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VicRoads
5th March 2014

Palmers Road Corridor Western Freeway to Calder Freeway

Transport Modelling Report

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Transport Modelling Report

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Table of Contents

List of Tables

List of Figures

Executive Summary

Introduction

AECOM was engaged by VicRoads to undertake transport modelling of the Palmers Road Corridor between the Western Freeway and the Calder Freeway. The aims of the modelling was to provide data to help determine whether there is a need to upgrade Palmers Road Corridor to a four or six lane arterial in this section of the corridor and the impact of providing the bridge link across the Koroit Creek. The modelling involved running the Victorian Integrated Transport Model (VITM) for a future year of 2046 and testing a base case with no network changes, that is with two lanes (one lane each way) and no bridge at Kororoit Creek. plus three network scenarios, these being:

- Palmers Road Corridor with two lanes (with bridge, one lane each way)
- Palmers Road Corridor with four lanes (two lanes each way)
- Palmers Road Corridor with six lanes (three lanes each way)

The outputs of the modelling are used to assess the scenarios against the Road Safety and Capacity objectives from the Environmental Effects Statement (EES) for the Palmers Road Corridor Project – Western Freeway to Calder Freeway. The Draft Evaluation objective from the EES is:

To improve the road-based transport capacity and connectivity in western Melbourne, by developing a six-lane dual carriageway arterial road along the Palmers Road corridor between Western Freeway and Calder Freeway, while maintaining the connectivity of the existing local transport routes.

The assessment of this objective is based on the road traffic volumes and travel time outcomes from the modelling of the scenarios.

Traffic volumes

Under the future Base Case with two lanes on the Palmers Road Corridor with no bridge, forecast traffic volumes for the year 2046 are relatively low when compared to the alternative north south routes of Kings Road and the northern extension of Hopkins Road. The Palmers Road Corridor carries approximately half the traffic of these other two roads.

The traffic volumes and network performance for the three scenarios were then compared against each other. Table 1 shows a summary of the modelled traffic for the three scenarios at the location with the highest daily volumes (just south of Taylors Road). This indicates that upgrading the Palmers Road Corridor to four (or six) lanes enables more travel in the corridor at both the AM peak and daily level. The observation that more traffic uses the road with six lanes compared to four lanes suggests that the congestion experienced with four lanes is a disincentive for some traffic to use the road.

Average speed

Table 2 shows the average speed for the corridor for the two hour weekday AM peak. This indicates that the south bound direction operates under more congestion than the northbound. It also indicates that upgrading from two to four lanes increases the average speed of the road and upgrading from four to six lanes further increases the average speed of the road.

Table 1 Summary Volumes for 2046 south of Taylors Road

	Direction	AM (number of vehicles)	Weekday (2-way)
2 lanes	Northbound	1,700	28,200
	Southbound	1,900	
4 lanes	Northbound	2,800	43,800
	Southbound	3,400	
6 lanes	Northbound	3,300	51,400
	Southbound	4,600	

Table 2 Average Speed 2046 AM (km/h)

	Direction	AM
2 lanes	Northbound	45
	Southbound	35
4 lanes	Northbound	56
	Southbound	46
6 lanes	Northbound	59
	Southbound	53

Congestion – Volume Capacity Ratios

Table 3 shows the percentage of travel by vehicle kilometres in conditions where the volume to capacity ratio is greater than 0.8. A volume capacity ratio of 0.8 is the point at which there is a large risk that traffic flows will break down. Table 3 shows that in the AM peak, with two lanes 68% of travel in the south bound direction is undertaken in congested conditions, while with four lanes 55% of travel in the south bound direction is undertaken in congested conditions. However, with six lanes 20% of travel is undertaken in congested conditions indicating that percentage of all kilometres travelled in congested conditions decreases significantly when increasing from four to six lanes.

Table 3 Percentage of peak direction travel in congested conditions (VCR>0.8)

	Congested travel
2 lanes	68%
4 lanes	55%
6 lanes	20%

Key findings

The analysis of the traffic modelling shows that introducing a bridge across Kororoit creek increases traffic on the Palmers Road Corridor and reduces traffic on adjacent corridors such as Caroline Springs Boulevard and Kings Road. Further upgrading Palmers Road Corridor from two to four lanes and from four to six lanes further reduces traffic on the adjacent routes. This increases the level of service of the adjacent routes both in terms of reduced travel times and increased reliability. This is of importance for adjacent routes providing public transport services and allows for increased ability to provide priority for public transport of these routes.

Further upgrading the Palmers Road Corridor from two to four lanes will significantly improve the network performance. While, upgrading from four to six lanes will enable further improvement in network performance and further facilitate strategic north-south movements. The two and four lanes options operate with significant congestion with over half the vehicle kilometres travelled in the peak direction being in congested conditions. The

six lane option provides a level of service with significantly less congestion in the peak period than the four lane and two lane options. With six lanes the Palmers Road Corridor will become the major north south route located between the Outer Metropolitan Ring Road and the Western Ring Road.

The assessment of the scenarios against the EES objectives for road safety and capacity are based on the road traffic volumes and travel time outcomes. According to these criteria the assessment of the scenarios is as shown in Table 4:

Table 4 Assessment against EES objective

Scenario	Assessment against EES objective (traffic volumes and travel times)
Base Case	Poor
Two lane	Moderately Well
Four Lane	Well
Six Lane	Very Well

Recommendation

Modelling shows a road connection across Kororoit Creek for the Palmers Road Corridor is critical to the arterial road network. Modelling also shows at four lanes, the Palmers Road Corridor is over capacity and therefore six lanes are required.

1.0 Background

1.1 Introduction

AECOM was engaged by VicRoads to undertake transport modelling of the Palmers Road Corridor between the Western Freeway and the Calder Freeway. The aim of the modelling was to provide data to help determine whether there is a need to upgrade the Palmers Road Corridor to a six lane arterial in this section of the corridor. The modelling involved running the Victorian Integrated Transport Model (VITM) for a future year base case of 2046 and testing three network scenarios, these being:

- Palmers Road Corridor with two lanes and no Kororoit Creek bridge (base case, one lane each way)
- Palmers Road Corridor with two lanes (one lane each way)
- Palmers Road Corridor with four lanes (two lanes each way)
- Palmers Road Corridor with six lanes (three lanes each way).

1.2 Background

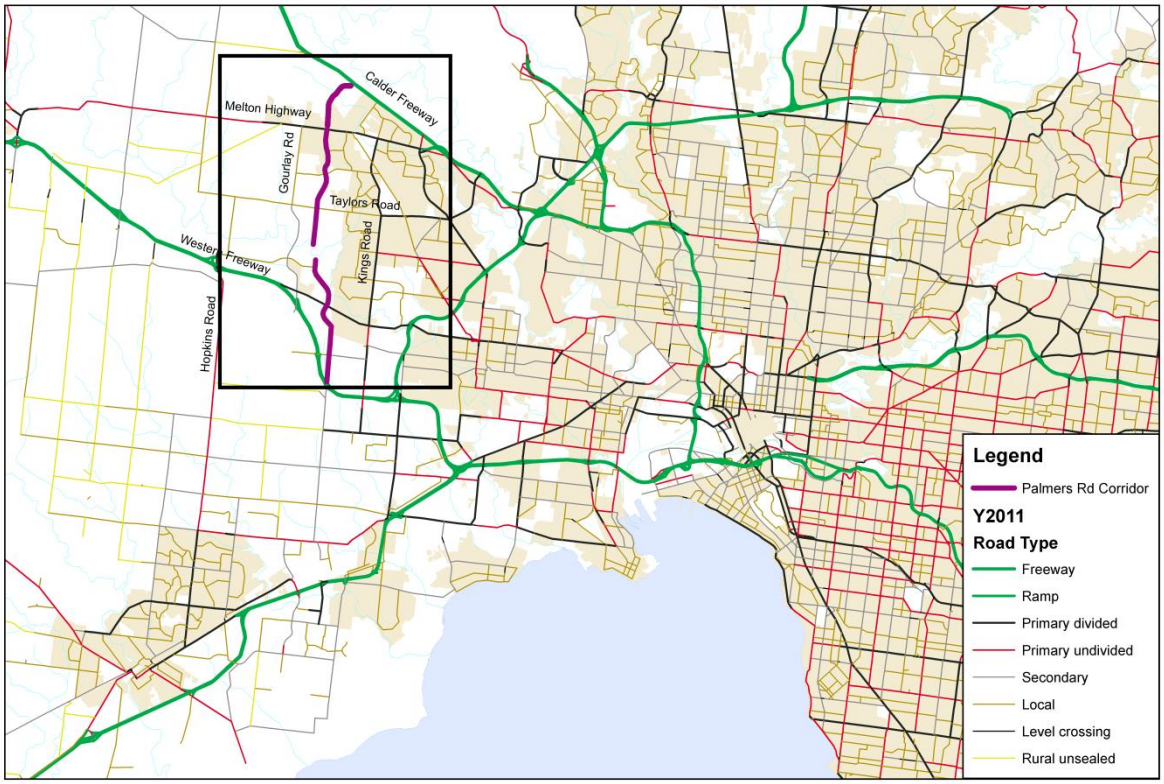
The Western Growth Area is a one of the fastest growing regions of Melbourne. The focus of this report is on the north-south route between the Western Freeway and the Calder Freeway (comprising Robinsons Road, Westwood Drive and Calder Park Drive). This route is referred to as the 'Palmers Road Corridor' in this report, taking the name of southern extension of this route to Williams Landing.

The route is currently disjointed, with a break at Kororoit Creek. However, there are plans for a bridge crossing to be constructed in the near future subject to planning approval.

Until then, the two alternative north south routes are either Caroline Springs Road or Kings Rd. The attractiveness of these two routes compared to the existing Palmers Road Corridor can be seen in Figure 3 and Figure 4, these two routes have more capacity, higher speed limits and no 'gap' and as a result are more highly trafficked at this point in time.

The Palmers Road Corridor 'gap' and the area of focus for this report can be seen in Figure 1.

Figure 1 The Palmers Road Corridor – Existing Road Network



1.3 Environmental Effects Statement

The Environmental Effects Statement (EES) for the Palmers Road Corridor Project – Western Freeway to Calder Freeway includes a section on Road Safety and Capacity. The Draft Evaluation objective for this section of the EES is:

To improve the road-based transport capacity and connectivity in western Melbourne, by developing a six-lane dual carriageway arterial road along the Palmers Road corridor between Western Freeway and Calder Freeway, while maintaining the connectivity of the existing local transport routes.

The assessment of this objective is based on the road traffic volumes and travel time outcomes from the transport modelling of the alternative future network scenarios.

1.4 Traffic Model

The VITM is a 'four step' strategic model that incorporates both road and public transport within greater metropolitan Melbourne. It is owned by the Department of Transport and has been used extensively for the assessment and testing of future network scenarios across Melbourne.

The traffic modelling was conducted using the 'Western Growth Areas' version of the Victorian Integrated Transport Model (VITM). A copy of the Western Growth Corridor VITM Project – Modelling Report is attached in Appendix A. This model provides more detailed zoning and networks than the standard VITM and was built during 2012 for the purpose of studying projects that fall within the Western Growth Area.

The development of the "Western Growth Areas" model involved implementing changes to more accurately represent the 2011 demographic inputs. These changes were implemented in consultation with Melton and Wyndham councils and resulted in amendments to both population and employment assumptions.

The demographic data input to the VITM includes a number of variables such as total population, number of households, population split into age groups, number of dependents split into age groups, total employment, employment by type and education.

The changes made during this calibration process were made directly to the ‘total population’ and ‘total employment’ assumption for each zone. For zones in which the population or employment were updated, the values for the other demographic variables, such as the number of households, were derived using the relevant average value of the Local government area of the zone.

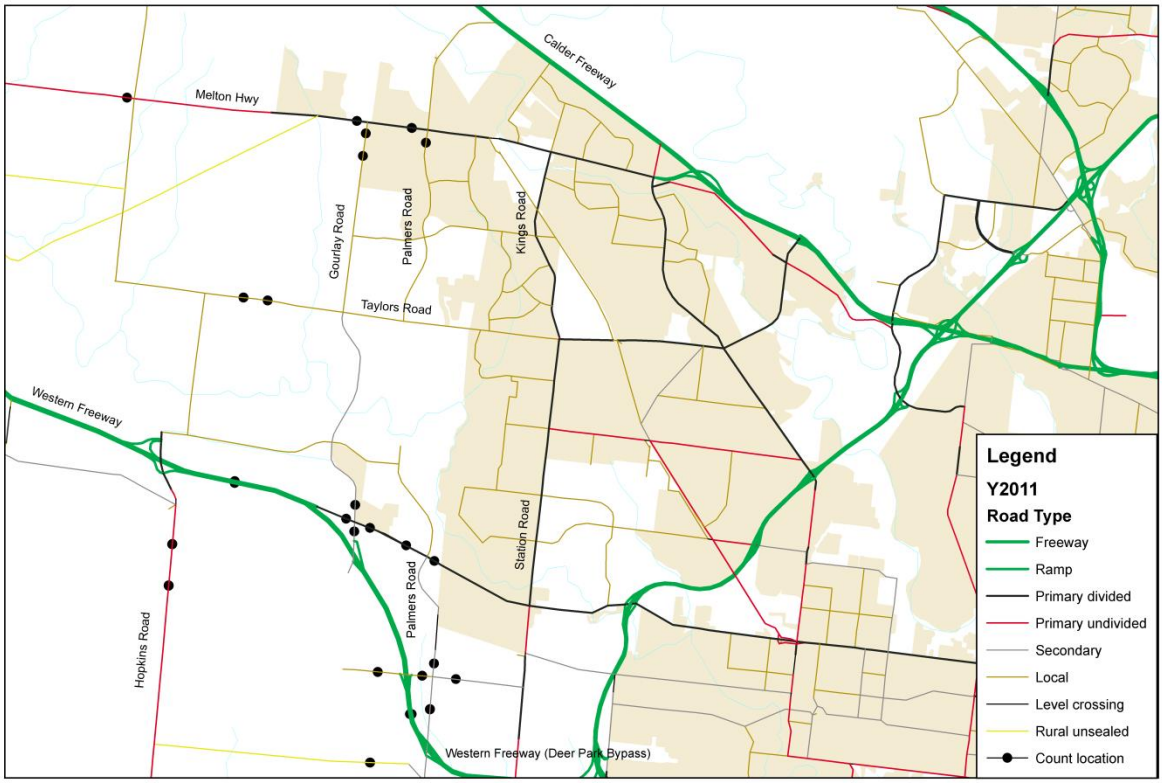
It is noted that the Calder Park industrial precinct / business park, which could generate up to 25,000 jobs, is not represented in the model. However, other major traffic generators such described in Plan Melbourne, as the East Werribee Employment Cluster and the Western Interstate Freight Terminal are included in the model.

2.0 Review of Base Year Model

2.1 Focus Area

The model used for this report incorporates the whole of the VITM area. However, the validation of traffic counts has focussed on the area of interest surrounding Palmers Rd Corridor as shown in Figure 2.

Figure 2 Model Focus Area



2.2 Network coding

The base year road network has been coded to reflect the road network as it stood in 2011. The following figures show the number of lanes and the speed limit assumptions of this network. The classification of each road can be seen in Figure 2.

Figure 3 2011 Network – Number of Lanes

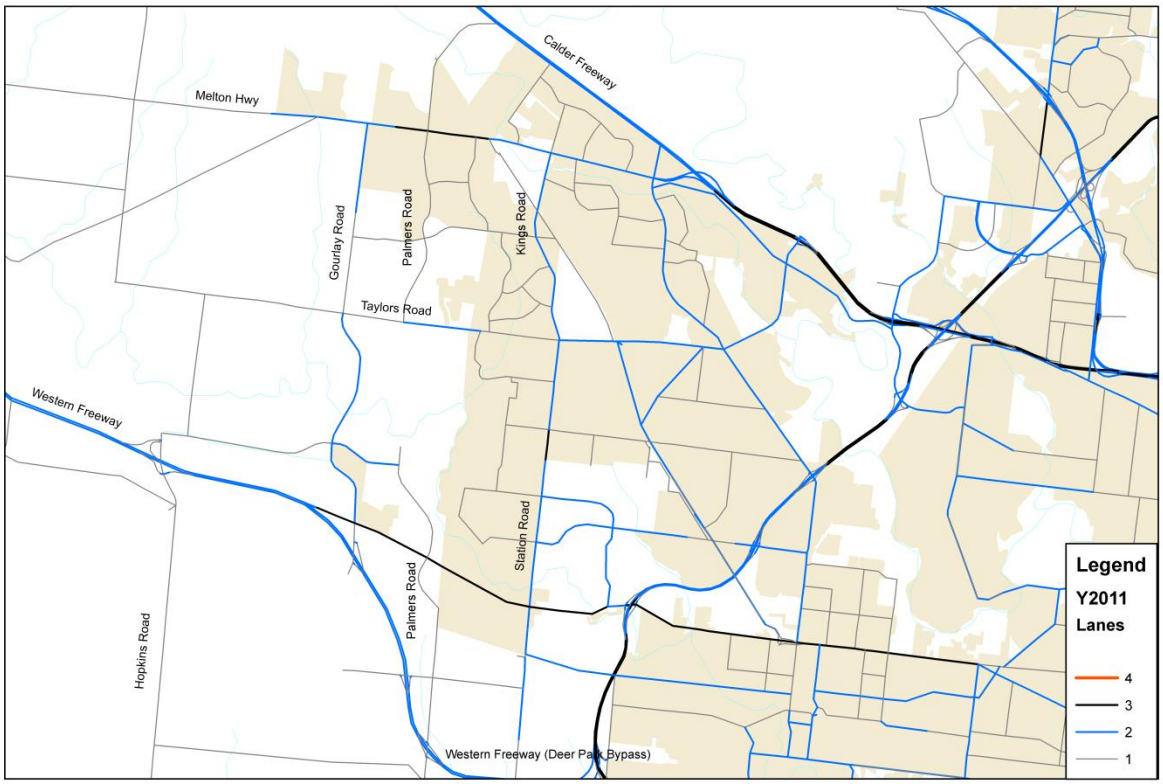
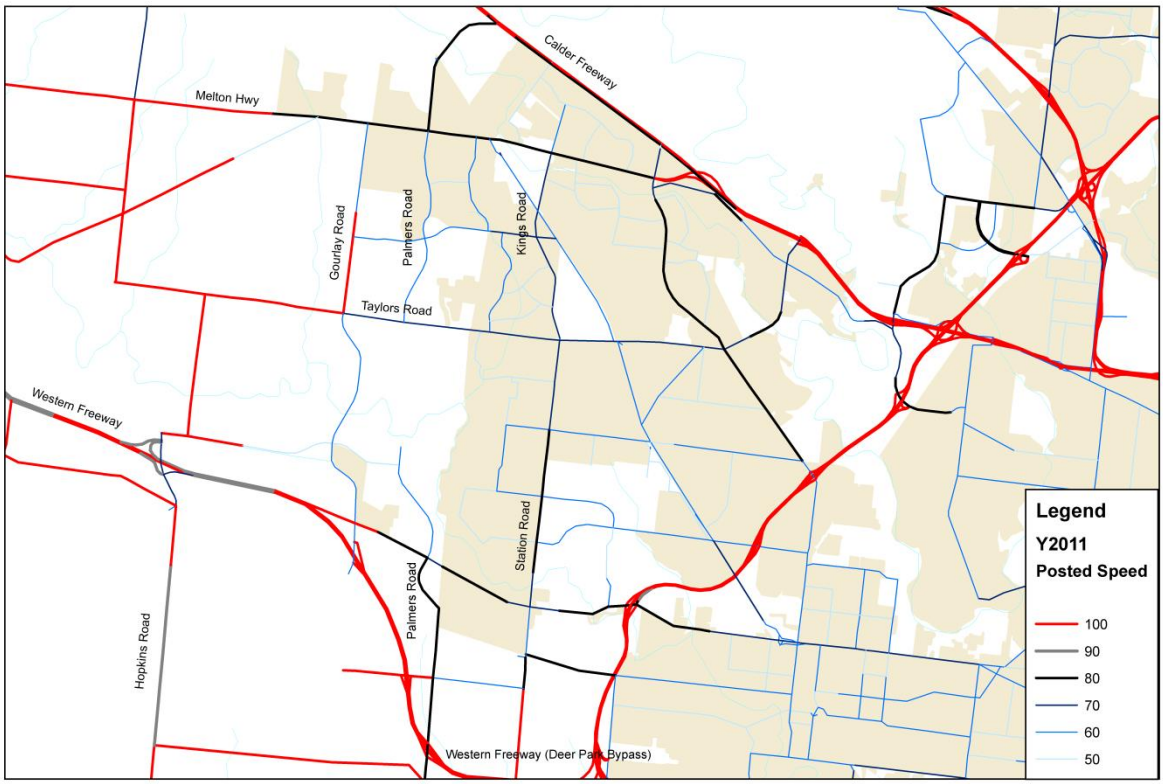


Figure 4 2011 Network – Speed Limit



2.3 Comparison to traffic counts in area

The Western Growth Areas model was previously validated to 2011 traffic counts (See 'Western growth corridor modelling report, August 2012'). For the purposes of this study, the model validation was confirmed against 2011 counts for the local area of Palmers Rd Corridor.

Scatter plots of the AM peak traffic volumes compared to modelled volumes for both the Western Growth Area and the Palmers Rd Corridor local area show an acceptable level of validation. These plots are shown in Figure 5 and Figure 6 below.

As it was noted in the Western growth corridor modelling report, model validation of this region is made difficult due to the rapid level of construction and change that has occurred during the last few years. The road works associated with duplication of Gourlay Road for example, would have influenced the travel behaviour and route choice on this road.

Despite this, the validation of the Palmers Road Corridor area of interest is at an acceptable level.

Figure 5 AM Peak Scatter Plot – Modelled versus Observed Volume Comparisons (Western Growth Area)

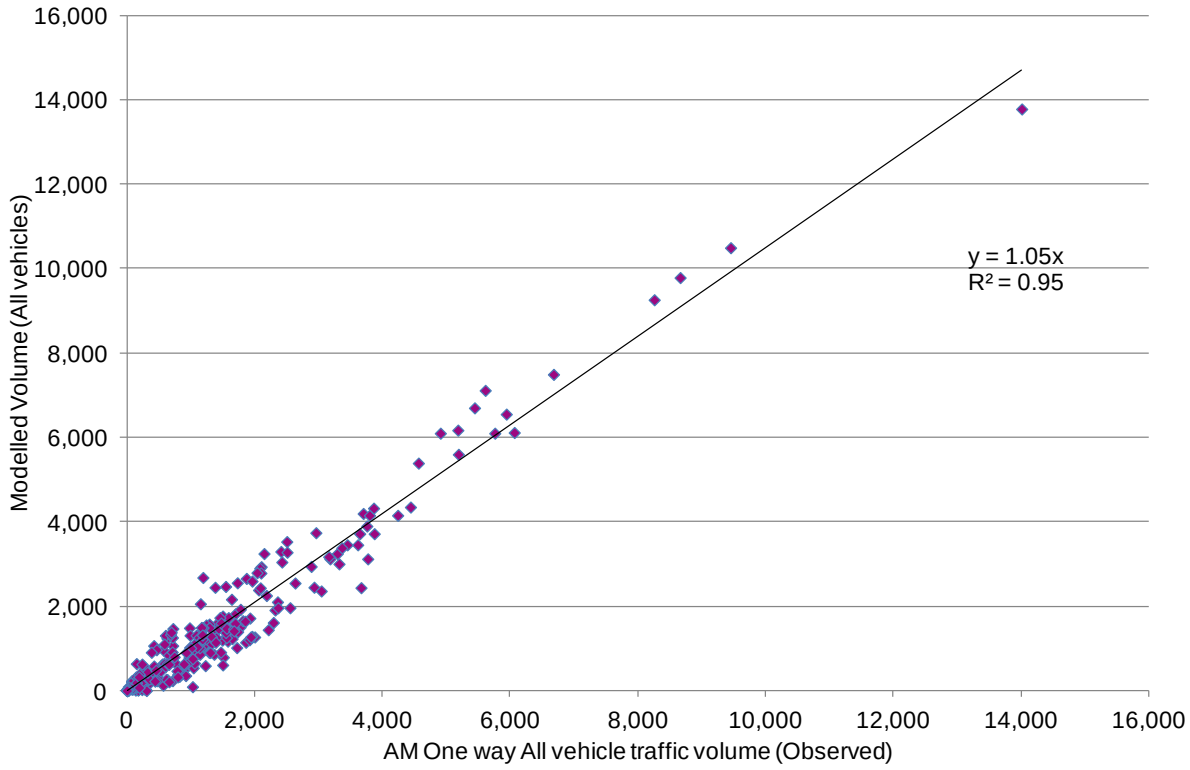
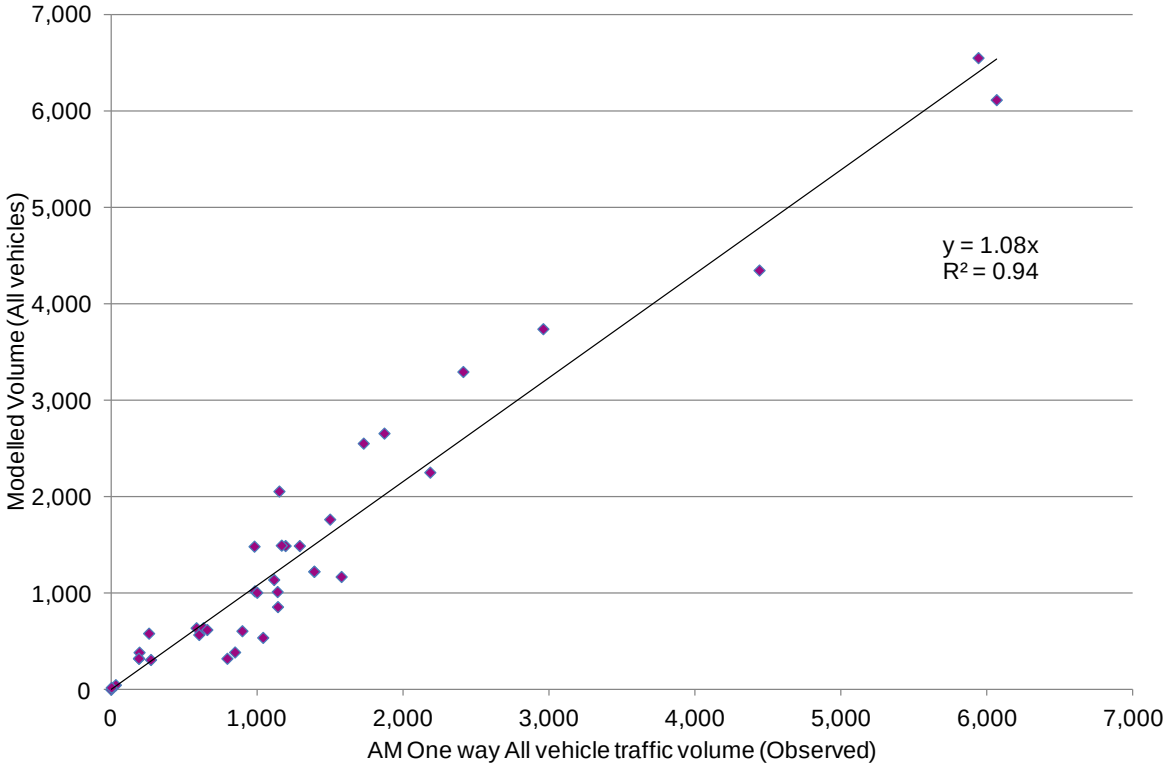


Figure 6 AM Peak Scatter Plot – Modelled versus Observed Volume Comparisons (Palmers Rd Corridor local area)



3.0 2046 Model

3.1 Overview

The 2046 model provides a 'full build out' scenario for the Western Growth Area. The model incorporates all planned network improvements in the area as well as 2046 population and employment projections. The network, population and employment assumptions for the Western Growth Area were provided by the Growth Areas Authority (GAA). This network represents a possible full build scenario as shown in the Western Growth Corridor Plan prepared by GAA (http://www.gaa.vic.gov.au/wp-content/uploads/2012/11/West-Growth-Corridor-Plan.pdf).

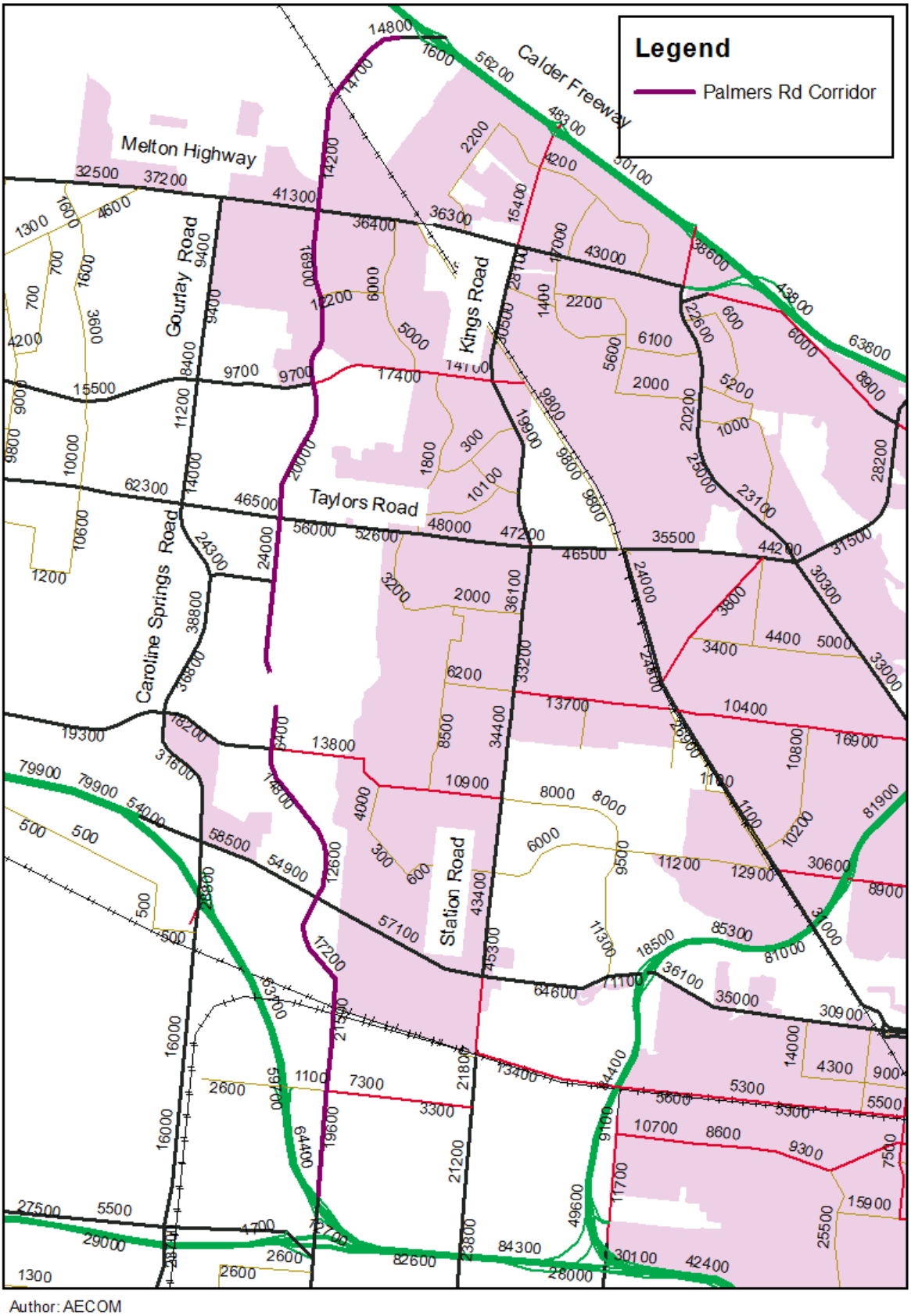
The 2046 model was used to test four alternative network assumptions for the Palmers Road Corridor, specifically:

- **Base Case** – two lanes from the Western Freeway to the Calder Freeway with no bridge across the Kororoit Creek
- **Two** lanes from the Western Freeway to the Calder Freeway
- **Four** lanes from the Western Freeway to the Calder Freeway
- **Six** lanes from the Western Freeway to the Calder Freeway (the entire corridor)

As an overview of the four scenario results, daily two way volumes on the Palmers Road Corridor between the Western Freeway and the Calder Freeway are shown in Figure 7 to Figure 10.

