DEDJTR

Western Distributor Network Impact Assessment

November 2015

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1. Introduction

The Department of Economic Development, Jobs, Transport and Resources (DEDJTR) has engaged GHD to assist the State to review and assess Transurban's proposed concept for the Western Distributor project, as part of the State's Stage 3 assessment under the Market-Led Proposal Guidelines.

The State has developed its own preferred concept for the Western Distributor project, which Transurban's design can be benchmarked against; the State concept has been assessed in this report. The purpose of this report is to document the impact of the proposed works on the road network. This includes:

- Understanding the current conditions and performance of the road network;
- Assessing the future performance based on the indicative 2031 network and estimated traffic volumes; and
- Comparing the base 'no project' network against a future network with the Western Distributor project.

1.1.1 Study area

This report focuses on two key transport corridors in Melbourne – the Western Corridor and the South-East Corridor, as presented in Figure 1. The M1 Freeway which runs through these two corridors is one of the busiest thoroughfares in Victoria, with sections of the freeway carrying in excess of 200,000 vehicles per day. The efficient operation of the M1 and in particular these two corridors are essential to the current and future economic prosperity of the state.

Figure 1 – Study area map

1.2 Structure of this report

This report is split into two parts, covering the Western Corridor and the South-East Corridor:

Part one focuses on the Western Corridor and the proposed Western Distributor project, including:

- An assessment of the existing road network and the planned road network and performance in 2031;
- An overview of the proposed Western Distributor project; and
- An assessment of network performance with the Western Distributor project.

Part two focuses on the South-East Corridor, and the proposed works on the Monash Freeway:

- Existing and future traffic volumes on the Monash Freeway; and
- An assessment of the impacts of the proposed works along the South-East Corridor.

1.3 Methodology

The network impact assessment consists of three scenarios:

- A 2014 base case detailing existing conditions;
- A 2031 base case assessing network performance under a 'no project' scenario; and
- A 2031 project case assessing the future performance of the network with the proposed Western Distributor and M1 Corridor Improvements.

The assessment of each scenario includes traffic volumes and travel times along key routes on the freeway and arterial road network. The assessment also considers the impacts of incidents and overall network resilience.

The existing 2014 base case has been established from existing traffic data provided by VicRoads. The 2031 base case and project case scenarios have been derived from data extracted from the VLC Zenith model which contain 2011 and 2031 base and project year scenarios. An annual percentage change between the two Zenith model time periods has been used to interpolate the estimated change between the 2014 and 2031 network volumes and travel times. The growth rate from the strategic model has then been applied to the observed 2014 data to estimate 2031 volumes. The assessment focuses on the AM peak period as this is the critical peak in regards to traffic volumes and congestion. However it is acknowledged that similar problems occur in the PM peak period.

This is a suitable approach to investigate the potential impacts of the project to the transport network. It is acknowledged that this approach differs from the economic methodology which requires broader strategic level inputs, and accordingly uses outputs directly from the Zenith model.

It is noted that detailed assessment of traffic flow and intersection performance has not been undertaken at this strategic stage of the project. This current approach is believed to be appropriate for a business case level concept. Should the concept proceed beyond the business case, further analysis, such as microsimulation modelling will be required.

1.4 Assumptions

Assumptions have been made to develop the base and future traffic volume estimates in this report.

- It is assumed that the traffic volume and travel time data reported is a fair and suitable representation of typical traffic conditions and patterns;
- Traffic growth forecast by the VLC Zenith model is a fair representation of future conditions based on Victorian Government land use and population forecasts;
- Future road and rail network improvements as identified in Section 4 represent those that are planned or committed.

Part 1
The Western Corridor

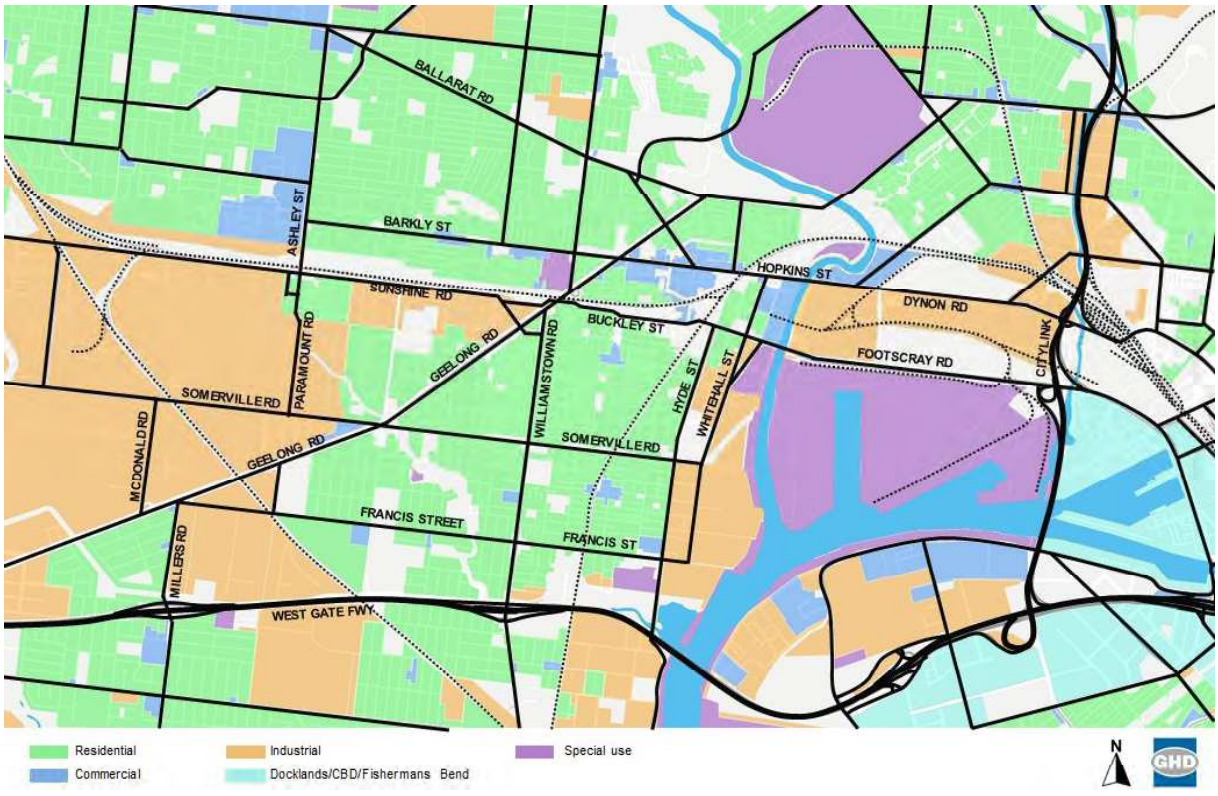
2. The western suburbs and the Inner West

The western suburbs of Melbourne have experienced rapid population growth over the last decade largely due to a combination of land use change, urban renewal in the inner suburbs and development of the outer fringe suburbs. It has been one of fastest growing regions in Melbourne, with the western metropolitan Local Government Area populations of Brimbank, Hobsons Bay, Maribyrnong, Melton, Moonee Valley and Wyndham growing by 33 per cent between 2004 and 2014, from 600,000 people to 800,000 people (ABS, 2015).

In particular the Inner West, the area immediately west of the Maribyrnong River and approximately five kilometres from Melbourne's central business district has been a key contributor to the growth of the region. The Inner West, comprising the suburbs of Yarraville, Kingsville, Seddon, Tottenham, Brooklyn and Footscray contains a wide range of industrial, commercial and residential land uses co-existing in close proximity to each other. The competing needs of each land use must be careful balanced especially as the area further develops.

A large number of trucks utilise the local, arterial and freeway road network in the Inner West due to the close proximity of the Port of Melbourne east of the Maribyrnong River. Sizable industrial precincts also exist in Tottenham and Brooklyn, and further west in Laverton and Truganina; traffic generated by the Port and nearby industry is often at conflict with the residential nature of parts of local road network. The multiple land uses in the Inner West can be seen in Figure 2.

Figure 2 – Land use in the Inner West



This industry and the general residential population of the western suburbs and the Inner West are expected to grow significantly in the coming years, placing additional pressure on the existing road network, in particular the limited number of river crossings across the Maribyrnong River. Investment in transport infrastructure along the Western Corridor will be essential to cater for the current and future needs of the west and facilitate the development of one of the key economic centres of Victoria.

2.1 Port of Melbourne

Situated to the east of the Maribyrnong River and west of Melbourne's central business district, the Port of Melbourne is the economic lifeblood of Victoria, providing a competitive advantage to many of the state's industrial sectors. It is the busiest container port in Australia, handling approximately 2.5 million containers annually or 36 per cent of Australia's container trade (Port of Melbourne Corporation, 2015). Approximately $84 billion worth of trade moves through the port annually, contributing to the prosperity of businesses and the general population of the state.

The Port of Melbourne will expand and grow significantly over the coming decades, with container traffic estimated to increase fourfold from 2.5 million twenty foot equivalent units (TEUs) in 2013-2014 to 11.2 million TEUs in 2045-2046 (DTPLI, 2013). This will lead to a significant growth in road freight movements in the vicinity of the port. The Melbourne Freight Movement Model estimates that the number of truck trips in Melbourne will increase from 300,000 per day to 650,000 movements per day in 2046, of which a large proportion can be directly attributed to the Port of Melbourne.

While there are existing rail linkages to and from the Port of Melbourne, a high proportion of freight is currently and will continue to be carried by road. A challenge will be to ensure that the existing transport networks are able to accommodate and facilitate the growing freight task.

2.2 Arterial road network

The development of the road network in the Inner West has been shaped primarily by its industrial heritage, where large parcels of land were developed around a limited number of poorly connected roads. Over time, these roads were upgraded to an arterial road standard resulting in a road network with low levels of permeability and connectivity, in stark contrast to the highly resilient grid network of the eastern suburbs.

As a result, the road network in the west of Melbourne relies heavily on a limited number of key routes such as the West Gate Freeway and Geelong Road (Princes Highway). The West Gate Freeway is the key east-west link, providing a direct connection from the city and eastern suburbs to western suburbs such as Altona, Laverton, Point Cook, Hoppers Crossing, Werribee and the city of Geelong via the Princes Freeway. The West Gate Freeway also serves the industrial precincts in the west and provides a connection to the M80 Western Ring Road and Western Freeway further west. Geelong Road provides an alternative to the West Gate Freeway, however limited freight connectivity at its northern end results in the road being under-utilised as a strategic freight route.

Connectivity is further constrained by the Maribyrnong River and Yarra River which form a natural barrier to vehicle movements. There are only four key river crossings between Spotswood in the south and Maribyrnong further north:

- West Gate Freeway (West Gate Bridge);
- Footscray Road/Napier Street (Shepherd Bridge);
- Dynon Road (Hopetoun Bridge); and

- Ballarat Road (Lynchs Bridge).

The high dependency on these key routes culminates in a network with a low level of redundancy. With few alternative routes in the event of an accident or closure, a single incident on the network can cause widespread disruption.

The land use mix within the Inner West has its own set of complex issues, with road freight movements often at conflict with the residential use of some areas. This has led to the implementation of truck curfews and bans on local and arterial roads ranging from school peak curfews, night time curfews to full time bans. Truck restrictions have gradually been implemented on Somerville Road, Moore Street, Francis Street and Hyde Street to varying degrees. Aligning the use of roads in the Inner West with their primary land uses will remain an issue now and into the future, but at the same time consideration must be given to the needs of industry and retaining accessibility to the Port of Melbourne.

2.3 Western Corridor project objectives

The need for additional transport infrastructure in Melbourne's west has led to the exploration of a number of potential solutions. The objectives detailed below form the basis of the State's assessment framework for any proposal along the Western Corridor:

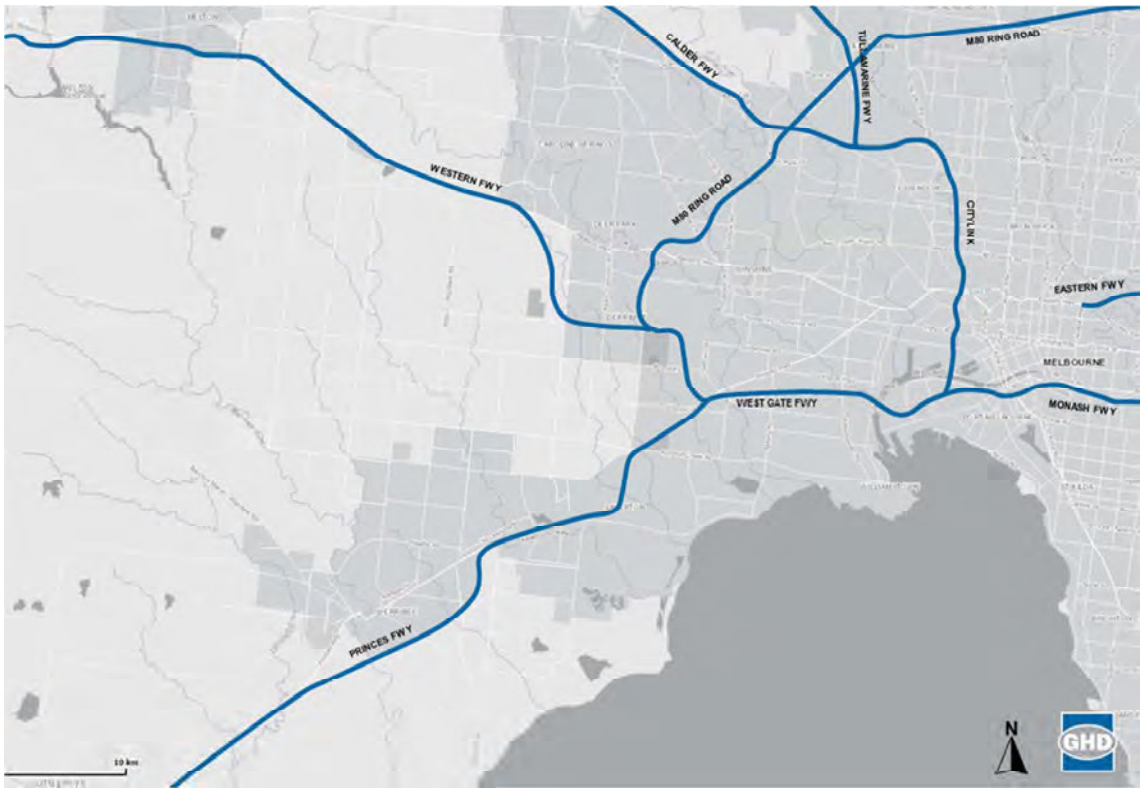
- To improve network efficiency through the provision of increased capacity in the Western Corridor;
- To improve network resilience and redundancy to provide reliable transport alternatives to respond to varying demands or major incidents along the Western Corridor
- To improve freight and supply chain efficiency through the provision of dedicated freight access to the Port of Melbourne and other major freight and logistics hubs; and
- To improve amenity and safety for residential communities and activity centres in the Inner West through the reduction of freight on local streets.

3. 2014 base case – existing conditions

Understanding current and future base conditions provides a basis on which any potential project can be benchmarked and compared against. The following section provides an overview of the 'base' network in the Inner West in the year 2014.

The existing road network in the west is presented in Figure 3

Figure 3 – Current road network



3.1 General traffic

3.1.1 Traffic volumes

The traffic volumes on key Inner West arterial roads are presented in Figure 4 and Table 1 overleaf. Existing truck volumes are presented in Figure 5.

Figure 4 - 2014 base case (two-way, 24 hour weekday volumes)

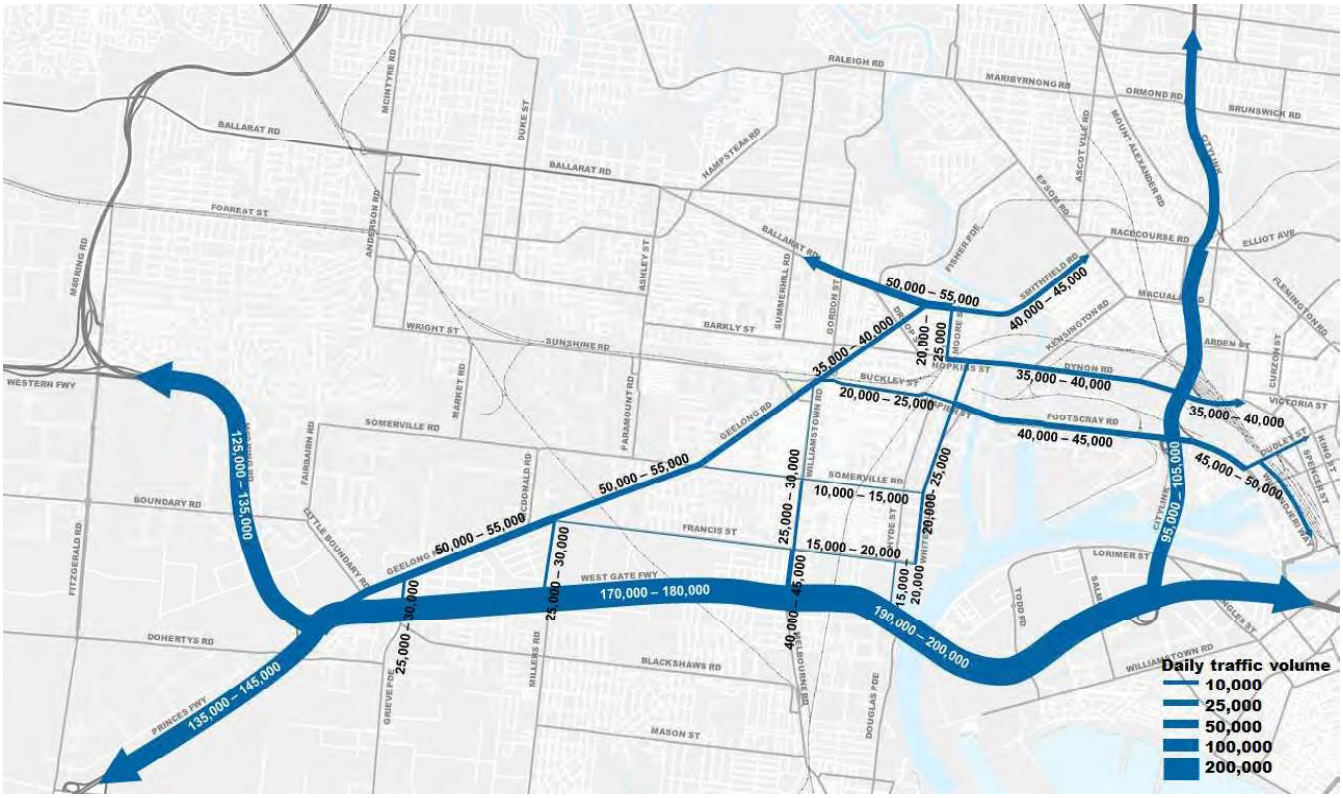


Table 1 - 2014 and 2031 key roads - base case traffic volumes

Road	Daily 2014 traffic volume (two-way)	AM Peak traffic volume (city bound, 7-9am)
Princes Freeway (West of M80)	135,000 - 145,000	10,000 – 12,000
West Gate Freeway (M80 Ring Road to West Gate Bridge)	170,000 - 180,000	12,500 – 14,500
West Gate Freeway (At West Gate Bridge)	190,000 - 200,000	15,000 – 17,000
M80 Ring Road (Western Freeway to West Gate Freeway)	125,000 - 135,000	8,000 – 10,000
CityLink (West Gate Freeway to Footscray Road)	95,000 - 105,000	5,000 – 7,000
Whitehall Street (Between Francis Street and Napier Street)	20,000 - 25,000	1,500 – 2,500
Williamstown Road (Between Somerville Rd and Francis Street)	25,000 - 30,000	1,500 – 2,500
Williamstown Road (Between Francis St and West Gate Freeway)	40,000 - 45,000	2,000 – 3,000
Millers Road (Between Francis St and West Gate Freeway)	25,000 - 30,000	2,000 – 3,000
Grieve Parade (Between Geelong Road and West Gate Freeway)	25,000 - 30,000	1,500 – 2,500
Hyde Street (Between Francis Street and West Gate Freeway)	15,000 - 20,000	1,500 – 2,500
Geelong Road (Between West Gate Freeway and Millers Road)	50,000 - 55,000	5,000 – 6,000
Geelong Road (Between Millers Road and Williamstown Road)	50,000 - 55,000	4,500 – 5,500
Geelong Road (Between Williamstown Road and Ballarat Rd)	35,000 - 40,000	3,000 – 4,000
Ballarat Road (Between Geelong Road and Moore Street)	50,000 - 55,000	3,500 – 4,500
Ballarat Road (Between Moore Street and Epsom Road)	40,000 - 45,000	2,500 – 3,500
Francis Street (between Williamstown Rd and Hyde St)	15,000 - 20,000	1,000 – 2,000
Somerville Road (between Williamstown Rd and Hyde St)	10,000 - 15,000	1,000 – 2,000
Buckley Street (Between Victoria Street and Albert Street)	20,000 - 25,000	1,500 – 2,500
Moore Street (At Donald Road)	20,000 - 25,000	1,000 – 2,000
Dynon Road (At Hopkins Street Bridge)	35,000 - 40,000	3,500 – 4,500
Dynon Road (Between CityLink and Dryburgh Street)	35,000 - 40,000	3,500 – 4,500
Footscray Road (At Shepherd Bridge)	40,000 - 45,000	4,500 – 5,500
Footscray Road (At Dock Link Road)	40,000 - 45,000	4,500 – 5,500
Footscray Road (Between Pearl River Road and Waterfront Way)	45,000 - 50,000	5,500 – 6,500

Figure 5 - 2014 base case (two-way, 24 hour weekday truck volumes)

3.1.2 West Gate Freeway

The West Gate Freeway carries greater than 60 per cent of all trips across the Maribyrnong River and Yarra River screenline (referred to within this document as the Maribyrnong River screenline). With such high demand, the Freeway currently experiences very heavy peak period volumes.

The critical peak period that experiences the concentration of high volumes and regular flow breakdown is the AM peak period in the inbound direction.

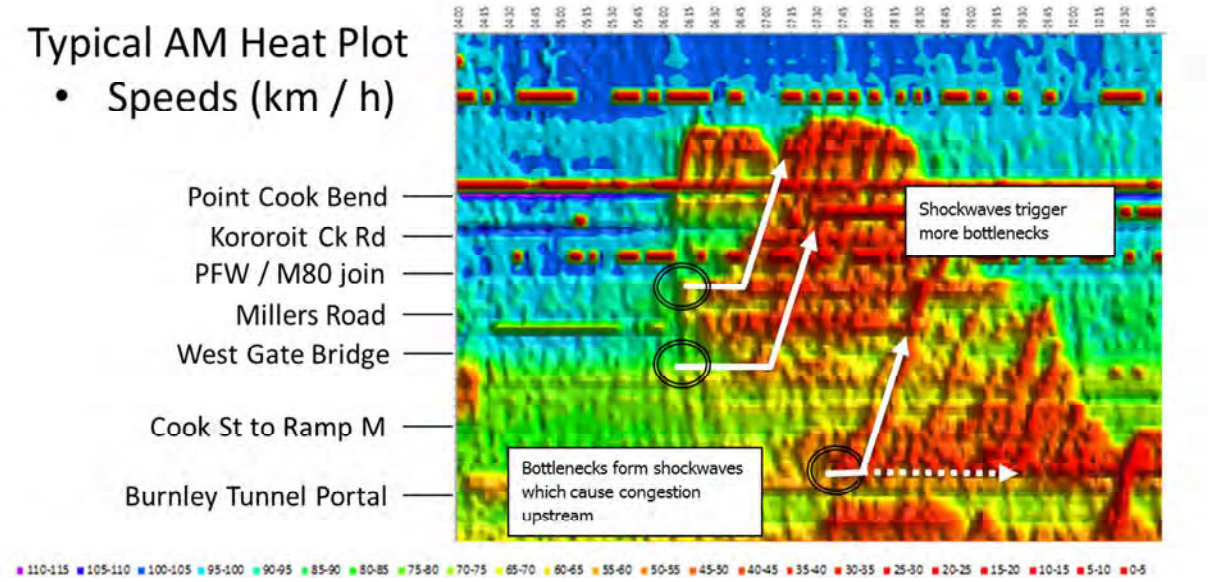
The existing, general operating conditions on the Westgate Freeway inbound during the AM peak are summarised below for the section between M80 and the West Gate Bridge.

- The AM peak period is typically 3.5 to 4 hours (6:00 am to 10:00 am);
- Hourly flows are generally in the range of 6,000 to 8,000 vehicles per hour across the 4 lanes;
- Commercial vehicle proportions using the West Gate Freeway vary between 11 per cent and 15 per cent. It is noted that due to the size of larger commercial vehicles this can represent up to 30 per cent of the utilised lane space when considering standard passenger car unit sizes;
- Congestion (low speeds and reduced flows) are experienced on a daily basis;
- Following the onset of congestion and subsequent flow break down, traffic speeds are regularly below 30 km/h (level of service of F);
- These reduced speeds are regularly experienced for between 1 to 2 hours during the morning peak;
- The locations where existing operational bottlenecks occur are as follows:
  - M80 Ring Road / Princess Freeway interchange: Two system traffic streams come together and lane changing (weaving) occurs to access Millers Road, Williamstown Road and the West Gate Bridge;
  - Millers Road Entry: Merge bottleneck interacting with traffic exiting to Williamstown Road; and
  - Williamstown Road Entry: Merge and uphill grade bottleneck.
- As a result of the ramp metering operating on the M1 corridor, reasonably high mainline flow rates can be achieved for periods within the peak, sometimes as high as 2000 vehicles per hour per lane; however, the high demands on the corridor still result in significant flow break down and productivity losses. This results in excessive queuing on arterial roads as demand cannot be met. Queues on arterial roads such as Williamstown / Melbourne Road can extend up to one kilometre in the AM peak;
- Congestion and associated queues can extend back to upstream sections of the Princes Freeway West, even as far as Hoppers Crossing on some occasions. This can be partly attributed to downstream congestion on the West Gate Freeway, as queues at the city exits affect mainline flows.

