of the project investigations
- Identify the transport needs of the growth areas
- Investigate the options for implementing each potential project.

The structure of this report is as follows:

- Section 2.0: Overview of each planned growth area
- Section 3.0: Baseline information including existing transport infrastructure and operations, planned projects, and the consultation process undertaken with key stakeholders
- Section 4.0: Investigation of the outer orbital traffic route project
- Section 5.0: Investigation of the commuter railway station project
- Section 6.0 Investigation of the western rail corridor project
- Section 7.0: Findings of the study and recommendations on next steps

2.0 Growth areas

The G21 Regional Growth Plan (RGP) has identified the West Geelong Growth Area (WGGA) and the North Geelong Growth Area (NGGA) as areas to potentially accommodate significant population growth in the Geelong region. An overview of each of these areas is provided in the following sections.

2.1 Western Geelong Growth Area

The Western Geelong Growth Area (WGGA) is bound by the Ballarat-Geelong train line on the north, Barwon River on the south, Geelong Ring Road on the East and Friend in Hand/Dog Rocks Road on the west, as shown in Figure 2. For the purpose of this assessment, the growth area is assumed to accommodate the following:

- 22,000 dwellings (approximately 61,600 residents)
- Five neighbourhood activity centres
- One primary activity centre
- Ten primary schools
- Three secondary schools.

This area currently includes an active quarry along with a private school and recreational reserve. Challenges to development of housing in the area include Batesford Quarry and its overburdens (expected remaining life of 10-20 years), areas with steep slopes, Dog Rocks Reserve, Covenant College and land prone to flooding.

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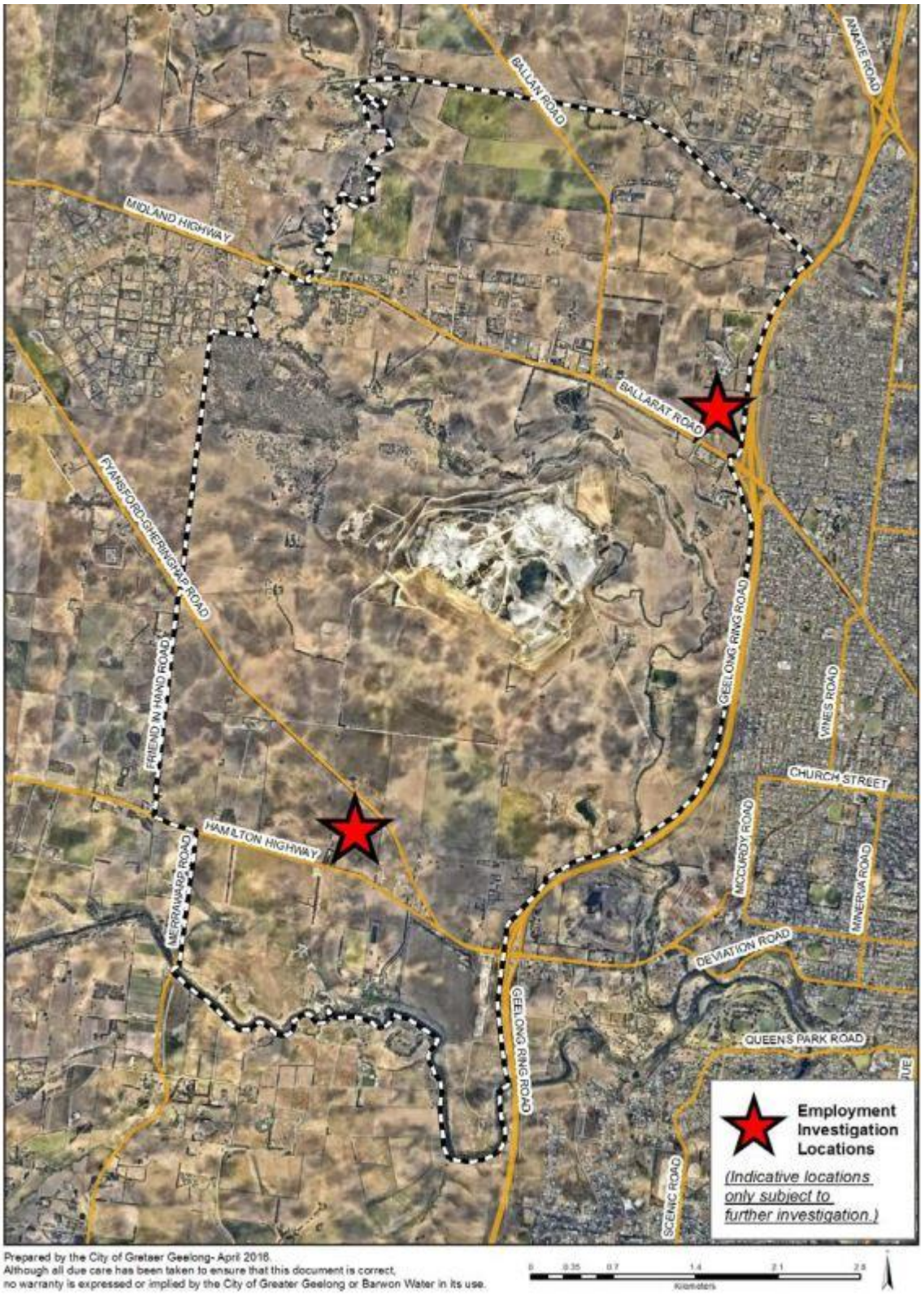
Figure 2 West Geelong Growth Area (Source: CoGG)



2.2 Northern Geelong Growth Area

The Northern Geelong Growth Area (NGGA) is bounded by Anakie Road in the east, Bacchus Marsh Road in the west, Geelong Ring Road in the south and Staceys Road in the north, as shown in Figure 3. For the purpose of this assessment, the growth area is assumed to accommodate the following:

- 18,000 dwellings (approximately 50,400 residents)
- Four neighbourhood activity centres
- Ten primary schools
- Three secondary schools.

There is a low level of existing activity in the NGGA, compared to the WGGA, with the Geelong Baptist School, Barwon Water and a service station the only land uses outside rural farming and rural living developments. There are also some significant additional considerations which may present a challenge to development, including south West Gas Pipeline easement (requiring a 500 metre buffer), electricity transmission powerline easements, and land buffers to industrial areas (Lara Energetic Materials Manufacturing Plant, Geelong Ring Road Employment Precinct).

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Figure 3 North Geelong Growth Area (Source: CoGG)

3.0 Baseline information

The following sections provide an overview of existing transport infrastructure and operations, a discussion of planned projects and policies, and a summary of the consultation process undertaken with key stakeholders.

3.1 Road network

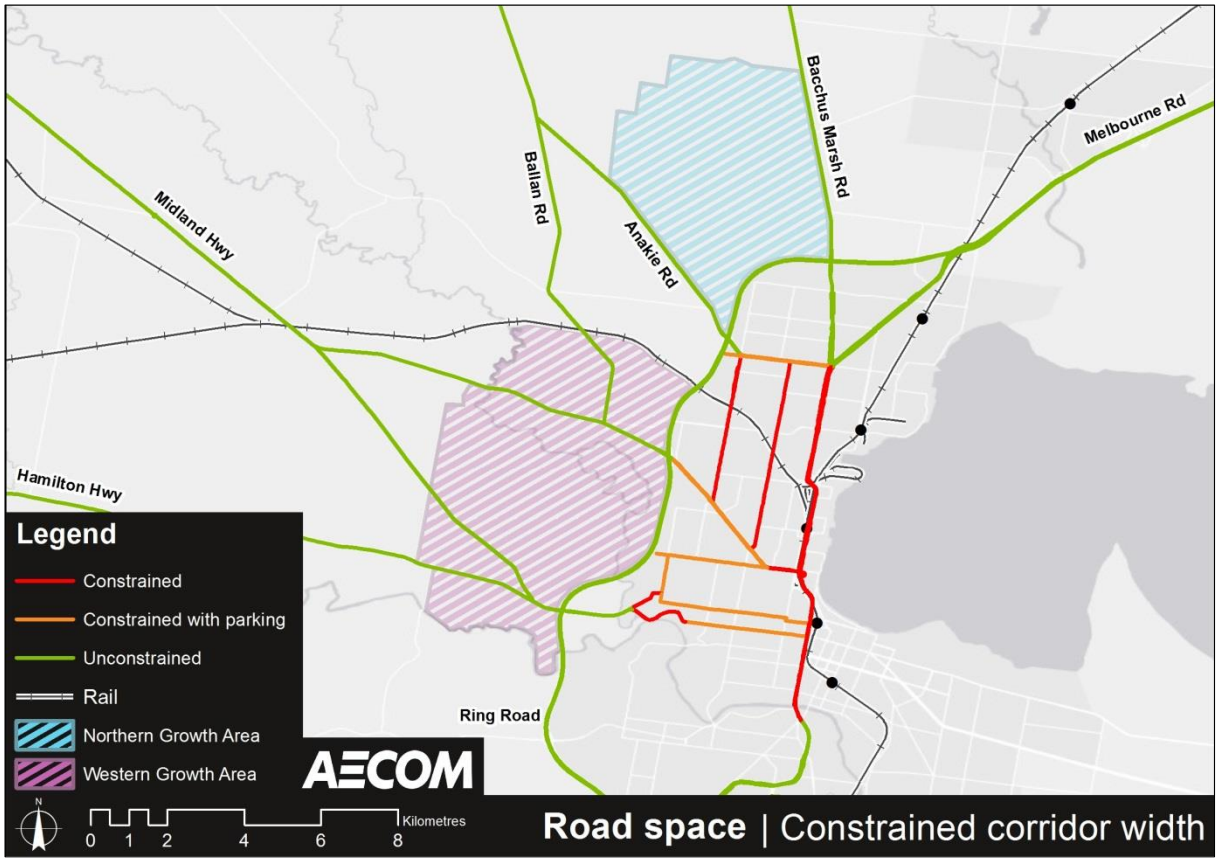
The key road corridors linking the growth areas to the Geelong Ring Road and wider network are shown in Figure 4. These are (from the south) Hamilton Highway, Midland Highway, Anakie Road and Bacchus Marsh Road.

This plan also illustrates the potential for each corridor to be widened to accommodate increased demand. Corridors have been classified as:

- Unconstrained: Widening could be achieved without the need for land acquisition or the loss of parking bays.
- Constrained with parking: Widening could be achieved with the loss of parking lanes.
- Constrained: Widening could not be achieved without land acquisition.

It should be noted that no corridor is unconstrained along its entire length, suggesting that in order to accommodate increased demand, alternative forms of transport will need to be provided or the existing road space will need to be used more efficiently.

Figure 4 Existing key road utilisation

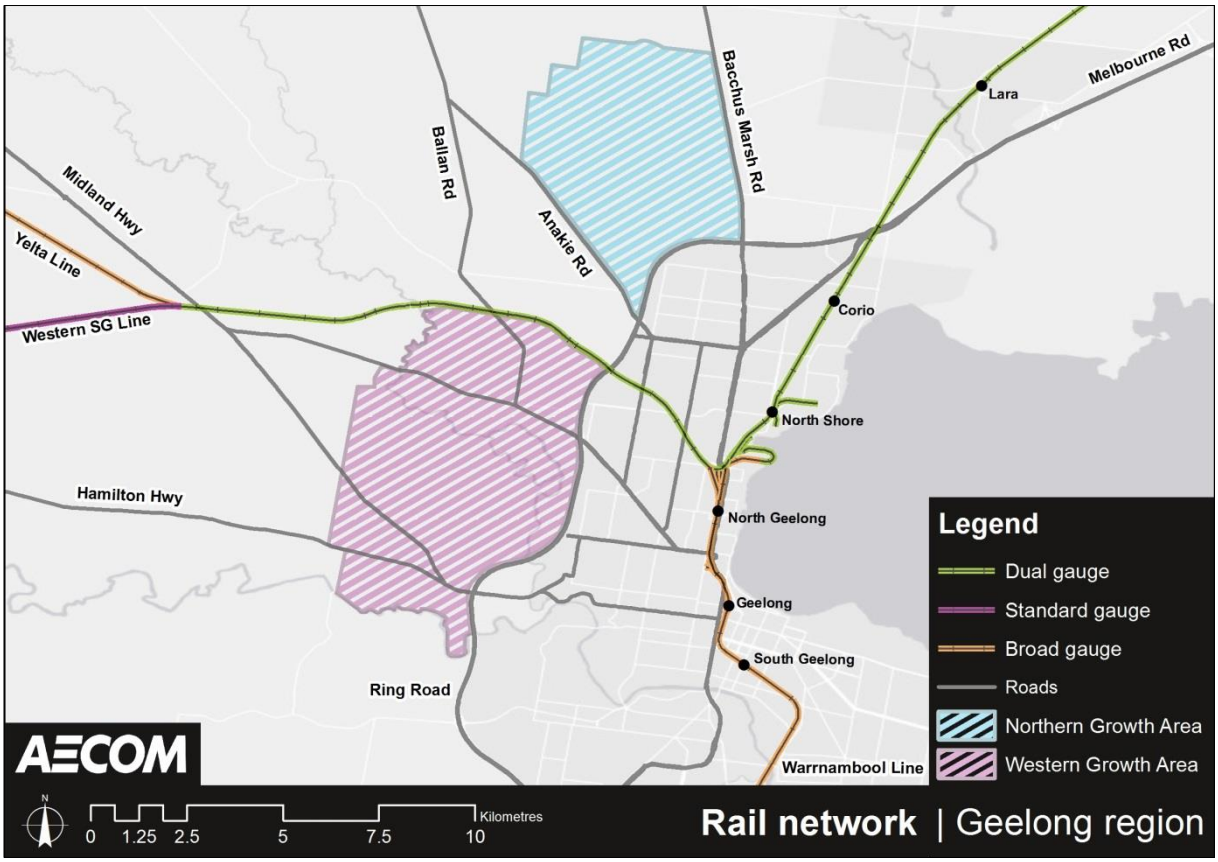


3.2 Rail network

The existing rail network servicing the Geelong region, including its gauge, is shown in Figure 5. The section of railway bordering the WGGA is dual-gauge, meaning that both standard and broad-gauge rolling stock can utilise it. This dual-gauge track extends from Gheringhap (at the junction of the Yelta and Western standard-gauge lines) into Melbourne. The network that extends to the south from North Geelong is broad-gauge only.

This network carries both interstate passenger (the Overland) and freight rail services.

Figure 5 Transport infrastructure in Geelong (Source: data.vic.gov.au)



3.2.1 Passenger

There are eight commuter railway stations within the Geelong region. These are listed in Table 1, including the number of car parks provided at each.