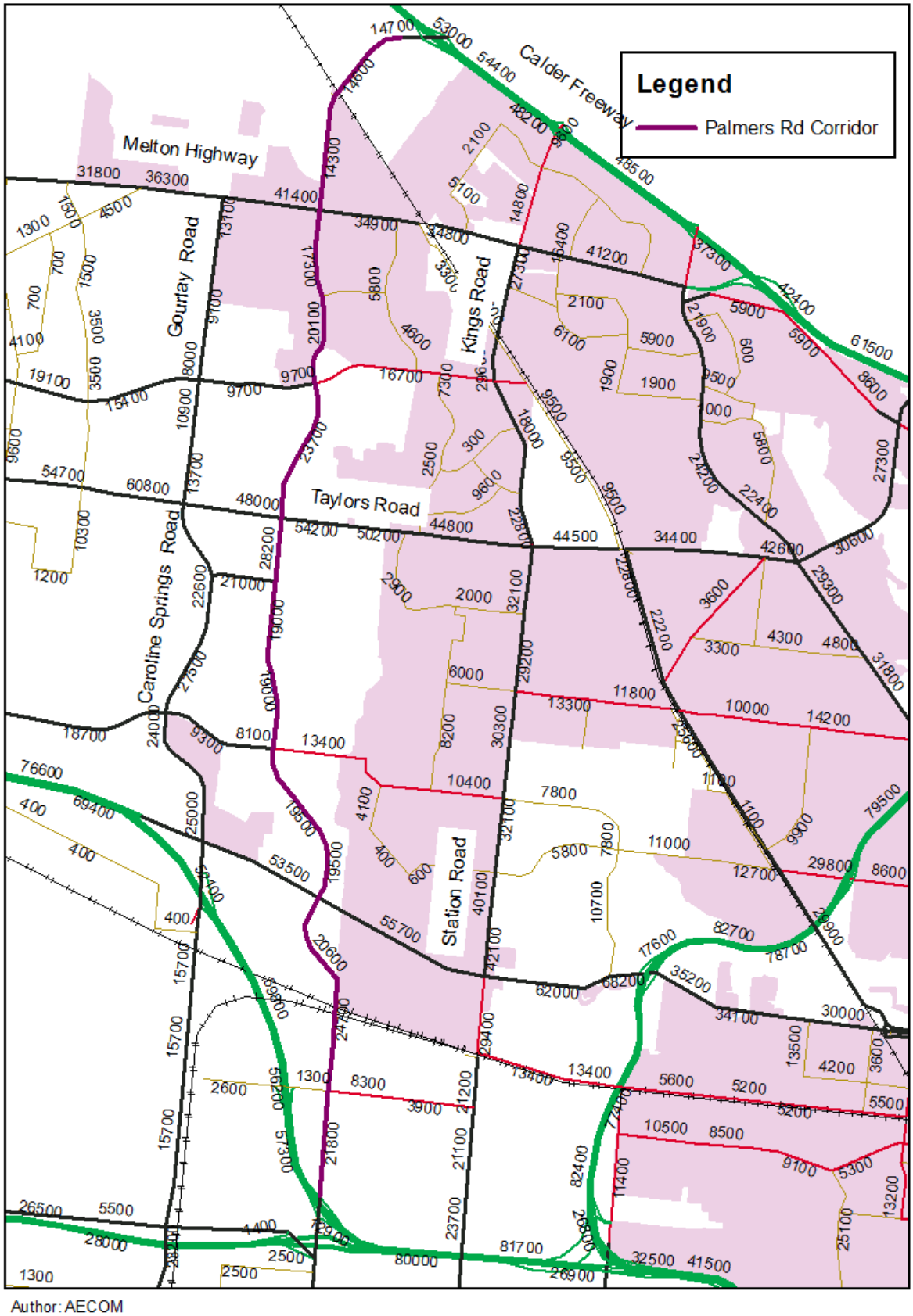
The daily volume plots show that traffic increases on the Palmers Road Corridor as the Kororoit Creek bridge is completed and the number of lanes increase. Daily two way volumes in the base case range from 14,800 to 24,000 and in the two lane scenario range between 17,300 and 28,200 vehicles, for the four lane scenario volumes ranged from 24,600 to 43,800, while under the six lane scenario, daily two way volumes increase to between 28,300 and 51,400 vehicles. Analysis of these results shows that traffic is being drawn from several other north south routes, including Kings Road, Caroline Springs Road and Gourlay Road and redistributed from the Outer Metropolitan Ring Road (OMR). This is considered to be a positive outcome as the strategic intent for Palmers Road Corridor is for it to be an arterial road with a priority for private vehicles whereas adjacent routes such as Gourlay Road and Kings Road will cater for both public transport and private vehicle travel.

Figure 7 2046 Daily two way volumes – Base case - Palmers Road Corridor between Western Freeway and Calder Freeway



Author: AECOM

Figure 8 2046 Daily two way volumes – Two lanes on Palmers Road Corridor between Western Freeway and Calder Freeway



Author: AECOM

Figure 9 2046 Daily two way volumes – Four lanes on Palmers Road Corridor between Western Freeway and Calder Freeway

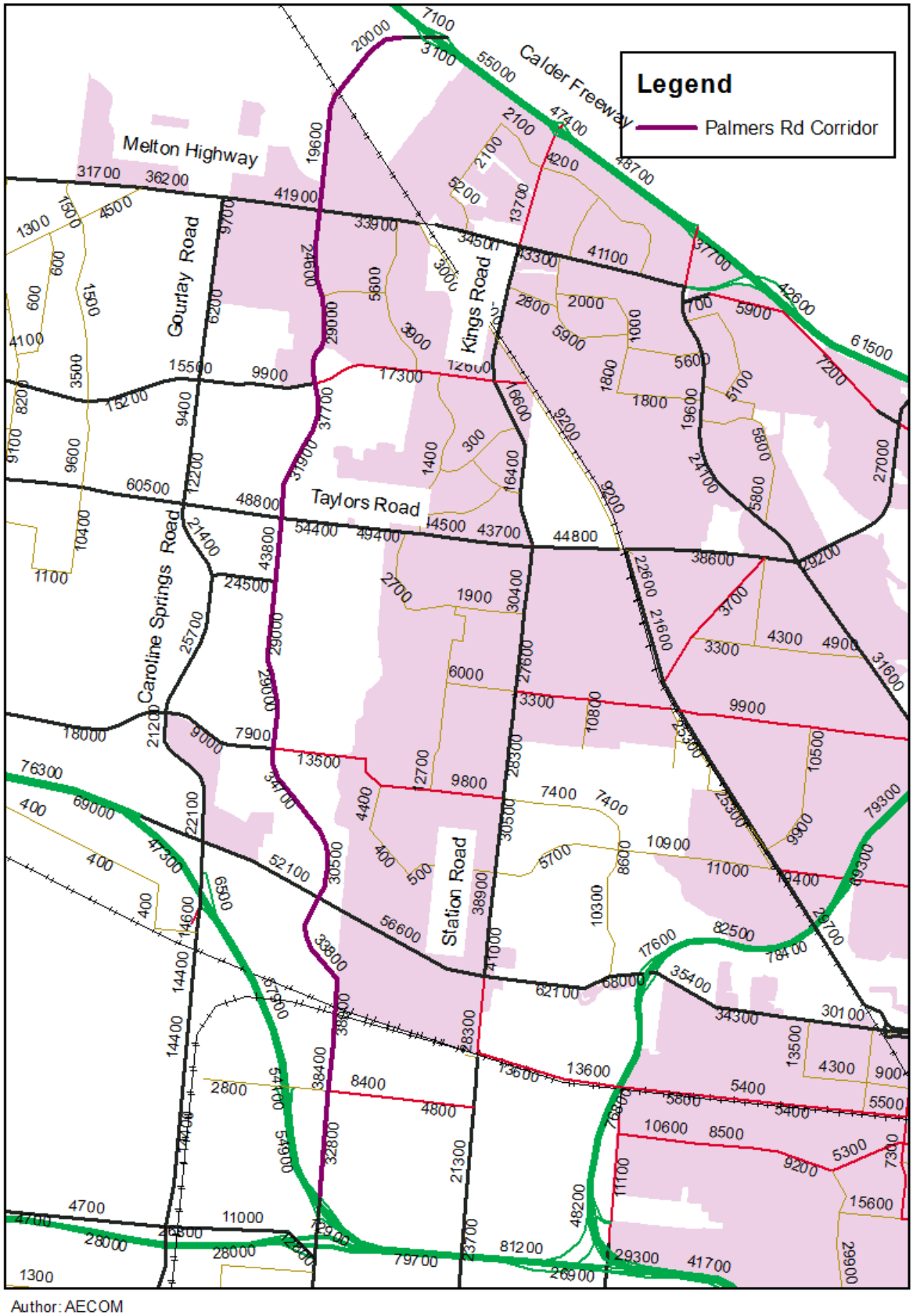
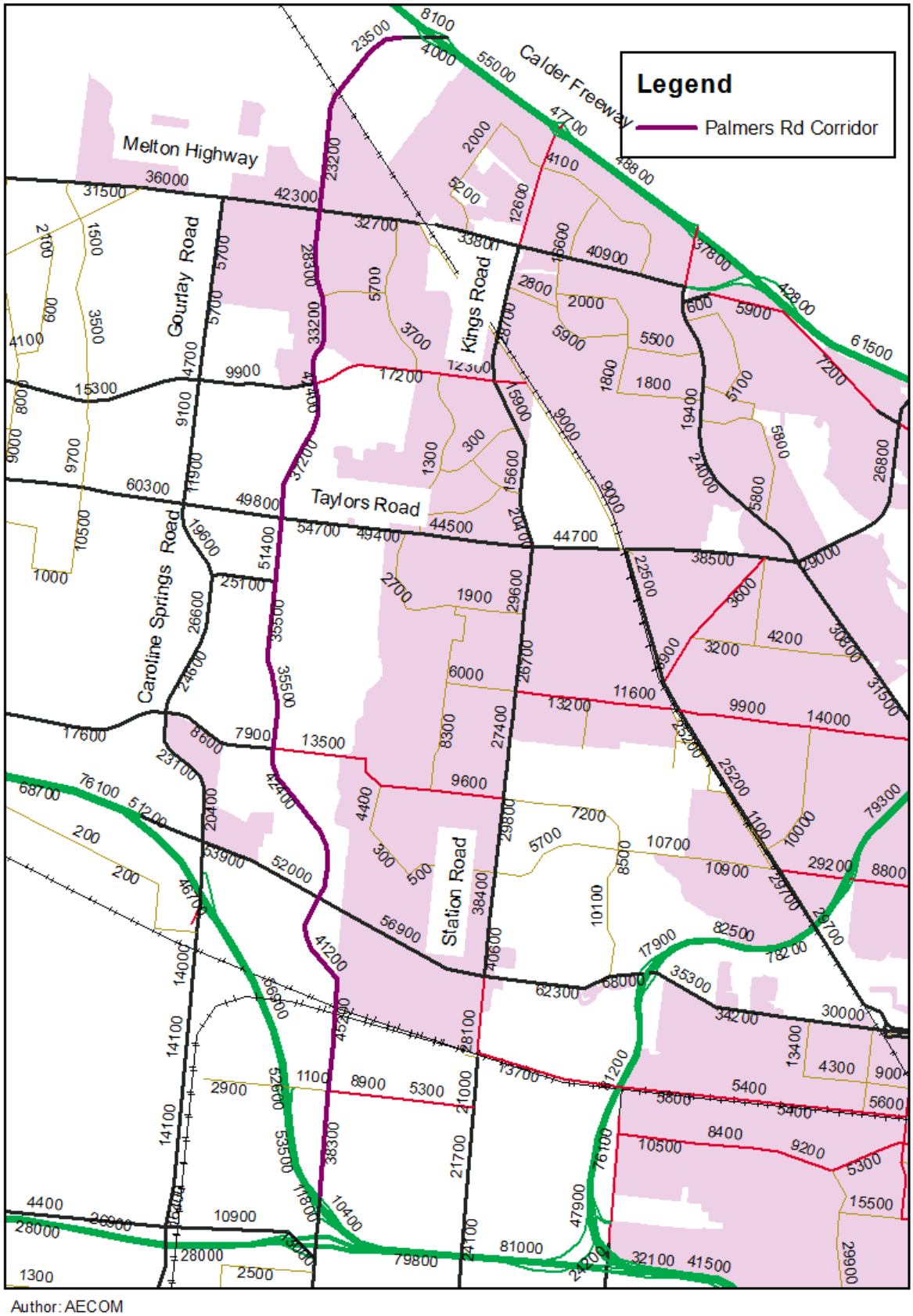


Figure 10 2046 Daily two way volumes – Six lanes on Palmers Road Corridor between Western Freeway and Calder Freeway



3.2 Base Case (no bridge)

The minimum build (or Base Case) is for Palmers Road Corridor to be two lanes (one lane each way) for this segment and does not include the bridge link across the Kororoit Creek. The 2046 modelling results for this two lane no bridge scenario are described in this section.

3.2.1 Daily Volumes

Under the Base Case two lane scenario on the Palmers Road Corridor with no bridge, traffic volumes are relatively low when compared to the alternative north south routes of Kings Road and Caroline Springs and Gourlay Road. The Palmers Road Corridor carries approximately half the traffic of these other two roads.

Figure 7 shows the 2046 Base Case daily two way volumes on the Palmers Road Corridor between the Western Freeway and the Calder Freeway. In 2046, the modelling shows that southbound traffic is in the peak direction in the AM, and the opposite is true in the PM. Table 5 gives the modelled two way volumes and the average southbound travel speed during the AM for four locations along the Palmers Road Corridor. This table demonstrates that traffic increases towards the south reaching a peak near Taylors Road (north of Commercial Road).

Table 5 Base Case no bridge (two lanes) Daily two way volumes along Palmers Rd Corridor

Location	Modelled 2046 (Two way daily Volume)	Average speed (km/hr) (AM southbound direction)
South of Calder Freeway	14,800	60
South of Keilor-Melton Road	16,900	49
South of Taylors Road (excluding bridge)	24,000	45
South of Ballarat Road	17,100	36

3.2.2 AM Peak

The 2046 AM peak modelling for the Base Case two lane scenario with no bridge shows a similar result to the daily volumes. Traffic is higher in the south and is generally lower than alternative north south routes.

A plot of one way volumes for the AM peak is shown in Figure 11, and a plot of volume-capacity ratios for the AM peak are shown in Figure 12. Congested condition can be considered to be where volume capacity ratios are greater than 0.8. This is the point where it is likely that flow will break down causing stop-start conditions and traffic queuing.

Figure 11 Base Case scenario 2046 AM peak – one way volume plot

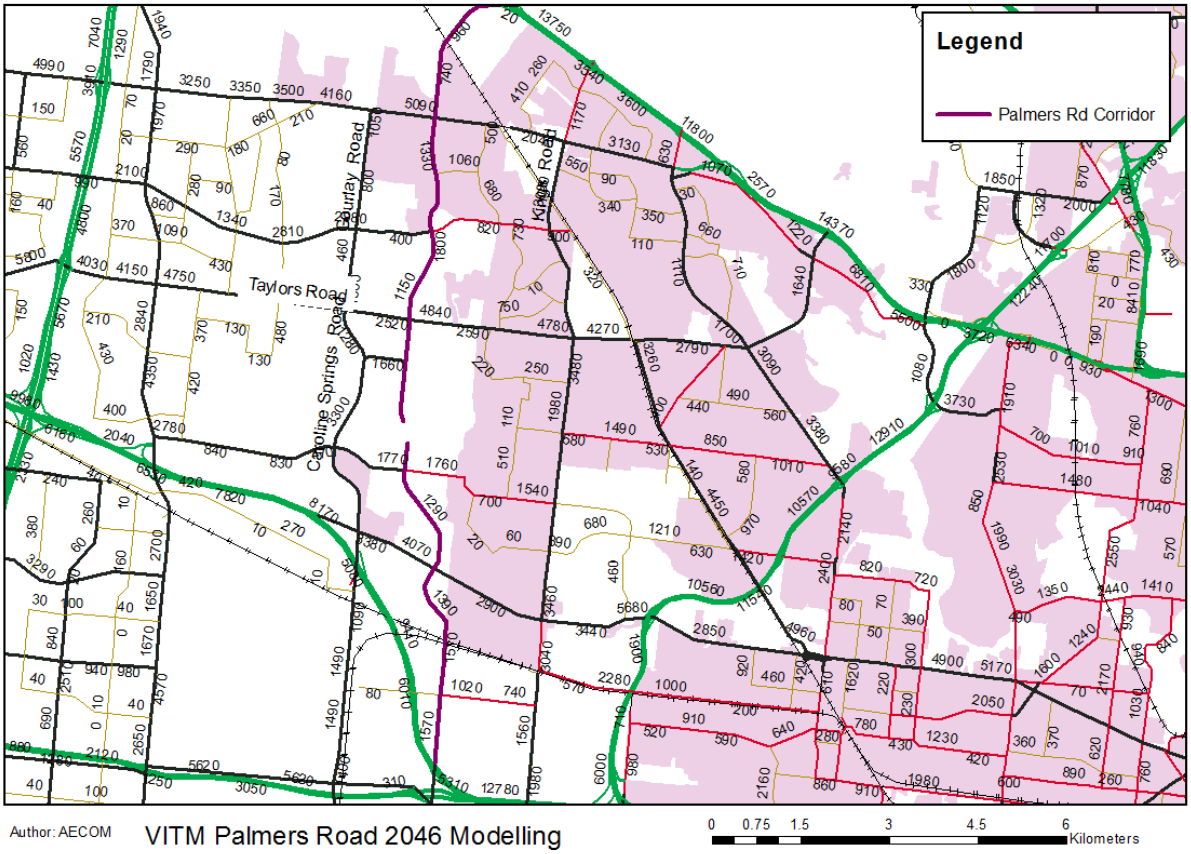
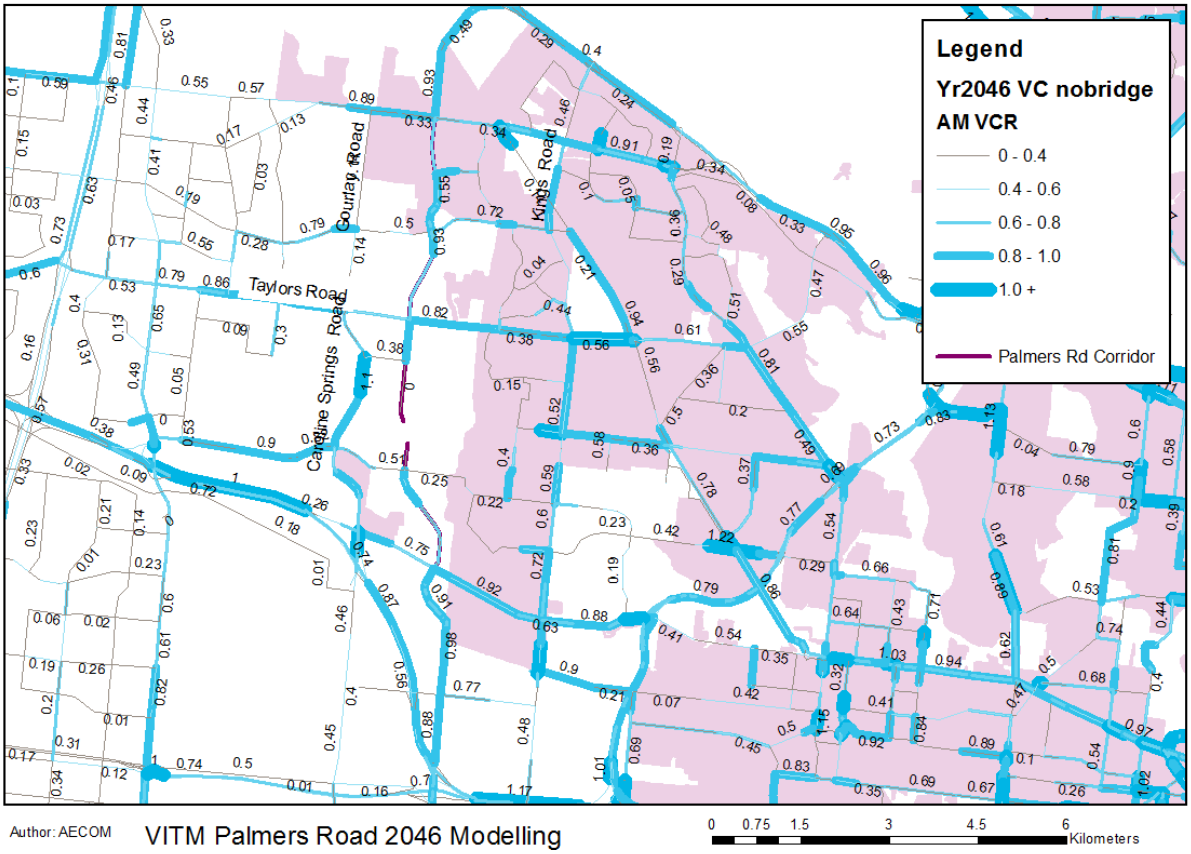


Figure 12 Base case scenario 2046 AM peak – Volume-capacity ratio



3.3 Two lane scenario

The first scenario tests the Palmers Road Corridor with two lanes and the bridge across the Kororoit Creek in place. Therefore, the only difference between this scenario and the base case is the inclusion of the bridge creating a continuous road along the Palmers Road Corridor and a freeway interchange at the Calder Freeway.

3.3.1 Daily Volumes

Under the two lane scenario on the Palmers Road Corridor, traffic volumes are relatively low when compared to the alternative north south routes of Kings Road and the northern extension of Caroline Springs Boulevard and Gourlay Road. The Palmers Road Corridor carries approximately half the traffic of these other two roads.

In 2046, the modelling shows that southbound traffic is in the peak direction in the AM, and the opposite is true in the PM. Table 6 gives the modelled two way volumes and the average southbound travel speed during the AM for four locations along the Palmers Road Corridor. This table demonstrates that traffic increases towards the south reaching a peak near Taylors Road. Similarly, the AM average speed is slowest at this location.

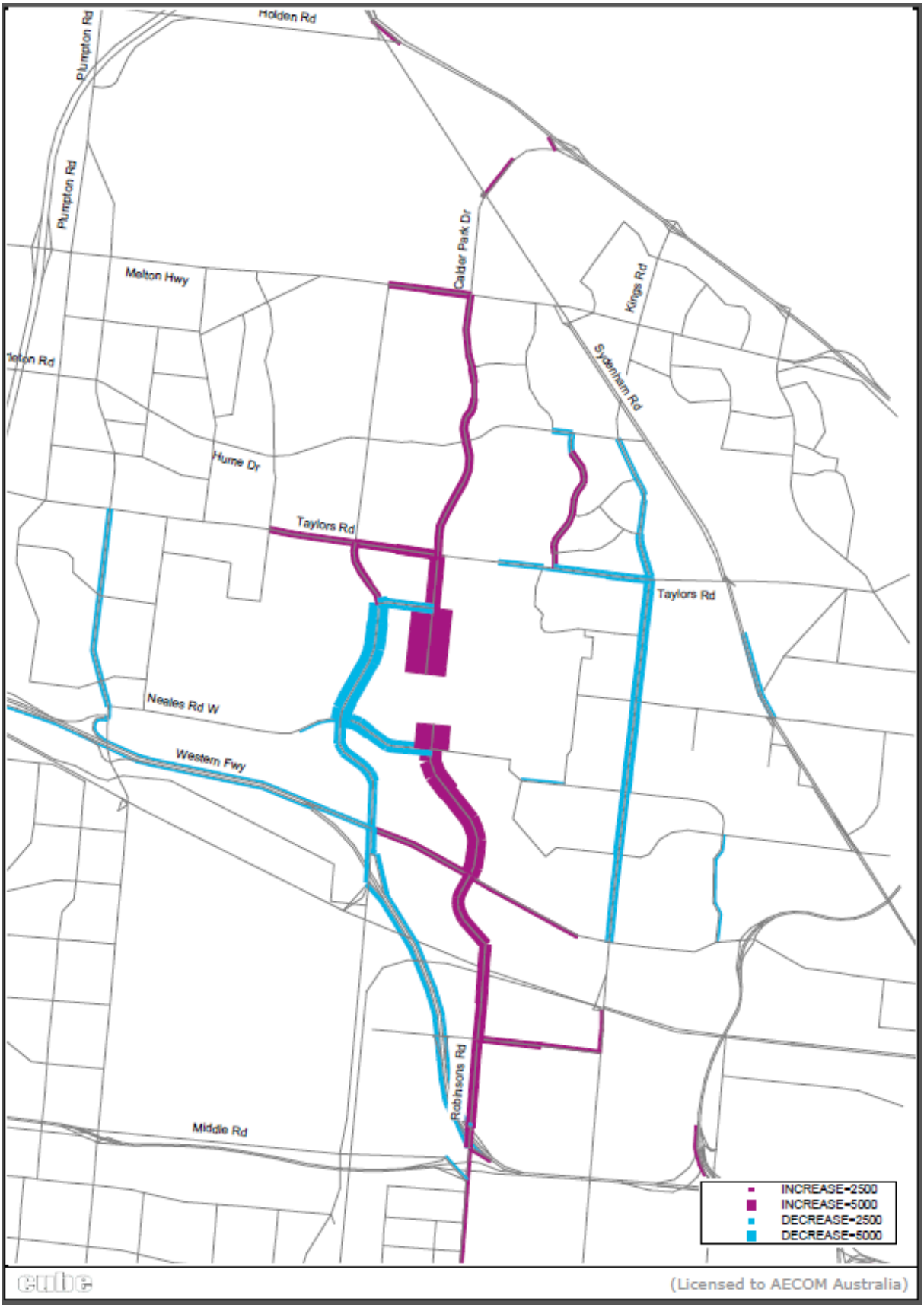
Table 6 Two Lane Daily two way volumes along Palmers Rd Corridor

Location	Modelled 2046 (Two way daily Volume)	Average speed (km/hr) (AM southbound direction)
South of Calder Freeway	14,700	61
South of Keilor-Melton Road	17,300	46
South of Taylors Road	28,200	31
South of Ballarat Road	20,600	33

To examine the traffic differences between the two lane scenario and the base case, a bandwidth plot was created to highlight roads that see either an increase or decrease in daily two way traffic. This plot is shown in Figure 13.

It is clear that by introducing a bridge across the Kororoit Creek, the Palmers Road Corridor becomes a more attractive alternative for north-south travel. It can also be seen that traffic is drawn from Caroline Springs Boulevard, the Western Freeway and Kings Road.

Figure 13 Difference Bandwidth between Two lane scenario and Base Case



3.3.2 AM Peak

The 2046 AM peak modelling for the two lane scenario shows a similar result to the daily volumes. Traffic is higher in the south and is generally lower than alternative north south routes.

A plot of one way volumes for the AM peak is shown in Figure 14, and a plot of volume-capacity ratios for the AM peak are shown in Figure 15. Congested condition can be considered to be where volume capacity ratios are greater than 0.8. This is the point where it is likely that flow will break down causing stop-start conditions and traffic queuing. Analysis of the data in Figure 15 indicates that of all the vehicle kilometres travelled in the south bound direction in the AM peak, 68% was in conditions with volume capacity ratios greater than 0.8.

Figure 14 Two lane scenario 2046 AM peak – one way volume plot

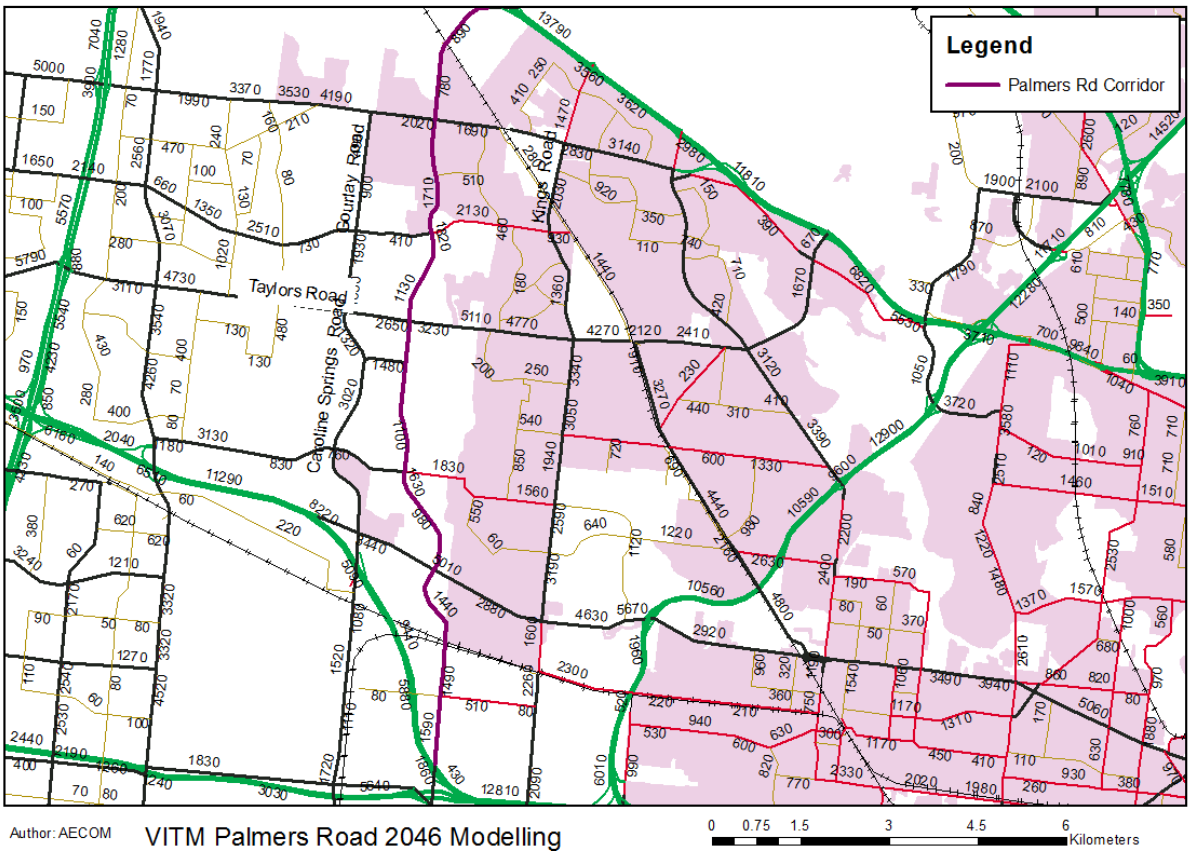
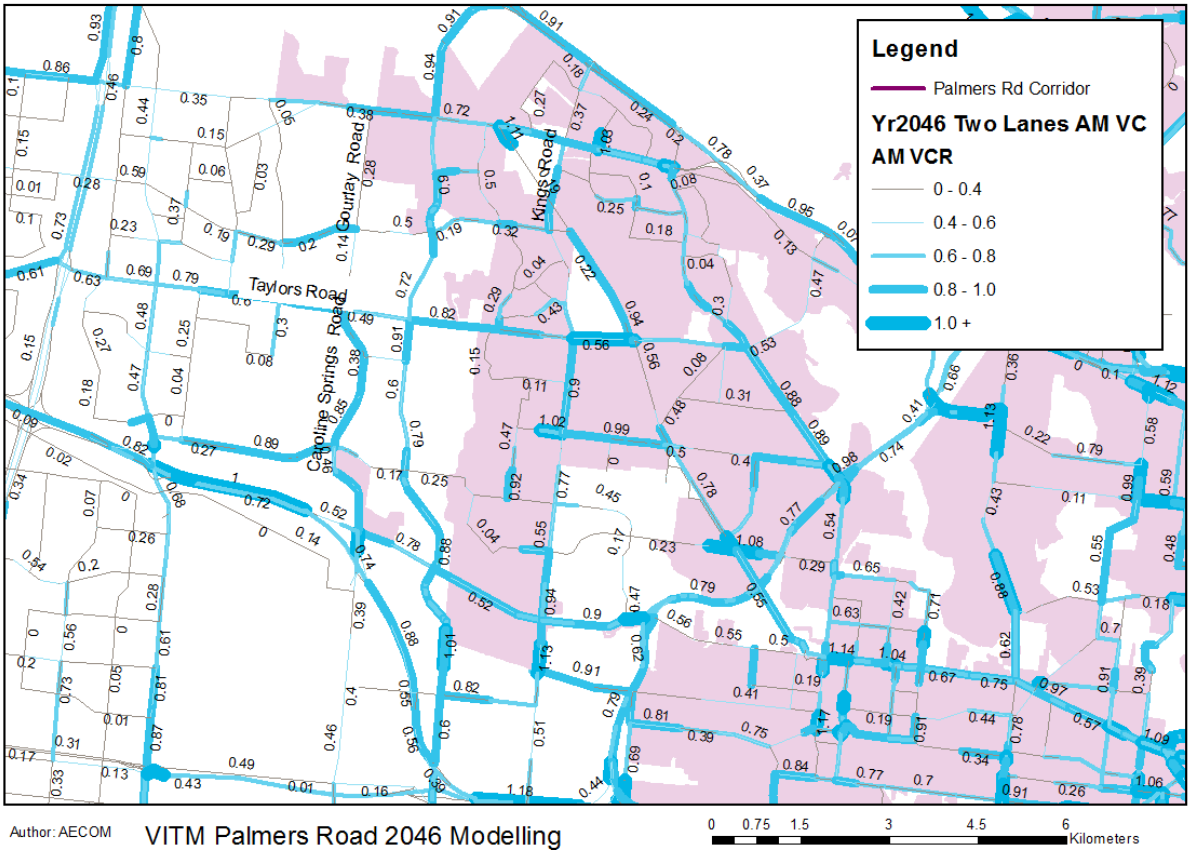


Figure 15 Two lane scenario 2046 AM peak – Volume-capacity ratio



3.4 Four Lane Scenario

The second scenario is for the Palmers Road Corridor to be four lanes (two lanes each way) for northern section of Palmers Road Corridor between Western Highway and the Calder Freeway.

