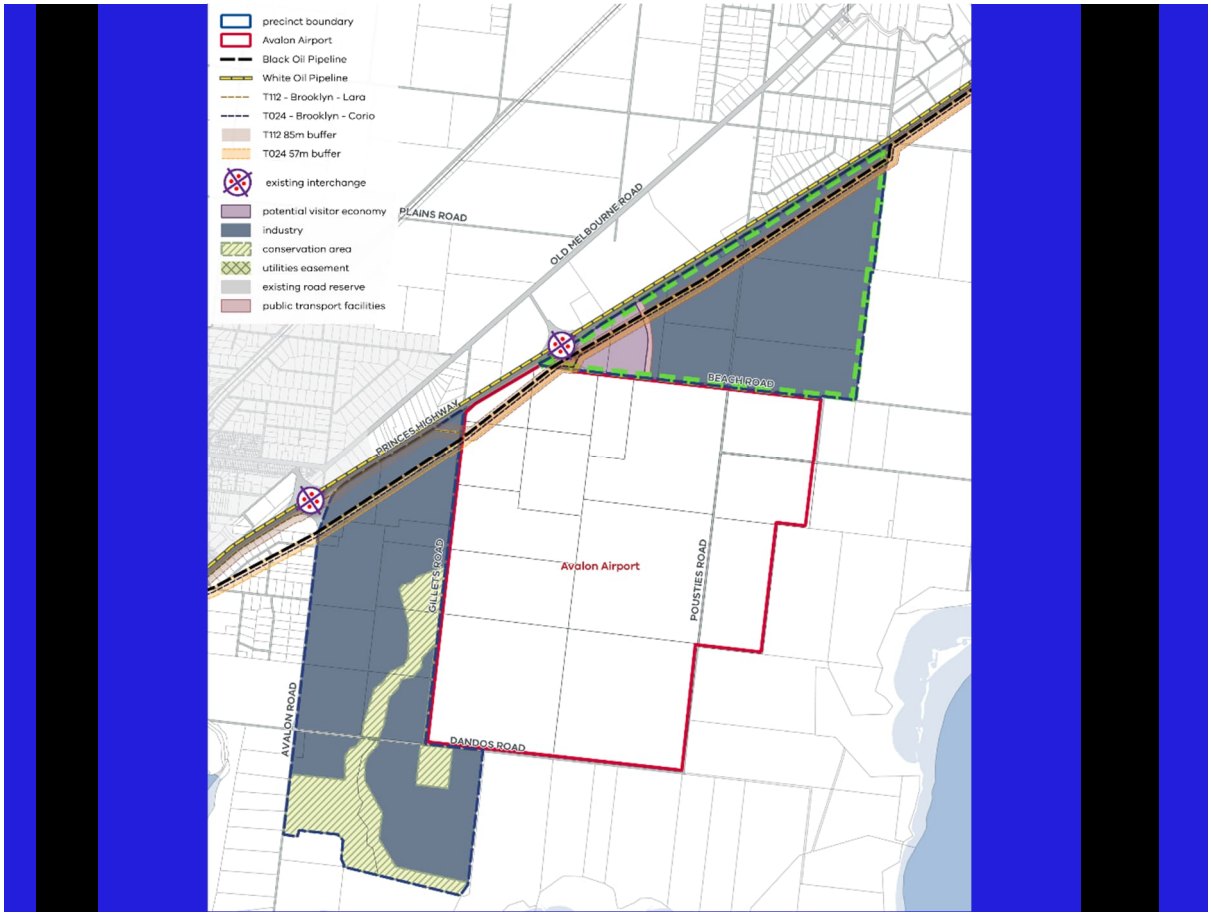
Strategic Transport Modelling Assessment Report

Victorian Planning Authority

Greater Avalon Employment Precinct
10 April 2026



Strategic Transport Modelling Assessment Report

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Executive summary

The Victorian Planning Authority (VPA) is currently developing a planning scheme amendment for the Greater Avalon Employment Precinct (GAEP). Jacobs has been engaged by the VPA to undertake an assessment of the proposed future transport network. The Project involves preparing a Strategic Transport Modelling Assessment to examine traffic impacts of the proposed development of the planning scheme amendment and understand future transport planning requirements. The Project has utilised the VITM24 version of the Victorian Integrated Transport Model (VITM) and the development of a 2056 project-specific model.

The 2056 Project Case model includes the latest proposed land use and transport networks for GAEP. Overall, the full development scenario includes 26,350 jobs and Avalon Airport handling 9.66 million air passenger per annum, which overall generates 82,100 daily vehicle movements. This is broken down as follows:

- 8,400 Airport employees and employees in businesses located on Airport land generates 17,800 daily vehicle trips
- Air passengers generate 24,100 daily vehicle trips
- 7,900 employees in GAEP-West generate 15,600 daily vehicle trips
- 10,000 employees in GAEP-North generate 24,500 daily vehicle trips

This report details the results of the 2056 Project Case model runs, which test different levels of development across GAEP and Avalon Airport. The Strategic Transport Modelling Assessment shows that the proposed road network within the precinct area will be largely appropriate for the projected traffic volume. Short sections of Avalon Road and Beach Road (near the freeway interchanges) will need to be duplicated.

External to the precinct area, traffic on the Princes Freeway is forecast to more than double from 72,000 vehicles per day in 2019 to 150,000 vehicles per day in 2056[1]. This is unlikely to be a sustainable volume of traffic with each lane carrying close to 2,000 vehicles per hour throughout the AM and PM peak periods. Additional lanes and ramp metering will likely be required and require further investigation by the Department of Transport and Planning (DTP). GAEP and Avalon Airport play a role in this growth, but it is the background growth that is the main contributor with this section of freeway connecting one of the fastest growing metropolitan councils (Wyndham) with one of the fastest growing regional councils (Geelong).

Crossings of the Princes Freeway are forecast to be at or approaching capacity during the AM and PM peak periods and will require further investigation with DTP. Ramp metering and widening will need to be considered. Upgrades to Beach Road will ultimately be guided by the ongoing Commonwealth funded Beach Road Upgrade Feasibility Study. The study will explore options to upgrade Beach Road at Avalon, improve access to the Airport and help transform the precinct into a transport and logistics hub

Bus routes have been considered which provide connectivity through the precinct area, to Avalon Airport and to Lara station. Further enhancements to the bus routes, including bus priority infrastructure, have the capability to reduce the number of vehicles on the road. Although large employment precincts dominated by manufacturing do not tend to generate high public transport usage due to their dispersed layouts.

[1] This compares to the following 2019 annual average daily traffic volumes: West Gate Freeway 181,000 (5-lanes), Tullamarine Freeway (south of Bell Street) 132,000 (5-lanes), Monash Freeway at Wellington Road170,000 (5-lanes), Western Ring Road east of Pascoe Vale 151,000 (4-lanes). Source: Historical Annual Average Daily Traffic Volume - Data Collection - Open Data - Transport Victoria

Important note about this report

The primary purpose of this report and the associated services performed by Jacobs is primarily to document the assumptions used in the development of the VITM 2056 Project Case and the model outputs for the Greater Avalon Employment Precinct in accordance with the scope of services set out in the contract between Jacobs and the VPA.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate, or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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Acronyms and abbreviations

CBD	Central Business District
COGG	City of Greater Geelong
DTP	Department of Transport and Planning
GAEP	Greater Avalon Employment Precinct
GAEP-N	Greater Avalon Employment Precinct North
GAEP-W	Greater Avalon Employment Precinct West
STMA	Strategic Transport Modelling Assessment
VITM	Victorian Integrated Transport Model
V/C	Volume Capacity
VPA	Victorian Planning Authority
VPD	Vehicles Per Day

1. Introduction

1.1 Background

The Victorian Planning Authority (VPA) is working with the City of Greater Geelong to prepare a planning scheme amendment (including a Framework Plan and a Development Plan Overlay) for a state-significant employment precinct in Avalon. Jacobs has been engaged by the VPA to undertake an assessment of the proposed future transport network for the Greater Avalon Employment Precinct.

The project is located approximately 20km north-east from the regional city of Geelong and 55km south-west of the Melbourne CBD and features the Avalon International Airport as a key land use within the precinct. The Greater Avalon Employment Precinct (GAEP) is identified in the Avalon Corridor Strategy and Plan for Victoria and will use its proximity to the Airport to establish an Airport Precinct that will feature significant industrial and commercial opportunities.

The GAEP includes two parts, GAEP-North and GAEP-West as shown in Figure 1-1.

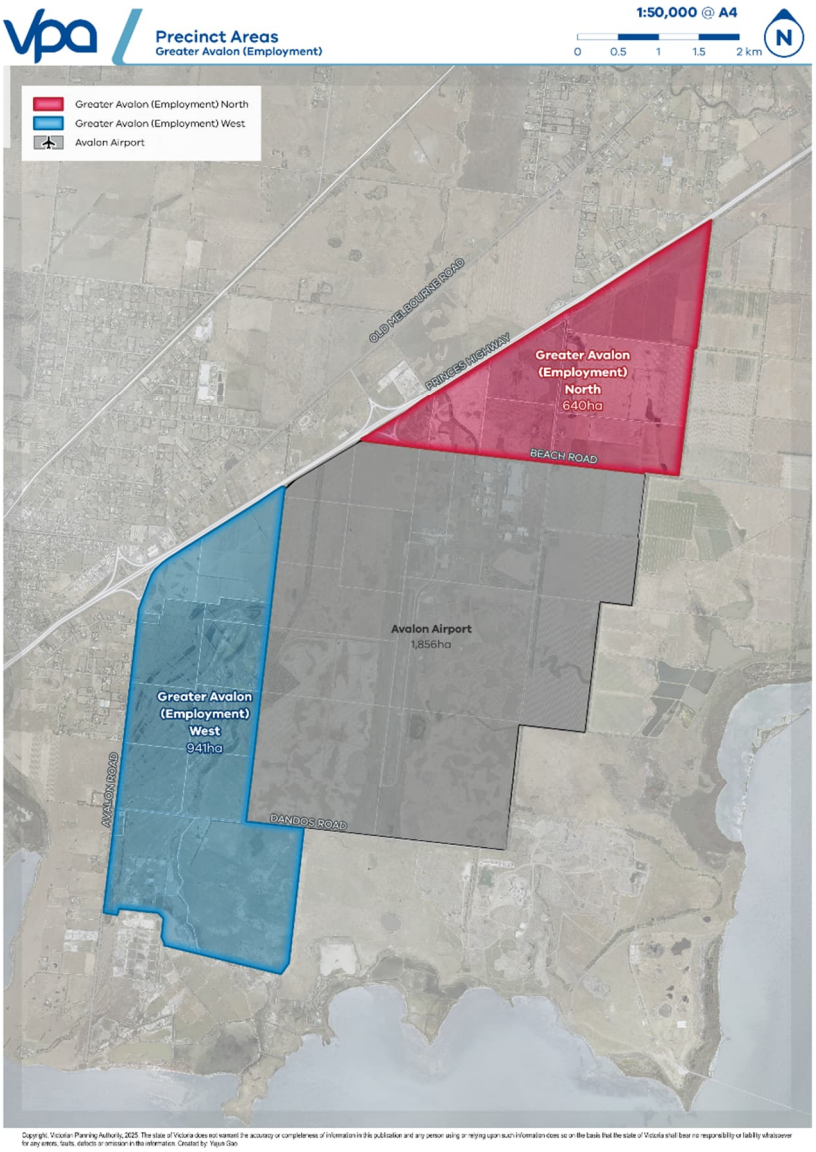


Figure 1-1: Greater Avalon Employment Precinct study area (Source: VPA)

1.2 Study Overview

This study involves preparing a Strategic Transport Modelling Assessment (STMA) to examine traffic impacts of the proposed development of the precinct (refer to Figure 1-2) and understand future transport planning requirements. It includes a review and validation of the VITM 2018 Reference Year model and development of a future (2056) project-specific model which is then used for option testing.

A Transport Assessment Memo will also be prepared to provide recommendations for the amendment to support the development of a complete, integrated multi-modal precinct. This will involve a detailed background review and understanding of the existing conditions and draft amendment. The findings from the STMA will then be considered to develop recommendations for the public transport, active travel and road networks within the precinct.

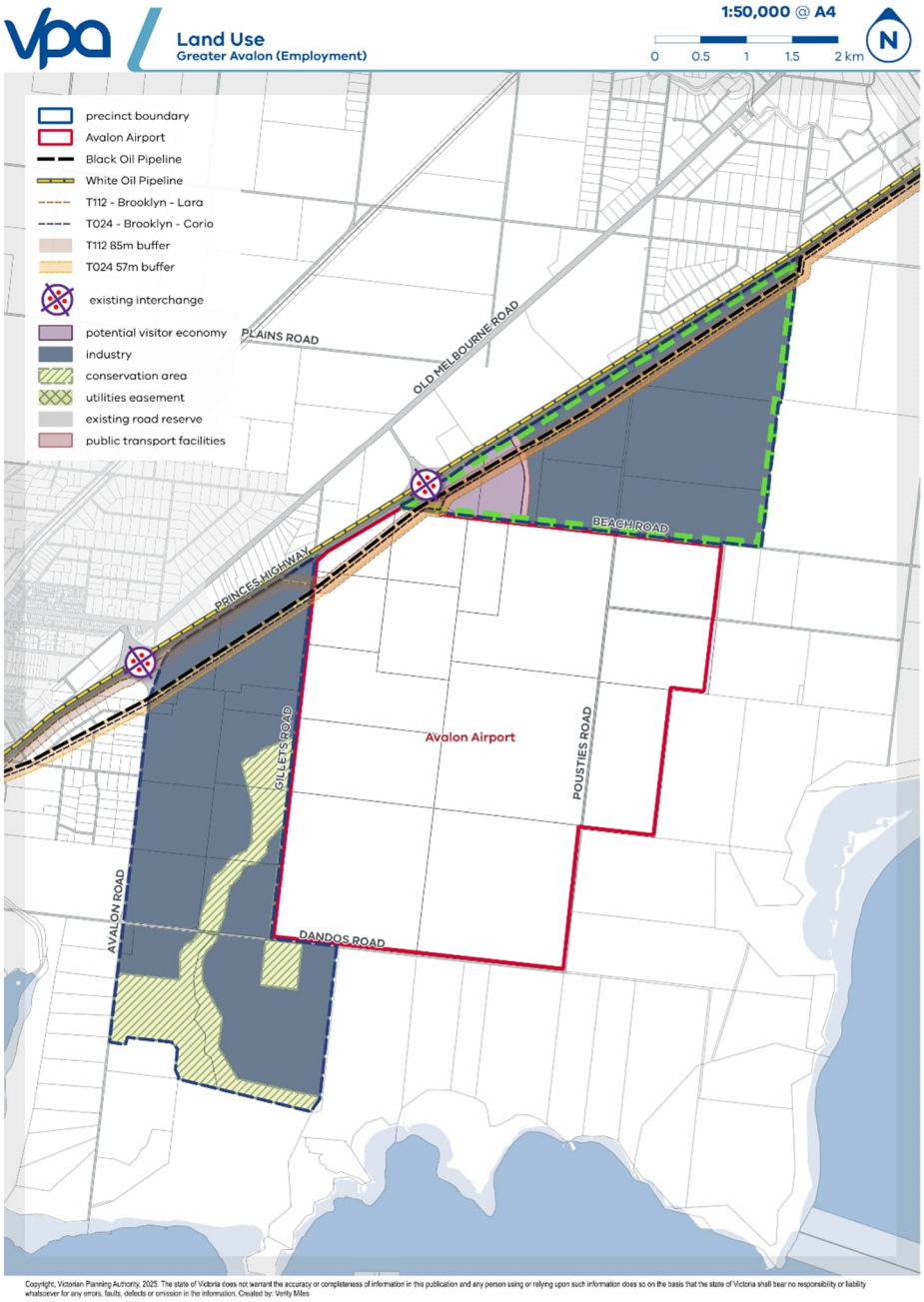


Figure 1-2: Draft GAEP Framework Plan

2. Model

2.1 Base Model

The Victorian Integrated Transport Model (VITM) provided by the Department of Transport and Planning (DTP) has been used for the strategic modelling of this study, version number VITM24_v2_03. VITM models an average weekday during the school term. Events associated with the Airport, such as the Avalon Airshow, are outlier events and are not considered as part of this assessment.

The two parts of GAEP, GAEP-North and GAEP-West, are both located in an area of VITM that lacks detail about the transport network and is covered by a single travel zone (3959), as shown in Figure 2-1. Avalon Airport (AVV) is also located within the same travel zone and there is currently no consideration of AVV air passenger trips within VITM. Therefore, adding a more detailed zone system, road networks and the inclusion of Avalon Airport air passengers were key updates required to VITM and are outlined in the following sections.

The validation of the updated model is detailed in Appendix A. This confirms the model as fit for purpose for assessing the transport impacts in and around the GAEP.

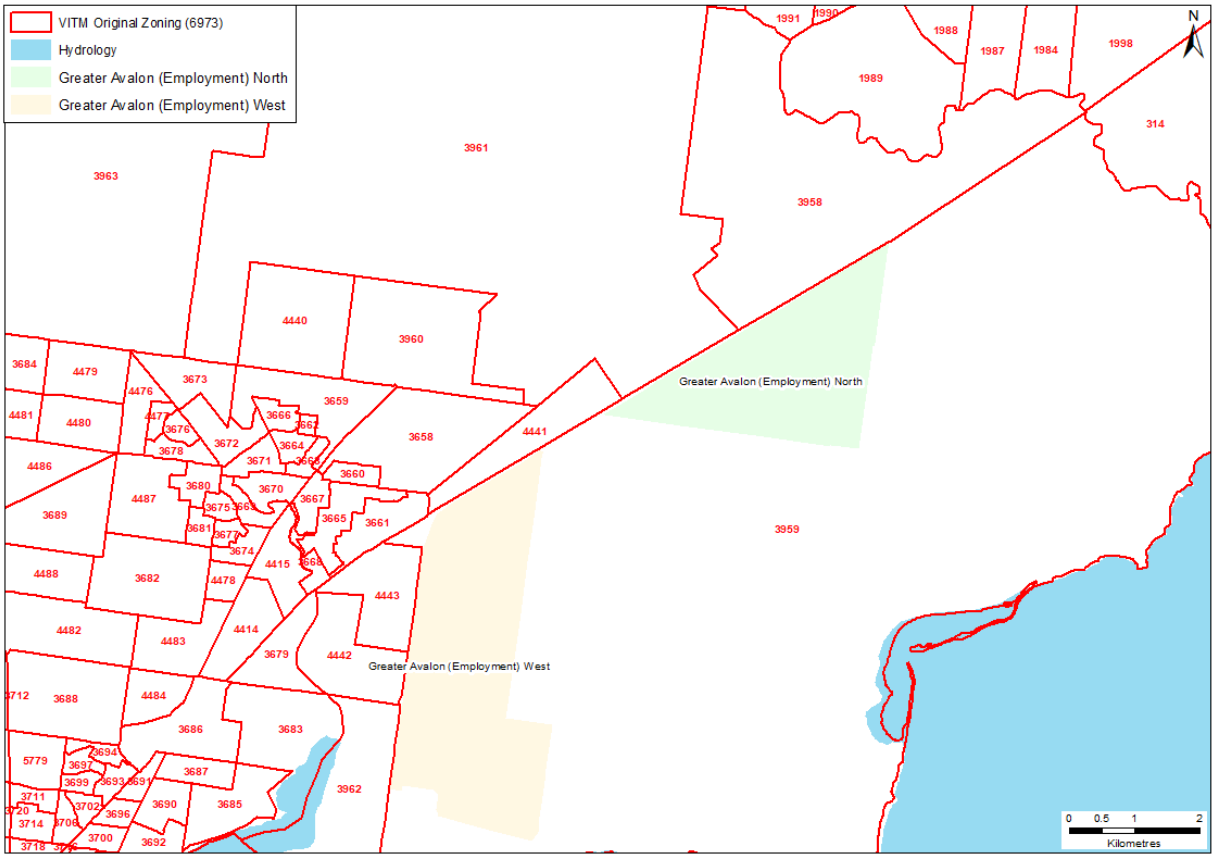


Figure 2-1: Original VITM zoning (6973 zones)

2.2 Zone disaggregation

To capture sufficient detail to inform the GAEP strategic modelling, the standard VITM zone configuration required further disaggregation. This section outlines Jacob's approach for zone disaggregation within the study area and the zone configuration ultimately adopted, as shown in Figure 2-2.

In addition to GAEP, Jacobs were made aware of the potential for a large parcel of land to the north-east of the Beach Road / Princes Freeway interchange to be developed in the long term (as per the Lara Structure

Plan). This area was covered by two travel zones (3961 and 3958) and has been disaggregated to future proof the model for future testing.

The large VITM travel zones in the GAEP study area (as shown in Figure 2-1) have been individually considered and split based on VPA's Draft GAEP Framework Plan (refer to Figure 1-2), homogeneousness of land use and natural or other barriers as zone boundaries.

Outside of the GAEP study area, the Geelong standard model aggregation system was used, which is tailored for projects in the Geelong region and on the western side of metropolitan Melbourne.

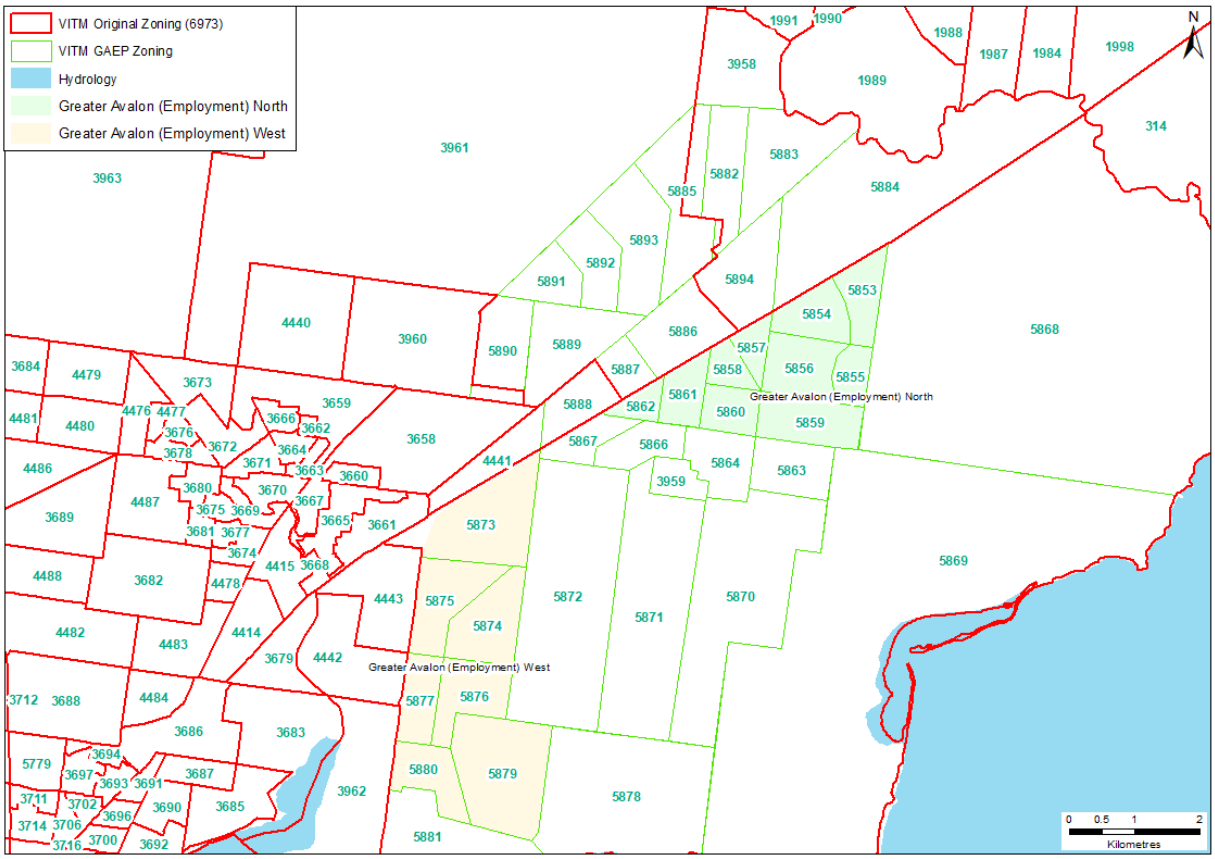


Figure 2-2: Updated VITM zoning

Figure 2-3 shows the updated set of VITM travel zones along with centroid connectors, the break-down utilises 32 additional zones to represent the GAEP and surrounding areas. After aggregation between zones that don't impact the distribution of traffic in the study area, the process created a total of 2,310 zones, this will enable sufficient granularity for the study area and model run time.

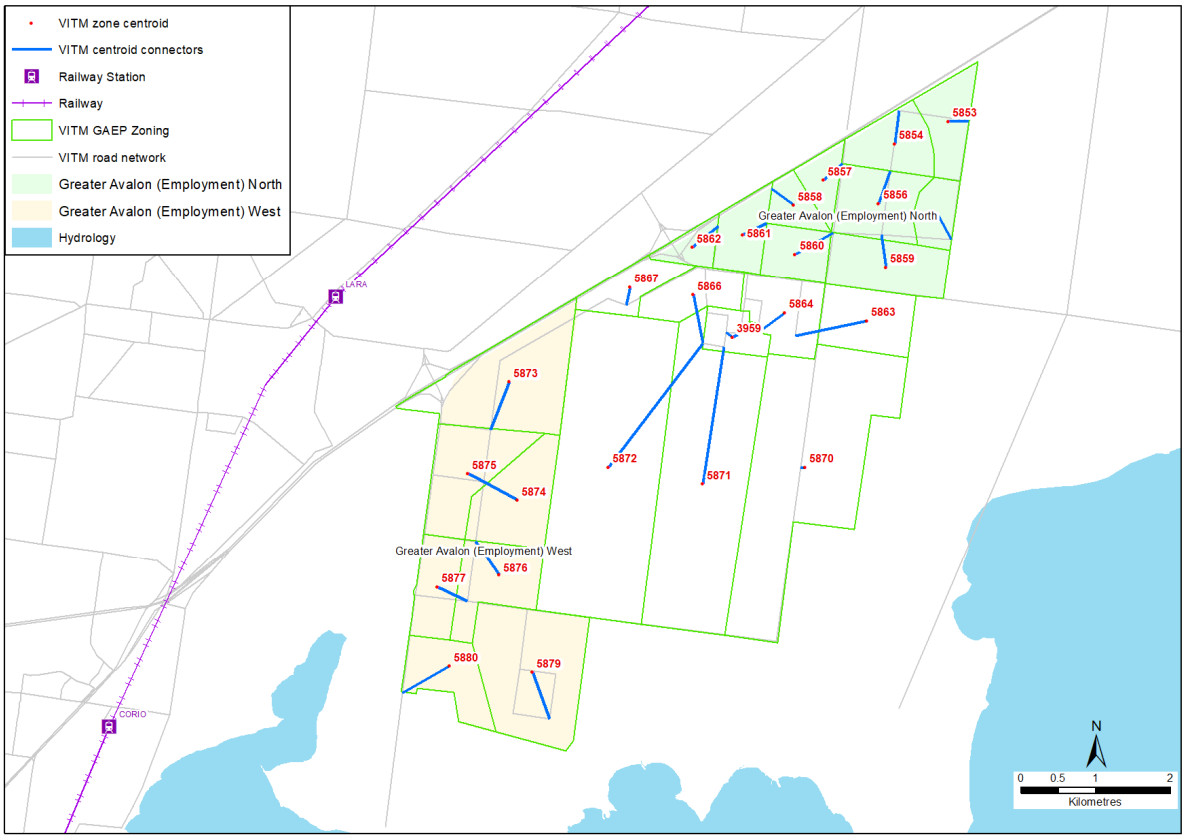


Figure 2-3: GAEP Study Area with updated VITM Zones and centroid connectors

2.3 Avalon Airport Air Passengers

Annual air passenger forecasts were provided by Avalon Airport for inclusion in the VITM model (refer to Table 2-1), along with an estimate of air passengers in 2018[2]. In addition to this, Avalon Airport also shared traffic assumptions used for their internal planning works. This included several assumptions about air passengers which we have adopted for consistency. The most important is the conversion factor from annual air passengers to vehicle trip ends per day of 400.

Table 2-1: Avalon Airport Air Passenger Forecasts

	2018	2026	2031	2036	2041	2046	2051	2056
Annual air passengers	1,650,000	1,375,725	3,350,659	5,272,261	6,185,559	7,460,077	8,509,820	9,656,264
Daily vehicles (in and out)	4,125	3,439	8,377	13,181	15,464	18,650	21,275	24,141

Matrices of air passenger vehicle trips were generated by time period using a gravitational model with a cut-off distance of 50km and calibrated with a scaling constant to reflect the pre-determined number of trips to be generated. This generated vehicle movements similar to those assumed by Avalon Airport. To assign these trips, the matrices of private vehicle trips were added to VITM before the Highway assignment. More detail on the process is provided in Appendix A.

[2] There are no publicly available data sources to validate this as "*Avalon Airport is excluded for commercial-in-confidence reasons*" from common aviation statistics such as those published by BITRE. Airport traffic data | Bureau of Infrastructure and Transport Research Economics. However, based on the number and type of flights in 2018, the true figure is likely to be less than one million air passengers.

3. 2056 Model Inputs

VITM has been used to test the following options in the year 2056:

- 2056 Base: no GAEP-N or GAEP-W development scenario, Airport at 100% of AVV air passenger forecasts
- 2056 Option 1A: GAEP-N and GAEP-W, Airport at 50% of AVV air passenger forecasts
- 2056 Option 1B: GAEP-N and GAEP-W, Airport at 100% of AVV air passenger forecasts
- 2056 Option 2A: GAEP-W only, Airport at 50% of AVV air passenger forecasts
- 2056 Option 2B: GAEP-W only, Airport at 100% of AVV air passenger forecasts

The following sections describe the inputs to these scenarios with respect to the future road network (Section 3.1), the future public transport network (Section 3.2), land use (Section 3.3) and Avalon Airport Assumptions (Section 3.4).

3.1 Future Road Network

Options 1A and 1B contain the full road network set out in the Movement Network Plans provided by VPA (refer to the left image in Figure 3-1). Options A and B only differ with respect to growth assumptions for air passengers at Avalon Airport.

Options 2A and 2B do not include the GAEP-North road network, as per the right image in Figure 3-1. The 2056 Base (no development) does not include the GAEP-North or GAEP-West road networks and is similar to the 2018 base road network within the study area. Each of the coded networks are shown in the following sections.

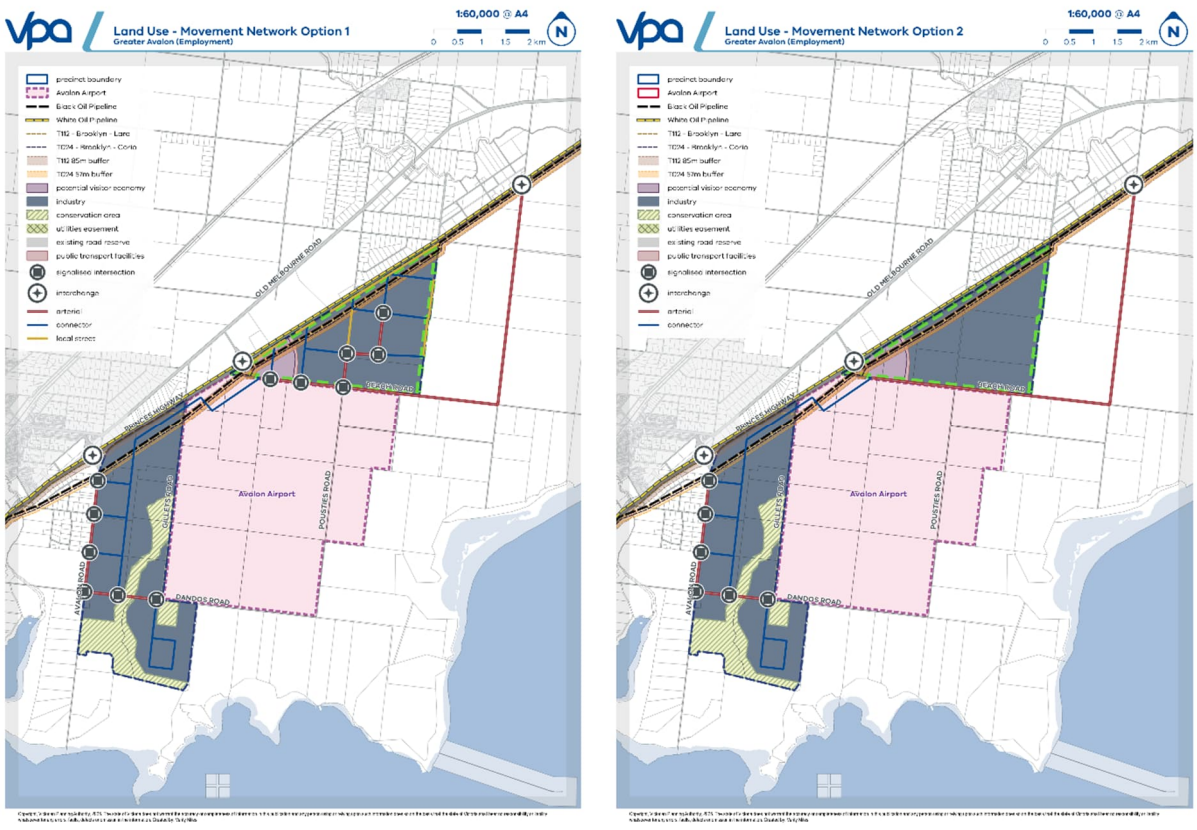


Figure 3-1: 2056 Option 1 (left) and 2 (right) Movement Network Plan

Outside the precinct road network, such as the Princes Freeway, there are no significant changes to the wider transport network between 2018 and 2056.

3.1.1 2056 Base Case Road Network

The network for 2056 Base Case is described in the following plots:

- Road classification (Figure 3-2)
- Zone centroids (Figure 3-3), due to the limited road network in the base case, many zones are connected to the same location, this will not impact the results as it is a no development scenario for GAEP, meaning there are no trips to distribute.
- Lane configuration (Figure 3-4)
- Posted speed limits (Figure 3-5)