Currently there are no commuter services that utilise the Yelta or Western standard-gauge lines. However the twice-weekly Overland service between Melbourne and Adelaide operates on the Western standard-gauge line, with a stop at North Shore Station.

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Table 1 Commuter railway station parking numbers

Station	Number of car parks
Lara	350
Corio	80
North Shore	65
North Geelong	360
Geelong	450
South Geelong	380
Marshall	380
Waurn Ponds	277

3.2.2 Freight

Grain is delivered to the Port of Geelong and Melbourne for export or processing via the Yelta and Western standard-gauge lines. Standard and broad gauge rolling stock fleets are available for the transportation of grain, allowing access to both the grain loop at the Port of Geelong through North Geelong, and to Melbourne via the dual gauge track.

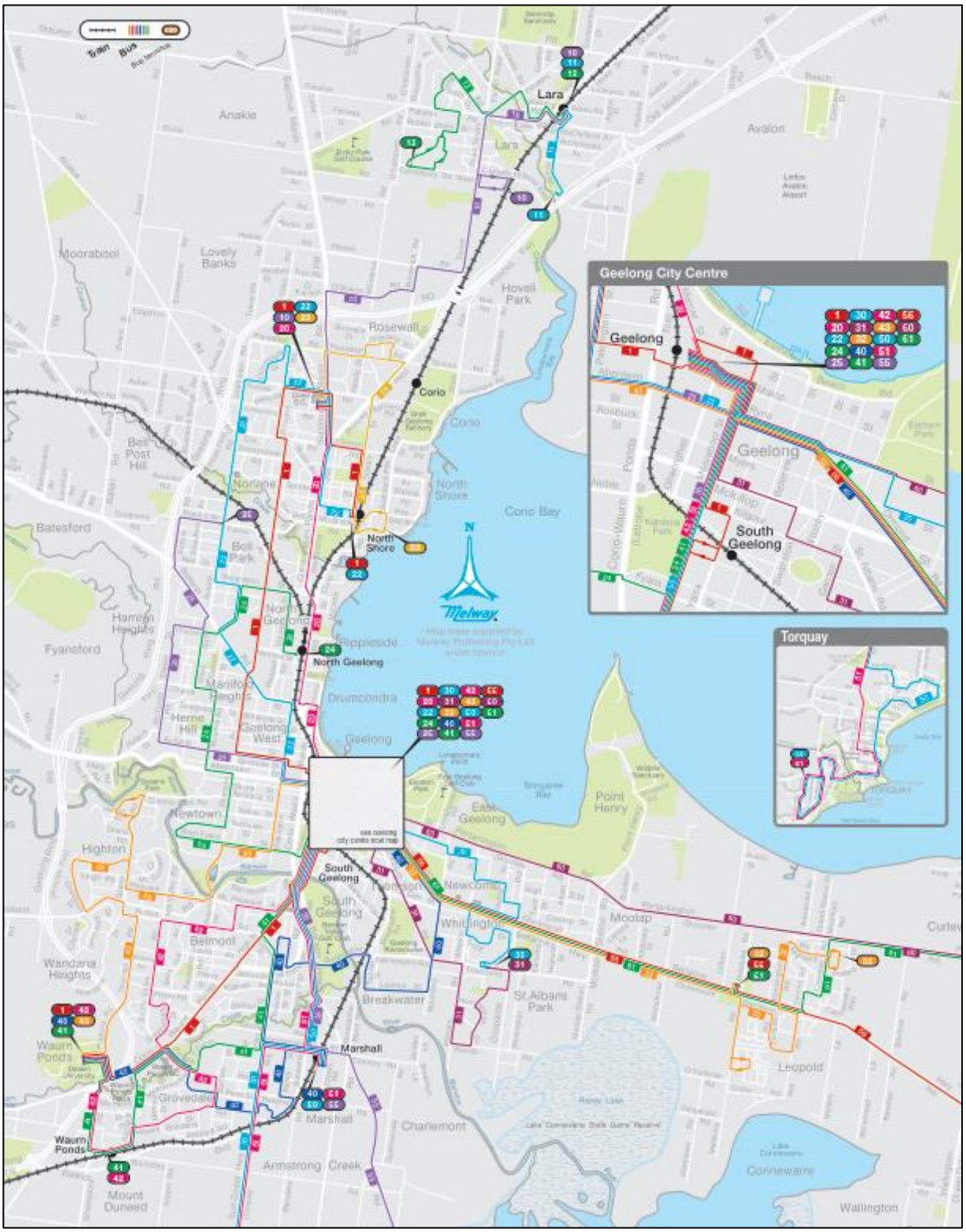
The grain industry is significant to Victoria's regional economy, however it is highly seasonal and variable between years, meaning that the utilisation of rail track by grain trains is difficult to estimate. Over the long term, grain production is projected to increase steadily, which will also increase the volume of grain and the number of trains using the rail infrastructure.

Historically, logs have also been transported to the Port of Geelong by rail to be chipped and exported. Although none of these services remains in operation, there is potential for this market to re-open in the future.

3.3 Bus network

The existing bus network for the northern Geelong region is shown in Figure 6. The bus network provides coverage within the Geelong Ring Road, however very few services extend beyond it. Note that the Route 19 Bannockburn service (not shown in Figure 6) runs between Central Geelong and Bannockburn via the Midland Highway.

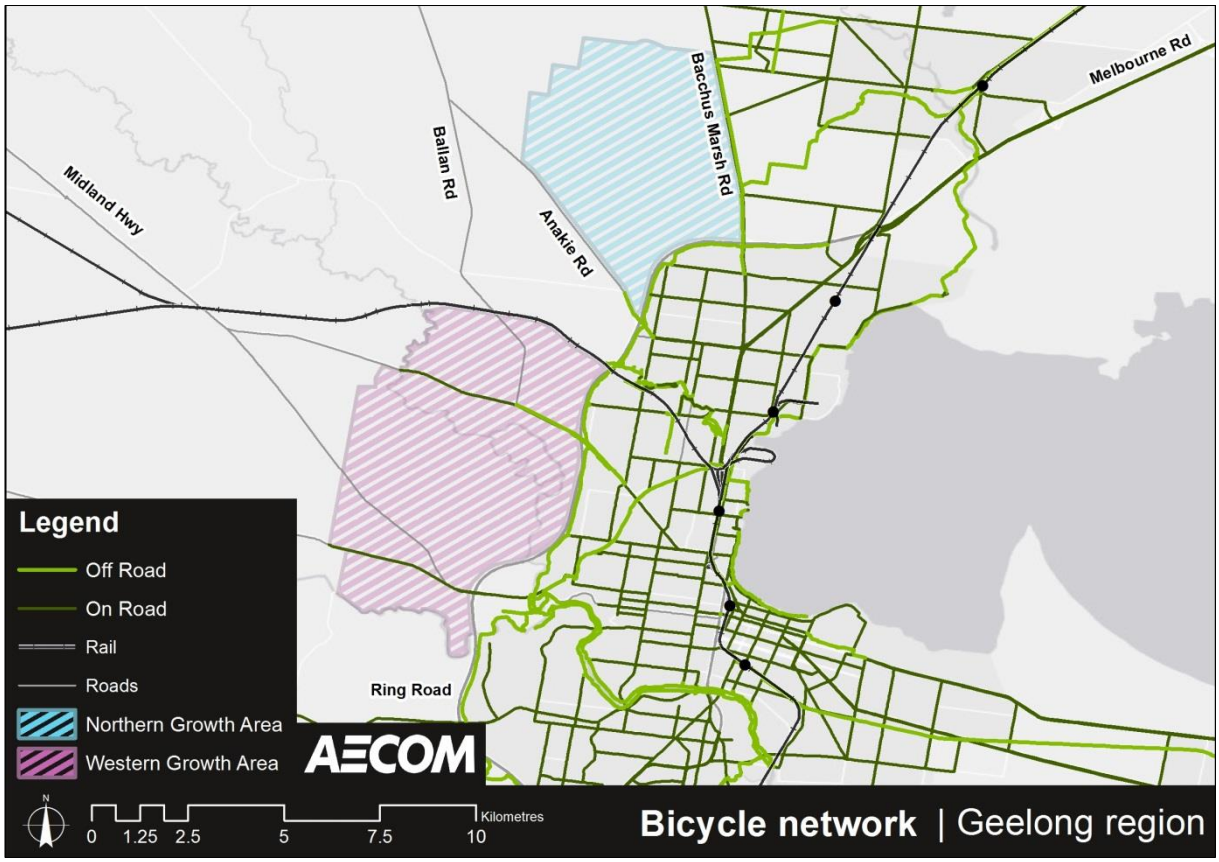
Figure 6 Geelong bus network (Source: PTV)



3.4 Bicycle network

The principle bicycle network in the Geelong region is shown in Figure 7 with on-road and off-road bicycle paths differentiated by colour. As shown, the network provides reasonable coverage throughout most of the Geelong region within the Ring Road. Existing cycle path coverage outside the Ring Road is limited due to the lack of development. Further growth in the cycling network and connectivity outside the Ring Road could strongly support active transport use within the future growth areas.

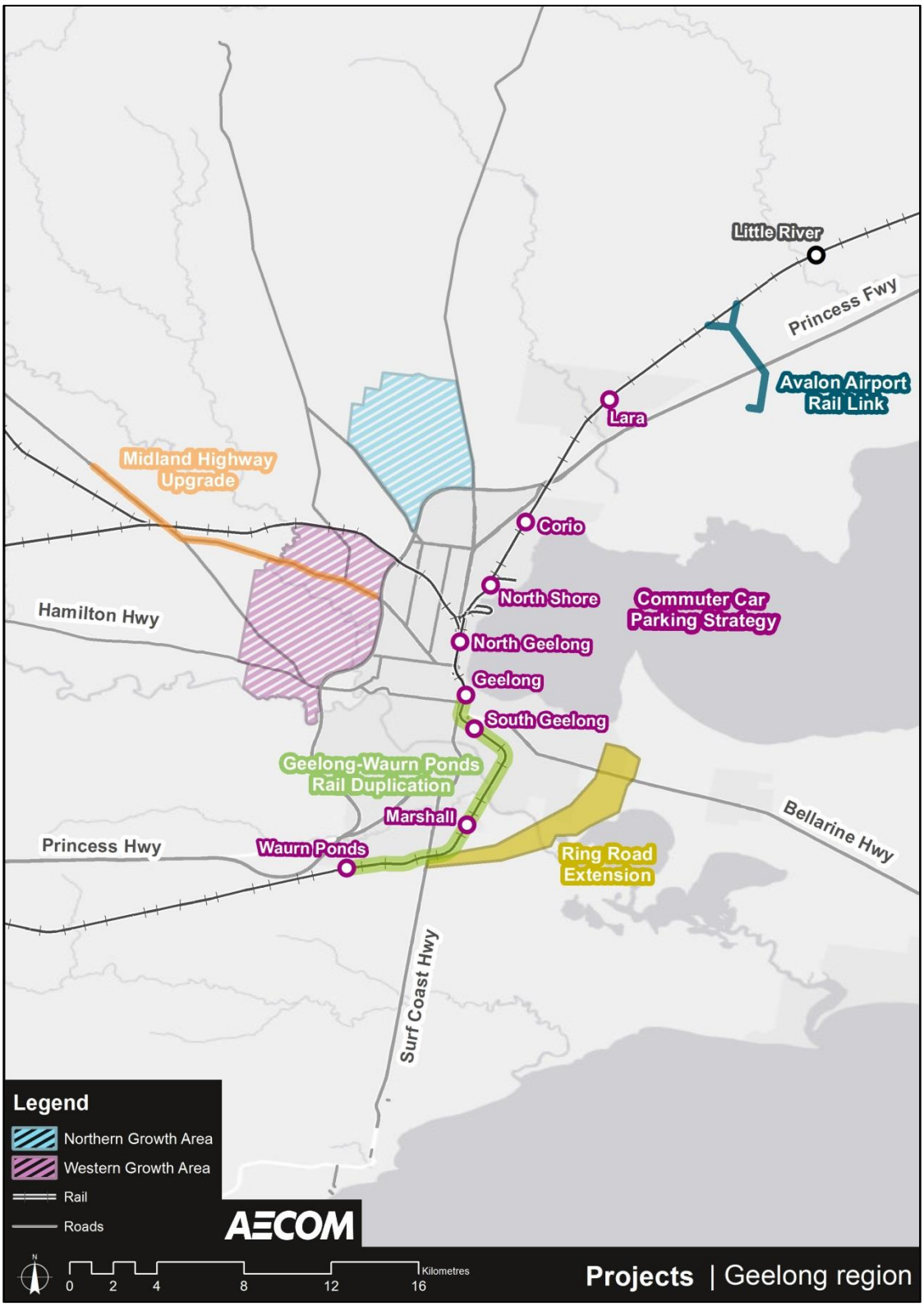
Figure 7 Principle bicycle network in Geelong (Source: City of Greater Geelong)



3.5 Relevant projects and studies

A number of projects and planning studies have been completed, or are underway, which have the potential to influence the investigations of this study. These are displayed in Figure 8 and are discussed below.

Figure 8 Relevant projects in the Geelong region



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Midland Highway Upgrade

VicRoads are currently managing the construction of overtaking lanes between Geelong and Meredith, in response to growth in freight and residential traffic on the corridor and also an increase in crashes. It is understood these works will be completed throughout 2017.

A planning study investigating the upgrade options for the Midland Highway is also currently underway. This will investigate upgrade options between Bannockburn and Geelong and assess the safety, transport, land use, and economic and environmental benefits of the upgrade.

Geelong Ring Road Extension (Bellarine Link)

The Bellarine Link will connect the Geelong Ring Road and Portarlington Road and is being planned in response to current and planned growth on the Bellarine Peninsula. This study – which will include consideration of a number of route and connection options – is due for completion in early 2018, at which point a preferred alignment will be selected and planning approvals will commence.

Outer Metropolitan Ring Road

The Outer Metropolitan Ring Road (OMR) is a planned road corridor through Werribee, Melton, Tullamarine, Craigieburn and Epping. The designated corridor has provision for four lanes in each direction and freight railway in the median. One of the key drivers of this project is improved connections to key international transport hubs and employment precincts including Avalon Airport and Port of Geelong. The western terminus of the corridor will be an interchange with the Princes Freeway between Little River Road and existing Werribee Refuse Disposal Facility on Wests Road.

The corridor was reserved in a planning scheme amendment in 2010. Infrastructure Victoria's 30 Year Strategy recommends the construction of the road within 15 to 30 years.

South Geelong to Waurn Ponds Railway Duplication

In the most recent stage budget, funding was committed to a business case into the duplication of the railway line between South Geelong Station and Waurn Ponds Station. This was followed by federal funding to build the duplication. This project will allow additional train services to operate between Melbourne and Geelong.