The 2046 modelling results for this four lane scenario are described in this section.

3.4.1 Daily

Increasing the Palmers Road Corridor from two lanes to four lanes has a significant impact on the traffic in the corridor. Traffic increases all along the corridor, with the biggest increases occurring south of Taylors Road. Despite the higher number of vehicles, the traffic speeds also improve. Table 7 shows the daily two way volumes under the four lane scenario and compares them to the two lane scenario. A comparison between the AM peak southbound speeds is also given.

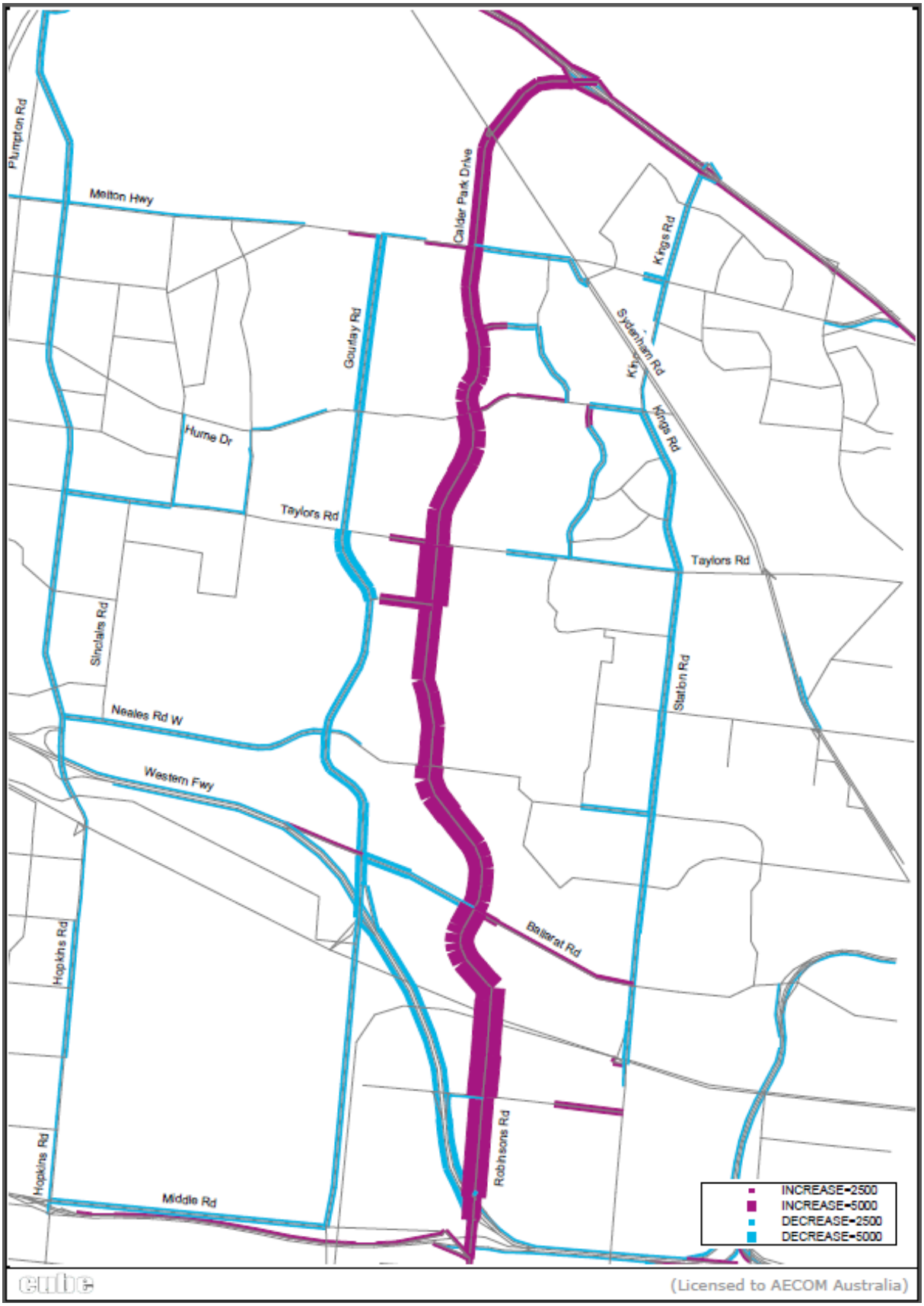
Table 7 Four Lane Daily two way volumes along Palmers Rd Corridor

Location	Modelled 2046	Average speed (km/hr) (AM southbound direction)	Daily volume increase from two lanes	AM speed (km/hr) difference from two lanes
South of Calder Freeway	20,000	62	5,300 (36%)	1
South of Keilor-Melton Road	24,600	57	7,300 (43%)	11
South of Taylors Road	43,800	44	15,600 (55%)	14
South of Ballarat Road	33,400	43	12,800 (62%)	9

To examine the traffic differences between the four lane scenario and the two lane scenario, a bandwidth plot was created to highlight roads that see either an increase or decrease in daily two way traffic. This plot is shown in Figure 16.

It is clear that by increasing the number of lanes from two to four, the Palmers Road Corridor becomes a more attractive alternative for north-south travel. It can also be seen that traffic is drawn from multiple routes in the corridor.

Figure 16 Difference Bandwidth between Four lane scenario and Two lane scenario



Notes: Palmers Road Corridor is the central vertical magenta corridor.

3.4.2 AM Peak

The 2046 AM peak modelling for the four lane scenario shows the Palmers Road Corridor becoming a more significant north-south route. Increasing the corridor to four lanes also results in an overall lowering of volume-capacity ratios.

A plot of one way volumes for the AM peak is shown in Figure 17, and a plot of volume-capacity ratios for the AM peak are shown in Figure 18. Analysis of the data in Figure 18 indicates that of all the vehicle kilometres travelled in the south bound direction in the AM peak, 55% was in conditions with volume capacity ratios greater than 0.8, which is congested conditions.

Figure 17 Four lanes 2046 AM Peak – one way volume Plot

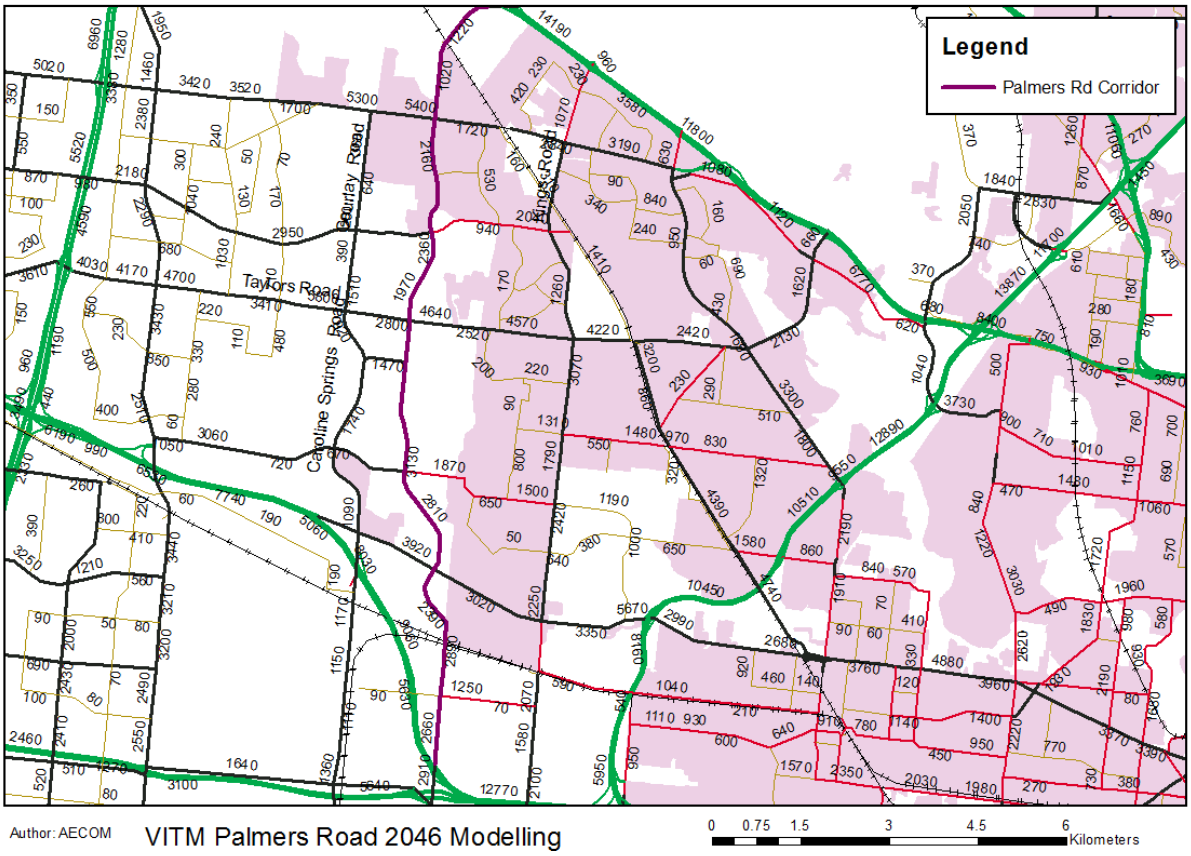
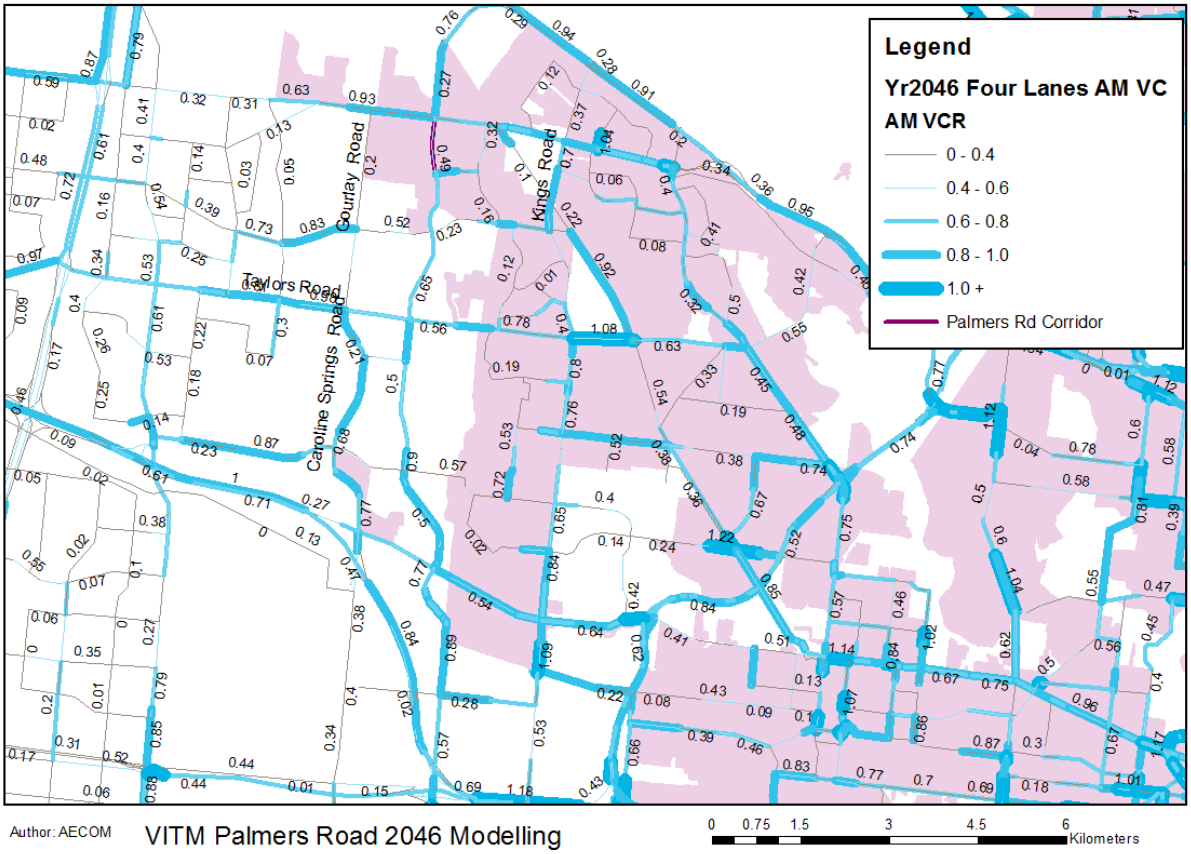


Figure 18 Four lane 2046 AM Peak – Volume Capacity Ratio



3.5 Six Lane Scenario

The third test scenario is for the Palmers Road Corridor to be six lanes (three lanes each way) for the northern section between Western Highway and the Calder Freeway.

The 2046 modelling results for this six lane scenario are described in this section.

3.5.1 Daily

Increasing the Palmers Road Corridor from two lanes to six lanes has a similar but larger impact in the corridor than the increase from two to four lanes. Traffic is approximately 60%-100% greater than that of the two lane scenario. AM peak southbound speeds are also noticeably faster than both the four lane scenario and the two lane scenario.

Table 8 shows the daily two way volumes under the six lane scenario and compares them to the two lane scenario. A comparison between the AM peak southbound speeds is also given.

Table 8 Six Lane Daily two way volumes along Palmers Rd Corridor

Location	Modelled 2046	Average speed (km/hr) (AM southbound direction)	Daily Volume increase from Two Lane Case	AM speed (km/hr) difference from Two Lane Case
South of Calder Freeway	23,500	62	8,800 (60%)	2
South of Keilor-Melton Road	28,300	59	11,000 (64%)	13
South of Taylors Road	51,400	52	23,200 (82%)	21
South of Ballarat Road	40,700	51	20,100 (98%)	18

Figure 19 shows the change in speed on Palmers Road Corridor by location for two, four and six lanes. This indicates that the level of service improves for most of the sections of road when upgrading from four to six lanes.

The daily volume difference bandwidth plot for the six lane scenario is shown in Figure 20. The bandwidth plot for the six lane scenario shows a similar pattern to that of the four lane scenario, but with a wider and larger impact. Signified by the links shown in red, the bandwidth plot shows that the majority of additional traffic on the Palmers Road Corridor is being drawn from Gourlay Road and Kings Road and to a lesser extent from Hopkins Road and the OMR. Traffic conditions on all of these roads improve under this scenario.

Figure 19 Change in AM peak speeds on Palmers Road Corridor by route section

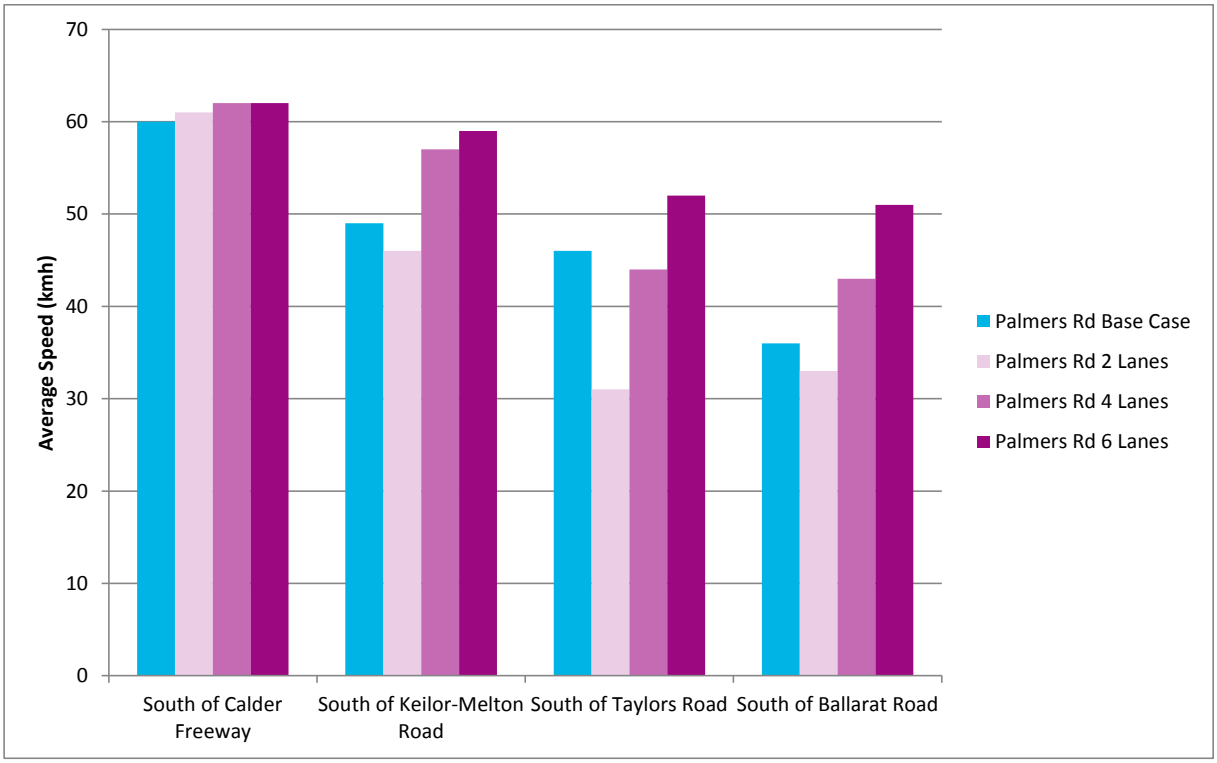
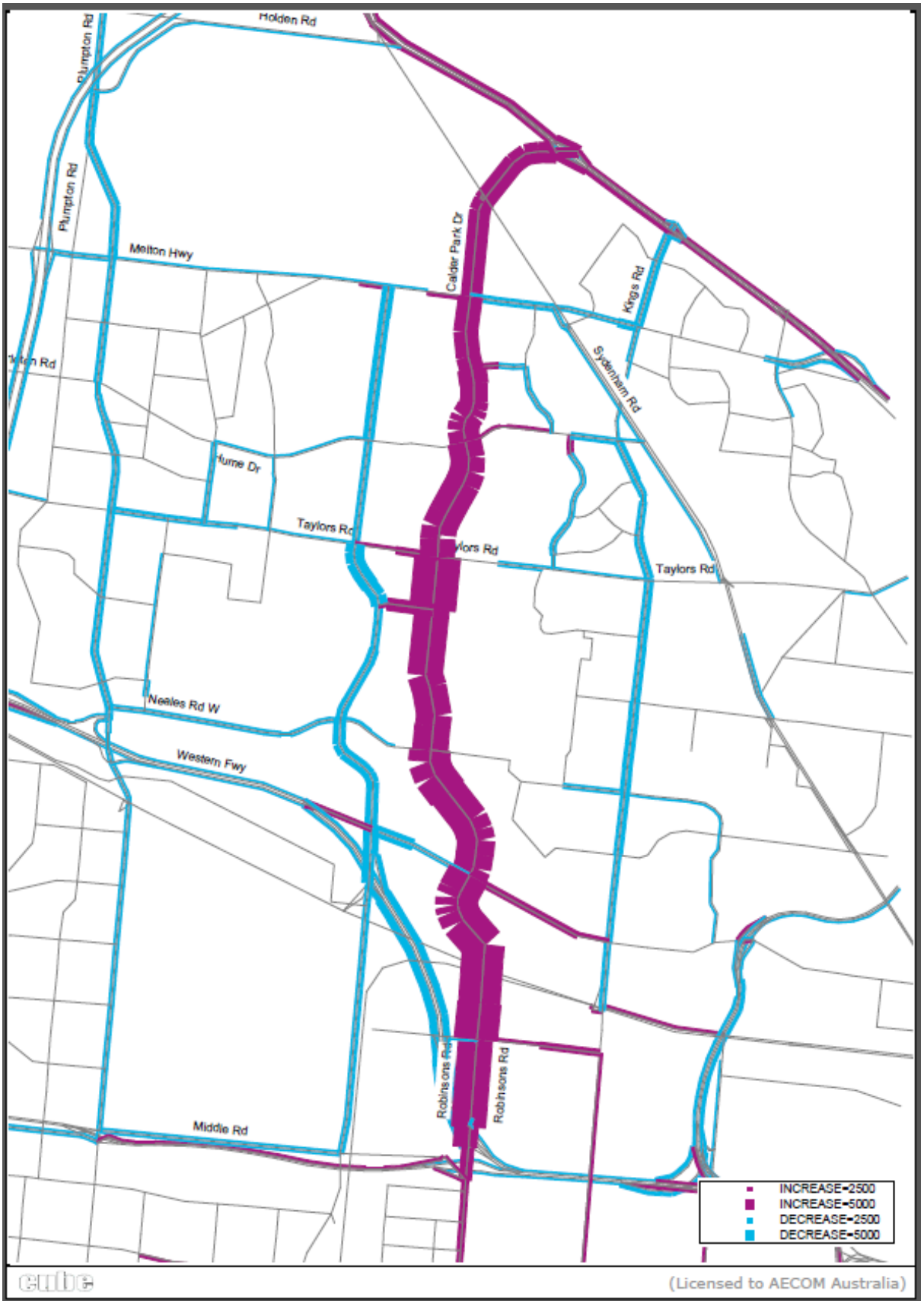


Figure 20 Volume difference bandwidth between Six lane scenario and two lane scenario



Notes: Palmers Road Corridor is the central vertical magenta corridor.

3.5.2 AM Peak

The 2046 AM peak results show that Palmers Road Corridor is the dominant north south route under the six lane scenario. Figure 21 gives a one way volume plot of the AM peak where it can be seen that volumes are higher than the four lane scenario, yet are within the capacity limits of the road.

It can be seen in the Volume Capacity ratio plot in Figure 22 that the VC ratios on all of the north south routes in the Palmers Road Corridor are relatively low. The only exception being Mount Derrimut Road (Kings Road) near the railway crossing. Analysis of the data in Figure 22 indicates that of all the vehicle kilometres travelled in the south bound direction in the AM peak, 20% was in conditions with volume capacity ratios greater than 0.8.

Figure 21 Six lanes 2046 AM Peak – one way volume Plot

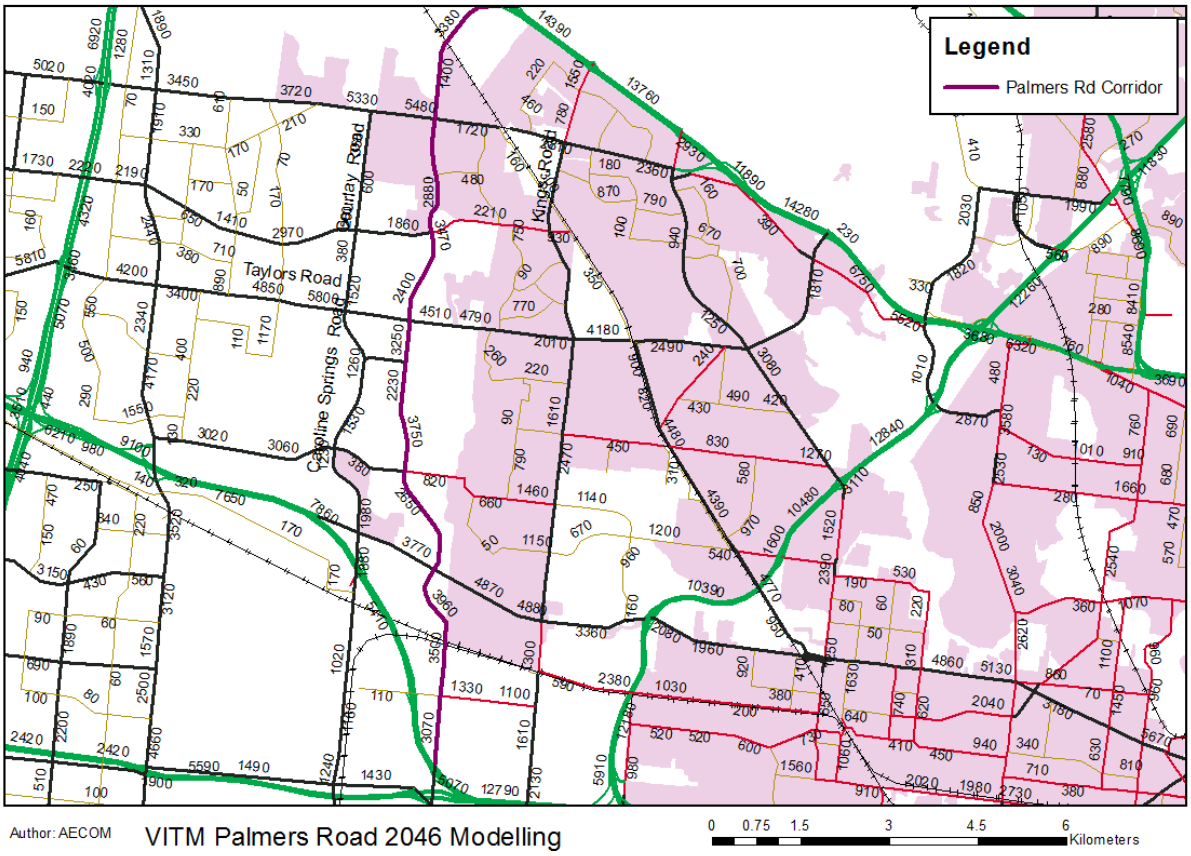
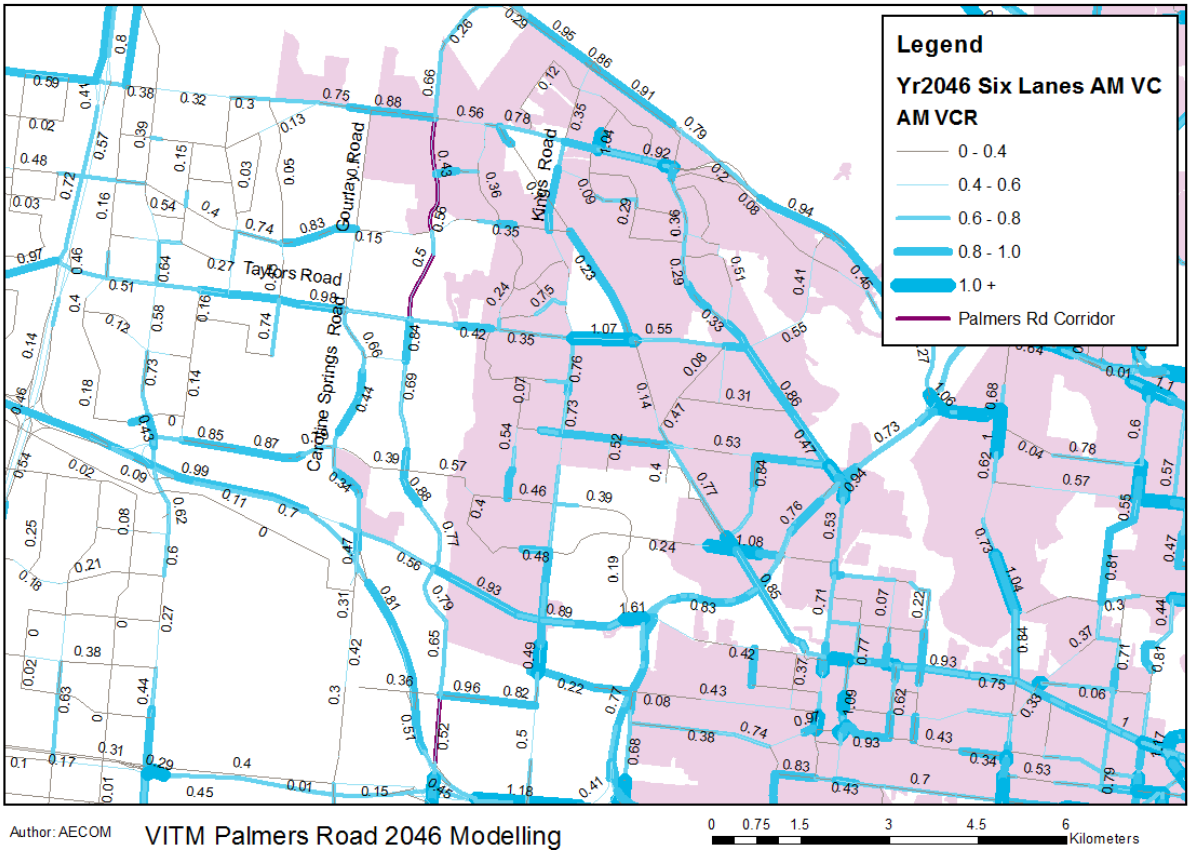


Figure 22 Six Lane 2046 AM Period – Volume Capacity Ratio



3.6 Impacts of the Palmers Road Corridor at two, four and six lanes

3.6.1 Corridor Impacts

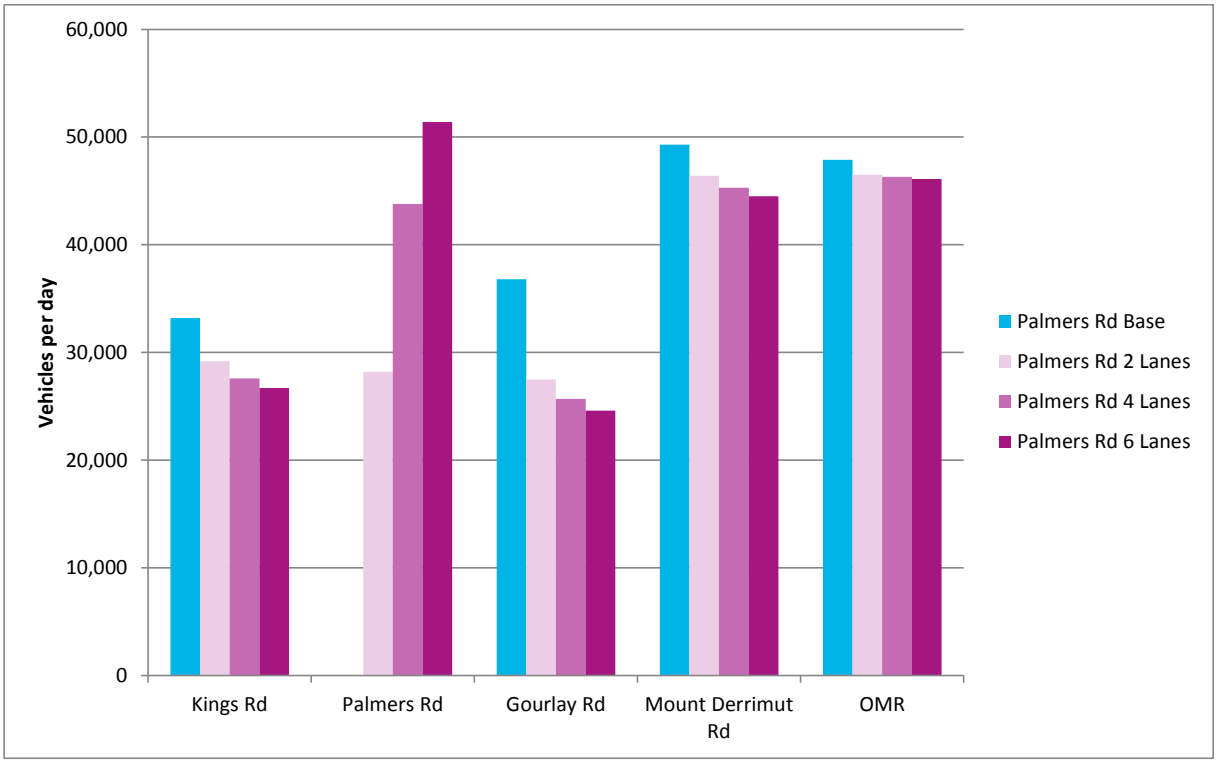
As the bandwidth plots in Sections 3.4 and 3.5 show, a significant number of vehicles that use north south routes other than the Palmers Road Corridor in the Base Case scenario will switch to the corridor when its capacity is increased.