Figure 6 is a heat plot of the Princes Freeway West and West Gate Freeway inbound demonstrating typical AM peak operation. The direction of travel is down the plot and the time scale is left to right (from 4AM to 11AM). Red / orange indicates slow speeds while blue / green indicate high speeds. The white arrows highlight the occurrence of shockwaves. Shockwaves are the ripple effect of congestion in one location, rapidly impacting upstream traffic and affecting a far greater traffic volume. Shockwaves typically occur when there are high volumes of traffic travelling with minimal headways and gaps to other cars (a typical scenario on the

West Gate Freeway in the AM peak). In this situation something as simple as tapping the breaks or changing lanes can slow or stop the traffic flow. These shockwaves have large impacts on the performance of the network and can affect thousands of people each day.

Figure 6 - West Gate Freeway heat plot showing the speed along the Princes / West Gate corridor during a typical weekday AM peak



3.1.3 Over reliance on the West Gate Bridge

The limited availability of jobs in the western suburbs has led to a situation where a high proportion of residents from the west travel across the Maribyrnong and Yarra Rivers to work in the city and eastern suburbs each day. This is placing increasing pressure on the existing river crossings especially as the population of the inner west grows.

Table 2 lists the existing road crossings of the Maribyrnong River screenline that serve the western road corridor and presents the proportion of the 305,000 to 330,000 trips per day that use each crossing. It shows that nearly two thirds of all trips to/from the west rely on the West Gate Freeway. When the West Gate Freeway is congested it affects the majority of trips from the west.

Accordingly, any incident that occurs along the West Gate Freeway has a significantly disruptive impact on the ability to efficiently and reliably move people and goods between the west, the city, the Port of Melbourne and other surrounding locations of employment and education. There is little spare capacity on other parallel routes to cater for redistributing demands during periods when an incident has occurred.

Table 2 - Maribyrnong River screenline assessment

River crossing	Number of lanes (inbound)	Percentage of traffic (2014 base case)
West Gate Freeway (West Gate Bridge)	5[1]	59% - 63%
Footscray Road (Shepherds Bridge)	2[2]	12% - 15%
Dynon Road (Hopetoun Bridge)	2	11% - 13%
Ballarat Road (Lynchs Bridge)	2	12% - 15%
Total	**11**	**100%**

3.1.4 Network resilience – day to day variability

Resilience refers to how flexible the network is to changing conditions such as increased demand, congestion or incidents on the networks. Variability is further discussed in the travel time section below.

Incidents on the West Gate Bridge and West Gate Freeway are relatively commonplace and are therefore a strategic consideration in future planning for the Western Corridor.

Data from the VicRoads Road Crash Information System shows that there were approximately 850 incidents (including vehicle breakdowns, collisions or obstacles on the road) on the West Gate Bridge in 2014 and an additional 1,300 incidents on the remainder of the West Gate Freeway between M80 and Todd Road (2,150 incidents in total). This equates to an average of approximately six incidents per day on the West Gate Freeway. It is estimated that a single lane closure on the freeway accounts for 90 per cent of incidents while closures of two or more lanes occur 10 per cent of the time.

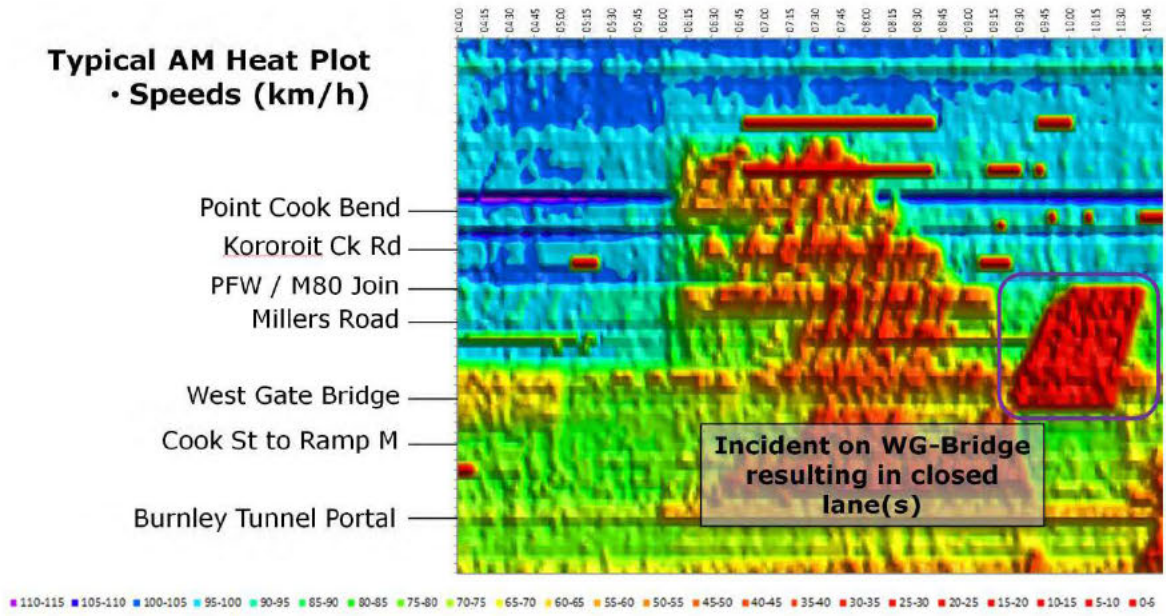
VicRoads has advised that it takes approximately 10 minutes to respond to an incident on the West Gate Freeway / West Gate Bridge and an additional 16 minutes to clear from the carriageway, however lane closures can vary from short momentary closures to complete freeway closures of up to six hours in the event of a fatal or major collision.

When incidents occur, the flow-on impact can be broad across the network, with the resulting congestion lasting much longer than the time taken to clear the original incident. The speed heat plot in Figure 7 below shows an incident on the West Gate Bridge that resulted in a reduction of one lane. The large red patch represents a very slow / stationary queue on the West Gate Freeway from the West Gate Bridge back to the M80 interchange, lasting from 9:30 AM to 10:45 AM. This demonstrates that when an incident occurs it can take hours for the freeway to recover. If this incident occurred during the middle of the peak such as 8:00 am, it is likely that it would take more than 2 hours for the network to recover.

The speed heat plot also shows congestion generated prior to the Burnley tunnel around 6am and then extending back to the West Gate Bridge and joining with the congestion on the West Gate Freeway some 90 minutes later. This demonstrates how the flow on the West Gate Freeway can be influenced by downstream conditions.

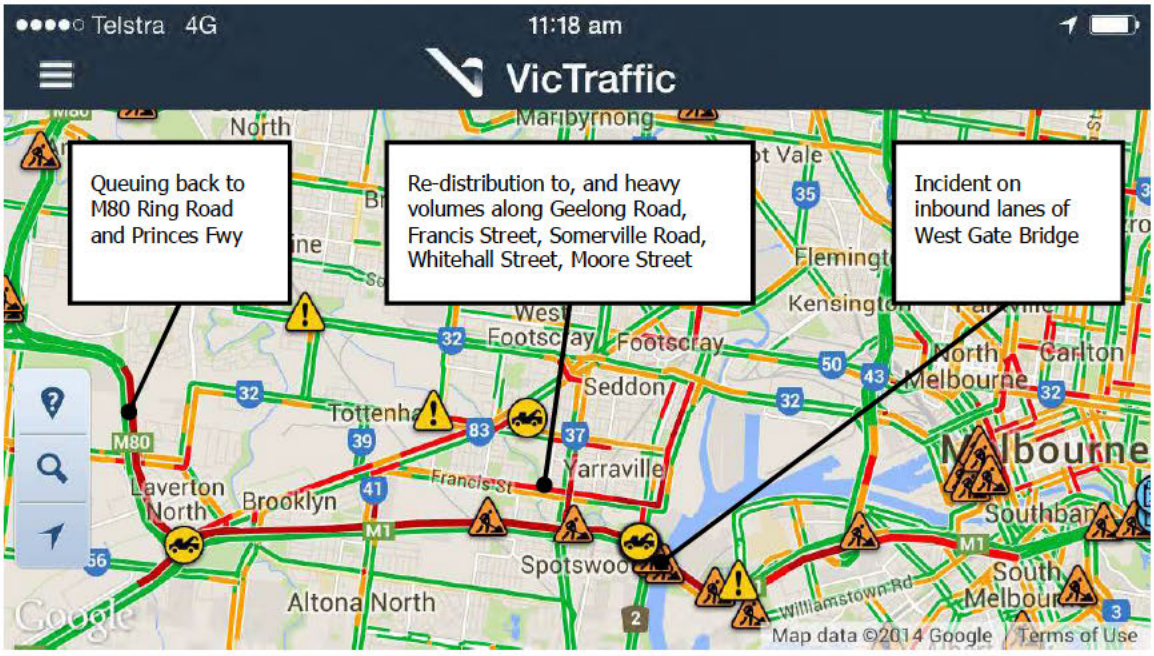
[1] Typical capacity of a freeway is 1,800 vehicles per hour per lane
[2] Typical capacity of an arterial road is 800 vehicles per hour per lane

Figure 7 - Impact on speeds and congestion as a result of an incident on the West Gate Bridge



When incidents do occur on the West Gate Freeway this can have a significant flow-on effect to other routes. As an isolated example, Figure 8 presents a screenshot from VicRoads' VicTraffic application for an incident that occurred on Wednesday 2nd December 2014. The image was taken at 11:18 am (an off-peak time) at a time when three inbound traffic lanes were closed on the West Gate Bridge due to a vehicle collision that occurred just before 10:00 am. The image presents the roads in the Inner West that were most impacted by the lane closures during this off-peak time. Specifically, it shows that when an incident occurred on the West Gate Bridge during the middle of the day that traffic congestion was created along the West Gate Freeway beyond the M80 interchange and onto the M80 as well as on roads within the Inner West including Geelong Road, Francis Street, Somerville Road, Whitehall Street and Moore Street.

Figure 8 - Impact of an incident on the West Gate Bridge



Source: VicRoads' VicTraffic application

3.1.5 Travel times

Currently, travel times along the West Gate Freeway vary significantly from day to day. Based on observed travel time data, a trip between Grieve Parade and Montague Street (route A to C in Figure 9) in the AM peak period takes 14 minutes on average, although it can vary between 8 and 19 minutes in length (averaging less than 35 km/hr) depending on freeway conditions.

Similarly, trips between Grieve Parade and Footscray Road via the West Gate Freeway and the Bolte Bridge (route A to B in Figure 9) also experience similar levels of variability in travel times. Trips along this route generally take 18 minutes on average and can vary between 14 minutes and 26 minutes. AM and PM peak travel times along four freeway and arterial road routes are presented in Table 3.

Further, when an incident occurs, travel time along this section can be even longer again. During one of the travel time survey days an incident occurred in Docklands which resulted in the closure of La Trobe Street and Wurundjeri Way. This impacted traffic conditions on the West Gate Freeway with travel times on the West Gate Freeway (Grieve Parade to Montague Street; A to C) increasing to 36 minutes (averaging 18 km/hr) during an AM peak travel time run, more than double the average travel time recorded. A trip between Grieve Parade and Footscray Road (A to B) during the same period took 30 minutes (averaging less than 23 km/hr).

An incident directly on the freeway with resultant lane closures can have similar or greater impacts on travel times. The variability in travel times and the effects of an incident can be seen in Figure 10 to Figure 17.

Figure 9 - Travel time routes

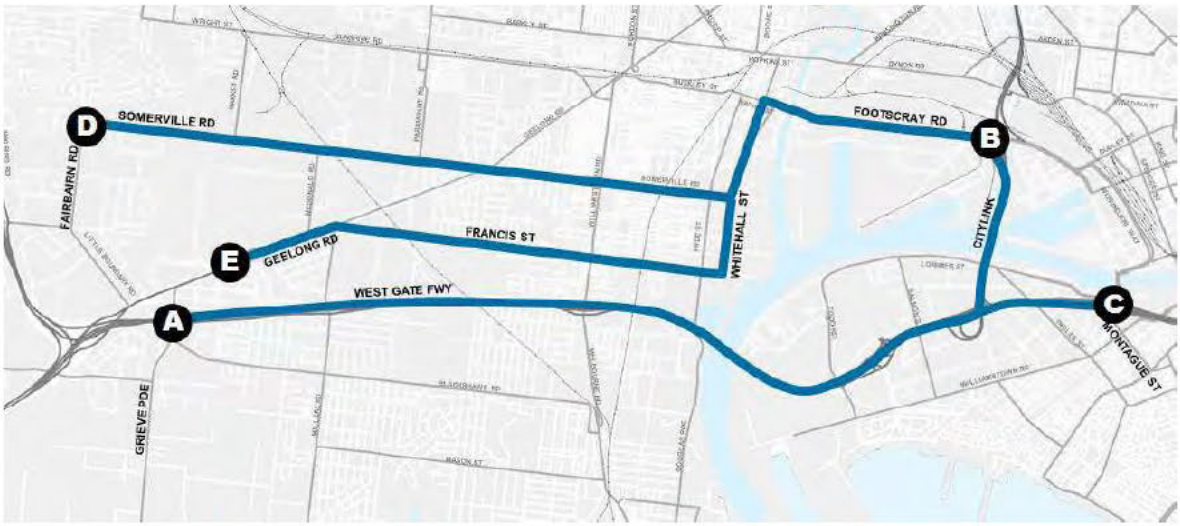


Table 3 - 2014 observed peak period travel times

Route	Distance	Time period	Direction	Min travel time	Average travel time	Max travel time	Max observed travel time during incident	Average speed
A to B	11.4 km	AM[3]	Inbound	14 min	18 min	26 min	30 min	38 km/h
B to A	11.7 km	PM[4]	Outbound	10 min	11 min	14 min	N/A	61 km/h
A to C	10.9 km	AM	Inbound	8 min	14 min	19 min	36 min	47 km/h
C to A	10.9 km	PM	Outbound	8 min	11 min	19 min	35 min	58 km/h
D to B	10.6 km	AM	Inbound	19 min	21 min	28 min	N/A	30 km/h
B to D	10.5 km	PM	Outbound	17 min	25 min	31 min	50 min	25 km/h
E to B	9.9 km	AM	Inbound	14 min	18 min	22 min	N/A	32 km/ h
B to E	9.8 km	PM	Outbound	14 min	17 min	24 min	36 min	34 km/h

[3] AM peak (7:00 am – 9:00 am)
[4] PM peak (4:00 pm – 6:00 pm)

Figure 10 - West Gate Freeway Existing 2014 AM peak travel times – Grieve Parade to Montague Street

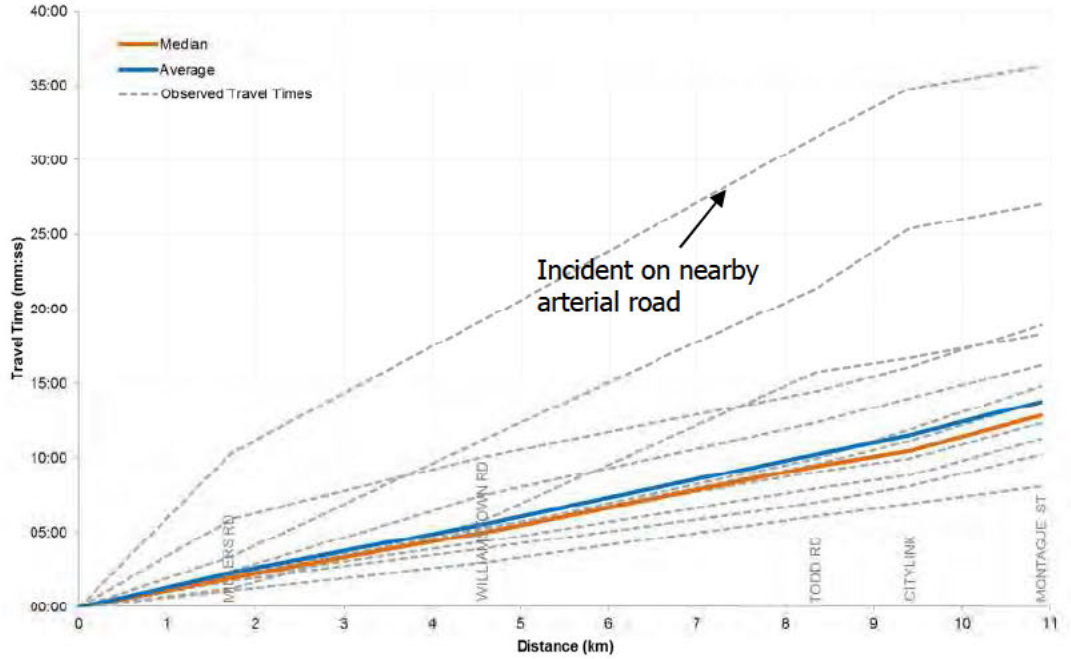


Figure 11 - West Gate Freeway Existing 2014 AM peak travel times – Grieve Parade to Footscray Road via Bolte Bridge

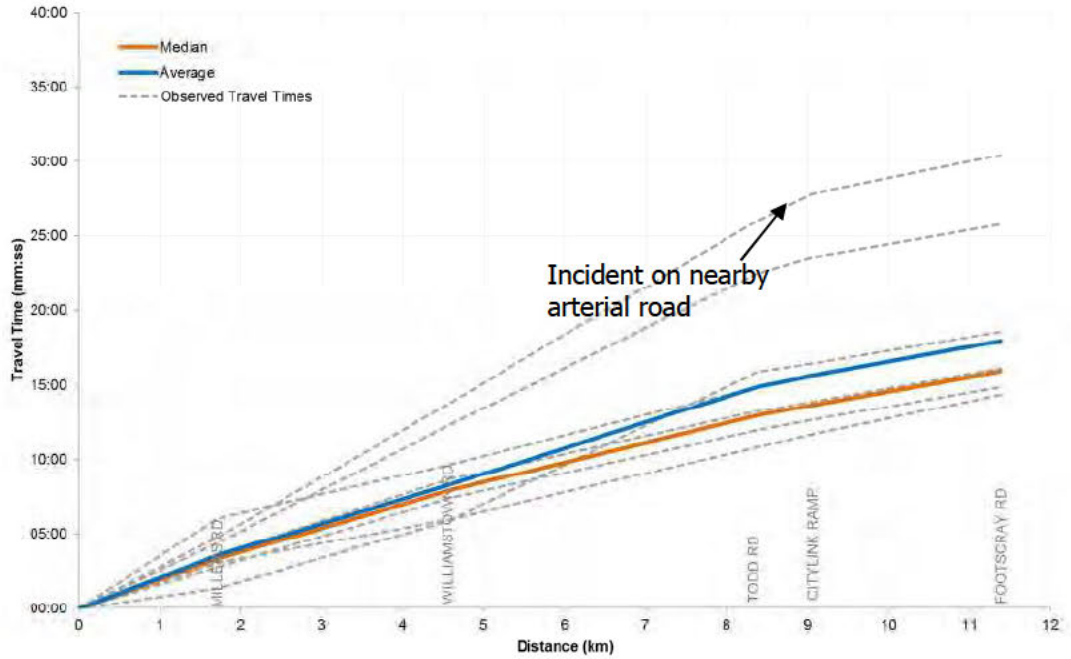


Figure 12 - Existing 2014 AM peak travel times – Somerville Road to Footscray Road

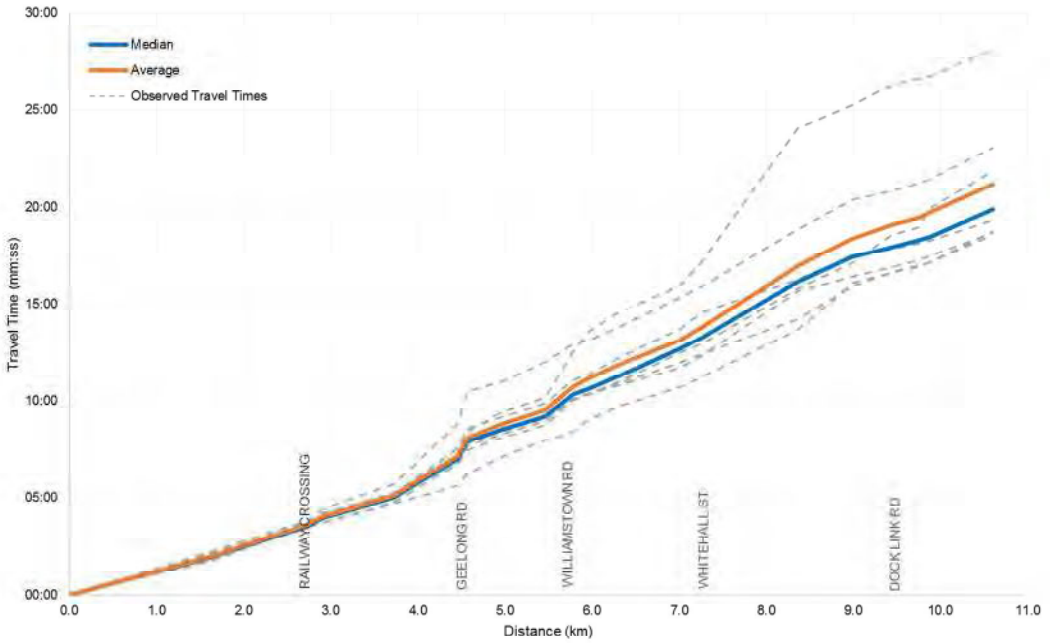


Figure 13 - Existing 2014 AM peak travel times – Geelong Road to Footscray Road

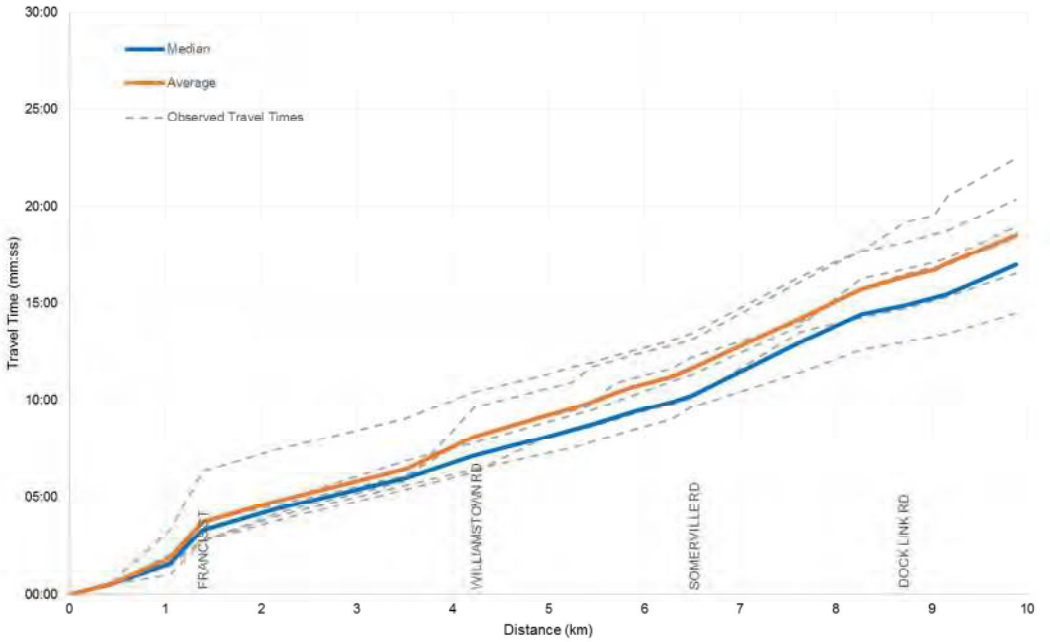


Figure 14 – West Gate Freeway Existing 2014 PM peak travel times – Montague Street to Grieve Parade

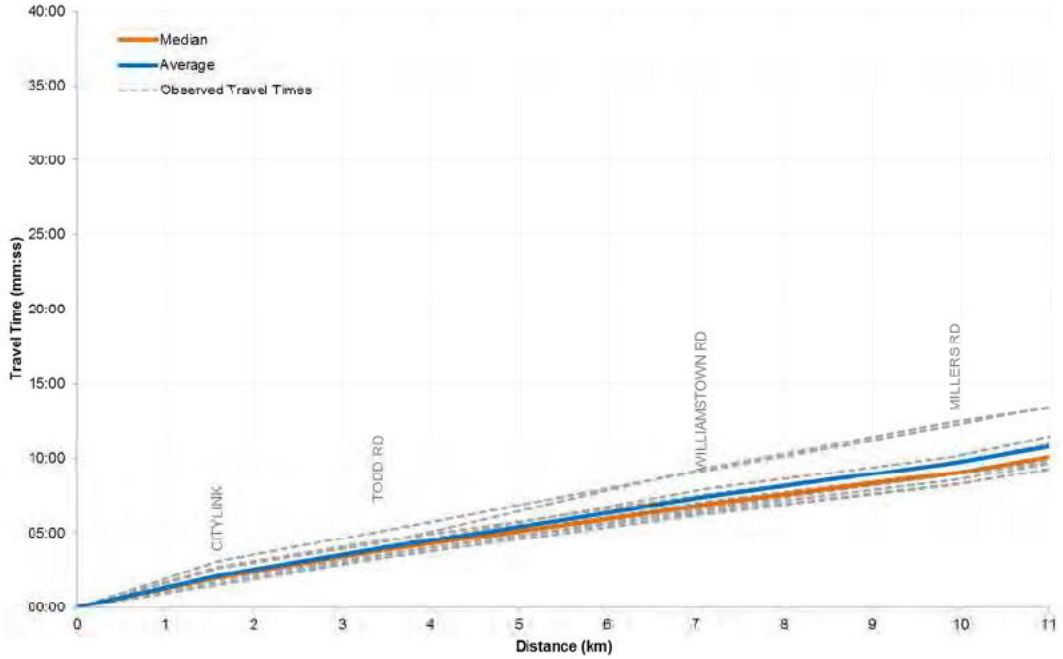


Figure 15 – West Gate Freeway Existing 2014 PM peak travel times – Footscray Road to Grieve Parade via Bolte Bridge