Avalon Airport Masterplan

The 2015 Avalon Airport Masterplan outlines the short, medium and long term ground transport plans for the site. These include:

- A doubling of car parking in the short-term from 1,500 to 3,000 spaces, in line with the development of the airport
- Upgraded access road connections between Avalon Airport and the Princes Highway
- Support for the Avalon Airport Rail Link.

Avalon Airport Rail Link

In 2014, the Avalon Airport Rail Link planning study confirmed the preferred alignment for a heavy rail corridor connecting Avalon Airport to the Geelong-Melbourne rail line. The preferred corridor allows for potential connections to both Melbourne and Geelong. In 2015 this corridor was preserved as part of a planning scheme amendment.

The Infrastructure Victoria 30 Year Strategy (2016) does not recommend a heavy rail connection to Avalon Airport. Alternate proposals – which were considered but also not recommended – included dedicated bus road priority between Avalon Airport and both Southern Cross and Geelong Stations, and a high-capacity rail shuttle operating between Avalon Airport and an interchange station on the Geelong-Melbourne rail line.

Rail Revival Study: Geelong – Ballarat – Bendigo

The Rail Revival Study was commissioned by Public Transport Victoria (PTV) in 2013, and investigated the long term feasibility of reinstating passenger rail services between Geelong, Ballarat and Bendigo. This study undertook detailed condition assessments of the existing corridor infrastructure, developed patronage forecasts, prepared cost estimates for corridor upgrades, and assessed the benefits of reactivating the railway line. Whilst the study identified a range of economic, social and operational benefits to the scheme, the benefit-cost ratio was estimated at between 0.1 and 0.2, due primarily to the high upfront infrastructure costs. If wider benefits were considered, the benefit-cost ratio would rise to between 0.3 and 0.5, however even then the study suggested that the project would not likely be successful in securing funding.

Geelong Station Masterplan

The Victorian Government released the Revitalising Central Geelong Action Plan (RCGAP) in July 2016 to establish priorities for change in central Geelong.

One of the key short term actions of the plan is the preparation of a land use and development strategy for the Geelong Station precinct that supports development and improves city centre connections. Another proposed action is to consider the long-term needs of the Department of Justice and Regulation and Victoria Police within the Geelong Station precinct, and investigate opportunities to relocate the Magistrates Court and police station to an alternative location.

Geelong Commuter Car Parking Strategy

This study is currently underway and will set the approach for accommodating car parks for rail commuters into the future, considering changes occurring as part of the revitalisation of Central Geelong. The results of this study will provide information on how the current commuter car parking is being used and how well commuter demand is being managed at the railway stations on the Melbourne to Geelong rail corridor between Lara and Waurn Ponds. It will also forecast future demand and identify what improvements can be made to safely accommodate further commuter car parking demand, including an assessment of current and future infrastructure needs.

G21 Region Public Transport Strategy

Released in 2014, this strategy has the overall goal of increasing the utilisation of public transport in Greater Geelong, including identification of the resulting benefits of reducing traffic congestion, improving the environment and overcoming social isolation. The four objectives identified in the study are listed below.

- Access for all: A base level of service should be available to all persons across the region, and all services should be accessible to all potential users.
- A well connected region: A complete public transport network should serve the need for access to and between all the region's centres.
- Urban public transport for an urban centre: Develop a 'go anywhere' public transport network by re-shaping and simplifying the current network.
- Improving information, planning and partnerships: Find new ways to implement better public transport as soon as possible.

Torquay Transit Corridor Study

This recently completed study examined alternatives for public transport service along the Torquay corridor via the high-growth Armstrong Creek area. It included assessment of heavy rail, light rail and bus rapid transit (BRT) options, all of which would have the potential to be integrated with public transport service to the Western and Northern growth areas to form a region-wide system with shared vehicles and stabling/maintenance facilities.

3.6 Consultation

Consultation was undertaken with a number of key stakeholders at the commencement of this study to determine the following:

- Transport requirements arising from the growth areas
- Potential road and rail connection options
- Previously investigated road and rail initiatives.

Stakeholders, including City of Greater Geelong, Golden Plains Shire Council, Transport for Victoria, Public Transport Victoria, VicRoads and the development consortia were all invited to take part in the consultation process.

Key items discussed in relation to the outer orbital traffic route included:

- The primary function of the Geelong Ring Road is to carry long-haul trips. It is therefore preferable to avoid 'interchange hopping' for local trips, which have the potential to significantly impact on the operation of the corridor.
- There is potential for an additional lane in each direction on the Ring Road, however this would ideally be reserved for additional long-haul demand.
- Adequate road connectivity between the growth areas will need to be planned, with Ballan Road and Evans Road as potential viable options.
- Significant growth in Bannockburn is also expected which may impact on the surrounding road network.

Key items discussed in relation to the commuter railway station included:

- An increase in public transport mode share is a primary objective.
- Current overcrowding on train services results in a lack seating for passengers north of Geelong. This can influence commuter behaviour and skew demand towards southern stations.
- Expansion of Corio or Lara railway stations, or a possible new Corio station, has the potential to alleviate capacity constraints.
- Direct Avalon Airport passenger services may be not be feasible due to capacity constraints along the corridor. However, if an express or shuttle service were provided as a separate project, it may be possible to consider a major transfer or park-and-ride facility on the Geelong-Melbourne rail line near the interchange station.

Key items discussed in relation to the rail corridor included:

- An increase in public transport mode share is a primary objective.
- Connectivity with Melbourne and Central Geelong are key drivers of travel demand. These have the greatest capacity to achieve mode shift towards public transport.
- Constraints exist on the Melbourne railway line which currently limits the number of services operating between Geelong and Melbourne. It is assumed that these constraints are outside the scope of this study and will be sufficiently resolved. The focus of this study is the movement of people between the growth areas and the railway line.
- Current overcrowding on train services results in a lack seating for passengers north of Geelong. This can influence commuter behaviour and skew demand towards southern stations.
- There is potential demand for connectivity to Deakin University.

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4.0 Outer orbital traffic route

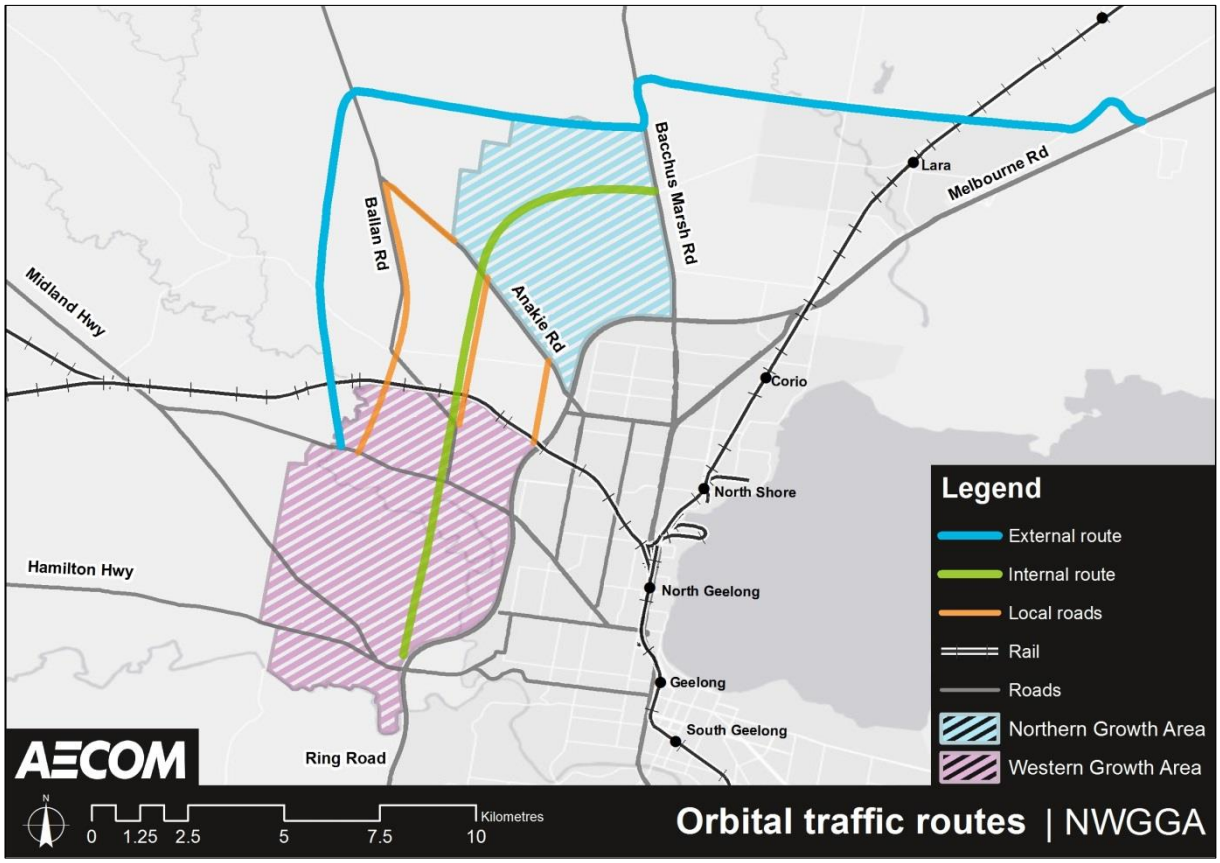
The original intent of the outer orbital traffic route was to provide an alternative to the Geelong Ring Road for access between Melbourne and the growth areas. This project would also provide additional connectivity between the growth areas but would have marginal impact on access to and from Central Geelong.

4.1 Options

Three outer orbital traffic route options were considered. These are shown in Figure 9 and discussed below:

1. **External Route:** A route external to the growth areas would be established between the Princes Highway and Midland Highway, utilising the existing Beach Road interchange, Windermere Road, Bacchus Marsh Road, Staceys Road and Ballan Road. A new route between Ballan Road and the Midland Highway would be required. This would provide an alternate route to the Geelong Ring Road for accessing the Princes Highway and remove the need to pass through the Western Geelong Growth Area.
2. **Internal Route:** A route internal to the growth areas would be established between Bacchus Marsh Road and Midland Highway, utilising the existing Evans Road corridor. A new route between Anakie Road and Bacchus Marsh Road would be required, with the option to utilise Elcho Road as an access to Lara. This would provide a more direct alternative to the Geelong Ring Road, between Midland Highway and Bacchus Marsh Road, than the external route.
3. **Multiple Local Roads:** As an alternative to providing a single arterial orbital road corridor, multiple local collector roads could form the requisite connection between the northern and western growth areas. Whilst not a genuine orbital traffic route, this would provide permeability between the growth areas and access to the arterial network, and avoid duplicating the long-haul trip function of the Geelong Ring Road.

Figure 9 Outer orbital traffic route options



4.2 Needs analysis

The Transport Movement and Access Strategies (GTA Consultants, 2017) provide details of forecast demands and have been used to determine project need. These studies have identified a number of arterial roads that may require significant capacity upgrades with the development of the two growth areas. These strategies also stated that longer term consideration should also be given to adding additional lanes to the Geelong Ring Road, particularly north of the Midland Highway.

The analysis suggests that the roads requiring widening are those providing direct access to the growth areas. As the functionality of these access routes would be unchanged even with the implementation of an external orbital route, it is likely that their widening would be required regardless.

The results suggest that a majority of the traffic generated by the NGGA will utilise Bacchus Marsh Road to access the precinct, and that access to the WGGA will be distributed according to its origin-destination either north or south of the quarry pit. It also highlights the importance of the north-south road connection between the growth areas.

4.3 Evaluation of options

A discussion of each option is provided below. High level construction cost rates are provided in Table 2.

Table 2 High level road construction costs ($million per km)

Type	Cost ($million per km)
Road Construction	15
Road Duplication	20

4.3.1 External route

- The route does not present an attractive alternative to and from the WGGA. A far more direct route to Melbourne would remain via Midland Highway or the Hamilton Highway and the Geelong Ring Road. Similarly, the route presents as a relatively indirect ‘detour’ for most of the NGGA, with the exception of its northern boundary.
- Should the location of the commuter station be decided as Lara, the external route has the potential to provide alternate access to the Geelong Ring Road or the constrained Bacchus Marsh Road.
- The external route has the potential to provide access to the proposed Lara West growth area, to be located between the NGGA and existing Lara township.
- At the northern end of the corridor, some realignment of the roads connecting to the Princes Highway-Beach Road interchange will be required. Road realignment works will also be required at the McIntyre Road level crossing.
- There are a number of constraints on the southern terminus of the corridor. These include established developments within Batesford, the Moorabool River, a crossing of the railway corridor, and flood plains.
- This route traverses some challenging topography between Midland Highway and Ballan Road and then again between Anakie Road and Bacchus Marsh Road.

4.3.2 Internal route

- This approach has the benefit of passing through the NGGA and connecting to the WGGA via Evans Road, which has been shown to be an important corridor for movements between the growth areas.
- This corridor has the potential to connect to Lara via Elcho Road, which could be advantageous should the location of the commuter station be decided as Lara.
- The majority of this route traverses relatively flat terrain.

4.3.3 Multiple local roads

- This approach has the benefit of utilising existing road corridors between the growth areas, including Evans Road and Ballan Road.
- The use of multiple local corridors has the benefits of maintaining pedestrian and cyclist permeability, as opposed to multi-lane arterials, which have the potential to act as obstacles to movement between precincts.
- Evans Road has been shown to be an important corridor under the currently planned transport network, and this could be taken advantage of.
- These routes traverse relatively flat terrain.

4.4 Summary

Based on the discussion above, the following recommendations have been drawn:

- For the purposes of providing access and movement benefits to the NGGA and WGGA, the external route has limited benefit. This route presents a genuine bypass route for traffic between the growth areas and Melbourne, however the existing arterial road network and the Geelong Ring Road would continue to be a more attractive alternative. Any additional lanes on the Geelong Ring Road would further diminish the attractiveness of the corridor. Whilst not considered suitable for the NGGA and WGGA at present, this could change into the future when considered within the context of the proposed Lara West growth area and the continued growth of Bannockburn.
- Further investigation of the Evans Road corridor has merit, whether as a single internal route or as part of multiple corridors between the growth areas. This route would not seek to duplicate the function of the Geelong Ring Road (i.e. bypassing, long-haul trips), but would provide localised access between the growth areas and on to Lara. The intent of this corridor would also be to limit any localised ‘interchange hopping’ along the Geelong Ring Road.
- The introduction of these orbital corridors, in isolation, would have limited impact on reducing the level of road widening required on the network. This is because the routes identified for widening would continue to be required to provide local access to the growth areas. Significant reductions in the requirements for widening could therefore only be achieved through mode shift.