Table 9 quantifies this change for each and includes the two lane, the four lane and the six lane scenarios. Daily two way volumes were calculated along an east-west screenline south of Taylors Road. The table shows that at this location, Gourlay Road provides the most traffic to the Palmers Road Corridor as the lanes on this corridor increase from two to six. This is shown graphically in Figure 23.

Table 9 Comparison of changes in daily two way volume across screenline south of Taylors Rd

	Palmers Road Corridor Base Case	Palmers Road Corridor Two Lanes	Palmers Road Corridor Four Lanes	Palmers Road Corridor Six Lanes
Station Rd - Kings Rd	33,200	29,200	27,600	26,700
Palmers Rd Corridor	-	28,200	43,800	51,400
Gourlay Rd	36,800	27,500	25,700	24,600
Mount Derrimut Road	49,300	46,400	45,300	44,500
OMR	47,900	46,500	46,300	46,100
	167,300	**168,500**	**173,800**	**177,400**

Figure 23 Change in Traffic on Palmers Road Corridor and Adjacent Routes



The modelling shows that with an increase in the number of lanes on the Palmers Road Corridor, traffic across the whole corridor sees a reduction in congestion. The following two tables demonstrate this improvement by comparing the 2046 modelled AM peak travel times between Western Highway / Middle Road in the south and Melton Highway in the north. While each of the routes are of a similar distance, they are not equal. The comparison for each should be made against the Base Case rather than against alternative roads.

The biggest improvements in travel time are observed in Table 11 which compares the southbound direction as this is the peak direction in the AM. This indicates that reducing congestion on the major parallel routes improves the level of service of these routes. As some of these routes, such as Gourlay Road, are public transport routes, the improved levels of service provide better opportunities for bus priority measures. It is noted that the strategic model does not capture detailed route operations where priorities for different modes will be allocated on the basis of Smart Roads priorities, for example using traffic signal operation and priority.

Table 10 Comparison of changes in northbound travel time (mins) between Western Hwy/Middle Rd and Melton Hwy

	Palmers Road Corridor Base Case	Palmers Road Corridor Two Lanes	Palmers Road Corridor Four Lanes	Palmers Road Corridor Six Lanes
Palmers Road Corridor	-	14.6	12.2	11.5
Station Road - Kings Road	18.3	18.2	17.5	17.3
Gourlay Road	17.2	16.4	15.9	15.9
Mount Derrimut Road	11.8	11.8	11.7	11.7
OMR	7.2	7.2	7.2	7.2

Table 11 Comparison of changes in southbound travel time between Western Hwy/Middle Rd and Melton Hwy

	Palmers Road Corridor Base Case	Palmers Road Corridor Two Lanes	Palmers Road Corridor Four Lanes	Palmers Road Corridor Six Lanes
Palmers Road		18.4	14.4	12.7
Station Road - Kings Road	20.9	20.7	19.0	18.6
Gourlay Road	20.3	19.2	17.8	17.0
Mount Derrimut Road	13.4	13.3	13.0	12.9
OMR	7.3	7.3	7.2	7.2

3.6.2 Palmers Road Corridor Impacts

The benefit of the Palmers Road Corridor being upgraded from two lanes to either four or six lanes varies along its length. This is best demonstrated by plotting volumes and speeds for each of the scenarios.

For the northbound direction, Figure 24 shows the daily volumes and Figure 25 shows the AM peak speeds. While for the southbound direction Figure 26 shows the daily volumes and Figure 27 shows the AM peak speeds.

These plots show that the main benefit from increasing the number of lanes compared to the Base Case is the large reduction in congestion at four to five choke points along the Palmers Road Corridor. They also show how traffic volumes increase from the Base Case in the two lane, four lane and six lane scenarios.

These plots indicate that the highest traffic volume and the best level of service as measured by AM speeds is achieved with the Palmers Road at six lanes scenario. The four lane scenario carries lower traffic volumes than the six lane scenario and slower speeds (in the AM peak). The two lane scenario carries lower volumes than the four lane scenario at lower speeds. This indicates that for the strategic objectives of the corridor to carry traffic volumes with improved travel times than the six lane scenario is superior to the four lane and two lane scenarios.

Figure 24 Palmers Road Corridor Northbound 2046 Daily volumes for Base Case (two lanes), Four Lane and Six Lane scenarios

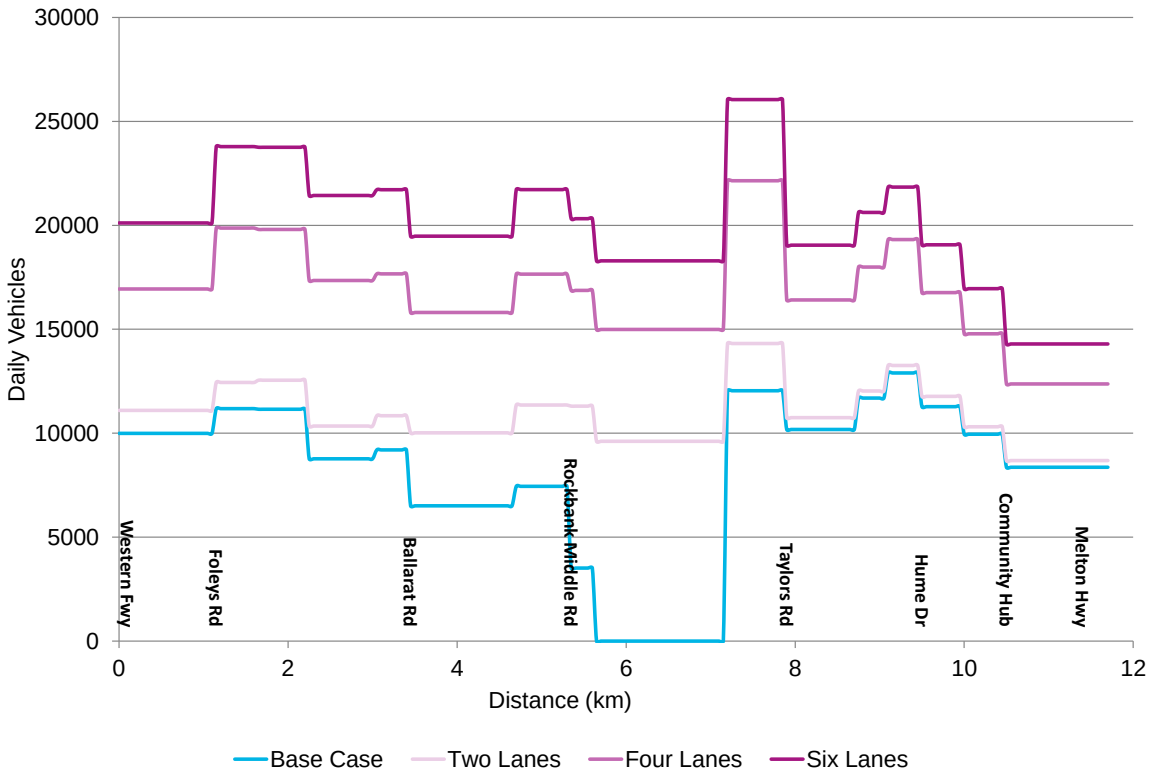


Figure 25 Palmers Road Corridor Northbound 2046 AM speed (km/hr) for Base Case (two lanes), Four Lane and Six Lane scenarios

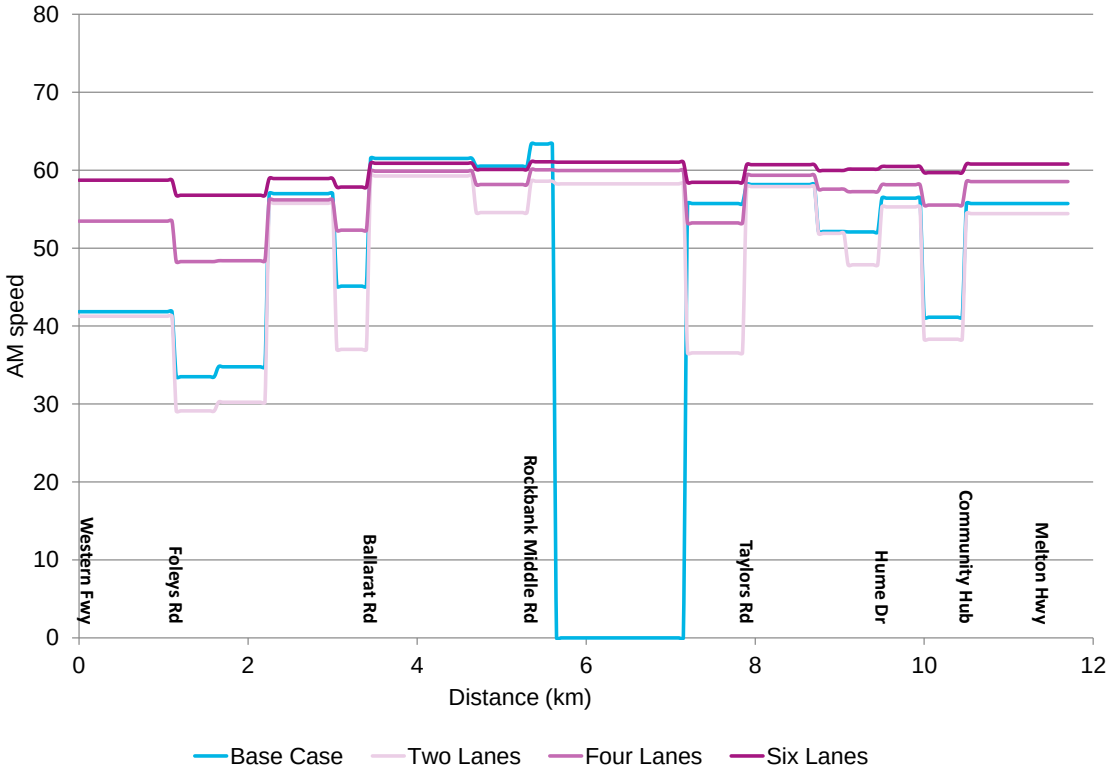


Figure 26 Palmers Road Corridor Southbound 2046 Daily volumes for Base Case (two lanes), Four Lane and Six Lane scenarios

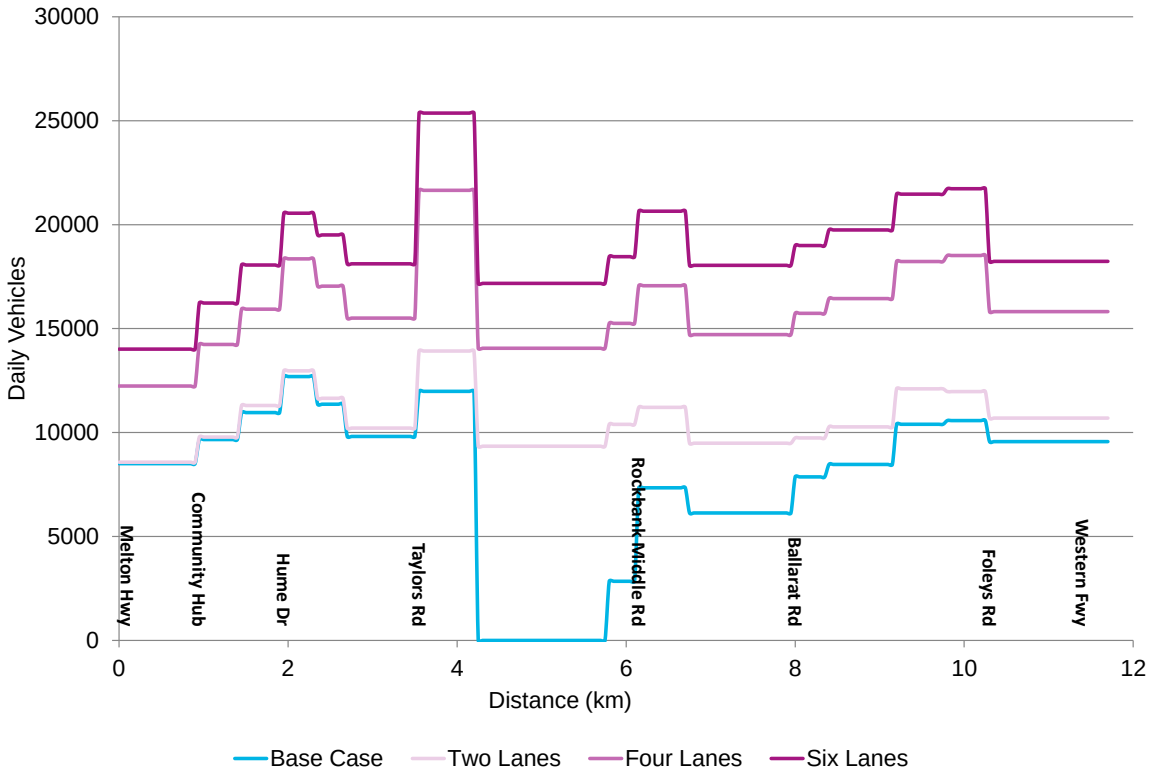
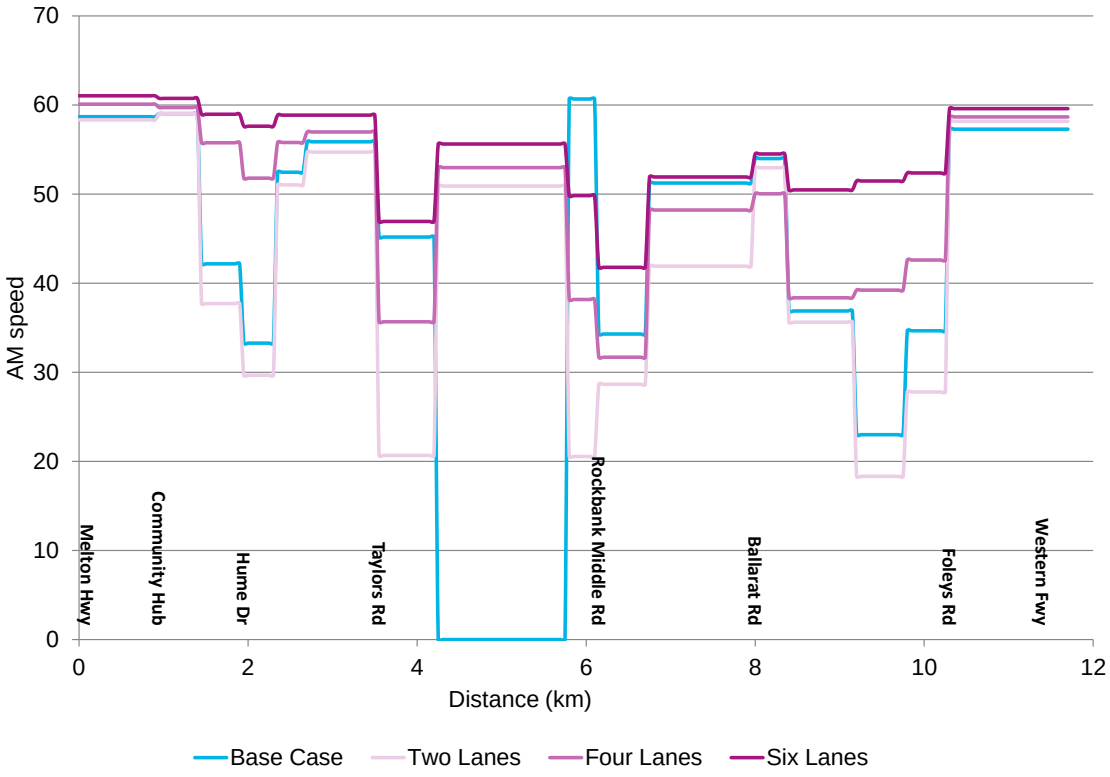


Figure 27 Palmers Road Corridor Southbound 2046 AM speed (km/hr) for Base Case (two lanes), Four Lane and Six Lane scenarios



3.7 Impact of Kororoit Creek Bridge

Another object of this study was to gauge the impact of introducing a bridge across the Kororoit Creek to link Westwood Drive between Commercial Road to the north and Rockbank Middle Road to the South. Figure 13 section 3.3 shows the difference in daily volumes between the base case and the two lane scenario in 2046 due to introducing the bridge across Kororoit Creek. Table 12 shows daily volumes for 2011, 2015 and 2046 for selected roads near the creek crossing with and without the bridge. This indicates that traffic increases on the Palmers Road Corridor when the bridge connects the road across Kororoit Creek.

Table 12 Daily volumes with and without the Kororoit Creek Bridge

Location	2011 no bridge	2011 with bridge	2015 no bridge	2015 with bridge	2046 no bridge	2046 with bridge
Calder Park Drive north of Taylors Road	2,100	3,800	13,000	21,300	20,000	21,000
Taylors Road west of Calder Park Drive	13,600	13,300	19,000	17,400	46,500	48,000
Taylors Road east of Calder Park Drive	14,400	15,000	18,00	20,500	56,000	54,200
Calder Park Drive south of Taylors Road	0	4,600	2,700	21,300	24,000	28,200
Commercial Road west of Westwood Drive	0	0	2,700	2,400	24,000	21,000
Westwood Drive south of Commercial Road (bridge)	0	4,600	0	20,200	0	19,000
Rockbank Middle Road west of Westwood Drive	0	100	2,400	1,500	12,800	8,100
Rockbank Middle Road east of Westwood Drive	0	0	1,600	1,500	13,800	13,400
Westwood Drive south of Rockbank Middle Road	6,300	5,800	9,700	22,800	14,800	22,600
Westwood Drive north of Ballarat Road	5,100	6,300	8,200	19,500	12,600	19,500
Westwood Drive south of Ballarat Road	5,900	6,600	10,400	17,600	17,100	20,600
Ballarat Road west of Westwood Drive	40,500	40,000	42,300	40,800	54,900	53,500
Ballarat Road east of Westwood Drive	42,500	42,300	44,800	45,900	61,300	59,700

4.0 Key findings and recommendation

4.1 Key findings

The transport modelling tested the Palmers Road Corridor from Western Freeway to Calder Freeway with two lanes and no bridge (Base Case), two lanes with bridge, four lanes and six lanes. Analysis of the model outputs suggests that introducing the bridge increases traffic on the Palmers Road Corridor, upgrading the road from two lanes to four lanes improves the network performance and allows for an increase in traffic volumes on the road. Upgrading from four to six lanes provides a further increase in network performance while allowing even greater volumes of traffic. Analysis of travel in the AM peak indicates that at four lanes, the Palmers Road corridor is operating over capacity. The percentage of all kilometres travelled in congested conditions decreases substantially when increasing from four to six lanes from 55% to 20%.

Upgrading Palmers Road reduces traffic and increases speeds on nearby adjacent routes. The reduced traffic and improved reliability could enable better provision of public transport priorities on routes such as Gourlay Road and Kings Road.

At six lanes, the Palmers Road Corridor becomes the major north south route located between the OMR and the Western Ring Road.

The assessment of the scenarios against the EES objectives for road safety and capacity are based on the road traffic volumes and travel time outcomes. According to these criteria the assessment of the scenarios is as shown in Table 13:

Table 13 Assessment against EES objective

Scenario	Assessment against EES objective (traffic volumes and travel times)
Base Case	Poor
Two lane	Moderately Well
Four Lane	Well
Six Lane	Very Well

4.2 Recommendation

Modelling shows a road connection across Kororoit Creek for the Palmers Road Corridor is critical to the arterial road network. Modelling also shows at four lanes, the Palmers Road Corridor is over capacity and therefore six lanes are required.

Appendix A

Western growth corridor VITM project - Modelling report

AECOM

Growth Areas Authority
1 August 2012

DRAFT

Western growth corridor - VITM project

Modelling report

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Western growth corridor - VITM project

Modelling report

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AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

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Quality Information

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Ref 60264682

Date 1 August 2012

Prepared by Geoff Ford

Reviewed by Paris Brunton

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	26-July-2012	Draft Report	Paris Brunton	
B	01-Aug-2012	Revised Draft Report	Paris Brunton	

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Table of Contents

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1.0 Introduction

This report describes AECOM's development of the Western growth area strategic model.

1.1 Background

The Western Growth Corridor includes land within the UGB in the municipalities of Wyndham and Melton. It incorporates land within the Urban Growth Zone, which when fully developed is expected to deliver in the order of 108,000 - 183,000 dwellings and be home to over 290,000 people. It will also provide almost 3,000 hectares of employment land expected to provide in excess of approximately 130,000 jobs.

AECOM was awarded the brief by the Growth Areas Authority (GAA) for the development of a transport model for the Western Growth Corridor. This development will allow the transport model to be used as a major input into the development of Precinct Structure Plans and their associated Development Contribution Plans in the Western Growth Corridor.

The first stage in the development of the model involved the calibration and refinement of the Victorian Integrated Transport Model (VITM) for the study area.

To achieve the aims of this stage of the project, AECOM has

- Received the latest (2012) version of the VITM
- Consulted with Melton Shire Council, Wyndham City Council and VicRoads regarding road network assumptions and updated the model accordingly.
- Consulted with Melton Shire Council and Wyndham City Council regarding land-use assumptions and updated the model accordingly
- In conjunction with the Department of Transport, revised the trip distribution of external car trips to better reflect the proximity to regional centres (e.g. Geelong, Ballarat, Bacchus Marsh)
- Scaled the external trips from the freight matrices to match the external cordon counts

Matrix Estimation was not included as part of the calibration and validation process. Therefore all of the changes that were made to VITM were within the existing model framework.

The second stage of the model development involved adding in the likely future transport networks for the growth areas as well as the future land uses for the growth areas. To achieve the aims of this stage of the project, AECOM has:

- Coded addition detail in to the future road network, including local roads, primary and secondary arterials and freeways
- Created additional zones to represent the distribution of land uses within the growth areas
- Created zone connectors to link the zones to the transport network
- Ensured the future planned bus routes were routed on the new roads
- Consulted with Melton Shire Council, Wyndham City Council and VicRoads regarding road network assumptions and updated the model accordingly.
- Consulted with Melton Shire Council and Wyndham City Council regarding land-use assumptions and updated the model accordingly
- Added both network detail and land use for the logical inclusion areas of Wyndham and Melton

1.2 Victorian Integrated Transport Model (VITM)

The Victorian Integrated Transport Model (VITM) is the name given to the Department of Transport's four-step strategic traffic model.

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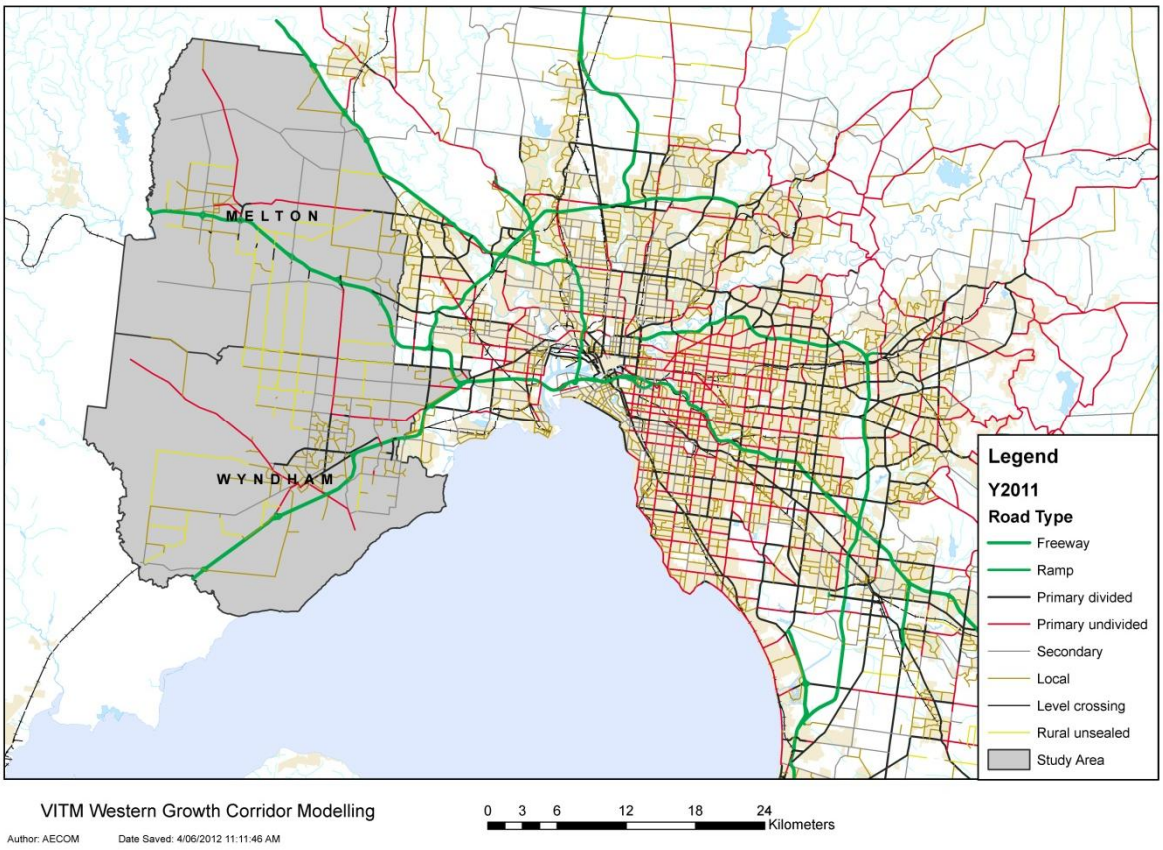
1.3 Study area

The Western growth corridor model does not involve a sub area extraction process. In all cases, the model includes the full extent of the VITM, however, for the purposes of the model calibration this project was limited to the Western growth corridor as shown in Figure 1 below.

Figure 1 Western growth corridor study Area



2.0 Model calibration

The VITM was refined with the purpose of improving the calibration in the Western growth area region. This primarily consisted of reviewing the road network assumptions, land-use assumptions, the VITM external model as well as small changes to externals of the freight matrices. These refinements are discussed in this section.

2.1 Network

The Western growth corridor has been the fastest growing regions of Melbourne in recent years. Accompanying the growth in population, households, employment and recreation, the road network within the growth corridor has also undergone continuous and significant improvements. Major roads projects have included:

- The Deer park bypass
- Additional lanes on the West Gate Bridge
- M80 upgrades
- Williams Landing station

There have also been numerous small roads projects in the region, including the construction of local roads for new housing estates and the sealing of unsealed roads.

In order to align with the demographic data used within VITM, the base year network was determined to be correct as of August 2011.

The process of reviewing and updating the VITM network involved using inputs from Melton Shire Council, Wyndham City Council, Growth Areas Authority and VicRoads.

The review process led to additional roads being added to the network as well as a number of changes being made to the network. These updates included changes to:

- Posted speed limits
- Number of vehicle lanes
- Link class (i.e. collector / secondary / primary road)
- Divided or Undivided status
- Road closures

To illustrate the final 2011 network within the Western growth corridor, Figure 2 shows the road type assumptions for the Wyndham area whilst Figure 3 shows the road type assumptions for the Melton area.