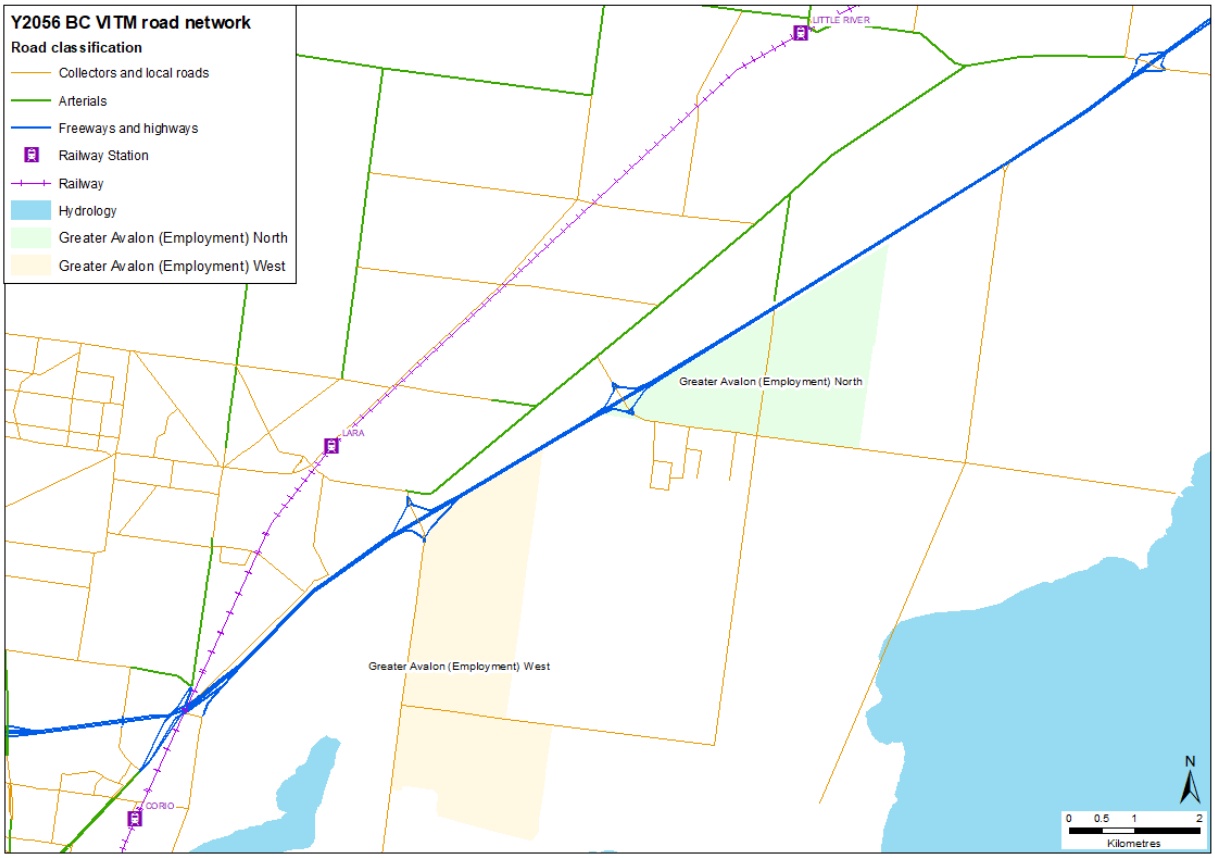


Figure 3-2: 2056 Base Case - road network classification

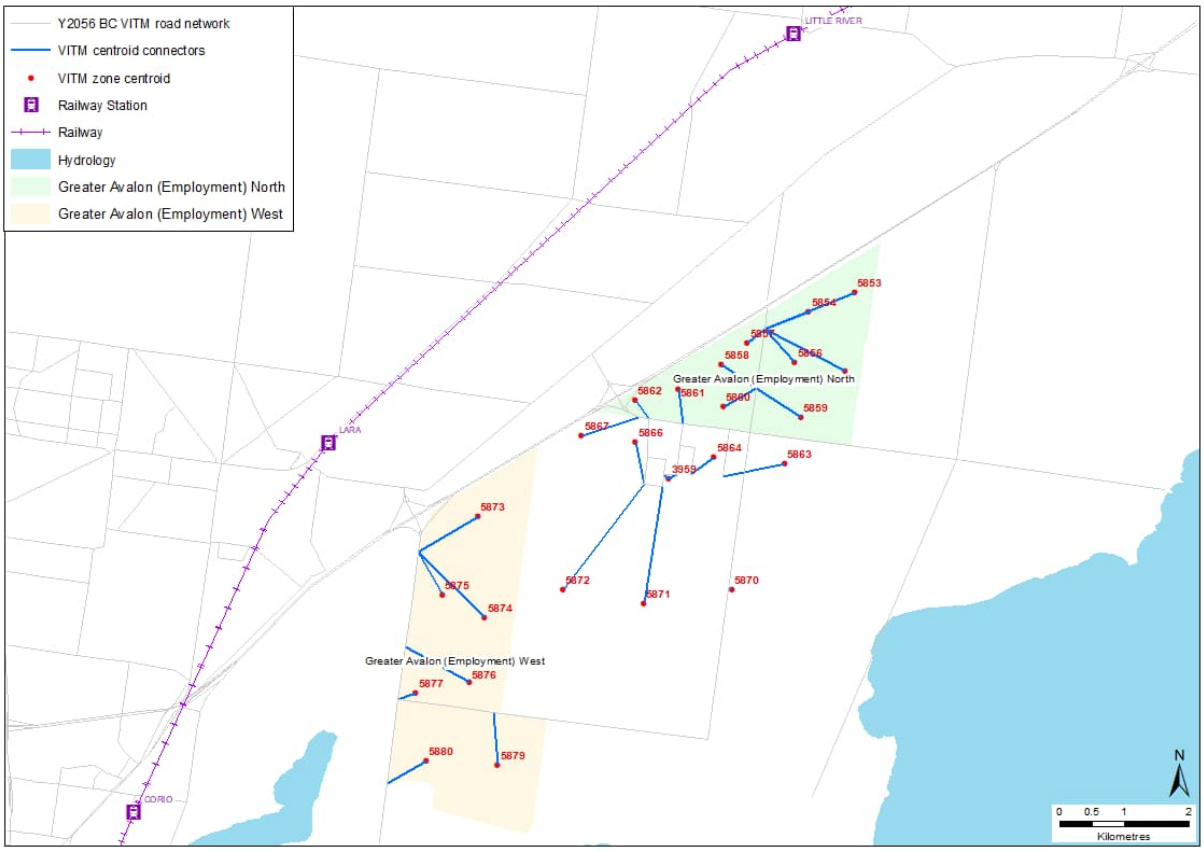


Figure 3-3: 2056 Base Case - zone centroids

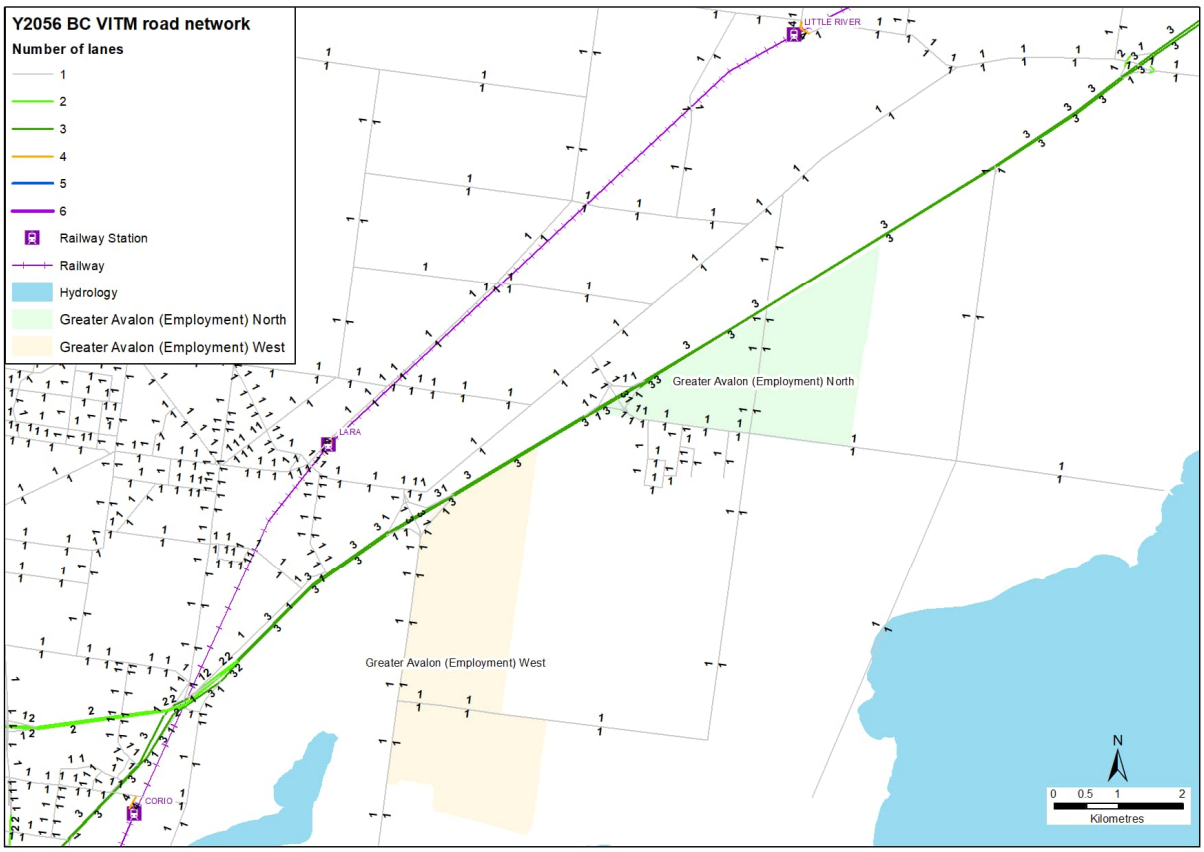


Figure 3-4: 2056 Base Case - road network number of lanes

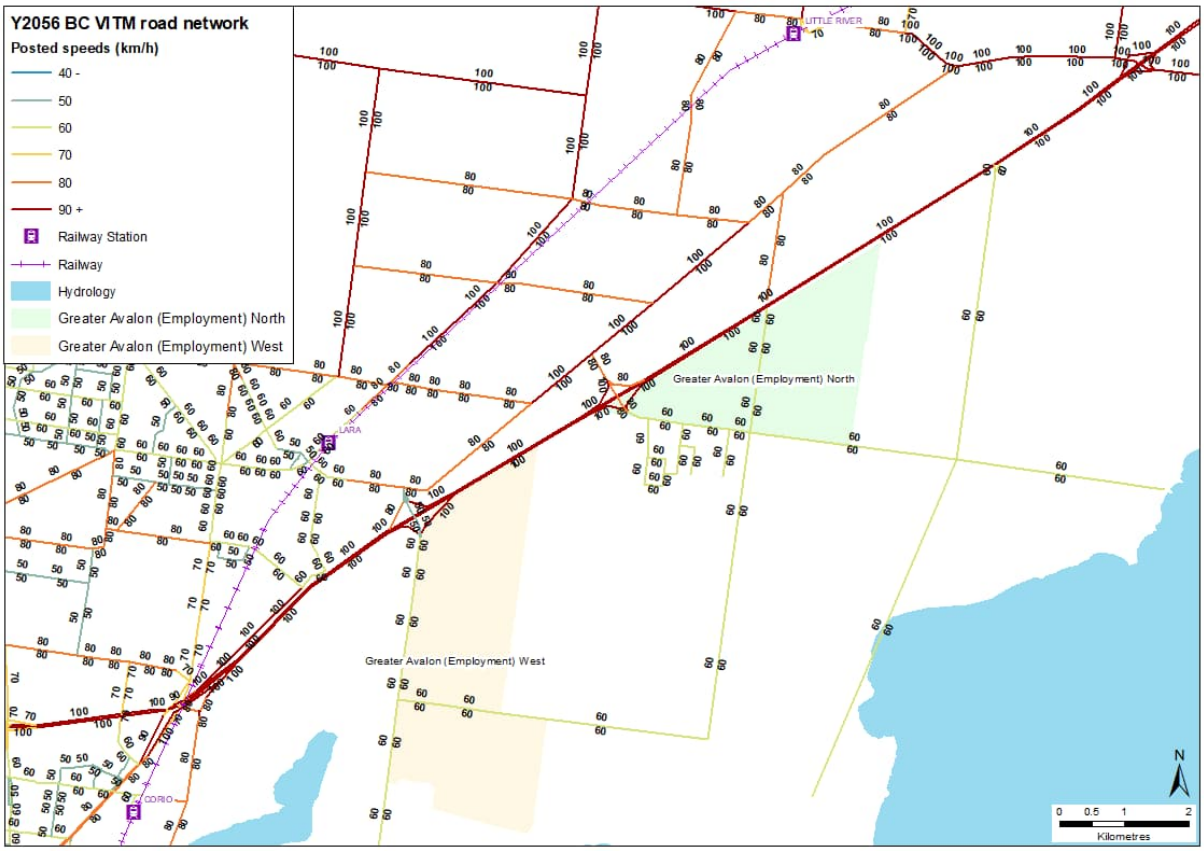


Figure 3-5: 2056 Base Case - posted speed limits

3.1.2 Option 1 Road Network

The network for 2056 Options 1A and 1B is described in the following plots:

- Road classification (Figure 3-6)
- Zone centroids (Figure 3-7)
- Lane configuration (Figure 3-8)
- Posted speed limits (Figure 3-9)

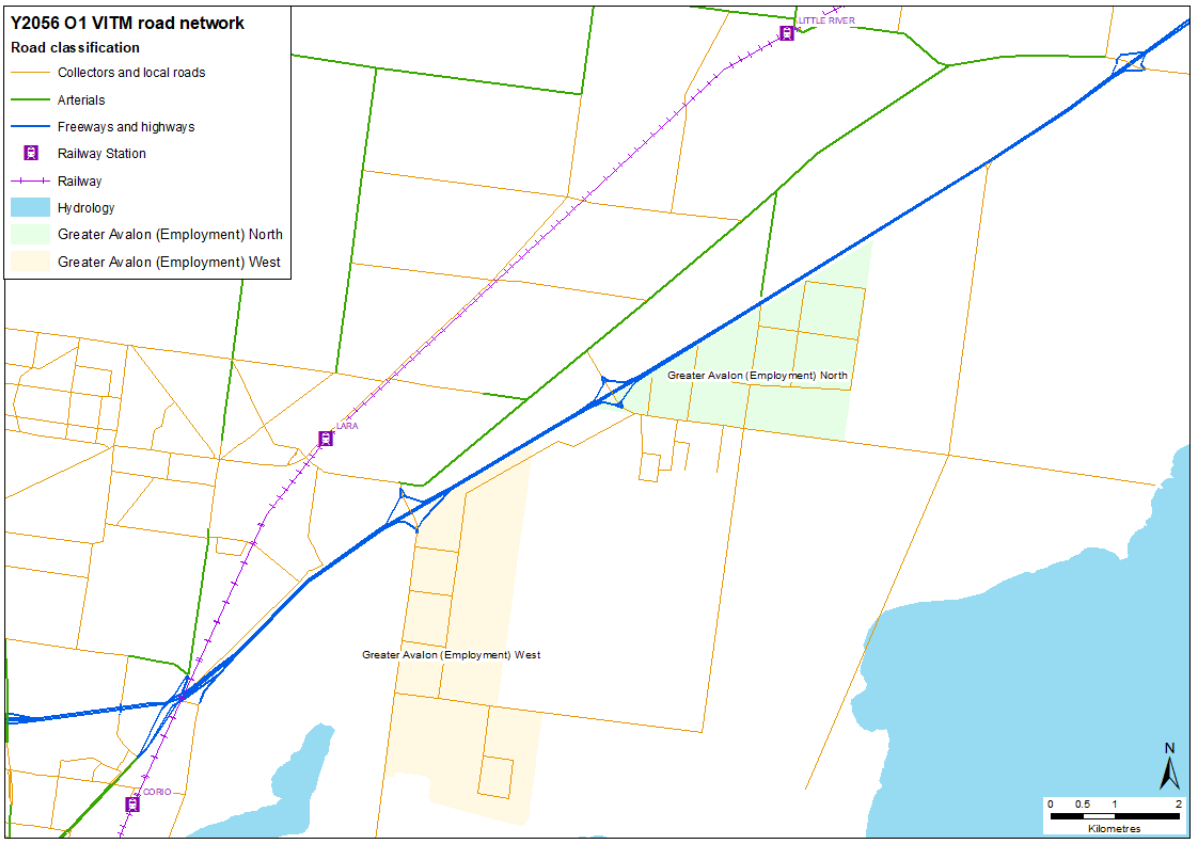


Figure 3-6: 2056 Options 1A and 1B - road network classification

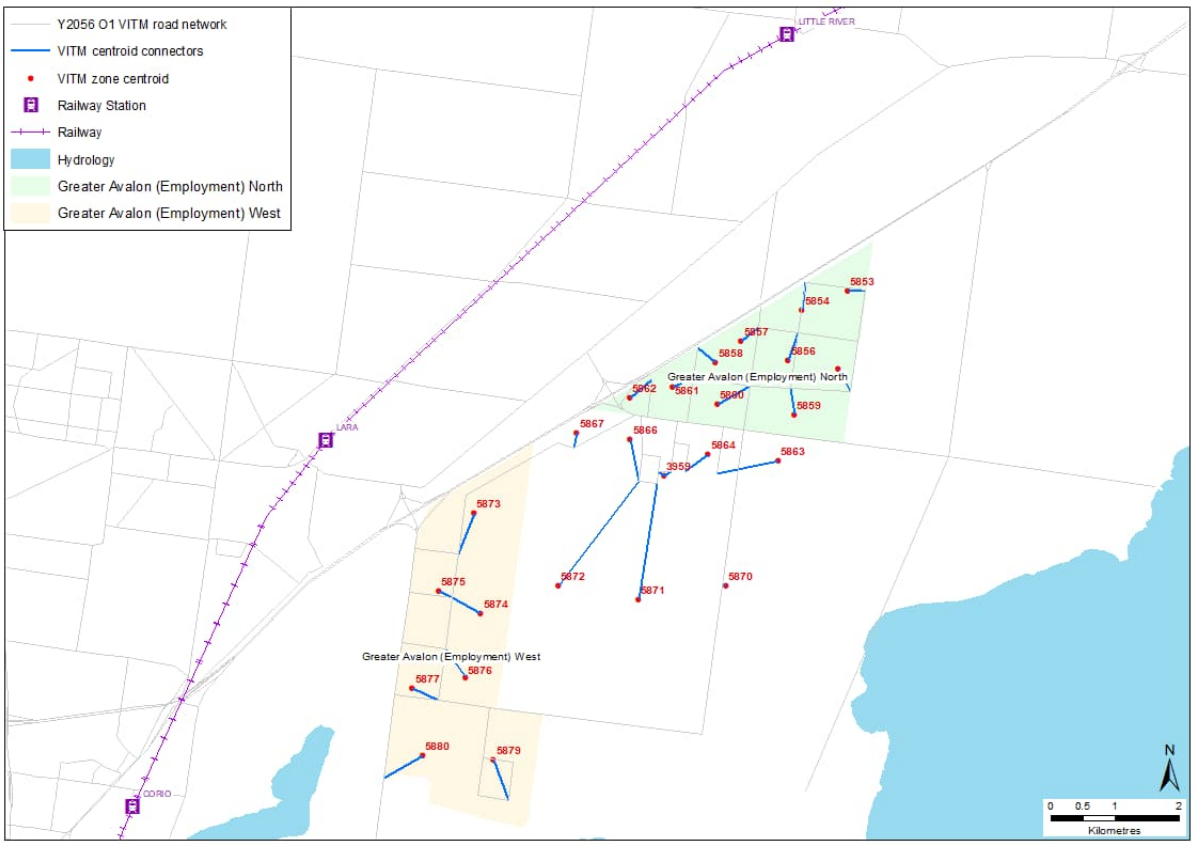


Figure 3-7: 2056 Options 1A and 1B - zone centroids

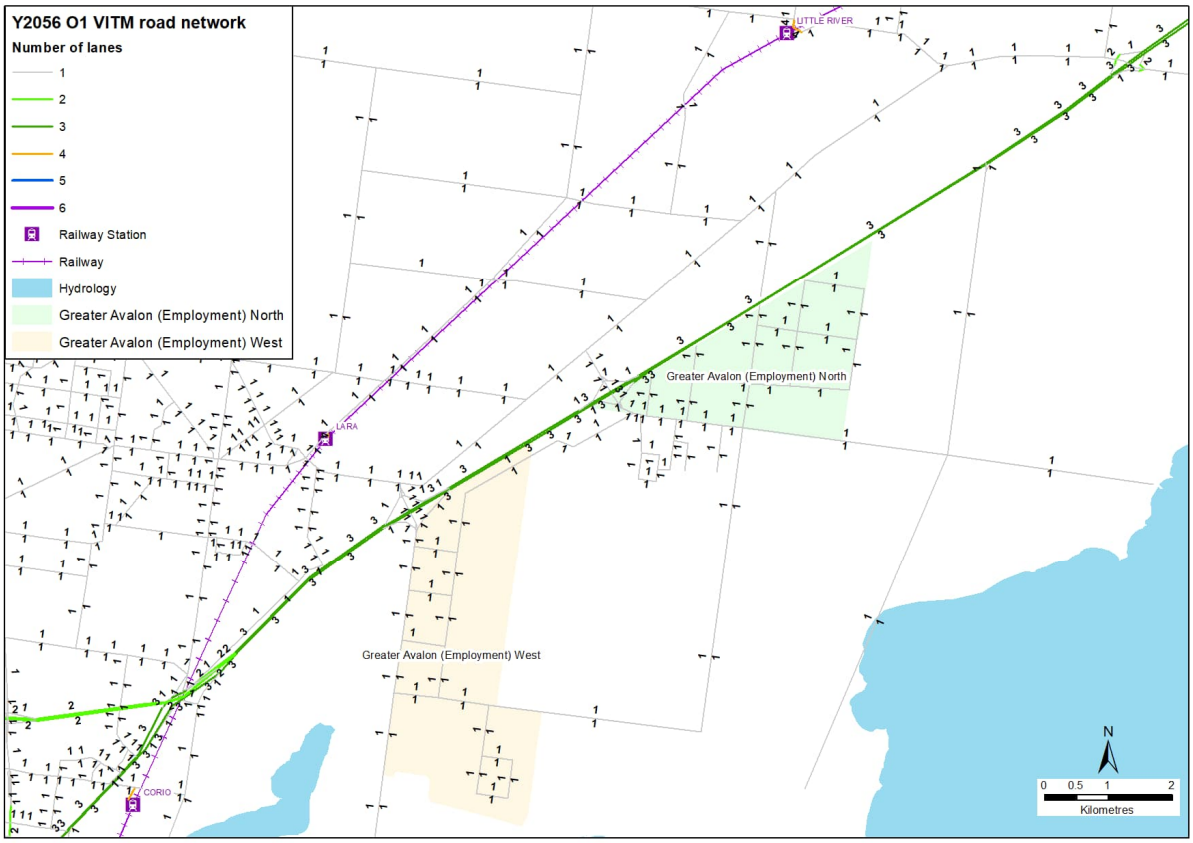


Figure 3-8: 2056 Options 1A and 1B - road network number of lanes

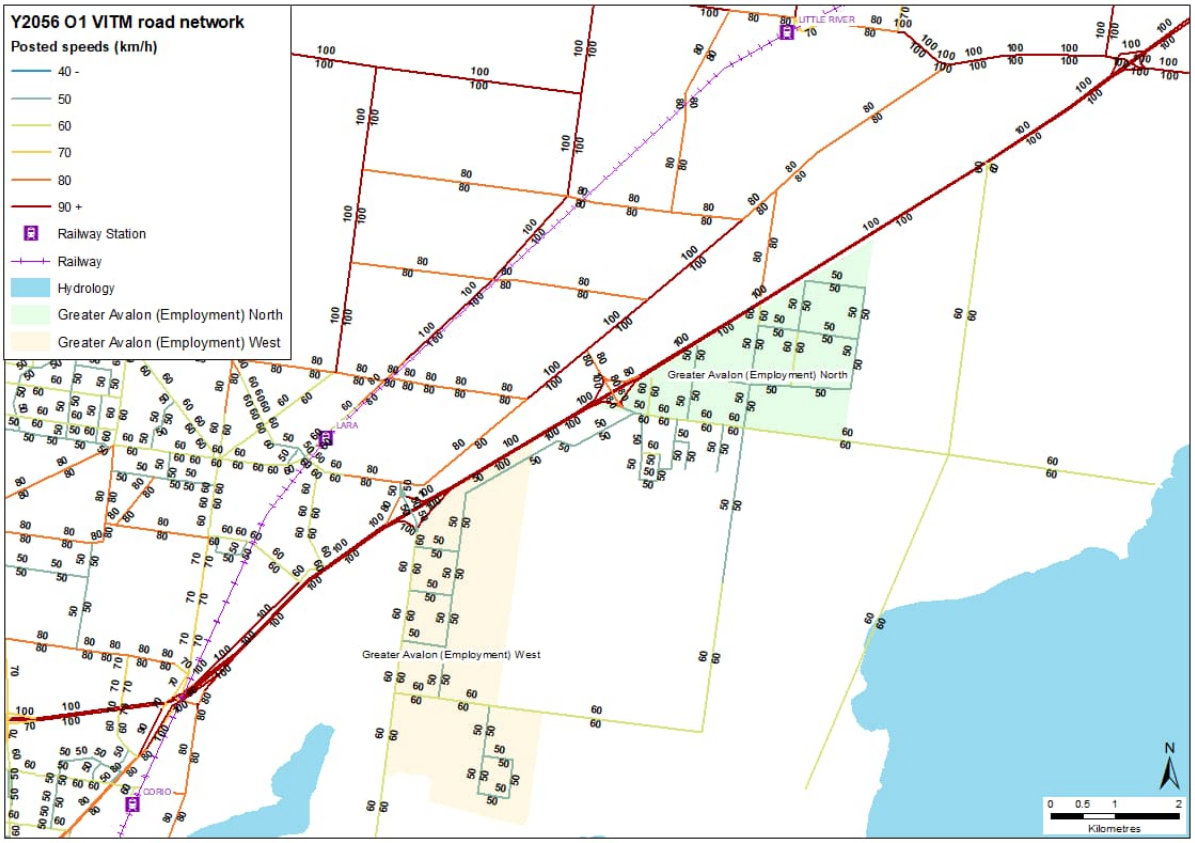


Figure 3-9: 2056 Options 1A and 1B - posted speed limits

3.1.3 Option 2 Road Network

The network for 2056 Options 2A and 2B is described in the following plots:

- Road classification (Figure 3-10)
- Zone centroids (Figure 3-11)
- Lane configuration (Figure 3-12)
- Posted speed limits (Figure 3-13)

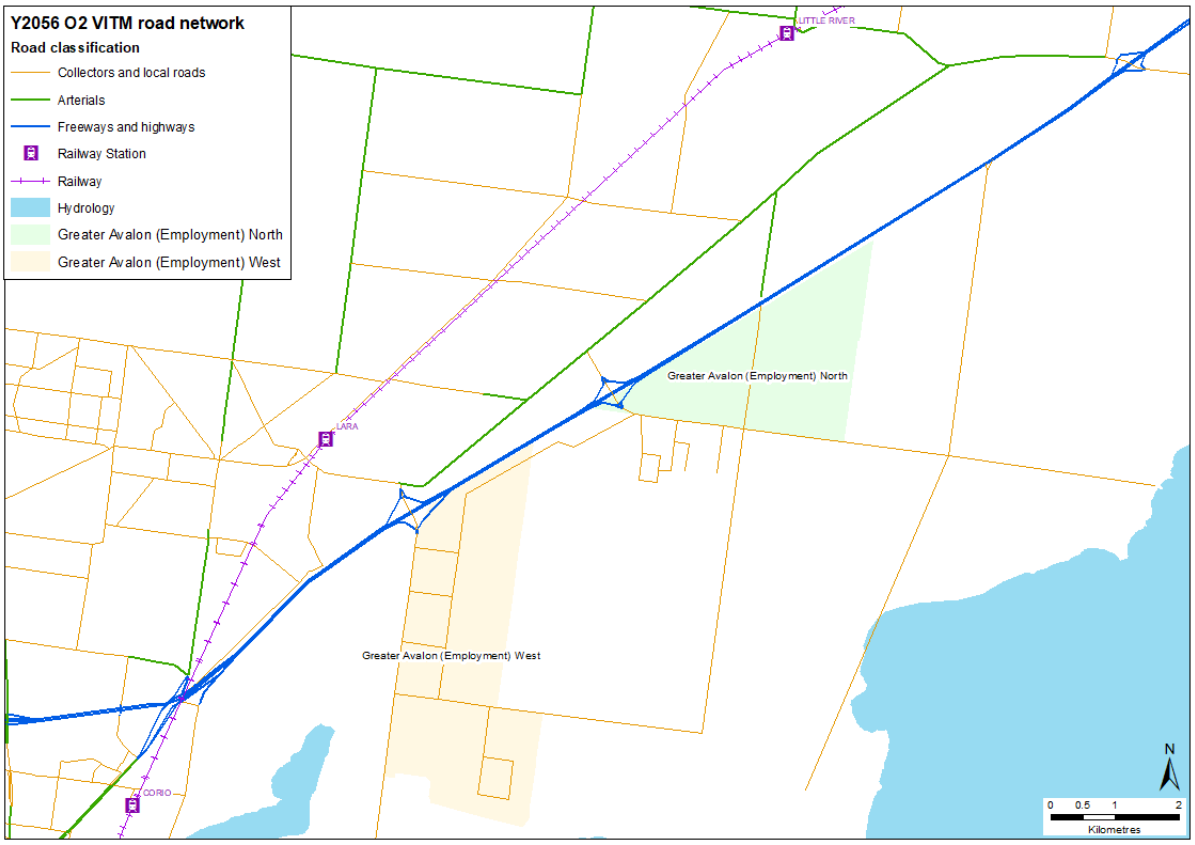


Figure 3-10: 2056 Options 2A and 2B - road network classification

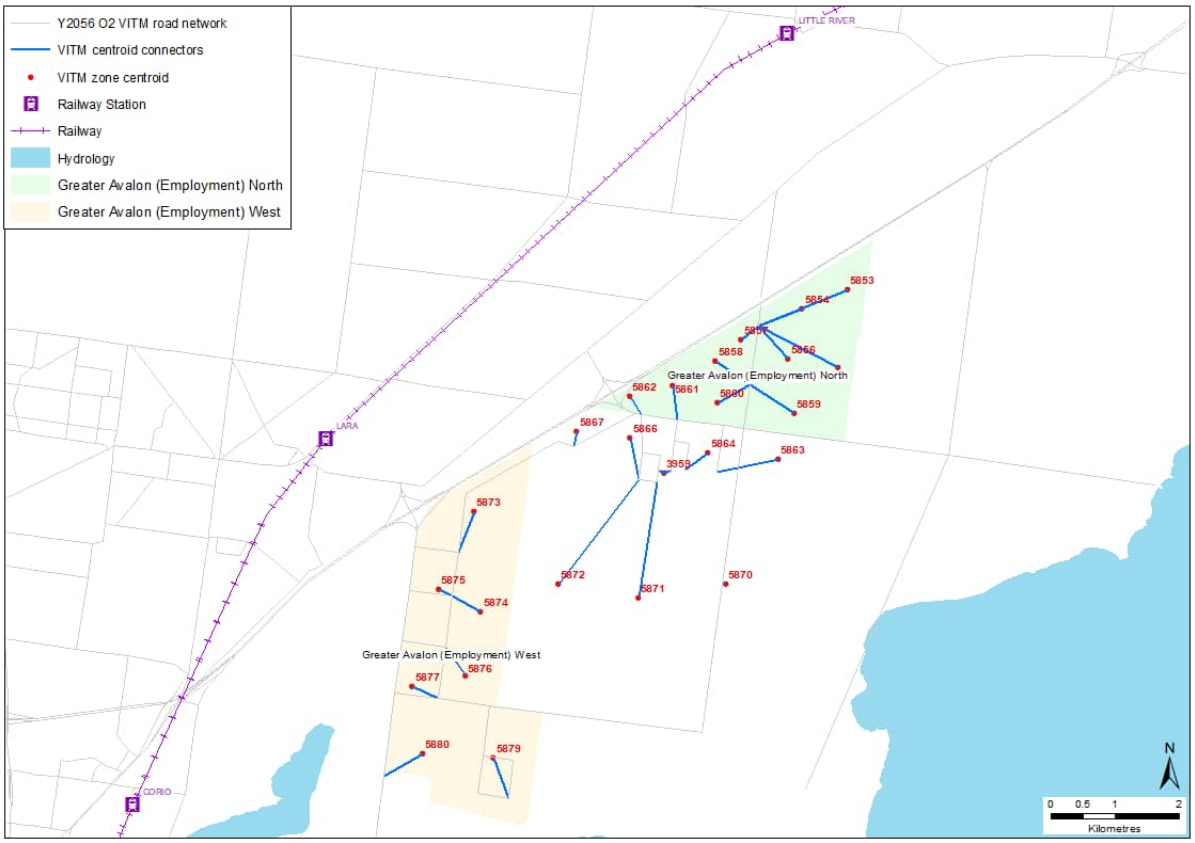


Figure 3-11: 2056 Options 2A and 2B - zone centroids

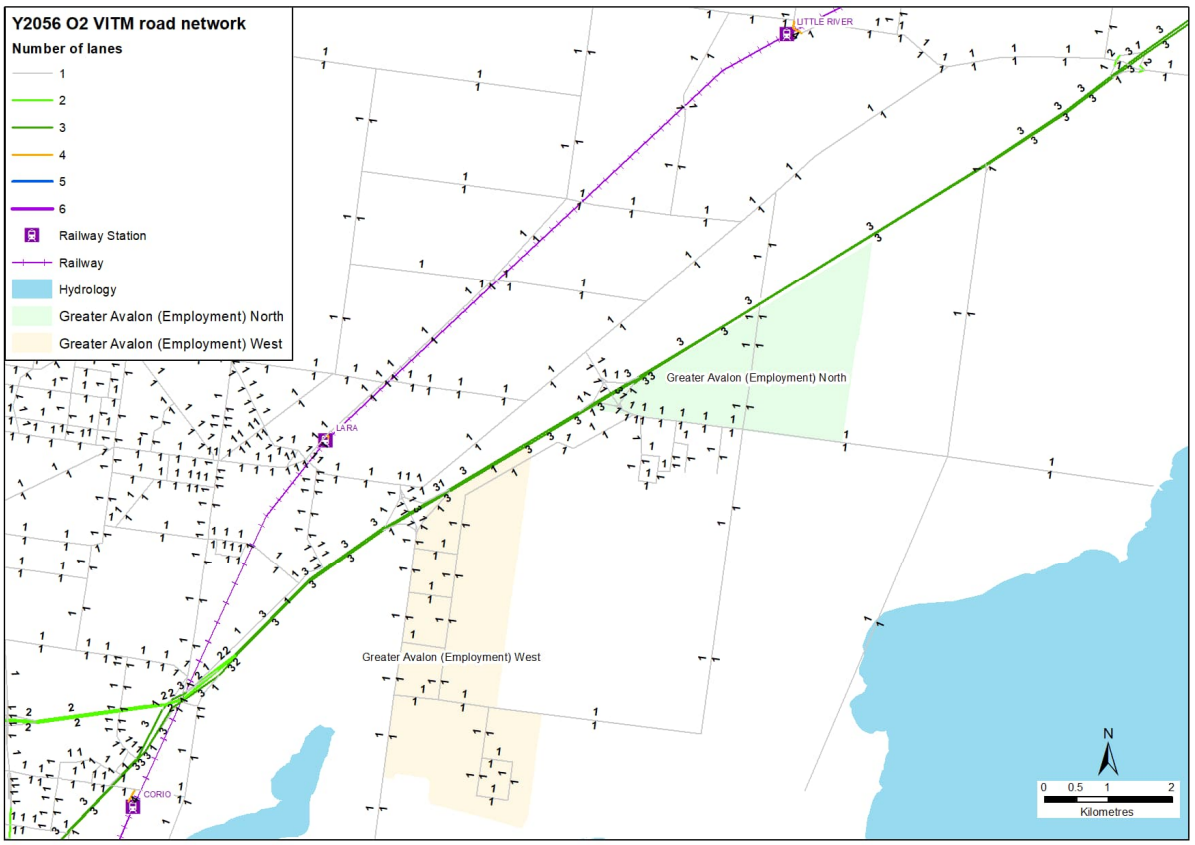


Figure 3-12: 2056 Options 2A and 2B - road network number of lanes

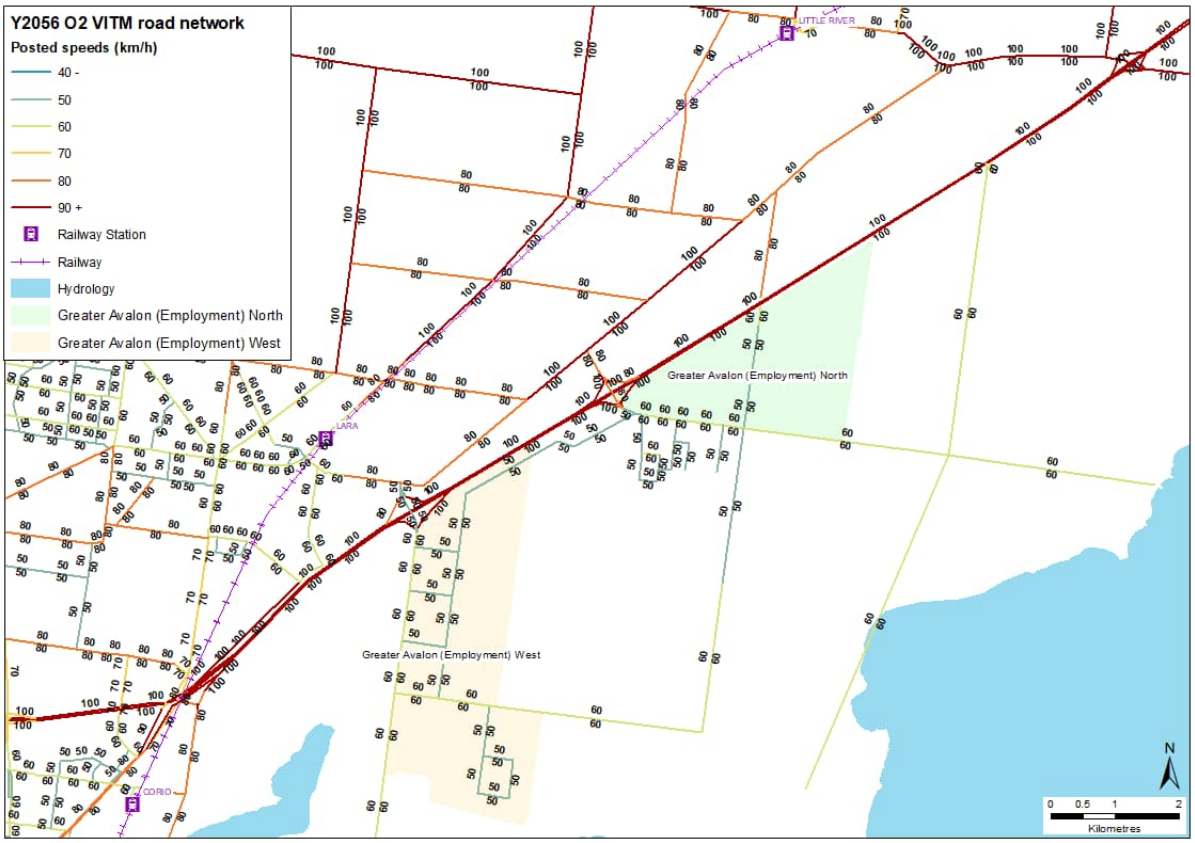


Figure 3-13: 2056 Options 2A and 2B - posted speed limits

3.2 Future Public Transport Network

The 2056 VITM Reference Case public transport network has been expanded to include bus services connecting GAEP-N and GAEP-W to Lara Station and Avalon Airport. These additions are shown in Figure 3-14, the new GAEP-W service is included in all options, whereas the GAEP-N service is only included in Option1A and 1B. It is assumed that both services will run at a 30min frequency all day. These details are set out in Table 3-1.

Note that the role of the network is to ensure bus capable routes, bus frequencies will be set by DTP on a as needs basis in the future.

It is noted that there is a Public Acquisition Overlay (PAO) for a potential future rail spur line to Avalon Airport which would pass through zone 5861. DTP advised that there are currently no plans to activate this in the long term and it has not been considered as part of this study.

Table 3-1: New bus service details

Route	Description	Frequency	Base	Option 1A	Option 1B	Option 2A	Option 2B
GAEP-N	Lara Station to GAEP North via Beach Road (+ reverse direction)	30 minutes all day	×	✓	✓	×	×
GAEP-W	Lara Station to GAEP west via Avalon Road then to Avalon Airport employment precinct (+ reverse direction)	30 minutes all day	×	✓	✓	✓	✓

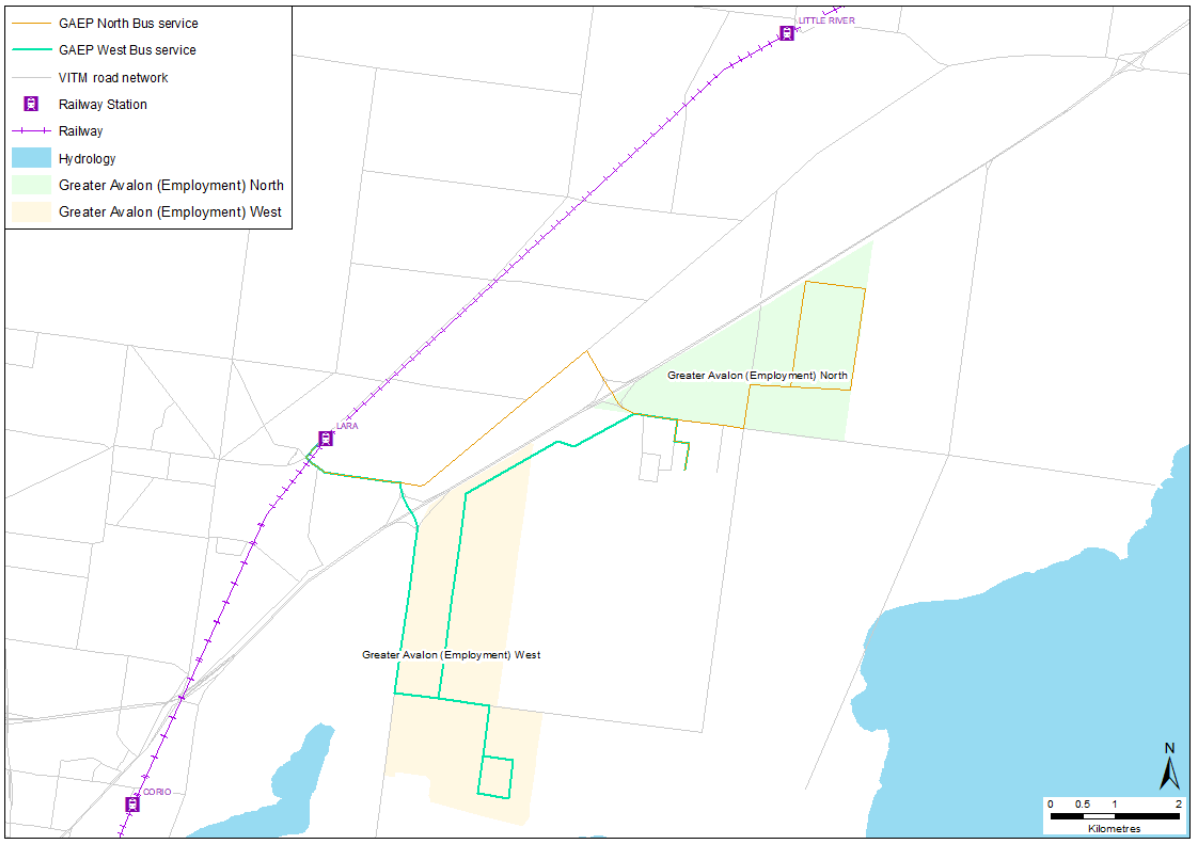


Figure 3-14: 2056 additional GAEP bus services

3.3 Future Land Use

A summary of the employment assumptions for the study area for both 2018 and 2056 (full build out) are shown in Table 3-3. As indicated by the DTP, about 64% of both precincts is considered developable area. There are no residents or school enrolments within these zones. The Avalon Airport air passenger terminal is located in zone 3959 and is further described in Section 3.4. Staff are assumed to report to work in zone 5864, hence there is no employment in the terminal zone.

It is noted that a potential Victorian Home of Motorsport has been proposed for the precinct, however, minimal information is available that would enable it to be considered for modelling purposes.

Table 3-2: Zonal land use data for the GAEP study area (by job type)

TZN	Region	2018 Emp.	2056 Employment by type (full build out)								
			IC3	IC7	IC8	IC9	IC11	IC12	IC13	IC14	Total
5853	North	-	369	-	-	784	-	-	-	-	1,153
5854	North	-	411	-	-	873	-	-	-	-	1,284
5855	North	-	220	-	-	467	-	-	-	-	687
5856	North	-	558	-	-	1,186	-	-	-	-	1,744
5857	North	-	121	-	-	257	-	-	-	-	378
5858	North	-	212	-	-	451	-	-	-	-	663
5859	North	-	340	-	-	721	-	-	-	-	1,061
5860	North	-	332	-	-	704	-	-	-	-	1,036
5861	North	-	113	291	291	241	-	194	97	97	1,324
5862	North	-	-	202	202	-	-	135	67	67	673
5863	Airport	-	81	-	-	366	-	-	-	-	447

TZN	Region	2018 Emp.	2056 Employment by type (full build out) IC3	IC7	IC8	IC9	IC11	IC12	IC13	IC14	Total
5864	Airport	481	76	-	-	941	-	-	-	-	1,017
3959	Airport	-	-	-	-	-	-	-	-	-	-
5866	Airport	-	-	-	-	-	487	-	487	244	1,218
5867	Airport	-	-	300	200	-	233	-	233	116	1082
5870	Airport	-	389	-	-	1,749	-	-	-	-	2,138
5871	Airport	-	-	-	-	-	-	-	-	-	-
5872	Airport	-	283	-	-	1,275	-	-	-	-	1,558
5873	West	-	608	-	-	1,291	-	-	-	-	1,899
5874	West	-	232	-	-	493	-	-	-	-	725
5875	West	-	456	-	-	968	-	-	-	-	1424
5876	West	-	350	-	-	744	-	-	-	-	1,094
5877	West	-	224	-	-	476	-	-	-	-	700
5878	Airport	-	171	-	-	769	-	-	-	-	940
5879	West	-	674	-	-	1,431	-	-	-	-	2,105
5880	West	-	4	-	-	9	-	-	-	-	13
5881	West	-	-	-	-	-	-	-	-	-	-
Total GAEP-North		-	2,675	493	493	5,685	-	329	164	164	10,003
Total GAEP-West		-	2,547	-	-	5,413	-	-	-	-	7,960
Avalon Airport		481	1,000	300	200	5,100	720	-	720	360	8,400
Total GAEP-W + GAEP-N and AVV		481	6,222	793	693	16,198	720	329	884	524	26,363

IC3 = Manufacturing
IC7 = Retail trade
IC8 = Accommodation and Food Services
IC9 = Transport, Postal and Warehousing
IC11 = Financial and Insurance Services
IC12 = Rental, Hiring and Real Estate Services
IC13 = Professional, Scientific and Technical Services
IC14 = Administrative and Support Services

A summary of the employment assumptions for each of the 2056 scenarios are shown in Table 3-3.