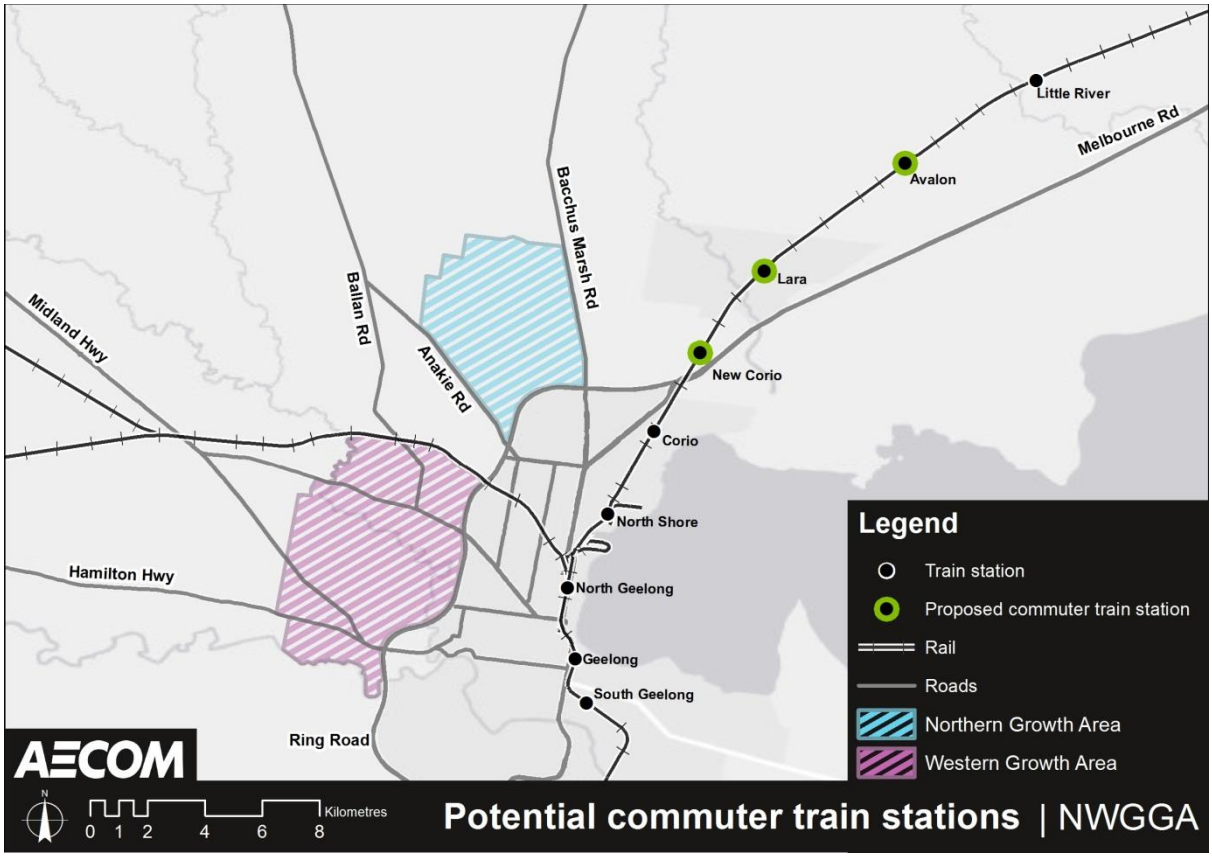
5.0 Commuter railway station

The provision of a new or expanded commuter car parking railway station north of Geelong has been identified as an option for serving trips predominantly between the NGGA and Melbourne. Whilst trips from the WGGA may utilise such a station, they are more likely to utilise the closer existing stations.

5.1 Options

Lara railway station, a new Corio rail station and a potential future Avalon rail station have been identified as potential sites for commuter parking. Figure 10 shows the location of these three stations. The distances between the centre of the NGGA (as the crow flies) and these site are Corio (5.9 km), Lara (7.6 km) and Avalon (12.5 km).

Figure 10 Location of commuter train station options



5.2 Needs analysis

General planning policy is moving towards creating integrated, reliable and seamless public transport provision rather than encouraging commuters to drive and park at stations. Large carparks also constrain transit-oriented development, and can compete with providing well designed and safe pedestrian and cycling access to stations. Provision of commuter parking can also deter people from taking public transport to access a station.

The beneficiaries of a commuter railway station will be commuters from Geelong to Melbourne. And while this movement of commuters will remain important into the future, it reinforces Geelong as a commuter city for Melbourne based workers. This proposal is not consistent with the long term aspiration of Geelong as an employment destination.

NWGGA Road and Rail Planning Investigations

The level of demand expected at a proposed commuter parking station is a complex interplay between a range of factors beyond the size of the growth areas and location of the station. These include:

- Level of public transport service between the growth areas and the station, potentially reducing the need for parking
- Parking increases or reductions at other railway stations within Geelong
- Rail service patterns at the station including timetabling, express running and potential service starts and terminations
- Strategic policy decisions impacting employment distribution patterns.

And equally, the introduction of a commuter parking facility can influence each of the characteristics listed above. Much of this will be explored during the Geelong Commuter Car Parking Strategy, which is currently underway. The required parking provision across Geelong will be a key outcome of this study, including the locations of highest demand.

5.3 Evaluation of options

A discussion of each location is provided below.

5.3.1 Lara Railway Station

- Lara rail station is within proximity to the town centre and currently provides commuter car parking. The existing carpark creates a barrier to the group of shops located to the east of the station. There is a heavy reliance on private motor vehicles and the local road network can become constrained at peak times, including peak periods of the train timetable.
- There is an opportunity to better integrate the train station with the existing town centre and include provision for increased commuter parking within future plans.
- The future intention to expand the retail and commercial offering of Lara town centre (Geelong Planning Scheme Clause 21.13-1) would likely be supported by an increase in commuters interchanging at Lara.
- An increase in commuter parking would encourage more traffic movements and put pressure on the existing road network which is already constrained at peak times (Lara Town Centre Urban Design Framework, 2006). Increased traffic could also detract from the town centre.
- Increased commuter parking does not support the strategic objective to improve active and public transport services within and to/from the town centre (Geelong Planning Scheme, Clause 21.13-1).

5.3.2 New Corio Railway Station

- The proposed new Corio Railway Station site is a greenfield site bounded by the Princes Freeway and the railway corridor that would be accessed by an extension of Heales Road. This extension would require grade separation of the rail corridor. It is the closest of all the sites located 5.6 km from the centre of the NGGA. Introduction of a new Corio commuter station would likely result in the removal of the existing Corio Railway Station, which currently has low utilisation and poor amenity.
- This proposal was raised by a rail advocacy group, Rail Futures. The scheme includes the construction of a 4,000 space car park on the 20 hectare site alongside the railway corridor. It should be noted that this proposal is not part of any current government plan or strategy.
- Due to topographical challenges this location is not a convenient cycling destination from the NGGA.
- There is direct access along Heales Road which could also accommodate a high-quality public transport service, assuming grade separation of the rail corridor is implemented.

5.3.3 Avalon Airport Rail Interchange Station

- A rail link to Avalon Airport from the Melbourne-Geelong rail line has been proposed. A land corridor has been reserved through Planning Scheme Amendment C308. Whilst the rail link plan shows the alignment joining at two connections between Lara and Little River, the form of the interchange with the Melbourne-Geelong line has not been confirmed. No additional station on the main line is currently indicated. It is therefore unclear as to where commuter parking would be located. Infrastructure Victoria assessed a rail link and did not designate it as an infrastructure priority (Infrastructure Victoria, 2016).
- There is a high level of uncertainty as to the prospects of using this location to provide commuter parking.
- Avalon airport is the furthest of all sites from the NGGA and is therefore likely to be the least attractive option for commuters to Melbourne.
- Alternatively, there is the potential for Avalon Airport to become an employment destination for both Geelong and Melbourne residents. A station could encourage public transport based commuting and bring related economic benefits to the Geelong community.
- There is the potential for commercial conflicts between any large scale commuter parking facility and parking at Avalon Airport. Any commuter parking station, which would presumably be free or very low cost with direct access to Avalon Airport, could present as an attractive alternative to on-airport car parking.

5.4 Summary

Based on the discussion above, the following observations have been made on the potential commuter parking options:

- If a commuter station is pursued further, a new station at Corio may offer the most attractive option for Melbourne commuters, being the closest distance to the NGGA and not currently constrained. It is also easily accessed via Heales Road. The provision of further commuter parking needs to consider how provision would interact with – and support or detract from – the other options presented in this study such as heavy and light rail. For example, the provision of excess car parking at rail stations may deter commuters from taking public transport. Provision of commuter parking also needs to consider the effects on the functions of and future intentions for town centres and retail areas at Lara and Corio.
- How the provision of additional commuter parking aligns with the long-term strategic aspirations for Geelong should also be explored further prior to proceeding with any option.

The provision of a large commuter car-parking facility on the main line to Melbourne may not support the longer-term vision for Geelong as a strengthened employment and mixed-use centre. While recognising the importance of convenient linkages to Melbourne, the reliance on a park-and-ride model could inadvertently contribute to the continuation of a car-oriented residential development paradigm. The outcome of this could include further need for road capacity upgrades (for example to/from the commuter railway station) and a resulting lack of encouragement of walking, cycling and use of connecting public transport.

While the links to Melbourne should continue to be considered as important, these should be complemented with links to/from central Geelong, and focus – wherever possible – on sustainable transport modes. The commuter railway station would therefore not need to be overwhelmingly reliant on car parking, but rather be designed to support alternative access in the form of continuous walking paths and cycling lanes (plus secure bike parking) as well as a substantially upgraded public transport link to the surrounding communities including the two growth areas.

The discussion in the following section compares multiple options for upgraded public transport links within Greater Geelong, including the potential for a reliable high-frequency bus rapid transit (BRT) connection to a main-line commuter railway station. This could help suit the purpose of limiting the need for expansive commuter parking and better support the long-term sustainability objectives of the Geelong region.

6.0 Western rail corridor

The western rail corridor offers an opportunity to rethink the manner in which travel demand to/from central Geelong — and potentially Melbourne — could be accommodated. As an uninterrupted former passenger-rail route, the western rail corridor could potentially be reconfigured to support modern public transport — heavy rail or light rail — for trips to central Geelong and beyond. This chapter discusses the public transport opportunities associated with the western rail corridor, including their potential effects on the road projects currently presumed to be needed to support high-demand trip patterns. These options are also compared with a potential on-road bus rapid transit (BRT) concept that could be designed to serve the same function.

6.1 Needs analysis

To determine the impact of the proposed growth areas on the surrounding transport infrastructure, an estimate has been made with respect to the number of additional trips that will be generated during the critical PM peak period. The PM peak was selected as the critical analysis period for this evaluation due to the overlapping multi-functional travel demands during this time frame, consisting of return-from-work journeys, shopping trips, entertainment-related trips, and additional localised trips between the two growth areas and to/from additional outer Geelong destinations such as Deakin University/Waurn Ponds. In order to inform the infrastructural requirements driven by these estimates, the major priority trip patterns have been assigned an identification number corresponding with the relevant peak-period movement, per the following:

1. Melbourne to NGGA and WGGA (i.e. regional commute return-to-home trips)
2. Geelong to NGGA (return commute and shopping trips)
3. NGGA to Geelong (entertainment trips)
4. Geelong to WGGA (return commute and shopping trips)
5. WGGA to Geelong (entertainment trips)
6. NGGA to WGGA (local multi-purpose trips including additional outer Geelong destinations)

These movements are identified diagrammatically in Figure 11. The estimated magnitude of generated trips associated with each of these movements is shown in Table 3. Details of how these values were calculated can be found in Appendix A.

Figure 11 Major traffic flows (PM peak)

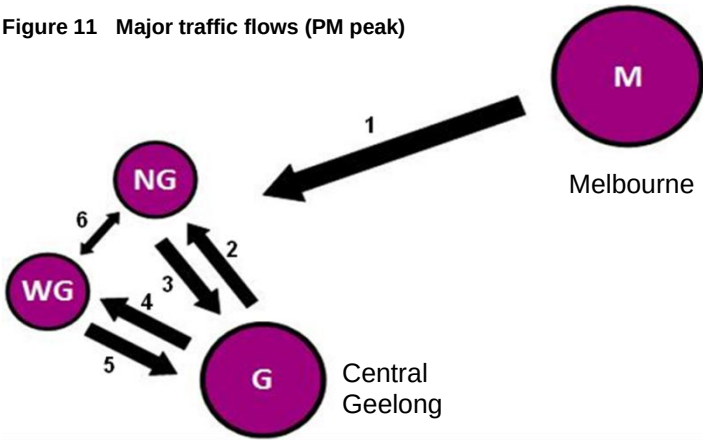


Table 3 Existing and growth-area generated traffic (PM peak)

Movement	1	2	3	4	5	6
Existing volume (v/h)	1,400	2,800	2,300	1,980	1,650	-
Additional volume (v/h)	6,630	4,563	1,755	6,349	2,231	5,747
'Build out' volume (v/h)	8,030	7,363	4,055	8,329	3,881	5,747

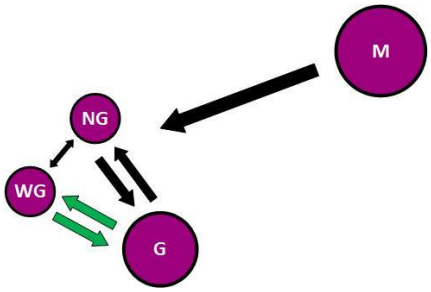
6.2 Options

As discussed in the next section, the conventional assumption is that the vast majority of the projected peak movements will be accommodated to some degree by car, either for the entire journey (i.e. for most Geelong trips and a portion of Melbourne trips) or for that part of the journey in the immediate vicinity of the two study areas (for instance, park-and-ride commute trips to Melbourne). In such a scenario the resultant road network would by necessity include significant capacity upgrades of numerous existing road corridors to accommodate the additional trip demand.

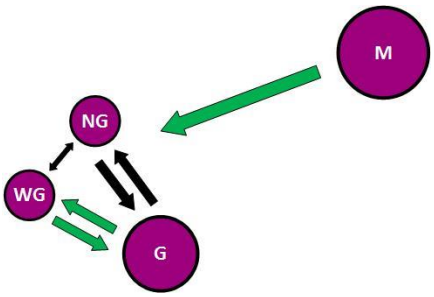
This study postulates the potential effect on these assumptions of an aggressive public transport program designed to accommodate the specific critical trip patterns that have led to the conclusion that several existing rural road corridors will need to be transformed into major highways. For each potential project – ranging from conventional bus extensions to new passenger rail services – the potential carrying capacity of each is compared with the peak saturation flow rate of a typical arterial traffic lane to assess the range of possible effects on any proposed road-widening program.