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Figure 2 2011 VITM network configuration – Wyndham

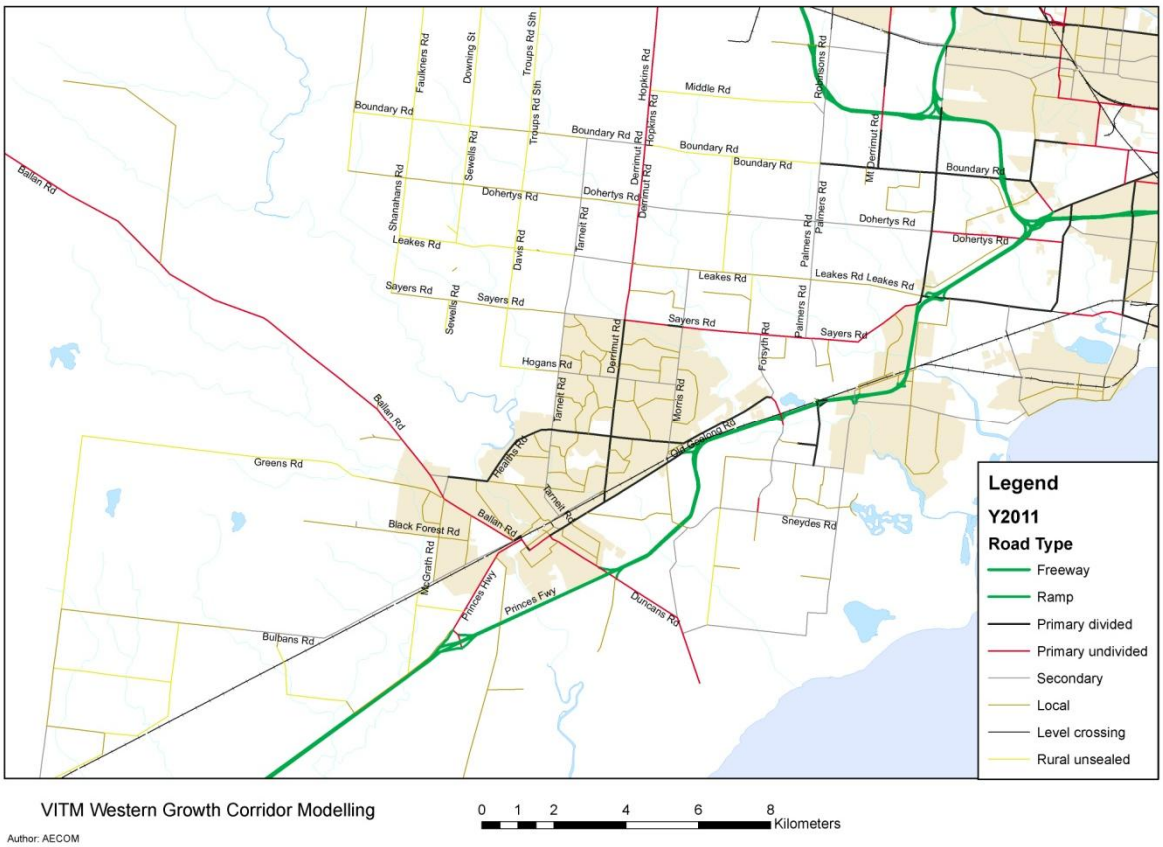

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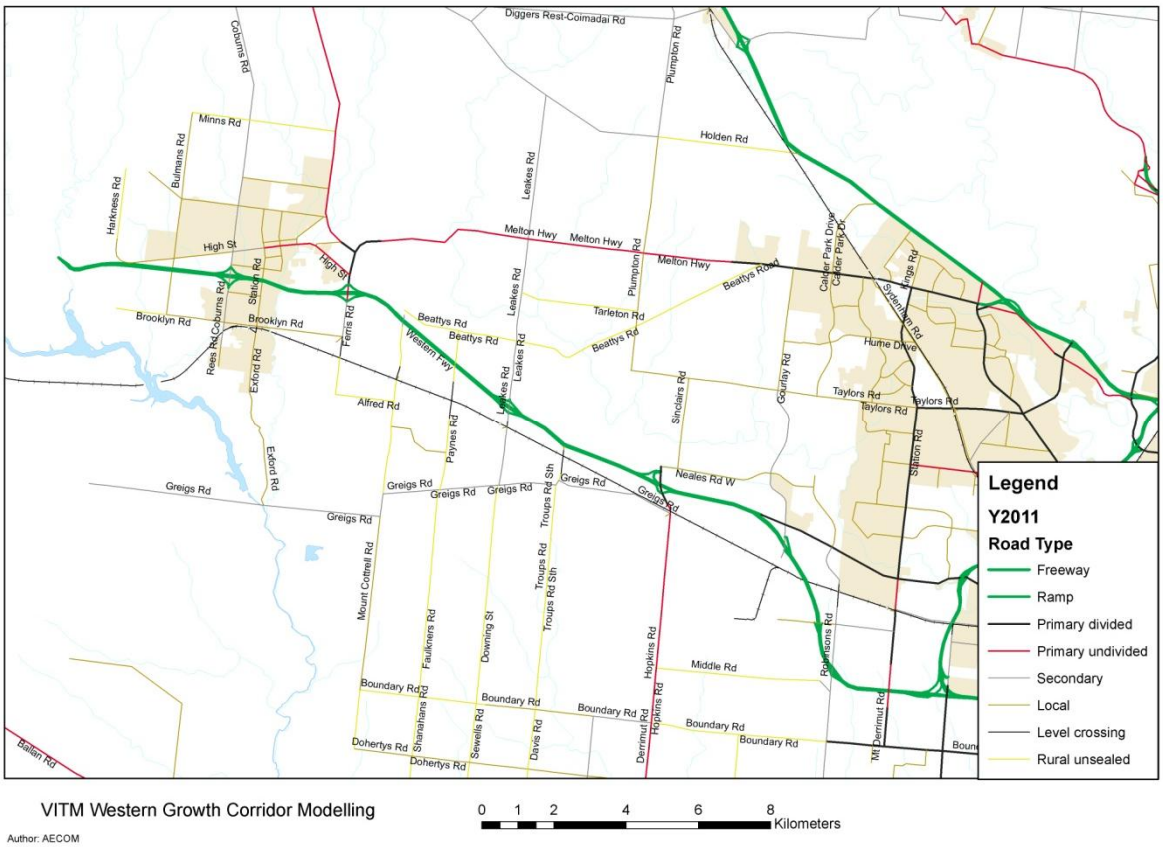
Figure 3 2011 VITM network configuration – Melton



2.2 Land-Use

In addition to the network refinements described above, changes were made to the 2011 demographic inputs. The consultation process with Melton and Wyndham councils resulted in amendments to both population and employment assumptions.

The demographic data input to the VITM includes a number of variables such as total population, number of households, population split into age groups, number of dependents split into age groups, total employment, employment by type and education.

The changes made during this calibration process were made directly to the 'total population' and 'total employment' assumption for each zone. For zones in which the population or employment were updated, the values for the other demographic variables, such as the number of households, were derived using the relevant average value of the Local government area of the zone.

The zones in which the population and employment assumptions were changed are shown in Figure 4 and Figure 5 respectively. Tables detailing the changes that were made are shown in the appendix.

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Figure 4 Western growth corridor zones where population assumptions were updated.

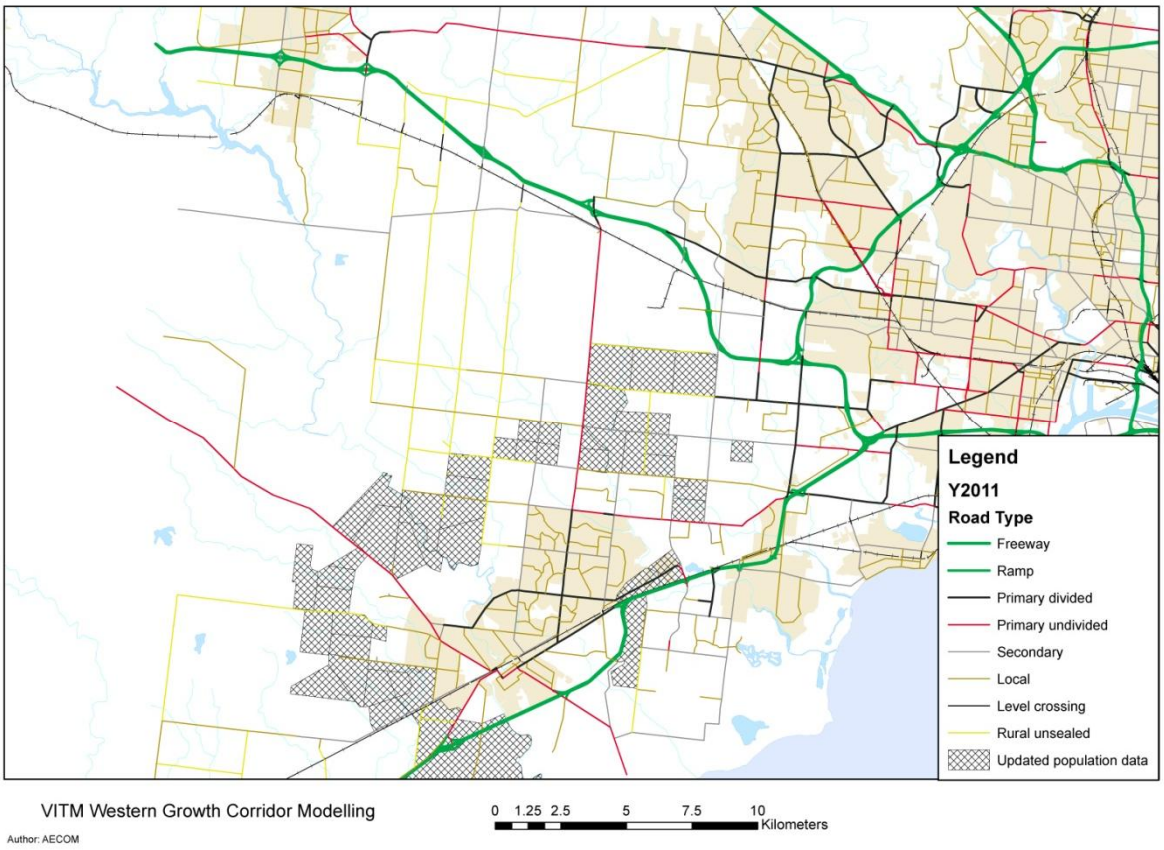
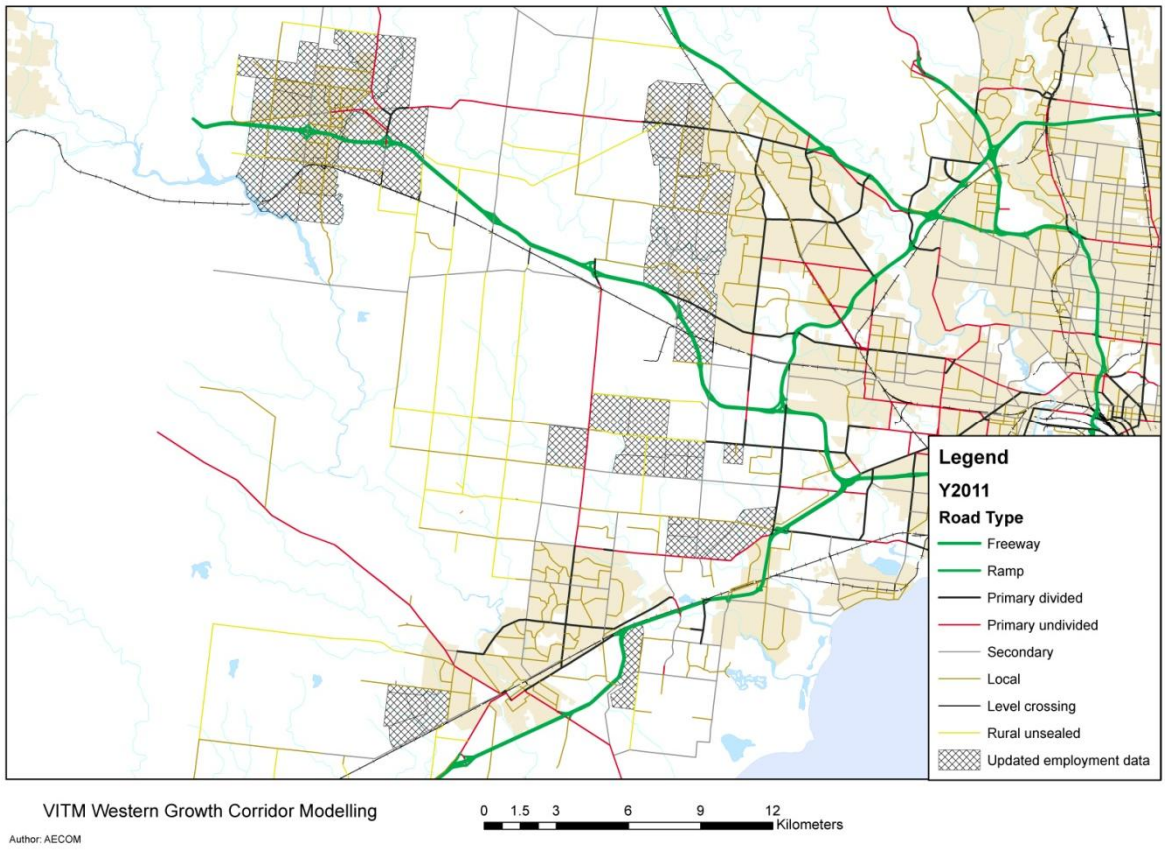


Figure 5 Western growth corridor zones where employment assumptions were updated



2.3 Freight matrices

An examination of the 2011 matrices showed that they were underestimating truck trips to and from the external zones. As part of the calibration process, the external trips in the freight matrices were factored to match the counts at the external cordon. That is, the 'shape' of the matrix was not changed but rather OD pairs that include an external zone were grown to match the truck count at the external.

2.4 External matrices

Following a discussion with the Department of Transport, the distribution of external trips was revised to better reflect the proximity of the each external to regional centres outside of the metropolitan area. The number of external trips was left unchanged.

This change means that the model now shows a stronger relationship between Geelong and Werribee. That is, the calibrated model now has more trips that originate in Geelong having a destination in Werribee and vice versa.

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3.0 Validation data

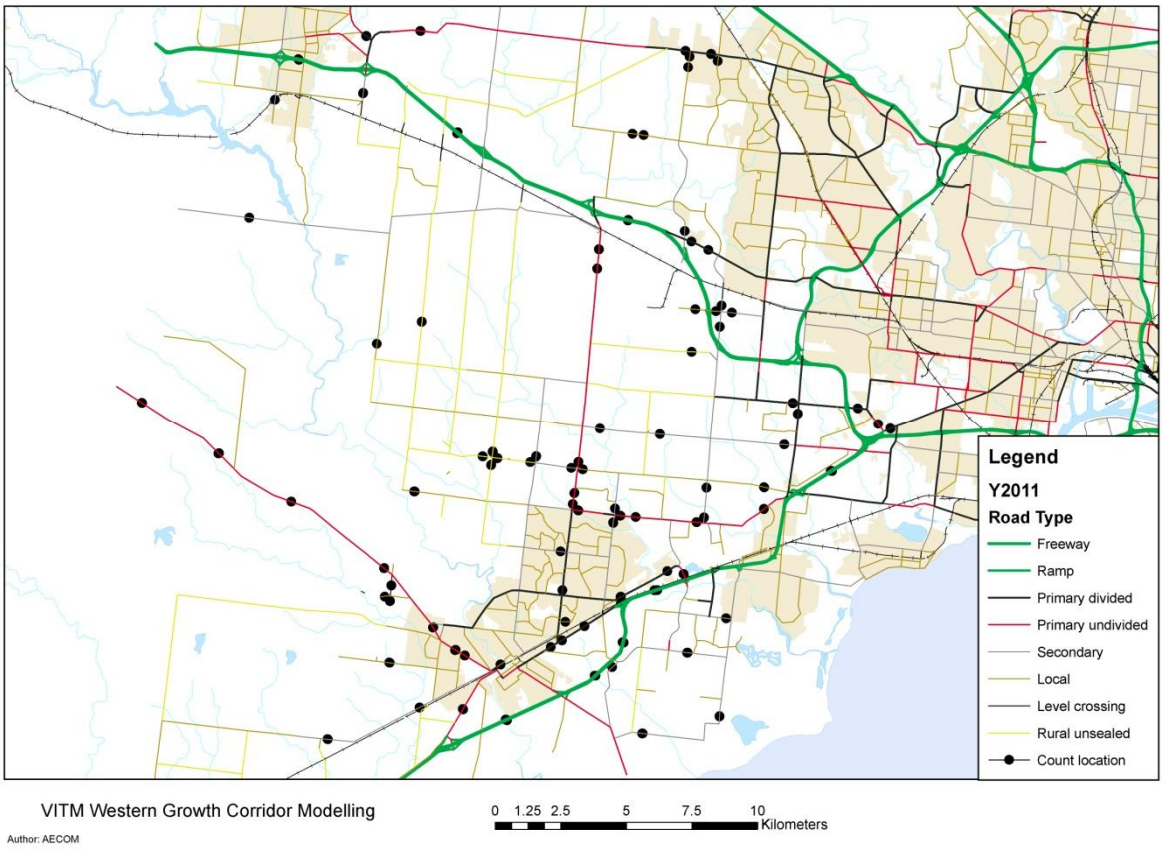
For the purposes of validation and calibration of the model, historic traffic count data was obtained from VicRoads, Wyndham City Council and Melton Shire Council.

The traffic count data consists of an extensive set of counts taken between 2009 and 2012 on most of the important roads in the Western growth corridor. However, due to the extensive land use changes and traffic growth that has occurred in the corridor during this period, a sensibility check of the counts was conducted. This check involved removing counts that were deemed to be outdated or conflicted with a more recent count. For example, if there was found to be two counts in close proximity that showed a large difference in traffic volume, a preference was given to the more recent count.

Furthermore, the scale and nature of the growth in the corridor meant that it was not appropriate to factor the counts to a base year or to apply seasonality factors.

The location of the counts used in the validation is shown in Figure 6 below.

Figure 6 Traffic count locations



To assist in the validation, six screenlines were created. These screenlines cover all the major movements within the corridor and their locations are shown in Figure 7.

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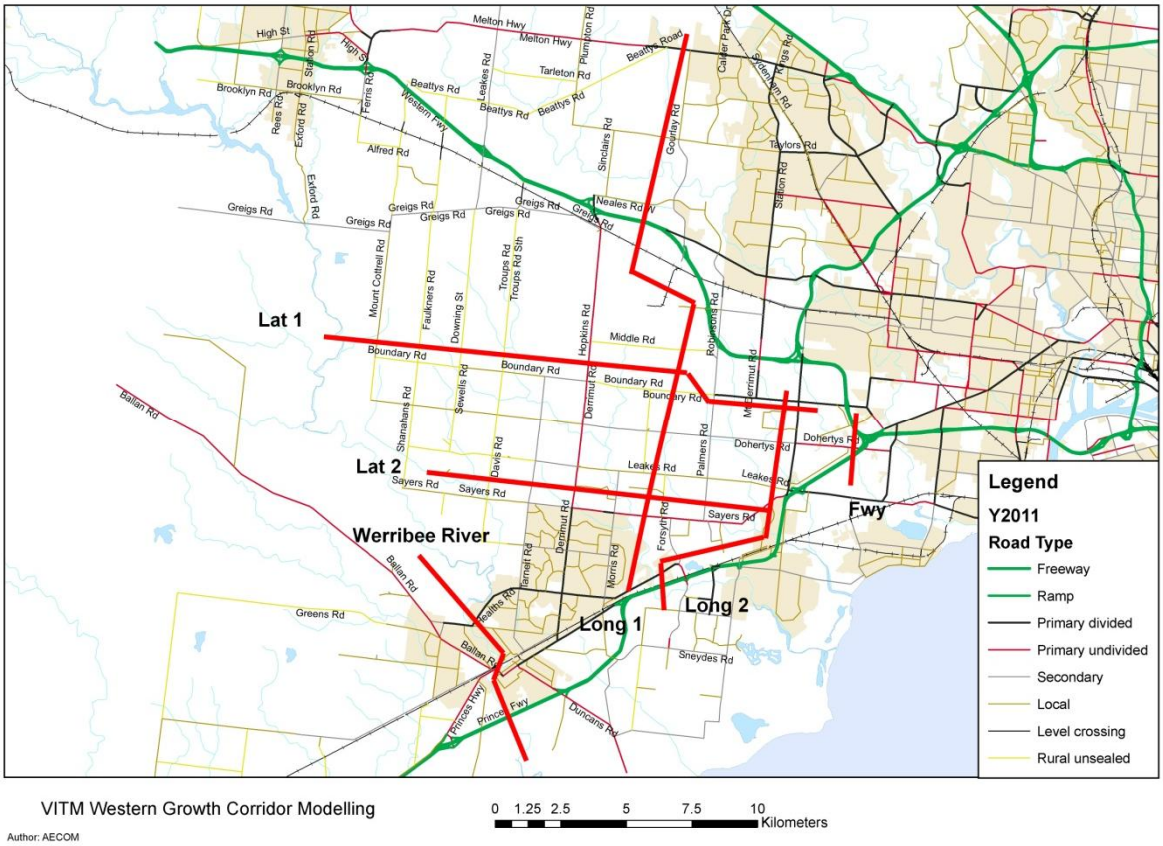
Figure 7 Screenline location map



4.0 2011 base year model validation

This section of the report describes the model validation results which are used to assess whether the model can satisfactorily represent existing traffic patterns in 2011. The criteria and checks adopted have been based on those recommended in the VicRoads guidelines titled *Guidelines on the Validation Process and Criteria for Strategic Transport Modelling (March 2010)*.

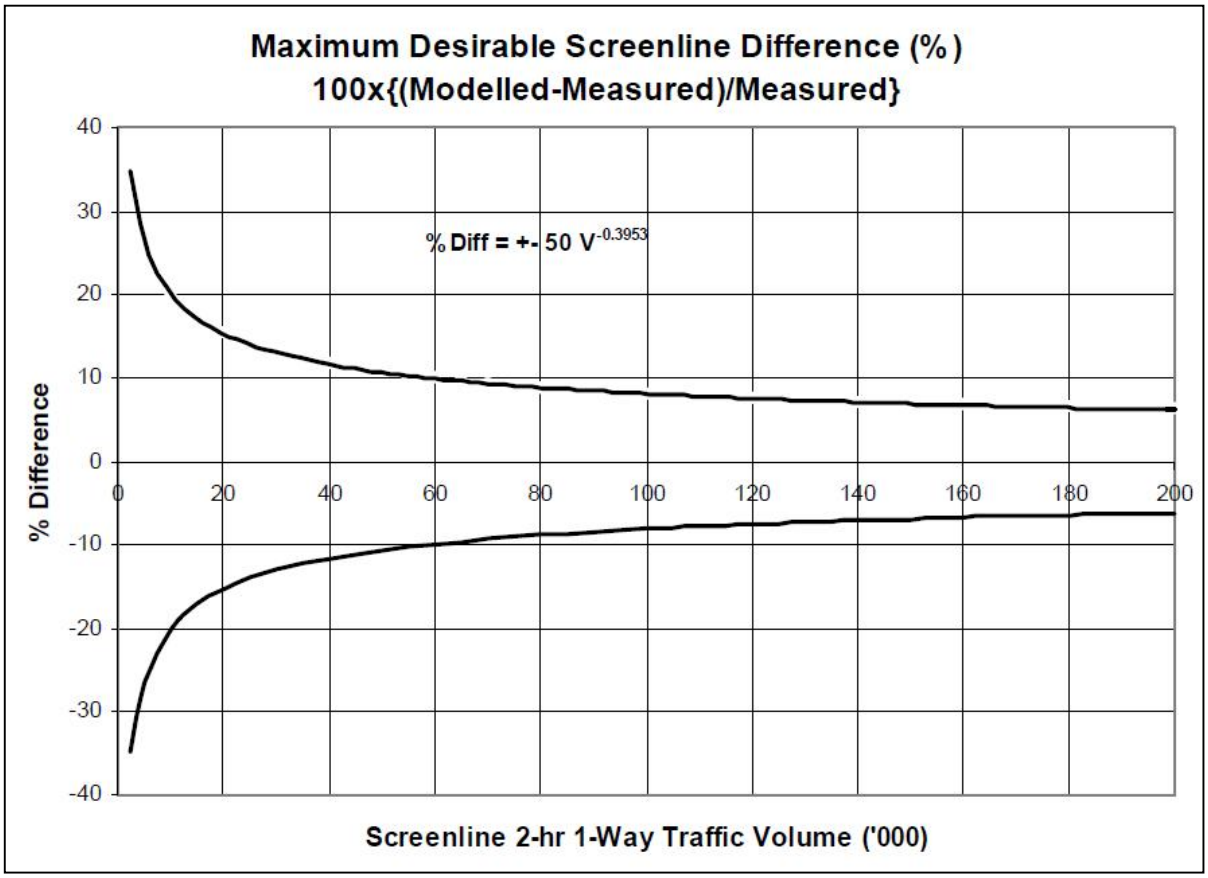
The model validation checks that were undertaken included comparisons of surveyed and modelled:

- Screenline traffic volumes;
- Traffic volumes for individual road links; and
- Travel times.

4.1 Comparison of observed and modelled screenline traffic volumes

To meet the requirements of the VicRoads screenline criteria, the percentage difference between the observed and modelled screenline 2-hour traffic volumes needs to be within the values bounded by the two curves shown in Figure 8. (The bounding curves for the daily screenlines are given by $+-80.145V^{-0.3953}$)

Figure 8: Validation criteria for 2-hour 1-way screenline traffic volumes



The six screenlines shown in Figure 7, were used to test the model against the VicRoads criteria. The results showing the percentage difference between the modelled and observed volumes for each of the screenlines by direction are shown for the AM peak period in Figure 9 , PM peak in Figure 10 and Daily in Figure 11. It can be seen that for both peak periods and the 24-hour period, each of the six screenlines are within the VicRoads screenline criteria.

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Figure 9: Comparison of observed and modelled screenline traffic volumes (all vehicles) for the AM peak period

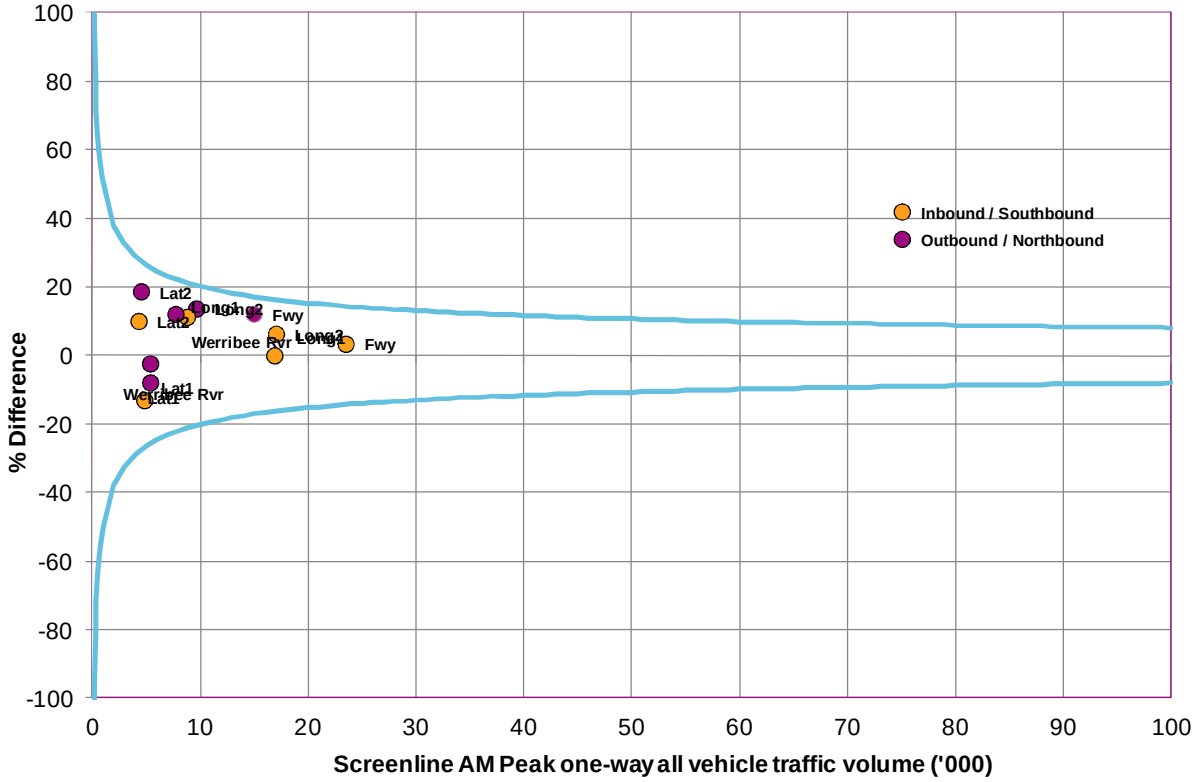


Figure 10: Comparison of observed and modelled screenline traffic volumes (all vehicles) for the PM peak period

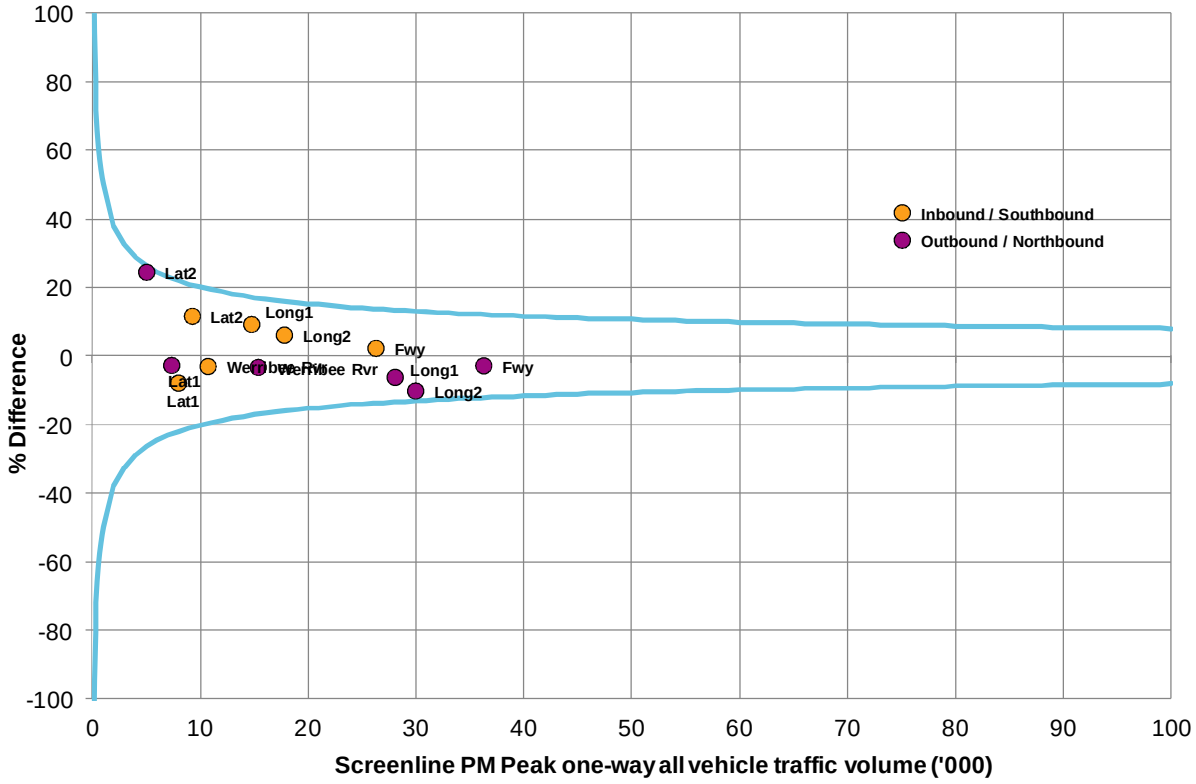
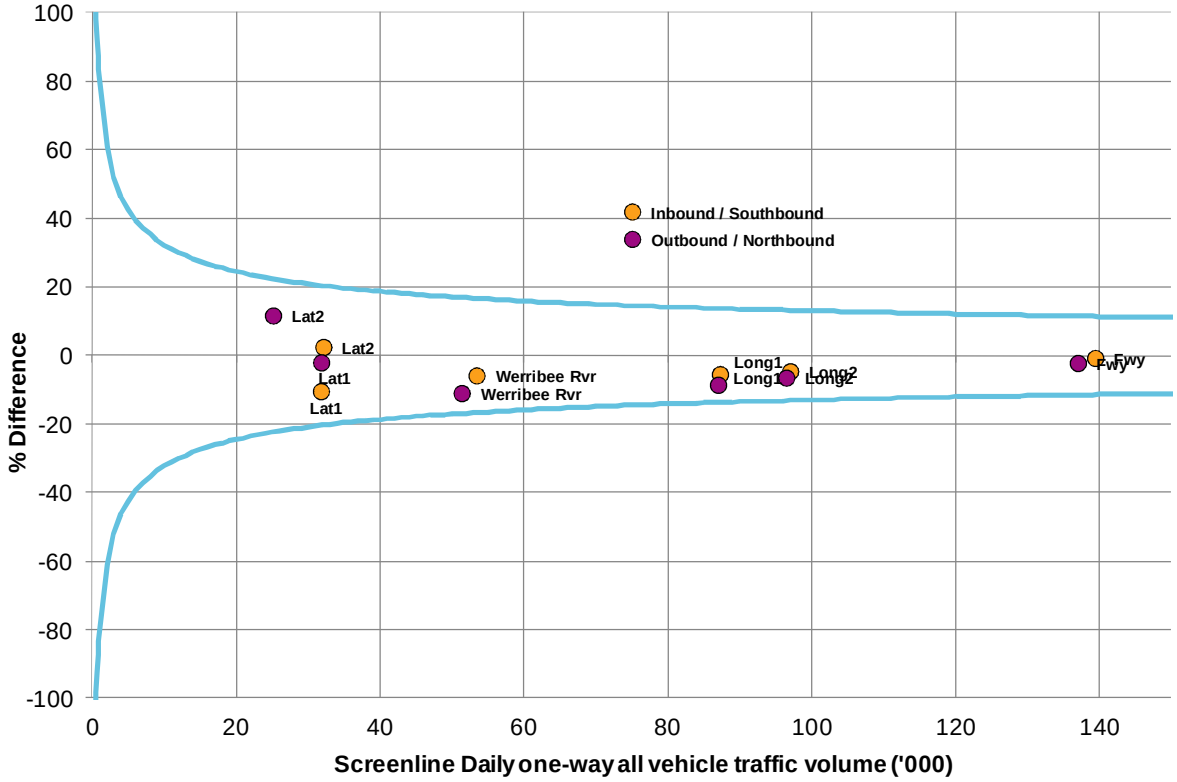


Figure 11: Comparison of observed and modelled screenline traffic volumes (all vehicles) for the Daily



4.2 Comparison of observed and modelled traffic volumes for individual road links

To meet the requirements of the VicRoads criteria for individual road links, a scatter plot of the observed and modelled traffic volumes for individual road links needs to have a line of best fit with a slope of between 0.9 and 1.1, and a statistical correlation (R^2) greater than or equal to 0.90.