Table 3-3: Zonal land use data for the GAEP study area (by scenario)

TZN	Region	2056 Base	Option 1A	Option 1B	Option 2A	Option 2B
5853	North	-	1,153	1,153	-	-
5854	North	-	1,284	1,284	-	-
5855	North	-	687	687	-	-
5856	North	-	1,744	1,744	-	-
5857	North	-	378	378	-	-
5858	North	-	663	663	-	-
5859	North	-	1,061	1,061	-	-
5860	North	-	1,036	1,036	-	-
5861	North	-	1,324	1,324	-	-
5862	North	-	673	673	-	-
5863	Airport	447	447	447	447	447
5864	Airport	1,017	717	1,017	717	1,017
3959	Airport	-	-	-	-	-

TZN	Region	2056 Base	Option 1A	Option 1B	Option 2A	Option 2B
5866	Airport	1,218	1,218	1,218	1,218	1,218
5867	Airport	1,082	1,082	1,082	1,082	1,082
5870	Airport	2,138	2,138	2,138	2,138	2,138
5871	Airport	-	-	-	-	-
5872	Airport	1,558	1,558	1,558	1,558	1,558
5873	West	-	1,899	1,899	1,899	1,899
5874	West	-	725	725	725	725
5875	West	-	1,424	1,424	1,424	1,424
5876	West	-	1,094	1,094	1,094	1,094
5877	West	-	700	700	700	700
5878	Airport	940	940	940	940	940
5879	West	-	2,105	2,105	2,105	2,105
5880	West	-	13	13	13	13
5881	West	-	-	-	-	-
Total GAEP-North		-	10,003	10,003	-	-
Total GAEP-West		-	7,960	7,960	7,960	7,960
Avalon Airport		8,400	8,100	8,400	8,100	8,400
Total GAEP-W + GAEP-N + AVV		8,400	26,063	26,363	16,060	16,360

It is worth noting that both the council of Greater Geelong, which contains the study area, and the adjacent council of Wyndham are projected to be one of the fastest growing metropolitan and regional local council areas in Victoria, in terms of absolute population growth, as shown in Figure 3-15. This growth will have a large impact on the amount of background traffic around the study area, particularly the Princes Freeway.

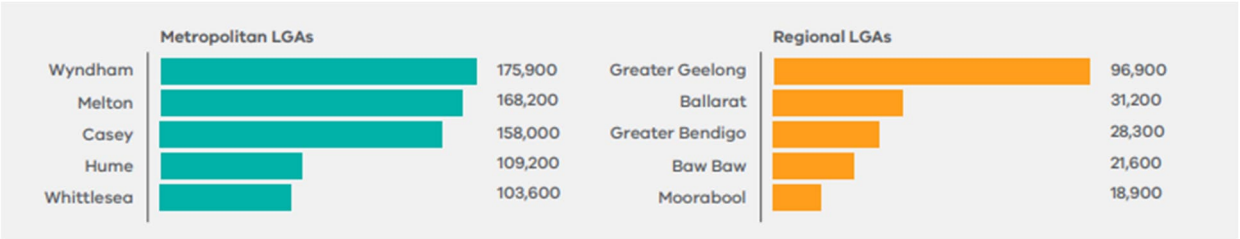


Figure 3-15: Population growth, 2021 to 2036, Metropolitan and Regional Local Government Areas[3]

3.4 Avalon Airport Assumptions

After converting the annual air passenger projections into daily vehicles using the assumptions set out in Appendix A.3.2. The number of vehicles shown in Table 3-4 were added to VITM before the Highway assignment. More detail on the process is provided in Appendix A.

Table 3-4: Avalon Airport Air Passenger Vehicle Trips

	2056 Base	Option 1A	Option 1B	Option 2A	Option 2B
Daily vehicles (in and out)	24,141	12,070	24,141	12,070	24,141

[3] Victorian in Future 2023, source: Victoria in Future 2023 Population and Household Projections to 2051 November 2023

4. 2056 Model Performance

This study considered the following five scenarios, outputs for each are presented in their own section and then comparisons are made in Section 4.6.

- 2056 Base (Section 4.1)
- 2056 Option 1A (Section 4.2)
- 2056 Option 1B (Section 4.3)
- 2056 Option 2A (Section 4.4)
- 2056 Option 2B (Section 4.5)

4.1 2056 Base Case

4.1.1 Model Inputs

The 2056 Base Case scenario adopts the following key model assumptions:

- Demographics – no development within the GAEP-North or GAEP-West (refer to Table 3-3)
- Avalon Airport – assumed to be at full build out with 9.66 million annual air passengers
- Road Network – adopts the existing road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.1.

4.1.2 Model Outputs

The performance of the 2056 base model is presented in this section from Figure 4-1 to Figure 4-6. This scenario sets the platform for the performance of the transport network in the absence of development occurring in GAEP-W or GAEP-N, but with the Avalon Airport at full build out.

Figure 4-4 (AM peak) and Figure 4-5 (PM peak) highlight that the Princes Freeway is at capacity and the Beach Road interchange and roads around Avalon Airport are over capacity.

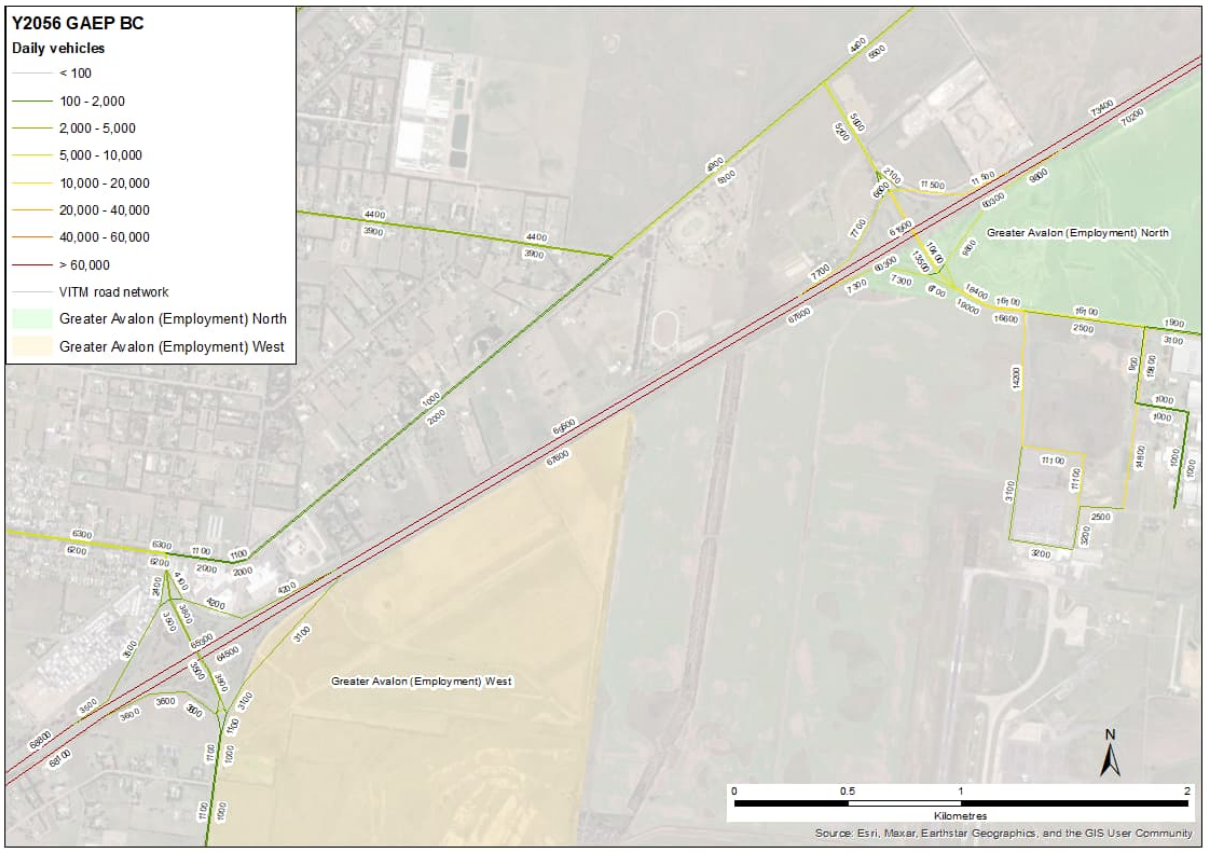


Figure 4-1: 2056 Base, Daily Vehicle Volumes

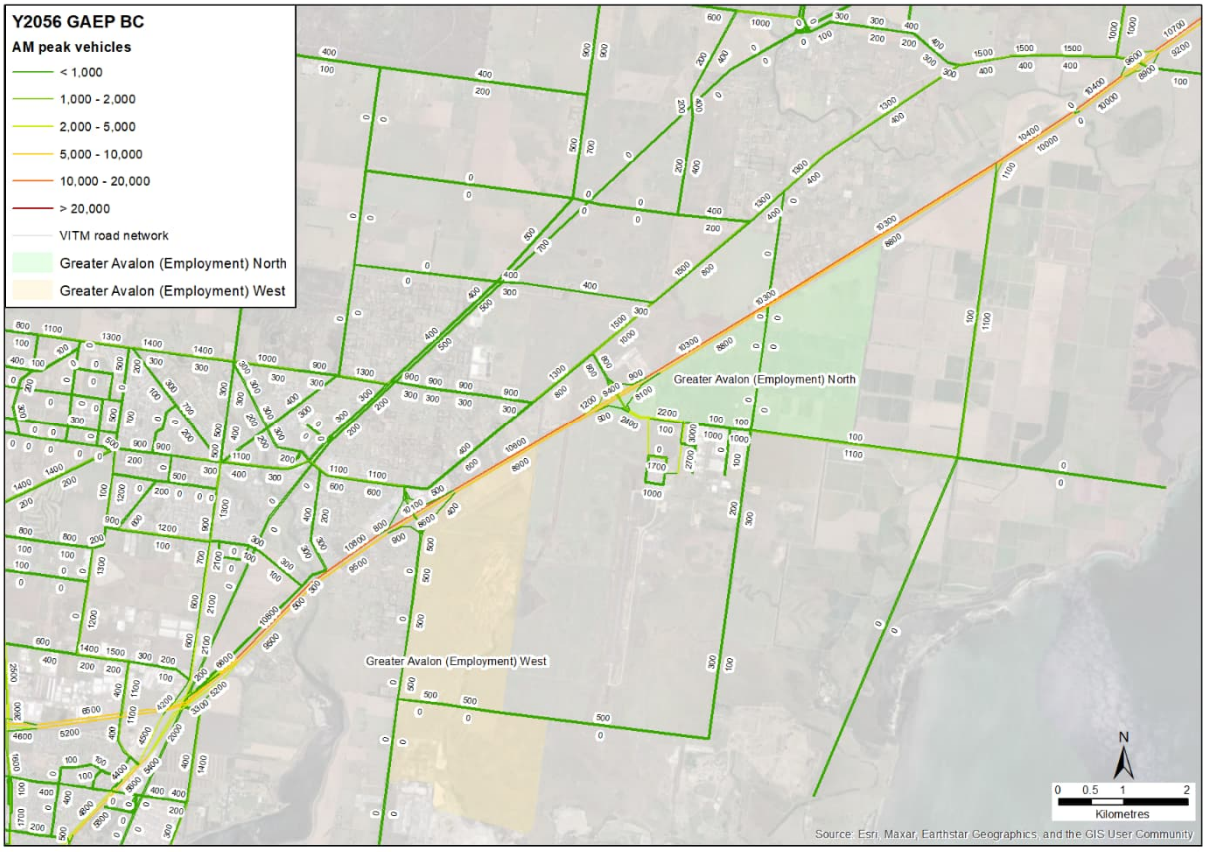


Figure 4-2: 2056 Base, AM Peak Volumes

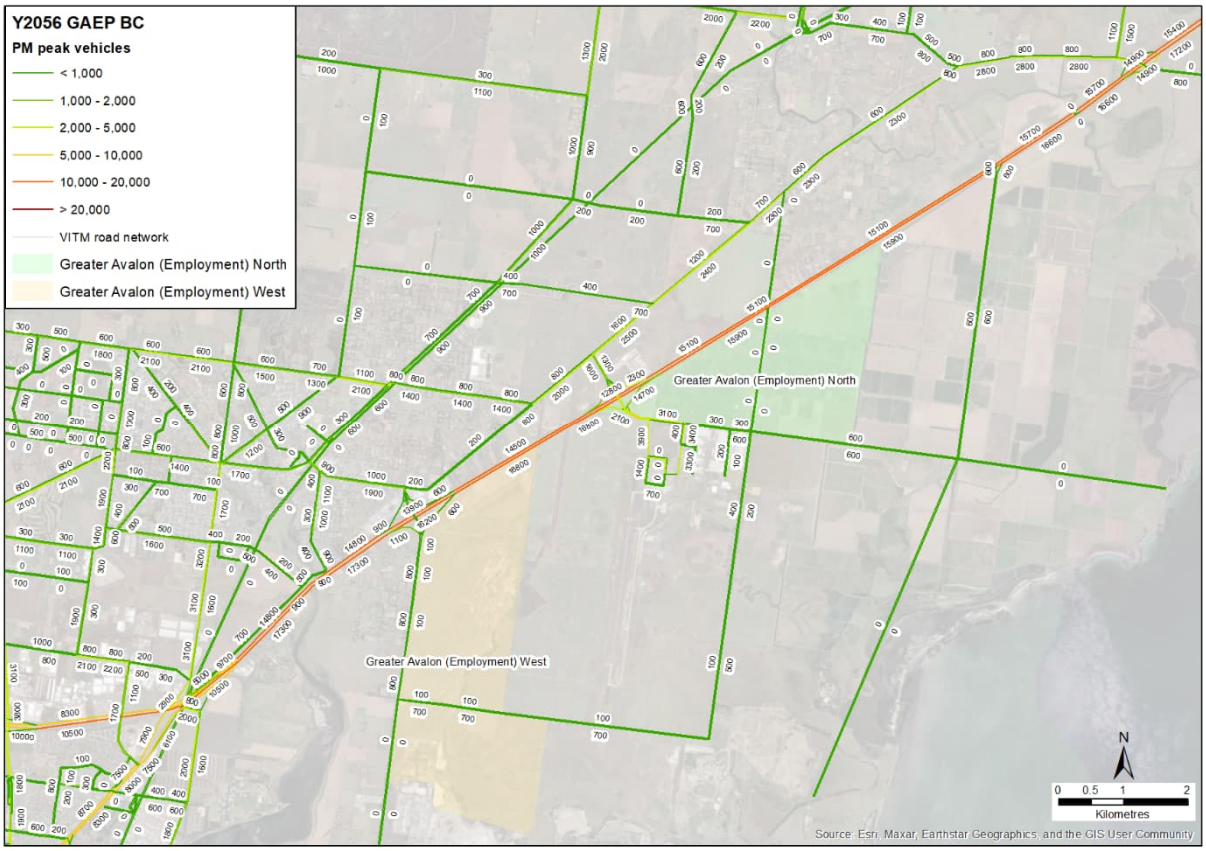


Figure 4-3: 2056 Base, PM Peak Volumes

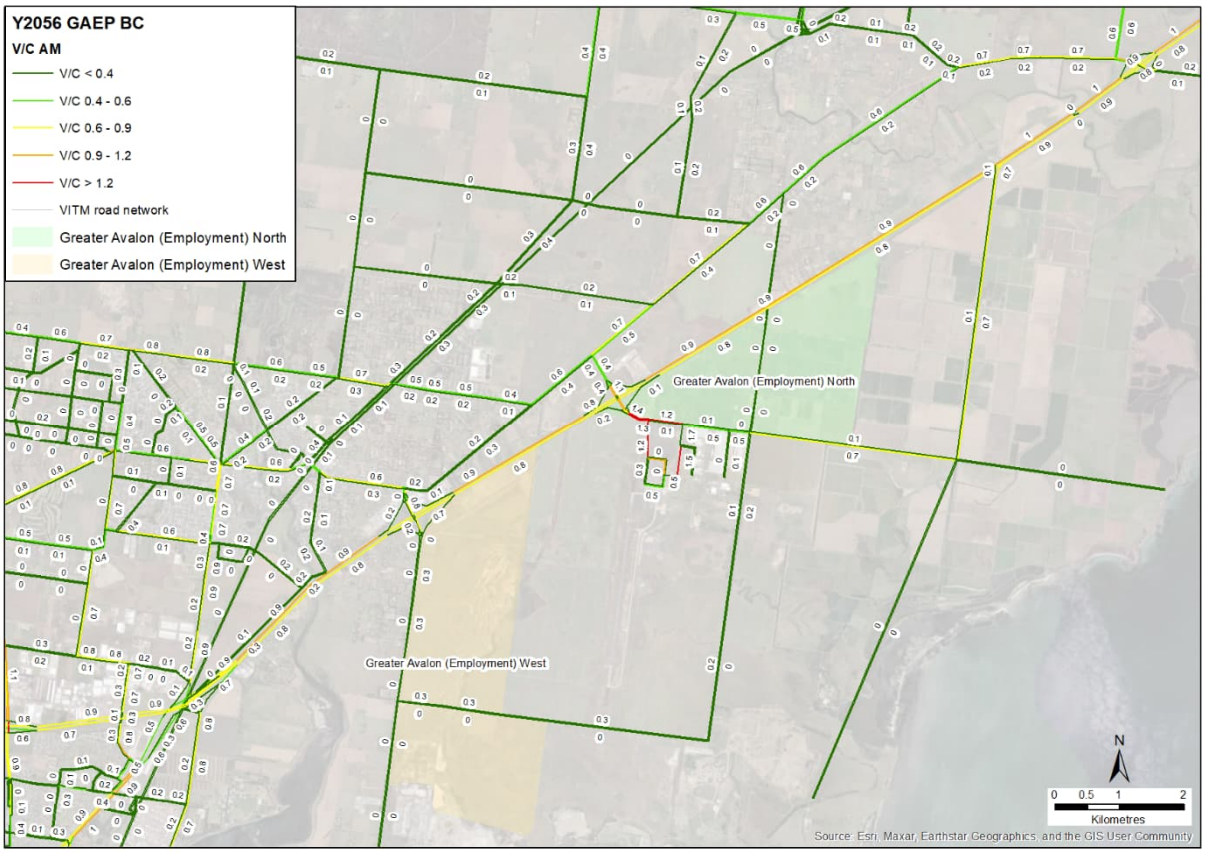


Figure 4-4: 2056 Base, AM Peak Volume / Capacity Ratios

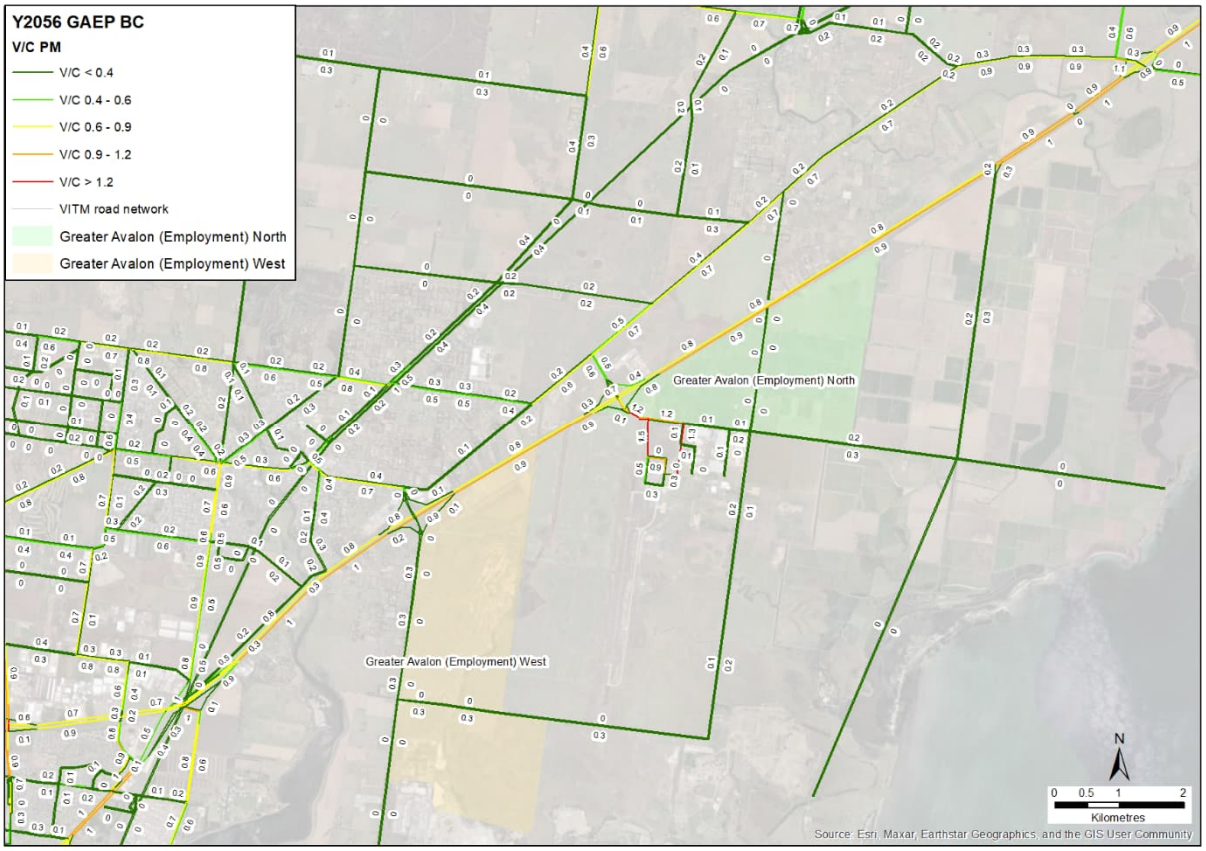


Figure 4-5: 2056 Base, PM Peak Volume / Capacity Ratios

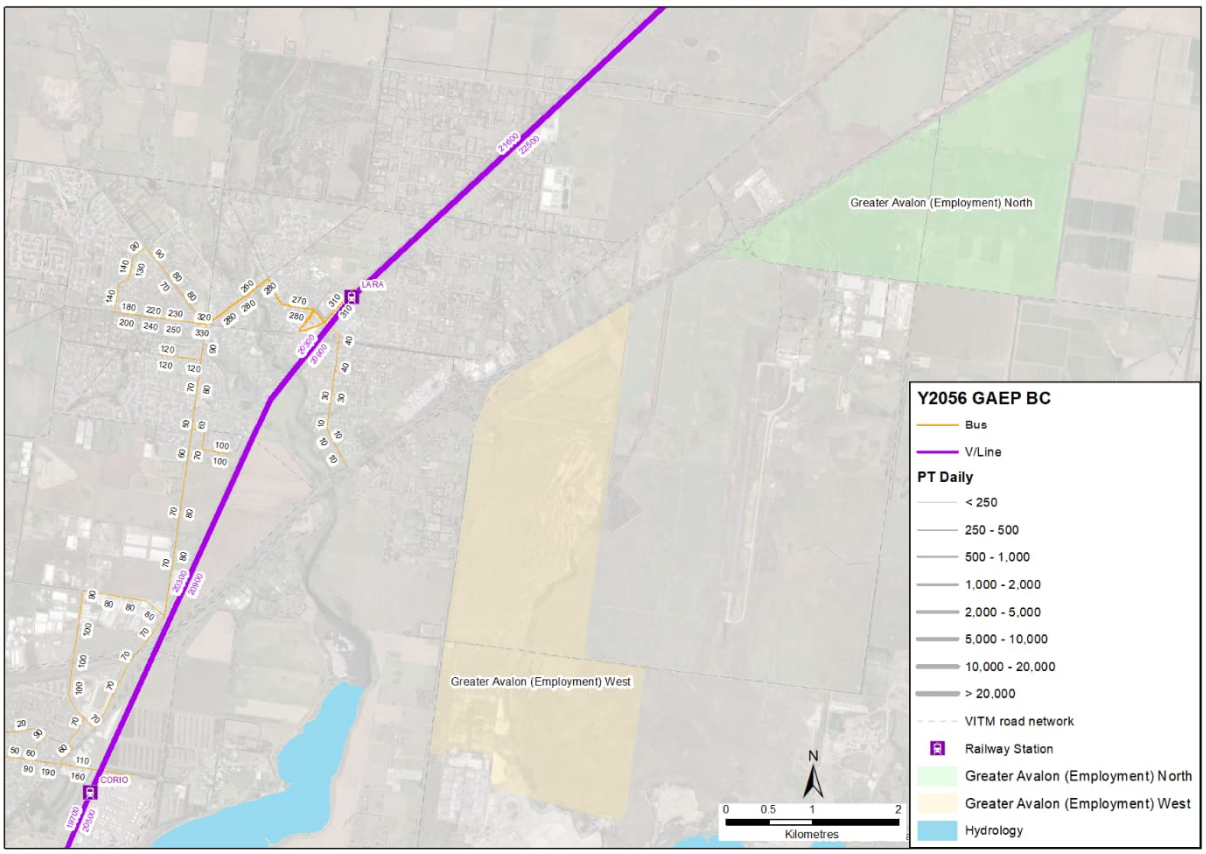


Figure 4-6: 2056 Base, Daily Public Transport Volumes

4.2 2056 Option 1A

4.2.1 Model Inputs

The 2056 Option 1A scenario adopts the following key model assumptions.

- Demographics – full development within both GAEP-North and GAEP-West (refer to Table 3-3)
- Avalon Airport – assumed to be at 50% build out with 4.83 million annual air passengers
- Road Network – adopts an updated road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.2.

4.2.2 Model Outputs

The performance of the 2056 Option 1A scenario is presented in this section from Figure 4-7 to Figure 4-12, to assist with the review of the transport needs for the study area with the GAEP fully developed and Avalon Airport at 50% build out.

Figure 4-10 (AM peak) and Figure 4-11 (PM peak) highlight that the Princes Freeway is at capacity, the Beach Road and Avalon Road interchanges are overcapacity, roads around Avalon Airport are over capacity and Point Wilson Road is approaching capacity. The issues are most pronounced in the PM peak. The internal road networks for GAEP-W and GAEP-N are appropriate.