Alternative transport options considered for this analysis include:

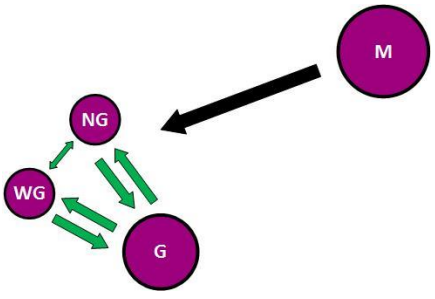
- **Light rail** along the western rail corridor, connecting into and through central Geelong via the surface street network. This would support movements primarily between the WGGA and central Geelong.



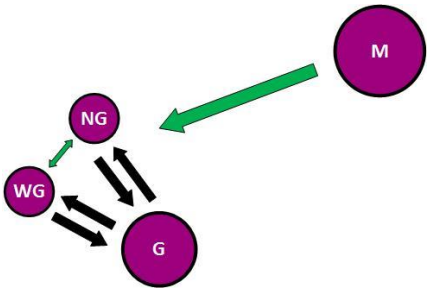
- **Heavy rail** along the western rail corridor, with options to connect into central Geelong and/or Melbourne depending on the provision of available train paths within either onward corridor.



- **Bus rapid transit** (BRT) along Midland Highway or Hamilton Highway, representing a fully traffic-separated advanced bus system that could potentially be extended through both growth areas and also connect with other regional projects.



- **Bus rapid transit** (BRT) as a peripheral connection through the growth areas to a new or upgraded commuter rail facility on the Geelong-to-Melbourne main line, supporting localised trips between the two growth areas as well as connections to the rail system for travel to Melbourne.



High level construction cost rates of the various public transport options discussed below are provided in Table 4.

Table 4 High level public transport construction costs ($million per km)

Type	Cost ($million per km)
Light Rail	20
Heavy Rail	40
Bus Rapid Transit	10
Local Bus	<1

6.3 Evaluation of options

Attempting to accommodate all the pending growth in transport demand via the street and highway network would necessitate a significant investment in new road infrastructure, particularly the widening of existing corridors. This could have the following implications:

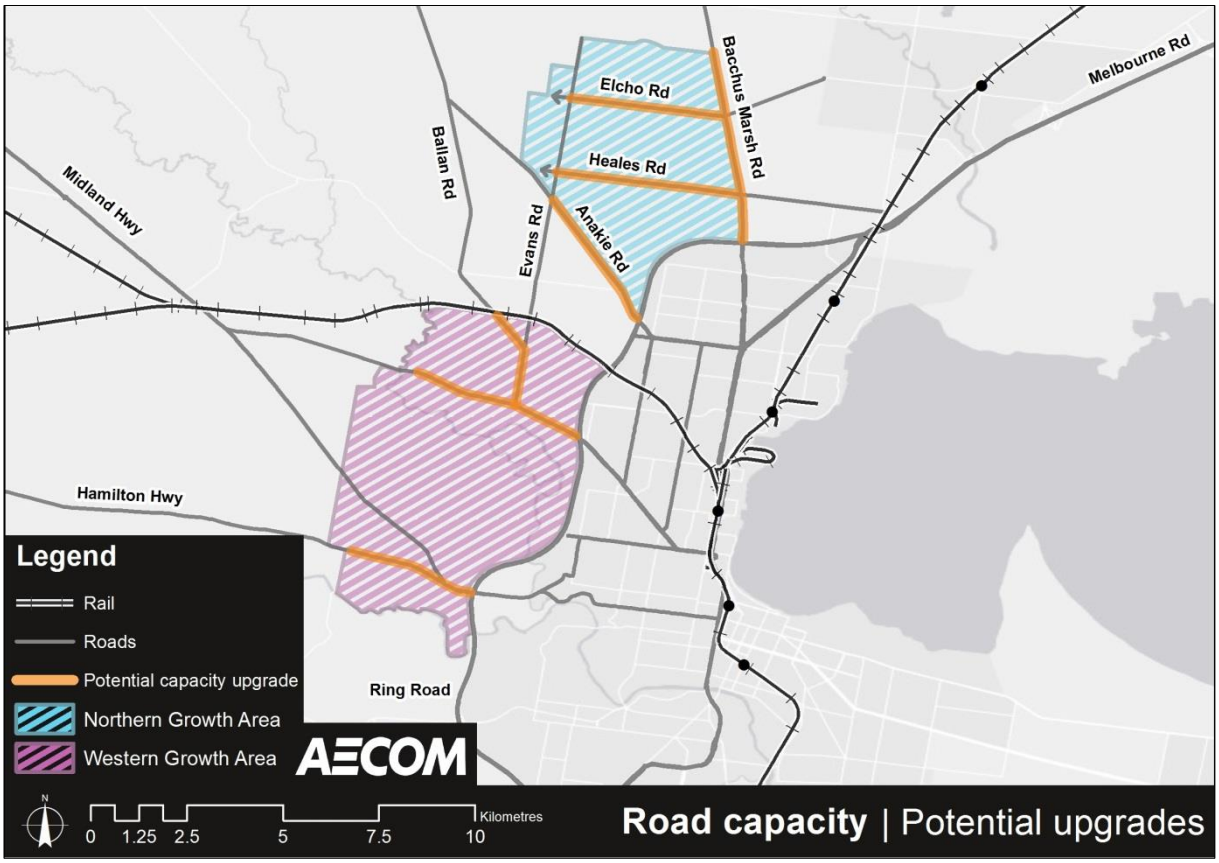
- Significant change of road character
- Potential creation of physical or perceptual barriers to walking and cycling
- High traffic volumes and speeds
- Unbalanced utilisation of road space (i.e. highly concentrated traffic volumes on arterials and very low volumes on local streets)
- Degradation of pedestrian and cycling character (on-road).

Based on a variety of modelling scenarios, the following projects are projected to be necessitated by the impending population growth for the Northern and Western Growth Areas, assuming a continued 'status-quo' mode capture by public and active transport (Transport Movement and Access Strategies, GTA Consultants, 2017). These transport movement and access strategies represent the initial phase of the strategy, including existing conditions research, preliminary transport modelling and opportunities and constraints reporting. A final report (Phase 3) will interrogate a framework land use plan developed in Phase 2, including final transport modelling that considers developed conditions based on a future urban structure.

- Significant capacity upgrade of **Bacchus Marsh Road** between the Geelong Ring Road and Elcho Road
- Potential capacity upgrade of **Bacchus Marsh Road** between Elcho Road and Staceys Road, as this section is projected to approach the capacity limit of its current configuration assuming the continuation of current mode-split trends
- Potential capacity upgrade of **Elcho Road** west of Bacchus Marsh Road, as this section is projected to approach the capacity limit of its current configuration assuming the continuation of current mode-split trends
- Potential capacity upgrade of **Heales Road** west of Bacchus Marsh Road, as this section is projected to approach the capacity limit of its current configuration assuming the continuation of current mode-split trends
- Capacity upgrade of the **Midland Highway** between the Geelong Ring Road and Batesford
- Capacity upgrade of the **Hamilton Highway** between the Geelong Ring Road and the main north-south connection through the WGGA.

These potential projects are illustrated in Figure 12.

Figure 12 Potential capacity upgrade projects to accommodate NGGA and WGGA trip demand



Given the spatial land development characteristics of outer Geelong, conventional on-road public transport is unlikely to attract a significant step-change in the mode share profile of the area, due to:

- Lack of travel time savings by public transport versus private cars (given that journey times by bus would almost invariably be higher than driving, due to stops and indirect service patterns)
- Perception of conventional bus service as a travel mode of necessity rather than choice
- Limited frequencies and hours of service as would likely be dictated by the limited potential ridership.

However, several of the upgraded service types discussed below could potentially help achieve a significant increase in patronage by offering journey time savings and a superior service, particularly as they relate to the specific critical trip patterns that will define peak period travel to and from each of the growth areas. It follows that – given a sufficiently attractive order of service – the greater the share of public transport passengers within these specific corridors, the lesser the need to provide significant road capacity upgrades to the primary road corridors as assumed in the baseline case.

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As described above, public transport scenarios that have been identified and evaluated for their potential impact on road network demand include the following:

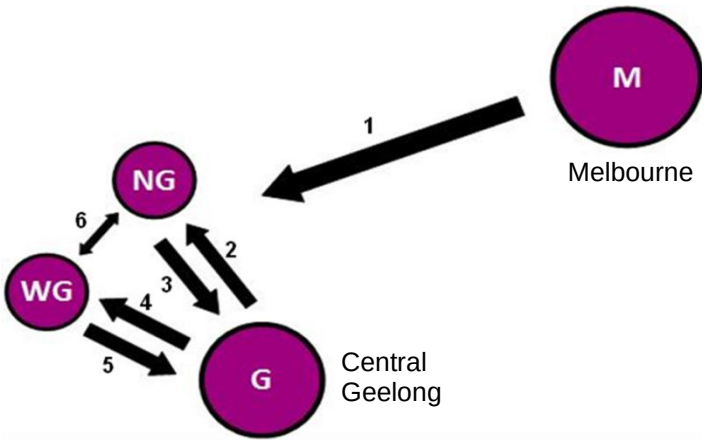
- Light rail along the western rail corridor
- Heavy rail along the western rail corridor
- Bus rapid transit to Geelong via the road network
- Bus rapid transit to a designated main-line train station
- Additional local bus upgrades.

Table 5 outlines the assumed operational parameters for each of these scenarios.

This analysis aimed to estimate the number of riders needed to justify each type of public transport service, and the impact that each service could have on the road-based infrastructure requirements assumed in the base case. Each scenario represents a public transport option designed to reduce the number of vehicles on the road network and thus the number of lanes required to satisfy the travel demand associated with each specific critical trip pattern.

Table 5 Proposed public transport options for each critical movement pattern

Scenario	Movement	Capacity per vehicle	Services per hour	Passengers per hour	Car equivalent per hour at 1.1 persons/car
Base case	-	N/A	N/A	N/A	N/A
Light Rail	4, 5	180	6	1080	980
Heavy Rail	1, 4, 5	300	3	900	820
BRT to Geelong	2, 3, 4, 5, 6	130	8	1040	940
BRT to Train Station	1, 6	130	8	1040	940
Local Bus	1, 2, 3, 4, 5, 6	50	6	300	270

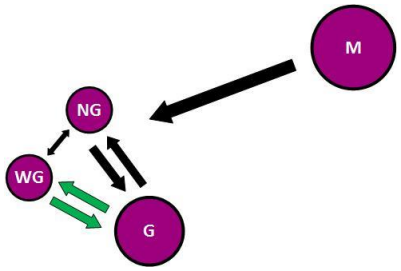


The base case represents the series of projects presented in Figure 12 above, with public transport limited to the extension of basic conventional bus services. The following sub-sections describe each of the public transport scenarios and their potential impact on the necessity of the assumed road-based improvement projects included in the base case.

6.3.1 Light rail

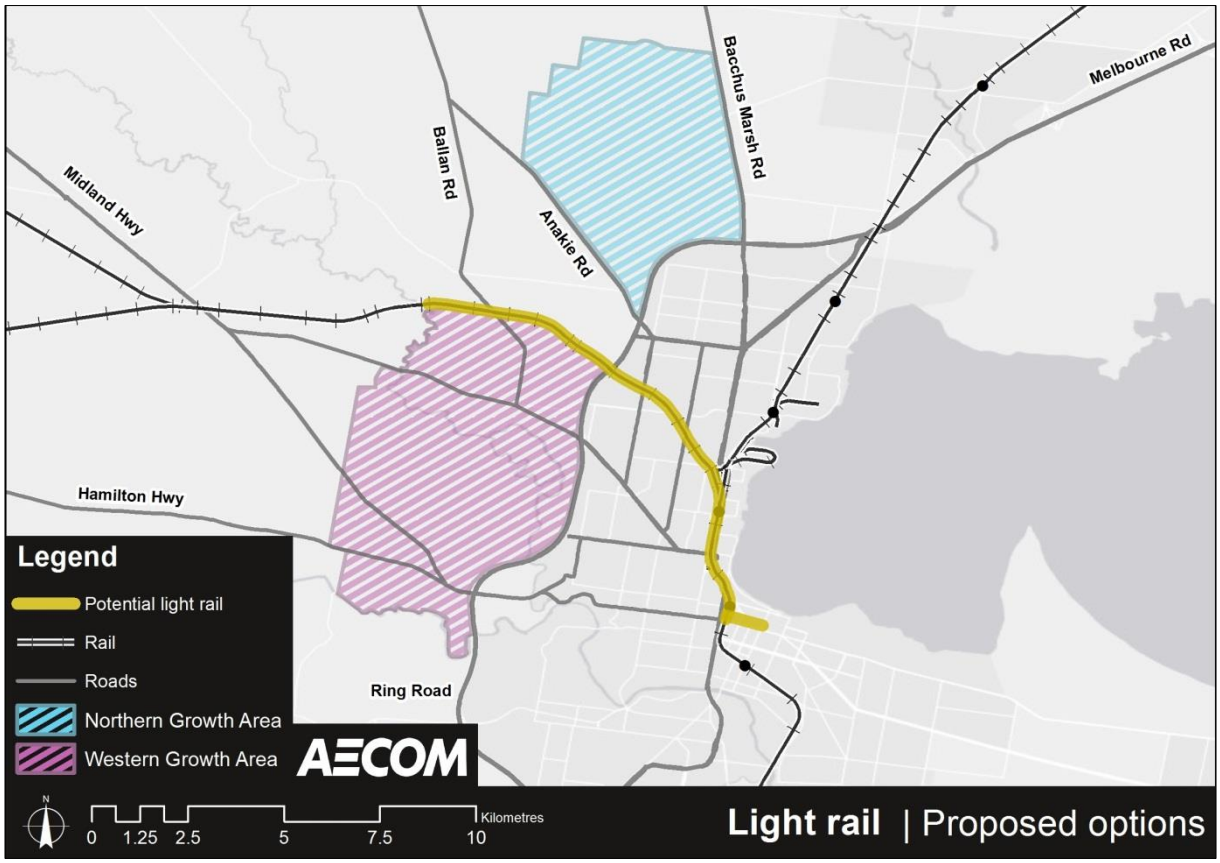
Light rail could potentially utilise the existing western rail corridor to accommodate trips to and from central Geelong with significant benefits to critical movements 4 and 5. Pending the acquisition of rolling stock and potential connectivity with a broader Geelong light rail system, the initial assumption is that it could operate at peak headways of up to 10 minutes.