In addition, the percentage difference between the measured and modelled traffic volumes (defined by the Percent Root Mean Square Error, %RMSE) should be less than 30 percent. %RMSE is defined as follows:

$$\%RMSE = 100N\frac{\sqrt{\sum(M-C)^2/(N-1)}}{\sum C}$$

Where:
N = number of count/modelled link pairs;
$\sum$ = summation of count/modelled link pair 1 to N;
M = modelled one-way link volume; and
C = surveyed one-way traffic volume

Scatter plots showing the difference between modelled and observed volumes were constructed for each of the modelled periods as well as for Daily.

The slopes and the R^2 for the lines of best fit are shown in Table 1, while the scatter plots are shown in Figure 12 to Figure 15.

It can be seen that with the exception of the slope for the off peak period, the lines of best fit of these scatter plots all meet the VicRoads criteria. Importantly, the scatter plots also show that despite using a large extent of traffic counts that have been taken over three years, there are no large outliers being produced by the model.

Interestingly, an examination of the traffic count data during the validation process revealed some significant peak spreading and congestion during the morning peak period. In some cases, the busiest hour of the day occurred

between 6am and 7am, technically in the off peak period. This has the effect of 'boosting' the off peak traffic count and subsequently, the model underestimating traffic volumes.

Table 1 Summary of scatter plot lines of best fit

Time Period	Number of counts	Slope of the line of best fit	R^2	Pass/Fail
AM peak	254	1.05	0.95	Pass
Inter peak	254	1.01	0.91	Pass
PM peak	254	0.97	0.92	Pass
Daily	254	0.97	0.94	Pass

Figure 12 Observed and modelled traffic volumes – all vehicles – AM Peak – VicRoads count data

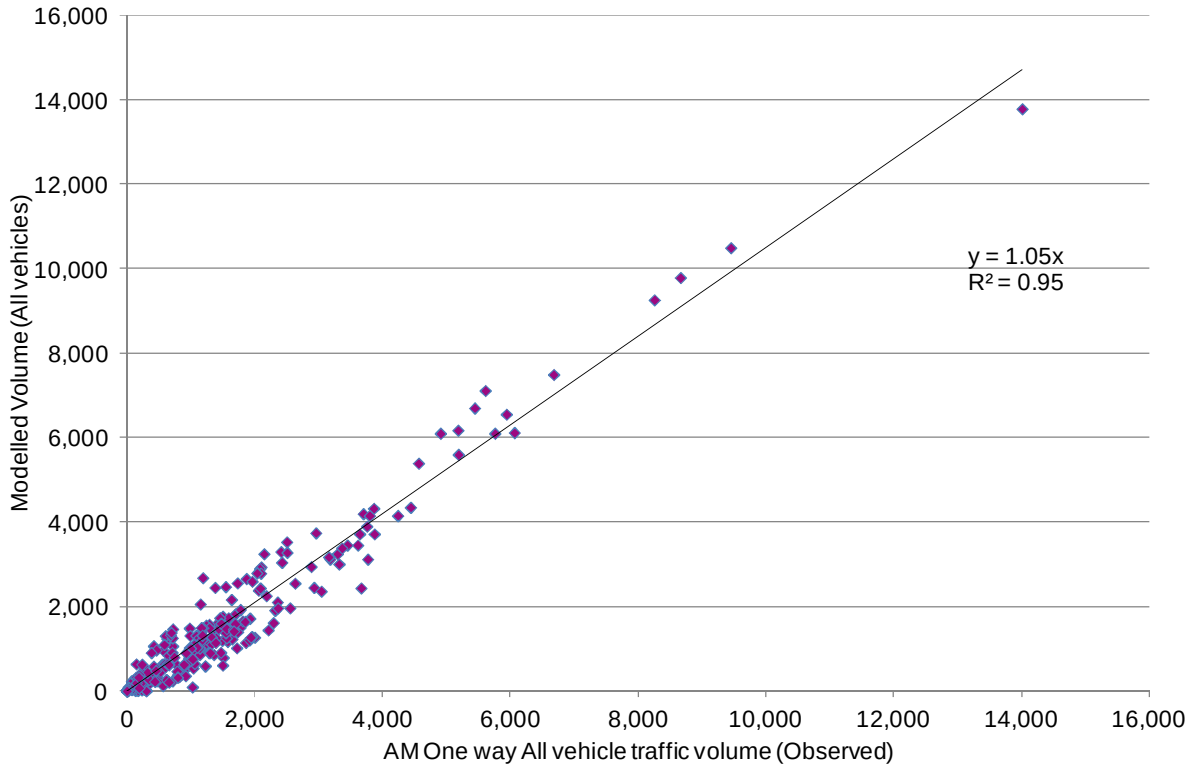


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Figure 13 Observed and modelled traffic volumes – all vehicles – Inter peak – VicRoads count data

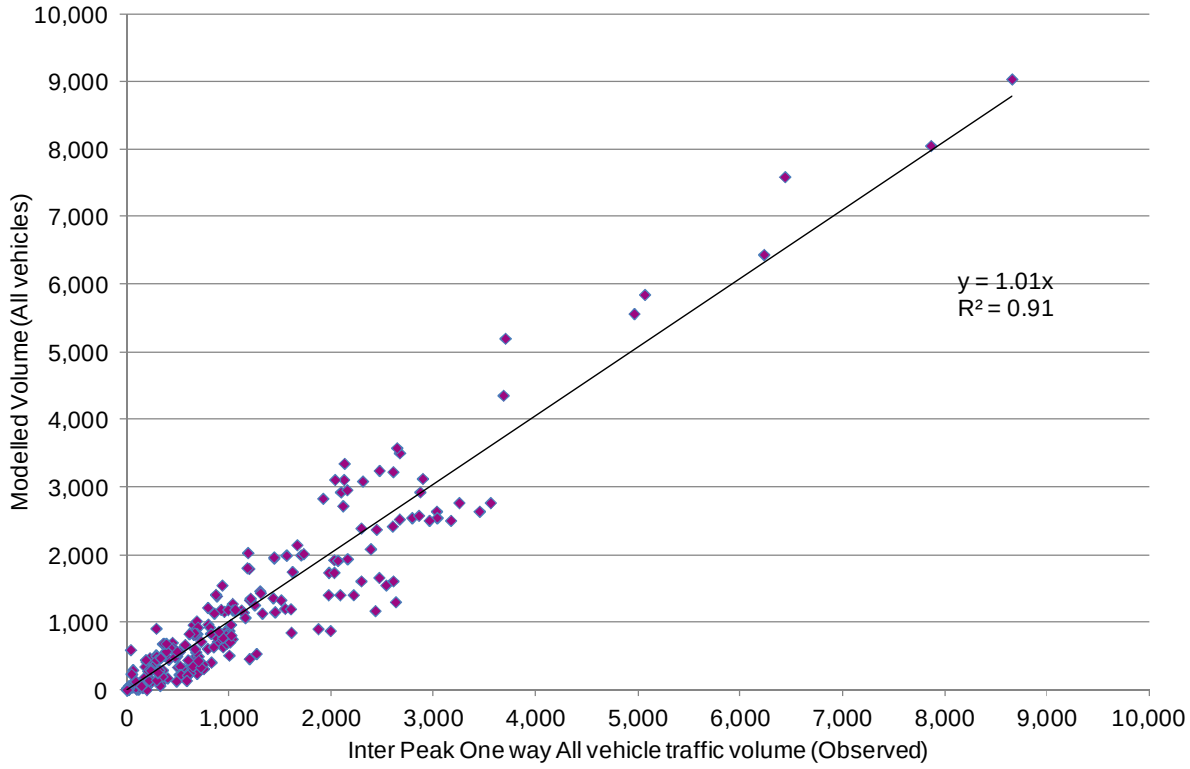

Figure 14 Observed and modelled traffic volumes – all vehicles – PM Peak – VicRoads count data

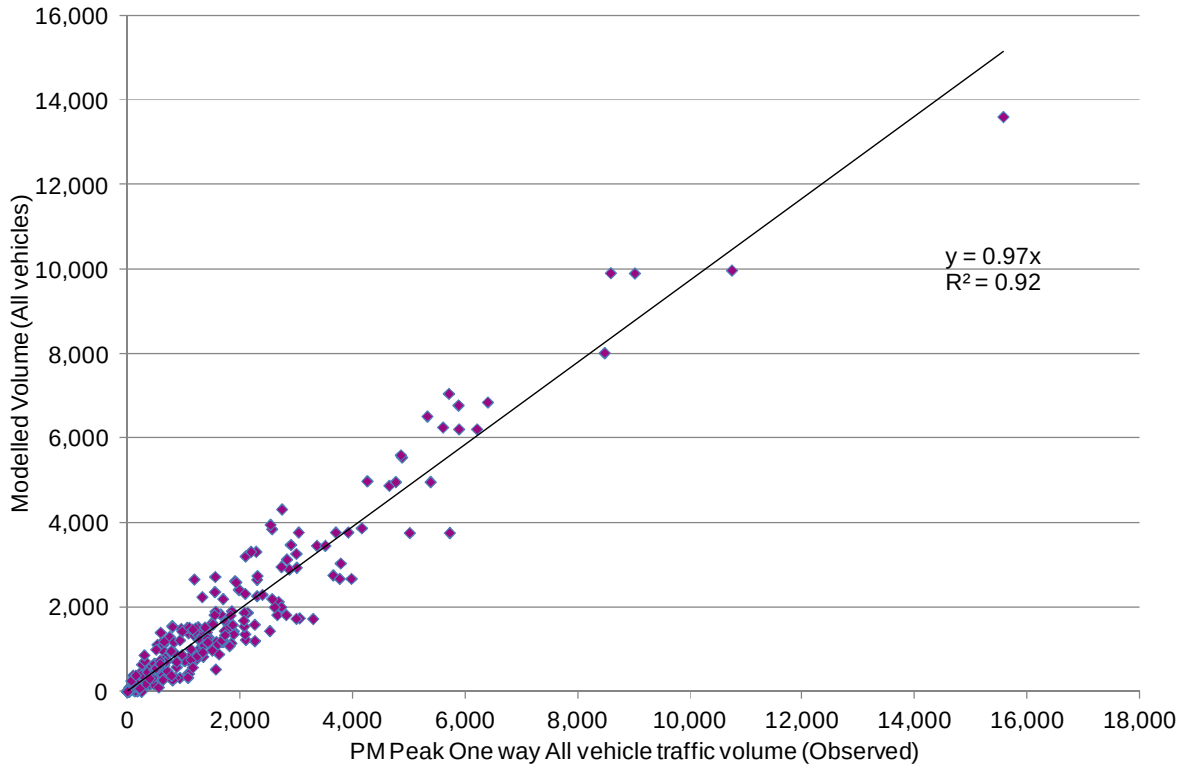

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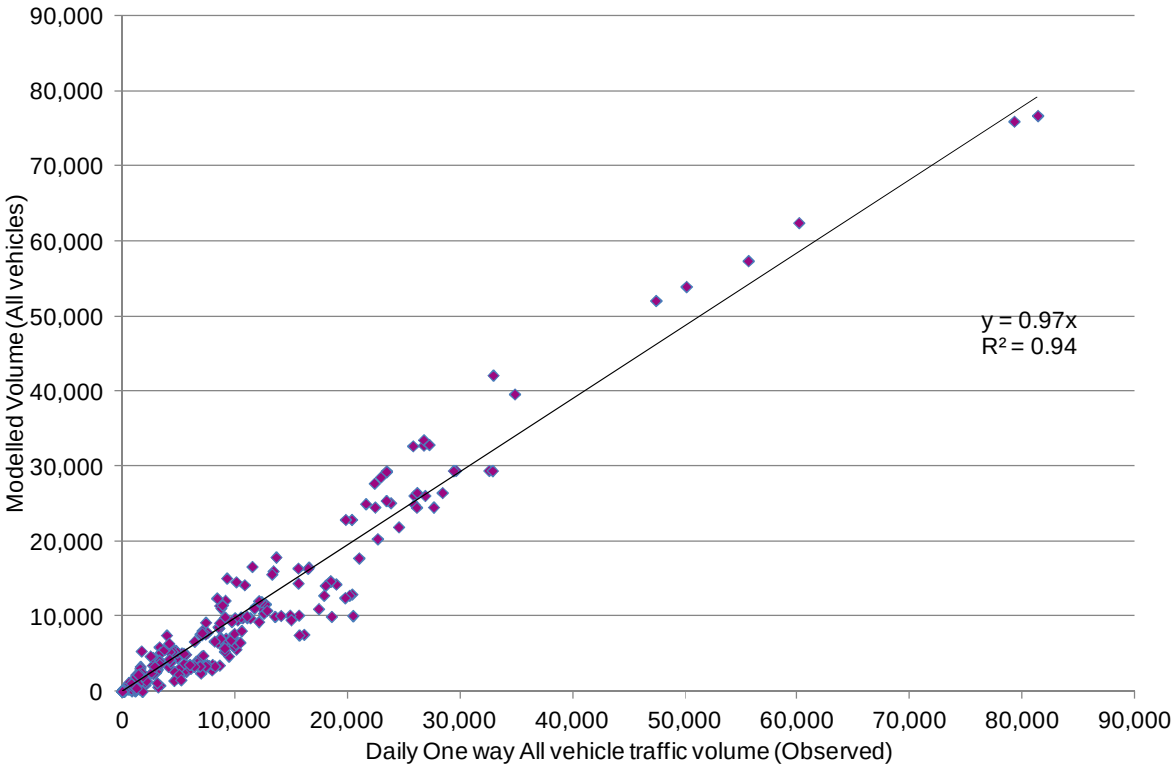
Figure 15 Observed and modelled traffic volumes – all vehicles – Daily



The Root Mean Square Error provides a way to compare errors between the model and observed traffic volumes while allowing for the relative size of the observed traffic count. That is, a large percentage difference is more important, in terms of model validation, on a high volume road than it is on a low volume road.

The VicRoads guidelines recommend applying the RMSE criteria to directional traffic volumes. The results are shown in Table 2 to Table 5 below. For this exercise, it was decided to use only counts that were taken post January 2010 as it was found that when counts from 2009 were included, the RMSE was, as expected, noticeably higher.

It can be seen from the tables that for the overall RMSE, the model meets the VicRoads criteria for the AM peak, Daily time periods while the PM peak is 0.7% higher than the 30% criteria. The RMSE for the inter-peak and off peak periods both exceed the VicRoads criteria.

It can also be seen that for all the time periods, the model performs better for roads with higher traffic volumes. This result is in part to be expected due to the scale of the network and zones within the strategic model. At the local road level, factors such as the size of transport zones and the placement of centroid connectors can significantly affect the modelled volume. Furthermore, the variability in the actual traffic on local roads often increases as the volume decreases.

Table 2 %RMSE statistic for all vehicles (AM Peak)

AM Peak 1-way all vehicle traffic volume	Number of directional sites	Sum of (modelled – surveyed traffic volumes)^2	Sum of surveyed traffic volumes	%RMSE
<1,000	86	6,541,832	38,846	61.4%
1,000 – 2,000	65	12,986,150	93,928	31.2%
2,000 – 5,000	40	12,983,825	120,791	19.1%
5,000 – 10,000	11	9,443,903	72,252	14.8%
>10,000	1	53,561	14,011	1.7%
Total	**203**	**42,009,272**	**339,828**	**27.2%**

Table 3 %RMSE statistic for all vehicles Inter -peak)

Inter Peak 1-way all vehicle traffic volume	Number of directional sites	Sum of (modelled – surveyed traffic volumes)^2	Sum of surveyed traffic volumes	%RMSE
<1,000	118	5,224,102	54,207	46.0%
1,000 – 2,000	40	8,298,746	54,857	33.6%
2,000 – 5,000	40	22,052,022	107,271	28.0%
5,000 – 10,000	5	2,172,564	34,249	10.8%
>10,000	0	0	0	
Total	**203**	**37,747,434**	**250,585**	**35.0%**

Table 4 %RMSE statistic for all vehicles (PM Peak)

PM Peak 1-way all vehicle traffic volume	Number of directional sites	Sum of (modelled – surveyed traffic volumes)^2	Sum of surveyed traffic volumes	%RMSE
<1,000	75	4,785,093	31,806	60.0%
1,000 – 2,000	67	15,324,890	98,416	32.8%
2,000 – 5,000	46	28,131,645	137,294	26.5%
5,000 – 10,000	13	13,116,678	83,239	16.3%
>10,000	2	4,412,249	26,304	16.0%
Total	**203**	**65,770,556**	**377,059**	**30.7%**

Table 5 %RMSE statistic for all vehicles (Daily)

Daily all vehicle traffic volume	Number of directional sites	Sum of (modelled – surveyed traffic volumes)^2	Sum of surveyed traffic volumes	%RMSE
<5,000	63	77,430,420	137,179	51.3%
5,000 – 10,000	61	531,094,890	477,205	38.0%
10,000 – 20,000	41	644,070,882	565,169	29.1%
20,000 – 40,000	32	702,314,075	819,738	18.6%
>40,000	6	76,661,640	373,866	6.3%
Total	**203**	**2,031,571,907**	**2,373,157**	**27.1%**

4.3 Key routes

In addition to comparing the model against screenlines and individual links, the model was also compared against observed traffic and travel times along key routes in the study area. This section shows how the model compares against observed traffic on the major inbound routes during the AM Peak period, this being the most important movement in terms of traffic volume, road capacity and network performance.

4.3.1 Princes Freeway AM peak period

Figure 16 shows the modelled traffic volumes on the Princess Freeway in the AM peak in the inbound direction. Spot counts are plotted against the modelled volumes to indicate how the model performs along the route. Figure 16 indicates that modelled volumes are close to the observed spot counts for the inbound direction, while Figure 18 indicates that modelled volumes are close to the observed spot counts for the outbound direction.

Figure 17 shows the modelled versus observed travel times for inbound trips on the Princess freeway in the AM peak. This shows that the modelled travel times are within the upper and lower observed travel times.

Figure 16 Princes Freeway inbound AM peak period. Modelled volumes by distance versus spot counts.

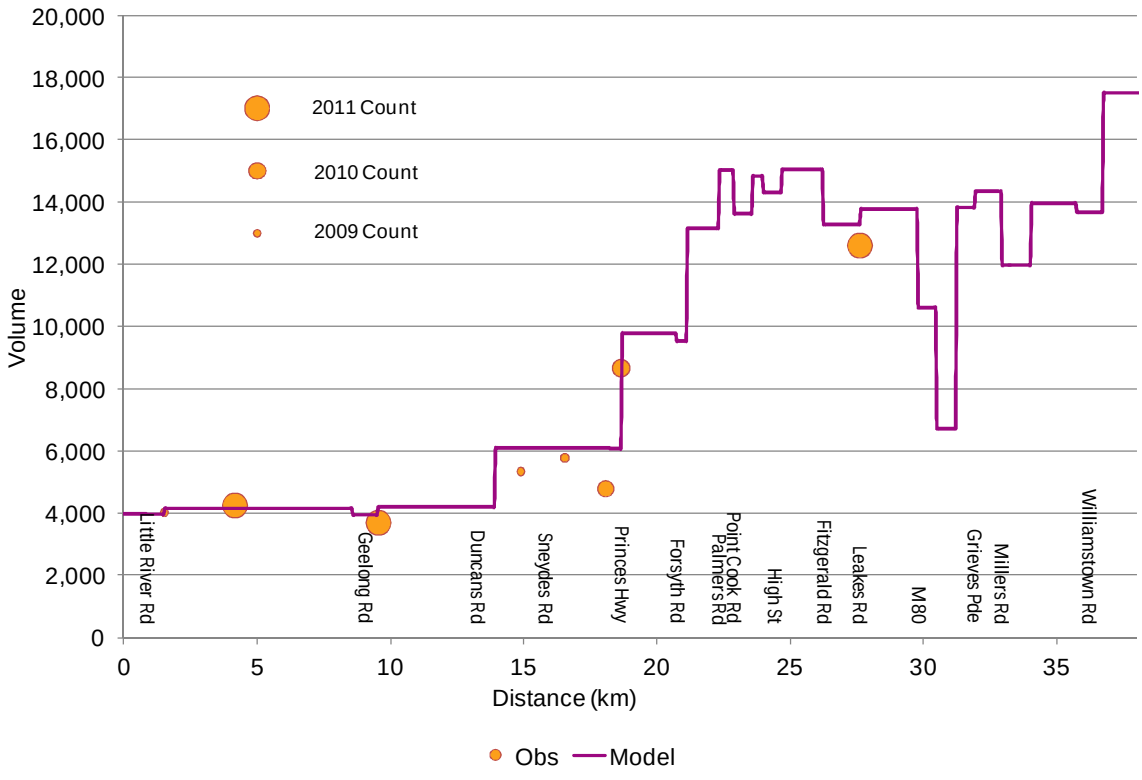


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Figure 17 Princes Freeway inbound AM peak period. Modelled travel time by distance versus observed travel time.

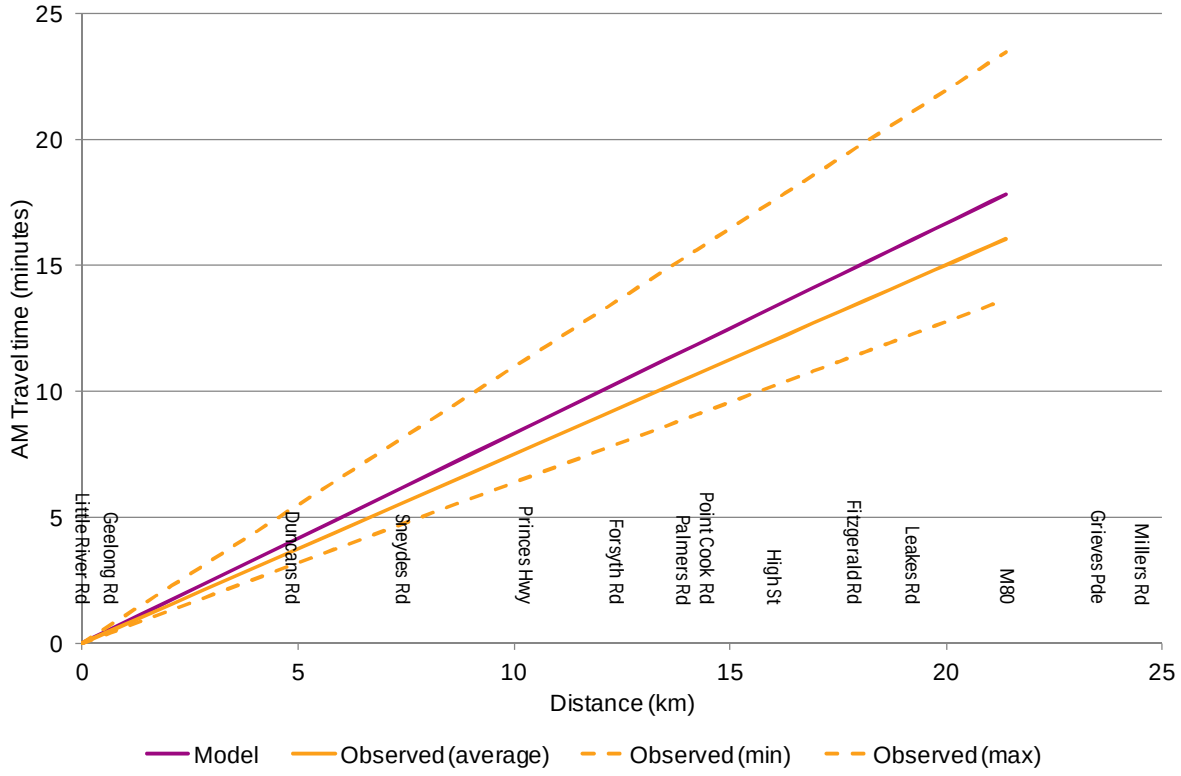
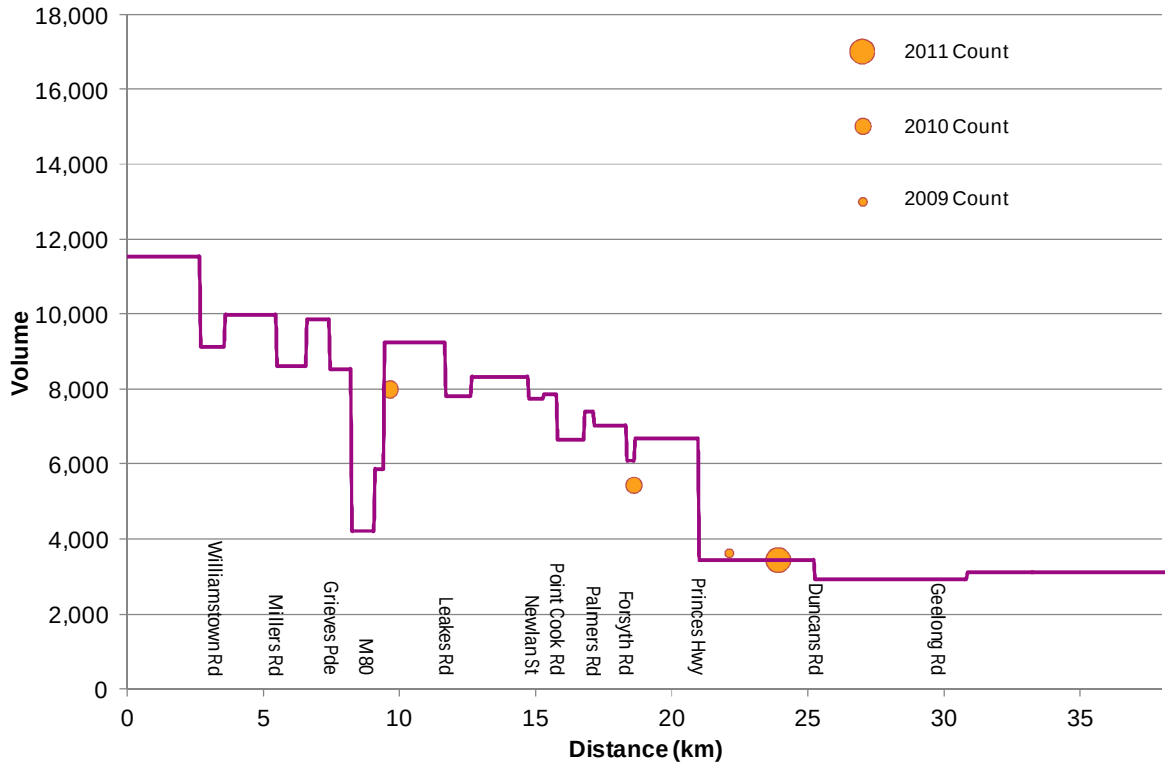


Figure 18 Princes Freeway outbound AM peak period. Modelled volumes by distance versus spot counts.



4.3.2 Western Freeway AM peak period

Figure 19 and Figure 20 show the modelled versus observed AM peak traffic volumes along the Western Freeway for the inbound and outbound directions respectively. This route includes the Deer Park Bypass and the M80 between the Deer Park Bypass and the Princess Freeway. These figures indicate that the model is close the observed volumes, slightly over estimating the observed volumes in both directions.

Figure 19 Western Freeway inbound AM peak period. Modelled volumes by distance versus spot counts.