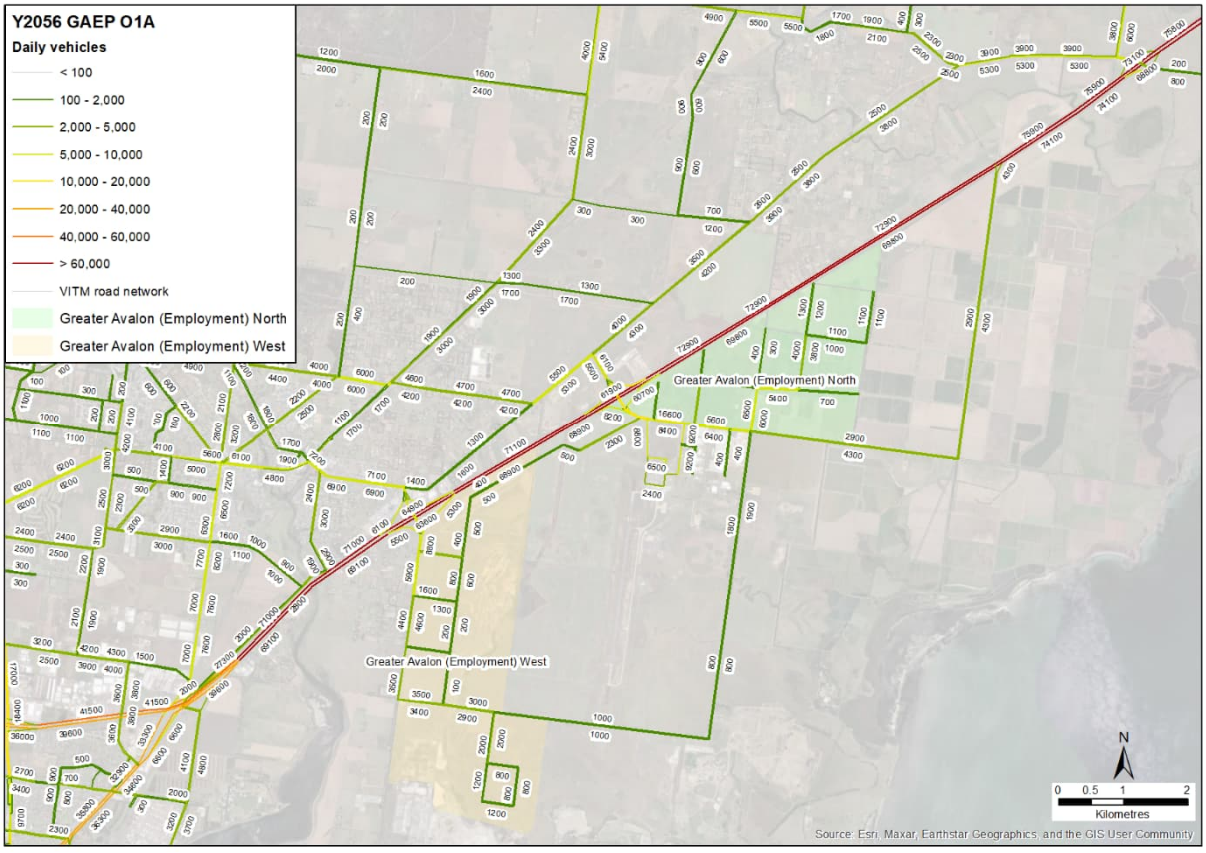


Figure 4-7: 2056 Option 1A, Daily Vehicle Volumes

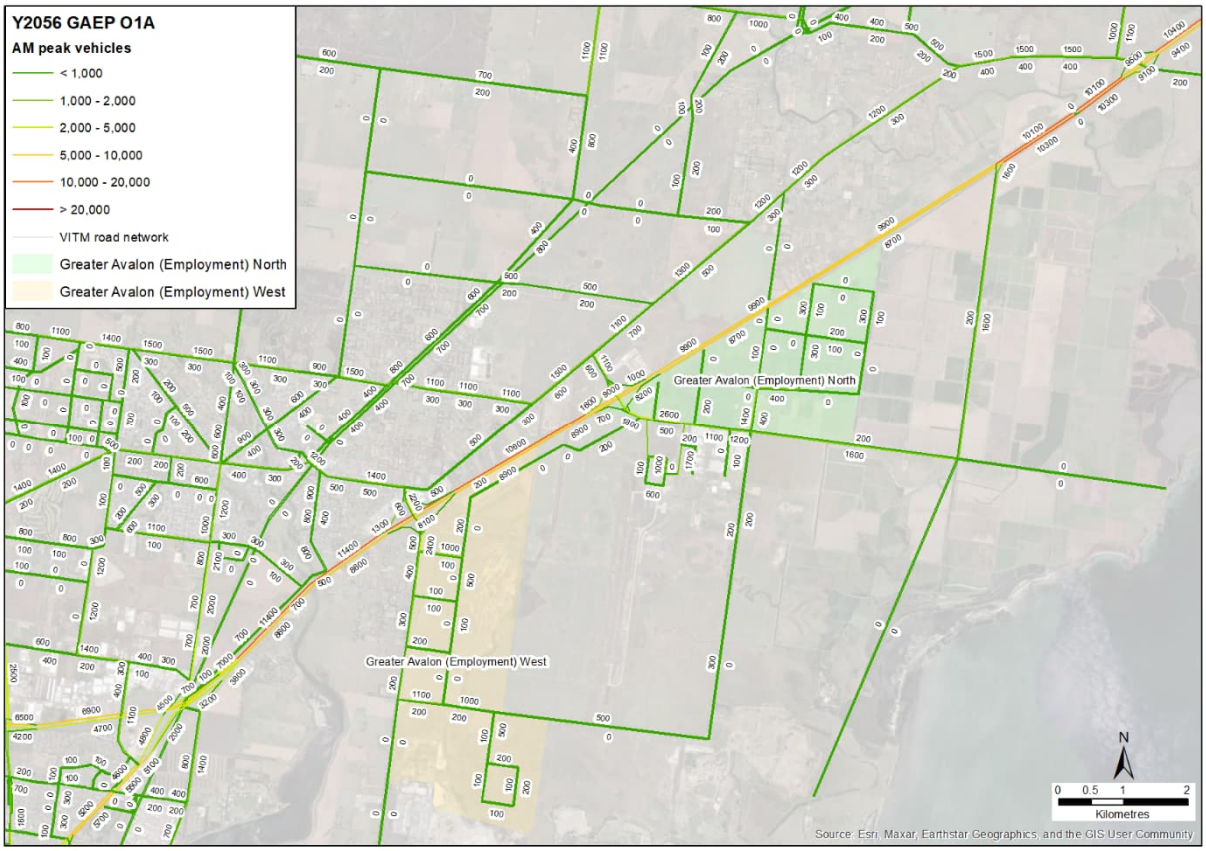


Figure 4-8: 2056 Option 1A, AM Peak Volumes

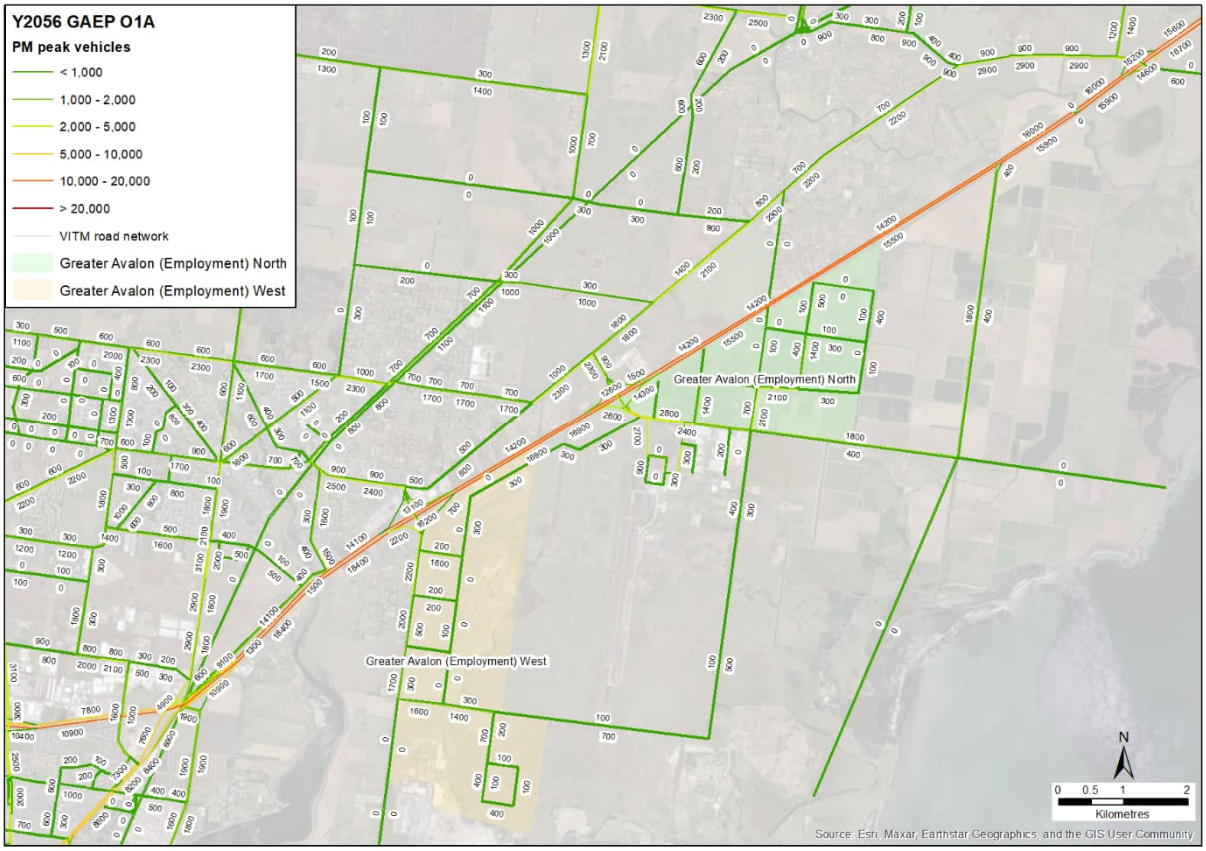


Figure 4-9: 2056 Option 1A, PM Peak Volumes

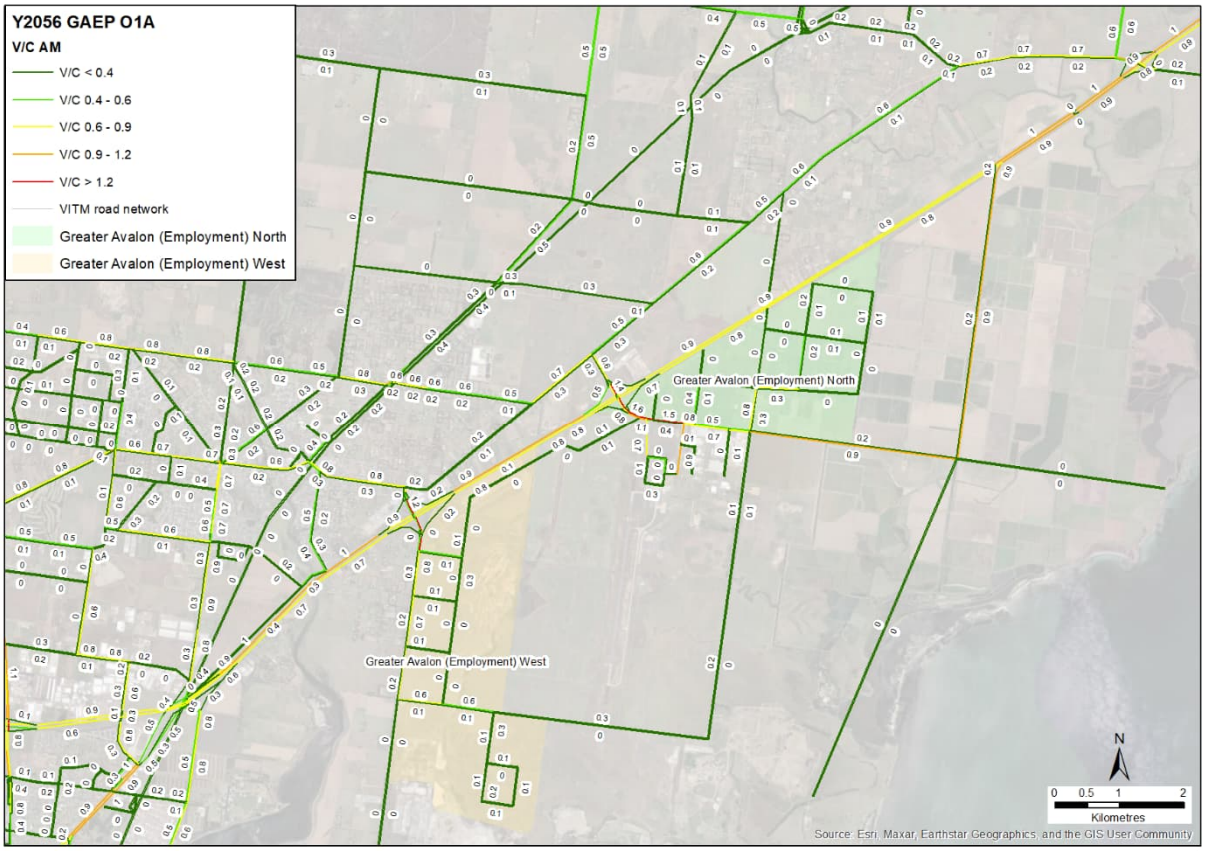


Figure 4-10: 2056 Option 1A, AM Peak Volume / Capacity Ratios

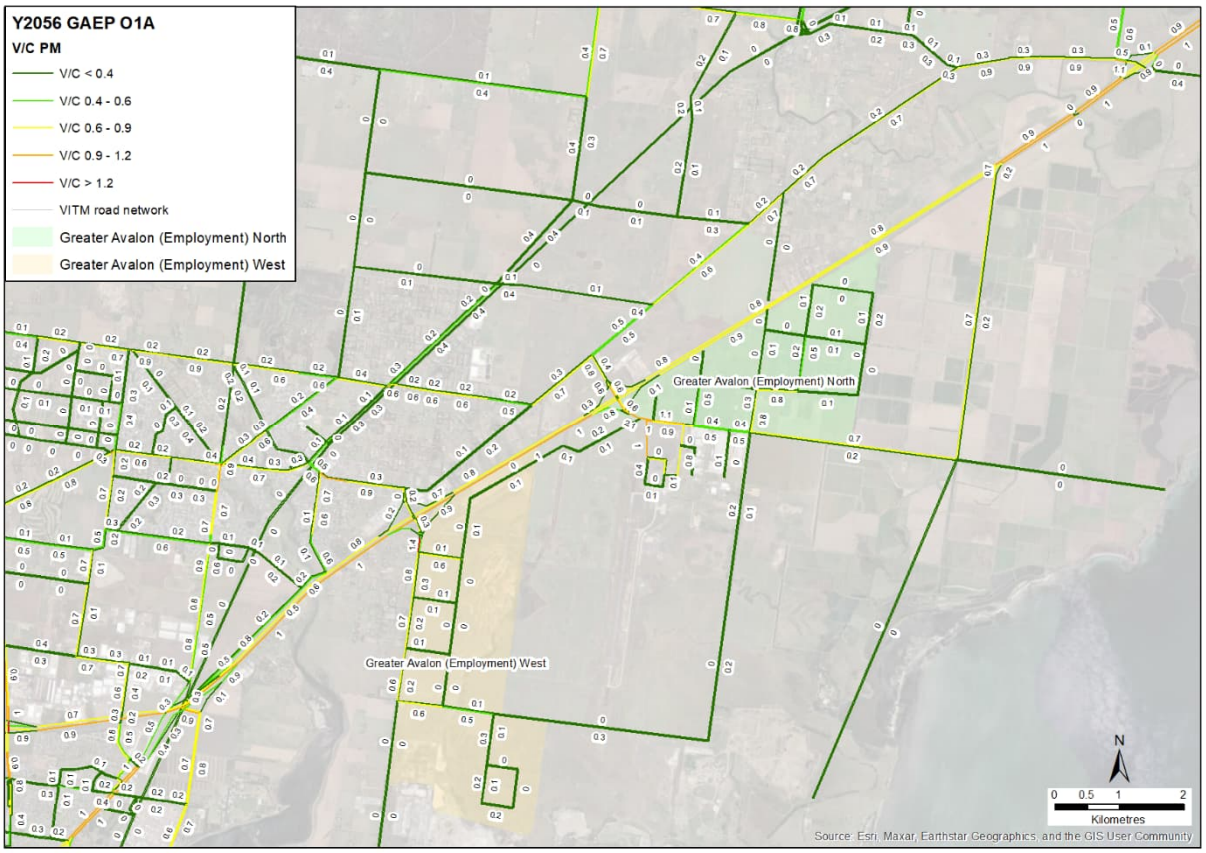


Figure 4-11: 2056 Option 1A, PM Peak Volume / Capacity Ratios

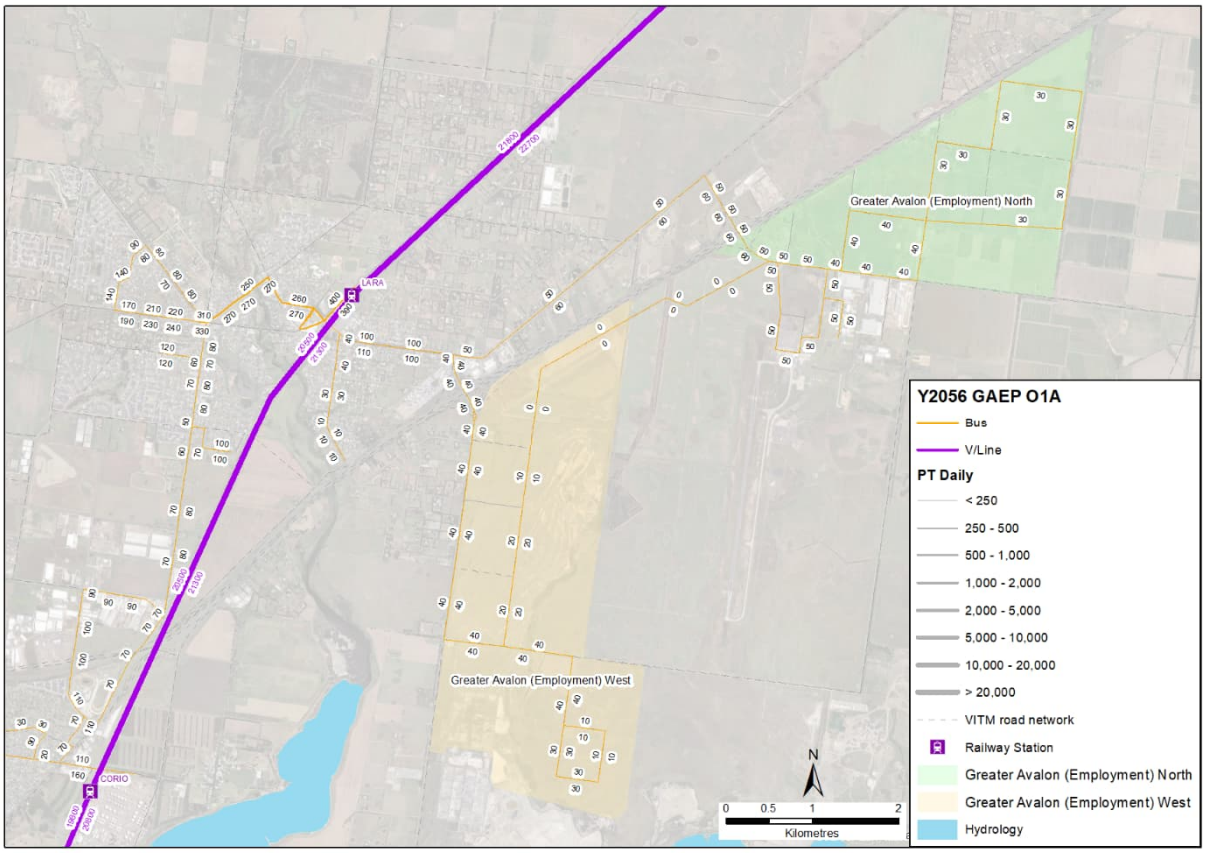


Figure 4-12: 2056 Option 1A, Daily Public Transport Volumes

4.3 2056 Option 1B

4.3.1 Model Inputs

The 2056 Option 1B scenario adopts the following key model assumptions.

- Demographics – full development within both GAEP-North and GAEP-West (refer to Table 3-3)
- Avalon Airport – assumed to be at full build out with 9.66m annual air passengers
- Road Network – adopts an updated road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.2.

4.3.2 Model Outputs

The performance of the 2056 Option 1B scenario is presented in this section from Figure 4-13 to Figure 4-18, to assist with the review of the transport needs for the study area with the GAEP fully developed and Avalon Airport at full build out.

Figure 4-16 (AM peak) and Figure 4-17 (PM peak) highlight that the Princes Freeway is at capacity, the Beach Road and Avalon Road interchanges are overcapacity, roads around Avalon Airport are over capacity and Point Wilson Road is at capacity. The issues are more pronounced in the PM peak and are slightly worse than Option 1A. The internal road networks for GAEP-W and GAEP-N are appropriate.

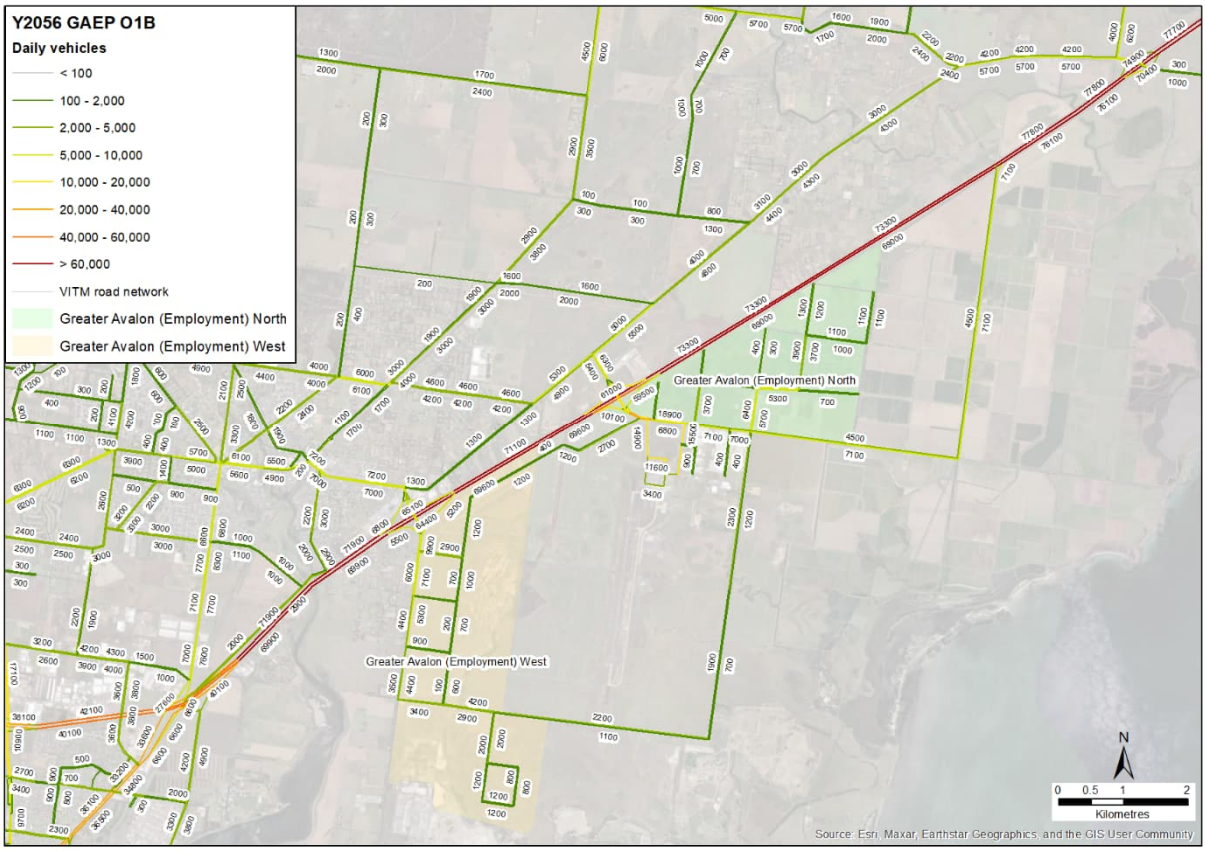


Figure 4-13: 2056 Option 1B, Daily Vehicle Volumes

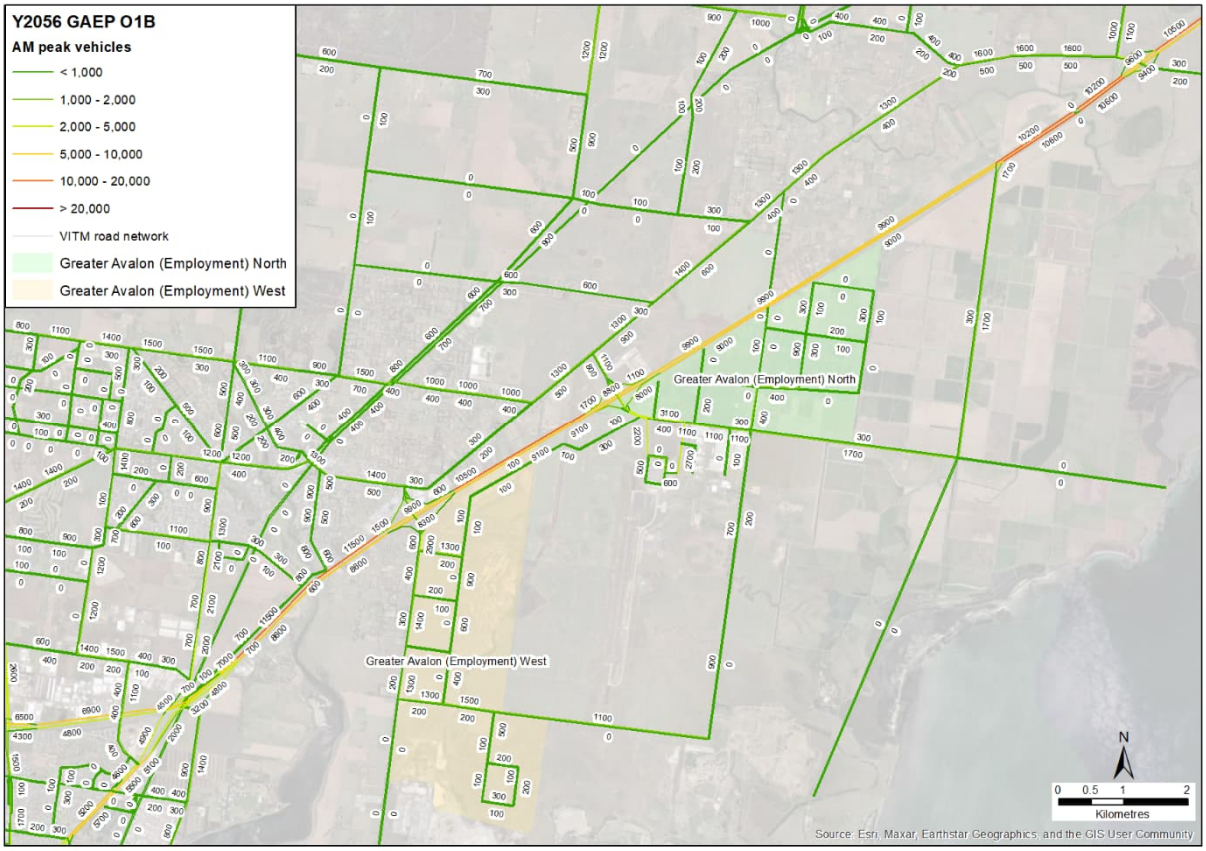


Figure 4-14: 2056 Option 1B, AM Peak Volumes

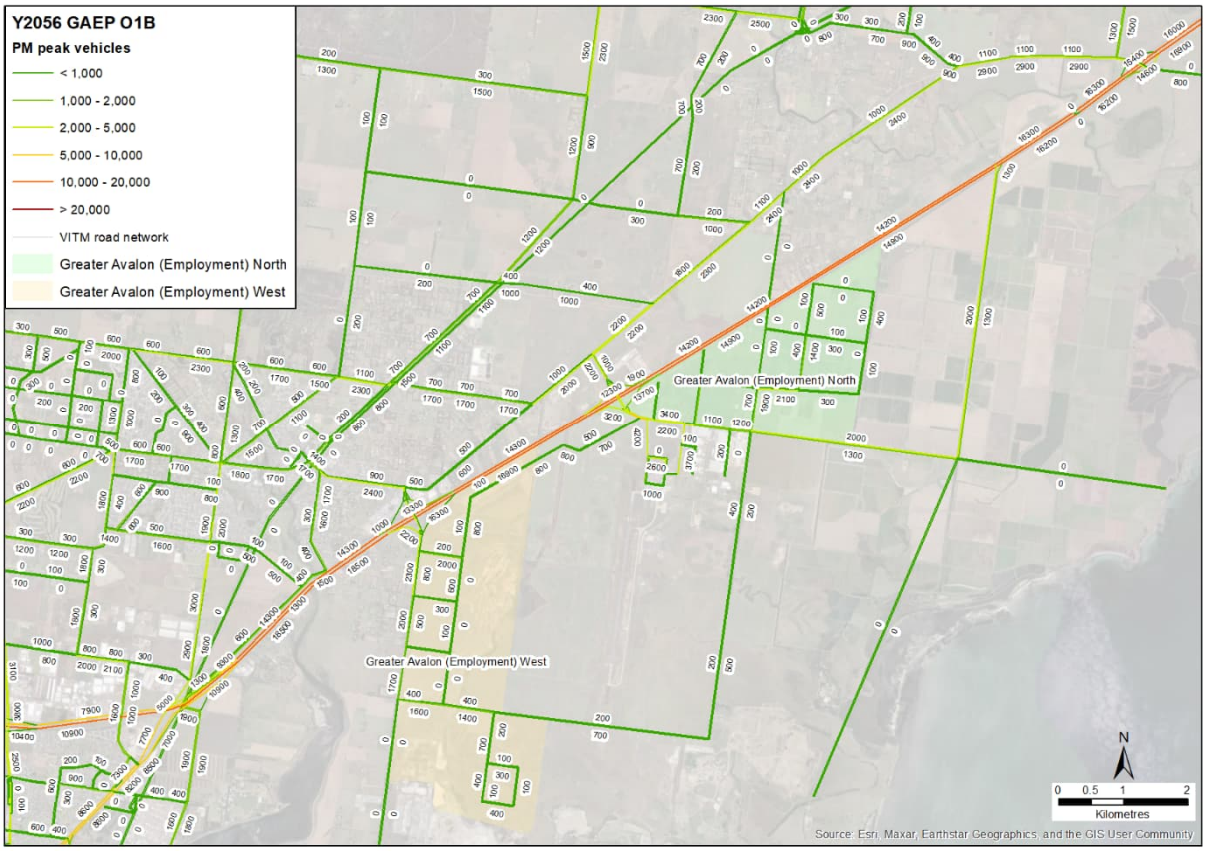


Figure 4-15: 2056 Option 1B, PM Peak Volumes

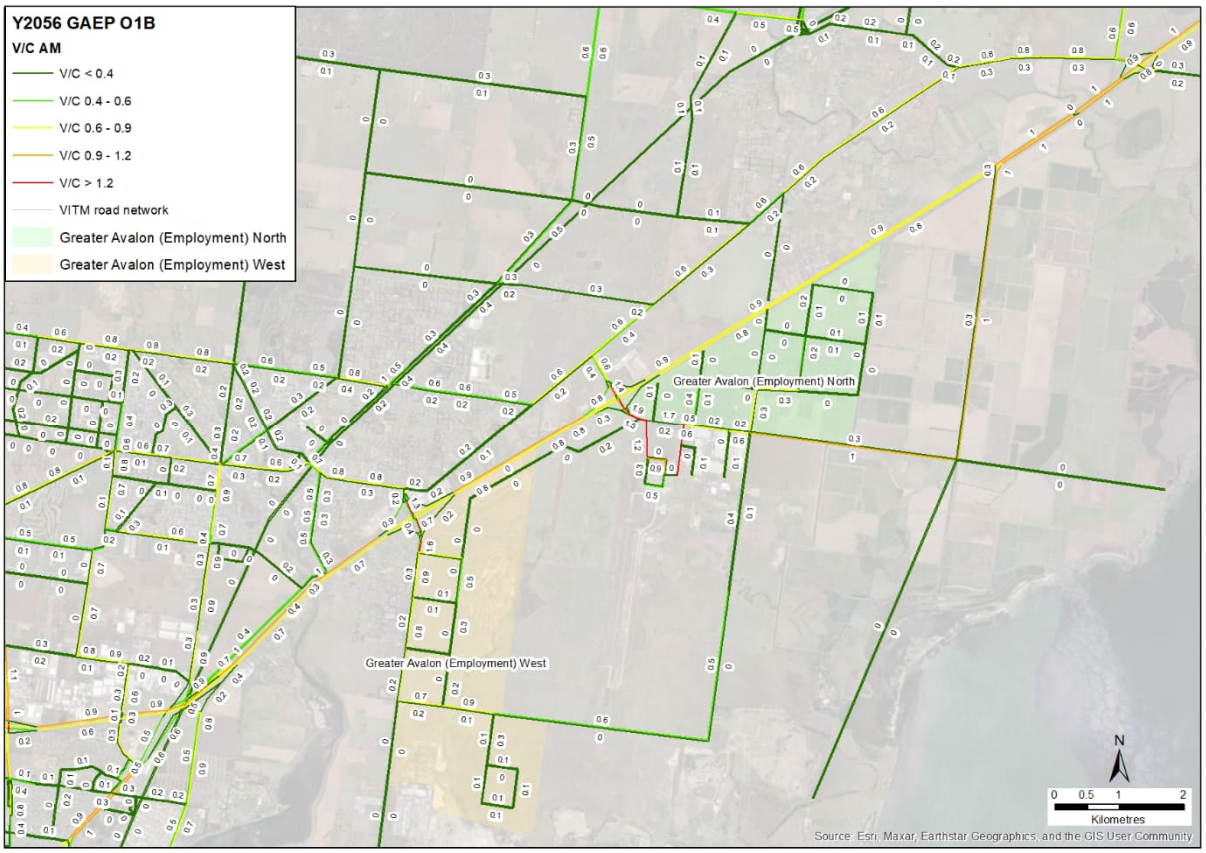


Figure 4-16: 2056 Option 1B, AM Peak Volume / Capacity Ratios

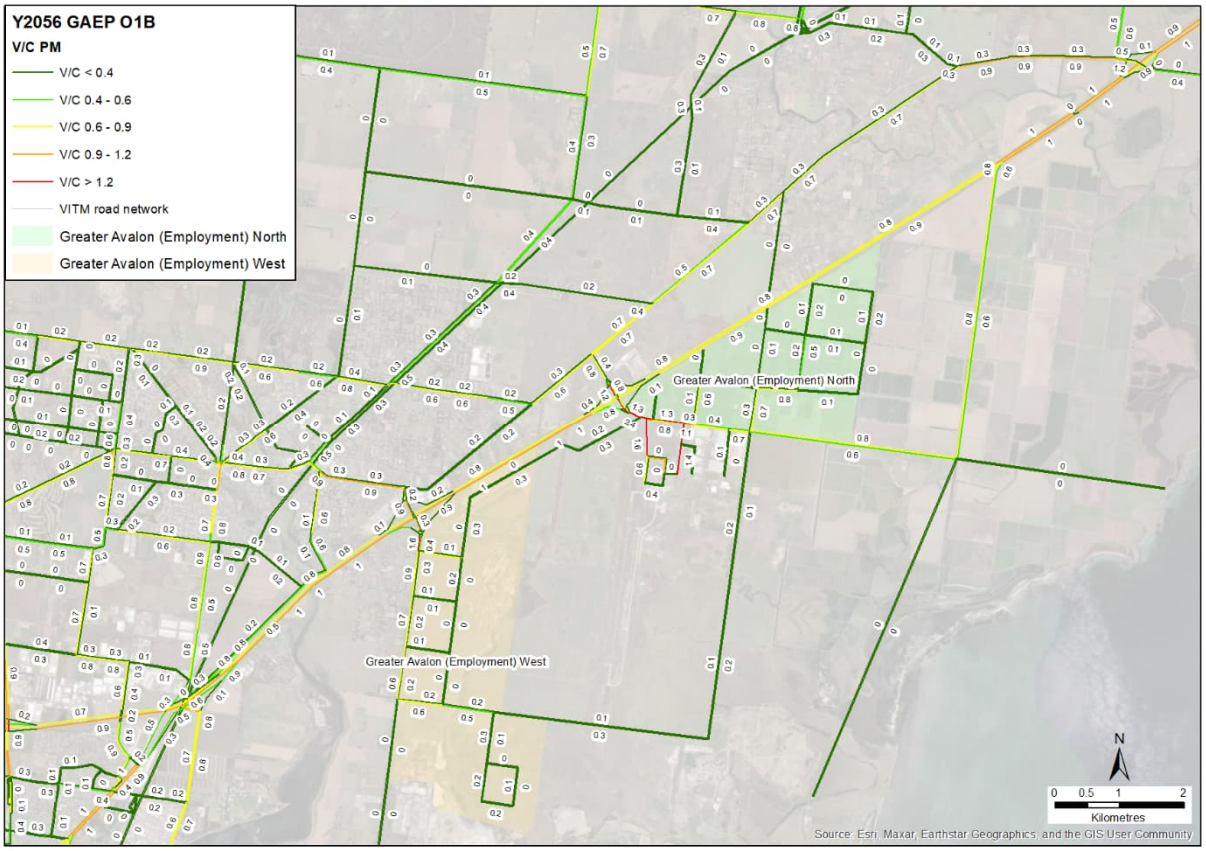


Figure 4-17: 2056 Option 1B, PM Peak Volume / Capacity Ratios

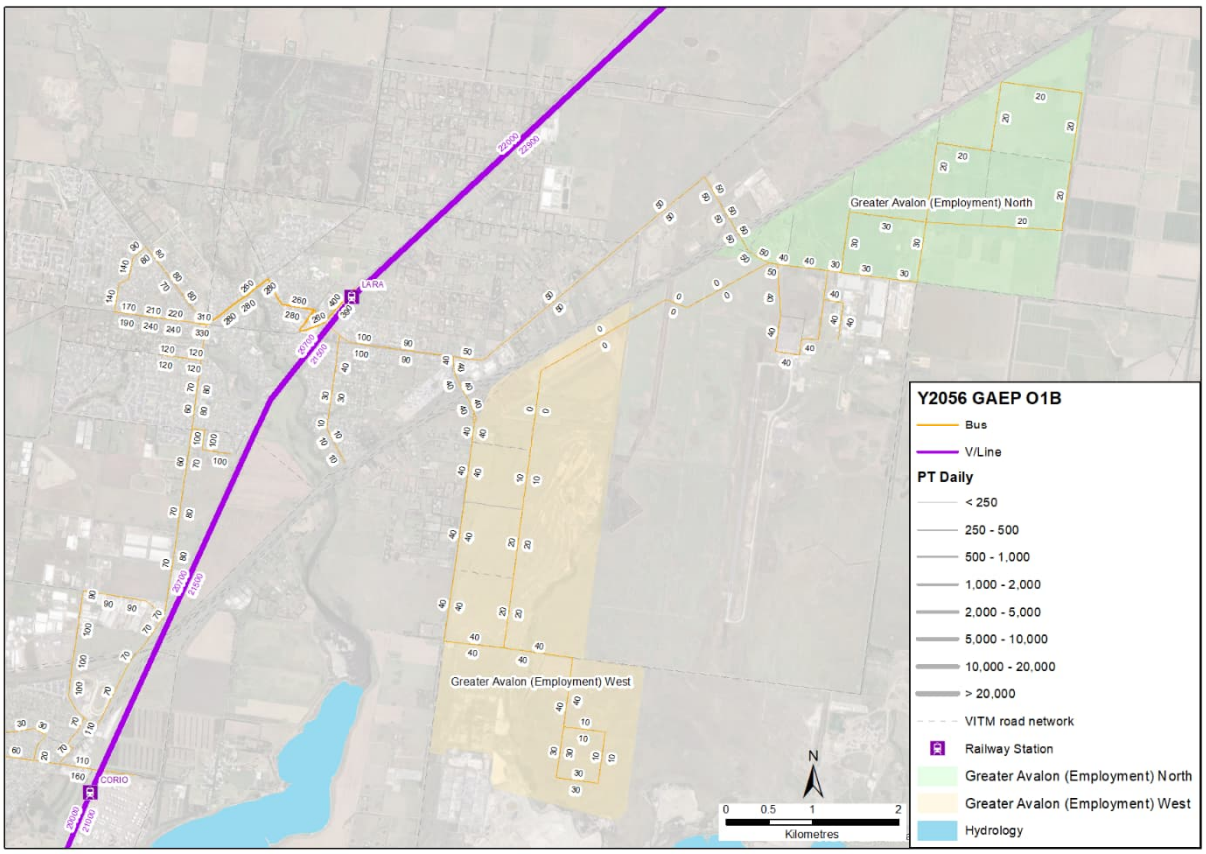


Figure 4-18: 2056 Option 1B, Daily Public Transport Volumes

4.4 2056 Option 2A

4.4.1 Model Inputs

The 2056 Option 2A scenario adopts the following key model assumptions.

- Demographics – only GAEP-West developed (refer to Table 3-3)
- Avalon Airport – assumed to be at 50% build out with 4.83m annual air passengers
- Road Network – adopts an updated road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.3

4.4.2 Model Outputs

The performance of the 2056 Option 2A scenario is presented in this section from Figure 4-19 to Figure 4-24, to assist with the review of the transport needs for the study area with GAEP-West only and Avalon Airport at 50% build out.

Figure 4-22 (AM peak) and Figure 4-23 (PM peak) highlight that the Princes Freeway and Avalon Road interchange are at capacity, the Beach Road interchange and roads around Avalon Airport are over capacity. The issues are most pronounced in the PM peak and are slightly worse than Option 1A. The internal road network is GAEP-W is appropriate.