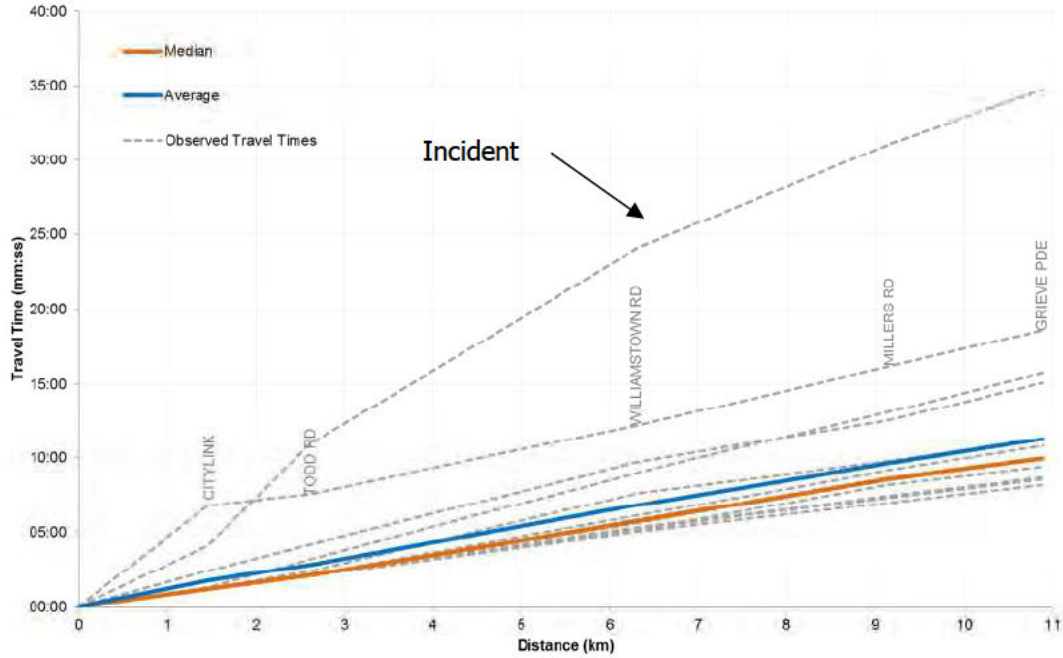


Figure 16 –Existing 2014 PM peak travel times – Footscray Road to Somerville Road

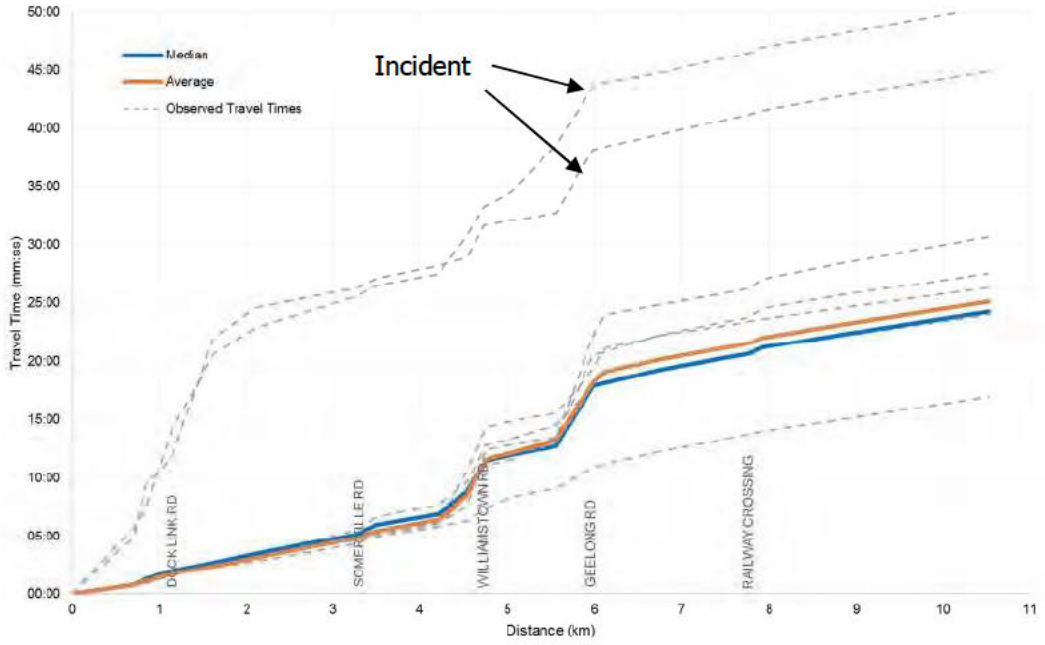
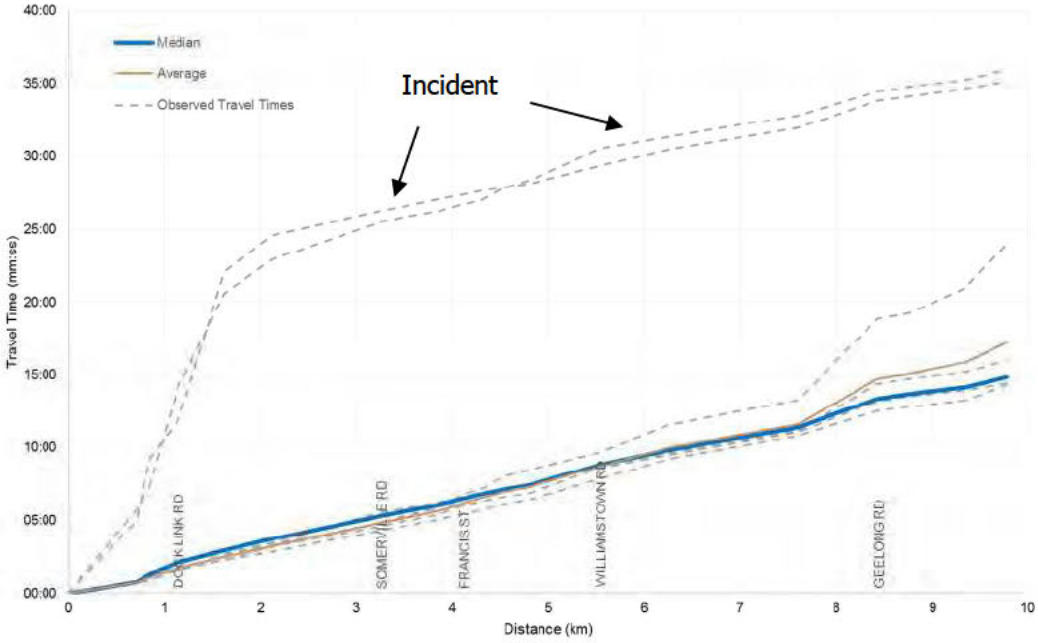


Figure 17 –Existing 2014 PM peak travel times – Footscray Road to Geelong Road



3.1.6 Traffic from the west accessing the city

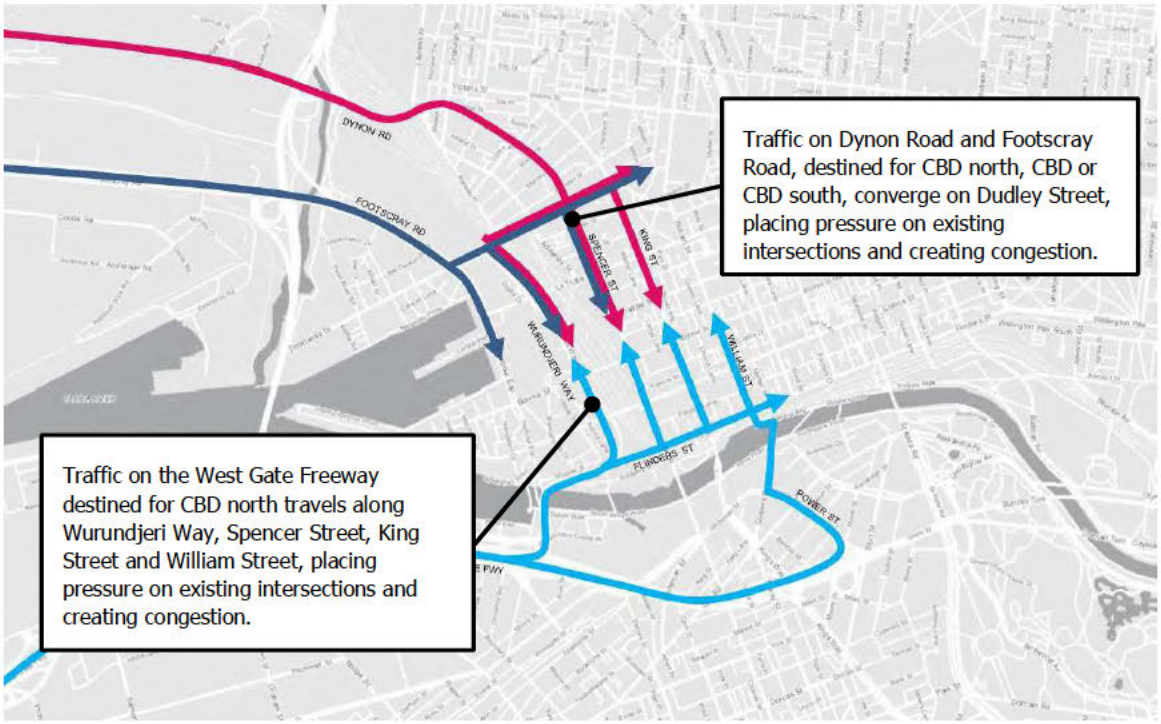
Vehicles travelling from the west currently have limited routes they can use to access the city. Routes include Footscray Road, Dynon Road and the West Gate Freeway via Montague Street/Charles Grimes Bridge or Power Street. During the AM and PM peak periods, these roads often experience high levels of congestion.

Travel time data provided by VicRoads show that the average vehicle speed on Footscray Road between CityLink and Dudley Street is 17km/h in the AM peak period.

Much of the traffic on Dynon Road and Footscray Road has an origin or destination within the inner north of Melbourne, the CBD or south of the CBD. Those trips that are travelling to south of the CBD are currently using routes that include streets within the CBD, such as Spencer Street and King Street. At the same time, traffic exiting the West Gate Freeway via Montague Street/Charles Grimes Bridge or Power Street is also travelling north through the CBD with destinations in the inner north of Melbourne. These trips are essentially loading these inner city streets with through traffic that does not need to travel within the CBD.

These traffic flows converge on Dudley Street and, in particular, the intersections of Dudley Street with Wurundjeri Way, Spencer Street and King Street. This places significant pressure on these intersections to cater for demands from competing directions, as indicatively represented in Figure 18, resulting in delays and queues.

Figure 18 - Footscray Road and Dynon Road - general traffic desire lines



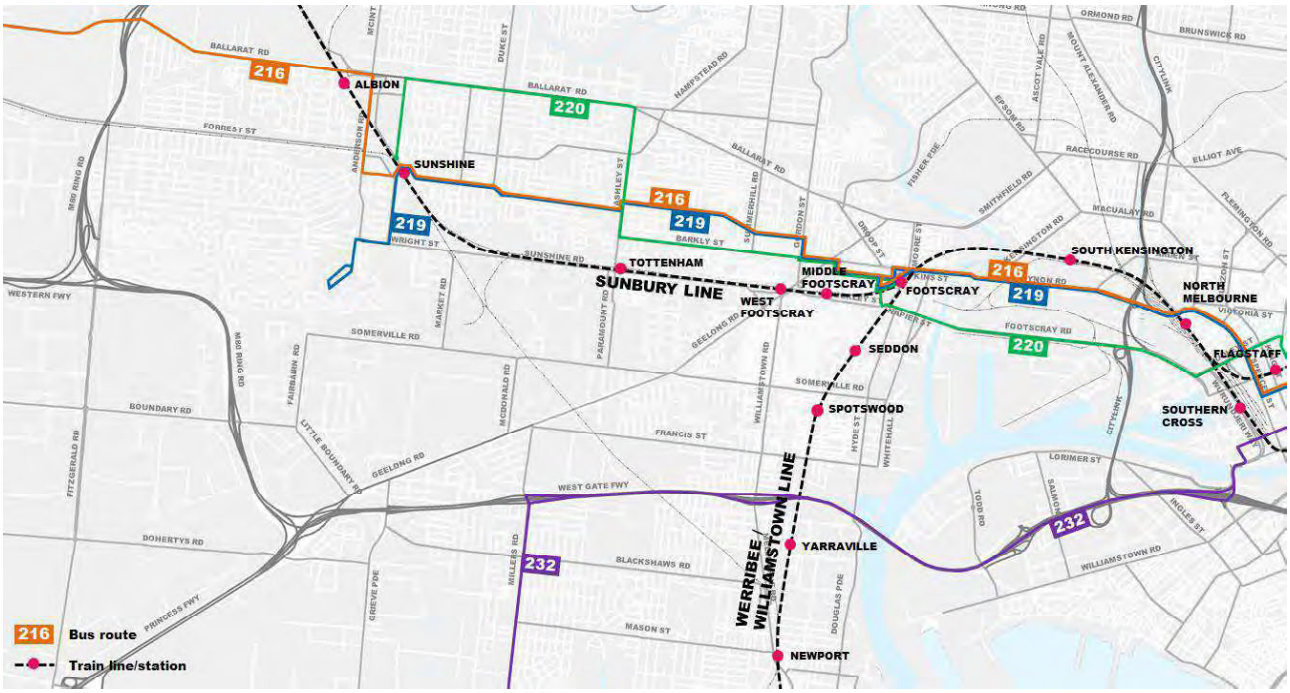
3.2 Public transport

The Inner West area is moderately well serviced by a range of public transport options, with coverage from bus, tram and train services. Its close proximity to the Melbourne CBD has resulted in the Inner West having a high public transport mode share compared to the state average. At the 2011 Census, 22.9 per cent of people in Maribyrnong and 15.5 per cent of people in Hobsons Bay travelled to work by public transport, which compares favourably to the Victorian average of 11.1 per cent.

3.2.1 Public transport network

Bus and train routes connecting the Inner West with the CBD are presented in Figure 19 overleaf.

Figure 19 – City-bound public transport routes



3.2.2 Buses

There are 21 bus routes operating within the Maribyrnong local government area, with the majority providing connectivity between residential areas and the nearby activity centres. Four of the bus routes connect the Inner West to the Central Business District and eastern suburbs, which are detailed in Table 4. As these buses travel along the key city bound roads of Footscray Road, Dynon Road and the West Gate Freeway; the impact on these services in particular must be taken into consideration when assessing any potential project along the Western Corridor.

Table 4 – Inner West – CBD bus routes

Bus route	Description	Key roads	Frequency (7-9am and 4-6pm)
216	Caroline Springs to Brighton Beach via Footscray and the CBD	Dynon Road	Approximately every 20 minutes
219	Sunshine South to Gardenvale via Footscray and the CBD	Dynon Road	Approximately every 35 minutes
220	Sunshine to Gardenvale via Footscray and the CBD	Footscray Road	Approximately every 11 minutes
232	Altona North – Queen Victoria Market	West Gate Freeway	Approximately every 15 minutes

3.2.3 Trains

Three train lines run through the western suburbs and the Inner West; the Williamstown Line, Sunbury Line and Werribee Line. Trains on these lines operate at a high frequency during the AM and PM peak periods connecting the west with the Central Business District and eastern suburbs. V/Line (regional train) services also operate through the Inner West, running on dedicated tracks from Geelong and Ballarat to the Melbourne CBD.

The risk involved in a road project along the Western Corridor is the potential to divert trips away from public transport. Reducing congestion along roads such as the West Gate Freeway may inadvertently cause people to shift from rail to road transport.

3.2.4 Current and future public transport projects

A number of public transport projects have recently been completed or are planned to be completed in the coming years, improving connectivity from the west to the CBD:

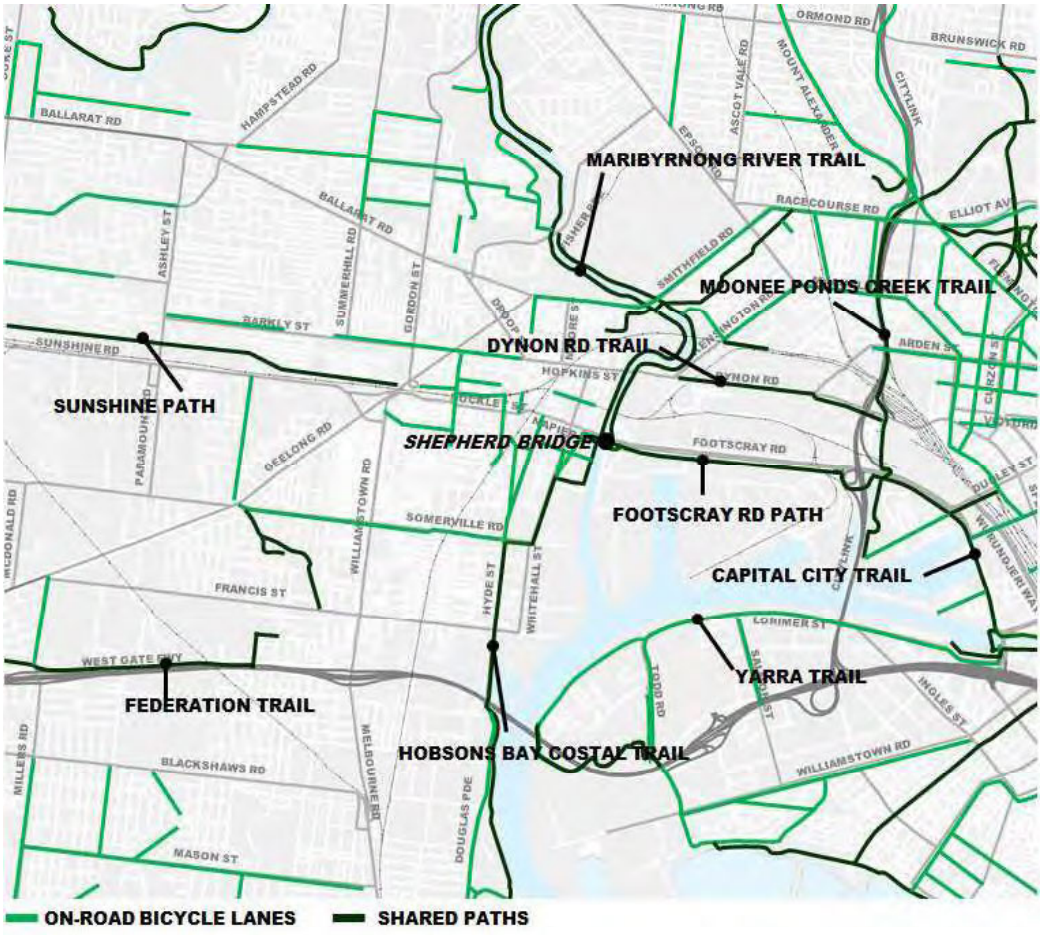
- Regional Rail Link – was a 48 kilometre rail project in the west of Melbourne, completed in June 2015. It involved the construction of new tracks and stations between Werribee and Deer Park, and upgrades to the existing rail corridor to remove major bottlenecks in the train network, separating V-Line from metropolitan trains. The project created capacity for an extra 23 metropolitan trains and 10 regional services during each morning and afternoon peak.
- Melbourne Metro Rail Project – is a planned rail tunnel running north-south through Melbourne's CBD from South Yarra to South Kensington. The project will untangle the network, with lines currently converging at the City Loop, improving capacity, reliability and frequency of services on train lines. The project is estimated to increase the capacity of the rail network by 20,000 passengers in peak hour.

3.3 Cycling

The Inner West has a sizeable off-road shared path network providing accessibility to both commuter and recreational cyclists. Key routes, presented in Figure 20 include:

- The **Federation Trail** – a 23 kilometre off-road shared path running parallel to the Main Outfall Sewer reservation and the West Gate Freeway from Werribee to Yarraville. The trail connects to the Werribee River Trail, Skeleton Creek Trail and Western Ring Road Trail;
- The **Footscray Road Path -** an off-road shared pedestrian and bicycle path that runs parallel to Footscray Road and Harbour Esplanade between the Maribyrnong River and Docklands. It is the main east-west path connecting the Melbourne CBD, northern and eastern suburbs with the western suburbs;
- The **Maribyrnong River Trail and Hobsons Bay Costal Trail -** an off-road shared pedestrian and bicycle path starting from Williamstown, running parallel to the Yarra River, Hyde Street and Whitehall Street before following the Maribyrnong River north to Brimbank Park in Keilor;
- The **Dynon Road Trail -** a narrow off-road shared pedestrian and bicycle path running parallel to Dynon Road between Sims Street (east of the Maribyrnong River) and the Moonee Ponds Creek Trail (CityLink);
- The **Moonee Ponds Creek Trail -** an off-road shared pedestrian and bicycle path running along Moonee Ponds Creek starting from Docklands in the south to Melbourne Airport in the north; and
- On-road bicycle lanes on Somerville Road, Hyde Street and Buckley Street.

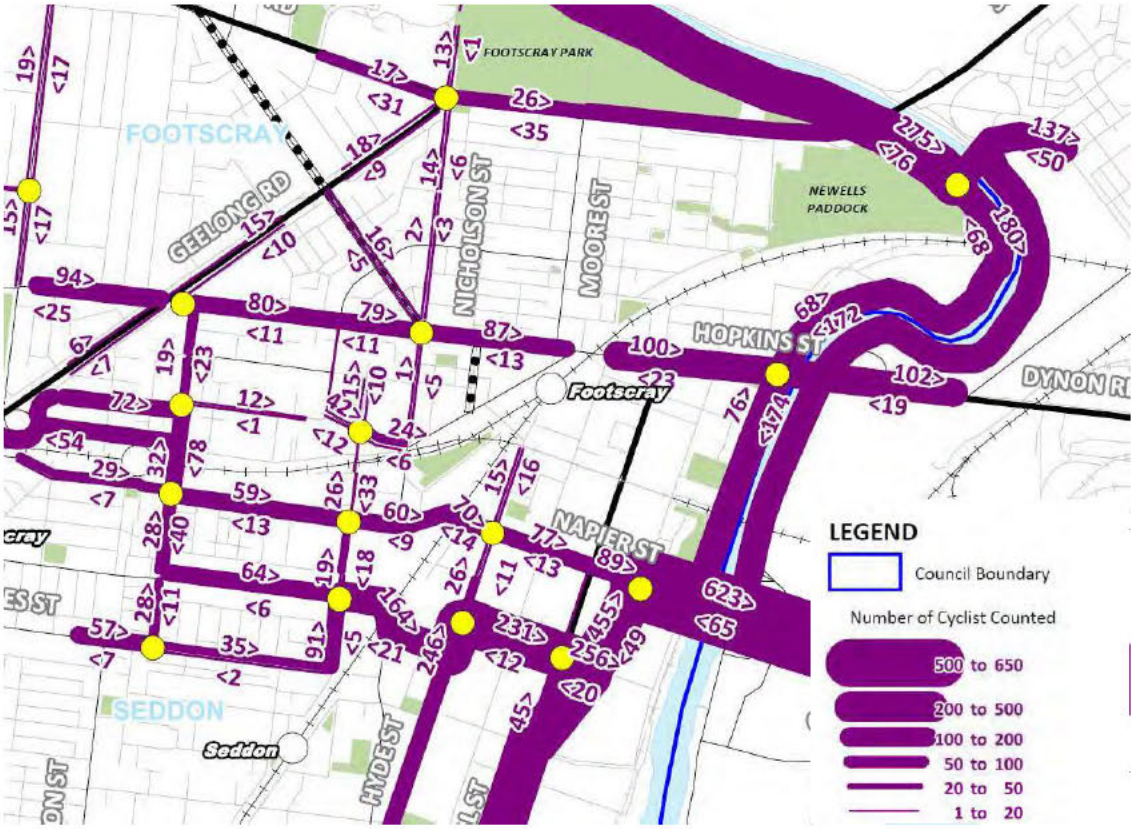
Figure 20 – Bicycle network in the Inner West



3.3.1 Bicycle volumes

2014 bicycle volumes have been sourced from Maribyrnong City Council's Super Tuesday counts conducted in March 2014 from 7:00 am to 9:00 am. Daily volumes have been estimated to be 1.25 times the AM and PM peak flows and are presented in Figure 21 (daily volume factor estimated from Figure 3-12 of the Maribyrnong Bicycle Strategy 2014).

Figure 21 – 2014 bicycle volumes 7:00 am – 9:00 am



Source: Maribyrnong Bicycle Strategy 2014 – Super Tuesday Counts

Key findings include:

- The highest number of cyclists recorded was along Footscray Road on Shepherd Bridge. 688 riders were recorded (two-way total) over the two hour AM survey period;
- The Maribyrnong River trail is a key cycling route during the AM peak, with 250 riders between Footscray Road and Dynon Road and 504 on the path south of Footscray Road (via Whitehall Street and Hyde Street);
- On road bicycle lanes on Buckley Street, Barkly Street, Hyde Street and Parker Street saw relatively high usage.

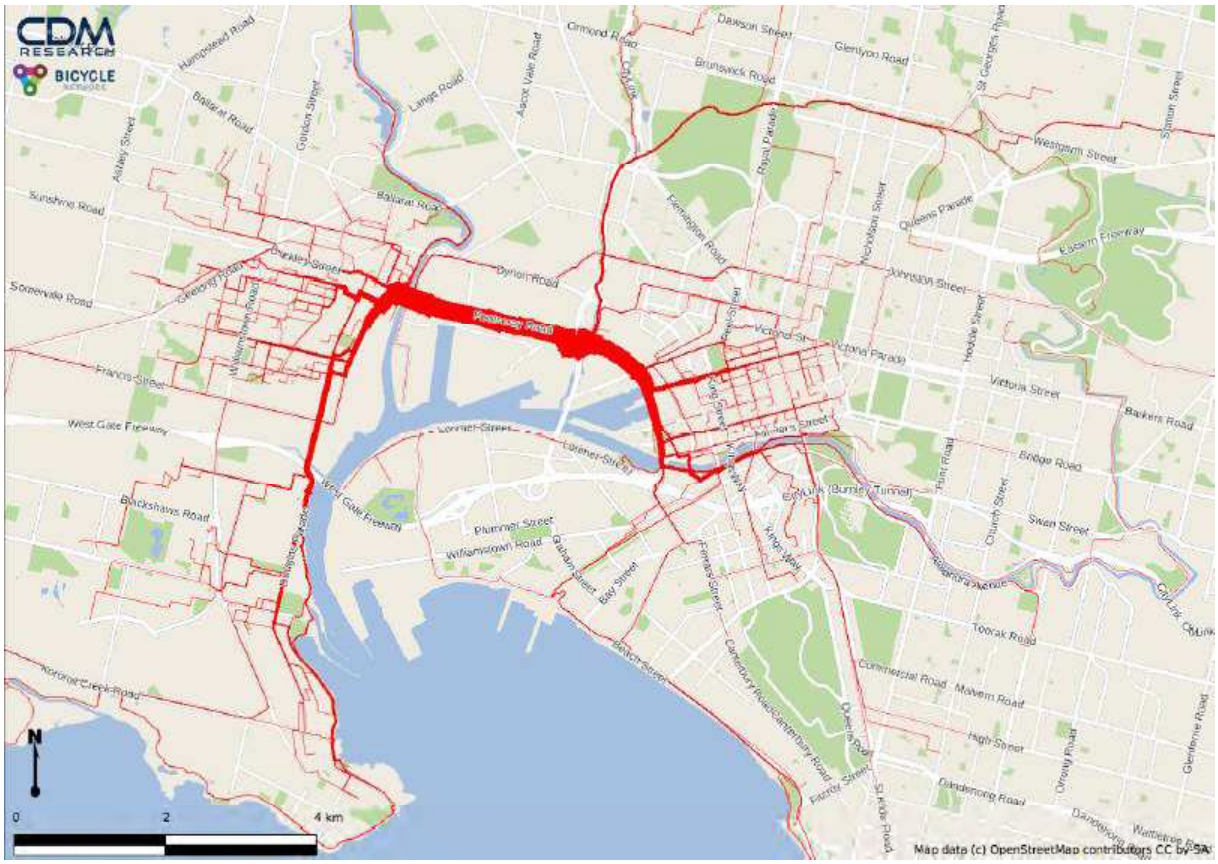
3.3.2 Origins and destinations

As the busiest bicycle location in the Inner West, Shepherd Bridge (across the Maribyrnong River on Footscray Road) is a pivotal part of the Inner West bicycle network. Origins and destinations of trips across Shepherd Bridge, presented in Figure 22 were logged by Bicycle Network through their 'Rider Log' phone app.