Figure 13 Sample light rail vehicle (E-class tram, source: Yarra Trams) & critical movements served



The precise characteristics of light rail are highly variable, ranging from small trams or modern streetcars to large trams or 2-3-car extended units. Based on the capacity equivalent of an E-class tram of 180 passengers per trainset, the total hourly carrying capacity for light rail at 10-minute headways would be 1,080 passengers.

Figure 14 Potential light rail alignment to central Geelong



As the hourly saturation volume of a multi-lane arterial highway is in the order of 900 to 1,000 vehicles per hour, it follows that the accommodation of 1,080 passengers during the critical PM peak period could equate to the need for approximately one traffic lane in the peak direction (adjusting for an average peak car occupancy of 1.1 persons).

However, to achieve this result would entail the following assumptions:

- High degree of peak-period travel between the WGGA and central Geelong
- Land use patterns and feeder services that support the use of the light rail stations
- Expansion of employment opportunities in central Geelong within a reasonable walking catchment of the light rail line
- Sufficiently loaded vehicles based on the service assumptions noted above.

Put into perspective, 1,080 passengers is approximately 1% of the total projected population of the combined WGGA and NGGA growth areas. However, the feasible catchment for light rail would likely be limited to the northern half of the WGGA only, representing approximately 33,000 residents based on a consistent population distribution with the growth area boundaries. In this case the 1,080 peak hourly light rail passengers would represent 3% of the population of the prime catchment area, or 8% of the working population based on an assumption that 40% of all residents actively participate in the workforce (reflective of growing area with marginally higher-than-average household sizes).

Based on the operational assumptions noted above, light rail has the potential to reduce traffic along Midland Highway by 980 vehicles per hour in the PM Peak period, with the most critical movement represented by the returning-from-work journey from central Geelong to the WGGA. Whilst the duplication of the Midland Highway may be required to accommodate traffic demand external to the growth areas (i.e. to and from Bannockburn), light rail has the potential to reduce the growth areas' contribution to congestion.

Several additional operational notes about the light rail option would need to be considered and investigated before this option could be advanced:

- It is not likely that light rail would be able to share the same tracks as the existing freight services unless the latter were contained to hours during which the light rail system was not operating (i.e. overnight).
- It may be possible to use the second track within the corridor where it exists and/or build an additional track alongside the freight alignment, pending the addressing of key constraints such as overpasses and underpasses.
- Complex track layouts from North Geelong into Central Geelong may warrant the consideration of an on-road north-south light rail alignment within this urbanised area.
- One of the benefits of light rail would be that it could proceed on-road directly into and through central Geelong, expanding the area within central Geelong that could reasonably be considered to be within the walking catchment of the light rail service (in comparison with heavy rail which would be limited to existing stops at Geelong and South Geelong Stations). Associated with this expanded catchment would be a potential reduction in central Geelong parking demand.
- It would be possible to link the light rail system to any similar service to additional growth areas of Greater Geelong (including Armstrong Creek and potentially Torquay) pending the outcome of studies into the potential suitability of various modes along these corridors.

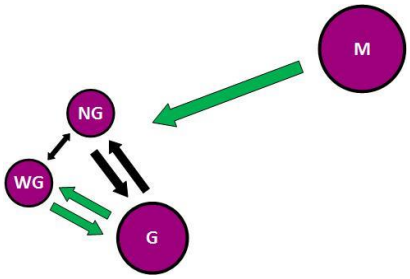
6.3.2 Heavy rail

This scenario involves the re-activation of commuter passenger services on the western rail corridor. Regular passenger services on this line were discontinued in 1978 however freight trains continue to use the broad gauge track. The Rail Revival study (PTV, 2013) was an investigation into the feasibility of re-activating the line for passenger services however no further action has been commissioned.

The heavy rail option consists of two possible permutations, each of which caters to a separate set of trip patterns:

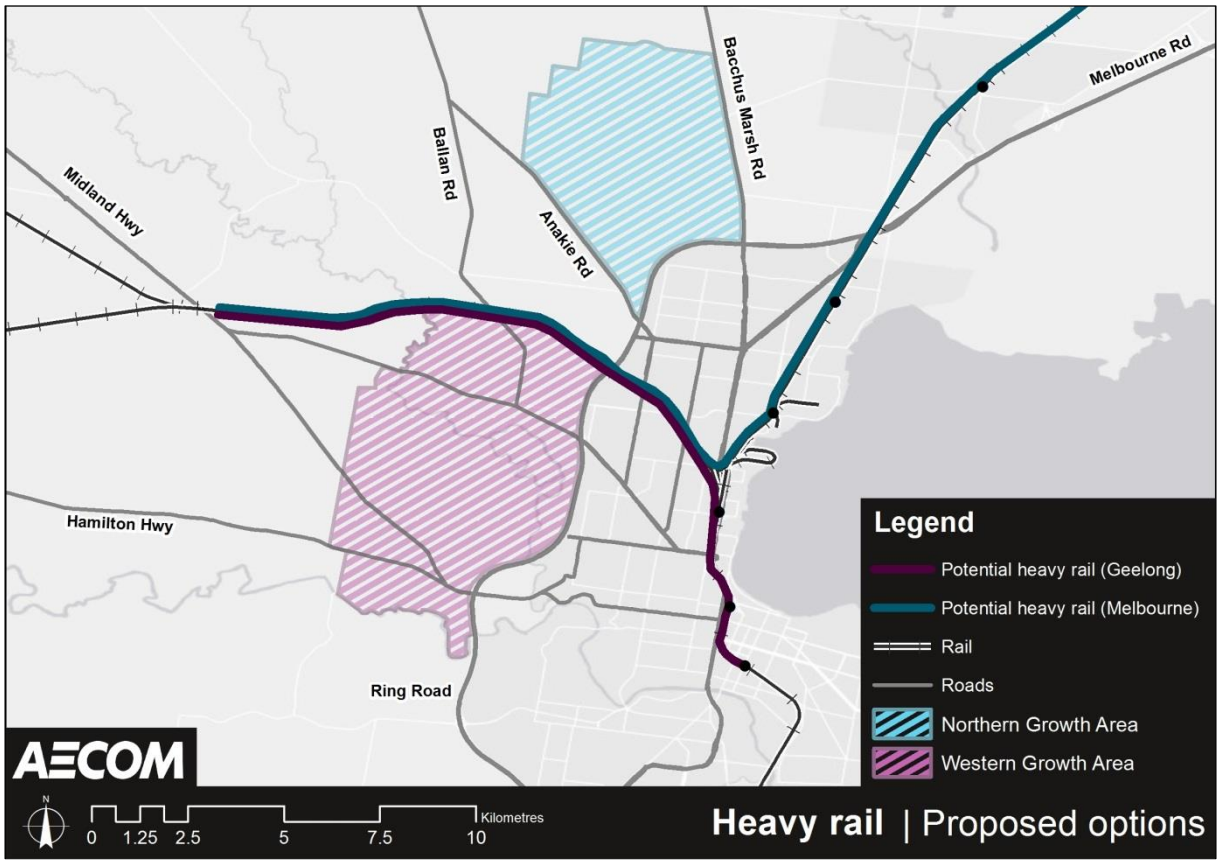
- Heavy rail to central Geelong, benefiting (like the light rail option) critical movements 4 and 5 between the WGGA and central Geelong
- Heavy rail direct to Melbourne, with benefits for key movement 1.

Figure 15 Sample heavy rail train set (V/locity 3-car train, source: Railway Pro) & critical movements served



The latter option would require substantial upgrade to the Geelong-to-Melbourne main line in order to accommodate the additional trains, as well as complex enabling works in the vicinity of North Geelong to support the continuous operation of trains from the WGGA through to Melbourne.

Figure 16 Potential heavy rail alignments (to Melbourne and central Geelong)



As with light rail, there are numerous potential configurations of heavy rail that would determine its ultimate carrying capacity, ranging from single-carriage sprinters or DMU's (diesel multiple-units) to the full 3-car V/locity trainsets now operating on the Geelong-to-Melbourne corridor.

For the purposes of this evaluation, it was assumed that a heavy rail service would operate at 20-minute headways to and from either central Geelong or Melbourne, with the potential (in a highly transit-oriented future) to operate alternating trains to each destination at 10 minutes apart.

Assuming the highest-capacity scenario, a three-car V/locity trainset has the capacity to carry 222 seated passengers, with aisles and doorwells assumed to accommodate another 33%, for a total train capacity of approximately 300 passengers. Operation of trains at 20-minute frequencies could therefore account for approximately 900 passengers per hour to Geelong, Melbourne or both.

As with light rail, the ability to capture this aspirational magnitude of passengers on a heavy rail service would depend on:

- High degree of peak-period travel between the WGGA and central Geelong and/or central Melbourne
- Land use patterns and feeder services that support the use of the heavy rail stations
- Expansion of employment opportunities in central Geelong within a reasonable walking catchment of Geelong and South Geelong Stations
- Sufficiently loaded vehicles based on the service assumptions noted above.

Heavy rail service into central Geelong could potentially have a similar effect on the configuration of the future road network as light rail, i.e. the potential to reduce the need for duplication of the Midland Highway, assuming heavily loaded trains based on the service assumptions noted above. This is based on 900 passengers per hour translating into a potential reduction of 820 cars assuming an average car occupancy of 1.1.

Heavy rail into Melbourne could also potentially reduce the need for travel along Midland Highway, as many WGGA long-distance commuters to Melbourne would (in the absence of a direct rail connection) use Midland Highway to access the Geelong Ring Road to continue driving either the full distance to Melbourne or to a park-and-ride station along the Geelong-to-Melbourne main line, either of which would have similar effects on the road expansion requirements in the vicinity of the growth area.

The combination of these two services (i.e. heavy rail to both Geelong and Melbourne) could help preclude the need for duplication without relying on a heavy proportion of trip pairs between any two origins and destinations. If both services were to be implemented, then it would be possible to achieve the threshold 900-vehicle reduction with smaller trains, lesser loadings, or lower frequencies on one or both of these services compared with what would be needed with either in isolation. However – as with light rail – this analysis does not account for growth further west in Bannockburn which will also affect future travel demand along the Midland Highway corridor.

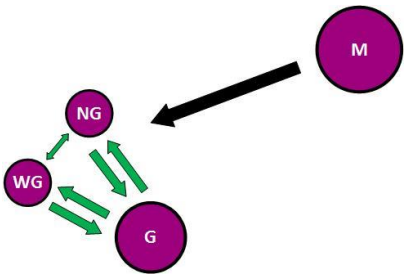
Although the potential hourly carrying capacity of heavy rail represents a similar carrying capacity to that of light rail, there are several key differences to consider (particularly with respect to the service to Geelong). For instance, heavy rail would have an advantage over light rail if it were to be extended longer distances either to the west or south (outside the efficient running range of light rail) whereas light rail would have the advantage that it could run along street corridors within Central Geelong resulting in a larger walking catchment from its more centralised station locations.

All in all, based on these assumptions, heavy rail has the potential to reduce traffic along Midland Highway by 800 to 1000 vehicles per hour in the PM Peak period based on whether a Geelong, Melbourne or combined service were to be implemented. As the duplication of this road is one of the projects cited as a requirement to handle the traffic projections for the WGGA, it follows that optimisation of the use of heavy rail along the western corridor for trips to/from Geelong and/or Melbourne could increase the potential for a more flexible design future for Midland Highway.

6.3.3 Bus rapid transit to Geelong

This scenario involves a rapid bus service between the growth areas and Central Geelong, relieving pressure on movements 2, 3, 4, 5 and 6. Bus rapid transit (BRT) requires a dedicated lane to ensure full separation from general traffic. However, acquiring road space for a dedicated BRT lane into Geelong may be difficult due to the already congested and space-constrained roads approaching central Geelong, so in certain circumstances less contiguous 'bus priority' measures could be considered if necessary.

Figure 17 Sample urbanised BRT-type corridor design (source: Deadline Detroit) & critical movements served



Full BRT may be possible along Hamilton Highway or Midland Highway if significant sections of on-street parking were sacrificed along connecting corridors inside the Geelong Ring Road (see Figure 19). In this case, it is possible that the proposed general expansion of either of these corridors could be replaced with continuation of bus lanes to and through the WGGA, then potentially connecting northward to the NGGA as an on-road bus corridor to maximise its catchment.