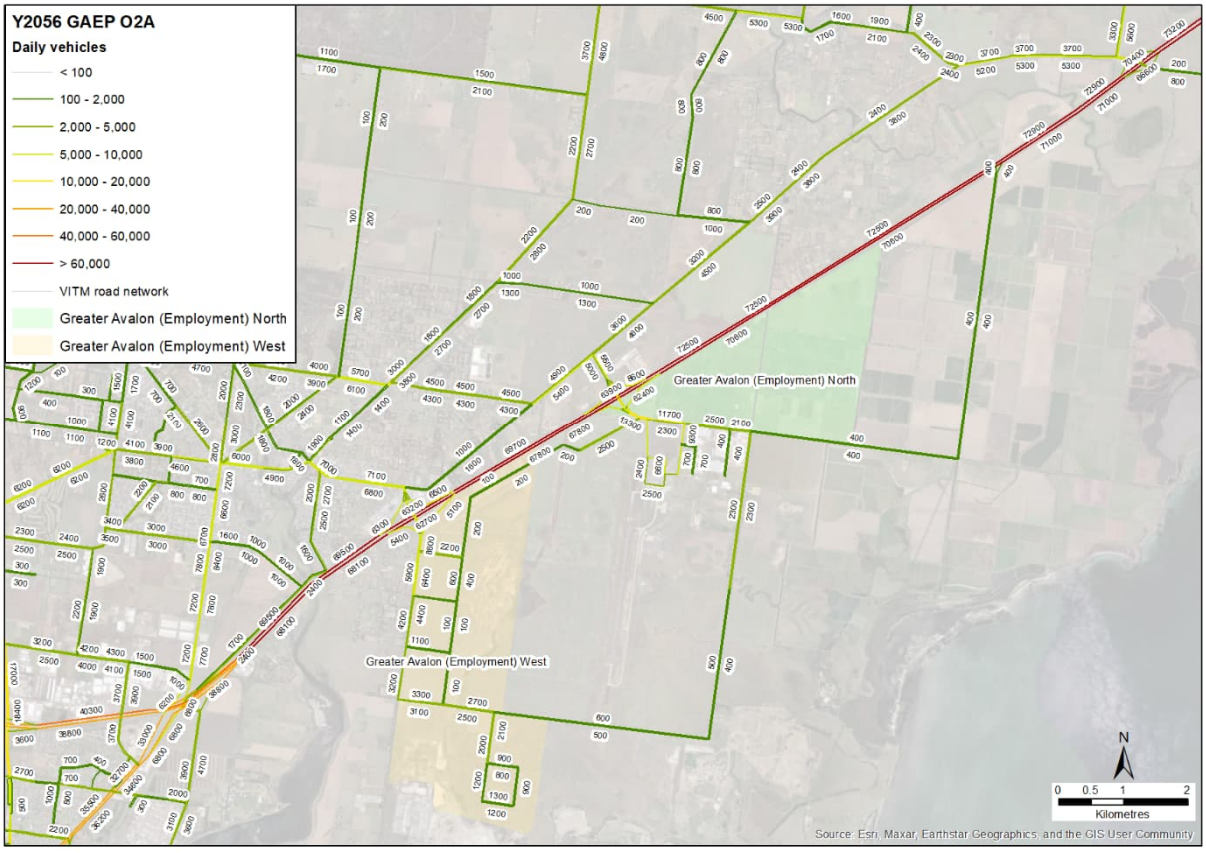


Figure 4-19: 2056 Option 2A, Daily Vehicle Volumes

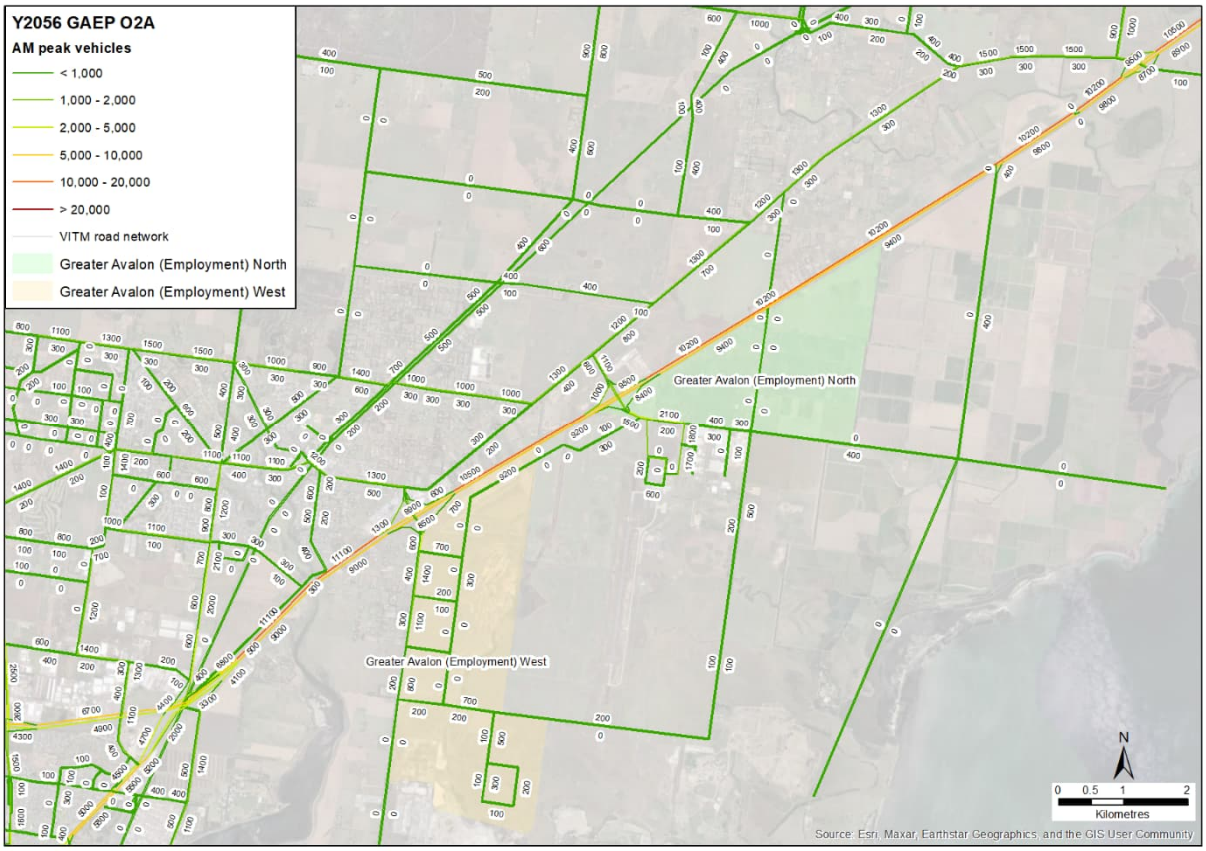


Figure 4-20: 2056 Option 2A, AM Peak Volumes

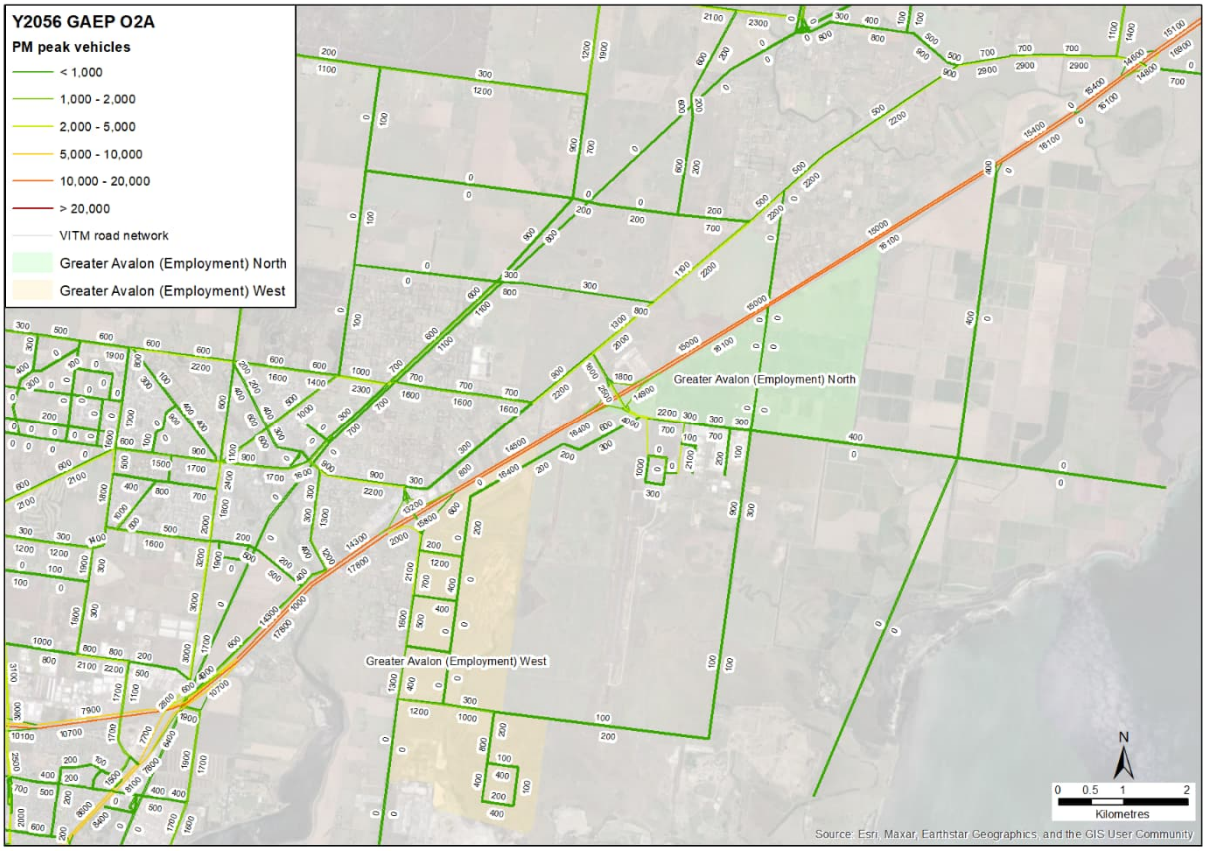


Figure 4-21: 2056 Option 2A, PM Peak Volumes

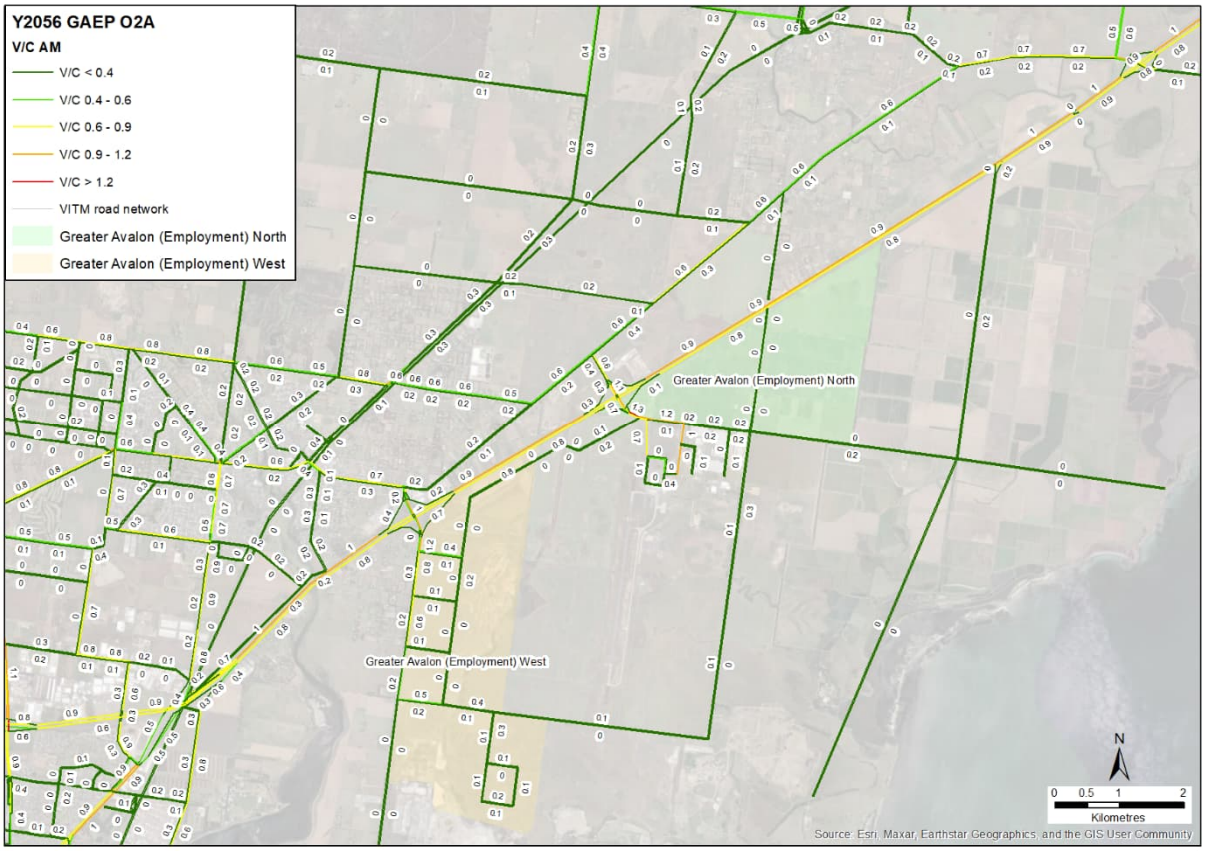


Figure 4-22: 2056 Option 2A, AM Peak Volume / Capacity Ratios

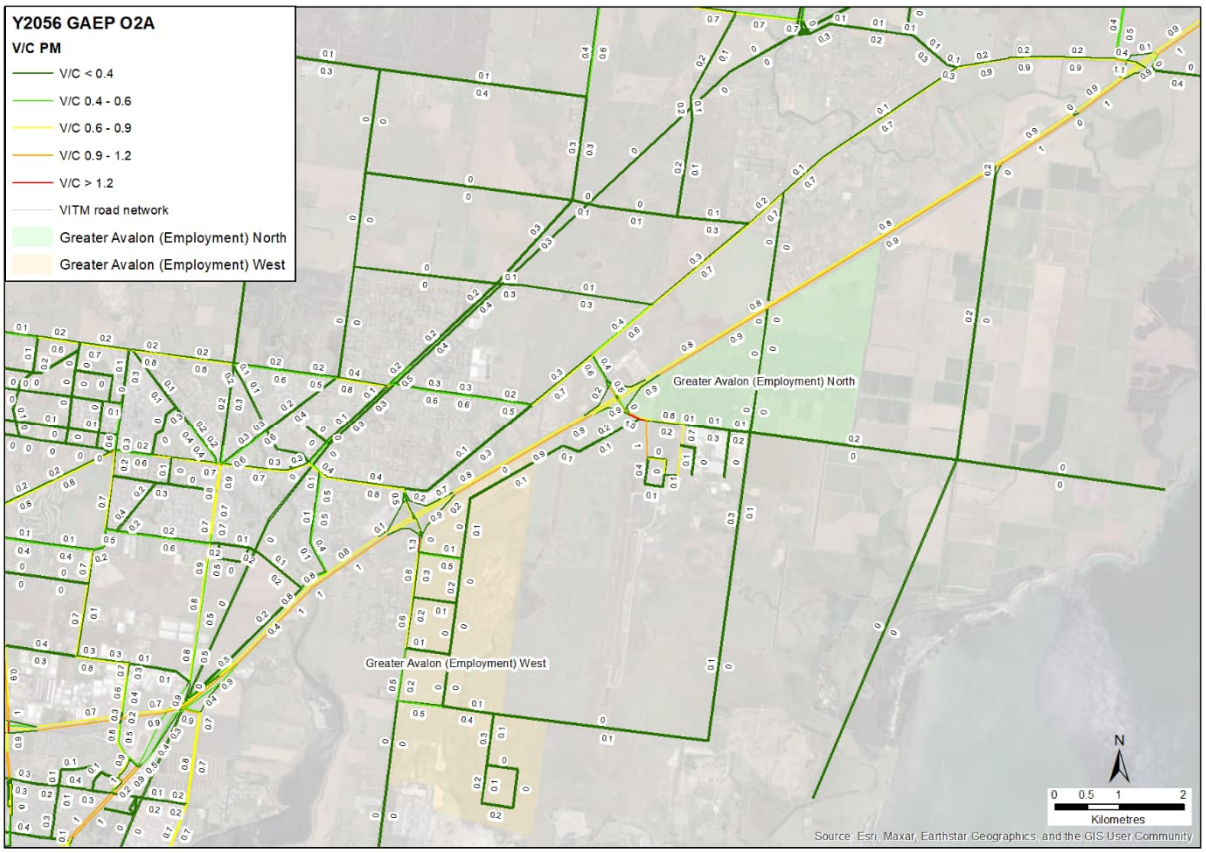


Figure 4-23: 2056 Option 2A, PM Peak Volume / Capacity Ratios

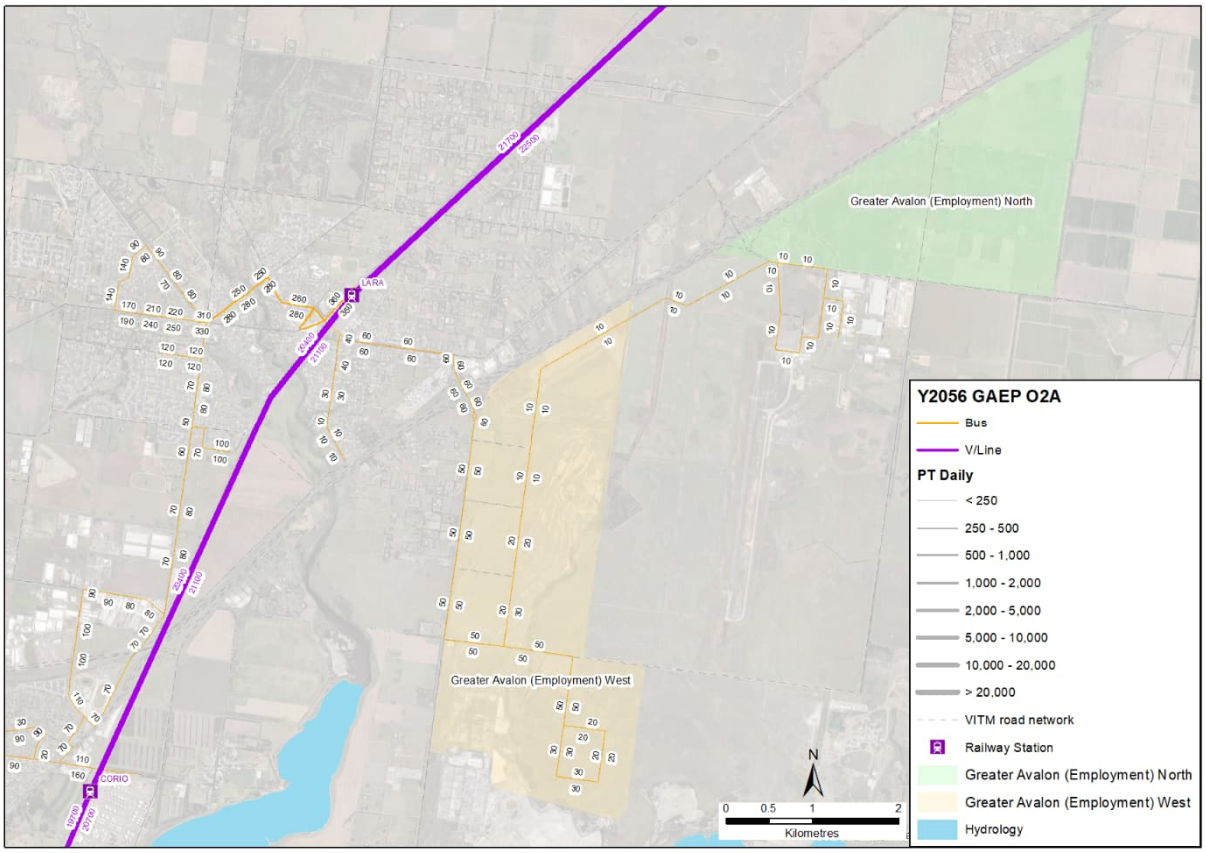


Figure 4-24: 2056 Option 2A, Daily Public Transport Volumes

4.5 2056 Option 2B

4.5.1 Model Inputs

The 2056 Option 2B scenario adopts the following key model assumptions.

- Demographics – only GAEP-West developed (refer to Table 3-3)
- Avalon Airport – assumed to be at full build out with 9.66m annual air passengers
- Road Network – adopts an updated road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.3.

4.5.2 Model Outputs

The performance of the 2056 Option 2B scenario is presented in this section from Figure 4-25 to Figure 4-30, to assist with the review of the transport needs for the study area with GAEP-West only and Avalon Airport at full build out.

Figure 4-28 (AM peak) and Figure 4-29 (PM peak) highlight that the Princes Freeway is at capacity, the Beach Road and Avalon Road interchanges are overcapacity, roads around Avalon Airport are over capacity. The issues are most pronounced in the PM peak. The internal road network for GAEP-W is appropriate.

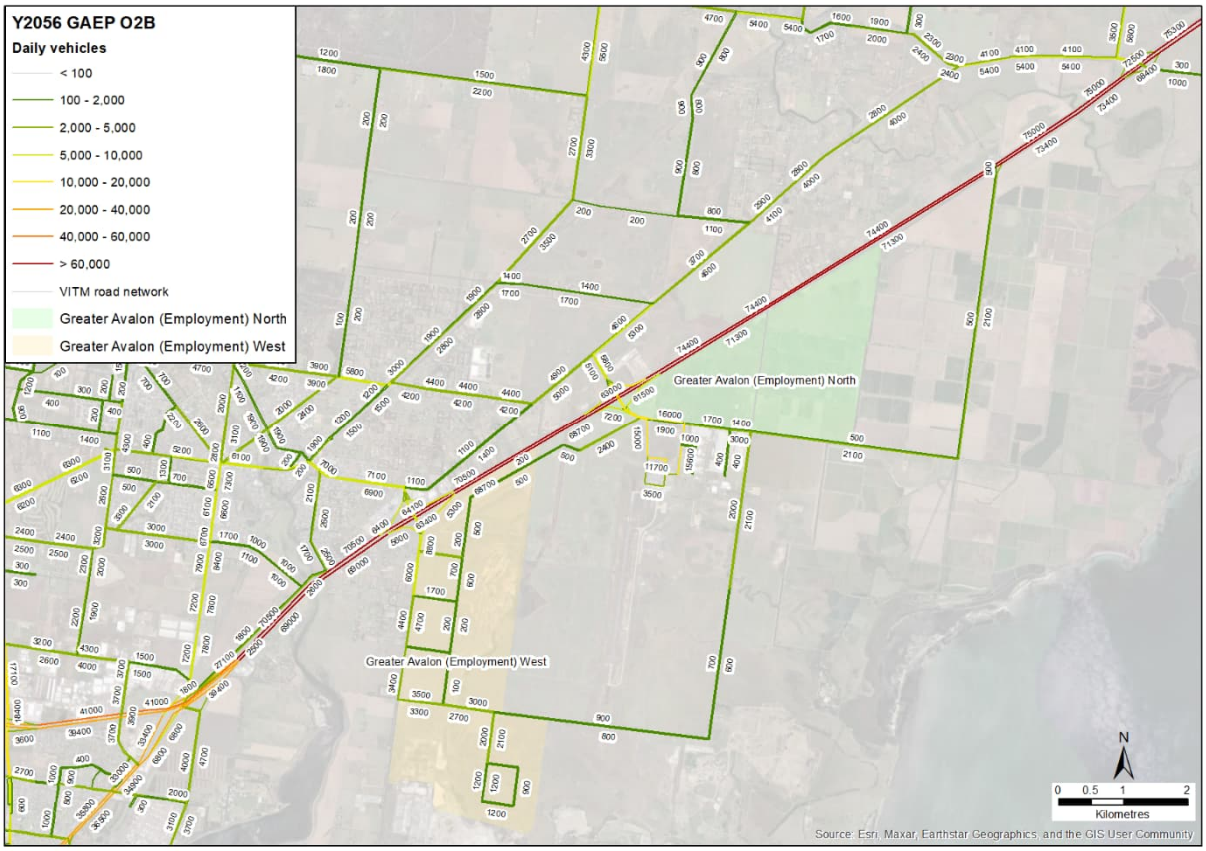


Figure 4-25: 2056 Option 2B, Daily Vehicle Volumes

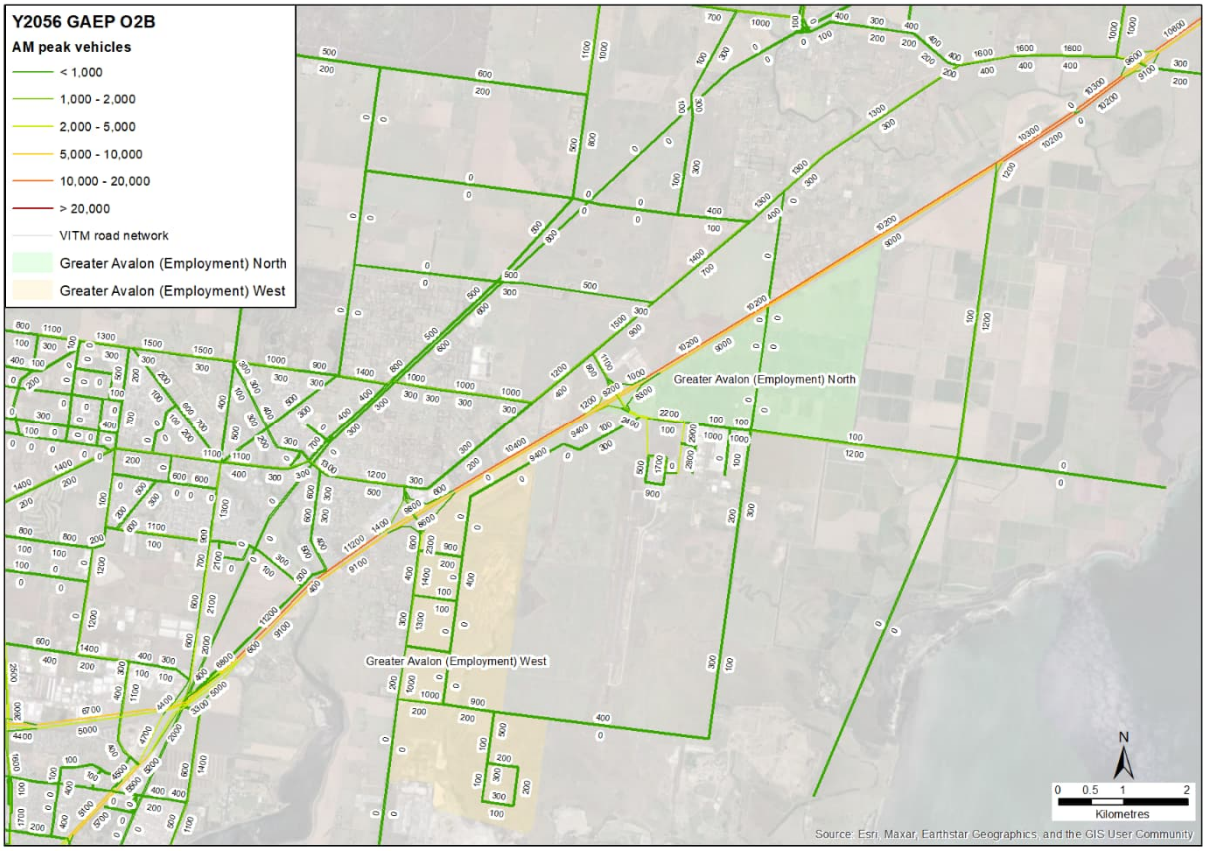


Figure 4-26: 2056 Option 2B, AM Peak Volumes

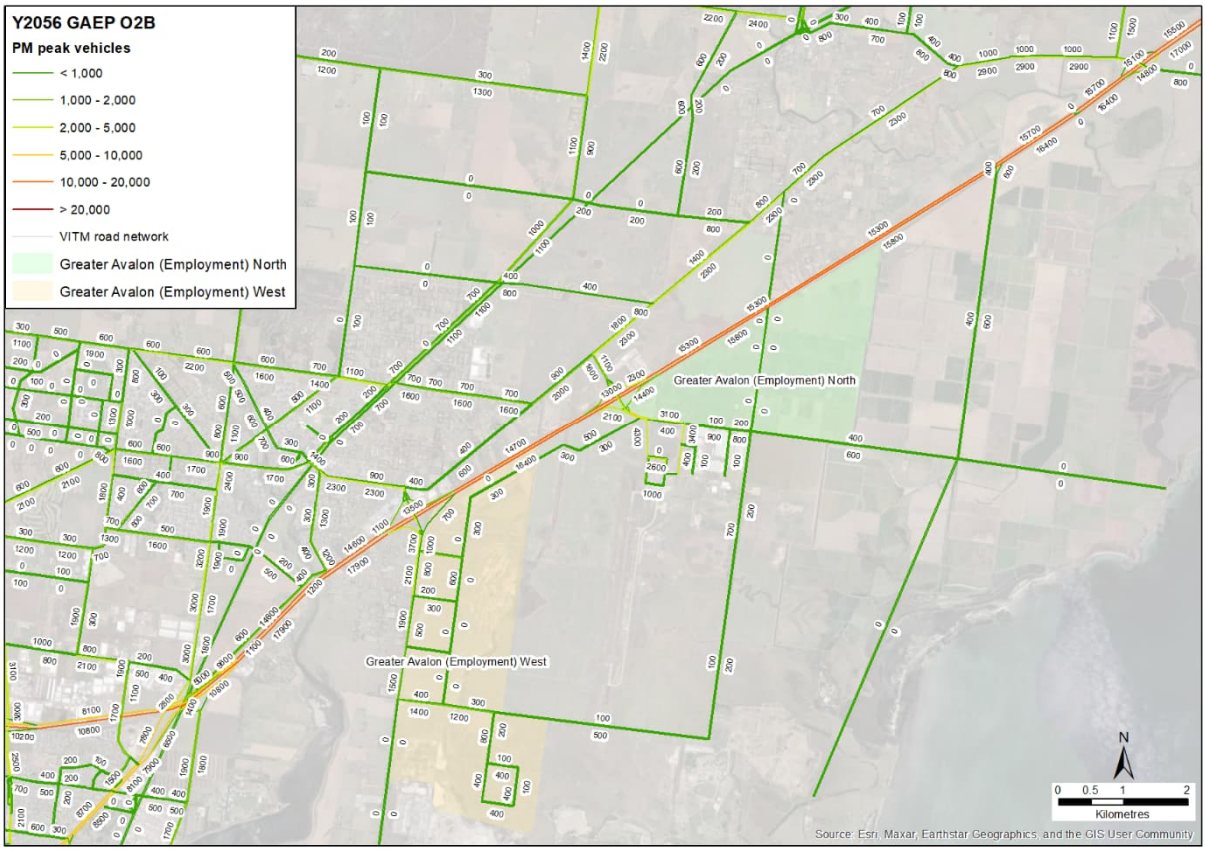


Figure 4-27: 2056 Option 2B, PM Peak Volumes

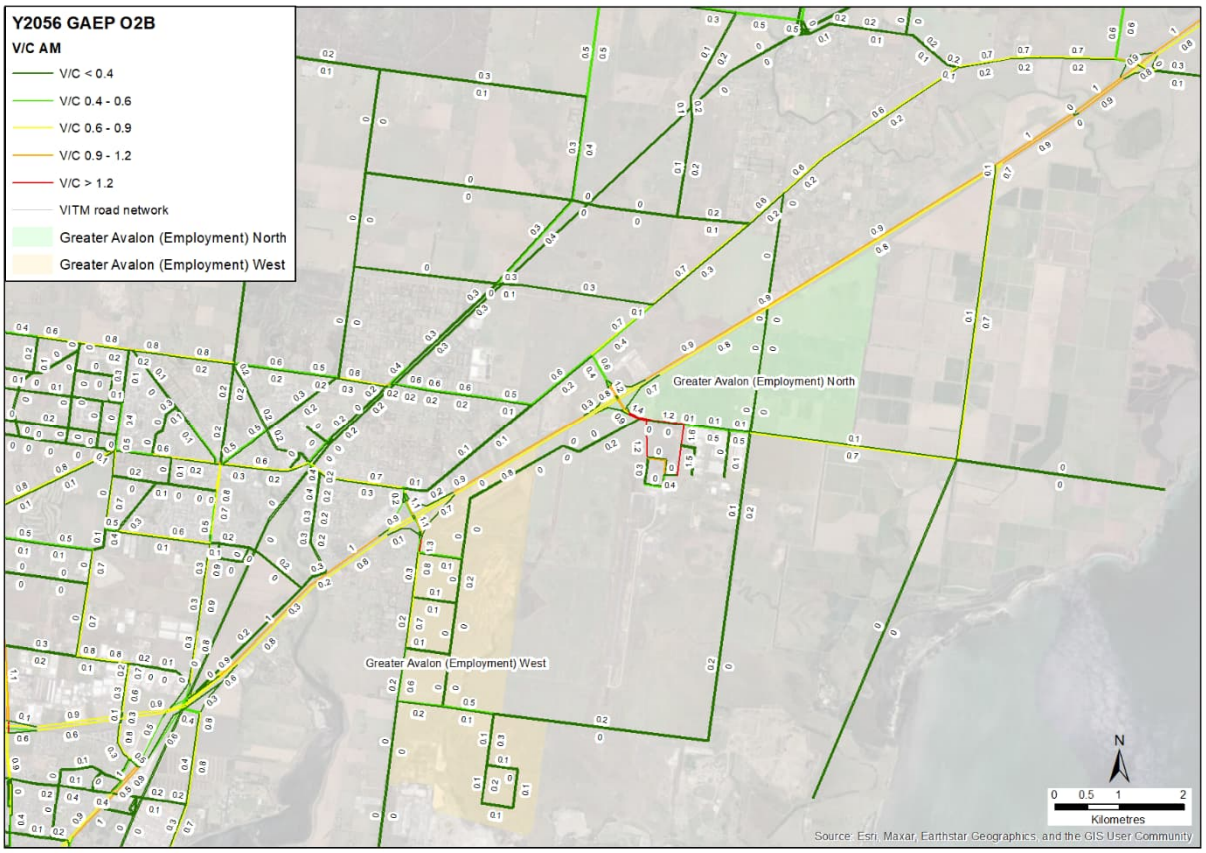


Figure 4-28: 2056 Option 2B, AM Peak Volume / Capacity Ratios

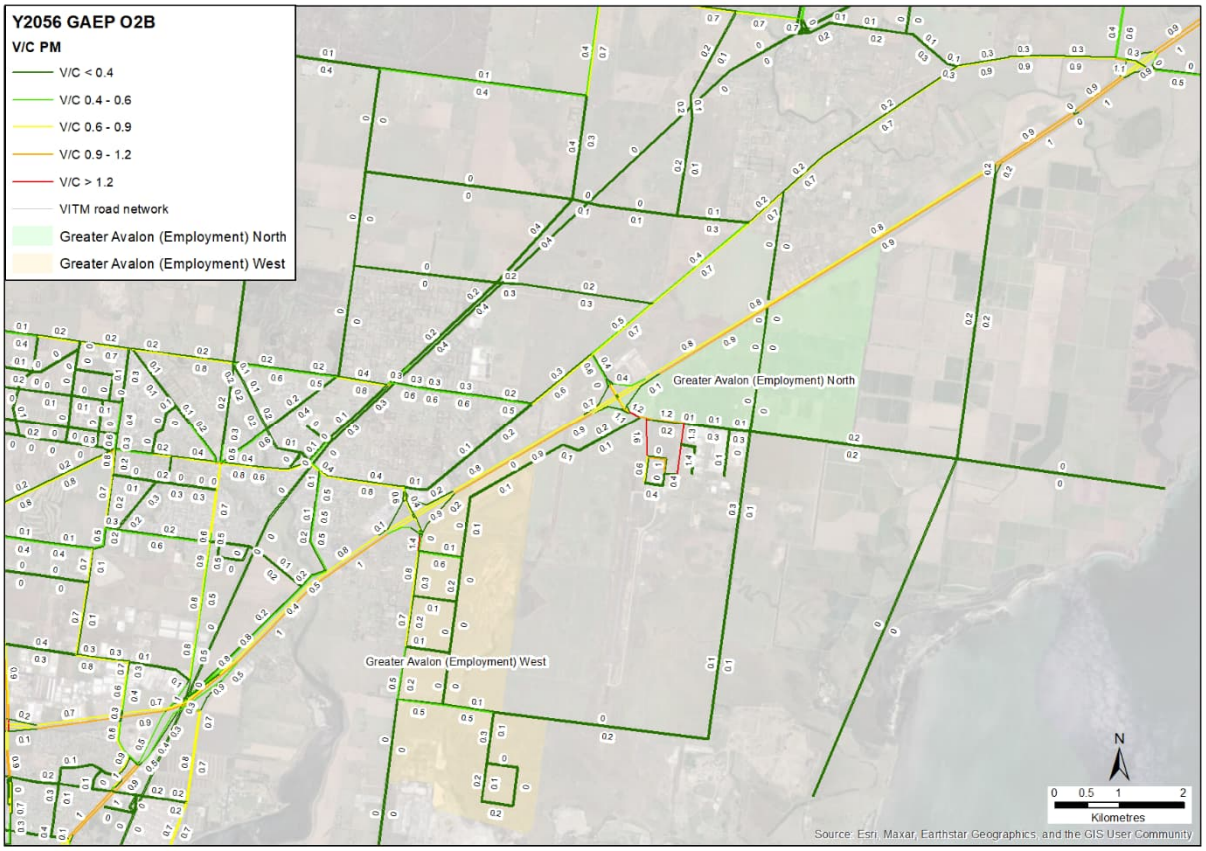


Figure 4-29: 2056 Option 2B, PM Peak Volume / Capacity Ratios

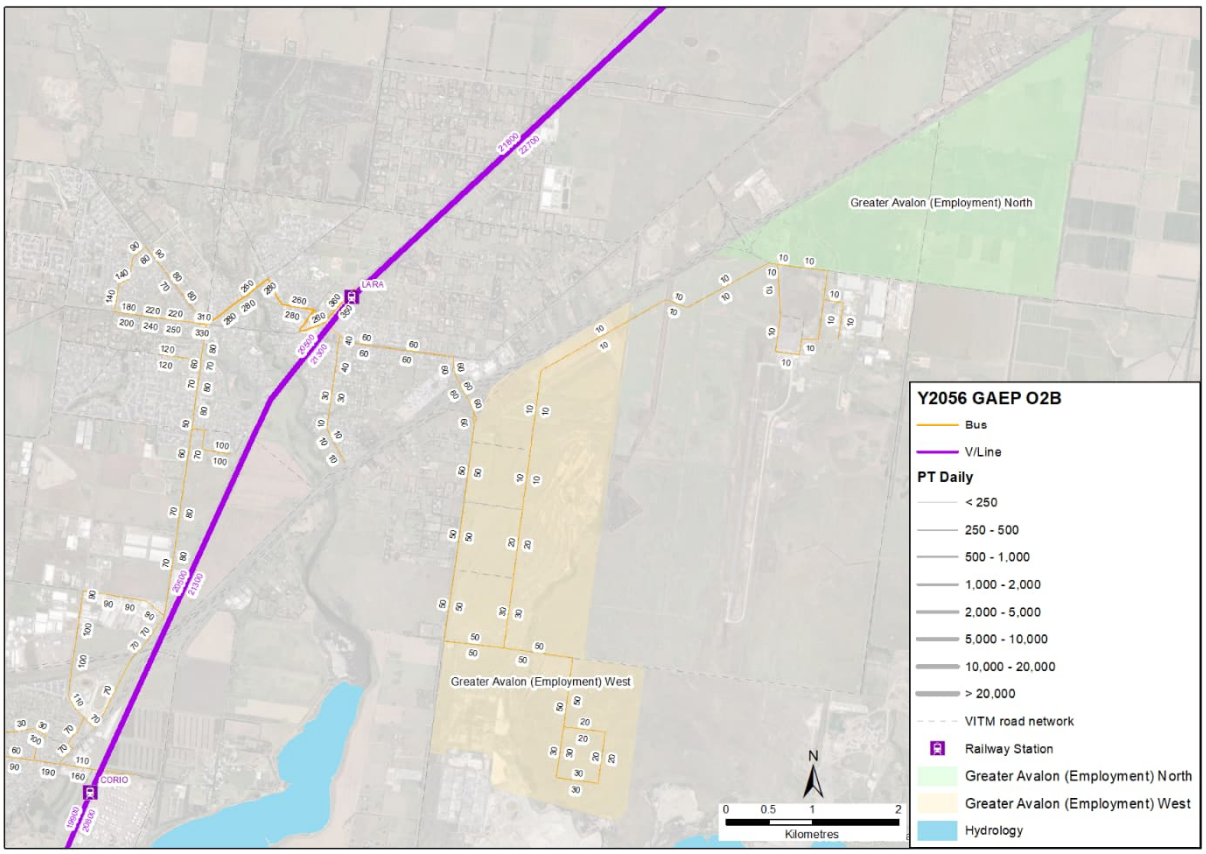


Figure 4-30: 2056 Option 2B, Daily Public Transport Volumes

4.6 2056 Comparison

4.6.1 Key road links

A range of select link plots have been produced to analyse where trips using key road links are starting and ending (refer to Appendix B). These help to understand the role that each road plays in the wider network, based on these plots the function of each road is as follows:

- **Princes Freeway**: as indicated in Section 3.3, there is large growth occurring in Wyndham and Greater Geelong councils, which are connected by the Princes Freeway. This is placing significant strain on the freeway which is further exacerbated by GAEP and Avalon Airport. The interchanges at Beach Road and Avalon Road are well utilised on both sides of the freeway with a rapidly growing population in Lara.
- **Airport passenger terminal access:** relies heavily on the Beach Road Freeway interchange with 87% of air passenger traffic passing through (based on Option 1B). Air passengers are predominantly distributed towards Melbourne (55%), then Geelong (30%) and the remainder (15%) through Lara and Little River.
- **Avalon Road** (just south of the freeway interchange): this is predominantly used by traffic generated by GAEP-W. There is a small amount (~10%) that connects through from Lara to the Airport or GAEP-W via the 'Dog Leg Connector' and another 20% that connect onto Dandos Road / Pousties Road (most likely to avoid the Beach Road interchange). There is a small amount of traffic generated from the south end of Avalon Road outside the precinct.
- **Beach Road** (just south of the freeway interchange): this is the primary access for Avalon Airport and one of two access points used for GAEP-N (in addition to Point Wilson Road). There are heavy flows from Beach Road towards Geelong, Melbourne and Lara.
- **Point Wilson Road** (just south of the freeway interchange): predominantly used by GAEP-N and then increasingly used by airport trips as congestion worsens at the Beach Road interchange (this is seen when comparing Option A to Option B)
- **'Dog Leg Connector'** (joining GAEP-W to GAEP-N and Avalon Airport): this is not a critical link in the network with only a short section used to provide access to Avalon Airport employment in zone 5867. Only 800vpd connect between GAEP-W and GAEP-N / Avalon Airport. CoGG advised this link should be kept given the uncertainty of Dandos Road upgrades and runway extension.

The daily volumes on each of the key road links is provided in Table 4-1. To assist with the apportionment of costs, the share of traffic on each road that can be attributed to GAEP-N, GAEP-W, Avalon Airport and background traffic has been estimated in Table 4-2.

Table 4-1: Select Link volumes (2018 and 2056 Scenarios)

Road Section	Direction	Daily Volumes (vpd[1])					
		2018	2056 BC	Option 1A	Option 1B	Option 2A	Option 2B
Airport Passengers	IN	2,100	12,300	6,200	12,300	6,200	12,300
	OUT	2,000	11,800	5,900	11,800	5,900	11,800
	TOTAL	4,100	24,100	12,100	24,100	12,100	24,100
Avalon Rd - South of Fwy Interchange	S'Bound	< 100	1,000	8,800	9,900	8,600	8,800
	N'Bound	< 100	1,100	8,600	9,200	8,300	8,700
	TOTAL	< 200	2,100	17,400	19,100	16,900	17,500
	W'bound	2,600	16,600	18,300	22,600	11,200	16,800
	E'bound	2,700	16,100	17,700	19,800	11,600	15,900

Road Section	Direction	Daily Volumes (vpd[1])					
		2018	2056 BC	Option 1A	Option 1B	Option 2A	Option 2B
Beach Rd - East of Fwy Interchange	TOTAL	5,300	32,700	36,000	42,400	22,800	32,700
Dog Leg Connector (north east end)	W'bound	N/A	N/A	2,300	2,700	2,500	2,400
	E'bound	N/A	N/A	2,200	1,900	2,400	2,100
	TOTAL	N/A	N/A	4,500	4,600	4,900	4,500
Point Wilson Rd	S'Bound	< 100	700	2,900	4,500	400	500
	N'Bound	< 100	2,200	4,300	7,100	400	2,100
	TOTAL	< 200	2,900	7,200	11,600	800	2,600
Princes Fwy - East of Beach Rd	W'bound	35,900	70,200	69,800	69,000	70,600	71,300
	E'bound	35,600	73,400	72,900	73,300	72,500	74,400
	TOTAL	71,500	143,600	142,700	142,300	143,100	145,700
Princes Fwy - East of Point Wilson Rd	W'bound	35,900	72,300	74,100	76,100	71,000	73,400
	E'bound	35,600	74,100	75,900	77,800	72,900	75,000
	TOTAL	71,500	146,400	150,000	153,900	143,900	148,400
Princes Fwy - West of Avalon Rd	W'bound	34,100	68,100	69,100	69,900	68,100	69,000
	E'bound	34,000	68,800	71,000	71,900	69,500	70,500
	TOTAL	68,100	136,900	140,100	141,800	137,600	139,500

[1] = vehicles per day

Table 4-2: Select Link traffic share (2056 Scenarios)

Road Section	Direction	2056 Daily				
		2056 BC	Option 1A	Option 1B	Option 2A	Option 2B
Avalon Rd - South of Fwy Interchange	GAEP-N	0%	0%	7%	0%	0%
	GAEP-W	8%	84%	73%	92%	88%
	Airport	92%	16%	20%	8%	12%
	Other	0%	0%	0%	0%	0%
Beach Rd - East of Fwy Interchange	GAEP-N	0%	45%	30%	0%	0%
	GAEP-W	0%	1%	0%	0%	0%
	Airport	100%	55%	70%	100%	100%
	Other	0%	0%	0%	0%	0%
Point Wilson Rd	GAEP-N	0%	66%	57%	0%	0%
	GAEP-W	0%	0%	0%	0%	0%
	Airport	100%	34%	43%	100%	100%
	Other	0%	0%	0%	0%	0%
Princes Fwy - East of	GAEP-N	0%	7%	7%	0%	0%
	GAEP-W	0%	2%	2%	2%	2%

Road Section	Direction	2056 Daily				
		2056 BC	Option 1A	Option 1B	Option 2A	Option 2B
Point Wilson Rd	Airport	15%	10%	14%	10%	15%
	Other	85%	82%	77%	87%	83%
Princes Fwy - West of Avalon Rd	GAEP-N	0%	6%	6%	0%	0%
	GAEP-W	0%	5%	5%	5%	5%
	Airport	11%	8%	10%	8%	11%
	Other	89%	82%	79%	87%	84%

4.6.2 Internal road network recommendations

The internal road network modelled (refer to Section 3.1) included a network of single lane, two-way arterial, connector and local roads. The model outputs presented in Section 4 highlighted a few sections that would be over capacity and others that were underutilised and not crucial for inclusion in the final road network. Our recommendations are as follows (also shown in Figure 4-31).

- **Avalon Road**: requires duplication between the freeway interchange and the first connector street, projected daily volumes are 17,000 – 19,000vpd.
- **Beach Road**: there is a strong need for duplication between the freeway interchange and the Airport entry, projected daily volumes are 23,000 – 42,000vpd
- **'Dog Leg Connector'**: there is minimal interaction between GAEP-W and GAEP-N or Avalon Airport, it is not a critical link in the network. However, the 'Dog Leg Connector' does provide resilience in the network (with Dandos Road and Pousties Road the alternative) and provides a more direct route for bus routes and emergency services.
- **Dandos Road:** there is some uncertainty around whether Dandos Road may be severed by future runway extensions at Avalon Airport. It is currently forecast to carry up to 3,300vpd in the full build out scenario and is a good connector from GAEP-W to GAEP-N and Avalon Airport, as it avoids congestion near the freeway interchanges. It would ideally be retained as part of the network.

Future Department of Defence uses within the Airport land and Point Wilson will also have an as-yet unknown additional transport impact on the network including the Beach Road interchange.

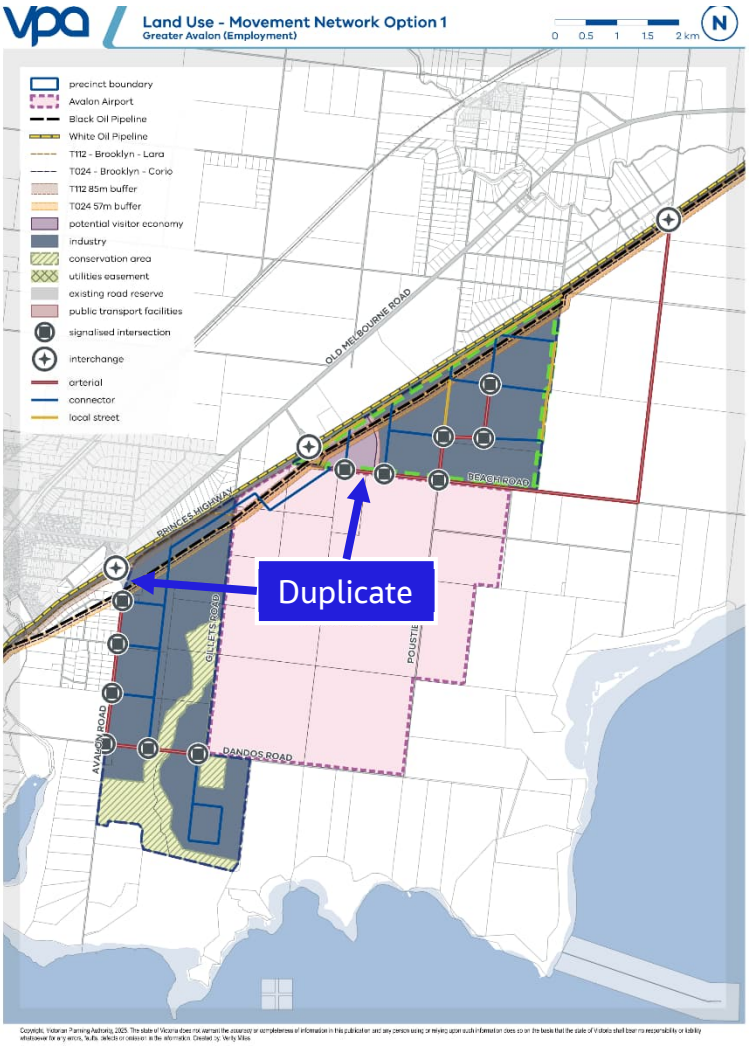


Figure 4-31: Internal road network recommendations

4.6.3 External road network recommendations

The modelling results highlight that the main concern is external to the GAEP. Namely the two crossings of the Princes Freeway at Avalon Road and Beach Road. Each of these are one-lane in each direction, both are full diamond interchanges. The most congested section of each interchange is the traffic crossing over the Princes Freeway (to then go straight or turn right onto the freeway). These have been summarised in Table 4-3 and show the impact that various development scenarios have on the crossings. Further detail and images are provided in Table 4-4 and Table 4-5.