It can be seen that the majority of trips across the bridge have an Inner West origin or destination immediately west of the bridge between Whitehall Street and Geelong Road, and further south along the Maribyrnong River Trail, with a skew towards origins and destinations to the south-west (Yarraville, Newport and Williamstown).

East of the bridge the dominant destination is the Melbourne CBD, however there are a small number of cyclists travelling north along the Moonee Ponds Creek Trail and east along the Capital City Trail (Yarra River). The majority of trips were between 5 and 10 kilometres in length.

Figure 22 – Shepherd Bridge origins and destinations



Source: Bicycle Network

The strategic importance of the Footscray Road Path and Shepherd Bridge means that the key focus should be on improving the quality of the path by removing bottlenecks and dangerous crossings, or improving connectivity from the surrounding bicycle network to the Footscray Road path.

3.3.3 Missing links and key network issues

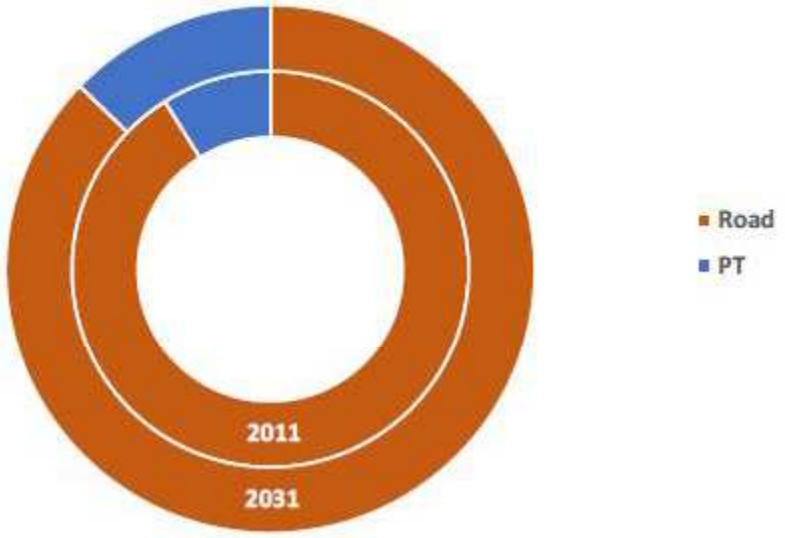
While there is a sizeable off-road bicycle network in the Inner West, there are key links missing and issues at certain location holding back further growth in bicycle ridership. Key issues or missing links that a Western Corridor project may be able to rectify include:

- A missing connection between the Federation Trail and Hyde Street. The current Federation Trail (starting from Werribee) running parallel to the West Gate Freeway ends at Fogarty Avenue. A connection further east to Williamstown Road and Hyde Street along the West Gate Freeway corridor would provide access to the Maribyrnong River Trail, Footscray Road Path and Melbourne's CBD further east;
- The lack of a suitable connection between the Footscray Road Path and the Sunshine Road path. The Sunshine Road path ends at West Footscray Station, forcing cyclists onto the road to connect to the Footscray Road path via Buckley Street and Napier Street;
- Steep grades along the Footscray Road Path at Appleton Dock Road discouraging cyclists from using the route;
- Unsignalised slip lanes along Footscray Road. Cyclists currently cross Sims Street at two unsignalised crossings carrying a large number of trucks each day. The intersection needs to be grade separated or signalised to remove the cyclist-truck conflict. Additionally, the slip lanes on Dock Link Road and Appleton Dock Road are unsignalised creating the potential for conflict between cyclists and trucks.

4. 2031 base case – the 'no project' scenario

In the 2031 base case scenario without the Western Distributor (i.e. 'no project'), trips originating in the west[5] are forecast to increase significantly across all modes, with demand for public transport growing more than 140 per cent and road demand growing by 60 per cent between 2011 and 2031. The majority of trips will continue to be completed via road with the number traffic trips expected be nearly seven times greater than those completed by public transport in 2031 as presented in Figure 23. This reinforces the need for both road and rail transport solutions, with a road solution being the focus of this business case.

Figure 23 - Number of public transport trips compared to all traffic trips in the west (2031 base case vs 2011)



4.1 General traffic

4.1.1 Traffic volumes

Forecast average weekday traffic demand in 2031 is presented in Figure 24 and Table 5. The demands presented have been derived by multiplying observed traffic volume data from 2014 by growth factors derived from the VLC Zenith strategic model and, as a consequence, the estimated demands may be higher than the practical capacities of the road links. Accordingly, the 2031 scenario volumes should be considered as demand for travel along these links.

Taking the West Gate Bridge as an example, a two-way daily volume of 250,000 would result in this road operating under heavy traffic conditions for the majority of the day. This may or may not occur, however if we consider the value of 250,000 as demand, we can understand the routes likely to be subjected to high levels of congestion.

Truck volumes are forecast to increase by approximately 70% on the arterial road network and approximately 50% on the freeway network by 2031. This will place significant pressure on roads within the Inner West, such as Francis Street which is forecast to carry up to 10,000 heavy vehicles a day. The forecast truck volumes are presented in Figure 25.

[5] LGAs of Melton, Wyndham, Hobsons Bay, Maribyrnong, Moonee Valley and Brimbank

Figure 24 – 2031 base case (two-way, 24 hour weekday volumes)

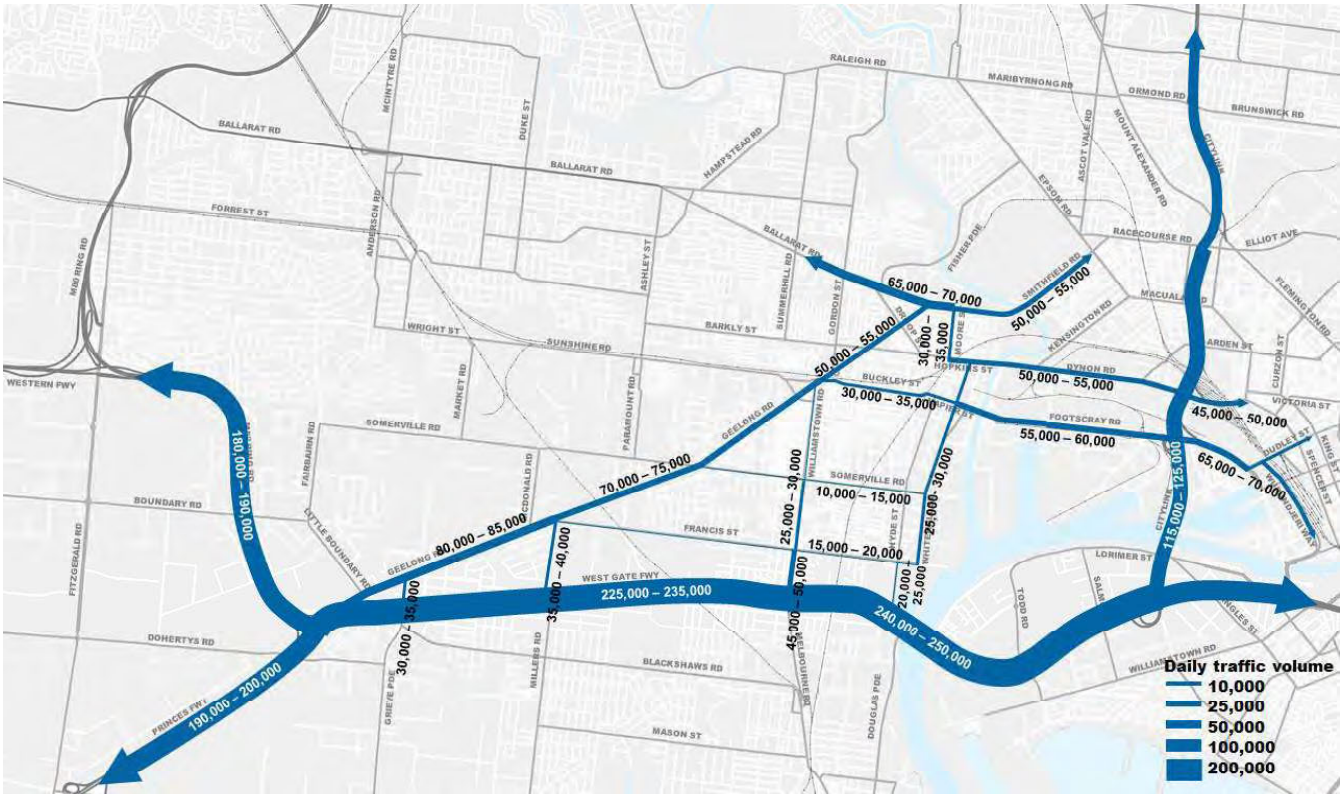


Table 5 - 2014 and 2031 key roads - base case traffic volumes

Road	Daily 2031 traffic volume (two-way)	AM Peak traffic volume (city bound, 7-9am)
Princes Freeway (West of M80)	190,000 - 200,000	11,000 – 13,000
West Gate Freeway (M80 Ring Road to West Gate Bridge)	225,000 - 235,000	14,000 – 16,000
West Gate Freeway (At West Gate Bridge)	240,000 - 250,000	18,500 – 20,500
M80 Ring Road (Western Freeway to West Gate Freeway)	180,000 - 190,000	11,000 - 13,000
CityLink (West Gate Freeway to Footscray Road)	115,000 - 125,000	6,000 – 8,000
Whitehall Street (Between Francis Street and Napier Street)	25,000 - 30,000	2,000 – 3,000
Williamstown Road (Between Somerville Rd and Francis Street)	25,000 - 30,000	1,500 – 2,500
Williamstown Road (Between Francis St and West Gate Freeway)	45,000 - 50,000	2,500 – 3,500
Millers Road (Between Francis St and West Gate Freeway)	35,000 - 40,000	2,500 – 3,500
Grieve Parade (Between Geelong Road and West Gate Freeway)	30,000 - 35,000	2,500 – 3,500
Hyde Street (Between Francis Street and West Gate Freeway)	20,000 - 25,000	2,500 – 3,500
Geelong Road (Between West Gate Freeway and Millers Road)	80,000 - 85,000	6,000 – 7,000
Geelong Road (Between Millers Road and Williamstown Road)	70,000 - 75,000	5,000 – 6,000
Geelong Road (Between Williamstown Road and Ballarat Rd)	50,000 - 55,000	3,500 – 4,500
Ballarat Road (Between Geelong Road and Moore Street)	65,000 - 70,000	4,000 – 5,000
Ballarat Road (Between Moore Street and Epsom Road)	50,000 - 55,000	3,000 – 4,000
Francis Street (between Williamstown Rd and Hyde St)	15,000 - 20,000	1,500 – 2,500
Somerville Road (between Williamstown Rd and Hyde St)	10,000 - 15,000	1,500 – 2,500
Buckley Street (Between Victoria Street and Albert Street)	30,000 - 35,000	1,500 – 2,500
Moore Street (At Donald Road)	30,000 - 35,000	1,500 – 2,500
Dynon Road (At Hopkins Street Bridge)	50,000 - 55,000	4,000 – 5,000
Dynon Road (Between CityLink and Dryburgh Street)	45,000 - 50,000	3,500 – 4,500
Footscray Road (At Shepherd Bridge)	60,000 - 65,000	5,500 – 6,500
Footscray Road (At Dock Link Road)	55,000 - 60,000	5,000 – 6,000
Footscray Road (Between Pearl River Road and Waterfront Way)	65,000 - 70,000	6,000 – 7,000

Figure 25 – 2031 base case (two-way, 24 hour weekday truck volumes)

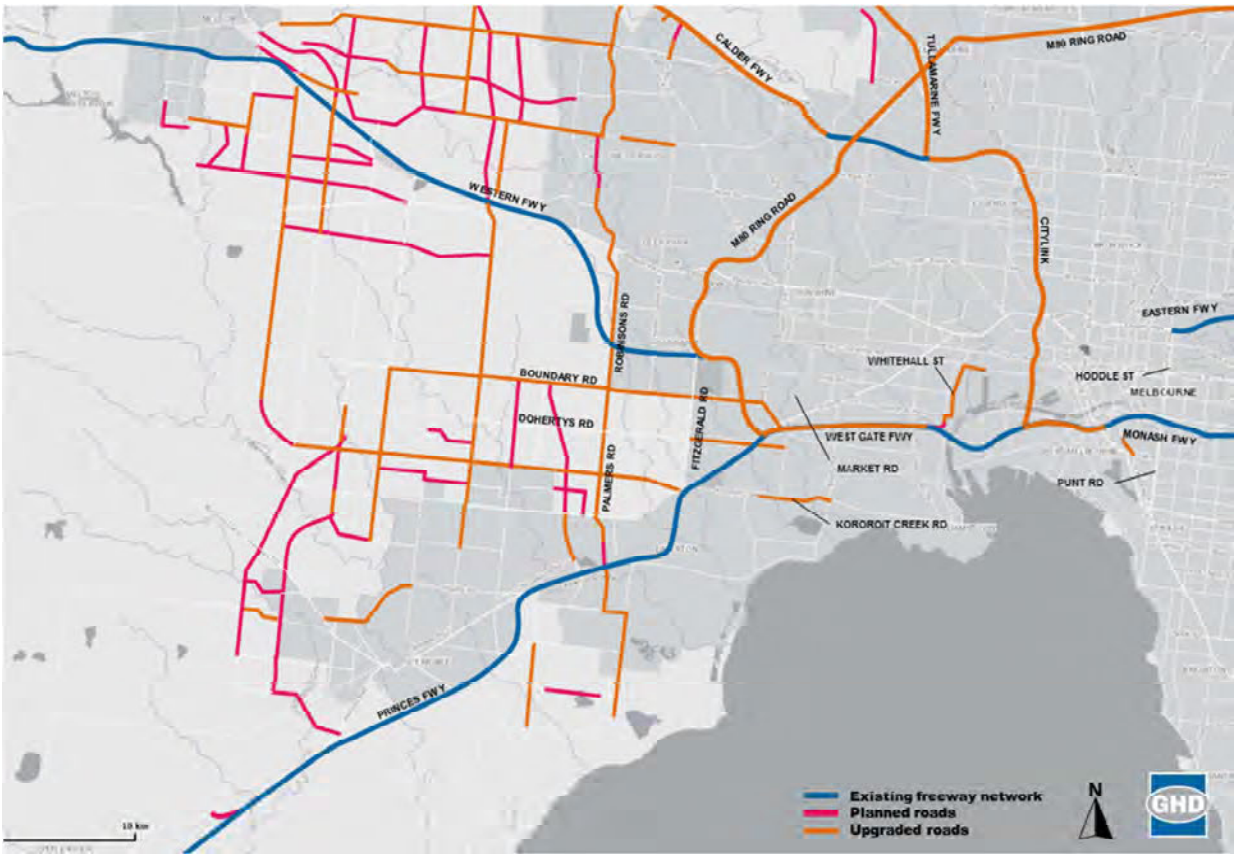
4.1.2 Road network

To accommodate the projected growth in population, the road network in the west is expected to expand, mainly west of the M80 Ring Road. DEDJTR has provided reference cases showing assumed changes in demographics and the transport network. Major changes to the network between 2014 and 2031 include:

- Upgrades to the existing freeway network - West Gate Freeway, Tullamarine Freeway, CityLink (Western Link), M80 Ring Road and Calder Freeway;
- Upgrades and new links in the Inner West, including the West Gate Distributor project with a connection between Hyde Street and the West Gate Freeway and additional lanes on Whitehall Street and Shepherd Bridge; and
- Completion of the Melbourne Metro rail project.

The future 2031 road network under a 'no project' scenario is presented in Figure 26 overleaf.

Figure 26 – Indicative 2031 network



4.1.3 Vehicle speeds

The high demand for road travel in 2031 under a 'no project' scenario is expected to cause increased delays, lower vehicle speeds and subsequently significantly increased travel times. Vehicle speeds during the AM peak are generally expected to decline across the entire road network, in the vicinity of 10 to 20 per cent. On the freeway network between 2011 and a 2031 'no project' scenario, vehicle speeds are expected to:

- Reduce by approximately 30 per cent in the inbound direction on the West Gate Freeway between the M80 Interchange and Williamstown Road.
- Reduce by 5 to 30 per cent in the inbound direction along the entire length of Geelong Road;
- Reduce by approximately 35 per cent in the inbound direction on Ballarat Road across the Maribyrnong River;
- Reduce by approximately 30 per cent in the inbound direction on Dynon Road across the Maribyrnong River; and
- Reduce by approximately 10 per cent in the inbound direction on Footscray Road.

4.1.4 Over reliance on the West Gate Bridge

The distribution of traffic across the Maribyrnong River screenline is not expected to change significantly between 2014 and a 2031 'no project' scenario. The West Gate Freeway will still be expected to carry a high proportion of traffic, with 58 to 61 per cent of all traffic across the Maribyrnong River, as presented in Table 6. The continued reliance on the M1 corridor and the West Gate Bridge means that a single incident will still impact the majority of vehicles trying to cross the Maribyrnong River to and from the west.

Table 6 - Maribyrnong River screenline assessment

River crossing	Number of lanes (inbound)	Percentage of traffic 2031 base case
West Gate Freeway (West Gate Bridge)	5	58% - 61%
Footscray Road (Shepherd Bridge)	3	14% - 16%
Dynon Road (Hopetoun Bridge)	2	12% - 14%
Ballarat Road (Lynchs Bridge)	2	12% - 14%

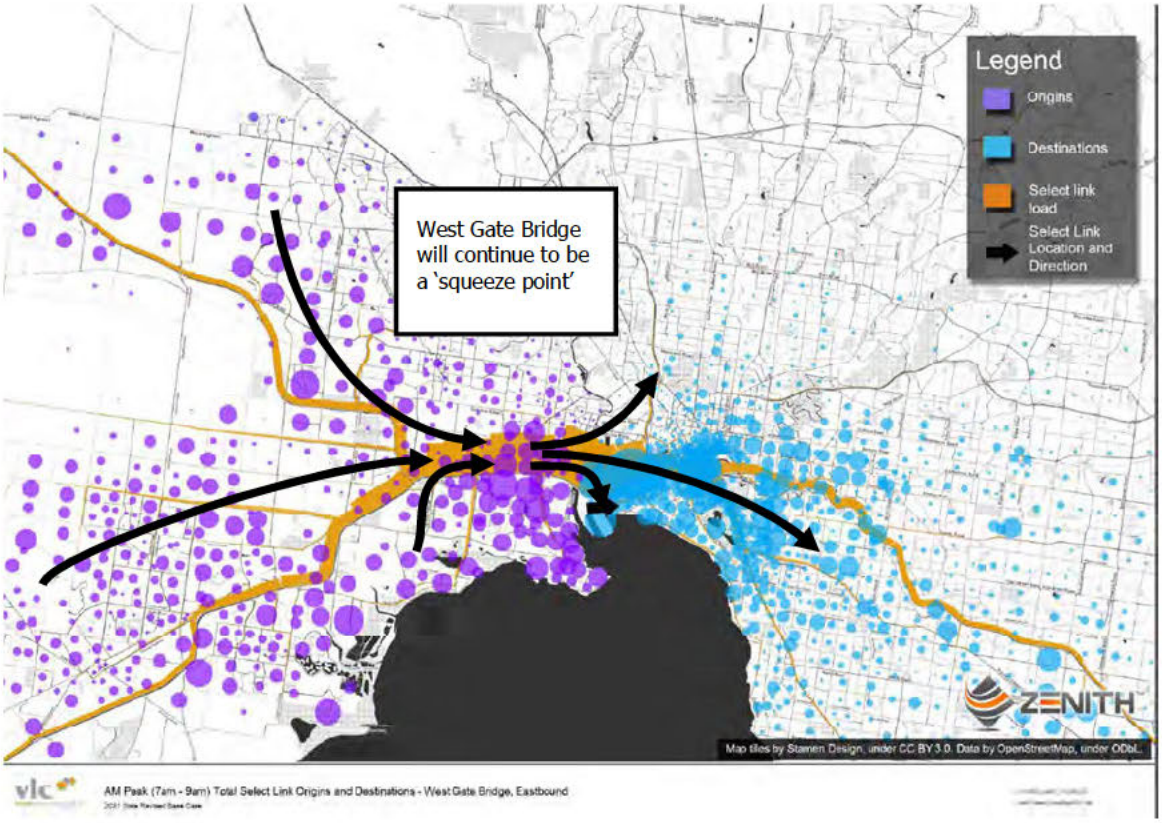
4.1.5 West Gate Bridge origins and destinations

In 2031 the West Gate Bridge will continue to carry the predominant load of trips to and from the west. The origins and destinations of vehicles travelling inbound across the West Gate Bridge during the AM peak period are presented in Figure 27. It highlights the high reliance placed on the West Gate Bridge in providing access between the western / north-western suburbs and the city, inner north and south-eastern suburbs.

The origins of vehicles on the West Gate Bridge, represented as purple circles are from a widely dispersed area, from the Princes Freeway in the west and the M80 Ring Road and Western Highway to the north-west. The destinations (represented as blue circles) are also equally dispersed as their origins.

This image depicts how the West Gate Bridge acts as a 'squeeze point', carrying movements to/from all over the metropolitan area. Accordingly, under a 'no project' scenario, in 2031 Melbourne will continue to not only be highly vulnerable to incidents along this corridor, but will also experience congestion in the precincts directly east and west of the West Gate Bridge as traffic channels to and disperses from this squeeze point.

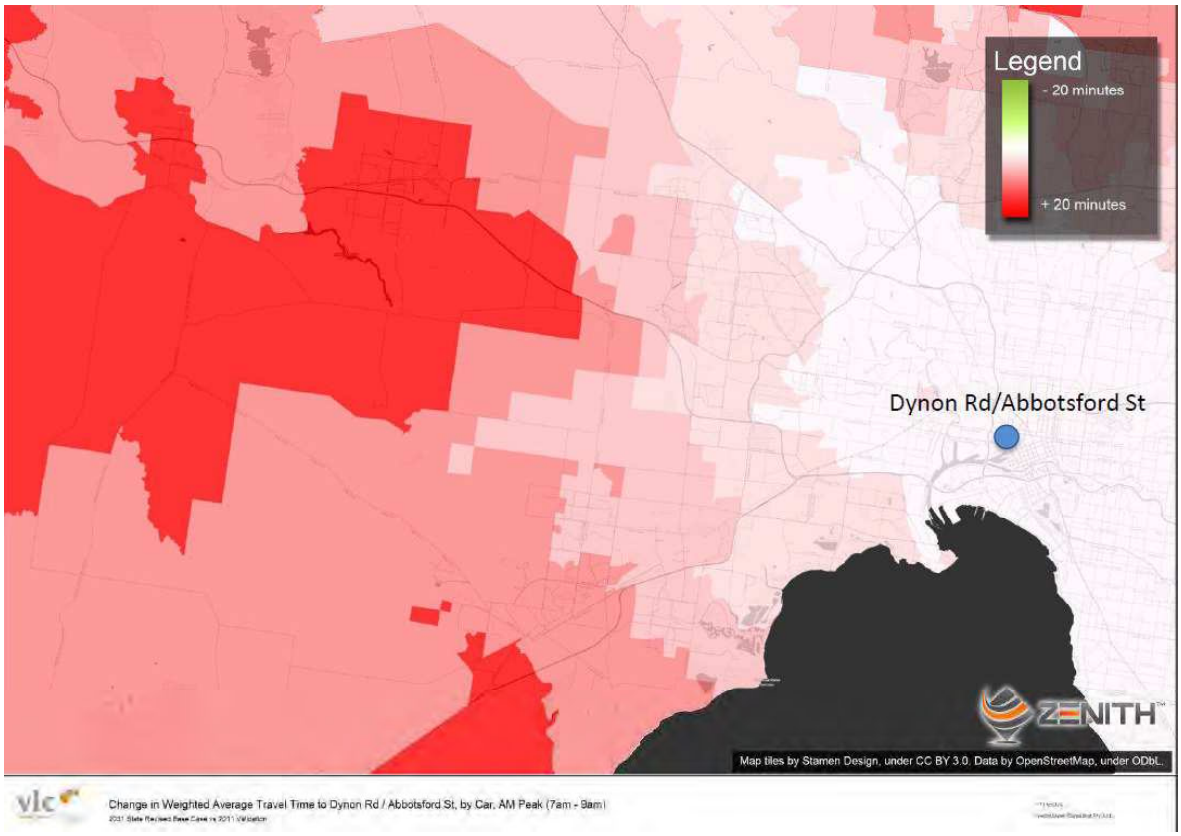
Figure 27 - Origins and destinations of vehicles using the West Gate Bridge during the AM peak (inbound) – 2031 base case



4.1.6 Travel times

Under a 2031 'no project' scenario, travel times to the city are expected to increase significantly, with the network unable to accommodate the projected growth, especially in the outer west growth areas. Figure 28 presents the estimated change in weighted average travel times between 2011 and a 2031 'no project' scenario for vehicles with a destination to the inner west of the CBD. It highlights that travel times are expected to be up to 20 minutes longer during the AM peak between the west and the city, with the greatest increases in travel times to the south of the Western Freeway / Highway and south of the Princes Freeway. Travel times are expected to increase broadly across the wider western and north-western suburbs.