Figure 18 Potential BRT corridors and connectivity options

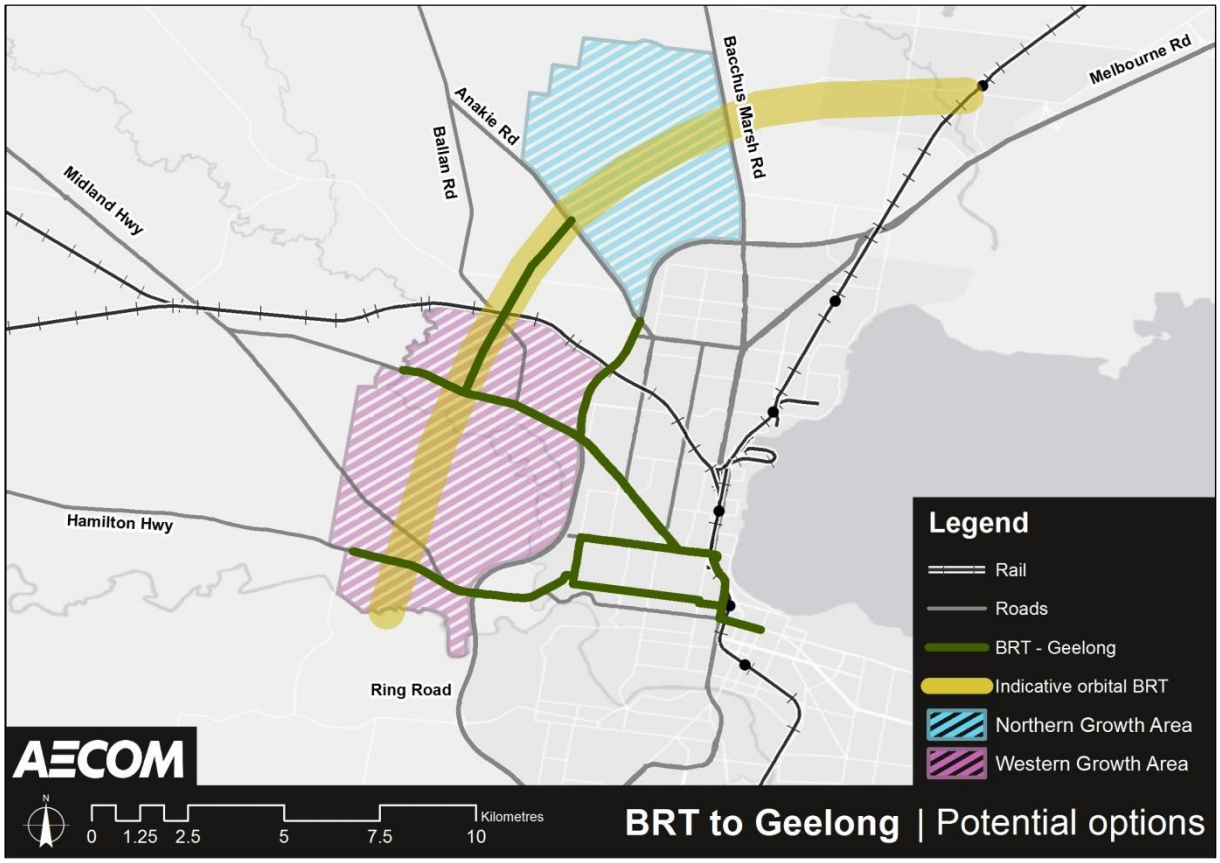
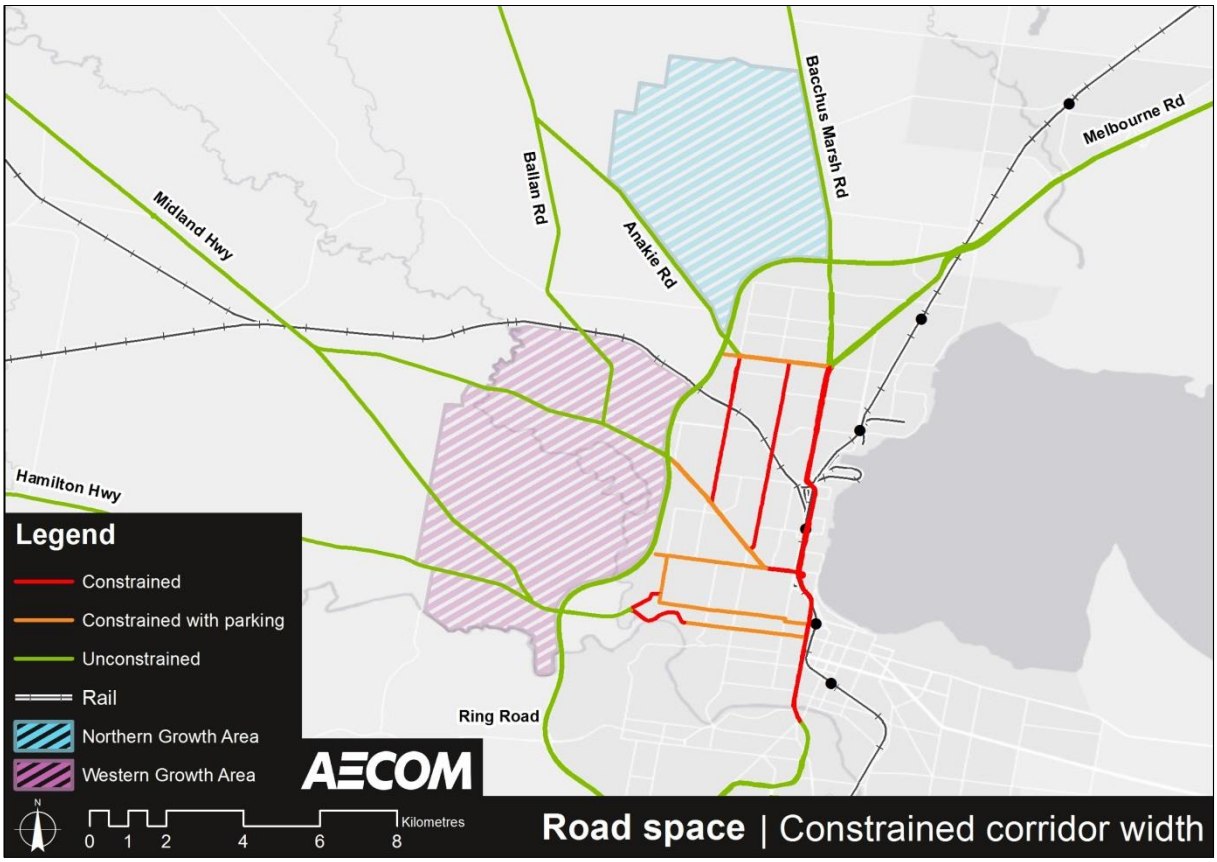


Figure 19 Characteristics of potential connecting road corridors into central Geelong



In order to justify the use of road space along Hamilton Highway or Midland Highway for a bus rapid transit system rather than for general traffic, it would be necessary to provide the capacity for approximately 1000 passengers during the critical PM peak hour translating into the equivalent of approximately 900 cars (at an assumed 1.1 persons per car).

At the top end of the spectrum, modern double-articulated BRT vehicles have the capacity to carry 130 to 150 passengers depending on seating versus standing configurations. This would translate into 7 to 8 services per hour (approximately 1 every 7 to 9 minutes) in order to carry the requisite numbers of passengers to justify the dedication of road space to the service.

The advantage of BRT over light rail – in this context – would be its potential to be more fully integrated with the WGGA with potential further extension into the NGGA. This would maximise the potential catchment and possibly tie into a larger system which could continue northward to an interchange station along the Geelong-to-Melbourne main heavy rail line.

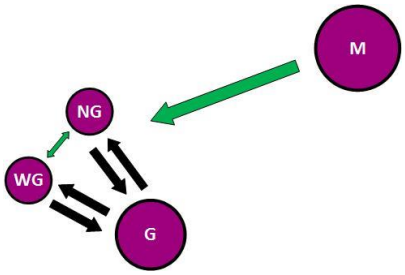
Like light rail, BRT could also be potentially extended through Central Geelong (to maximise its catchment at the employment end) and possibly connected into a wider system serving additional growth areas in Geelong's south. A Geelong-wide BRT network – with consistent operational parameters and branding – could significantly enhance the options for non-car travel throughout the region and help to support the Greater Geelong vision for a Clever and Creative Future which includes a target of 50 percent of journeys to work by public transport, walking or cycling.

The primary challenge of implementing BRT is the requirement for continuous road space between central Geelong and the two growth areas. Sacrifice of the 'traffic-separated' principle in constrained road sections could help avert this issue but would also affect journey times and reliability and thus the ability to attract large numbers of riders to the service. If these results could be achieved, however, then the use of the proposed widening reserve of either Hamilton Highway or Midland Highway for buses rather than general traffic could be justifiable and help lead to a more sustainable and inclusive transport future for these areas.

6.3.4 Bus rapid transit to a train station

This scenario, which could be implemented in conjunction with or separate from a BRT service into central Geelong, would focus on providing a connection to an existing or new train station north of Geelong for commute trips into Melbourne. This scenario would relieve pressure from critical movement 1 by absorbing trips that would otherwise entail either driving to Melbourne or using a park-and-ride facility at one of the main line train stations, each of which would similarly affect the road capacity requirements in the vicinity of the NGGA.

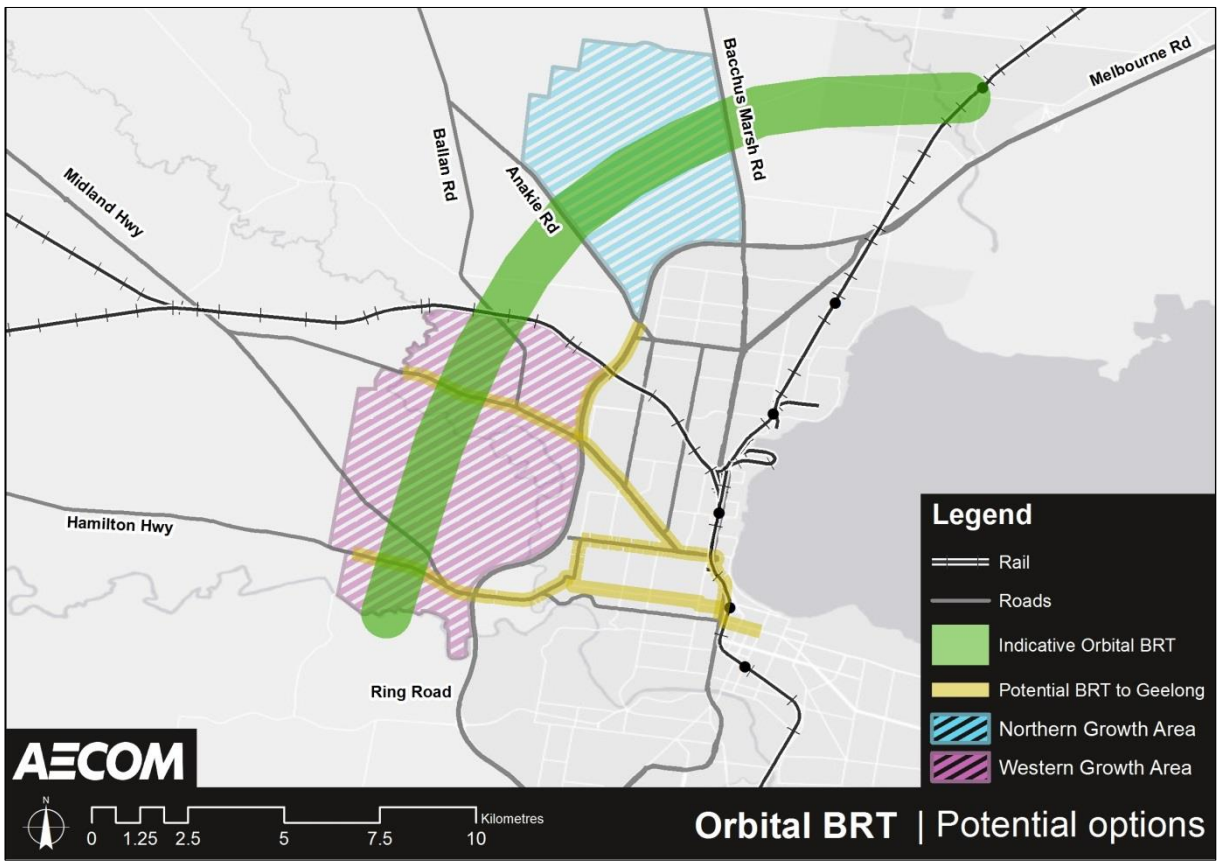
Figure 20 Sample BRT-type corridor design (source: Deadline Detroit) & critical movements served



The potential benefit of this service to the NGGA would be the lessening of the need for the following road expansion proposals:

- Significant capacity upgrade of Bacchus Marsh Road
- Potential capacity upgrade of Elcho Road
- Potential capacity upgrade of Heales Road.

Figure 21 Potential orbital BRT connection to Geelong-to-Melbourne passenger rail line



Capture of trips through this area could also potentially reduce the pressure to widen Midland Highway and Hamilton Highway given that travel between the WGGA and Melbourne would otherwise likely occur by car via the Geelong Ring Road.

As with the other potential public transport projects, the measure of the orbital BRT's potential to reduce the need for road widening would rely on its ability to carry approximately 1000 passengers per hour in the critical (PM Peak) time period. However, as the Elcho Road and Heales Road proposed capacity upgrades have been highlighted as 'potentially needed' projects, it is possible that lesser passenger numbers would be sufficient to keep these two corridors beneath the duplication threshold.

The main challenge of planning for BRT (as with the WGGA-to-Geelong corridor) is the reservation of traffic-separated road space for buses only – in order to ensure that journey times are competitive with (if not faster than) driving – without which the capture of substantial numbers of riders is not likely. However, in comparison with the urbanised WGGA-to-Geelong corridor, the potential suitable road corridors for the orbital BRT service are less constrained and therefore may be more readily available for a high-capacity bus service.

6.3.5 Local bus

This scenario involves initiation of additional local bus routes servicing the growth areas to relieve pressure on all road routes into and out of the region. Services would focus on connecting the growth areas to Central Geelong, train stations (for connecting trains to Melbourne) and also key employment nodes and educational facilities, such as Deakin University.

Figure 22 Conventional bus

However it should be noted that due to lack of prospective time savings versus driving (in contrast to the traffic-separated transport modes described above) the potential to attract significant numbers of riders to conventional on-road local bus services is limited. Therefore, it is not likely that the extension of conventional on-road bus services to the WGGA and NGGA could attract a mode share high enough to preclude the need for capacity expansion on the road corridors identified as part of the base case.

Nonetheless these types of services would help support travel equity and provide an additional layer of travel flexibility for people living in or visiting these areas.

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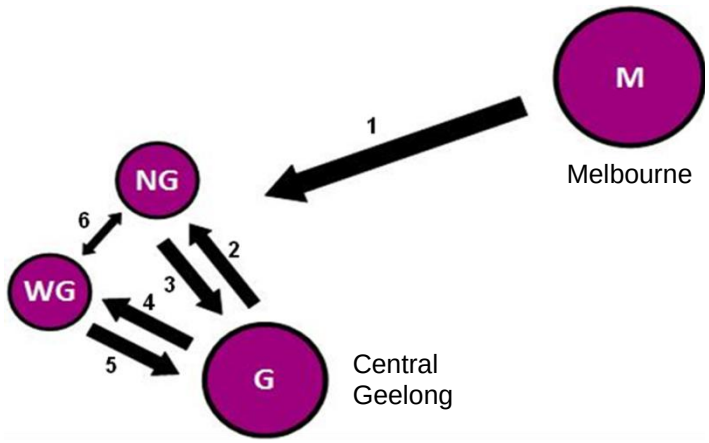
6.4 Summary

Table 6 shows the potential reduction in car trip volumes for each critical movement as potentially facilitated by each of the identified public transport options.

Table 6 Upper-limit reductions in car traffic for each critical movement pattern

Volume decrease	1	2	3	4	5	6
Base case	N/A	N/A	N/A	N/A	N/A	N/A
Light Rail	0	0	0	980	980	0
Heavy Rail	820	0	0	820	820	0
BRT to Geelong	0	*secondary*	*secondary*	940	940	*secondary*
BRT to Train Station	940	0	0	0	0	*secondary*
Local Bus	270	270	270	270	270	270



Projects that can potentially reduce the car volumes on key corridors by 800 to 900 cars are well positioned to reduce the need for any proposed road widenings. However, this assumes that enough passengers could be attracted to the public transport service to achieve these results, requiring:

- Strong demand along the trip patterns served
- Journey-time advantages over driving.

As a result, it is likely that the achievement of these objectives would be possible only in conjunction with supporting land use initiatives within the growth areas and also within central Geelong – the latter to ensure a sufficient level of synergy to drive demand along these specific corridors – as well as a fast reliable mode of transport that represents a step change above conventional bus service.