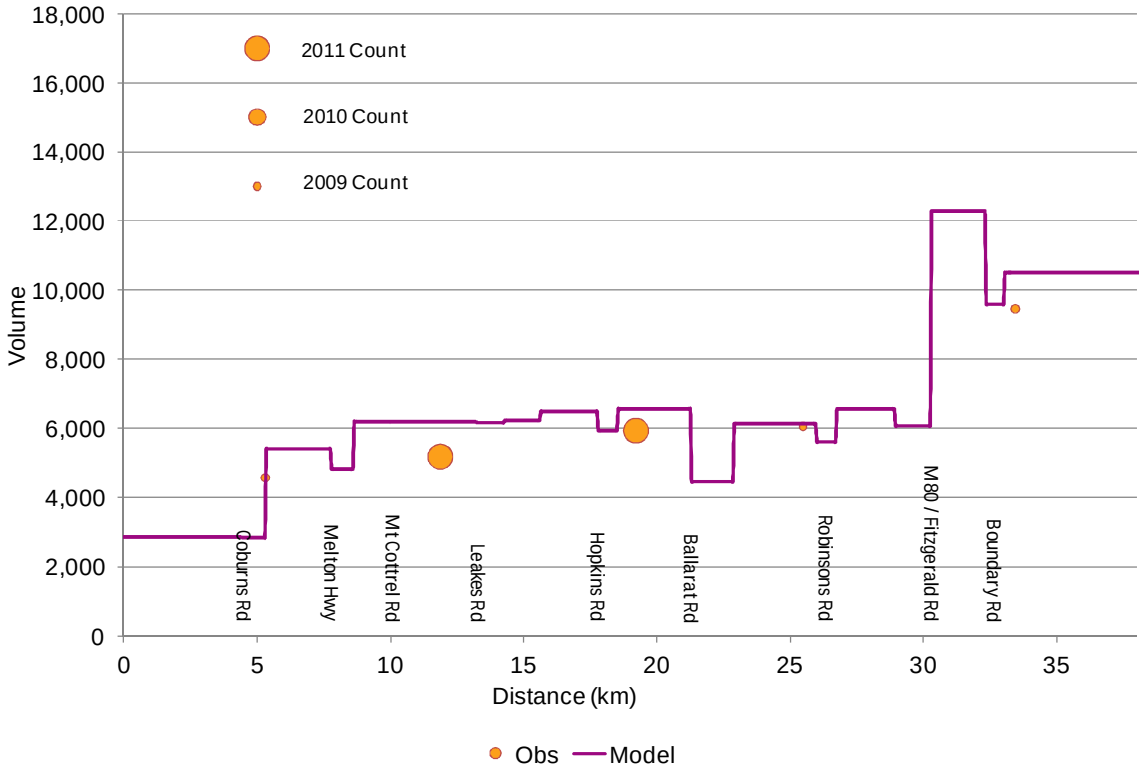


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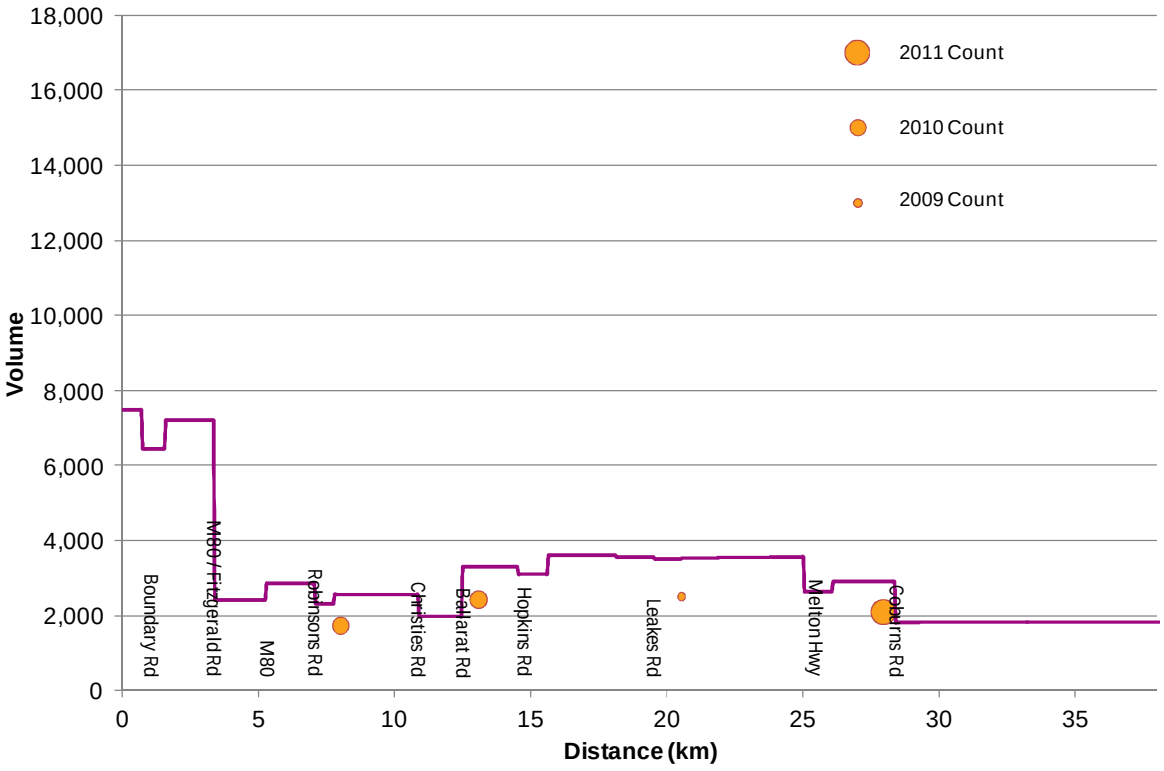
Figure 20 Western Freeway outbound AM peak period. Modelled volumes by distance versus spot counts.



5.0 Conclusion of validation

The model has been validated against screenline flows, link flows, corridor flows and corridor travel times. When compared against VicRoads validation criteria the model satisfies the criteria at both the screenline level and when considering all of the link flows. The model performs well along key corridors when comparing flow profiles and also travels times.

The best model validation results are observed for the AM peak and daily results, although the PM peak and interpeak periods still satisfied most of the validation criteria. The validation report indicates that the model is able to replicate observed traffic conditions at a level that is acceptable for strategic network analysis, particularly when observed at the AM peak or daily level.

6.0 Forecast year modelling

The validated Western growth area model was used to run to a 2046 future year scenario. The assumptions and the results of this 2046 run are described in this section.

6.1 Assumptions

The 2046 model scenario differs from the validated base year model in terms of the following assumptions:

- Road network
- Land use
- Public transport services
- Other VITM cost inputs (Tolls, parking costs etc.)

The 2046 assumptions for public transport and other VITM inputs are consistent with the Department of Transports 2046 reference case model and are not described here. The assumptions for the 2046 road network and land use have been refined for the Western growth area and are described below.

6.1.1 Network

The 2046 Western growth area network is essentially the '2046 plus' VITM network that has been refined within the Western growth area. This means that outside of the Western growth area, the network includes '2046 plus' projects such as North East link and the East West link road. Importantly, the '2046 plus' network should be considered as a full build, or unconstrained network rather than a most likely network scenario. For example, the '2046 plus' network includes the full East West Link project, the full Outer Metropolitan Ring Road project and North East Link project. Within the Western growth area, the network was refined using inputs from the:

- VicRoads
- Wyndham City Council
- Melton Shire Council
- Growth Areas Authority

The 2046 network assumptions relating to road type, number of lanes and posted speed for the Western growth area are shown in the following figures.

There has been no major refinements made to the public transport services, which are based on the Department of Transport reference case. An exception is moving a Regional rail link station from Leakes Road to Sayers Road and adjusting the associated bus services.

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Figure 21 Future roads by type – western growth area - north

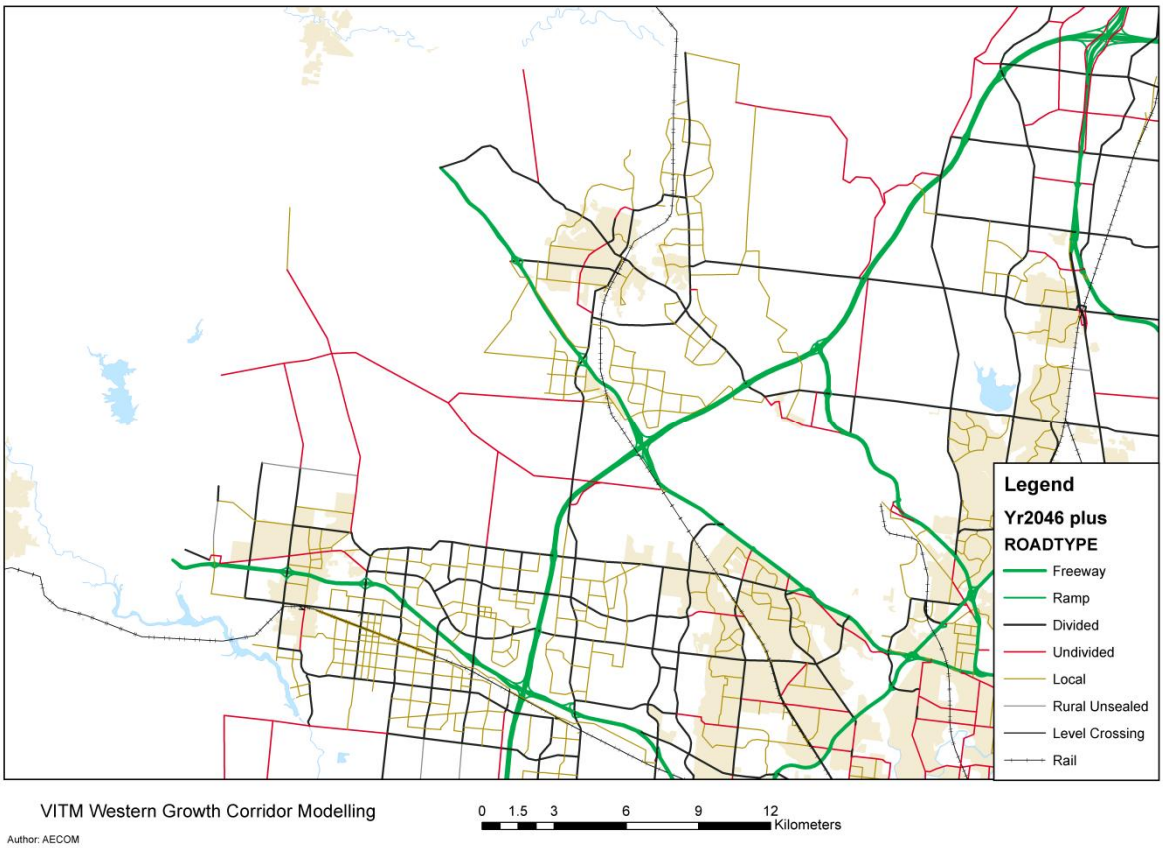

Figure 22 Future roads by type – western growth area - south

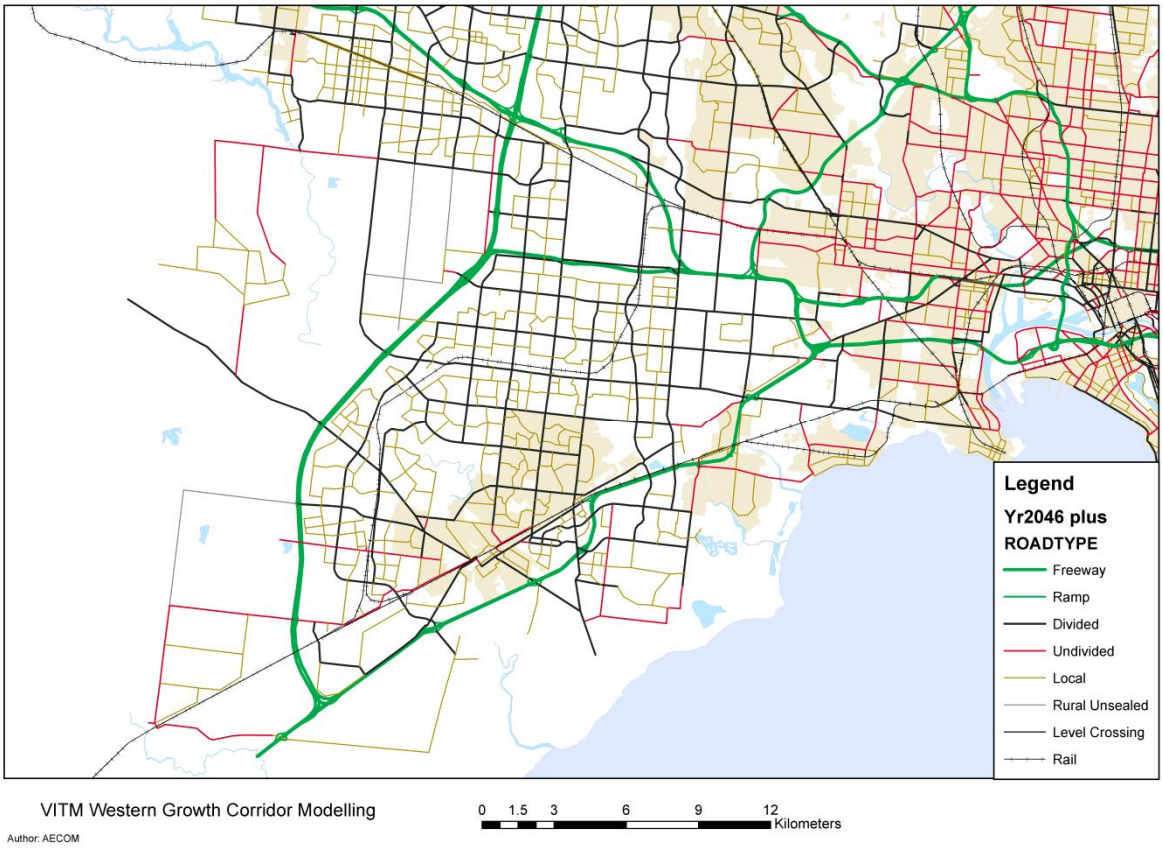

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Figure 23 Future roads by posted speed – western growth area - north

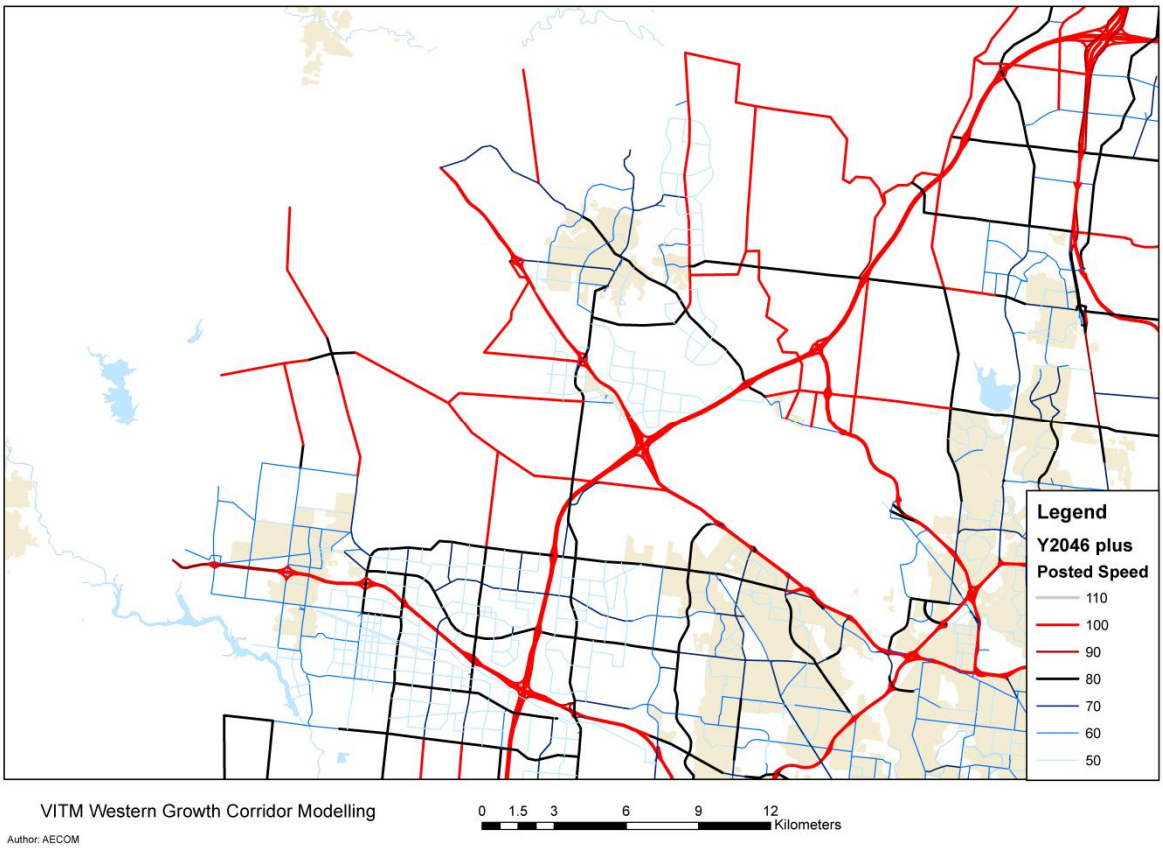

Figure 24 Future roads by posted speed – western growth area - south

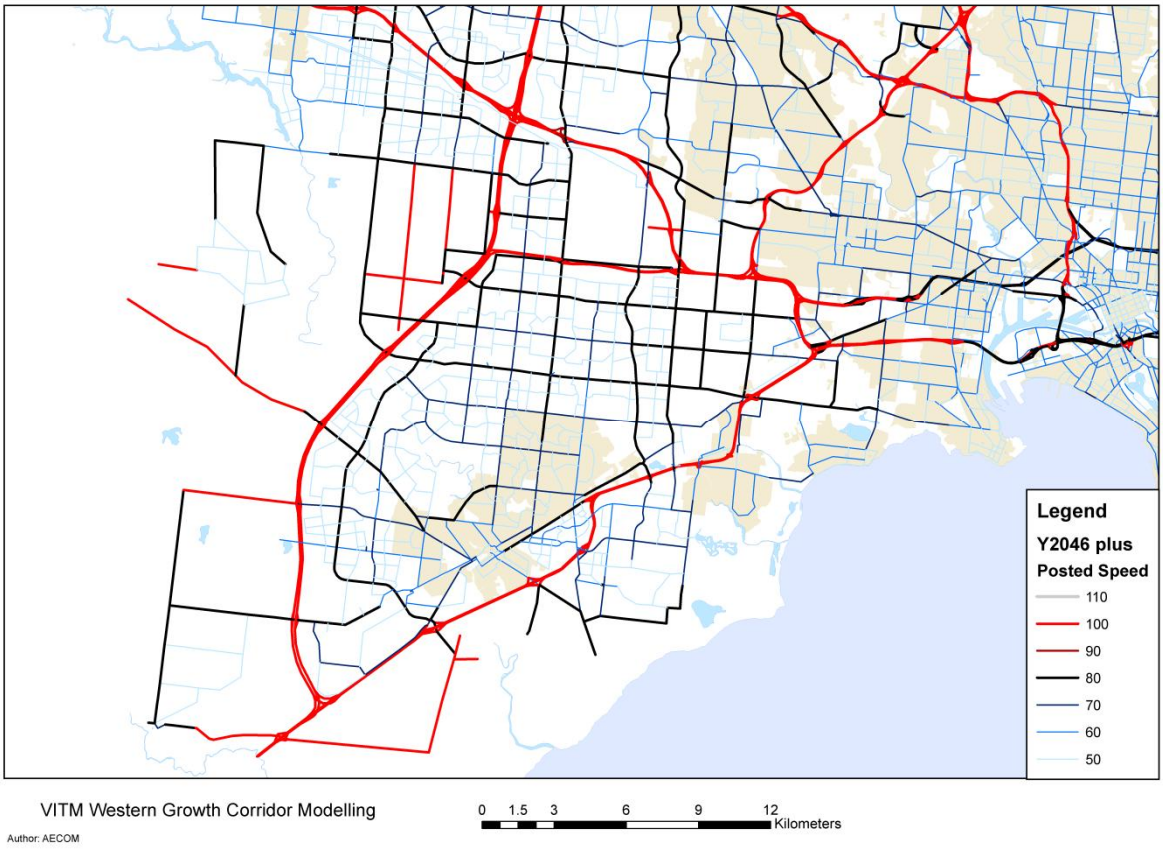

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Figure 25 Future roads by direction lanes – western growth area - north

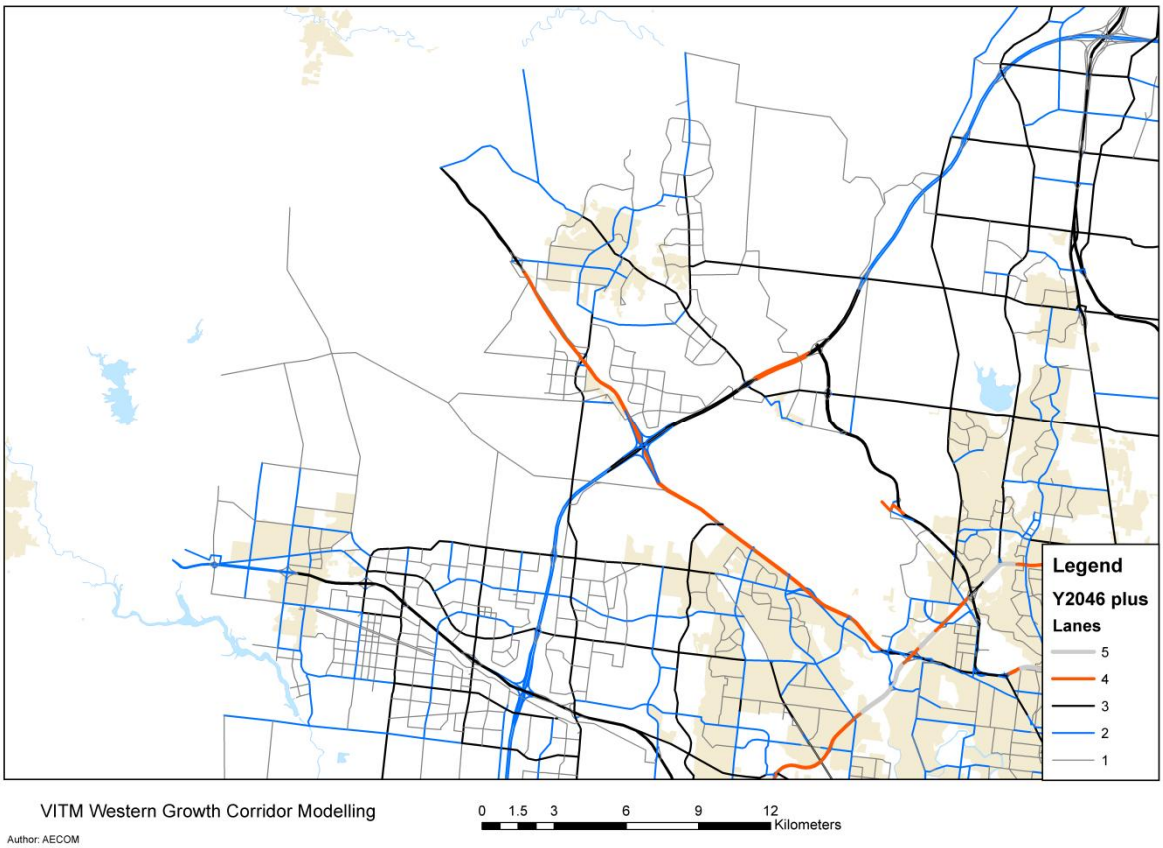
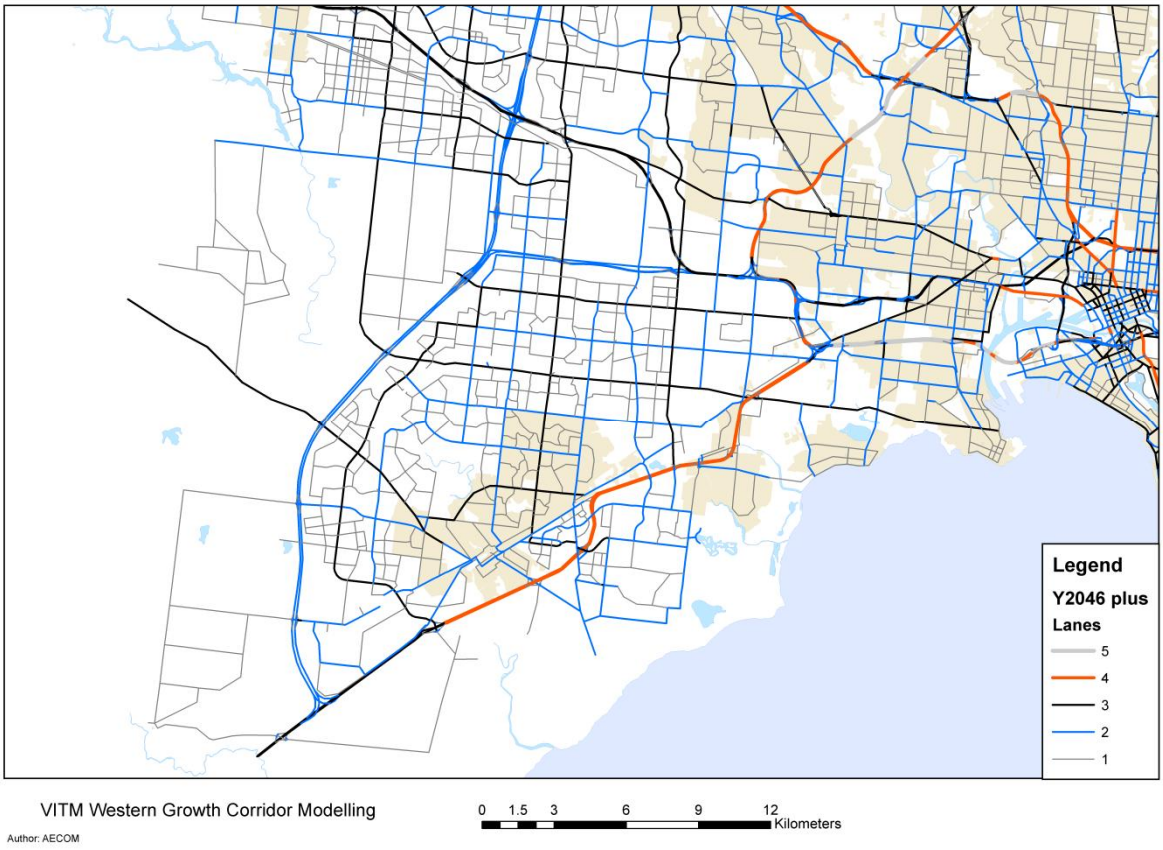


Figure 26 Future roads by direction lanes – western growth area - south



6.2 Land use

6.2.1 Transport zones

The Western Growth area includes the suburbs of Werribee, Werribee South, Wyndham Vale, Tarneit, Mount Cottrell, Truganina, Rockbank, Melton South and Melton. Logical inclusion areas are located in Melton West, Werribee and Point Cook. To cater for the mostly green field development that is forecast to occur in these suburbs, AECOM has disaggregated zones to produce 359 additional zones and altering 501 zones. Diggers Rest and Sunbury had addition detail added to the network and zone representation. Whiles these areas are outside the western growth areas, they form the interface between the western and northern growth areas.

The addition of the new zones is not applicable for the base year as they have specifically been made for future developments, however, for completeness the zones before and after disaggregation are shown in the Figures below.

Figure 27 shows the transport zones in the northern part of the western growth areas prior to zone disaggregation, while Figure 28 shows the transport zones in the northern part of the western growth areas after to zone disaggregation. Similarly Figure 29 shows the zones in the southern part of the western growth areas prior to disaggregation, while Figure 30 shows the zones in the southern part of the western growth areas after disaggregation.

6.2.2 Demographic data

Demographic data in the form of population, employment and school enrolments was provided by the Growth Areas Authority for approximately 500 transport zones in the Western growth area. For transport zones in the remainder of the model the Department of Transport 2046 demographic data was used

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Figure 27 Transport zones before disaggregation – western growth area - north

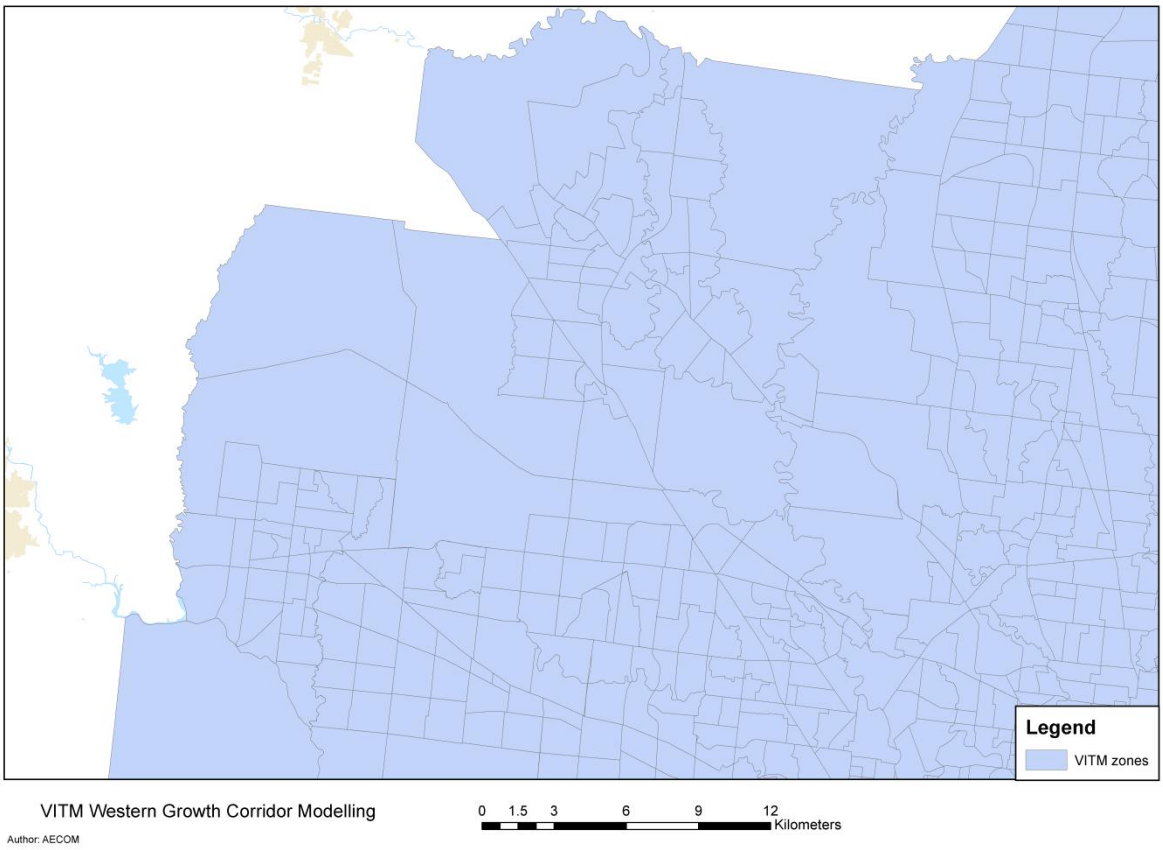

Figure 28 Transport zones after disaggregation – western growth area - north

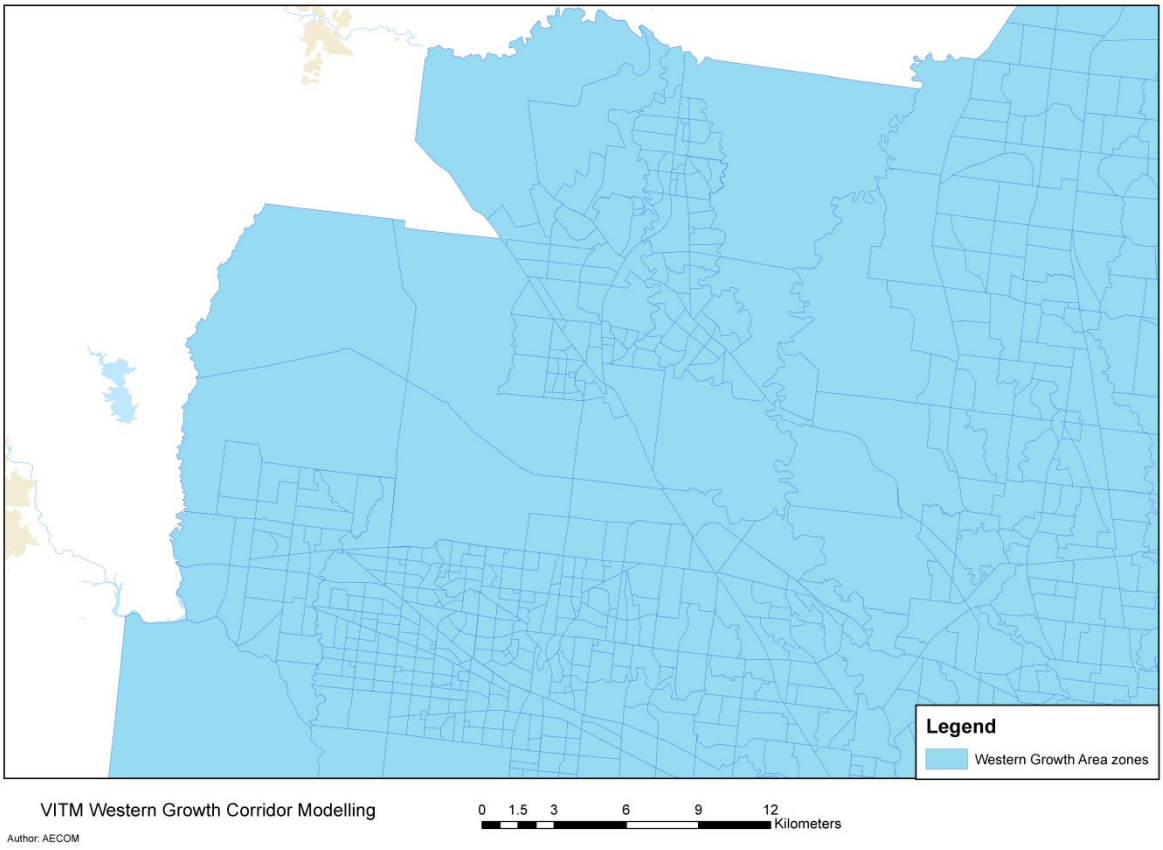

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Figure 29 Transport zones before disaggregation – western growth area - south