Figure 28 - Change in AM peak travel times between 2031 base and 2011 to west of CBD



5. Proposed project

5.1 Overview of link

5.1.1 Transurban Proposal

Under the State Government's market-led proposal framework, Transurban, the operator of CityLink has proposed the Western Distributor project. The new tolled link will connect the West Gate Freeway to the Port of Melbourne, CityLink and the central business district. The March 2015 proposal can be broken down into three components:

- A tunnel connecting the West Gate Freeway near Williamstown Road with the Port of Melbourne and CBD and an elevated motorway over the Maribyrnong River and Footscray Road;
- Widening of the West Gate Freeway with additional lanes from the M80 Ring Road to the West Gate Bridge; and
- Improvements to the Webb Dock access including upgrading Cook Street and the West Gate Freeway to Bolte Bridge ramp.
- A map showing the proposed alignment is presented in Figure 29 overleaf.

Figure 29 – Proposed Western Distributor alignment

Source: Transurban

5.1.2 State Government business case concept

In response to Transurban's marked led proposal, the State Government has developed a State business case concept for the Western Distributor project. This concept is the design which the Transurban proposal can be benchmarked against. This concept will not necessarily be the final alignment and connection options for the project and may be amended based on further discussions with stakeholders.

The initial concept alignment provides a connection from the West Gate Freeway towards the City, the Port of Melbourne and CityLink through a combination of tunnel, at grade and elevated road sections.

An overview of the State Government business case concept is presented in Figure 30 and Figure 31 overleaf. Key features of the project include:

Table 6 - Western Distributor Business Case Concept Scope

Project Component	Description
West Gate Freeway - Widening	Widening, associated pavement rehabilitation and carriageway separation of the West Gate Freeway in both directions to provide overall capacity of 6 lanes each direction (additional 2 lanes each way) between Williamstown Road and M80 configured as 3 lanes on each of the separated carriageways. Separated carriageways with braided connections with the following features: – Eastbound – The outer carriageway destined for the Western Distributor and inner carriageway destined for the West Gate Bridge with grade separated connections at each end as well a flyover connection from the outer to inner carriageway near the standard gauge freight railway overpass (west of Williamstown Road). Arterial road connections provided along the outer carriageway. – Westbound – The outer carriageway destined for M80 and the central carriageway destined for Princes Freeway West grade separated connections to both carriageways from the Western Distributor and the West Gate Bridge. Williamstown and Millers Road access via the outer carriageway and Grieve Parade access from the central carriageway via a braided flyover of the M80 carriageway. Strengthening of bridges along the West Gate Freeway to 75% SM1600 to accommodate High Productivity Freight Vehicles (HPFV) at higher mass limits Separation of carriageways via solid safety barrier, provision of emergency lanes in the central carriageways and stopping bays along the outer carriageways Posted speed of 100km/h from M80 to west of Williamstown Road Replacement of two existing pedestrian bridges spanning over the West Gate Freeway in the vicinity of Wembley Avenue and Rosala Avenue Upgrade noise walls along the West Gate Freeway with concrete and Perspex noise walls

Project Component	Description
Western Distributor – Yarraville alignment (including tunnel)	Connections between the West Gate Freeway and the tunnel portals and rebuilding of the Williamstown Road interchange bridges New west-facing ramps for vehicles to access Hyde Street from the elevated connection Two 15.5m diameter bored, 1.6km tunnels ultimately catering for three traffic lanes in both directions, operating only as two lanes with shoulders initially, using a single tunnel boring machine Southern portal on the north side of the West gate Freeway near Hyde Street Northern portal east of Whitehall Street, north of Somerville Road, west of the Maribyrnong River
Western Distributor – Elevated road and port access	Single span bridge across the Maribyrnong River Direct access to the Port of Melbourne at Mackenzie Road (to/from West Swanson Dock) Viaducts in both directions above Footscray Road Eastbound viaduct connection to Appleton Dock Road at the existing intersection with Footscray Road (to access East Swanson Dock, Victoria Dock, Appleton Dock) with a return westbound viaduct connection from Footscray Road Grade separated shared user facility at Appleton Dock Road, Footscray Road and Mackenzie Road intersections
Webb Dock Access	Single lane widening of Cook Street (Eastbound) from Todd Road to the West Gate Freeway ramp terminal intersection. Dedicated new connection and an upgrade to the West Gate Freeway-to-CityLink northbound ramp(Ramp M) including widening for ramp metering, realignment and regrading along the ramp and signalisation of the Cook Street/Salmon Street intersection.
Western Distributor – Eastern interchange	Inbound and Outbound: Connections to CityLink via modified Dynon Road ramps Access via ramps onto Footscray Road with additional connections to Dynon Road and Wurundjeri Way. Final resolution of scope will include consultation with Melbourne City Council, other stakeholders and the community.

Figure 30 – Western Distributor – State Preferred Concept

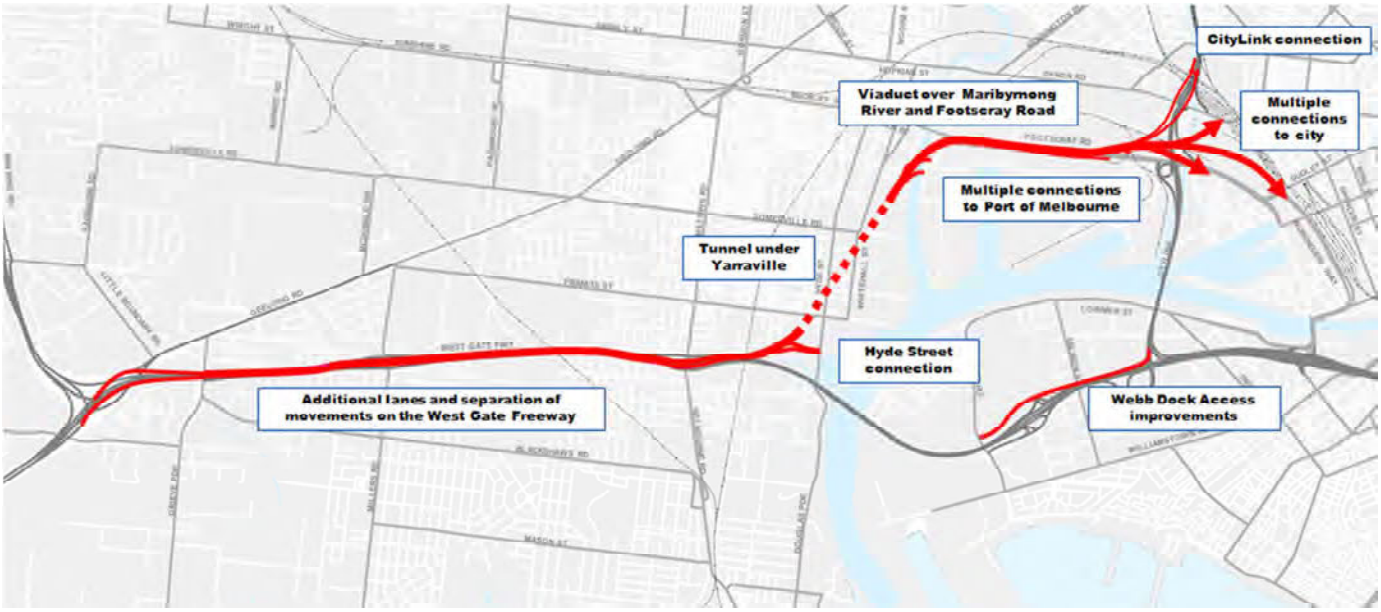
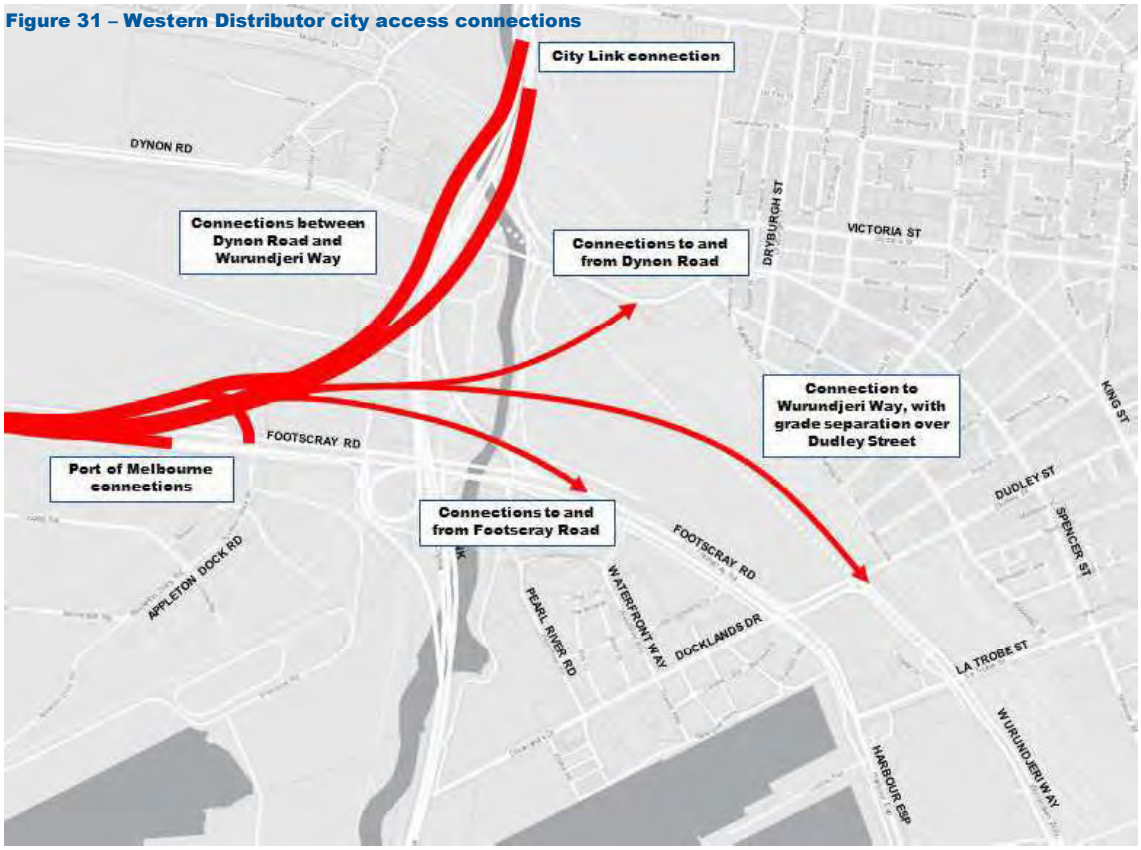


Figure 31 – Western Distributor city access connections



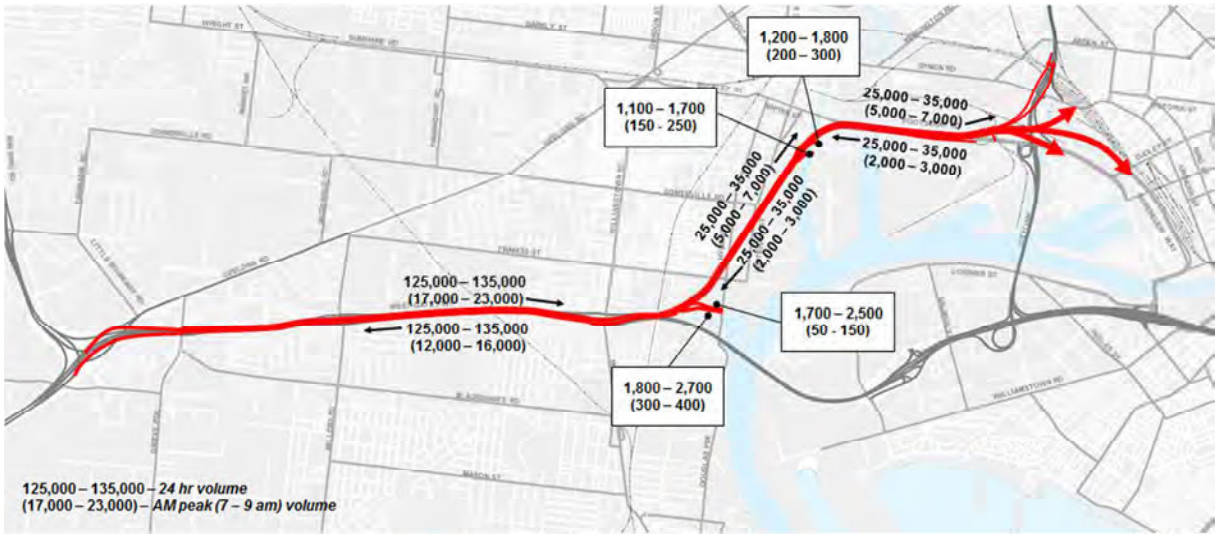
6. Future network 2031 (with project)

6.1 Traffic volumes

The Western Distributor is forecast to carry approximately 50,000 to 70,000 vehicles per day across the Maribyrnong River by 2031.

A summary of the forecast 2031 traffic volumes on the new road links is presented in Figure 32.

Figure 32 - Western Distributor - forecast 2031 volumes

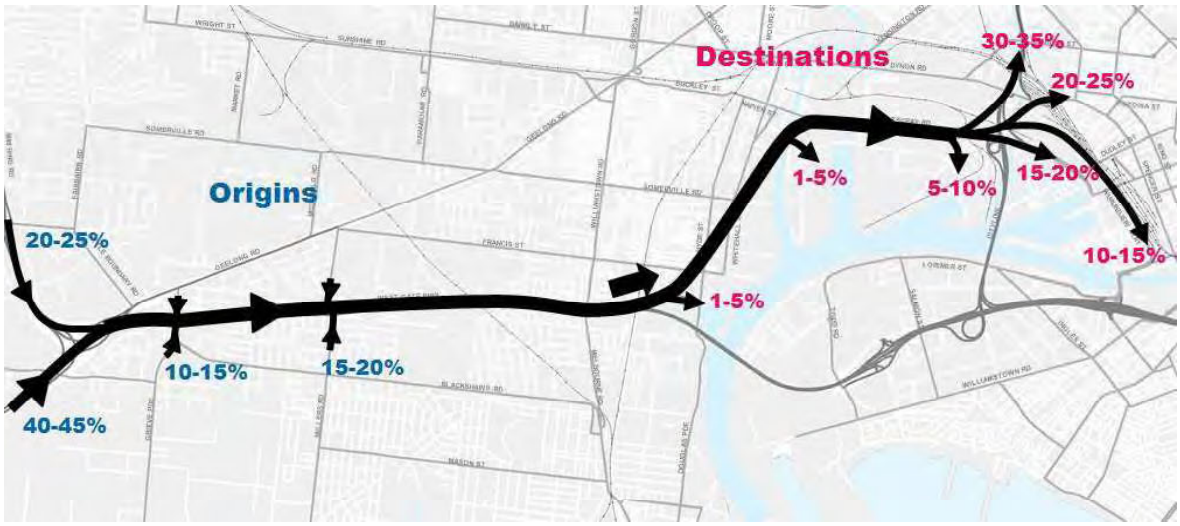


Note: Mackenzie ramps are commercial vehicles only

The majority of vehicles expected to use the Western Distributor originate from the outer western suburbs, with 20 to 25 per cent of vehicles in the AM peak coming from the M80 Ring Road or Deer Park Bypass and 40 to 45 per cent of vehicles coming from the Princes Freeway. 25 to 35 per cent of vehicles originate from the Inner West via Millers Road and Grieve Parade. The origins and destinations of inbound traffic on the Western Distributor during the AM peak are presented in Figure 33.

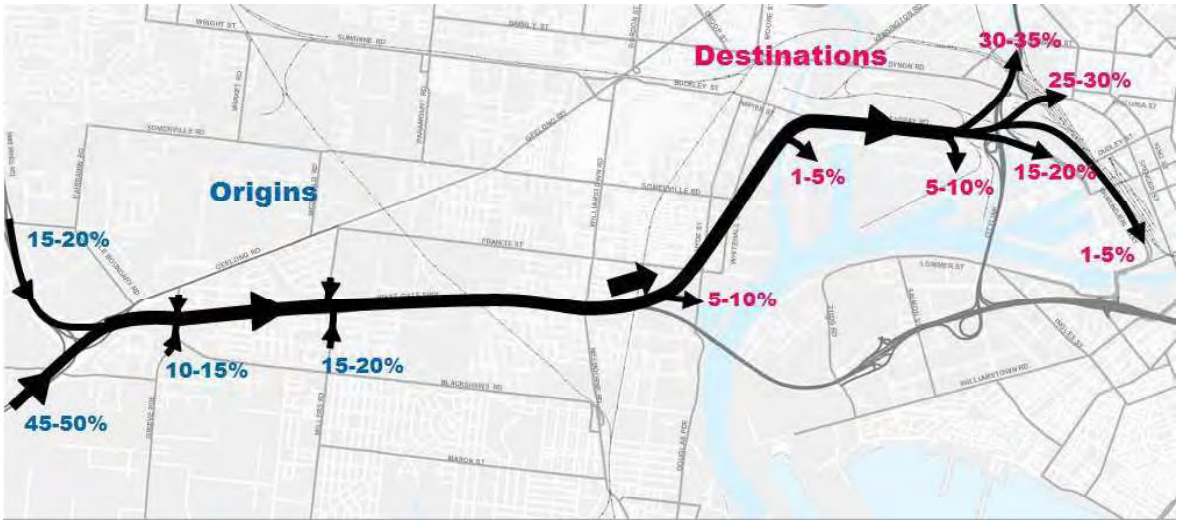
The figure shows that a high proportion of vehicles in the AM peak travel the entire length of the Western Distributor, exiting at the either the Eastern Interchange (30-35 per cent), Dynon Road (20-25 per cent), Footscray Road (15-20 per cent) or the Wurundjeri Way extension (10-15 per cent). While volumes on the Hyde Street connection are lower than other exits, it is nevertheless a vital connection which will allow placarded loads to travel between the fuel refineries in Yarraville and the M1 corridor. These vehicles are unable to use the Western Distributor tunnel and would otherwise be required to travel along residential sections of Francis Street and Williamstown Road.

Figure 33 - Origins and destinations of Western Distributor traffic – inbound AM peak (7-9am)



The distribution of traffic across the exit ramps on the Western Distributor do not change significantly over a 24 hour period compared to the AM peak. The 24 hour origins and destinations presented in Figure 34, which shows that there is less traffic using the Wurundjeri Way extension outside the AM peak period (due to lower levels of congestion on the rest of the road network). Additionally, as a high proportion of traffic using the Hyde Street connection are placarded loads, which typically travel outside the AM peak period.

Figure 34 - Origins and destinations of Western Distributor traffic – inbound (24 hrs)



6.2 Network impacts and performance

The Western Distributor will add additional network capacity for trips across the Maribyrnong River screen line and will help to relieve the pressure on the West Gate Bridge, Footscray Road, Dynon Road and Ballarat Road. A summary of the changes in volumes between the 2031 base case (i.e. no project) and the 2031 project case is presented in Figure 35.

Based on strategic modelling (accounting for tolling scenarios), traffic is expected to:

- Decrease on the West Gate Bridge and CityLink on the Bolte Bridge;
- Decrease on the parallel routes of Geelong Road, Ballarat Road, Footscray Road and Dynon Road west of CityLink;
- Decrease on the Inner West arterial road network of Francis Street, Somerville Road, Buckley Street and Whitehall Street.
- Decrease on arterial roads within the CBD and West Melbourne;
- Increase at the western end of the Western Distributor, with traffic volumes increasing along the West Gate Freeway between the M80 Ring Road and Williamstown Road (the upgraded section) and increase marginally on the M80 Ring Road and Princes Freeway; and
- Increase at the eastern end of the Western Distributor including CityLink north of Footscray Road, Wurundjeri Way and Dynon Road east of CityLink.

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Figure 35 - Change in total daily traffic volume between 2031 base case vs 2031 project case (24 hour average weekday model volumes)

The previous diagram shows the change in volume as a direct output from the model. Elsewhere in this report, volumes are reported in ranges to reflect the level of uncertainty of forecasting future scenarios out to 2031.

By 2031, the Western Distributor will remove approximately 16,000 to 22,000 vehicles per day from the West Gate Bridge and approximately 9,000 to 13,000 vehicles per day from Geelong Road (between Grieve Parade and Francis Street) compared to a 'no project' scenario.

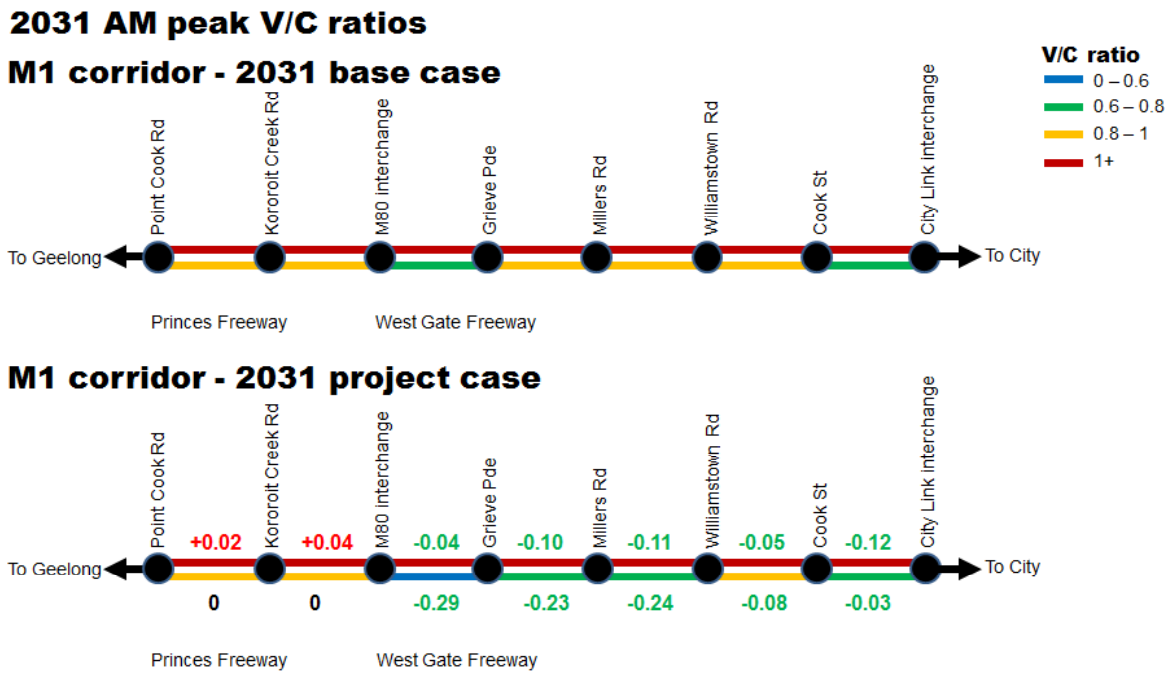
6.2.1 M1 corridor

In the 2031 project case, in addition to increasing the traffic capacity along the corridor, the Western Distributor will also generally improve performance of the M1 corridor. However, when considering only the AM peak period, the M1 corridor will still be over capacity (i.e. VC ratio greater than 0.8) in the eastbound direction (as presented in Figure 36).

Performance should improve between the M80 interchange and the CityLink interchange, however V/C ratios are expected to increase between Point Cook Road and the M80 Interchange.

In the outbound (westbound) direction, V/C ratios are expected to be less than 1, with large improvements in performance between CityLink and the M80 interchange, largely due to the addition of two lanes in each direction.

Figure 36 – M1 corridor V/C ratios



6.2.2 M80 Ring Road and Western Freeway

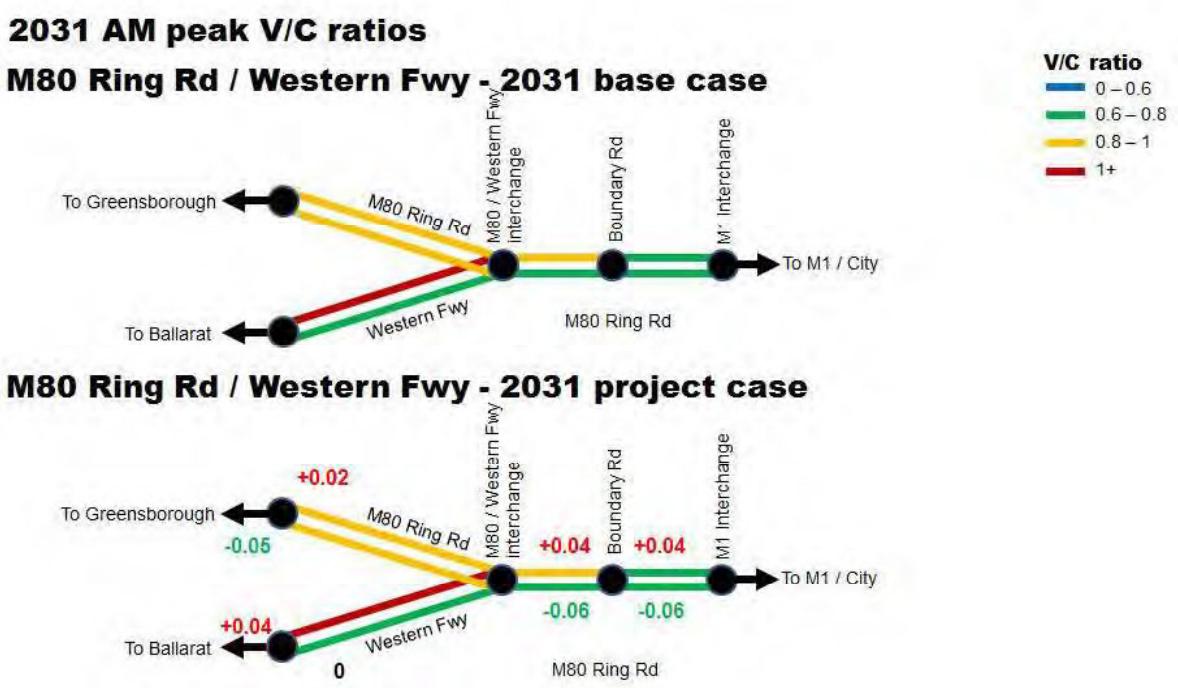
By 2031, the M80 Ring Road and Western Freeway are both expected to be over capacity during the AM peak. There is not expected to be significant change in performance between the base and project case (presented in Figure 37).