Table 4-3: Princes Freeway Interchanges – volume capacity ratio of most congested section

Location	Direction	Volume / Capacity Ratio									
		2056 BC		Option 1A		Option 1B		Option 2A		Option 2B	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Avalon Road	Northbound	0.3	0.3	0.5	0.6	0.5	0.9	0.5	0.6	0.5	0.7
	Southbound	0.8	0.3	1.2	0.3	1.3	0.3	1.0	0.3	1.1	0.4
Beach Road	Northbound	0.9	1.1	0.8	1.0	1.0	1.2	0.8	1.0	1.1	1.1
	Southbound	1.1	0.8	1.4	0.6	1.4	0.8	1.1	0.5	1.2	0.8

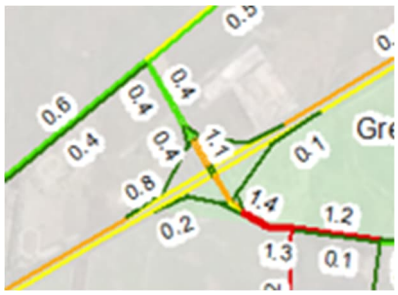
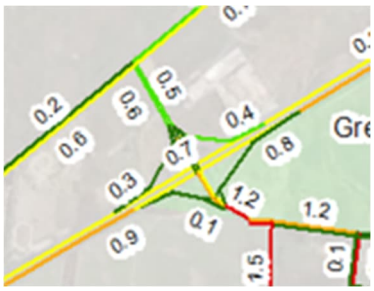
The Avalon Road freeway interchange operates acceptably in the 2056 Base Case but is then overcapacity in every scenario in the AM peak (PM peak is ok, with only the full build out scenario showing some stress), as shown in Table 4-4.

Table 4-4: Avalon Road / Princes Freeway interchange – volume capacity ratios

Scenario	AM V/C	PM V/C
Base Case		
Option 1A		
Option 1B		
Option 2A		
Option 2B		

The Beach Road freeway interchange is heavily congested in the 2056 Base Case and then overcapacity in most scenarios in both peak periods, as shown in Table 4-5.

Table 4-5: Beach Road / Princes Freeway interchange – volume capacity ratios

Scenario	AM V/C	PM V/C
Base Case		
Option 1A		
Option 1B		
Option 2A		
Option 2B		

5. Additional Modelling

Upon analysing the results from scenarios 1A, 1B, 2A and 2B, and acting on recommendations from earlier versions of this report, DTP requested modelling of two further VITM scenarios for the year 2056:

- **Revised 2056 Base Case:** with Avalon Airport development capped at 2026 levels
- **Project Option 3A:** with fully developed GAEP-West Precinct only and Avalon Airport development capped at 2026 levels

The intention of these scenarios is solely to isolate the impact that GAEP-West will have on the surrounding transport network. It does not reflect an expectation that the Avalon Airport precinct will not further develop, especially since there is the ongoing Commonwealth funded Beach Road Upgrade Feasibility Study. The study will include preparation of a planning study that will explore options to upgrade Beach Road at Avalon, improve access to the Airport and help transform the precinct into a transport and logistics hub, including:

- Explore opportunities to better connect the Airport, the industrial hub and the Point Wilson Wharf at Corio Bay and drive further economic growth in the region.
- Support the Airport's planned developments.
- Explore a range of options for the Airport and surrounding precinct, including upgrades to roads and improved access to support Avalon's growth.
- Ensure the surrounding road infrastructure is able to cater for staff and travellers to Avalon Airport and the surrounding precinct, including for freight and logistics movement.

5.1 New Scenario Assumptions

5.1.1 Avalon Airport Air Passengers

Annual air passenger forecasts for the additional scenarios are based on 2026 forecasts provided by Avalon Airport (refer to Table 2-1). This assumes 1.38 million annual air passengers, equivalent to approximately 3,400 vehicles coming in and out of the Airport per day. Vehicles are distributed as per the method provided in Appendix A.

Adopting 2026 forecasts reflects the current levels of domestic and international flights servicing Avalon Airport, and by adopting these for 2056 simulates a low growth scenario for the Airport. This enables the impact of GAEP-West on the transport network (in Option 3A) to be isolated from growth at Avalon Airport.

5.1.2 Future Public Transport Network

As this study was underway, DTP announced that a new bus route 18 would start operating between Lara Station and Avalon Airport. The service commenced on 15 March 2026 with 21 services per day (both directions combined). The route is shown in Figure 5-1.

For the Revised 2056 Base Case it has been assumed that service will continue to run, with an increased frequency of every 60 minutes throughout the day in each direction. For Option 3A, the route is extended to service GAEP-W and will connect to both Lara Station and Avalon Airport, as per Option 2 (refer to Table 3-1).

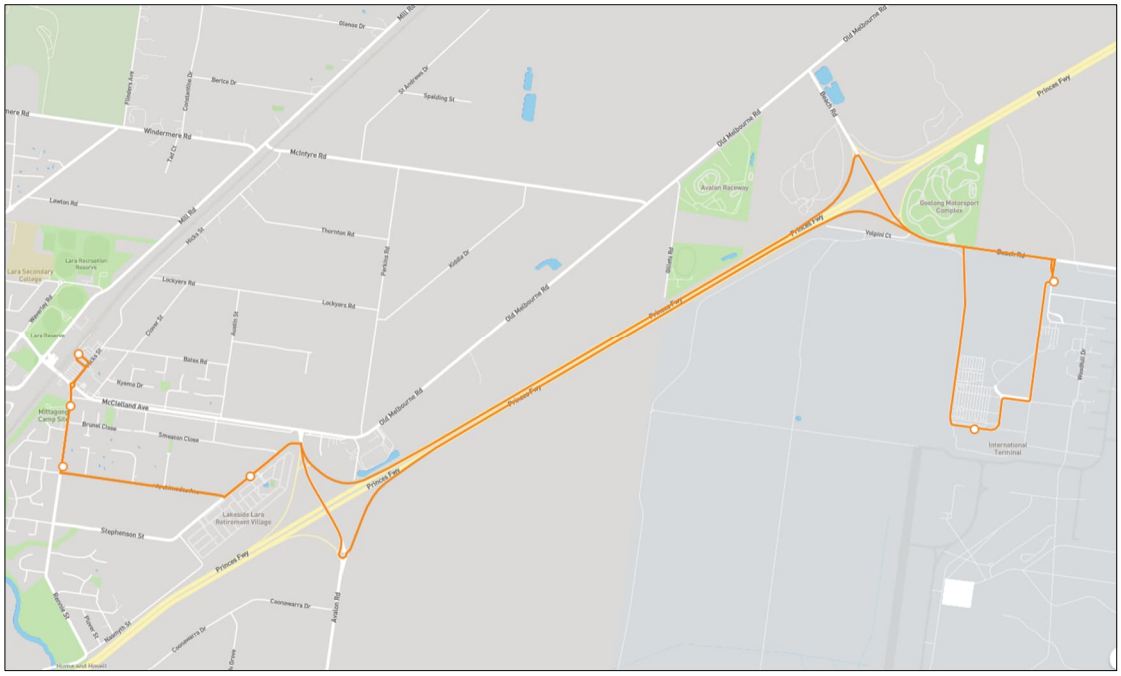


Figure 5-1 Bus Route 18: Lara Station to Avalon Airport Via Princes Fwy (Source: DTP)

5.1.3 Future Land Use

A summary of the employment assumptions for the two additional scenarios are shown in Table 5-1. The distribution by job type is assumed to have the same proportions as per the 2018 scenario (refer to Table 3-2). The 2,185 employees assumed at the Airport reflects the number of employees working in the Airport Precinct in 2026, meaning these scenarios represent no further developments in the Airport Precinct.

Table 5-1: Zonal land use data for the GAEP study area (for each additional scenario)

TZN	Region	2056 Base Modified	2056 Option 3A
5853	North	-	-
5854	North	-	-
5855	North	-	-
5856	North	-	-
5857	North	-	-
5858	North	-	-
5859	North	-	-
5860	North	-	-
5861	North	-	-
5862	North	-	-
5863	Airport	-	-
5864	Airport	2,185	2,185
3959	Airport	-	-
5866	Airport	-	-
5867	Airport	-	-
5870	Airport	-	-
5871	Airport	-	-
5872	Airport	-	-

TZN	Region	2056 Base Modified	2056 Option 3A
5873	West	-	1,899
5874	West	-	725
5875	West	-	1,424
5876	West	-	1,094
5877	West	-	700
5878	Airport	-	-
5879	West	-	2,105
5880	West	-	13
5881	West	-	-
Total GAEP-North		-	-
Total GAEP-West		-	7,960
Avalon Airport		2,185	2,185
Total GAEP-W + GAEP-N + AVV		2,185	10,145

5.2 Revised 2056 Base Case

5.2.1 Model Inputs

The Revised 2056 Base Case scenario adopts the following key model assumptions.

- Demographics – no development within either GAEP-North or GAEP-West (refer to Table 5-1)
- Avalon Airport – assumed to handle 1.38 million annual air passengers and no further development around the Airport beyond 2026 levels.
- Road Network – adopts the existing road network within the study area, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.1.
- Public Transport – in addition to the 2056 VITM Reference Case public transport network, the new Route 18 service is added with a frequency of 60 minutes throughout the day (as described in Section 5.1.2).

5.2.2 Model Outputs

The performance of the Revised 2056 Base Case scenario is presented in this section from Figure 5-2 to Figure 5-7, to assist with the review of the transport needs for the study area with GAEP-West fully developed (Option 3A).

Figure 5-5 (AM peak) and Figure 5-6 (PM peak) highlight that the Princes Freeway is just under capacity with a 0.9 V/C ratio in the peak direction. The Beach Road and Avalon Road interchanges are also under capacity, roads around Avalon Airport are all well under capacity. The same pattern is repeated in the PM peak. All roads surrounding Avalon Airport appear to be appropriate for the forecast traffic volumes.

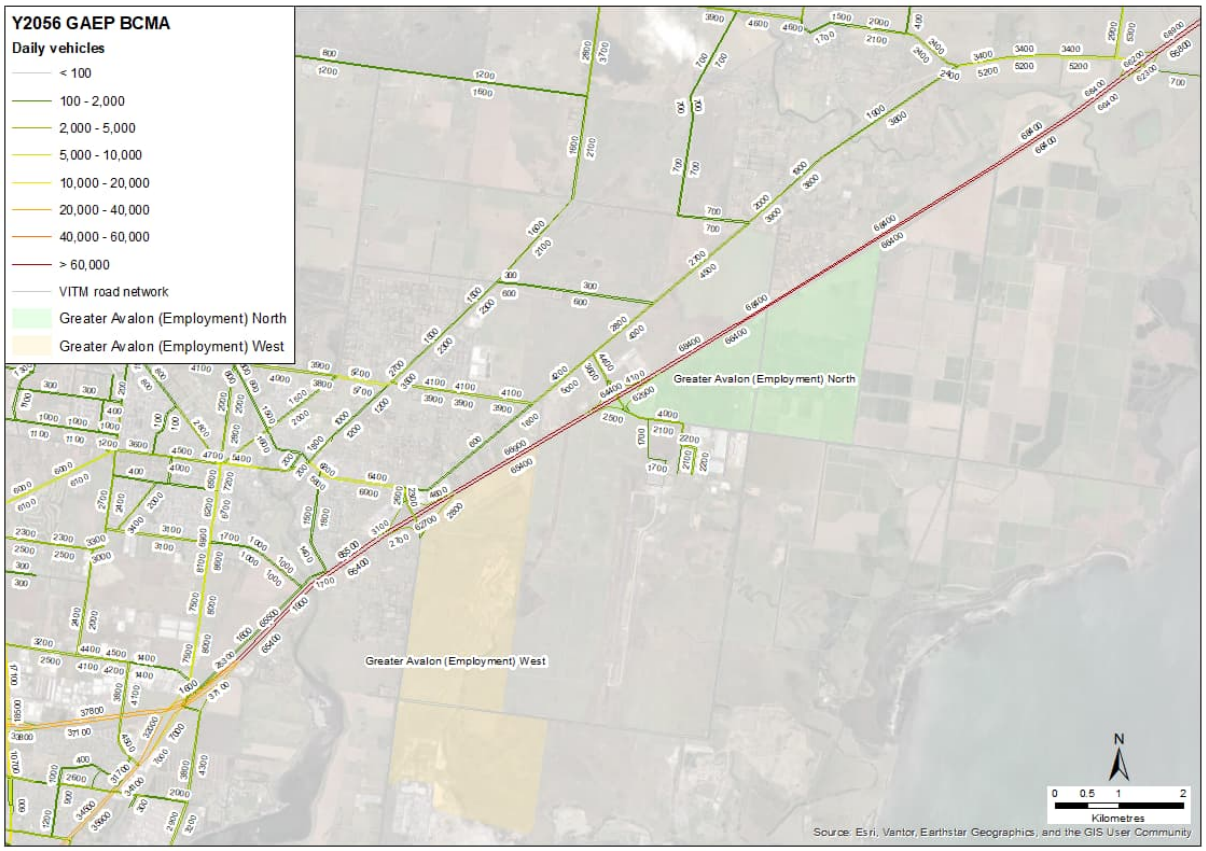


Figure 5-2: Revised 2056 Base Case, Daily Vehicle Volumes

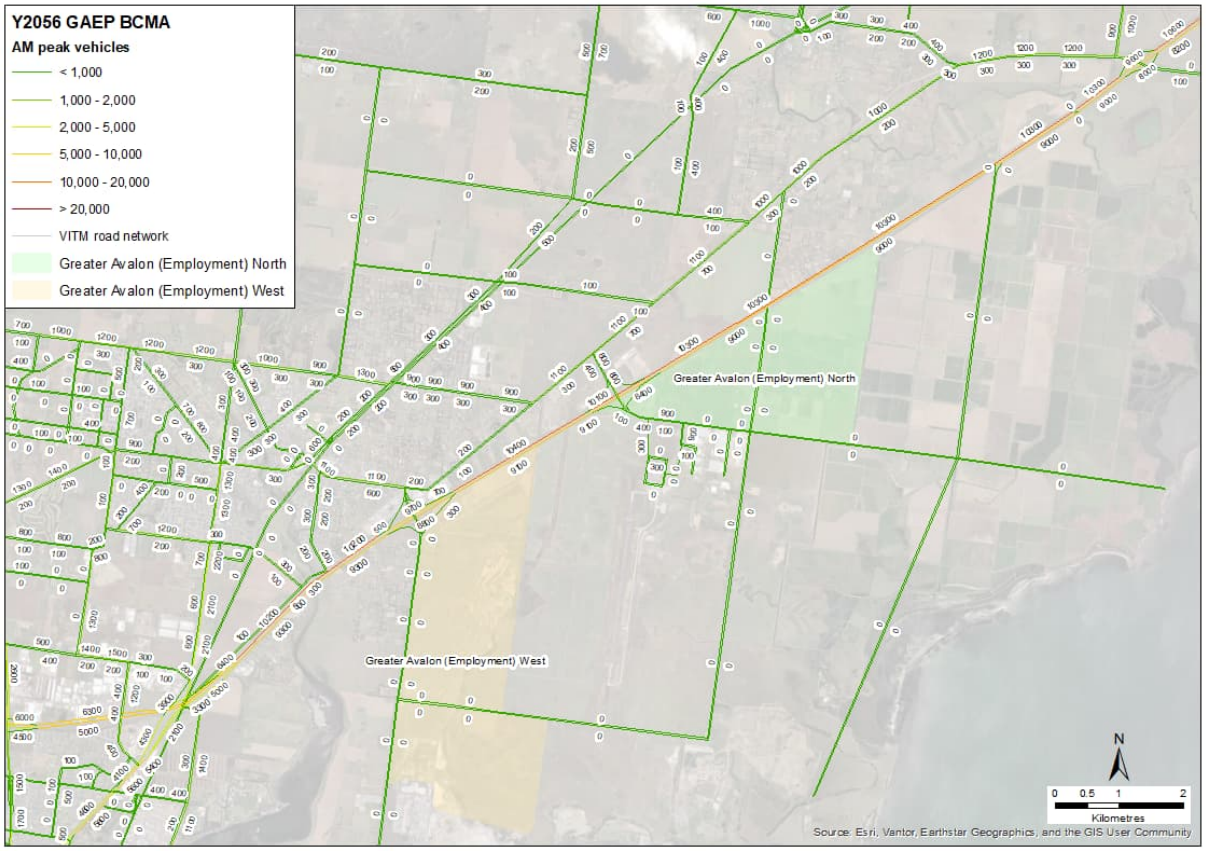


Figure 5-3: Revised 2056 Base Case, AM Peak Volumes

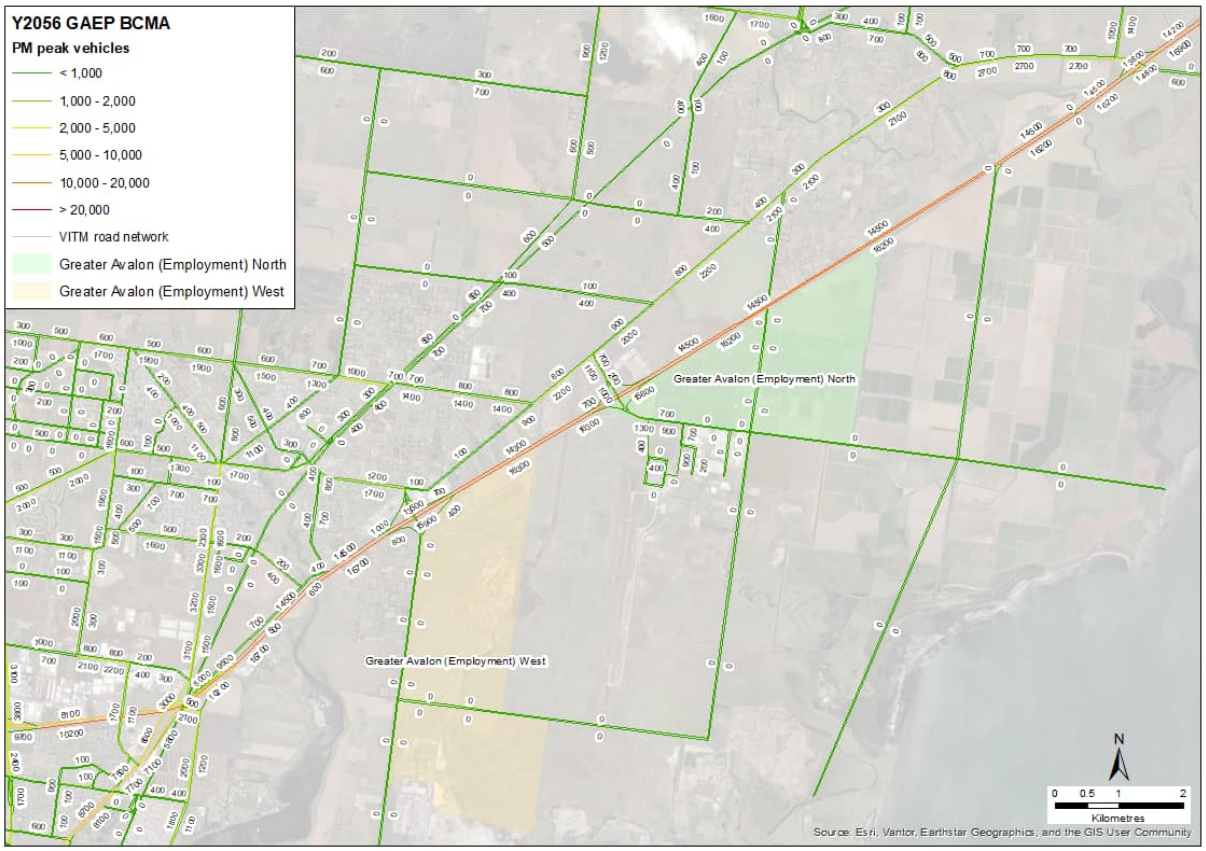


Figure 5-4: Revised 2056 Base Case, PM Peak Volumes

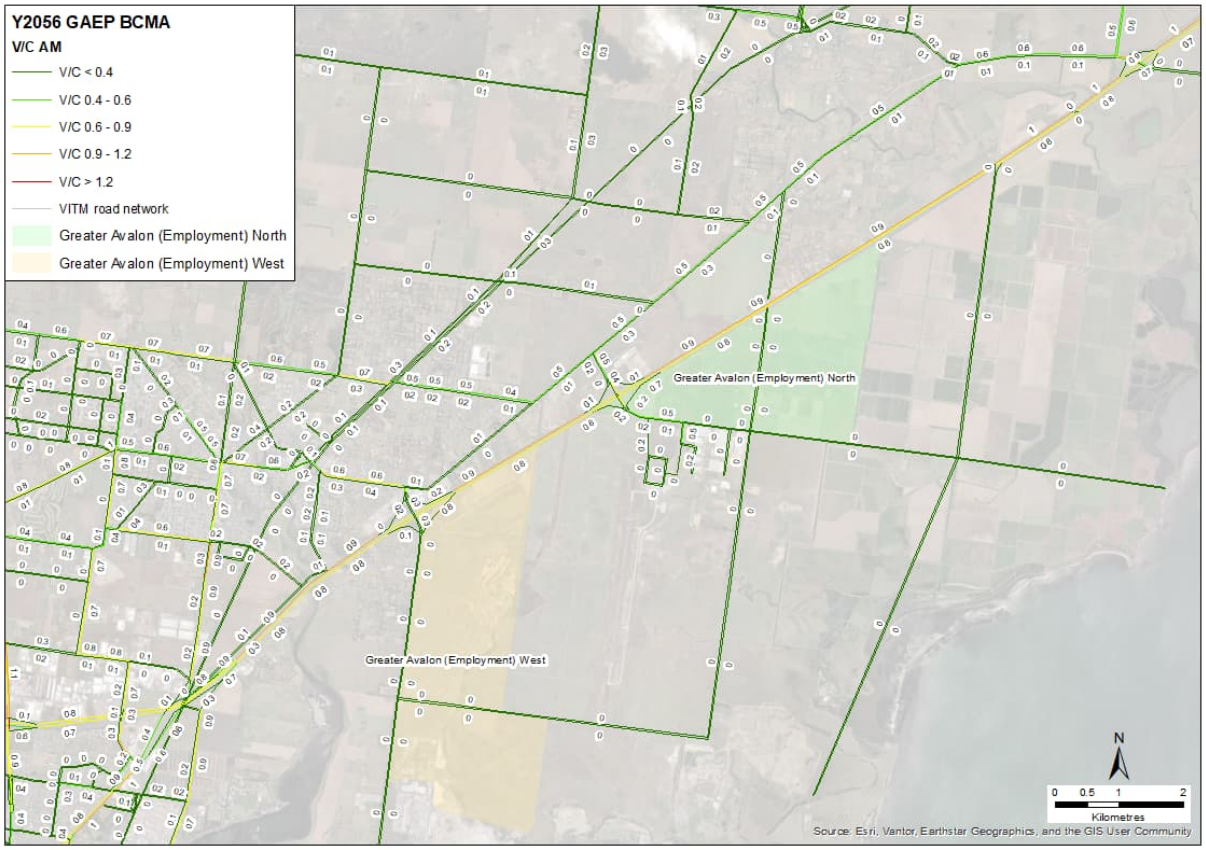


Figure 5-5: Revised 2056 Base Case, AM Peak Volume / Capacity Ratios

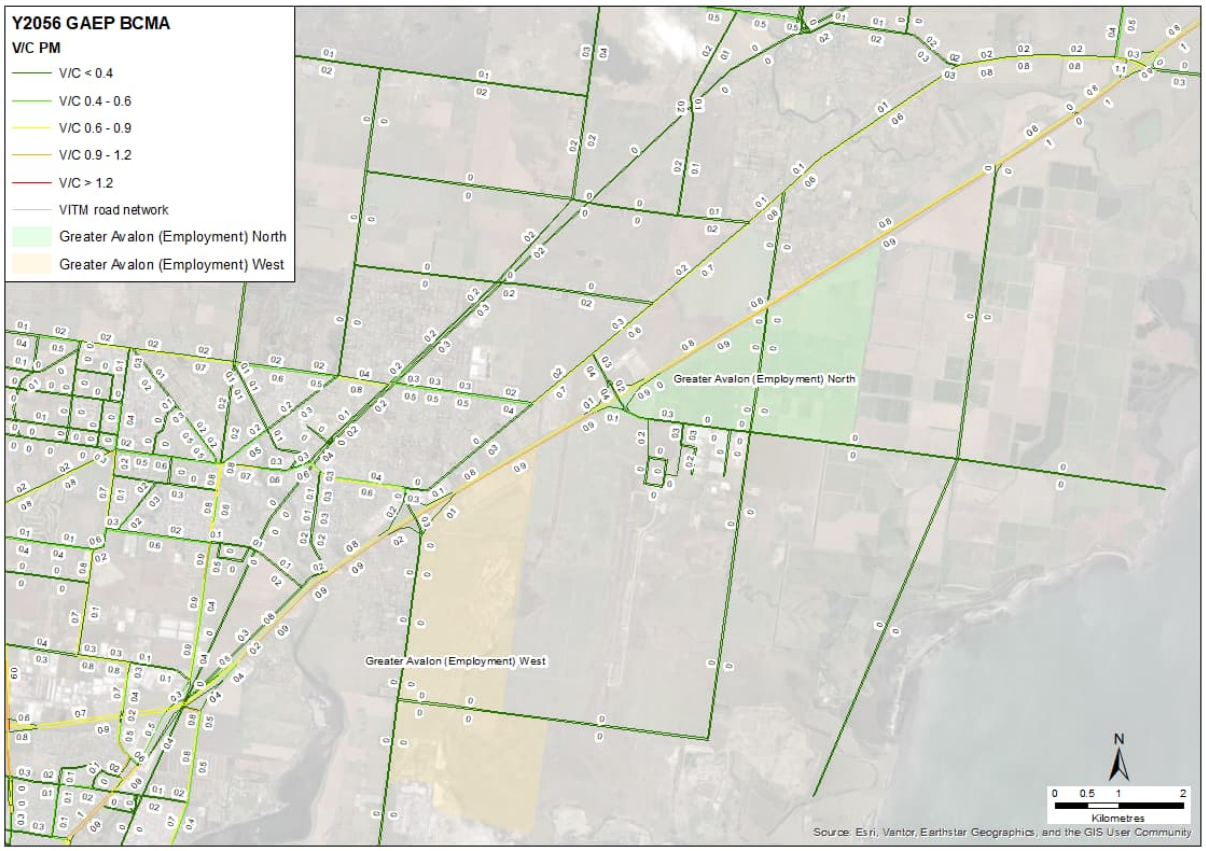


Figure 5-6: Revised 2056 Base Case, PM Peak Volume / Capacity Ratios

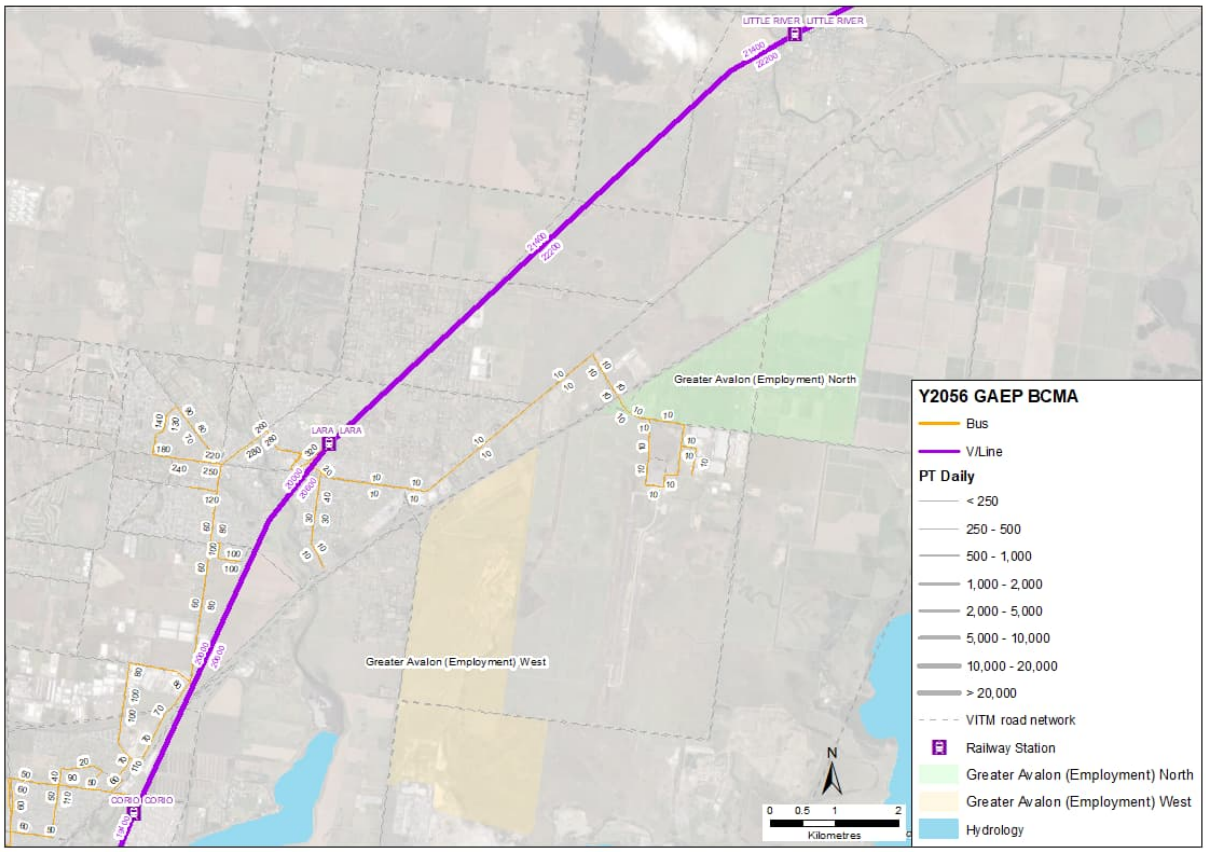


Figure 5-7: Revised 2056 Base Case, Daily Public Transport Volumes

5.3 2056 Option 3A

5.3.1 Model Inputs

The 2056 Option 3A scenario adopts the following key model assumptions:

- Avalon Airport – assumed to handle 1.38 million annual air passengers and no further development around the Airport beyond 2026 levels.
- Demographics – only GAEP-West developed (refer to Table 5-1).
- Road Network – adopts the same updated road network within the study area as per Option 2, the surrounding road network is as per the 2056 VITM reference case, as shown in Section 3.1.3.
- Public Transport – in addition to the 2056 VITM Reference Case public transport network, a new GAEP-W service is included with a frequency of 30 minutes throughout the day. Further details can be found in Section 3.2.

5.3.2 Model Outputs

The performance of the 2056 Option 3A scenario is presented in this section from Figure 5-8 to Figure 5-13, to assist with the review of the transport needs for the study area with GAEP-West fully developed and Avalon Airport at 2026 development levels.

Figure 5-11 (AM peak) and Figure 5-12 (PM peak) highlight that the Princes Freeway is just under capacity with a 0.9 V/C ratio in the peak directions. The Beach Road interchange is appropriate, and the Avalon Road interchange is nearing capacity. All roads around Avalon Airport are appropriate, as are the internal road networks for GAEP-W, except for a small section of Avalon Road near the interchange that needs duplication.