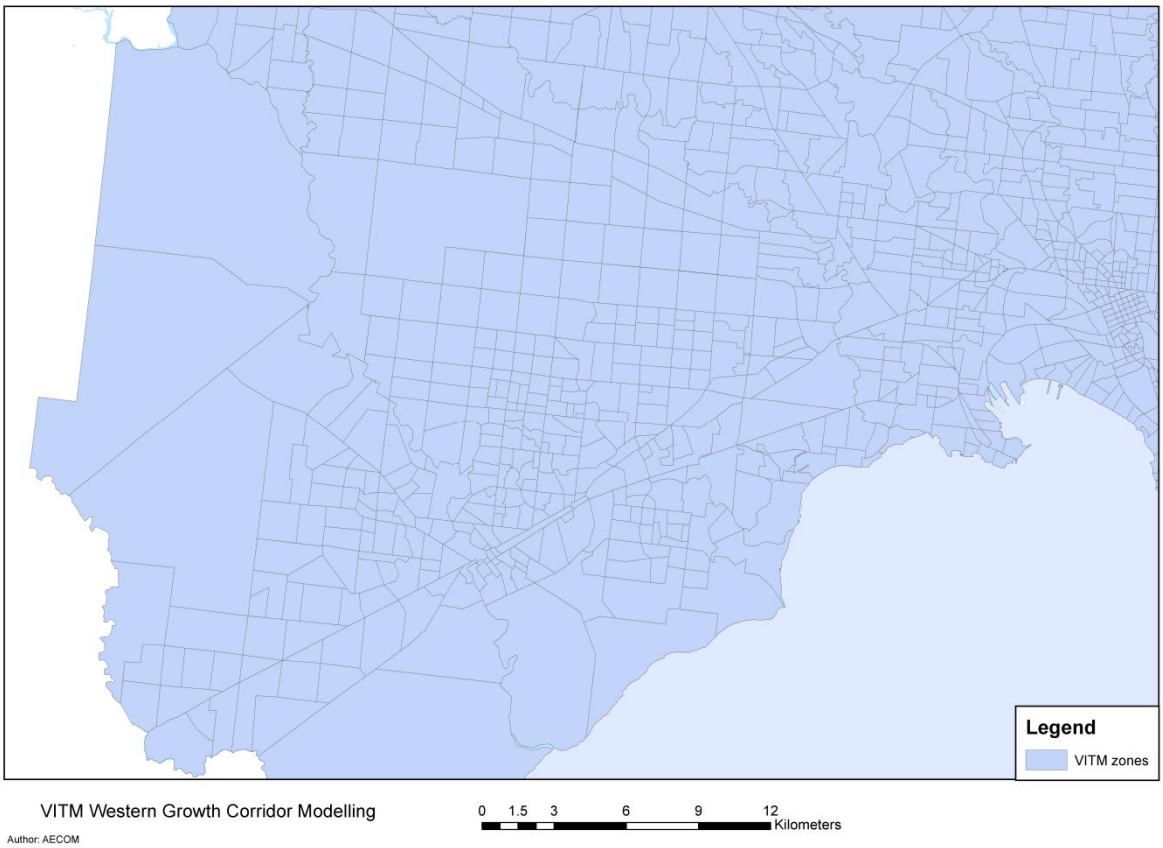
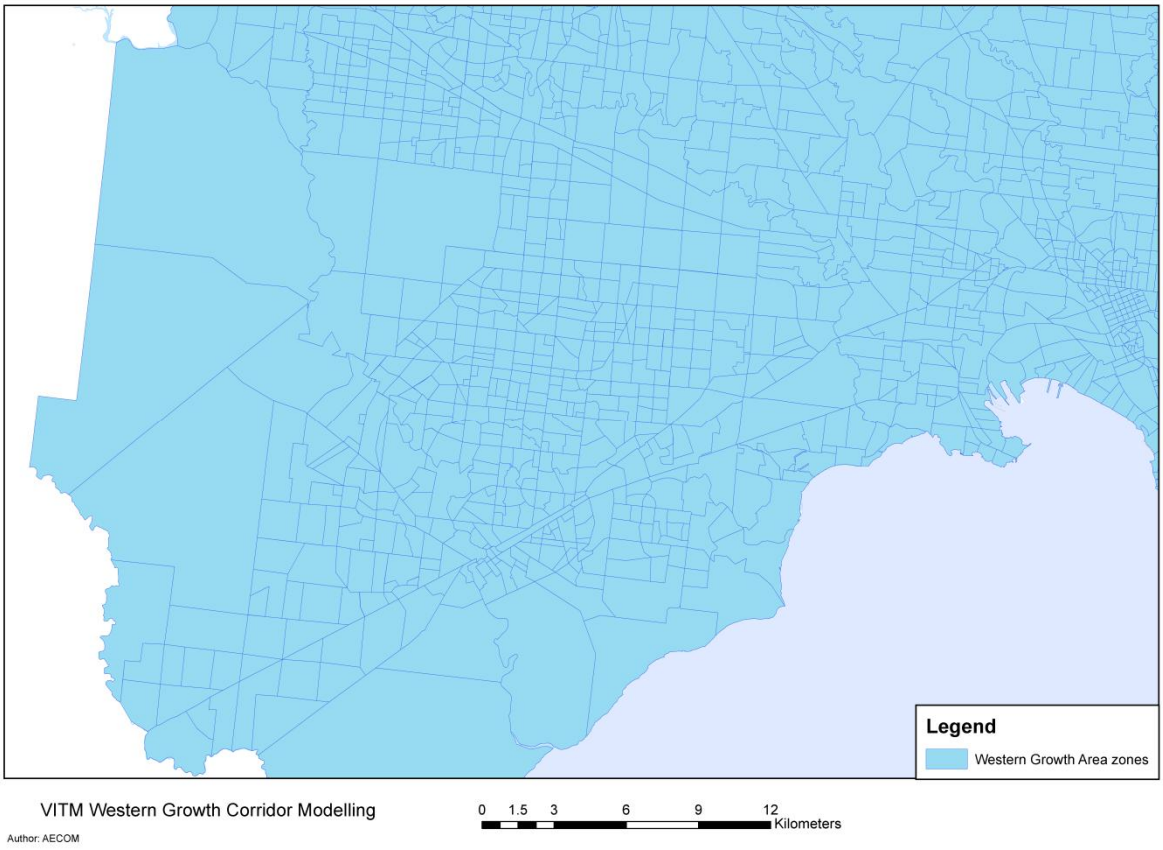


Figure 30 Transport zones after disaggregation – western growth area - south



6.3 Results

6.3.1 Traffic volumes

The results from the 2046 model show a reasonable level of road traffic performance within the Western growth areas. The plots of the weekday traffic volumes are shown in Figure 31 and Figure 32.

Plots of the average weekday traffic volume show how traffic is concentrated on the freeways and larger arterials within the network. In respect to the arterials, in the northern part of the western growth areas it can be seen that the Melton Highway and Taylors Road have particular importance amongst the east-west routes. Further to the south, the east-west Leakes Road is also carrying high volumes of traffic as is Boundary Road. Of the north-south arterials, traffic is highest on Derrimut Road / Hopkins Road.

The freeways play a major role in catering for strategic traffic movements. The Outer Metropolitan Ring Road (OMR) caters for a large volume of north-south movements, although volumes are higher north of Ballan Road than south of Ballan Road. The Western freeway, Deer Park Bypass and the East-West Link all carry significant east-west traffic.

More detailed volume plots have been provided at A0 scale (separate to this report). These show high weekday volumes in the East Werribee employment precinct, which result from the high intensity of development planned for this area and limited access options. It is likely that with this level of development increasing the levels of service for public transport and walking / cycling could reduce traffic demand to some degree.

High volumes are observed around the proposed Regional Rail Link (RRL) stations due to park and ride access to the stations. There is also evidence of relatively high volumes on some local roads near town centres. It is likely that most of the traffic generated around town centres occurs outside the peak periods, particularly where the town centres have a large retail component, which are generally utilised more heavily in the interpeak period than the peak periods.

In some instances the weekday volumes are high when there is a relatively balanced flow, such as Derrimut Road, where there is little difference between the peak direction volumes and counter peak volumes. Whereas, roads such as Boundary Road and Leakes Road indicate a more tidal pattern of high peak direction volumes and low counter peak volumes and therefore have lower total weekday volumes, while still experiencing some capacity constraints.

6.3.2 Volume capacity ratios

The Volume Capacity Ratio (VCR) is a useful measure of the performance of a road network. In general terms, a road with a volume capacity ratio less than 0.8 indicates that it is in uncongested conditions while a ratio greater than 0.8 indicates congested conditions. When the volume capacity ratio exceeds 1, the road can be thought of as being above capacity, and very slow congested conditions are expected.

Plots of the volume capacity ratio for the 2046 AM peak period are shown in Figure 33 for the northern part of the western growth areas and Figure 34 for the southern part of the western growth areas.

It can be seen in these plots that for the most part, the arterial roads of the western growth area are operating below capacity in the peak periods. However, sections of the Western Freeway, Melton Highway, Taylors Road, Derrimut Road and Leakes Road are operating in congested conditions. It should be noted that while Derrimut Road has relatively high weekday volumes, the VCR in the AM peak is similar to that recorded on other roads such as Boundary Road, which carries significantly lower weekday volumes. This is due to the balanced peak direction and counter peak volumes on Derrimut Road.

There are locations of local congestion around town centres and RRL stations as well as in the East Werribee employment precinct. However, compared to the forecast conditions outside of the western growth area the western growth area network is relatively uncongested.

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Figure 31 Weekday traffic – western growth areas - north

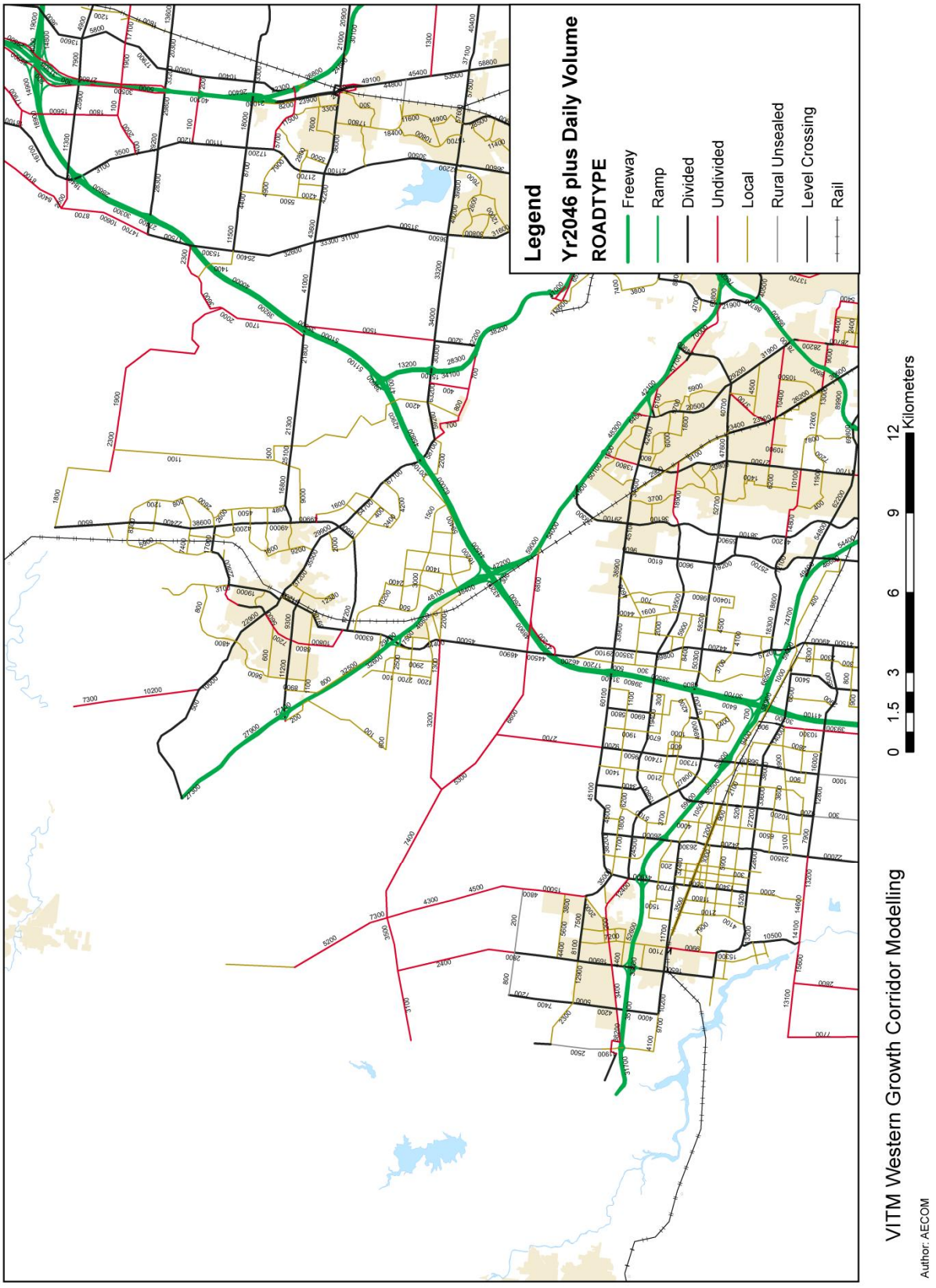

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Figure 32 Weekday traffic – western growth areas - south

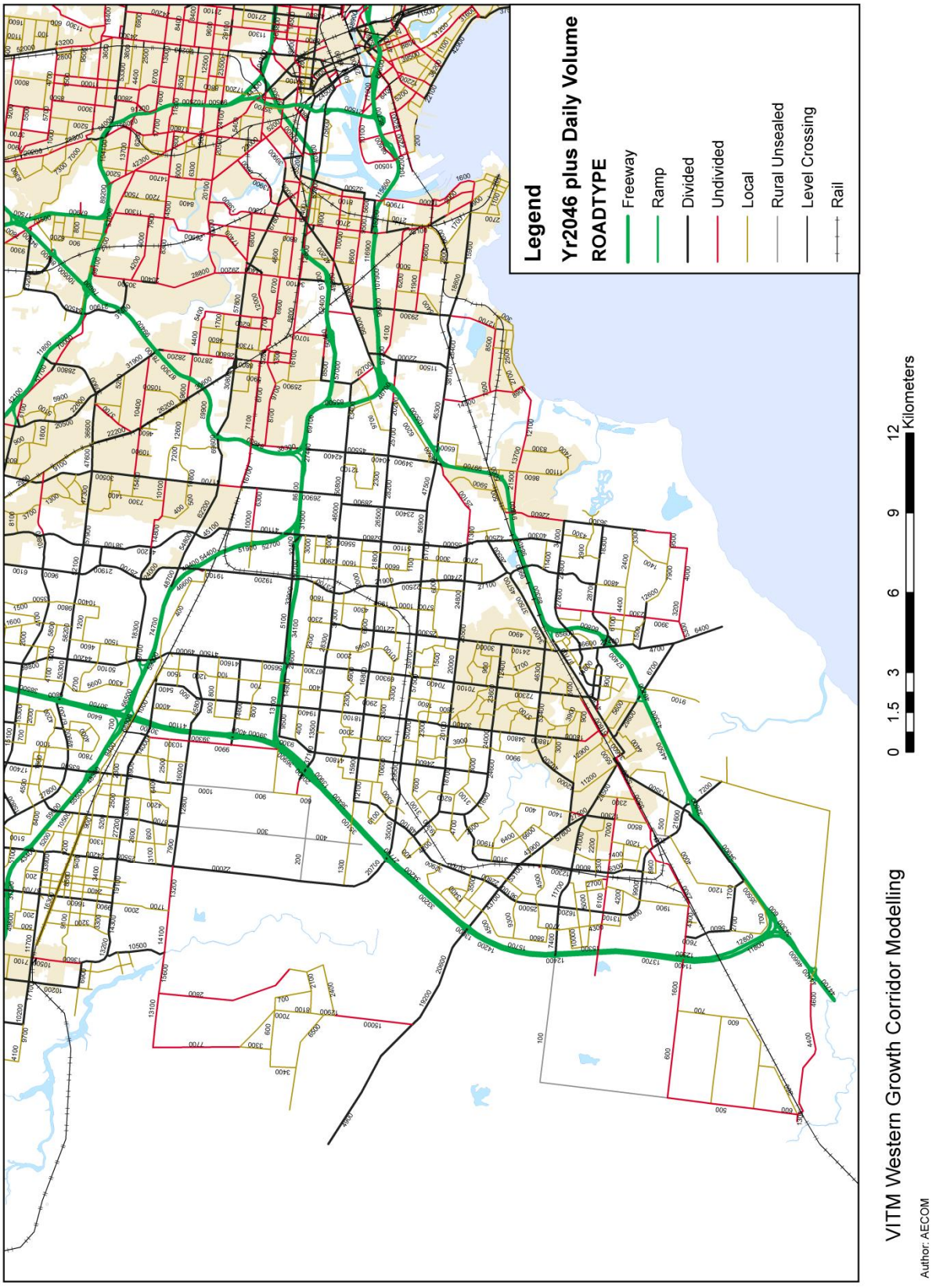

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Figure 33 AM volume capacity ratios – western growth areas - north

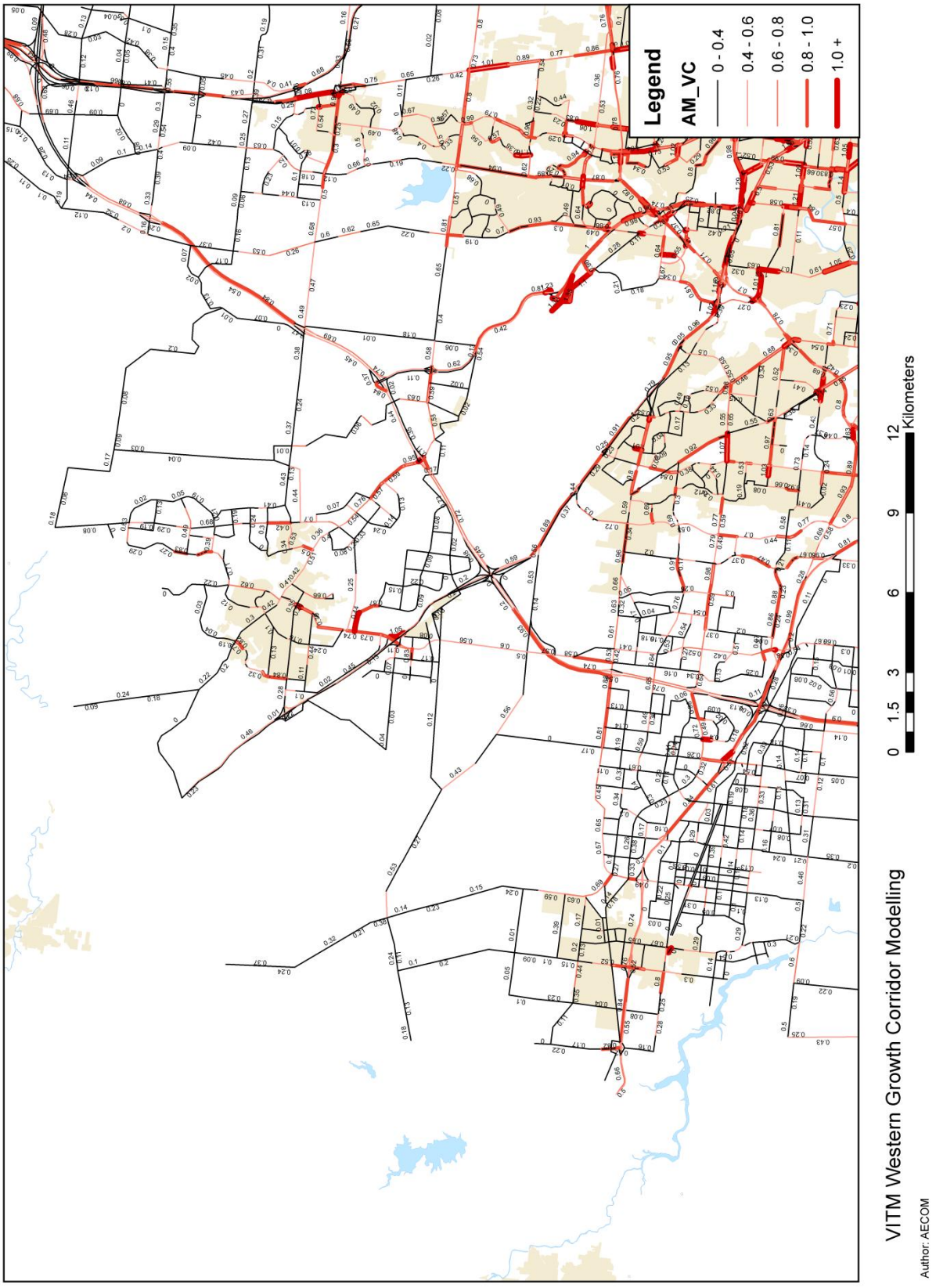

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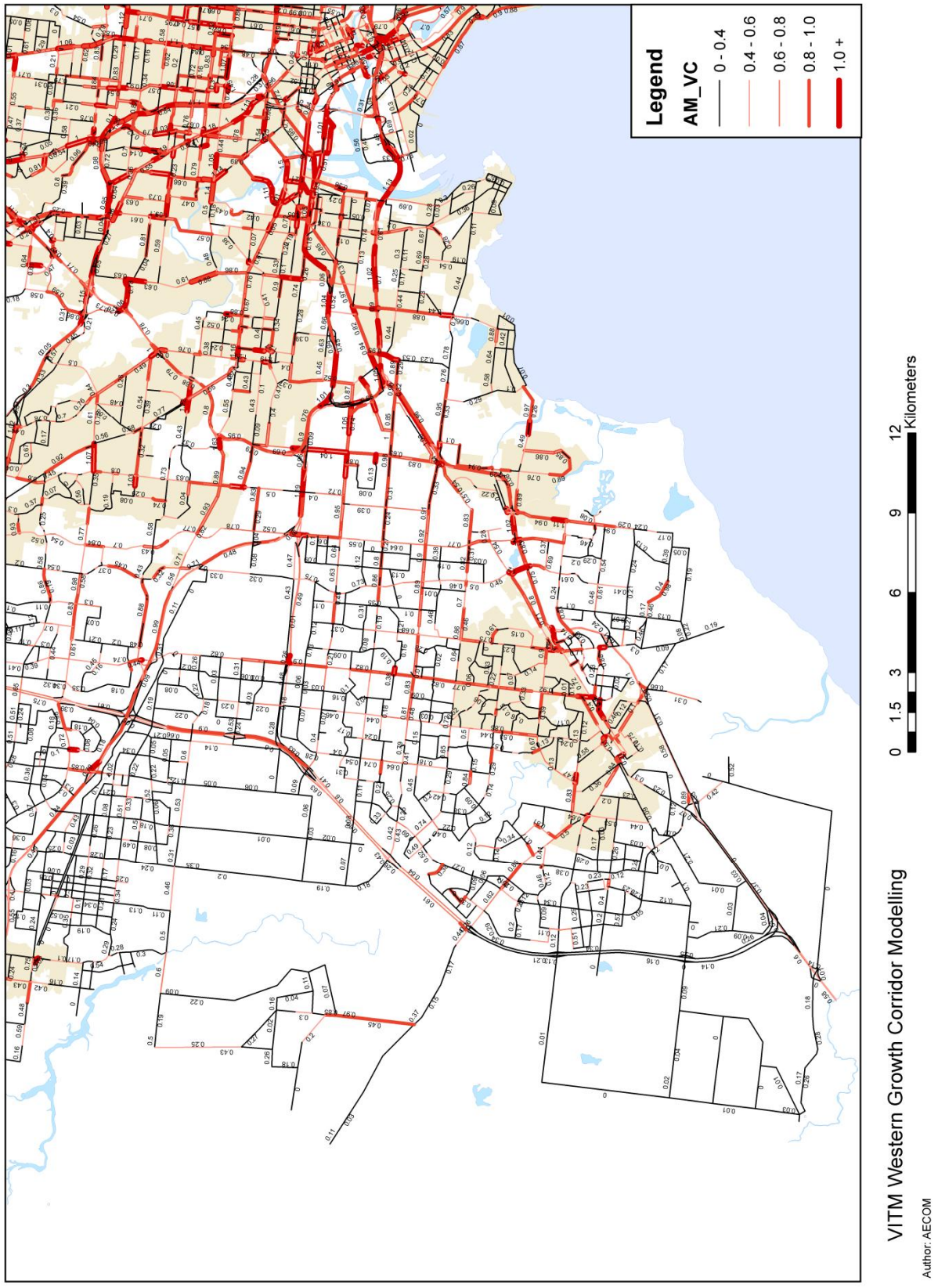
Figure 34 AM volume capacity ratios – western growth areas - south



Appendix A

2011 Demographic Changes

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Appendix A 2011 Demographic Changes

Table 6 Changes made to population and number of household assumptions

Zone	Original Population	Revised population	Difference	Original Households	Revised Households	Difference
239	28.7	6	-22.7	3.0	0.6	-2.3
259	41.8	6	-35.8	15.1	2.2	-13.0
261	5.7	0	-5.7	2.1	0.0	-2.1
264	47.1	0	-47.1	17.0	0.0	-17.0
285	26.1	2	-24.1	9.4	0.7	-8.7
290	41.3	3	-38.3	14.8	1.1	-13.8
295	2.3	0	-2.3	0.8	0.0	-0.8
297	64.5	9	-55.5	23.4	3.3	-20.1
302	177.3	0	-177.3	57.9	0.0	-57.9
309	230.4	0	-230.4	83.3	0.0	-83.3
311	195.2	24	-171.2	58.6	7.2	-51.4
1830	31.5	2	-29.5	7.9	0.5	-7.4
1866	1.6	0	-1.6	0.0	0.0	0.0
1877	2.9	0	-2.9	1.0	0.0	-1.0
1884	7.7	3	-4.7	2.7	1.1	-1.7
1886	12.9	3	-9.9	4.6	1.1	-3.5
1887	39.3	3	-36.3	14.1	1.1	-13.0
1888	8.6	0	-8.6	3.1	0.0	-3.1
1889	20.0	2	-18.0	7.2	0.7	-6.4
1897	24.7	6	-18.7	8.9	2.2	-6.7
1899	51.4	3	-48.4	18.5	1.1	-17.4
1921	10.2	0	-10.2	3.6	0.0	-3.6
1922	10.8	0	-10.8	3.9	0.0	-3.9
1923	13.7	6	-7.7	4.9	2.2	-2.8
1925	25.1	0	-25.1	9.0	0.0	-9.0
1926	7.5	3	-4.5	2.7	1.1	-1.6
1928	14.9	6	-8.9	5.3	2.2	-3.2
1929	14.2	3	-11.2	5.1	1.1	-4.0
1930	22.5	0	-22.5	8.0	0.0	-8.0
1931	27.9	9	-18.9	10.0	3.2	-6.8
1938	60.7	9	-51.7	21.8	3.2	-18.6
1939	98.0	9	-89.0	35.6	3.3	-32.3

D R A F T

Zone	Original Population	Revised population	Difference	Original Households	Revised Households	Difference
1943	54.5	9	-45.5	19.7	3.3	-16.4
1944	22.0	2	-20.0	8.0	0.7	-7.2
1952	36.7	0	-36.7	13.3	0.0	-13.3
1953	39.0	0	-39.0	14.1	0.0	-14.1
1954	44.5	0	-44.5	16.1	0.0	-16.1
1955	4.5	0	-4.5	1.6	0.0	-1.6
1958	15.6	0	-15.6	5.6	0.0	-5.6
1959	10.6	0	-10.6	3.8	0.0	-3.8
1960	26.1	0	-26.1	9.4	0.0	-9.4
1961	11.1	0	-11.1	4.0	0.0	-4.0
1962	39.2	0	-39.2	14.2	0.0	-14.2
1963	38.8	0	-38.8	14.0	0.0	-14.0
1972	25.8	0	-25.8	9.3	0.0	-9.3
1977	12.4	0	-12.4	4.5	0.0	-4.5
2547	2.7	0	-2.7	1.0	0.0	-1.0
2548	28.0	0	-28.0	10.1	0.0	-10.1
2552	24.6	9	-15.6	8.9	3.3	-5.7
2569	20.6	3	-17.6	0.0	0.0	0.0
2570	20.5	3	-17.5	0.0	0.0	0.0
Total	**1843.5**	**143**	**-1700.5**	**621.0**	**46.1**	**-574.8**

D R A F T

Table 7 Changes made to total employment assumptions

ZONE	Orig Emp	New Emp	diff	ZONE	Orig Emp	New Emp	diff
232	432.1	290	-142.1	1896	9.1	2	-7.1
233	88.9	240	151.1	1897	11.8	2	-9.8
234	278.7	269	-9.7	1958	4.9	0	-4.9
235	623.8	770	146.2	1959	5.5	0	-5.5
237	202.1	1680	1477.9	1960	9.7	0	-9.7
238	9.4	530	520.6	1972	3.7	0	-3.7
245	328.8	420	91.2	1977	11.4	0	-11.4
246	146.5	17	-129.5	2224	645.3	62	-583.3
247	223.2	175	-48.2	2225	166.1	1625	1458.9
248	1051.6	1160	108.4	2226	32.6	82	49.4
250	522.8	140	-382.8	2227	208.4	266	57.6
264	14.3	2	-12.3	2230	73.6	173	99.4
284	18.3	5	-13.3	2233	343.3	175	-168.3
286	14.9	123	108.1	2234	481.1	71	-410.1
295	4.1	0	-4.1	2236	75.2	150	74.8
296	57.2	275	217.8	2237	90.7	200	109.3
302	20.2	0	-20.2	2238	1172.5	2370	1197.5
1293	124.4	127	2.6	2240	88.6	625	536.4
1294	229.1	127	-102.1	2241	56.3	1243	1186.7
1295	169.3	229	59.7	2242	77.9	400	322.1
1296	230.3	84	-146.3	2243	62.4	500	437.6
1297	620.6	1092	471.4	2244	62.4	315	252.6
1298	535.7	590	54.3	2253	301.6	156	-145.6
1299	109.3	71	-38.3	2569	182.6	5	-177.6
1302	167.3	169	1.7	2570	181.8	5	-176.8
1854	249.6	500	250.4	2595	28.0	200	172.0
1875	1.0	405	404.0	2596	235.2	16	-219.2
1880	20.3	0	-20.3	2597	633.4	270	-363.4
1881	20.6	270	249.4	2600	445.9	112	-333.9
1882	28.2	0	-28.2	2601	646.7	250	-396.7
1883	21.5	5	-16.5	2603	286.4	50	-236.4
1884	21.6	5	-16.6	2616	40.2	570	529.8
1888	20.8	2	-18.8	2621	101.1	21	-80.1
1889	27.3	2	-25.3	2622	262.4	45	-217.4
1893	31.2	360	328.8	2623	16.9	120	103.1
Total					**13720.2**	**20215.0**	**6494.8**