The southbound carriageway (towards M1) of the M80 Ring Road will be at or over capacity (i.e. VC ratio greater than 0.8) by 2031, with a slight increase in traffic in the project case between the Western Freeway and the M1 interchange.

The northbound carriageway (towards Greensborough) of the M80 Ring Road will remain under capacity between the M1 interchange and the Western Freeway interchange with a slight decrease in traffic in the project case.

There will be minimal change in the performance of the Western Freeway.

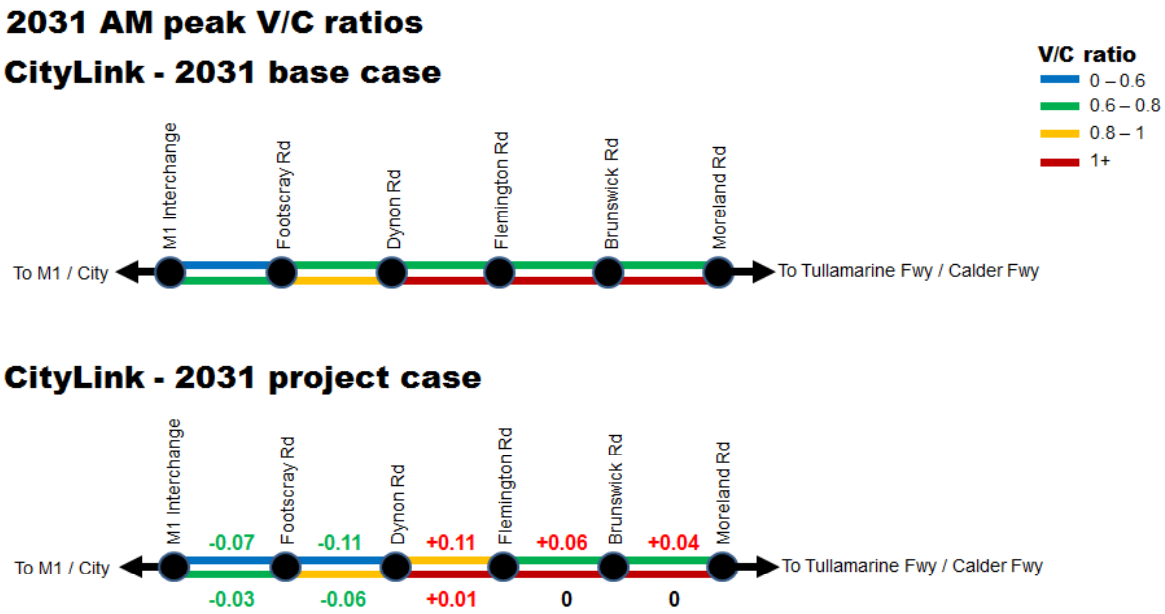
Figure 37 – M80 Ring Road and Western Freeway V/C ratios



6.2.3 CityLink (Western Link)

By 2031, CityLink will be overcapacity during the AM peak in the southbound direction and nearing capacity northbound. There will be an increase in V/C ratios north of Footscray Road in both directions between the base and project case, and a decrease in V/C ratios between the M1 interchange and Footscray Road. The decrease in traffic between the M1 and Footscray Road is most likely due to the redistribution of traffic destined/originating from north of CityLink onto the Western Distributor.

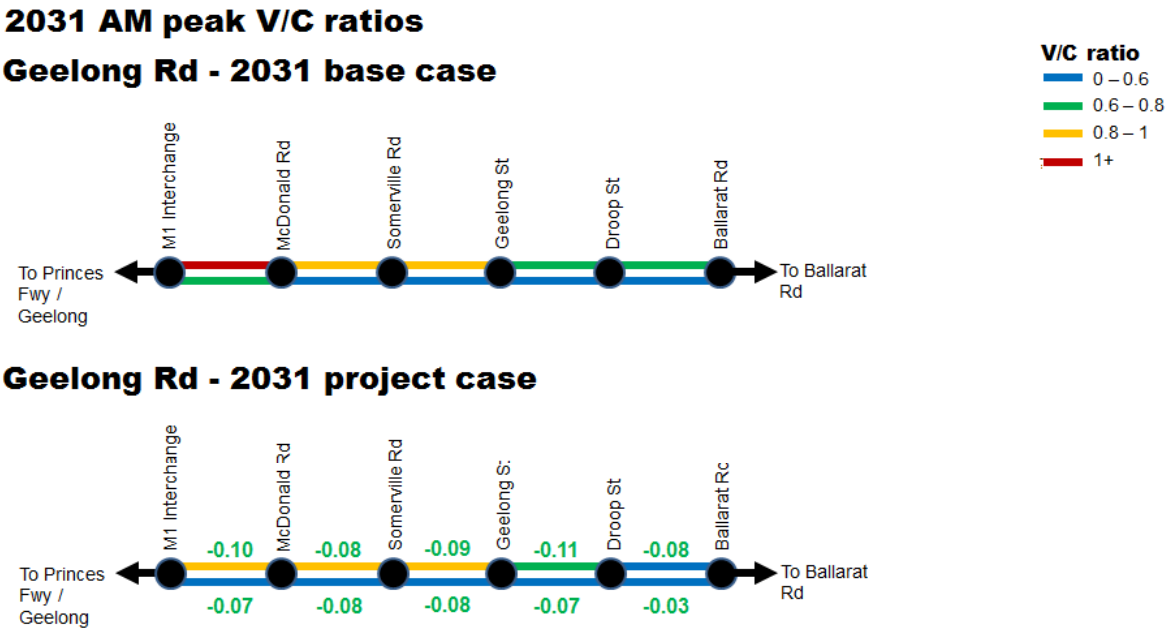
Figure 38 – CityLink V/C ratios



6.2.4 Geelong Road

By 2031, Geelong Road will be over capacity between the M1 and Geelong Street during the AM peak. V/C ratios are expected to decrease in both directions due to the redistribution of traffic away from Geelong Road and onto the Western Distributor.

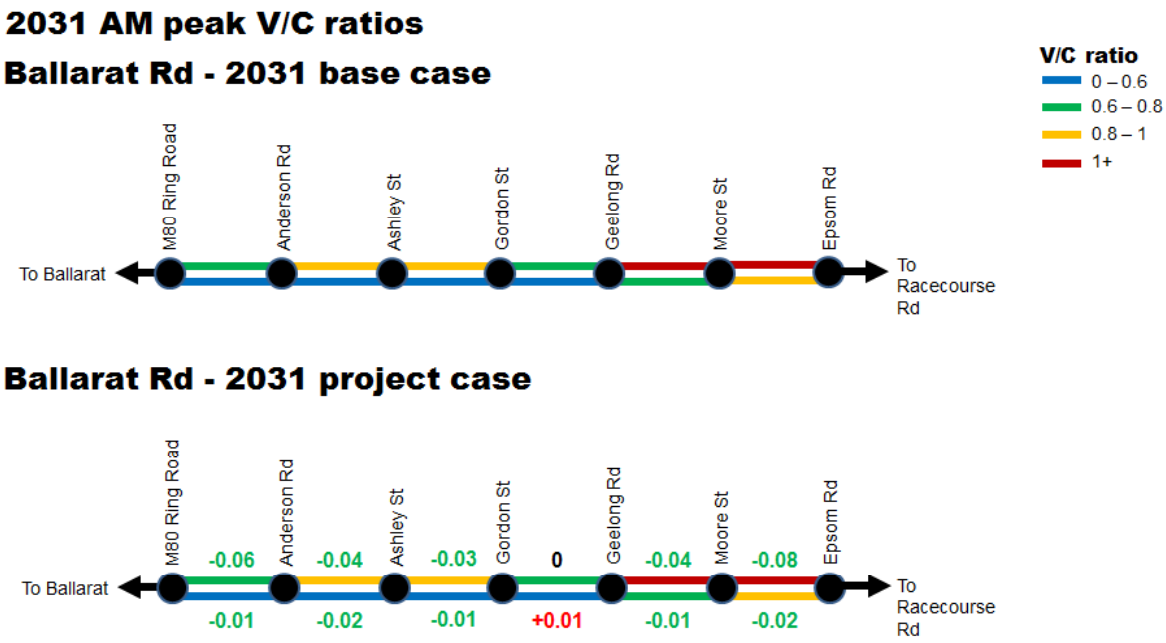
Figure 39 – Geelong Road V/C ratios



6.2.5 Ballarat Road

By 2031, Ballarat Road in the eastbound direction will be at or near full capacity during the AM peak. The Western Distributor is expected to redistribute traffic away from Ballarat Road to the Western Distributor. V/C ratios are expected to decrease slightly along the majority of Ballarat Road.

Figure 40 – Ballarat Road V/C ratios



6.2.6 Users of the Western Distributor - origins and destinations

The Western Distributor will provide an additional crossing of the Maribyrnong River, reducing the reliance on the West Gate Bridge 'squeeze point'. Figure 41 and Figure 42 present the origins and destinations served by both the Western Distributor and the West Gate Bridge, respectively.

Both the Western Distributor and West Gate Bridge will serve similar catchments in the west, however some of the key benefits of the project are evidenced by the catchments served east of the Maribyrnong River.

The Western Distributor provides access to and from the city, the Swanson precinct of the Port of Melbourne, and the inner north. The majority of vehicles using the Western Distributor do not have destinations south of the CBD.

In contrast, the West Gate Bridge provides access to and from the city, the Webb Dock precinct of the Port of Melbourne, areas to the south of the city and the southeast, with a limited number of users of the West Gate Bridge with destinations in the north.

Figure 41 - Origins and destinations of vehicles using the Western Distributor tunnel during the AM peak (inbound) – 2031 project case

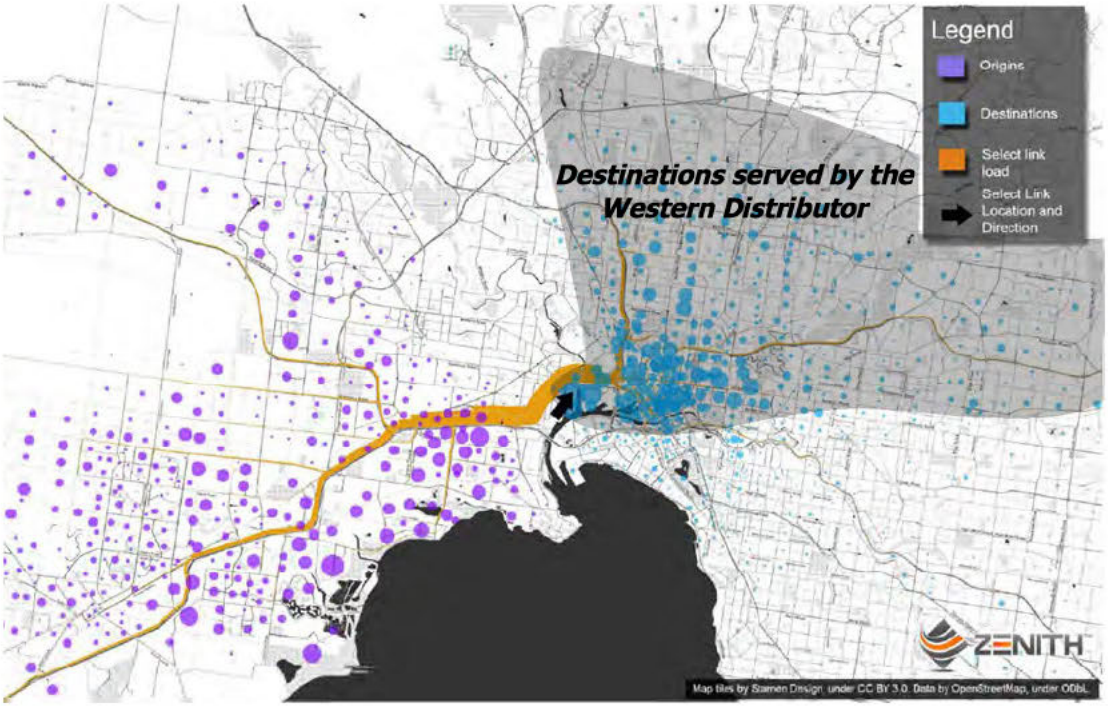
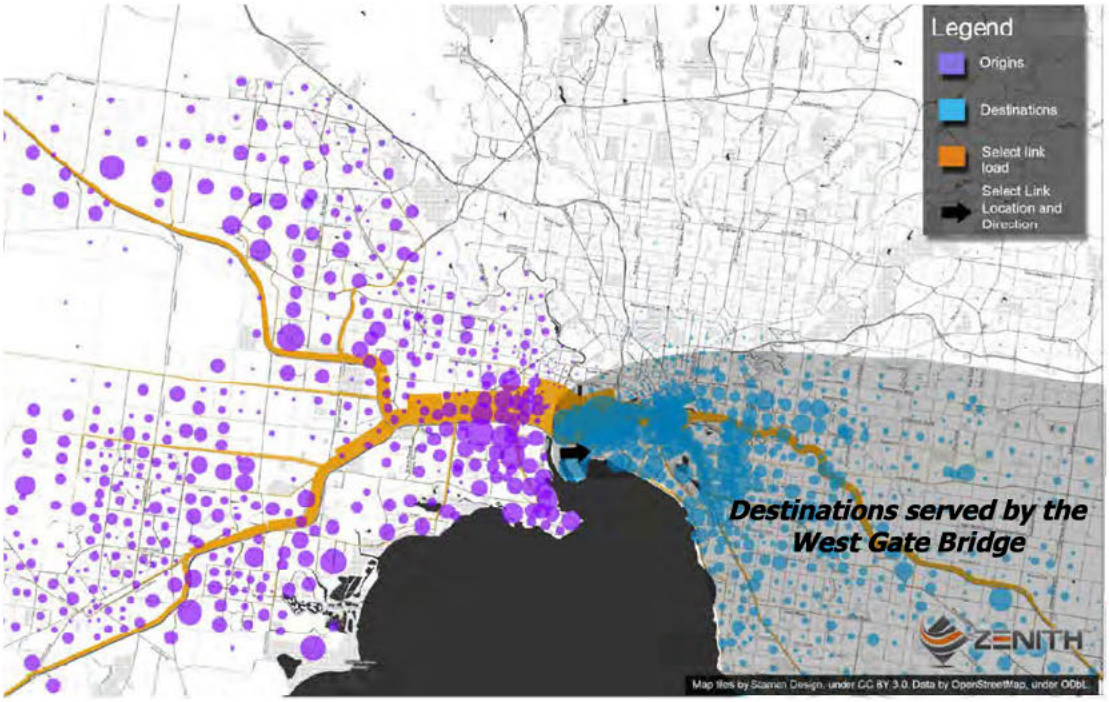


Figure 42 - Origins and destinations of vehicles using the West Gate Bridge during the AM peak (inbound) – 2031 project case



6.2.7 Travel time savings

The Western Distributor will provide benefits for vehicles travelling between the west and the city, the Swanson precinct of the Port of Melbourne, and the inner north by providing more reliable travel times (i.e. reducing the fluctuations in travel time on a day-to-day basis) and by reducing travel times across the western transport corridor. This will be achieved through a combination of:

- Increased lane capacity enabling more traffic to flow through the corridor;
- Collector-Distributor arrangement along the Freeway reducing the turbulence created by merge and weave movements;
- Two carriageway arrangement reducing the exposure to incidents that occur downstream of the Western Distributor (for example, if there is an incident on the West Gate Bridge, only the three inbound lanes on the Freeway approaching the West Gate Bridge would be affected, while the three lanes in the outer carriageway which serve the arterial roads and the Western Distributor tunnel would continue to flow); and
- Provision of Freeway Management System to manage and control traffic entering and travelling along corridor to optimise traffic flow under varying conditions.

By 2031, it is estimated that a trip starting from Grieve Parade on the West Gate Freeway and ending at the Footscray Road and CityLink interchange (route A to B in Figure 43) will be on average 7 to 12 minutes quicker via the Western Distributor in the AM peak compared to a West Gate Freeway and CityLink route in a 'no project' scenario. This saving could be as high as 20 minutes.

The project is also expected to provide travel time benefits to the wider freeway network compared to the 2031 base case. Travel time benefits are expected in the AM and PM peak periods of approximately 2 to 4 minutes on average on the West Gate Freeway between Grieve Parade and Montague Street. While this number may seem small, it does represent an increase in average speed in the order of 5 km/hr and when this is considered with the high volumes that use this corridor in the AM peak, these benefits are significant. Further, compared to the maximum travel times recorded along the West Gate Freeway, this could represent up to a 28 minute travel time saving.

A summary of changes in average travel times between 2014, the 2031 base case and the 2031 project case is presented in Table 7. It is noted that these average travel times do not reflect the additional improvements to travel time reliability that are also anticipated under the 'project case'.

Figure 43 - Travel time routes

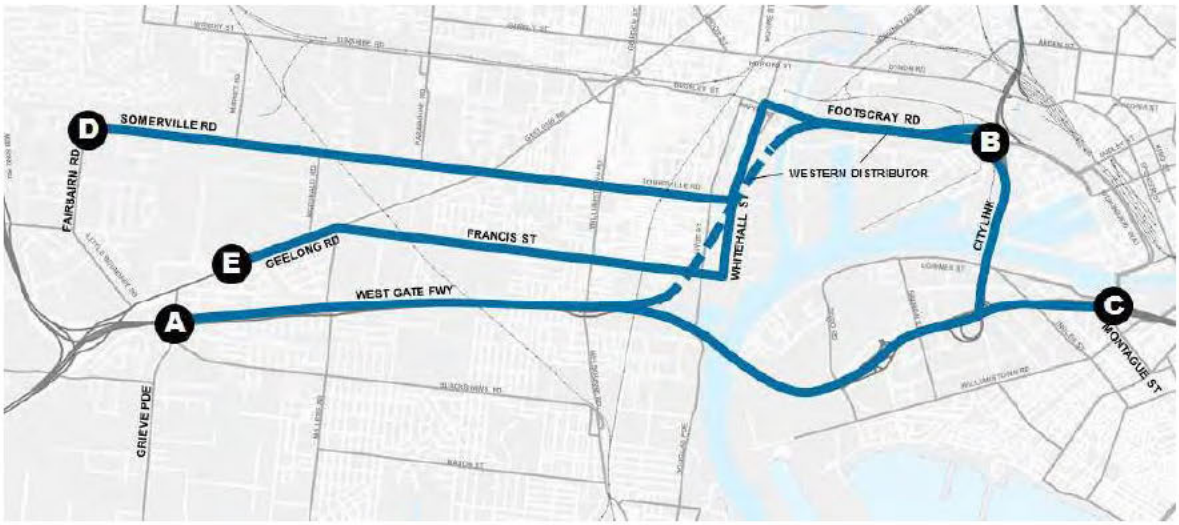


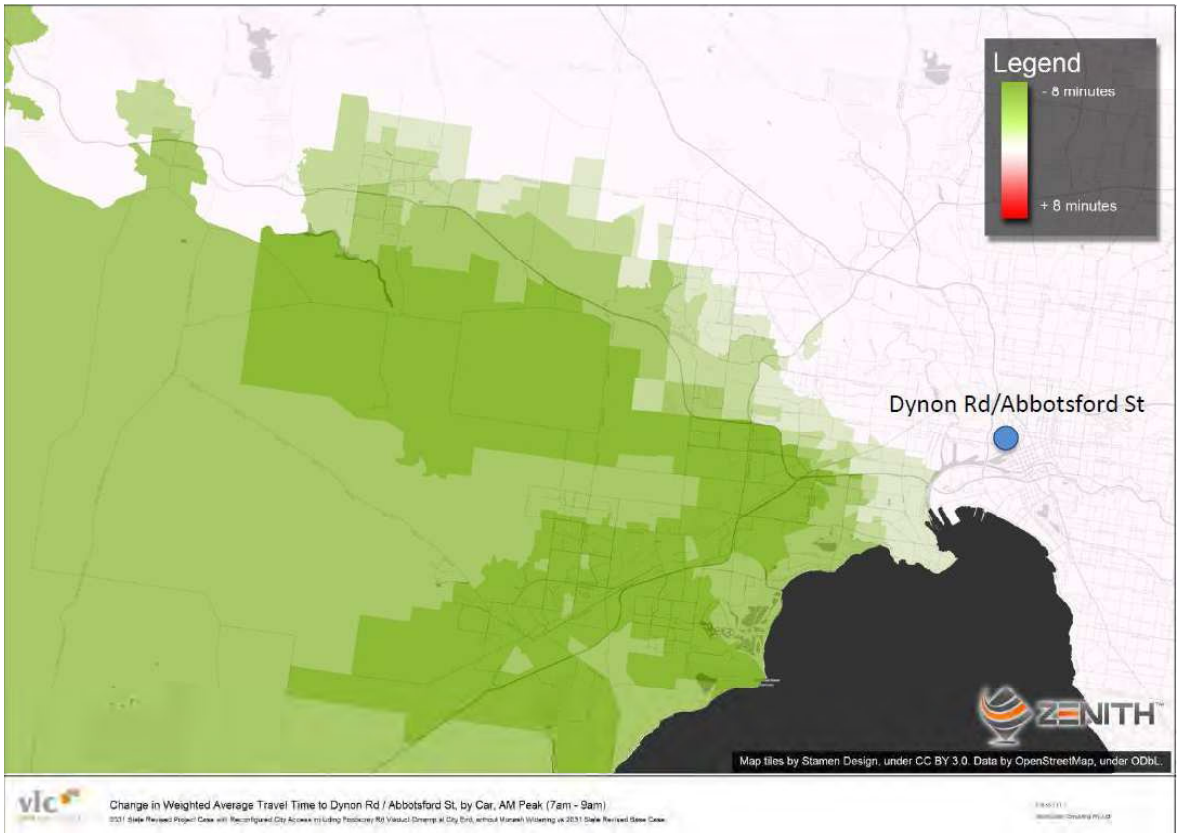
Table 7 - 2031 base and project case average travel times

Route	Direction	Time period	2014	2031 base case#	2031 project case#	Travel time benefit (2031 project vs base)	Change in speed (2031 project vs base)
A to B	Inbound	AM	14 – 26 min	17 – 30 min	10 – 18 min	7 to 12 min via Western Distributor	15 km/hr
	Outbound	PM	10 – 14 min	12 – 17 min	7 – 11 min	5 to 7 min via Western Distributor	20 km/hr
A to C	Inbound	AM	8 – 19 min	10 – 23 min	8 – 19 min	2 to 4 min	5 km/hr
	Outbound	PM	8 – 19 min	10 – 22 min	8 – 19 min	2 to 3 min	5 km/hr
D to B	Inbound	AM	19 – 28 min	22 – 33 min	19 – 29 min	3 to 4 min	5 km/hr
	Outbound	PM	17 – 31 min	20 – 37 min	18 – 33 min	2 to 4 min	5 km/hr
E to B	Inbound	AM	14 – 22 min	17 – 27 min	15 – 23 min	2 to 4 min	5 km/hr
	Outbound	PM	14 – 24 min	17 – 29 min	15 – 25 min	2 to 4 min	5 km/hr

#The range of travel times represented do not indicate the expected travel time variability. Future 2031 travel times have been based on 2014 observed data. It is likely that in future years, the variability will increase, This is discussed in the further in the next section.

Compared to a 2031 'no project' scenario, the Western Distributor project is expected to improve travel times between the west and the city. Figure 44 presents the estimated change in weighted average travel times for vehicles with a destination to the west of the CBD. It highlights that travel times are expected to be faster during the AM peak between the west and the inner west of the CBD, with the greatest travel time benefits achieved for vehicles with origins near the freeway corridors of the Princes Freeway, M80 Ring Road and Western Freeway.

Figure 44 - Change in AM peak travel times between 2031 base and 2031 project case to west of CBD



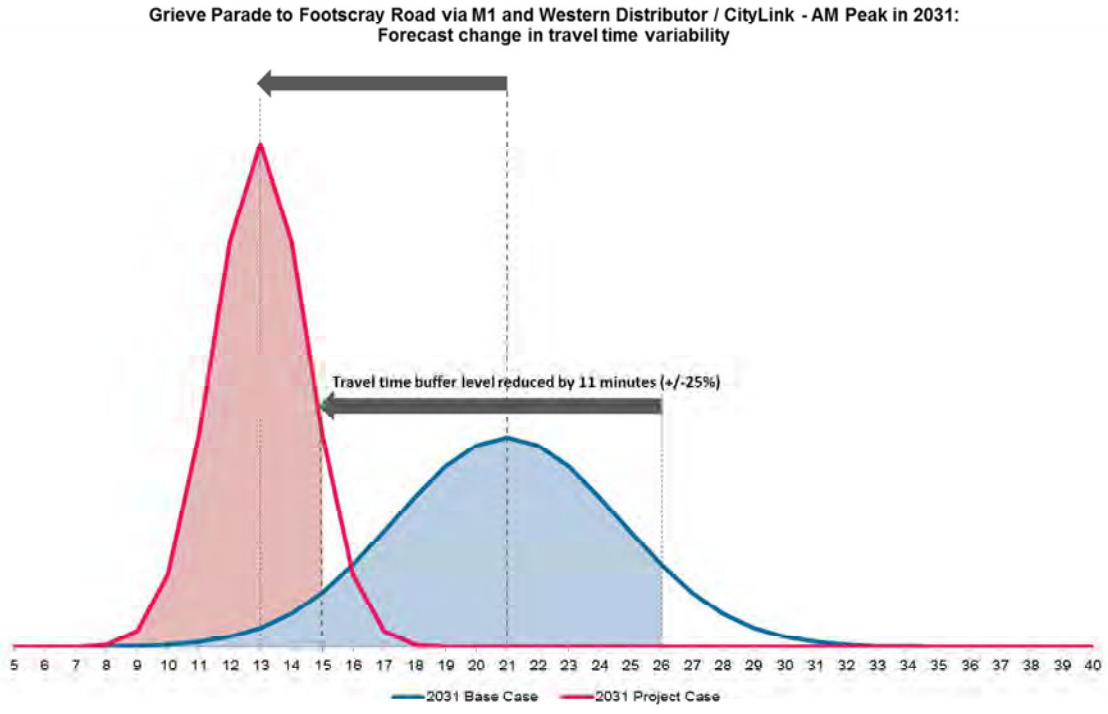
6.2.8 Travel time reliability

With the addition of the project it is expected that the variability in travel time will also reduce. The travel time variability is affected by many factors such as demand, congestion and operational issues. With the addition of the project and the related increased capacity, reduction in over-reliance on the West Gate Bridge and the separation of traffic flows it is expected that there will be significant reductions in travel time variability, thereby providing more reliability in the expected travel times during peak periods.