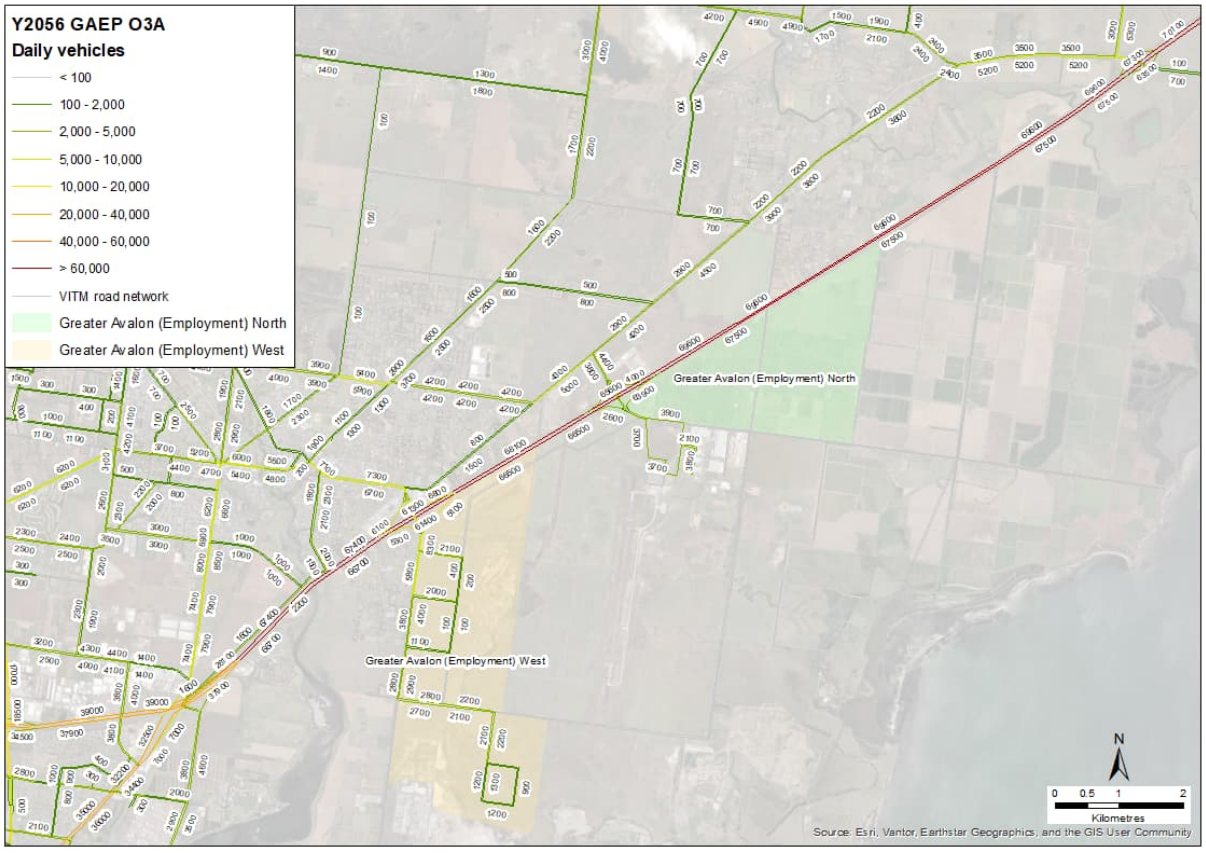


Figure 5-8: 2056 Option 3A, Daily Vehicle Volumes

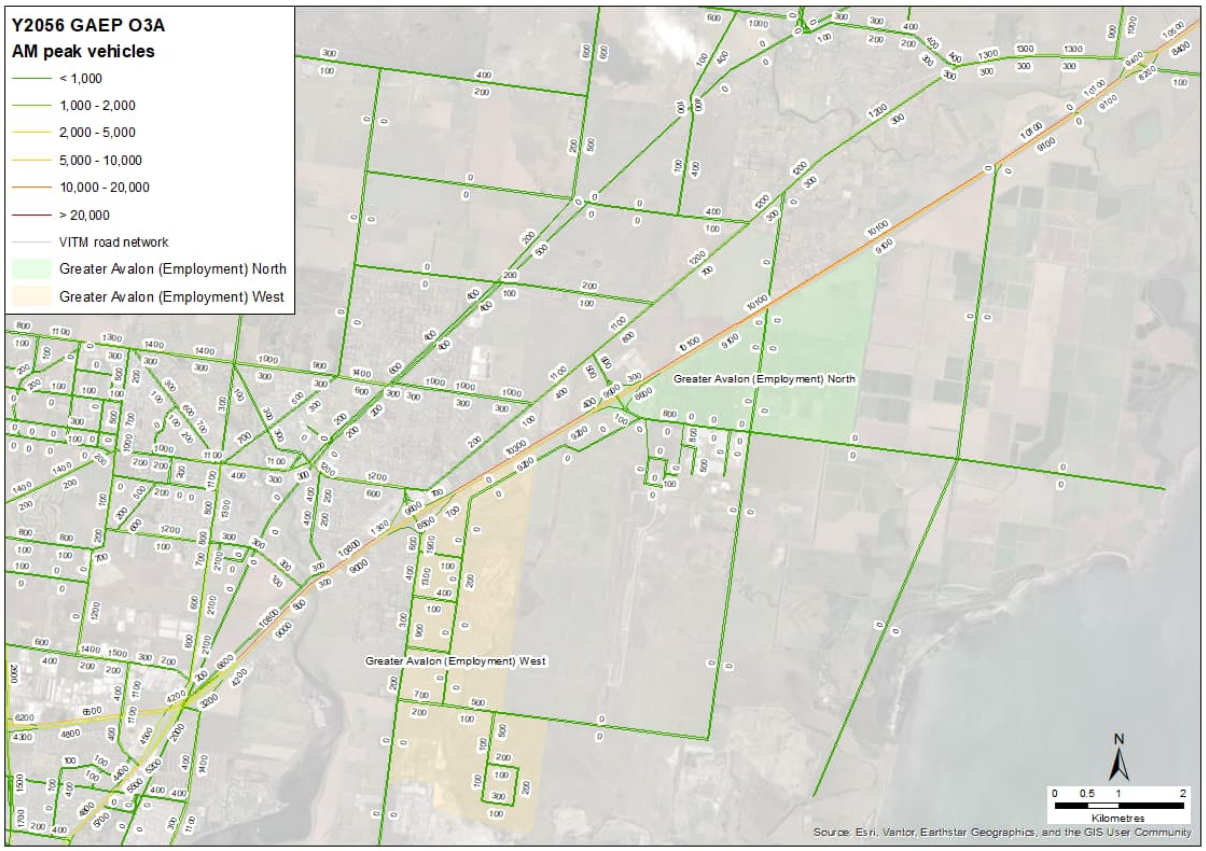


Figure 5-9: 2056 Option 3A, AM Peak Volumes

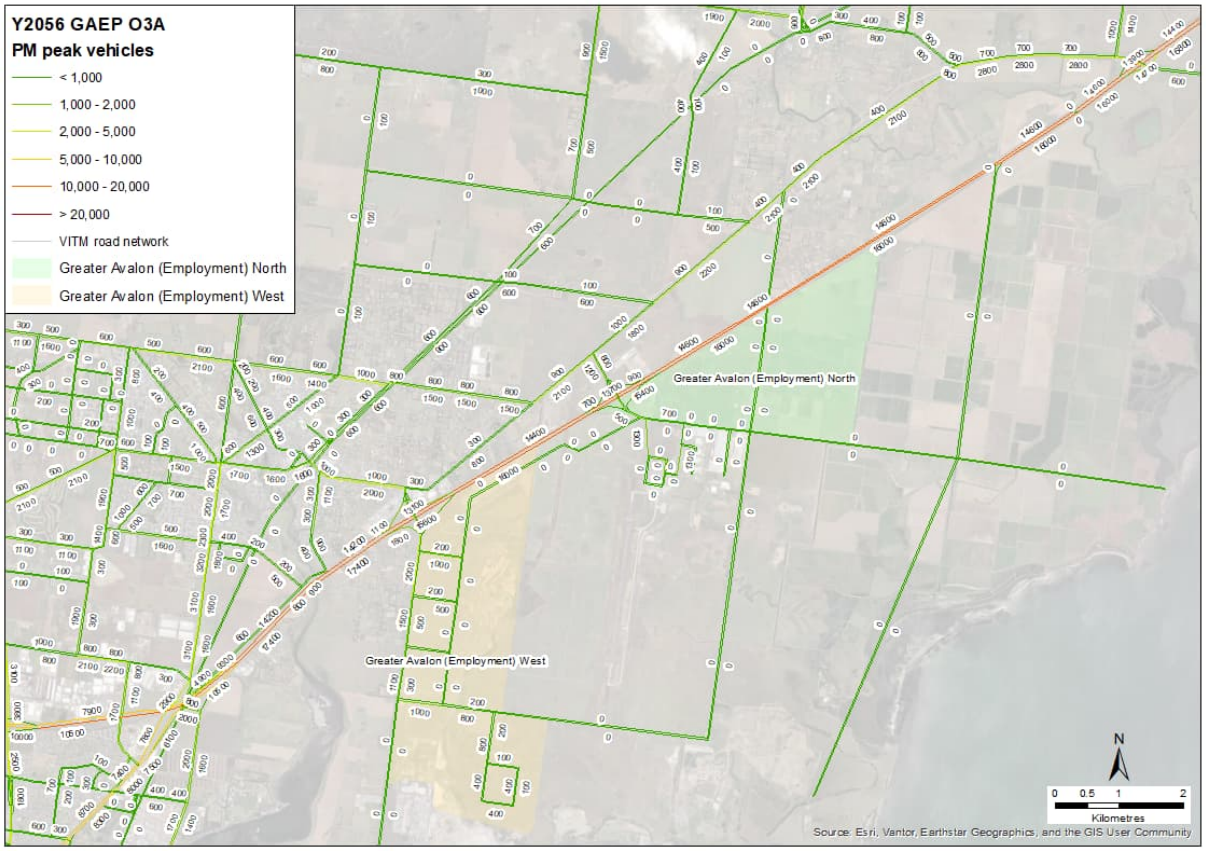


Figure 5-10: 2056 Option 3A, PM Peak Volumes

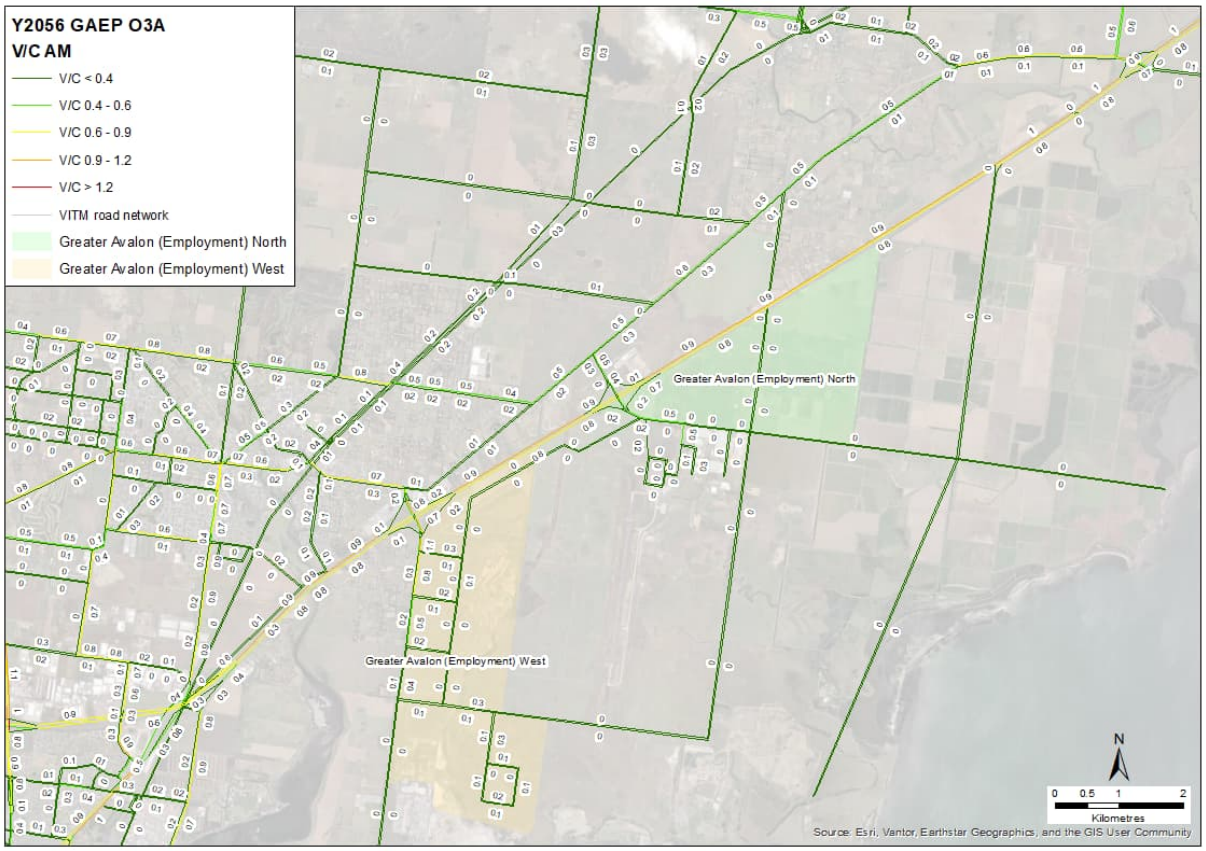


Figure 5-11: 2056 Option 3A, AM Peak Volume / Capacity Ratios

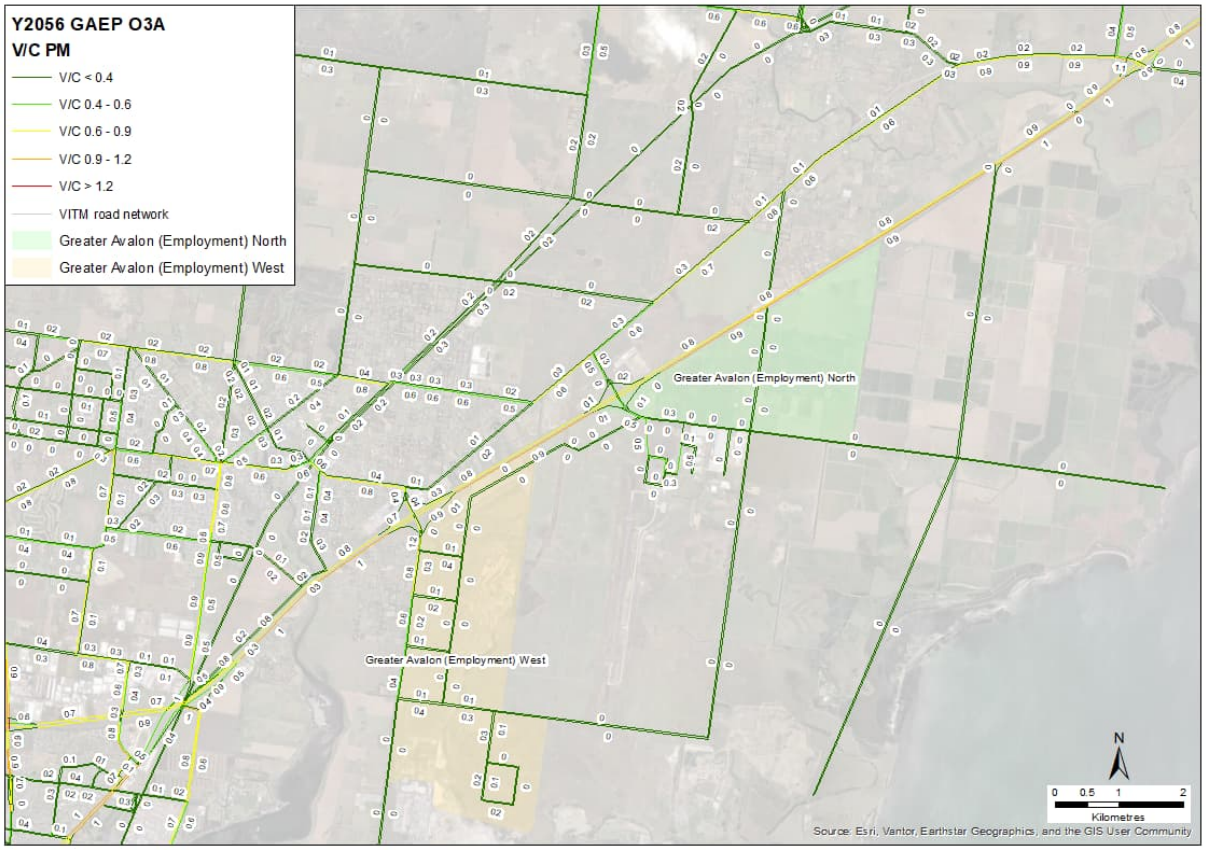


Figure 5-12: 2056 Option 3A, PM Peak Volume / Capacity Ratios

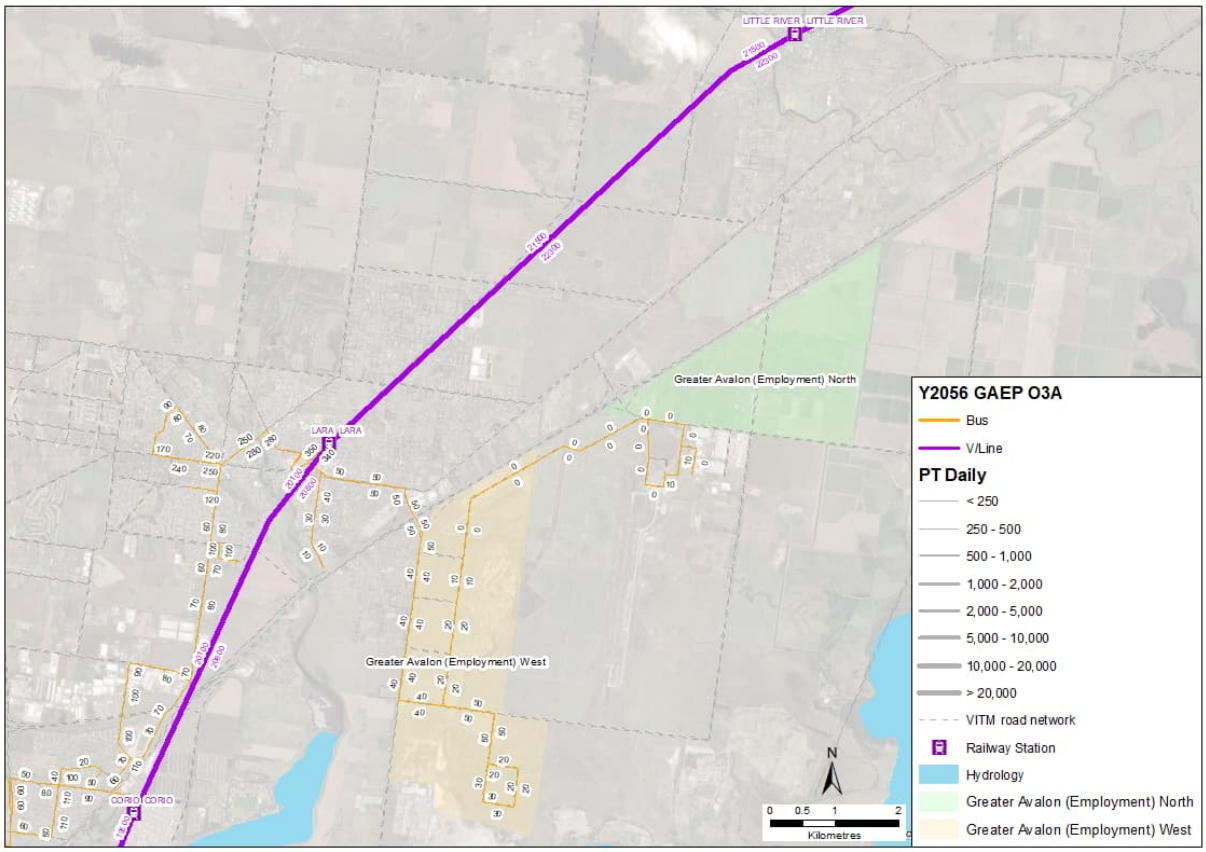


Figure 5-13: 2056 Option 3A, Daily Public Transport Volumes

5.4 2056 Comparison

The daily volumes on each of the key road links is provided in Table 5-2. As expected, the Airport related traffic drops significantly in the Revised 2056 Base Case and Option 3A, this has a major impact on the Beach Road interchange and a minor impact on the Avalon Road interchange.

Table 5-2: Select Link volumes (2056 Scenarios)

Road Section	Direction	2056 Daily Volumes (vpd[1])						
		2056 BC	Revised 2056BC	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A
Airport Passengers	IN	12,300	1,700	6,200	12,300	6,200	12,300	1,700
	OUT	11,800	1,600	5,900	11,800	5,900	11,800	1,600
	TOTAL	24,100	3,300	12,100	24,100	12,100	24,100	3,300
Avalon Rd - South of Fwy Interchange	S'Bound	1,000	< 100	8,800	9,900	8,600	8,800	8,300
	N'Bound	1,100	<100	8,600	9,200	8,300	8,700	7,900
	TOTAL	2,100	< 200	17,400	19,100	16,900	17,500	16,200
Beach Rd - East of Fwy Interchange	W'bound	16,600	3,800	18,300	22,600	11,200	16,800	3,700
	E'bound	16,100	4,000	17,700	19,800	11,600	15,900	3,900
	TOTAL	32,700	7,800	36,000	42,400	22,800	32,700	7,600
Dog Leg Connector (north east end)	W'bound	N/A	N/A	2,300	2,700	2,500	2,400	< 100
	E'bound	N/A	N/A	2,200	1,900	2,400	2,100	< 100
	TOTAL	N/A	N/A	4,500	4,600	4,900	4,500	< 200
Point Wilson Rd	S'Bound	700	< 100	2,900	4,500	400	500	< 100
	N'Bound	2,200	< 100	4,300	7,100	400	2,100	< 100
	TOTAL	2,900	< 200	7,200	11,600	800	2,600	< 200
Princes Fwy - East of Beach Rd	W'bound	70,200	66,400	69,800	69,000	70,600	71,300	67,600
	E'bound	73,400	68,400	72,900	73,300	72,500	74,400	69,600
	TOTAL	143,600	134,800	142,700	142,300	143,100	145,700	137,200
Princes Fwy - East of Point Wilson Rd	W'bound	72,300	66,400	74,100	76,100	71,000	73,400	67,500
	E'bound	74,100	68,400	75,900	77,800	72,900	75,000	69,600
	TOTAL	146,400	134,800	150,000	153,900	143,900	148,400	136,900
Princes Fwy - West of Avalon Rd	W'bound	68,100	65,400	69,100	69,900	68,100	69,000	66,700
	E'bound	68,800	65,500	71,000	71,900	69,500	70,500	67,400
	TOTAL	136,900	130,900	140,100	141,800	137,600	139,500	134,100

[1] = vehicles per day

To assist with the apportionment of costs, the share of traffic on each road that can be attributed to GAEP-N, GAEP-W, Avalon Airport and background traffic has been estimated in Table 5-3. The new options (Revised 2056BC and Option 3A) shows:

- A major reduction in Airport related traffic on Avalon Road.
- Removal of traffic from Point Wilson Road, due to the freeing up of capacity on other alternative routes. Noting that future Department of Defence uses are not modelled.

- The proportion of Airport traffic on the Princes Freeway drops from ~10%+ to 2% (however the road remains heavily congested).

Table 5-3: Select Link traffic share (2056 Scenarios)

Road Section	Direction	2056 Daily						
		2056 BC	Revised 2056BC	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A
Avalon Rd - South of Fwy Interchange	GAEP-N	0%	0%	0%	7%	0%	0%	0%
	GAEP-W	8%	97%	84%	73%	92%	88%	100%
	Airport	92%	3%	16%	20%	8%	12%	0%
	Other	0%	0%	0%	0%	0%	0%	0%
Beach Rd - East of Fwy Interchange	GAEP-N	0%	0%	45%	30%	0%	0%	0%
	GAEP-W	0%	0%	<1%	<1%	<1%	<1%	<1%
	Airport	100%	100%	55%	70%	100%	100%	99%
	Other	0%	0%	0%	0%	0%	0%	0%
Point Wilson Rd	GAEP-N	0%	0%	66%	57%	0%	0%	0%
	GAEP-W	0%	0%	0%	0%	0%	0%	0%
	Airport	100%	0%	34%	43%	100%	100%	0%
	Other	0%	0%	0%	0%	0%	0%	0%
Princes Fwy - East of Point Wilson Rd	GAEP-N	0%	0%	7%	7%	0%	0%	0%
	GAEP-W	<1%	<1%	2%	2%	2%	2%	3%
	Airport	15%	3%	10%	14%	10%	15%	3%
	Other	85%	97%	82%	77%	87%	83%	95%
Princes Fwy - West of Avalon Rd	GAEP-N	0%	0%	6%	6%	0%	0%	0%
	GAEP-W	<1%	<1%	5%	5%	5%	5%	6%
	Airport	11%	2%	8%	10%	8%	11%	2%
	Other	89%	98%	82%	79%	87%	84%	92%

5.4.1 Internal road network recommendations

The internal road network modelled (refer to Section 3.1) included a network of single lane, two-way arterial, connector and local roads. The outputs presented in Section 4 highlighted a few sections that would be over capacity and others that were underutilised and not crucial for inclusion in the final road network. Based on the additional scenarios, our recommendations for a GAEP-W only scenario with minimal growth at Avalon Airport, are as follows (also shown in Figure 4-31).

- **Avalon Road**: still requires duplication between the freeway interchange and the first connector street, projected daily volumes are 16,200vpd.
- **Beach Road**: there is a no need for duplication between the freeway interchange and the Airport entry.
- **'Dog Leg Connector'**: there is minimal interaction between GAEP-W and GAEP-N or Avalon Airport, it is not a critical link in the network. However, the 'Dog Leg Connector' does provide resilience in the network (with Dandos Road and Pousties Road being the alternative) and provides a more direct route for bus routes and emergency services.
- **Dandos Road:** with no GAEP-N and low growth at Avalon Airport, this road does not need to retained.

Future Department of Defence uses within the Airport land and Point Wilson will also have an as-yet unknown additional transport impact on the network.

5.4.2 External road network recommendations

The modelling results in Section 4 highlighted some concerns over the crossings of the Princes Freeway at Avalon Road and Beach Road. The updated results are summarised in Table 5-4 and show that with less growth at Avalon Airport, the Beach Road interchange now operates well within capacity. Meanwhile the introduction of GAEP-W in Option 3A (with lower airport growth only) pushes the southbound crossing in the AM peak close to capacity. Further detail and images are provided in Table 5-5 and Table 5-6.

Table 5-4: Princes Freeway Interchanges – volume capacity ratio of most congested section

Location	Direction	Volume / Capacity Ratio					
		2056 BC		Revised BC		Option 3A	
		AM	PM	AM	PM	AM	PM
Avalon Road	Northbound	0.3	0.3	0.3	0.1	0.4	0.7
	Southbound	0.8	0.3	0.3	0.3	0.9	0.4
Beach Road	Northbound	0.9	1.1	0.3	0.4	0.3	0.5
	Southbound	1.1	0.8	0.6	0.2	0.6	0.2

The Avalon Road freeway interchange operates acceptably in the Revised 2056 Base Case and remains marginally undercapacity in Option 3A, the busiest movement is the southbound crossing in the PM peak with a V/C ratio of 0.9, as shown in Table 5-5. Given that the congestion is isolated to one direction in the AM and PM peaks, there may be traffic engineering solutions such as optimised signal phasing and intersection layout design to increase capacity for the peak flow direction.

Table 5-5: Avalon Road / Princes Freeway interchange – volume capacity ratios

Scenario	AM V/C	PM V/C
Revised Base Case		
Option 3A		

The Beach Road freeway interchange operates under capacity in both the Revised 2056 Base Case and Option 3A in both peak periods, as shown in Table 5-6.

Table 5-6: Beach Road / Princes Freeway interchange – volume capacity ratios

Scenario	AM V/C	PM V/C
Revised Base Case		
Option 3A		

6. Summary Findings

The strategic transport modelling assessment shows that there is significant growth projected on the Princes Freeway, even without the development of GAEP-N, GAEP-W or Avalon Airport. This is largely due to the freeway connecting one of the fastest growing metropolitan councils (Wyndham) with one of the fastest growing regional councils (Geelong). The freeway interchanges at Avalon Road and Beach Road are also impacted by the large growth projected in and around Lara.

In the scenarios modelled, traffic on the Princes Freeway (3-lanes in each direction) grows from 72,000 vehicles per day in 2019 to between 135,000 and 154,000 (depending on the scale of development). Comparable volumes in Victoria only occur on freeways with 4-5 lanes[4]. Additional lanes and ramp metering will likely be required and will require further investigation with DTP.

The original options modelled all included significant development at Avalon Airport, both in terms of additional employment and air passengers. Overall, the full development scenario (Option 1B with GAEP-W and GAEP-N) includes 26,350 jobs and Avalon Airport handling 9.66 million air passenger per annum. As shown in Table 6-1 this generates 82,100 daily vehicle movements, approximately 50% being from Avalon Airport. As a result, upgrades are needed to both the Beach Road and Avalon Road freeway interchanges such as duplication of the overpasses, as well as localised duplication approaching the interchanges.

Table 6-1: Summary of weekday traffic generation by scenario

Region	2056 - weekday traffic generation				
	Base Case Airport full build out	**Option 1A** GAEP-W + GAEP-N Airport 50% build out	**Option 1B** GAEP-W + GAEP-N Airport full build out	**Option 2A** GAEP-W only Airport 50% build out	**Option 2B** GAEP-W only Airport full build out
Airport[5]	43,200	29,600	42,000	30,200	42,600
West	-	15,600	15,600	16,300	16,300
North	-	24,600	24,500	-	-
Total	43,200	69,900	82,100	46,500	58,900

Updated modelling with growth at Avalon Airport limited to 2026 levels (refer to Table 6-2) was undertaken to isolate the impacts of GAEP-West on the surrounding transport network. This highlighted that the Avalon Road interchange would require traffic engineering solutions such as optimised signal phasing and intersection layout design to address congestion at peak times but would likely avoid a need to duplicate the overpass.

Table 6-2: Summary of weekday traffic generation by scenario (additional scenarios)

Region	2056 - weekday traffic generation	
	Revised Base Case Airport at 2026 levels	**Option 3A** GAEP-W only Airport at 2026 levels
Airport	7.800	7,600
West	-	16,700
North	-	-
Total	7,800	24,300

[4] This compares to the following 2019 annual average daily traffic volumes: West Gate Freeway 181,000 (5-lanes), Tullamarine Freeway (south of Bell Street) 132,000 (5-lanes), Monash Freeway at Wellington Road170,000 (5-lanes), Western Ring Road east of Pascoe Vale 151,000 (4-lanes). Source: Historical Annual Average Daily Traffic Volume - Data Collection - Open Data - Transport Victoria

[5] Regions can generate slightly varying demand under different land use scenarios as VITM considers many factors such as mode choice, road network congestion and proximity of land use types. All of these factors impact total vehicle trips generated on the road network.

The strategic transport modelling assessment shows that the proposed road network within GAEP-W and GAEP-N is largely appropriate for the projected traffic volumes, with short sections of Avalon Road and Beach Road (near the freeway interchanges) needing to be duplicated. The 'Dog Leg Connector' is forecast to carry low volumes, but it does provide resilience to the road network (with Dandos Road and Pousties Road being the alternative) and provides a more direct route for bus routes and emergency services.

The performance of the critical freeway interchanges across all scenarios are summarised in Table 6-3, the key findings are:

- Significant development at Avalon Airport places considerable strain on the Beach Road freeway interchange prior to the development of GAEP-W or GAEP-N. A major upgrade will be required to support the growth of Avalon Airport.
- If the proposed growth at Avalon Airport were to remain at 2026 levels, then:
    - GAEP-W could potentially be delivered without needing to upgrade the Avalon Road freeway interchange. However, traffic engineering solutions would need to be explored to avoid isolated congestion in the AM peak (southbound on the overpass) and PM peak (northbound on the overpass)
    - GAEP-N could potentially be delivered without needing to upgrade the Beach Road freeway interchange, as it can also be accessed from the Point Wilson Road interchange. This scenario has not been modelled.

Table 6-3: Princes Freeway Interchanges – volume capacity ratio of most congested section

Location	Direction	Volume / Capacity Ratio													
		2056 BC		Option 1A		Option 1B		Option 2A		Option 2B		Revised 2056 BC		Option 3A	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Avalon Road	N'bound	0.3	0.3	0.5	0.6	0.5	0.9	0.5	0.6	0.5	0.7	0.3	0.1	0.4	0.7
	S'bound	0.8	0.3	1.2	0.3	1.3	0.3	1.0	0.3	1.1	0.4	0.3	0.3	0.9	0.4
Beach Road	N'bound	0.9	1.1	0.8	1.0	1.0	1.2	0.8	1.0	1.1	1.1	0.3	0.4	0.3	0.5
	S'bound	1.1	0.8	1.4	0.6	1.4	0.8	1.1	0.5	1.2	0.8	0.6	0.2	0.6	0.2

Upgrades to Beach Road will ultimately be guided by the ongoing Commonwealth funded Beach Road Upgrade Feasibility Study. The study will explore options to improve access to the Airport and help transform the precinct into a transport and logistics hub

Bus routes have been considered which provide connectivity throughout GAEP-W and GAEP-N, to Avalon Airport and to Lara station. Further enhancements to the bus routes, including bus priority infrastructure, have the capability to reduce the number of vehicles on the road. Airport passengers and employees will be good candidates for public transport usage with the appropriate routes and timing. Although large employment precincts dominated by manufacturing do not tend to generate high public transport usage due to their dispersed layouts.

Appendix A. Strategic Model Review

A.1 Introduction

The Victorian Integrated Transport Model (VITM) provided by the Department of Transport and Planning (DTP) has been used for the strategic modelling of this study, version number VITM24_v2_03.

This appendix presents a summary of the study area as represented in VITM and the steps undertaken to make it suitable for use on this project. The intent is to provide confidence that the model is fit for use. The key aspects discussed in the following sections include:

- Refining the VITM zone system for the study area
- The land use inputs for the disaggregated zone system, including consideration of Avalon Airport
- Updated transport networks around the study area
- The fitness for purpose of the model

A.2 Travel zones

Zones for the 2018 model were disaggregated as per Section 2.2

A.3 Land use assumptions

A.3.1 Demographics

All zones in the GAEP study area are vacant (no residents, jobs or schools) with the exception of Avalon Airport, with 481 jobs in zone 5854 in 2018.

A.3.2 Avalon Airport Air Passengers

Annual air passenger forecasts were provided by Avalon Airport for inclusion in the VITM model (refer to Table A.1), along with an estimate of air passengers in 2018[6]. In addition to this, Avalon Airport also shared traffic assumptions used for their internal planning works. This included a number of assumptions about air passengers which we have adopted for consistency. This included:

- Conversion factor from annual air passengers to vehicle trip ends per day of 400
- Traffic flows are balanced in and out of the airport
- 60% of air passengers are attracted towards Melbourne, 40% towards Geelong
- The airport operates for 18 hours per day

Table A.1: Avalon Airport Air Passenger Forecasts

	2018	2026	2031	2036	2041	2046	2051	2056
Annual air passengers	1,650,000	1,375,725	3,350,659	5,272,261	6,185,559	7,460,077	8,509,820	9,656,264
Daily vehicles (in and out)	4,125	3,439	8,377	13,181	15,464	18,650	21,275	24,141

[6] There are no publicly available data sources to validate this as *"Avalon Airport is excluded for commercial-in-confidence reasons"* from common aviation statistics such as those published by BITRE. Airport traffic data | Bureau of Infrastructure and Transport Research Economics. However, based on the number and type of flights in 2018, it is not possible to have achieved this figure. A figure closer to 50% of the quoted passenger numbers are more likely.

Table A.2 shows the allocation of daily vehicle trips into time periods that was assumed, this was based on the Traffix Group report provided by Avalon Airport and assumptions about the general operation of airports.

Table A.2: Avalon Airport Air Passenger Time Period Splits

Time Period	Airport Hours of Operation	Share
AM peak (7-9am)	2	17%
Inter peak (9am-3pm)	6	33%
PM Peak (3-6pm)	3	25%
Off peak (6pm-7am	7	25%

Based on the assumptions outlined above, matrices of air passenger vehicle trips were generated by time period using a gravitational model with a cut-off distance of 50km and calibrated with a scaling constant to reflect the pre-determined number of trips to be generated. This generated vehicle movements similar to those proposed in the Avalon Ground Transport Plan.

To assign these trips, the matrices of private vehicle trips were added to VITM before the Highway assignment where the demand matrices are prepared, as shown in Figure A.1.

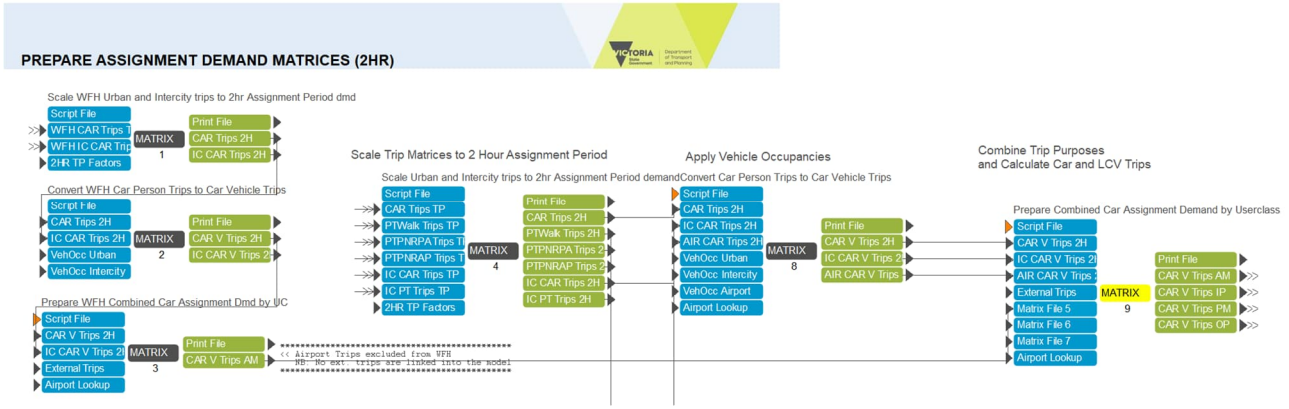


Figure A.1: VITM preparation of demand matrices before assignment

It is acknowledged that this is a less sophisticated method for representing air passenger trips than what is included for Melbourne Airport and there is no mode share model included. However, given the lack of public transport options, it is likely that the private vehicle trips dominate and the model updates reflect this assumption.

A.4 Transport Network

In order to run the 2018 base model, the road network required updating, as there was essentially nothing in the model south of the Princes Freeway. A road network was created, based on the network that existed at that time. This has been summarised through the following outputs:

- Road classification (Figure A.2)
- Lane configuration (Figure A.3)
- Posted speed limits (Figure A.4)

A summary of the daily vehicle volumes for the 2018 Base Case is provided later in the note in Figure A.6.

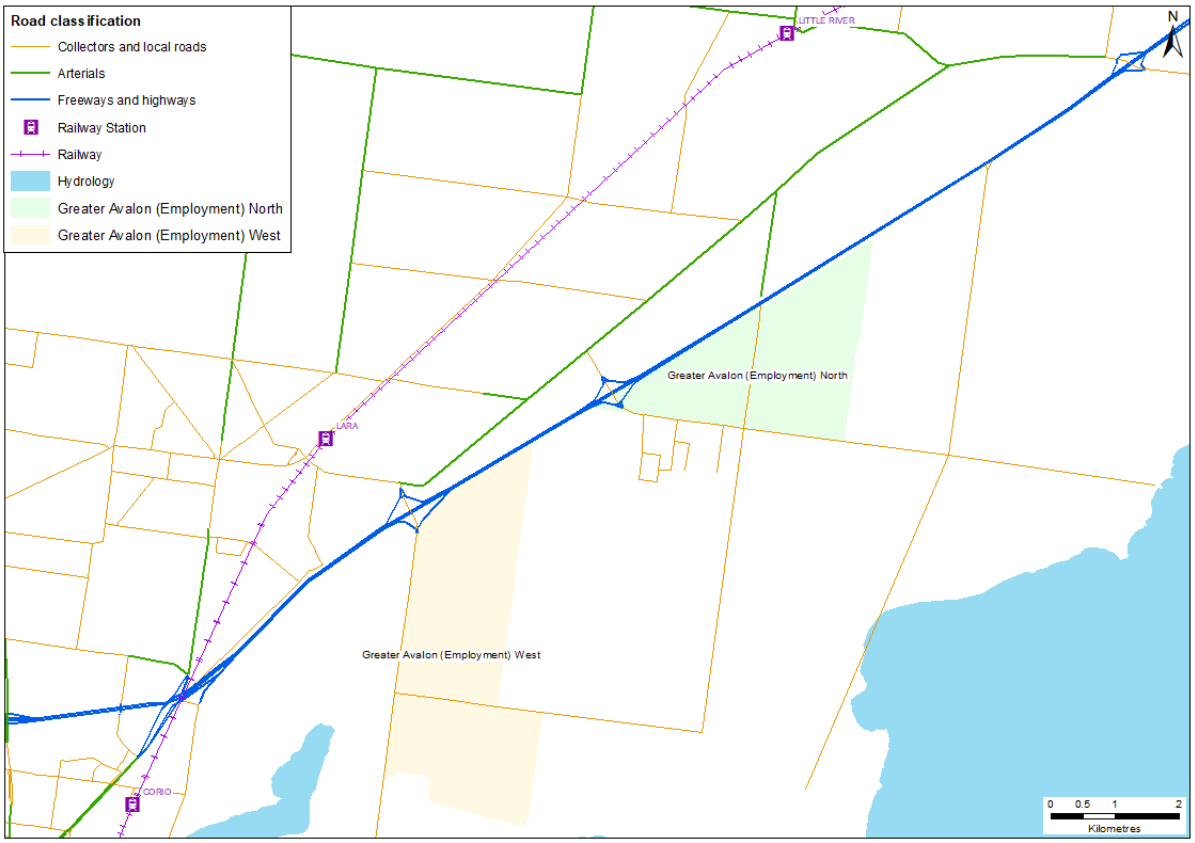


Figure A.2: 2018 VITM road network classification

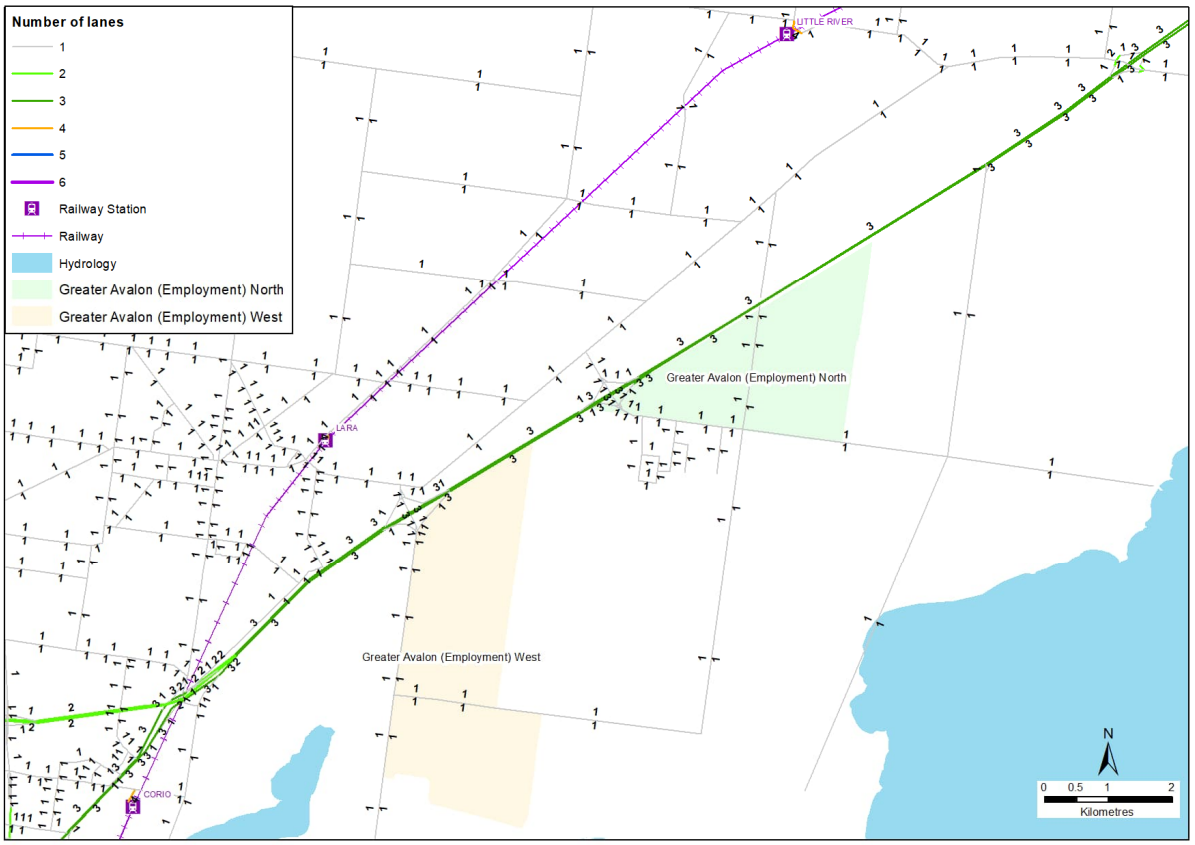


Figure A.3: 2018 VITM road network: number of lanes

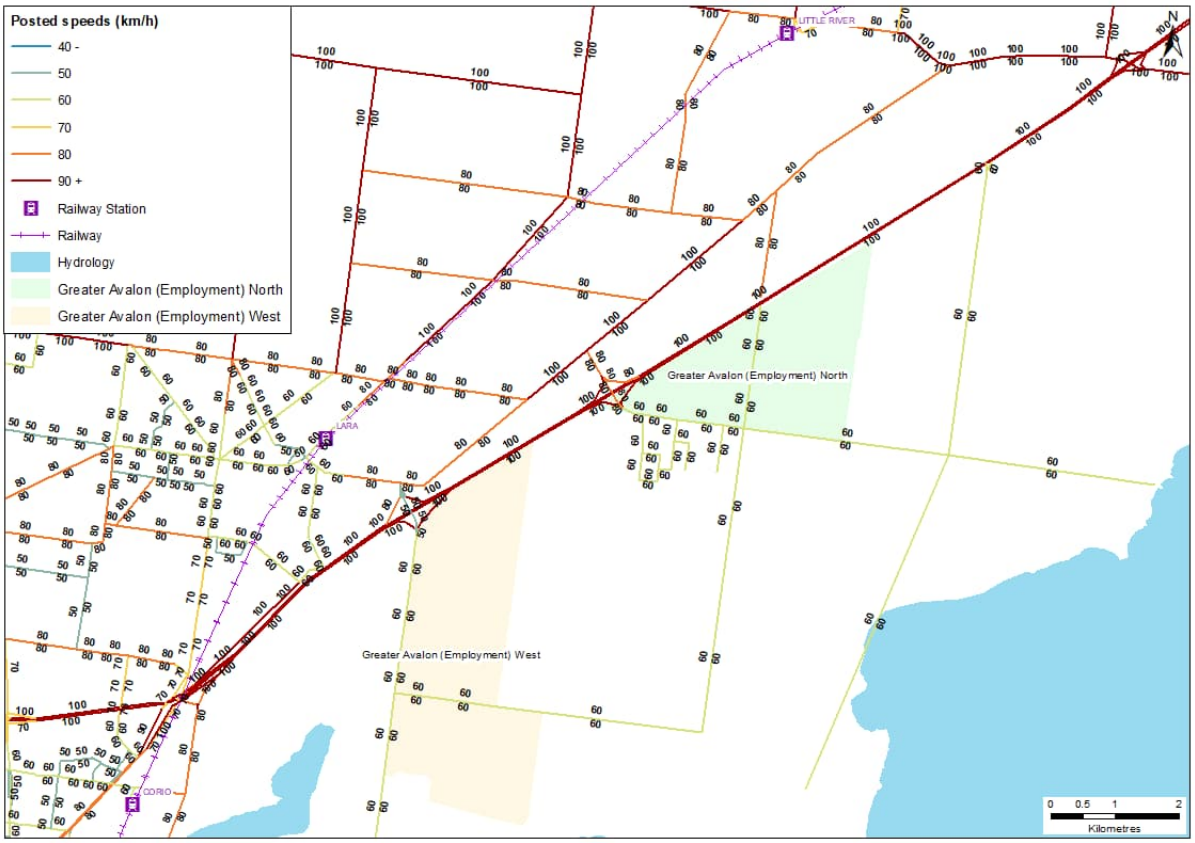


Figure A.4: 2018 VITM road network: posted speed limits

A.5 Base Year Validation

The validation performance of the 2018 model has been checked for the study area by comparing modelled outputs against observed data to ensure that it is fit for purpose for predicting travel behaviour on the road network surrounding the GAEP. This section also highlight any limitations when using the results for further assessment.

A.5.1 Validation Criteria

The validation criteria adopted for this project is outlined in Table A.3, these are taken from the *Strategic Modelling Validation Guidelines, Version 6 (Draft), Department of Transport and Planning (August 2024).* The guidelines provide guidance on the appropriate validation measures and targets, as well as suggesting that the importance of each measure be considered.

Existing traffic in the GAEP study is predominantly by private vehicle or freight vehicles. As such road traffic volumes from VITM (post zone and road network updates) is the key model output to validate. There was a lack of hourly traffic volumes available, so statistics such as GEH[7] have not been considered.

Table A.3: Project validation criteria

Measure	Target	Importance
Screenlines – 24hr volumes	Daily: $\pm 80.145V^{-0.3953}$	Important

[7] The GEH Statistic (named after Geoffrey E. Havers) compares two sets of hourly traffic volumes, it has a non-linear difference threshold which takes into the account the total volume on each road.