Finally it should be noted that the potential to reduce the need for general road capacity upgrades will vary depending on how far above the widening threshold each specific corridor is projected to sit, as public transport projects that capture just a fraction of the typical lane saturation volume (for instance, on the order of 200 to 400 passengers per hour) may in some cases be sufficient to reduce enough traffic pressure on the road to avoid the triggering of the widening project.

The effects of significantly upgraded public transport would include a range of benefits both directly and indirectly, including support for the Greater Geelong vision for a Clever and Creative Future which includes a target of 50 percent of journeys to work by public transport, walking or cycling. Long-term sustainability and more equitable access to quality transport for persons of all abilities and ages represent further objectives that would be very strongly supported by any proposed step-change in the quality and reliability of a Geelong-wide public transport system. The development of the NGGA and WGGA offers an unprecedented opportunity to anchor any such project and help change for the better the travel behavioural characteristics of Greater Geelong.

7.0 Conclusion

The conclusion of these investigations are that — in order to help preserve the valued natural qualities that currently define the areas designated for the NGGA and WGGA — aggressive public transport measures should be explored to enable a less car-centric design future for the road corridors in these areas.

In conjunction with the strategic connections as represented by the outer orbital route — any variation of which would need to be designed to be consistent with the desired community design character — as well as the development of a well-designed and well-located strategic commuter rail facility, the introduction of enhanced public transport could help ensure a more sustainable and inclusive future for existing and new residents.

The provision of a large commuter car-parking facility on the main line to Melbourne however may not support the longer-term vision for Geelong as a strengthened employment and mixed-use centre. While recognising the importance of convenient linkages to Melbourne, the reliance on a park-and-ride model could inadvertently contribute to the continuation of a car-oriented residential development paradigm. The outcome of this could include further need for road capacity upgrades and a resulting lack of encouragement of walking, cycling and use of connecting public transport.

While the links to Melbourne should continue to be considered as important, these should be complemented with links to/from central Geelong, and focus – wherever possible – on sustainable transport modes. The commuter railway station would therefore not need to be overwhelmingly reliant on car parking, but rather be designed to support alternative access in the form of continuous walking paths and cycling lanes (plus secure bike parking) as well as a substantially upgraded public transport link to the surrounding communities including the two growth areas.

Preliminary recommendations with respect to each of these features include:

- **Outer orbital traffic route:** Further investigation of the Evans Road corridor has merit, whether as a single internal route or as part of multiple corridors between the growth areas. This route would not seek to duplicate the function of the Geelong Ring Road (i.e. bypassing, long-haul trips), but would provide localised access between the growth areas and on to Lara. The intent of this corridor would also be to limit any localised ‘interchange hopping’ along the Geelong Ring Road.
- **Commuter railway station:** Any new or expanded commuter railway station should be designed to prioritise public and active transport access, and to ensure that any car parking does not interfere with simultaneous goals of increasing sustainability and walkability throughout the whole of Greater Geelong.
- **Western rail corridor:** As each of the main evaluated public transport options could be designed to offer a similar degree of passenger capacity (assuming full traffic separation), their ability to be integrated into a wider Geelong-wide public transport system should be considered as a primary criterion of their future evaluation.

The pending development of the NGGA and WGGA offers an opportunity for Greater Geelong to transition to a more sustainable future with a higher rate of public transport and active transport use throughout the region. As such, it is important that any infrastructural projects associated with these growth areas respond to these future aspirations.

Appendix A

Trip generation

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Trip generation estimation

Assumptions

The assumptions outlined in Table 7, Table 8 and Table 9 have been used in the trip generation calculations. Table 10 displays the results for the critical evening peak hour.

Table 7 Growth area general inputs

Inputs	West Geelong	North Geelong
Area (km^2)	31.69	17.39
Final population (2036)	66,000	44,000
Dwellings	20,000	17,000
Shopping centre area (m^2)	48,500	0
Shopping centre generation rate	4.4	4.4

Table 8 Trip generation rates (Austroads, 2016)

Time period	Generation rate
Daily trip rate	7.40
Weekday evening peak	0.78
Weekday morning peak	0.71

Table 9 Lane capacity assumptions

Road type	Vehicles per hour per lane
Local road	950
Arterial (assuming two lanes)	900
Highway	1,200

Table 10 Trips generated for the peak evening hour

Growth area	Trips generated
West	17,734
North	13,260
Total	30,994

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Movement definition

The trips generated by the growth areas need to be distributed onto the surrounding road network to identify capacity constraints, sections of the road network with adequate capacity and potential public transport needs. The movements identified in Figure 23 are used to distribute the trips generated; Table 11 shows the specific roads that these movements relate to and the sections of these roads where current traffic volume data has been used in modelling. These movements are specific to the evening peak hour, thus a movement from the growth areas to Melbourne has not been included since it is assumed that the volume of traffic on this movement would be insignificant on a typical weekday evening. Movement number 6 relates to all local movements in the growth areas regions and is not specific to movements between growth areas.

Figure 23 Key movement identification

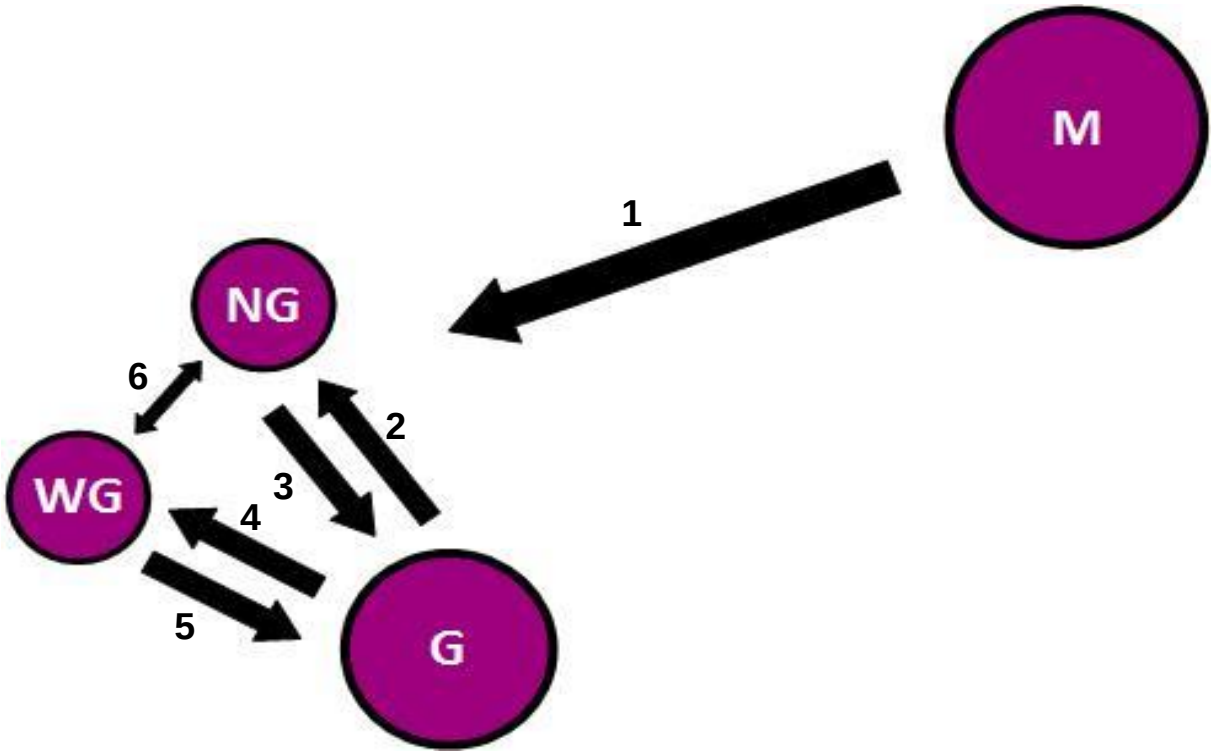

Table 11 Movement description

Movement	Roads included	Road section
1	Geelong Ring Road	Anakie Rd - Midland Highway
2	Princes Highway/Melbourne Road	Bell Pde - Church St
3	Princes Highway/Melbourne Road	Bell Pde - Church St
4	Midlands Highway	Anakie Rd-Thomson Rd
	Aberdeen Street	Pakington St - Latrobe Tce
5	Midlands Highway	Anakie Rd-Thomson Rd
	Aberdeen Street	Pakington St - Latrobe Tce
6	-	-

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Trip distribution

It is assumed that trips generated in the evening peak hour are distributed based on the spread of population and activity within the growth areas (for both commuter trips and trips for other activities such as shopping, sport, children etc.) Figure 24 and Figure 25 display the distribution estimated for both of these trip types.

Figure 24 Estimated trip distribution of commuter trips during the evening peak hour

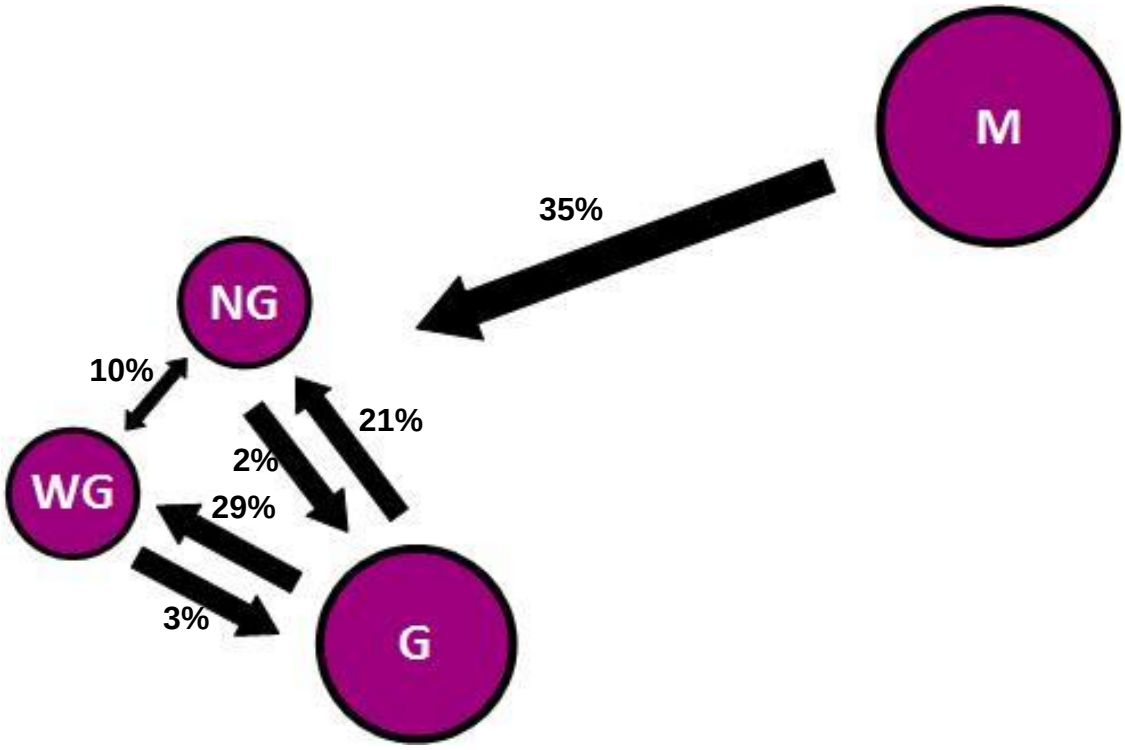
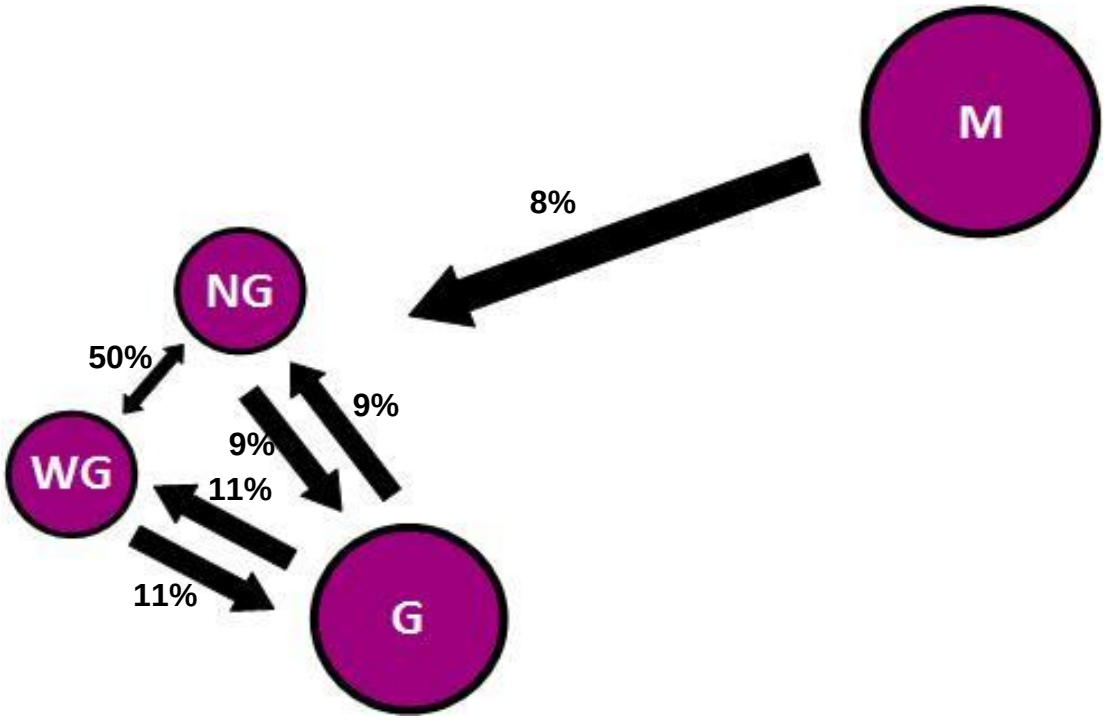


Figure 25 Estimated trip distribution of other trips during the evening peak hour



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Movement traffic volume

The traffic volume data displayed in Table 12 was gathered by VicRoads and represents the current conditions on the surrounding road network. These figures have been converted into an evening peak hour volume and escalated to a “Build Out” year, when it is assumed that the additional volume from the growth areas will be completely added to the network.

Table 12 Movement data and traffic volume (VicRoads)

Movement	1	2	3	4	5	6
Existing volume (per day)	14,000	28,000	23,000	19,800	16,500	0
Existing volume (v/h peak)	1,400	2,800	2,300	1,980	1,650	-
Additional volume	6,630	4,563	1,755	6,349	2,231	5,747
Total “Build Out” Volume	8,030	7,363	4,055	8,329	3,881	5,747