Modelling analysis (presented in Figure 45) suggests that to travel from Grieve Parade to Footscray Road via the M1 and Bolte Bridge in 2031 without the project, the average travel time would be around 21 minutes. However due to the expected variability in travel time due to the congested conditions, drivers would need to allow 26 minutes to have confidence that they would reach their destination in time. With the addition of the Project, this travel time variability reduces. With the same level of confidence, drivers can now allow only 15 minutes to reach their destination. This is an overall reduction in travel time variability of 11 minutes.

Travel time variability as shown in Figure 45 is represented by the width and height of the travel time distributions. The taller peak in the 2031 project case (pink curve) compared to the 2031 base case (blue curve) means that a higher number of trips in the project case are expected to be completed close or near to the average travel time. This means that in a scenario with the Western Distributor, a trip not only be faster, but is also more likely to take the same amount of time each day.

Figure 45 - 2031 base vs project case – change in travel time variability

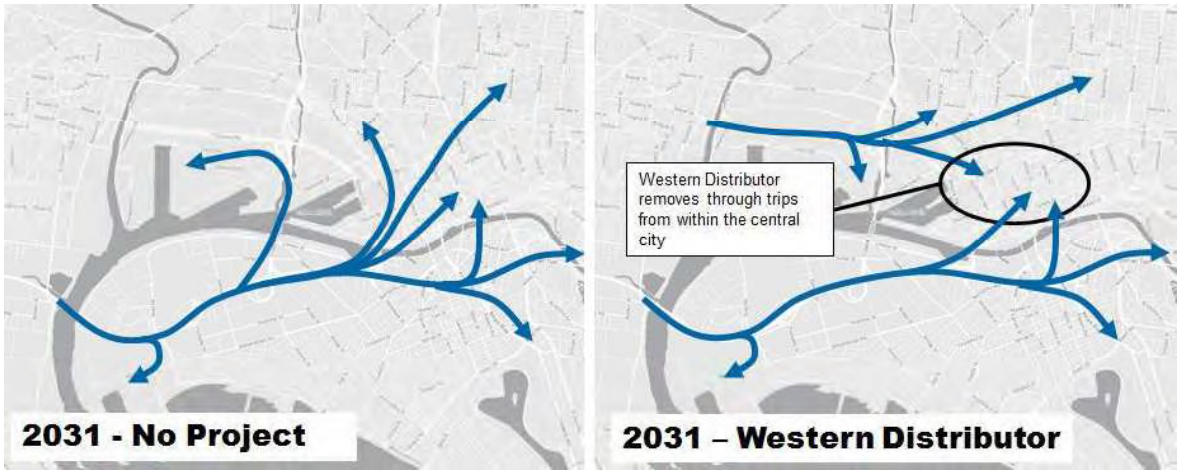


6.2.9 Accessing Central Melbourne and surrounds

The Western Distributor provides a new crossing of the Maribyrnong River and by doing so disperses and separates traffic travelling between the western suburbs, the city and north of the city from trips between the western suburbs, the city and southeast of the city. It also separates freight trips to and from Swanson Dock from those that will access Webb Dock.

A key benefit is that the Western Distributor removes through trips from within the central city that would otherwise have used inner city arterial roads to travel between the West Gate Freeway and the inner north. With the project, trips destined for the north city area and inner north no longer need to travel through the city to reach these destinations as the Western Distributor provides a more direct route. This is presented in Figure 46.

Figure 46 - Redistribution of traffic flows at eastern end of project



The Western Distributor CBD bypass extends Wurundjeri Way to Dynon Road via a grade-separated connection over Dudley Street. This connection provides a link for Dynon Road traffic to access the southern parts of the city without the need to travel through the city grid to get there. This connection provides three points of access from the Western Distributor, to Footscray Road, to Dynon Road and to the Wurundjeri Way extension.

Figure 47 presents the difference in modelled volumes between the 2031 base 'no project' scenario and the full Western Distributor. Orange indicates that the Western Distributor will reduce traffic volume on that link relative to the base case. Green indicates that the Western Distributor will increase traffic volume on that link relative to the base case.

Figure 47 - Western Distributor impact on city routes over 24 hours (2031 project case vs 2031 base case)

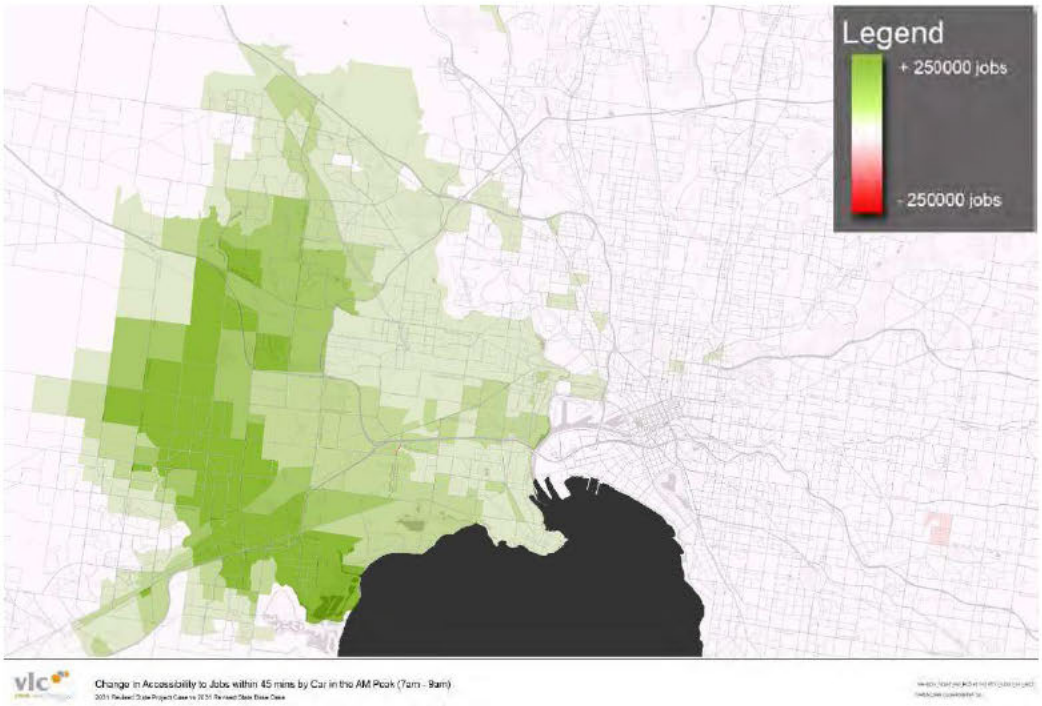
Of particular note, it is anticipated that the Western Distributor will result in a decrease in traffic demand along CBD streets such as Spencer Street and King Street. This is achieved by redistributing trips that have no purpose in the CBD away from Spencer Street and King Street and on to Wurundjeri Way or onto the project.

Specifically, strategic modelling indicates that the Western Distributor, reduces vehicle kilometres travelled (vkt) per day in the CBD Hoddle Grid and city north area by almost 66,000 vkt.

6.2.10 Job accessibility

The Western Distributor will provide a more direct connection between the western suburbs and the city, inner north and eastern suburbs. This will have the potential to increase the number of jobs accessible to residents in the west by reducing travel times and providing a more direct route to the city and key job markets. Figure 48 presents an analysis of the additional accessibility to jobs within a 45 minute car trip due to the introduction of the Western Distributor.

Figure 48 - Increased accessibility to jobs from the west – change in accessibility to jobs within 45 minutes by car (AM peak)



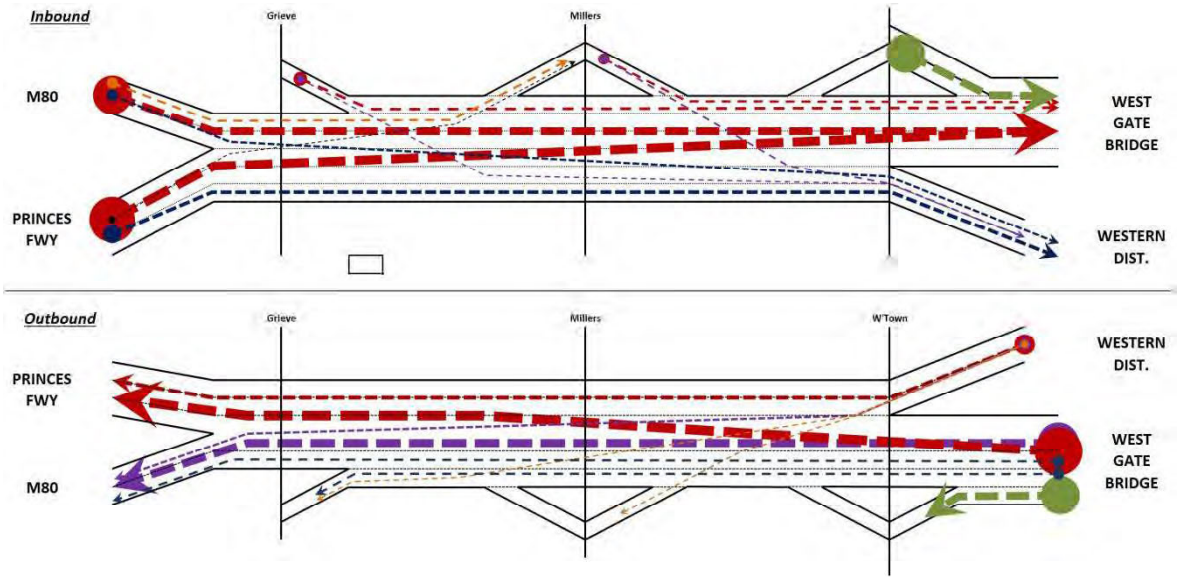
6.2.11 West Gate Freeway

The West Gate Freeway experiences high levels of congestion, particularly during the peak periods due to closely spaced interchanges and high levels of weaving movements. This congestion is expected to increase by 2031, resulting in longer delays and peak period spreading.

Initial proposals for capacity improvements on the West Gate Freeway considered adding two traffic lanes to each carriageway of the freeway, resulting in a six lane cross section in both directions. Early modelling of this arrangement indicated that the inclusion of the Western Distributor as a new strategic link, and the addition of lanes to the existing carriageways introduced significant lane changing and weaving with heavy traffic stream required to cross each other to access their desired destinations, which was considered to be unacceptable. The resulting turbulence would induce significant flow breakdown, restricting peak period flows and speeds to unacceptable levels and inducing unsafe operation.

Figure 49 demonstrates the conflicting movements that would occur in a single six-lane configuration.

Figure 49 - Conflicting weaving movements with all movements in single carriageways.



The preferred proposed lane arrangement for the West Gate has been designed to remove weaving between the M80 interchange and the tunnel portals. .The main carriageway will be separated into two carriageways in each direction, one providing priority to the West Gate Freeway traffic, with the other operating as a collector-distributor providing access to the surrounding arterial road network. The arrangement also protects the main traffic flow travelling to and from the West Gate Bridge, by having all merge movements from the surrounding arterial road network occur on the collector-distributors.

A new ramp will be constructed in the inbound direction, connecting the Princes Freeway to the collector-distributor. All entry and exit movements to the freeway will occur on the collector-distributor with a braided ramp linking the collector-distributor to the West Gate Bridge prior to Williamstown Road. The collector-distributor will also provide access to the Western Distributor tunnel.

In the outbound direction, the collector-distributor provides access to Williamstown Road and Millers Road with a new ramp connecting the West Gate Freeway to Grieve Parade. A new ramp will be constructed in the M80 interchange providing access to the Princes Freeway from the collector-distributor.

Freeway capacity

The number of lanes and the connections to the West Gate Freeway and the collector-distributor have been designed to allow for balanced flow in both carriageways, maintaining traffic flow and equality for all drivers along the freeway no matter their route choice.

6.2.12 Network redundancy

An important benefit of the Western Distributor is that it increases network redundancy in the event of an incident on the West Gate Bridge that requires either lane closures or complete closure of the bridge. It offers a high quality alternative route when such incidents occur.

Under an incident situation a Freeway Management System (FMS) will be activated well in advance on all strategic approaches to the West Gate Bridge and will direct traffic towards the Western Distributor.

Figure 50 and Figure 51 present an assessment of network alternatives in the event of an incident which closes one or all lanes on the West Gate Bridge in either the eastbound or westbound direction. Such an incident would otherwise cause severe flow breakdown during peak periods and take hours to recover. The Western Distributor provides some protection against this from occurring so only part of the stream is affected (due to the two carriageway arrangement of the reconfigured M1) and provides a viable bypass alternative.

Initial configuration of the project is to have two traffic lanes in the tunnel, but the design provides the ultimate width for three lanes in the future. In a scenario such as this with the West Gate Bridge affected, the third lane would be opened to maximise the alternative route capacity.

For westbound traffic (Monash Freeway to the West Gate Freeway), traffic will be diverted via Citylink and the Western Distributor or Wurundjeri Way, the proposed Wurundjeri Way extension and the Western Distributor. Placarded loads will be diverted to Hyde Street and Whitehall Street.

For eastbound traffic (West Gate Freeway to the Monash Freeway), traffic will be diverted via the Western Distributor and then Citylink or Wurundjeri Way. Placarded loads will be diverted to Hyde Street and Whitehall Street.

Figure 50 - Network redundancy – eastbound traffic on the M1

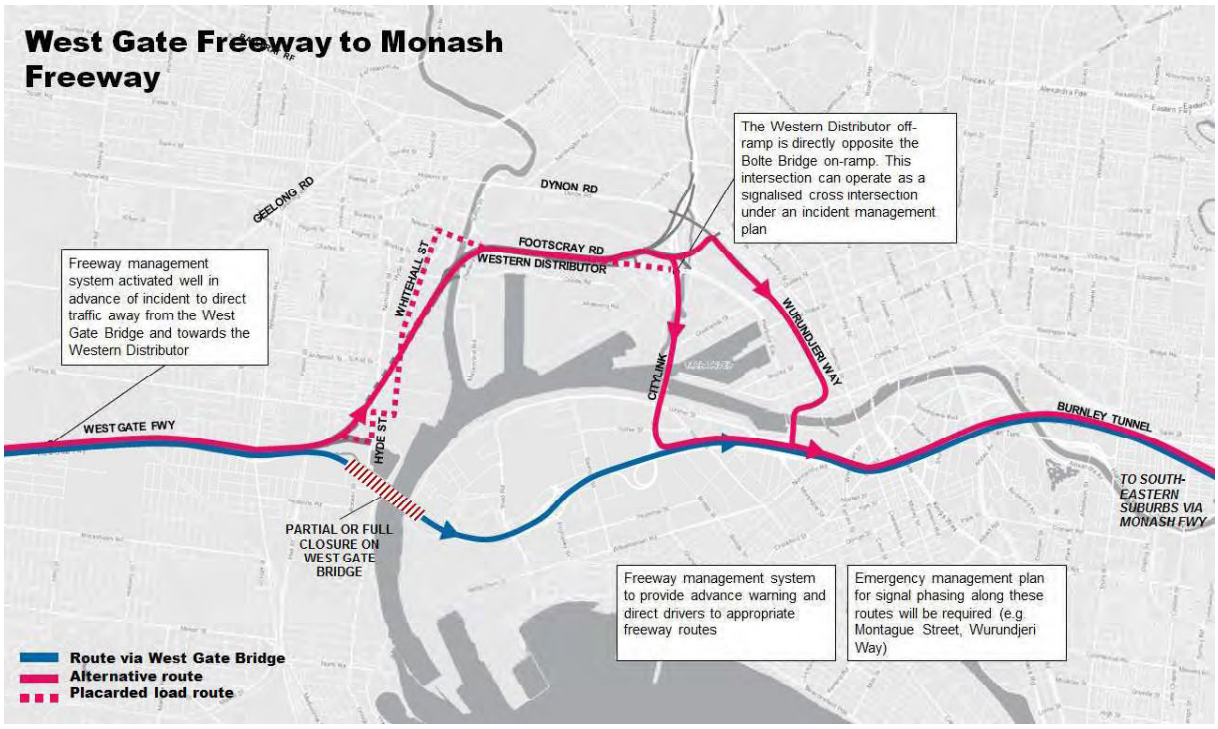
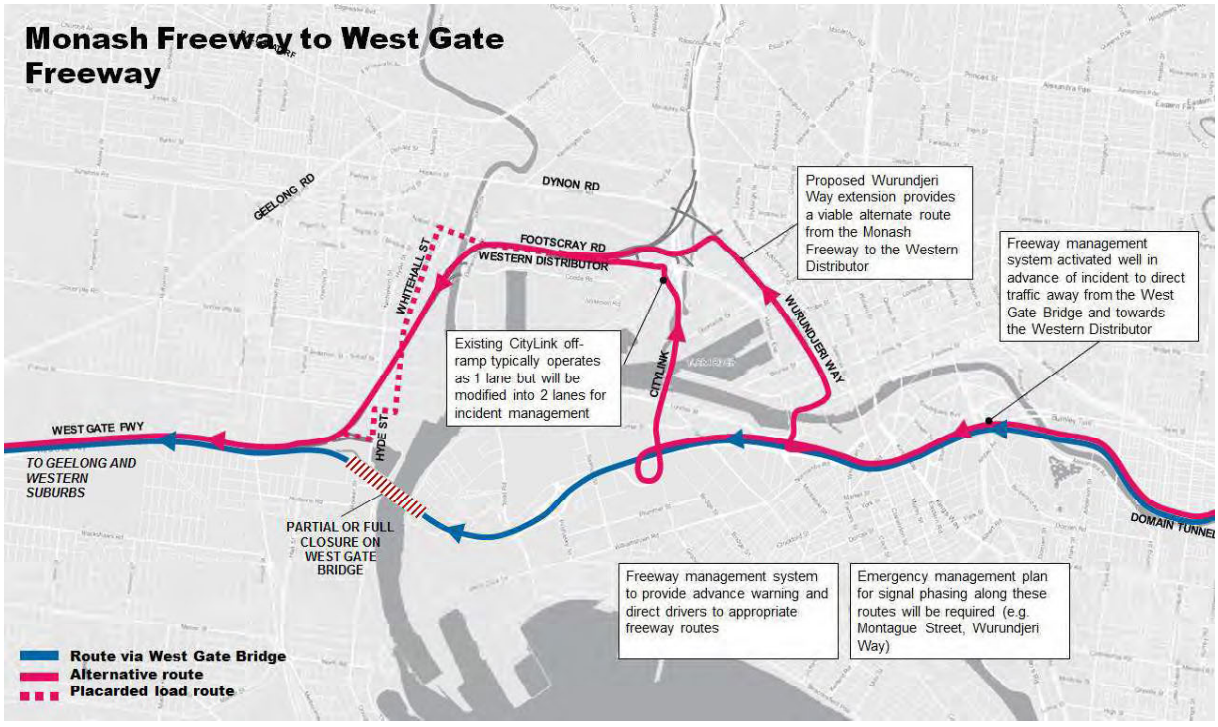


Figure 51- Network redundancy – westbound traffic on the M1



The Western Distributor also provides additional redundancy for trips with an origin or destination at Webb Dock, Swanson and Appleton Docks and the CBD and Docklands area. This is presented in Figure 52 to Figure 54.

Figure 52 – Network redundancy – West Gate Freeway to CBD

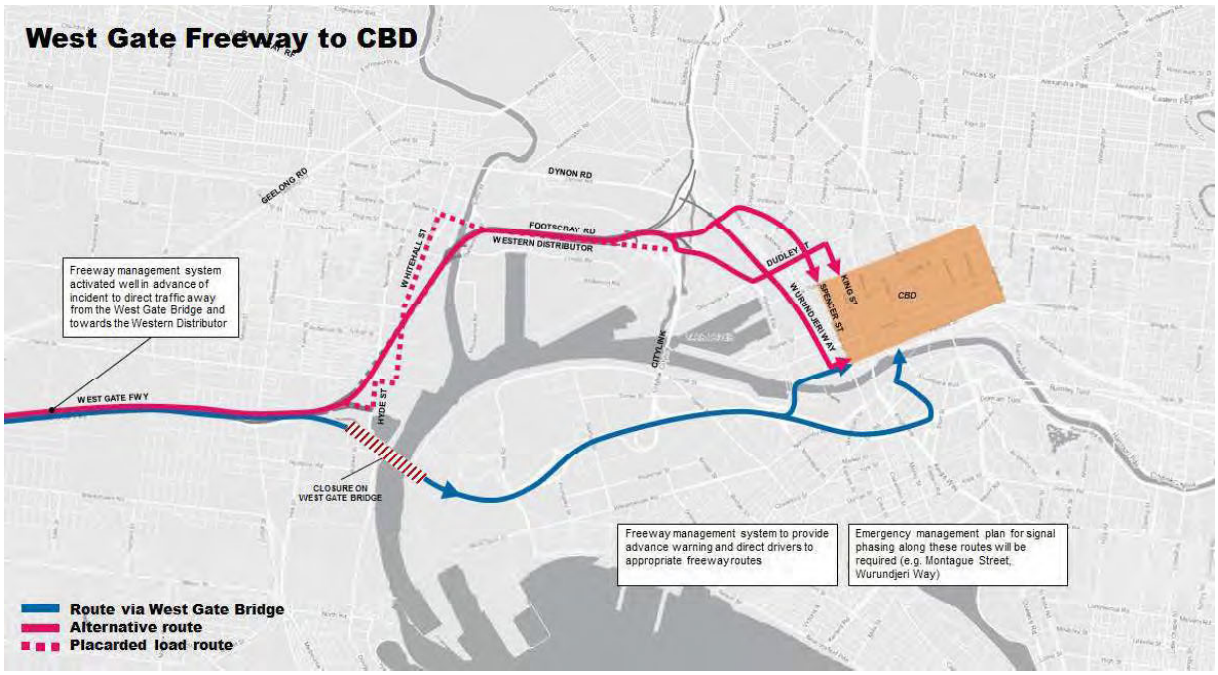


Figure 53 - Network redundancy – West Gate Freeway to Swanson and Appleton Dock

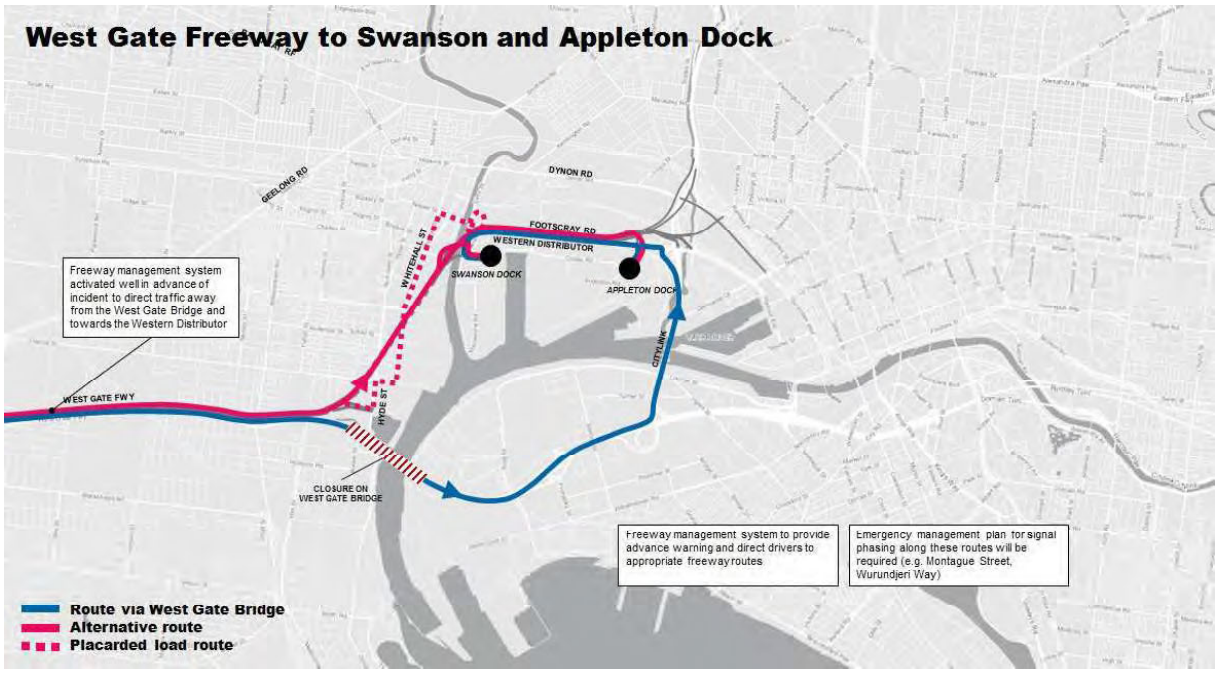
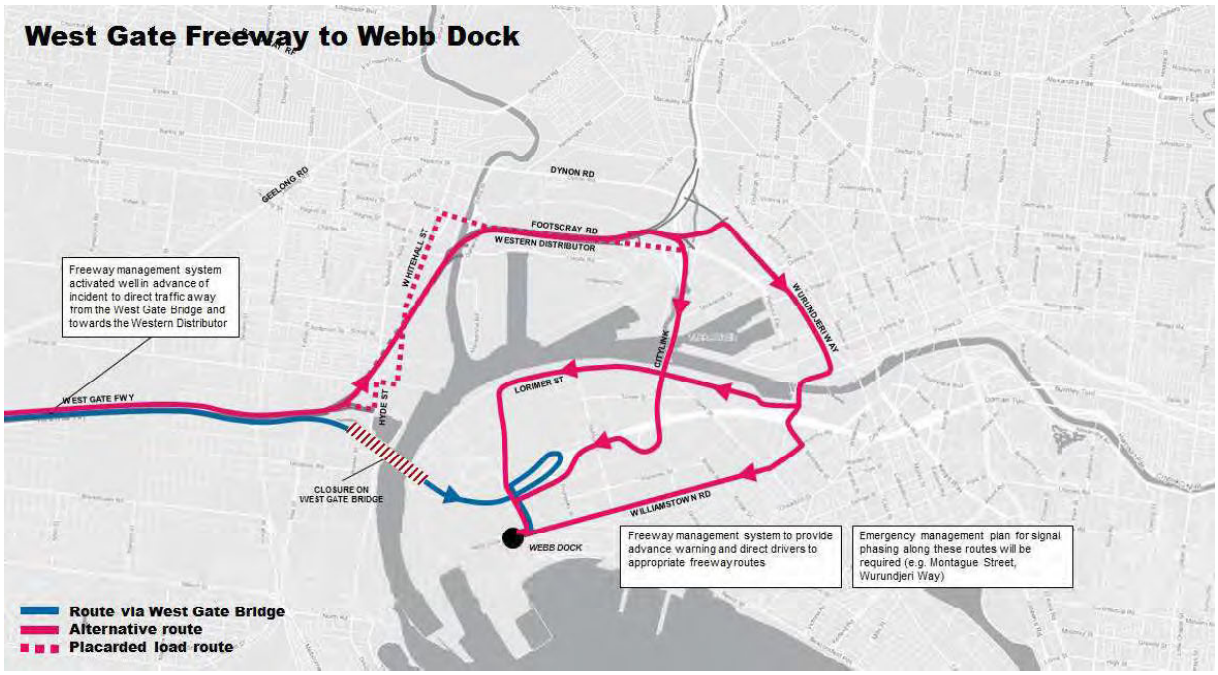