Measure	Target	Importance
Scatter Plot – 24hr volumes	Slope of best-fit regression line between 0.9 and 1.1 and R^2 greater than or equal to 0.9	Very important
Rail Patronage – average weekday boardings and alightings	±20% / professional judgement	Not essential
Bus Patronage – average weekday boardings	±20% / professional judgement	Not essential

A.5.2 Traffic Volumes

Modelled VITM volumes from the updated 2018 scenario were compared to observed volumes for each of the sites shown in Figure A.5, these are the locations where independent traffic counts were available from Greater Geelong City Council, Avalon Airport or from publicly available datasets. There were limited peak hour counts available, so the analysis has focussed on daily traffic volumes.

Figure A.6 shows the daily road volumes in the region surrounding the GAEP for 2018 as produced by the updated VITM base model.

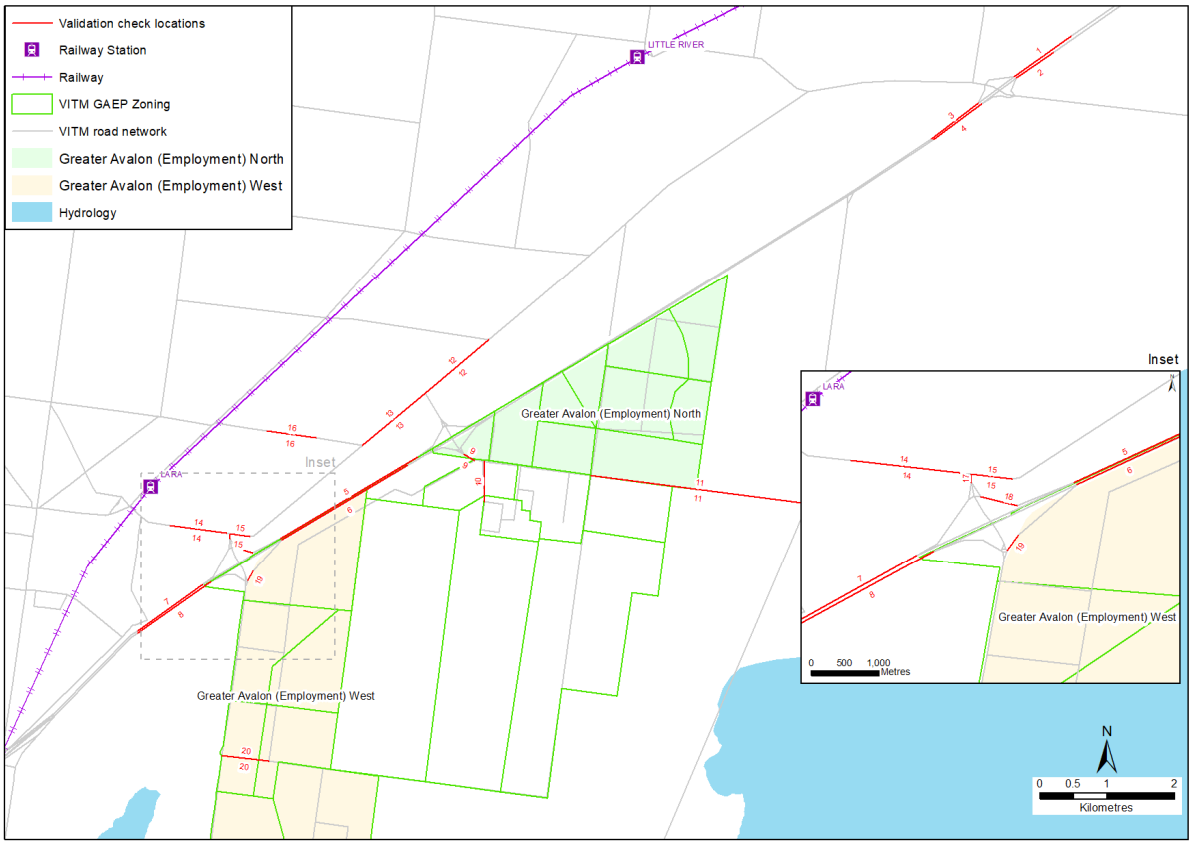


Figure A.5: Road volume count locations

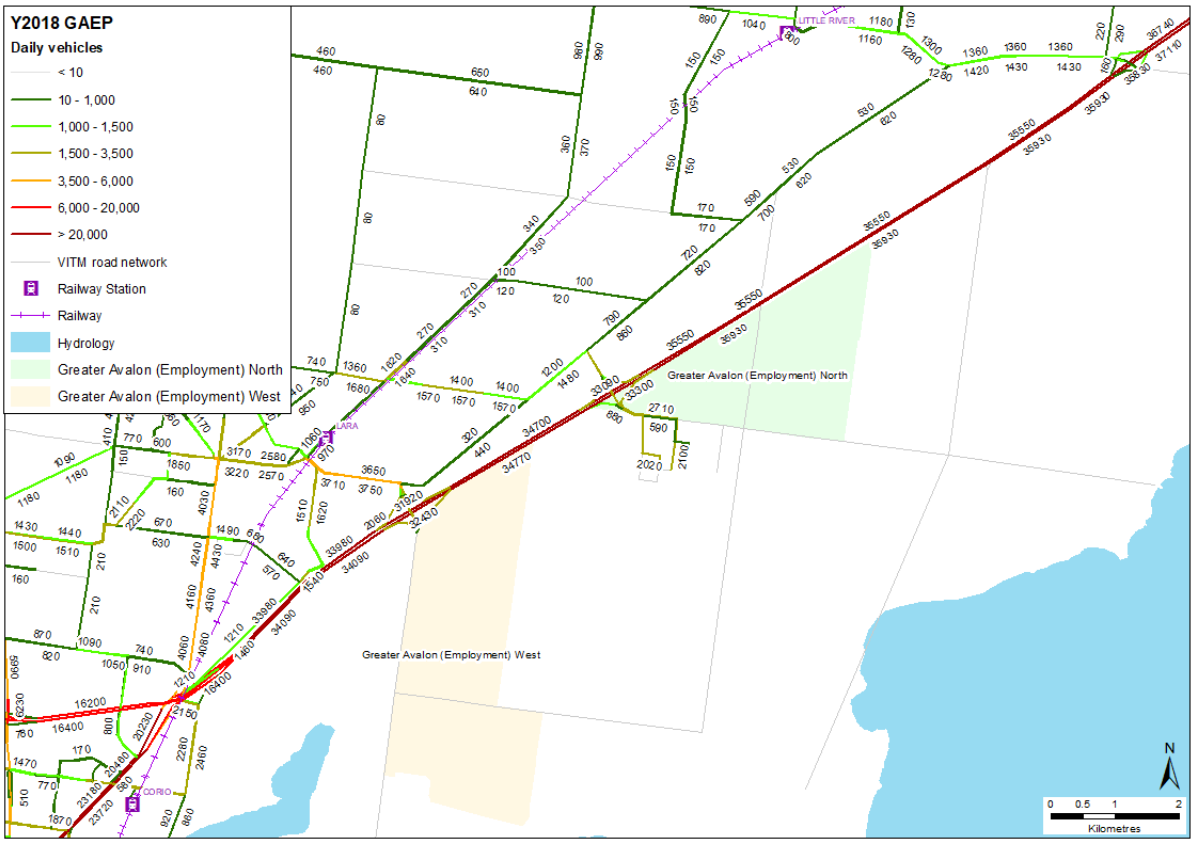


Figure A.6: 2018 Base VITM, daily volumes

Table A.4 presents a comparison of daily modelled volumes and the various observed datasets that were available for this project, this included:

- The DataVic.gov.au website (https://discover.data.vic.gov.au/dataset/traffic-volume) (in grey), typically representing 2019 data
- Traffic counts provided by the City of Greater Geelong from 2017/18 (in blue)
- Traffic counts provided by Avalon Airport from 2022 (in yellow)

Table A.4: Comparison of daily volumes on the main arterials surrounding the GAEP

Road section	ID	Direction	Observed	Modelled	Difference (Modelled – Observed)	% difference (Modelled – Observed)
Princes Freeway - East of Point Wilson Rd	1	WE	28,000	35,550	7,550	27%
Princes Freeway - East of Point Wilson Rd	2	EW	29,000	35,930	6,930	24%
Princes Freeway - West of Point Wilson Rd	3	WE	35,000	35,550	550	2%
Princes Freeway - West of Point Wilson Rd	4	EW	35,000	35,930	930	3%
Princes Freeway - West of Beach Rd	5	WE	34,000	34,700	700	2%
Princes Freeway - West of Beach Rd	6	EW	34,000	34,770	770	2%
Princes Freeway - West of Avalon Rd	7	WE	34,000	33,980	-20	0%
Princes Freeway - West of Avalon Rd	8	EW	32,000	34,090	2,090	7%
Beach Rd - West of Airport Egress	9	Both	3,226	5,320	2,094	65%
Avalon Airport Car Park Egress	10	SN	782	2,020	1,238	158%
Beach Rd - East of Pousties Rd	11	Both	400	0	-400	-100%
Old Melbourne Rd - East of Beach Rd	12	Both	1,341	1,650	309	23%

Road section	ID	Direction	Observed	Modelled	Difference (Modelled – Observed)	% difference (Modelled – Observed)
Old Melbourne Rd - West of Beach Rd	13	Both	2,455	2,680	225	9%
McClelland Av - West of Avalon Rd	14	Both	8,937	7,400	-1,537	-17%
Old Melbourne Rd - East of Avalon Rd	15	Both	1,171	760	-411	-35%
McIntyre Rd - West of Old Melbourne Rd	16	Both	1,717	2,970	1,253	73%
Avalon Rd - North of Princes Fwy	17	Both	5,737	7,740	2,003	35%
Avalon Rd - Princes Fwy On Ramp	18	WE	2,086	2,790	704	34%
Avalon Rd - Princes Fwy Off Ramp	19	EW	2,796	2,340	-456	-16%
Dandos Rd	20	WE	824	0	-824	-100%

Source of observed data: DataVic, Avalon Airport, City of Greater Geelong,

A.5.3 Screenlines

A screenline is a cordon line drawn across a transport corridor used to calculate the total volume of traffic travelling from one side of the line to the other. It is a useful method to validate the overall volume of traffic in a demand matrix, as it aggregates traffic that is travelling in a similar direction but on different (often competing) routes.

In the GAEP study area, traffic is dominated by the Princes Freeway with Old Melbourne Road the only viable alternative, but it only carries 4% of the traffic that the Princes Freeway does. Regardless, the screenline assessed in Figure A.7is for eastbound and westbound movements passing through both roads at Beach Road. The percentage difference between observed and modelled total traffic volumes for all screenlines should be within the bounds of the functions listed in Table A.3, as is the case below.

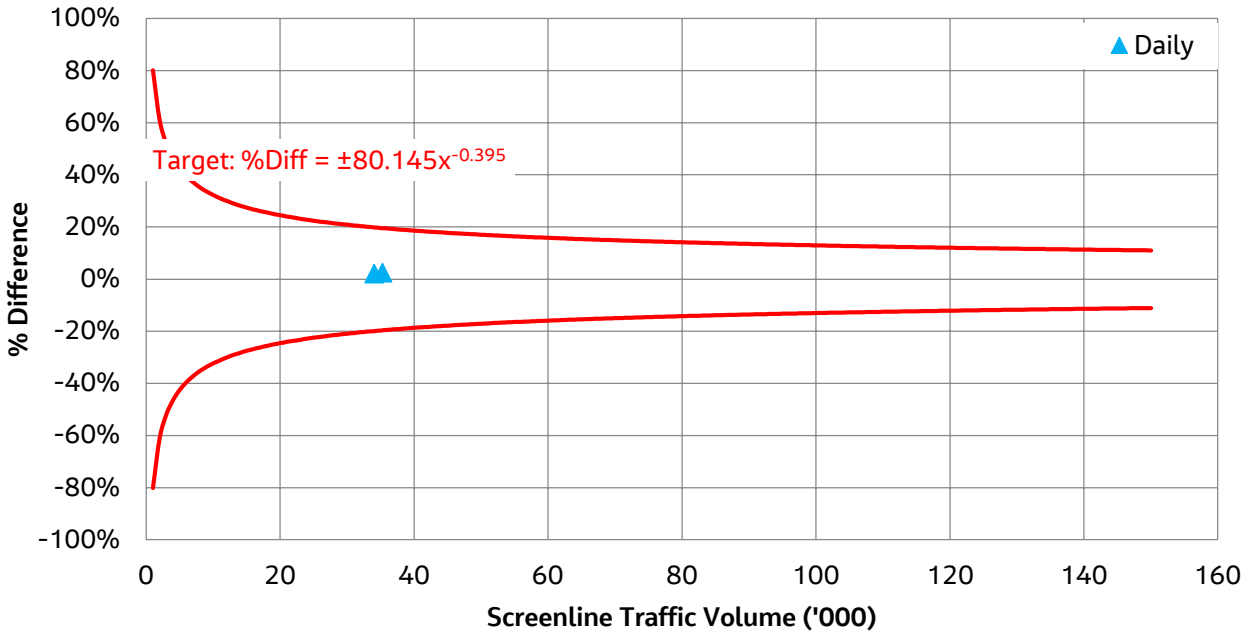


Figure A.7: 2018 Screenline Validation

A.5.4 Scatter Plots

Scatter plot analysis involves constructing a linear regression line of best fit between the modelled and observed volumes. The generally accepted criteria for acceptance of the modelled flows are:

- A coefficient of determination (R^2) of least 0.90
- The slope for the best-fit line through the origin should be in the range of 0.9 and 1.1

The resultant scatter plots of observed vs modelled volumes for daily volumes is presented in Figure A.8, this shows that the slope of best fit is within the target range of between 0.9 and 1.1. In addition, the R^2 value shown is greater than the target of 0.9.

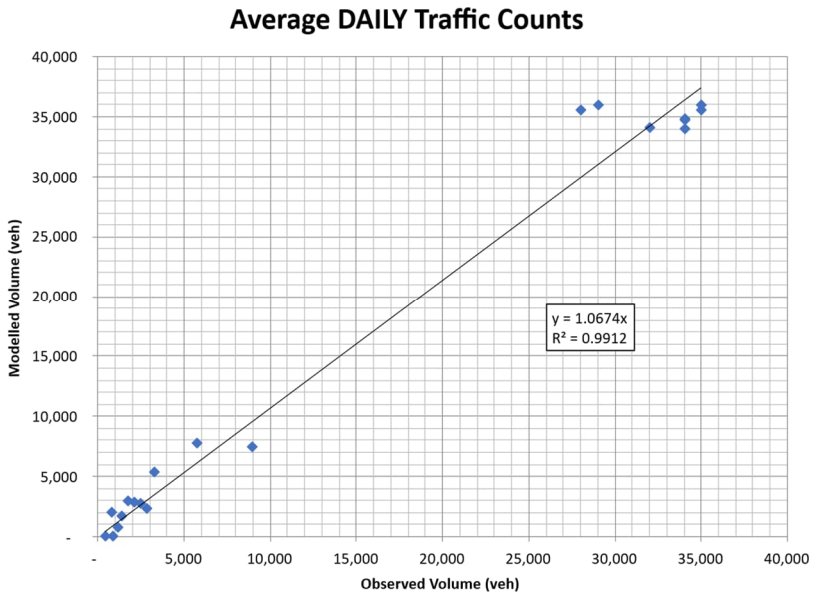


Figure A.8: Daily Observed vs Modelled traffic volumes

A.5.5 Public Transport Validation

Public transport services in the vicinity of the study area are shown in Figure A.9. There are three bus routes (10, 11 and 12) that service Lara, two are local and one travels to the Corio Village Shopping Centre. The closest rail line to the study area is the Geelong Line. Lara is the closest station, either side of this is Little River (9.9km north east) and Corio (6.4km south west).

Both Lara and Little River stations are the most relevant rail options for the study area, a comparison of modelled and observed data is shown in Table A.5, combining the two stations the model is underpredicting patronage by 25%.

Average weekday bus boardings on Route 10, 11 and 12 combined are less than 300 per day, this is too low to expect a strategic model to validate against. However, the results shown in Table A.6 are encouraging and indicate that the model is picking up patronage on each of those routes, albeit is over predicting by 400 passenger per day.

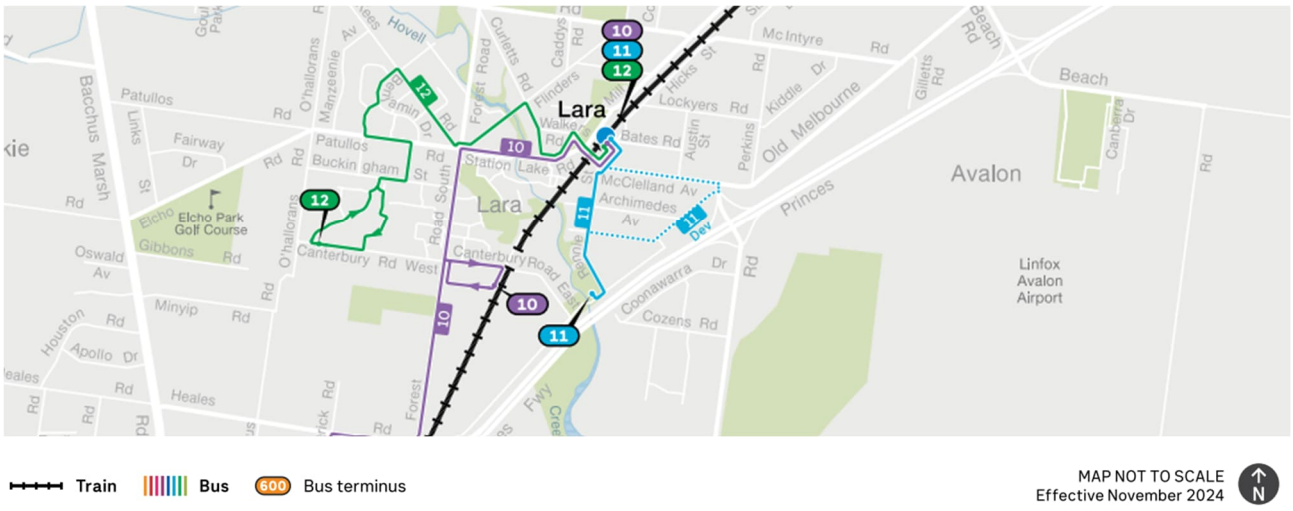


Figure A.9: Geelong Public Transport Network Extract[8]

Table A.5: Rail validation

Station	Boardings			Alightings		
	Observed	Modelled	% difference	Observed	Modelled	% difference
Lara	1,263	925	-27%	1,368	975	-29%
Little River	68	112	64%	76	108	42%
Both stations	**1,332**	**1,037**	**-22%**	**1,444**	**1,083**	**-25%**

Table A.6: Bus validation

Service number	Service description (O-D)	Average Daily Observed Bidirectional Patronage 2019	2018 Daily Modelled Bidirectional Patronage	Absolute Difference (Modelled -Observed)
10	Lara Station - Corio Village SC	137	260	+ 123
11	Lara Station - Lara East	7	77	+ 70
12	Lara Station - Lara West	129	328	+199
Total		**273**	**665**	**+392**

A.5.6 Validation Summary

The validation performance has been checked for the study area in 2018 by comparing modelled outputs against available observed 2018 data to ensure that is fit for purpose for predicting travel behaviour on the road network surrounding the GAEP

Table A.7 displays a summary of the validation for daily road traffic, rail and bus patronage. Based on these results, and in alignment with DTP guidelines, the model is deemed to have a 'Good' validation quality ranking and is fit for forecasting traffic impacts within and surrounding the GAEP. The following should be considered when interpreting results:

- VITM is marginally overestimating traffic demand in the study area, however it is within expected bounds for a strategic model.

[8] Source: Geelong-LAM_November.pdf

- The poorest validation occurs north of the Princes Freeway with some sections being under-estimated (IDs 14,15) in VITM and others being over-estimated (IDs 16,17).
- Some roads around the airport are overestimated in VITM (such as Beach Road), however it is noted that this is likely caused by the air passenger numbers being used being overstated.
- The Eastern and Southern sides of the airport are poorly represented in the model, especially Pousties Road (ID 11) and Dandos Road (ID 20), these are due to missing demographic data south of the study area.
- Public transport volumes are limited in the area and whilst VITM returns sensible results, the impacts from any significant changes in service provision should be closely checked.

Table A.7: Validation summary of daily volumes

Criteria	Target	Daily
Road traffic		
Screenlines	Daily: $\pm 80.145V^{-0.3953}$	2/2 Pass
Slope of Best Fit	0.9 -1.1	1.07
R^2	>= 0.9	0.99
Public Transport		
Rail	±20% / professional judgement	-25% (absolute diff. of 300 boardings per day)
Bus	±20% / professional judgement	+140% (absolute diff. of 400 boardings per day)

A.5.7 Conclusion

Significant upgrades have been made to VITM to allow for strategic modelling of the GAEP region. This includes the following key updates:

- An additional 32 travel zones, including future proofing for development on the north side of the Princes Freeway
- The addition of a road network south of the Princes Freeway between Avalon Road and Point Wilson Road, including Avalon Airport
- The inclusion of air passenger trips from Avalon Airport, noting that this assumes all air passengers will travel by car to the airport

The validation of the model shows that at a high-level the model is fit for the purpose of this assessment.

Appendix B. Select Link Plots

The following figures provide a range of select link plots to help understand the role of different roads and how traffic is distributed across the network. They were used to calculate the share of traffic on each road that can be attributed to GAEP-N, GAEP-W, Avalon Airport (refer to Section 4.6.1).

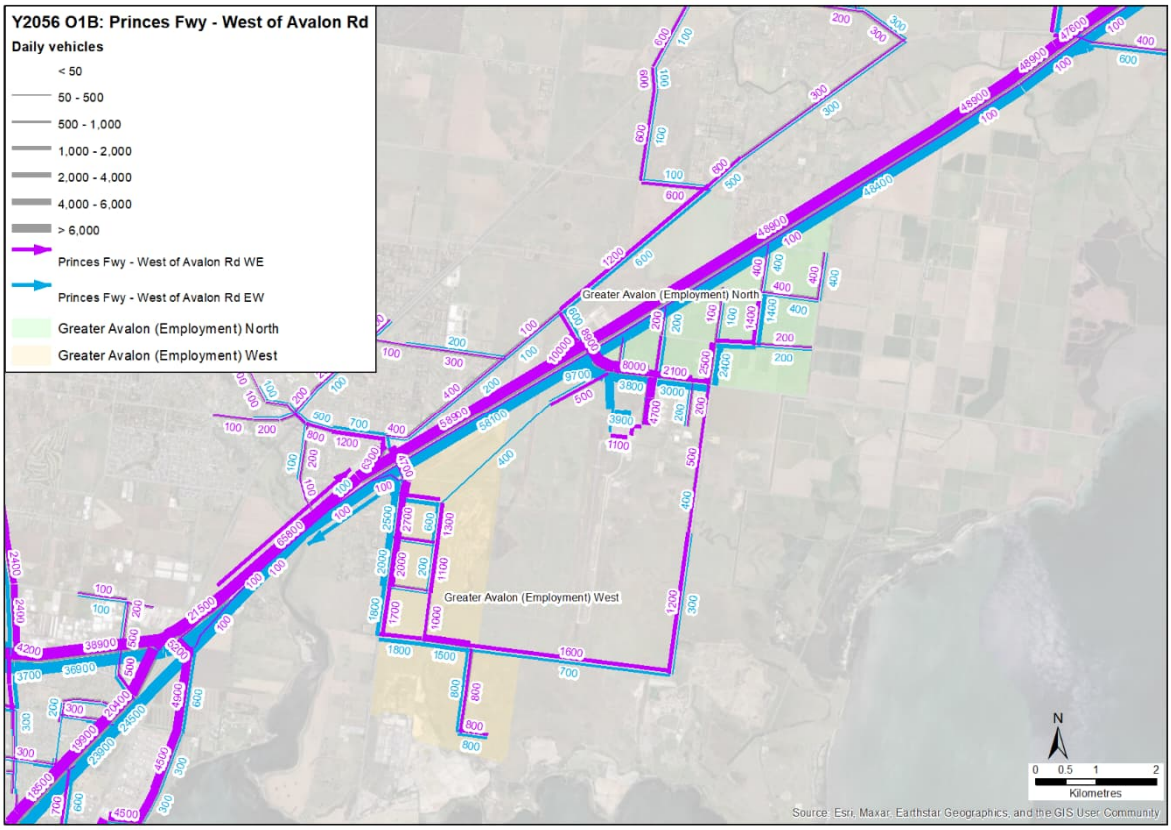


Figure B.1: Select Link, Princes Freeway – West of Avalon Road, Option 1B

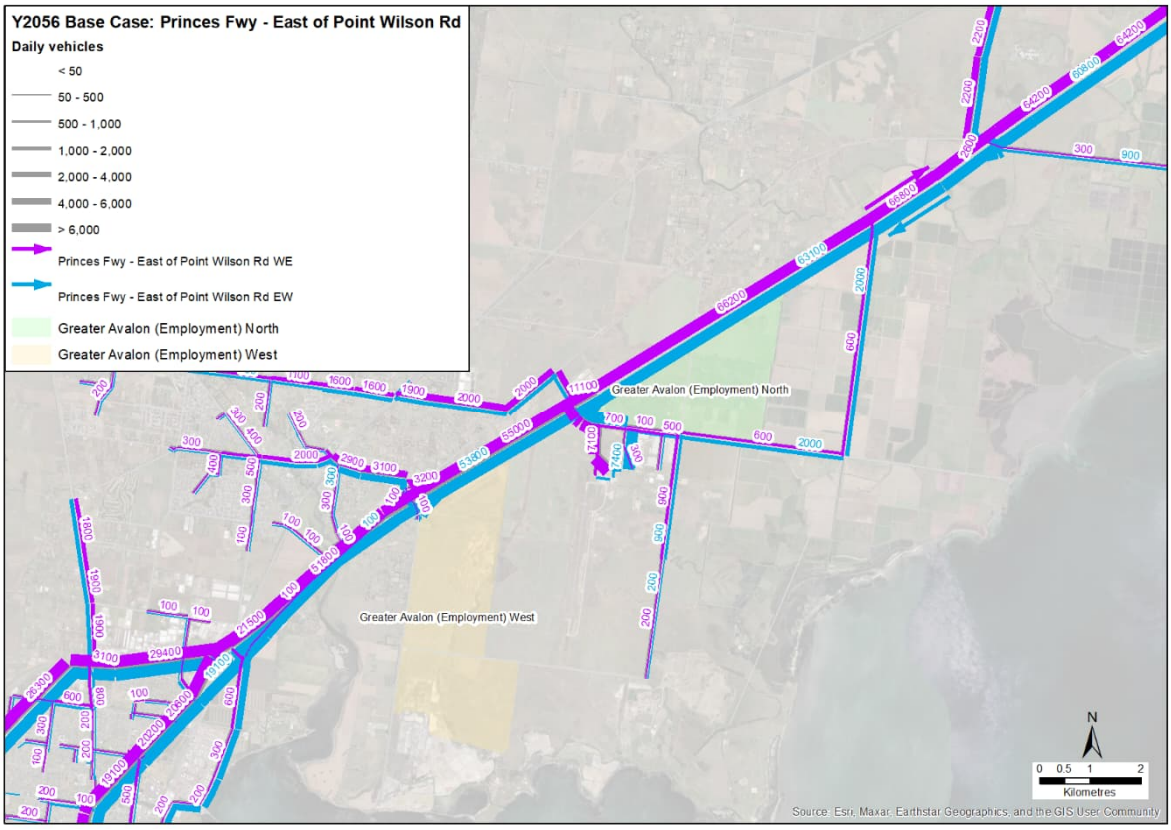


Figure B.2: Select Link, Princes Freeway – East of Point Wilson Road, Base Case

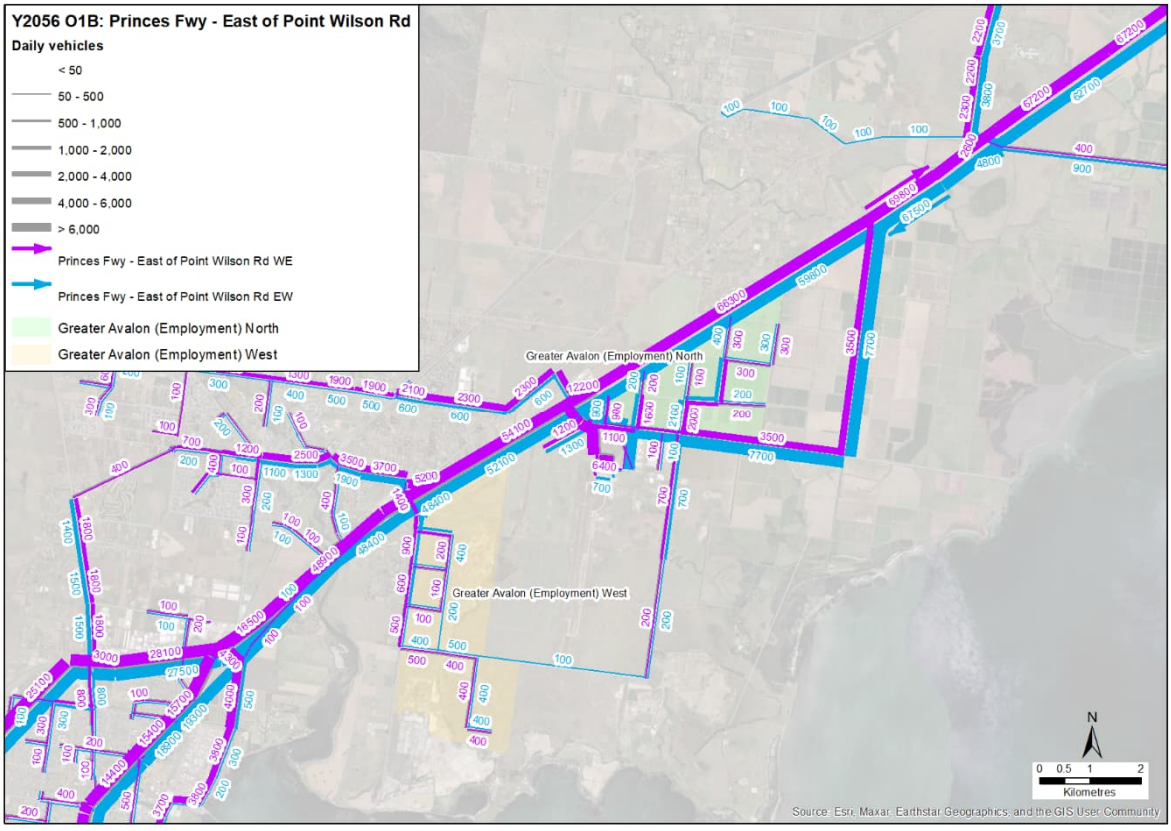


Figure B.3: Select Link, Princes Freeway – East of Point Wilson Road, Option 1B

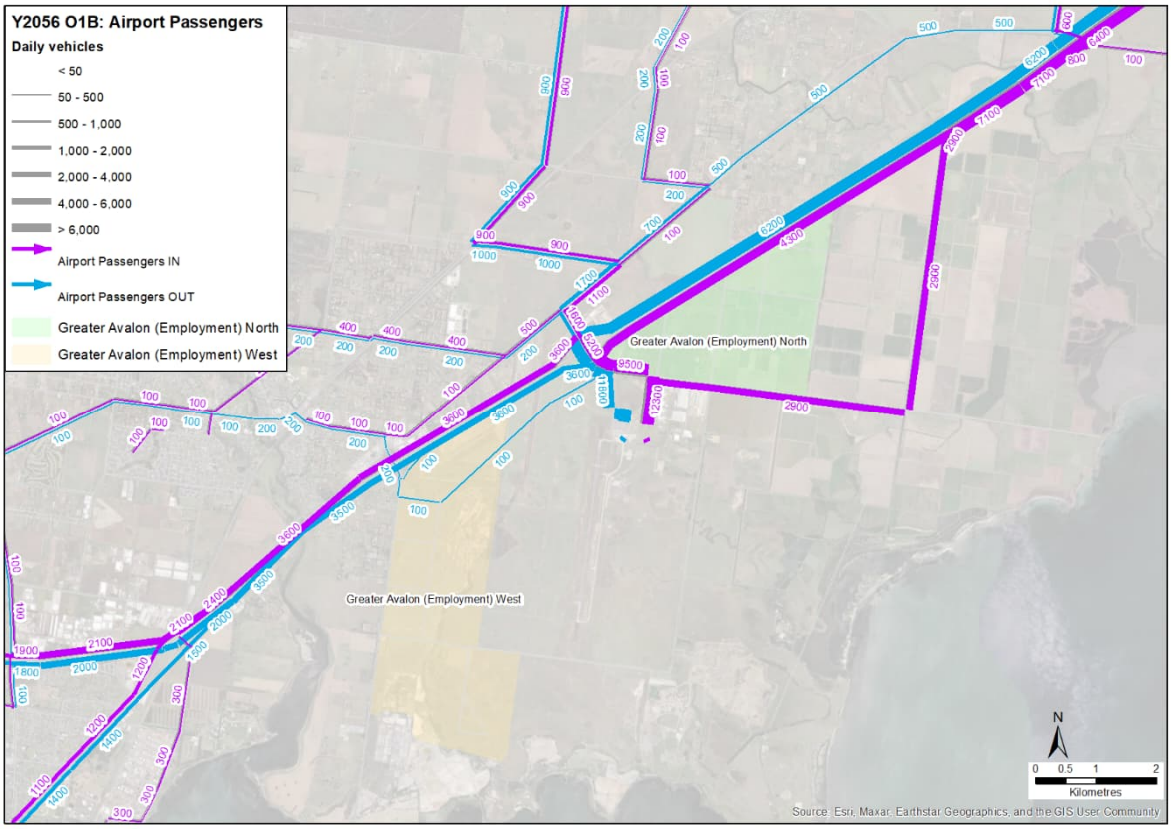


Figure B.4: Select Link, Airport Passengers, Option 1B

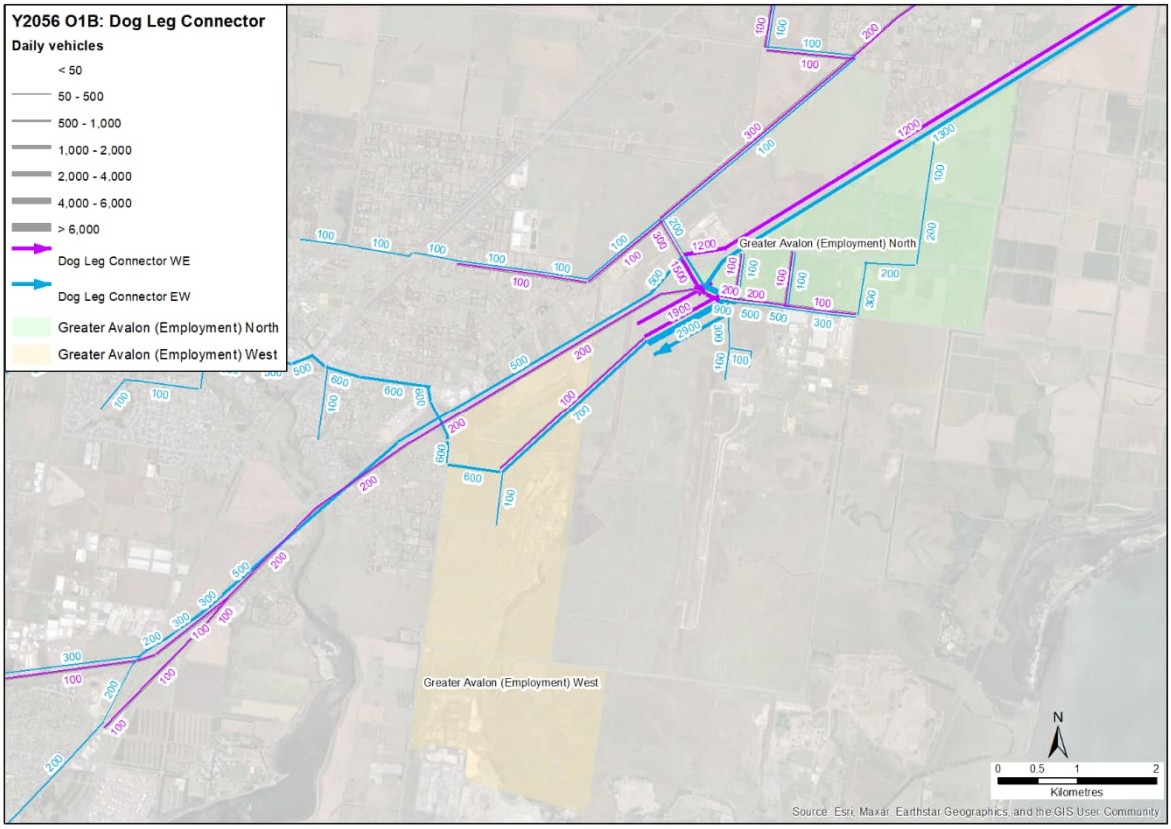


Figure B.5: Select Link, Dog Leg Connector, Option 1B

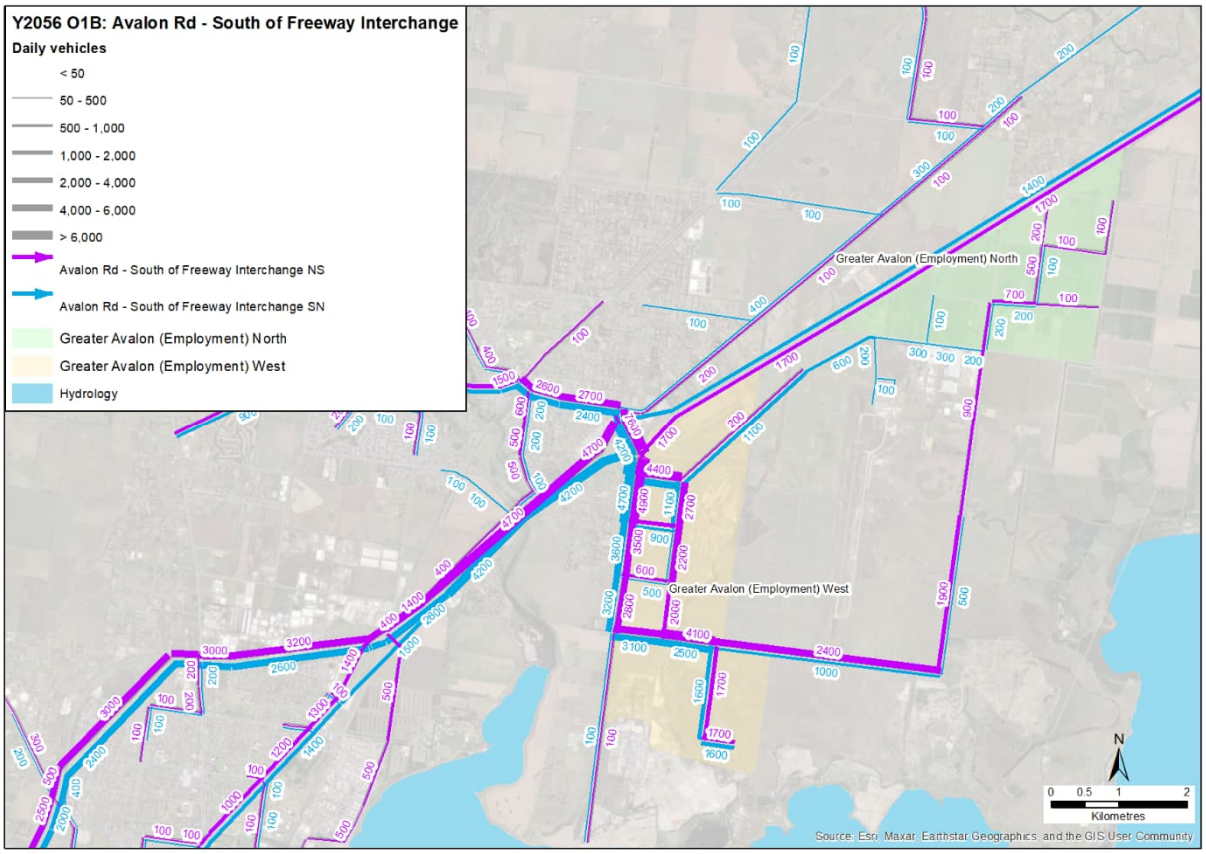


Figure B.6: Select Link, Avalon Road, Option 1B