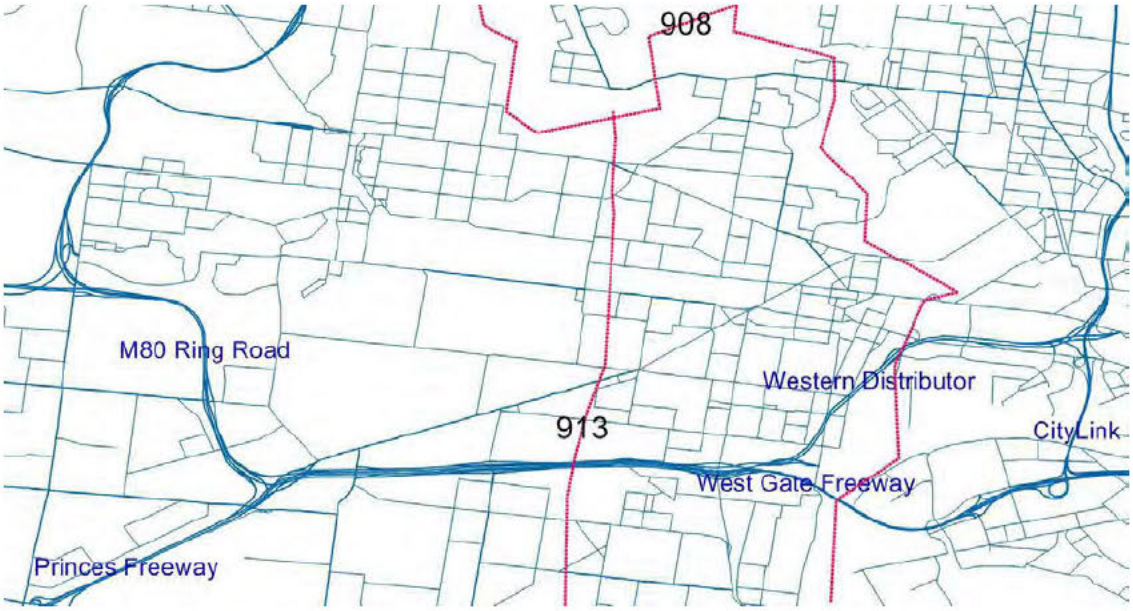
Figure 54 - Network redundancy – West Gate Freeway to Webb Dock



6.3 Additional crossing of the Maribyrnong River Screenline

Network resilience can be measured by the proportion of traffic crossing screenlines. VicRoads Screenline 908 and 913 have been assessed, with their locations presented in Figure 55.

Figure 55 – VicRoads Screenline locations



By 2031, the Western Distributor is expected to carry 11 to 16 per cent of all traffic crossing the Maribyrnong River screenline, as presented in Table 8. This will take considerable pressure off the West Gate Bridge, which will reduce its share of traffic from 58-61 per cent crossing the screenline to 49-54 per cent. It is expected that approximately 16,000-22,000 vehicles will be taken off the bridge in 2031 as a result of the Western Distributor project. This reduces the reliance on the West Gate Bridge for travel between the west and the central area and eastern suburbs, providing greater redundancy in the road network.

Table 8 - Maribyrnong River 2031 project case screenline assessment (24 hours)

River crossing	Number of lanes (inbound)	2031 base case percentage of traffic	2031 project case percentage of traffic
West Gate Freeway (West Gate Bridge)	5	58% - 61%	**49% - 54%**
Footscray Road (Shepherd Bridge)	3	14% - 16%	**11% - 13%**
Dynon Road (Hopetoun Bridge)	2	12% - 14%	**11% - 13%**
Ballarat Road (Lynchs Bridge)	2	12% - 14%	**11% - 13%**
Western Distributor (tunnel)	2	-	11% - 16%

While the Western Distributor will increase network resilience across the Maribyrnong River screenline, there will be continued reliance on the M1 corridor west of Williamstown Road.

VicRoads Screenline 913 runs north to south near Ashely Street and Cemetery Road. The Western Distributor will increase the percentage of traffic crossing the Screenline on the West Gate Freeway by 6 per cent, from 49 per cent to 55 per cent.

The increased reliance on the M1 corridor means that an incident on the West Gate Freeway west of Williamstown Road has the potential to block access to the Western Distributor and West Gate Bridge, causing congestion and reducing network resilience. For this reason, the State business case concept has sought to improve resilience along this corridor by assuming the inclusion of physical concrete barriers to separate traffic to/from the West Gate Bridge from the traffic to/from the Western Distributor.

An assessment of traffic crossing Screenline 913 is presented in Table 9.

Table 9 - VicRoads Screenline 913 (24 hrs)

Road	Location	2031 base case	2031 project case
Mitchell Street (eastbound only)	East of Ashley Street	2%	2%
Ballarat Road	East of Ashley Street	8%	7%
Churchill Avenue	East of Ashley Street	3%	3%
Barkly Street	East of Ashley Street	2%	2%
Sunshine Road	East of Ashley Street	6%	5%
Somerville Road	East of Paramount Road	1%	1%
Geelong Road	North-east of Cemetery Road	13%	11%
Francis Street	East of Cemetery Road	3%	2%
West Gate Freeway	East of Millers Road	49%	55%
Blackshaws Road	East of Millers Road	5%	5%
Mason Street	East of Millers Road	3%	3%
Kororoit Creek Road	East of Millers Road	5%	4%

6.4 Webb Dock Access

Webb Dock access improvements have arisen from the need to improve safety and efficiency of truck access to the new Webb Dock container berth. Inadequate access and egress capacity at the Port of Melbourne threatens freight efficiency and productivity. Furthermore, the route currently available to trucks leaving the Webb Dock and bound for CityLink has safety and reliability impacts for the road network in this area.

Currently heavy vehicles from Webb Dock wishing to travel north over the Bolte Bridge have to enter the West Gate Freeway at Cook Street. The entry of slow moving heavy vehicles, combined with a weave movement from the West Gate Freeway to the Bolte Bridge exit, can result in reduced speeds and congestion on the inbound carriageway of the West Gate Freeway.

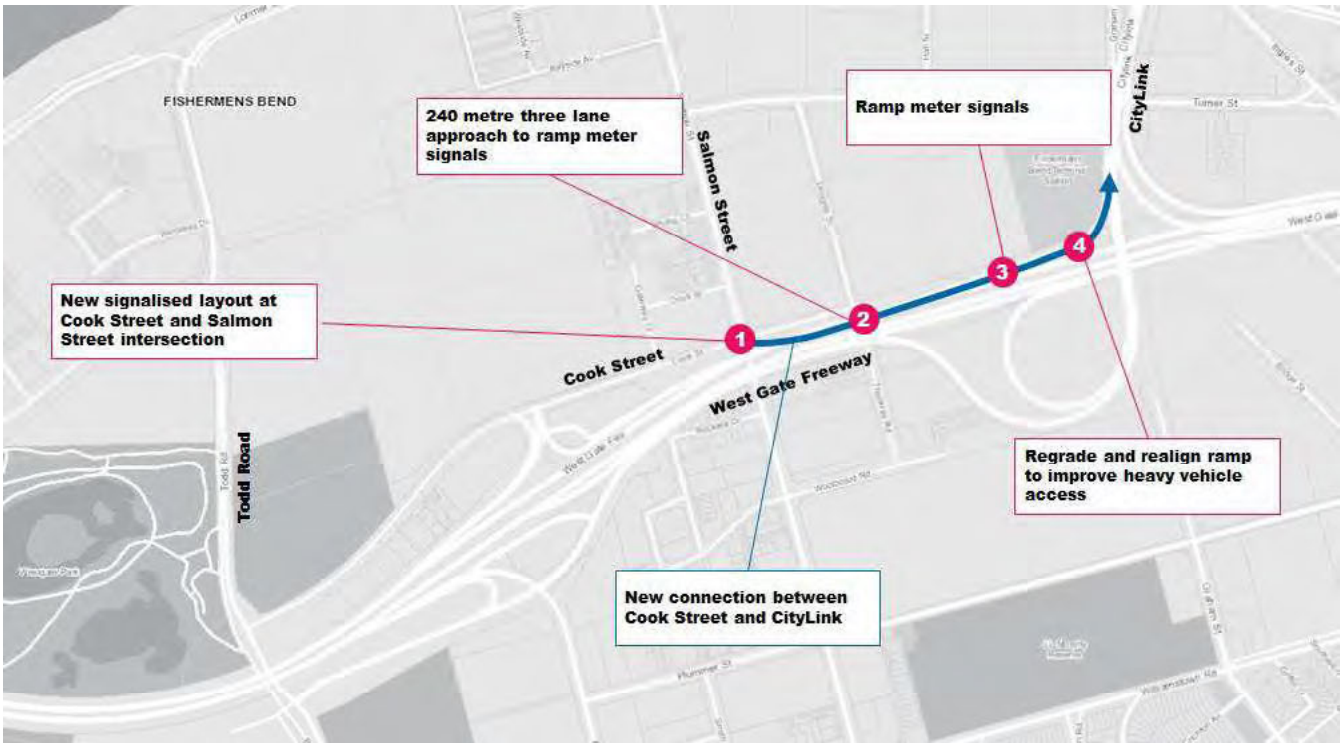
There is also a history of crashes on the tight curve on Ramp M (connection from West Gate Freeway eastbound to Western Link northbound) prior to the CityLink entry nose (City bound exit from Westgate Freeway). With increased traffic volumes, including high proportions of trucks, there is an increased potential for truck roll overs to occur on Ramp M if left untreated.

6.4.1 Proposed Works

The proposed layout of the realigned ramp to the Botle Bridge and associated works are shown in and can be summarised as follows:

- Replace the roundabout at the intersection of Cook Street and Salmon Street with traffic signals
- Extent Cook Street east of Salmon Street to the new ramp
- Realign and raise Ramp M to improve the grade of the ramp
- Install ramp meter on Ramp M with three lanes
- Provide new diverge from the West Gate Freeway mainline to Ramp M

Figure 56 – Proposed layout of Cook Street and Ramp M



6.4.2 Performance Assessment

Currently, traffic flow along the West Gate Freeway in the vicinity of Cook Street ramp and Ramp M is susceptible to flow breakdown due to downstream congestion, particularly in the AM peak period. However, with the works being undertaken on the CityLink to Tullamarine Widening Project, the downstream congestion issues should be improved.

The existing and proposed road network has been tested in VISSIM, a microsimulation modelling package, to assess the travel time for vehicles travelling through the network. Table 10 provides a summary of the options that have been tested in VISSIM.

Table 10 - Summary of Options Tested

Option	Summary of Option
2014 Base Model	Existing traffic network and 2014 traffic volumes
2031 Do Nothing	Existing traffic network with '2031 Without Western Distributor' traffic volumes.
2031 Webb Dock Access With Western Distributor	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 With Western Distributor' traffic volumes, which assumes the Western Distributor scheme is built.
2031 Webb Dock Access Without Western Distributor	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 Without Western Distributor' traffic volumes
2031 Webb Dock Access With Western Distributor (PoMC Sensitivity Test)	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 With Western Distributor' traffic volumes, which assumes the Western Distributor scheme is built as well as additional Webb Dock truck volumes.

Existing traffic volume data has been provided by VicRoads, with future volumes extracted from the VLC strategic model.

Travel time assessment

Travel time results were extracted from each of the models to assess model performance. Four routes were chosen, shown in Figure 57:

- Route 1 – West Gate Freeway from Todd Road underpass to Ramp M;
- Route 2 – West Gate Freeway from Todd Road underpass to Western Link Overpass;
- Route 3 – Cook Street from Todd Road intersection to Ramp M; and
- Route 4 – Cook Street from Todd Road intersection to Western Link Overpass.

Figure 57 - Travel Time Routes

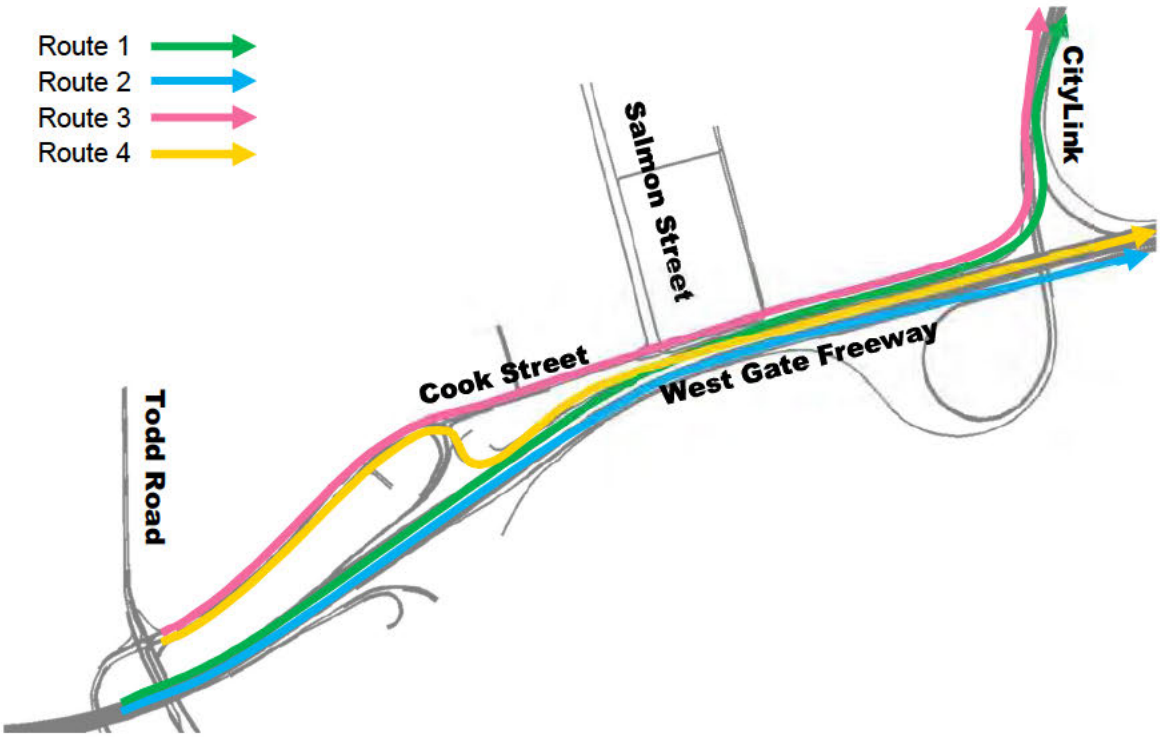


Figure 58 summarises AM Peak travel times for each of these routes for cars. It can be seen that:

- In Route 1 it can be seen that there is an increase in travel time in the Webb Dock Access models. This is because of the ramp meters installed in these options;
- In Route 2 there are very minor differences in travel times across each of the options relative to the 2014 Base and 2031 Do Nothing model;
- In Route 3 there are small increases in travel time in each option test relative to the 2014 Base. However, there is little difference between these options and the 2031 Do Nothing Model; and
- In Route 4 there are minor differences between the 2014 Base Model and the option tests. However, the option test travel times are quicker than the 2031 Do Nothing model – the reason for this is that in the option tests traffic travelling from Cook Street to Ramp M no longer uses the same ramp, thereby reducing congestion on the Cook Street ramp.

Figure 59 summarises PM Peak travel times for each of these routes for cars. It can be seen that:

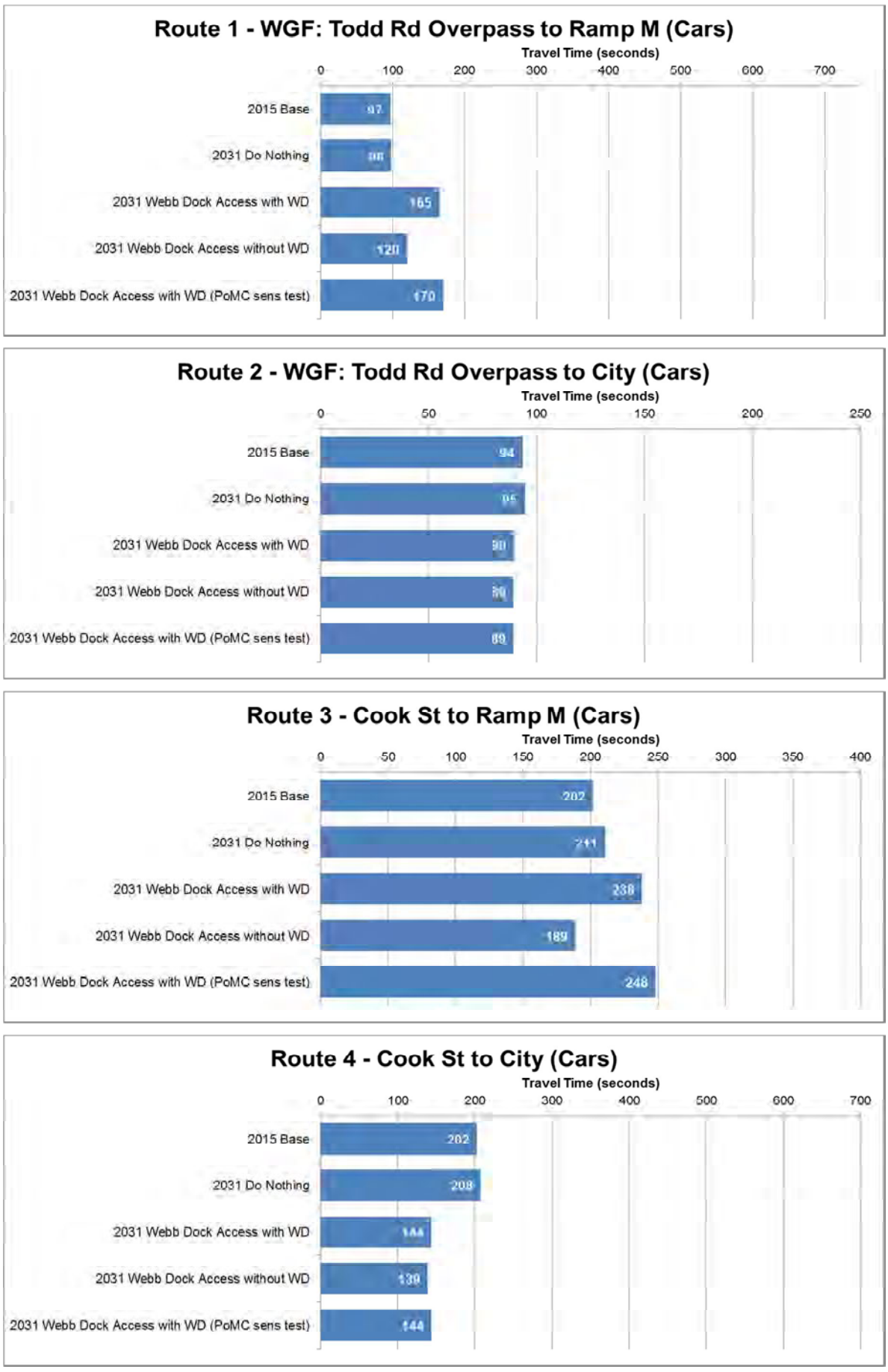
- In Route 1 it can be seen that there is an increase in travel time in the Webb Dock Access models. This is because of the ramp meters installed in these options. It is noted that the '2031 Webb Dock Access without Western Distributor' model has a quicker travel time compared to the other options. This is because of a slightly shorter cycle time in this option model as it was observed that traffic did queue on occasions back onto the West Gate Freeway with a 7.5 second ramp meter cycle length;
- In Route 2 there are very minor differences in travel times across each of the options relative to the 2014 Base and 2031 Do Nothing model;
- In Route 3 there are increases in travel time in each option test relative to the 2014 Base with the exception of the '2031 Webb Dock Access without Western Distributor' model.

As observed for Route 1 this is because of a slightly shorter ramp meter cycle time in this model to mitigate queues, leading to an overall improved travel time; and

- In Route 4 there are improvements in the travel time between the option models and the 2014 Base model and the 2031 Do Nothing model. The reason for this is that in the option tests traffic travelling from Cook Street to Ramp M now uses a dedicated ramp, thereby reducing traffic volumes on the Cook Street ramp.

Figure 58 - AM Peak Travel Times

Figure 59 - PM Peak Travel Times



6.4.3 Summary

The microsimulation modelling shows that the proposed realignment of Ramp M with direct access from Cook Street does not have an adverse impact on vehicle travel times, particularly in the critical AM peak period.

Some movements do experience a longer travel time due to the introduction of the ramp signals, however these signals will only be in operation during times of high congestion along Western Link which may be unlikely during the AM peak period.

Part 2

The South-East Corridor

7. The south-eastern suburbs

The south-eastern suburbs, roughly defined as the local government areas surrounding the Monash Freeway and Princes Highway (Monash, Casey and Greater Dandenong), generally contains low density residential housing, and pockets of light industrial land uses. However, there are major activity centres along the corridor generating large number of trips into the area, located in Dandenong, Springvale, Glen Waverley, Oakleigh, Narre Warren, Berwick and Monash University. In addition, there are major employment clusters at Monash, Dandenong South, Dandenong and Fountain Gate/Narre Warren.

The Monash Freeway has enabled the development of vast tracts of land relatively far from the CBD, with recent developments in Berwick, Narre Warren and Cranbourne transforming Casey into the most populous LGA in the state.

7.1 Transport network

A large number of people rely on the South-East Corridor routes of the Monash Freeway (M1) and Princes Highway, which places a large degree of stress on the network, especially during the morning and afternoon peak periods.

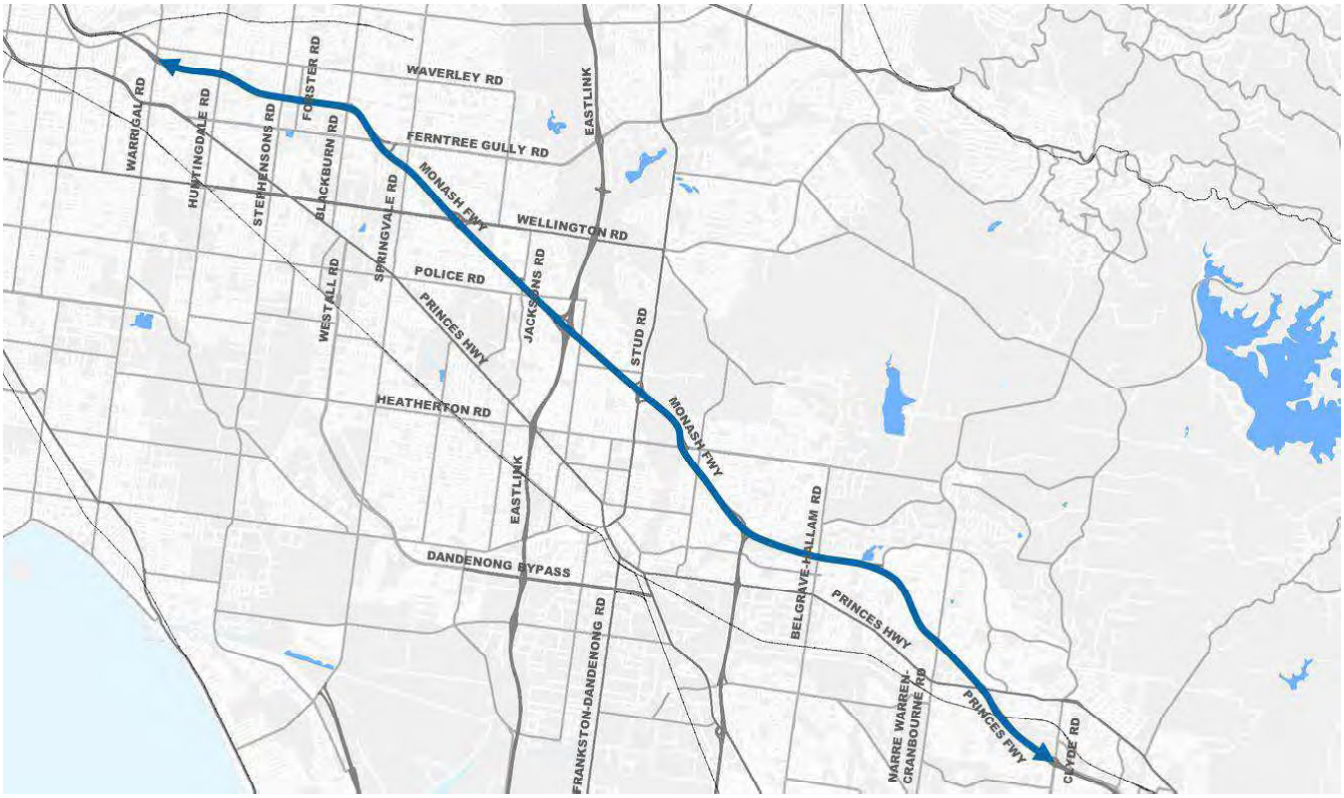
The Monash Freeway is the most critical of the two roads between the south-eastern suburbs and the CBD, with a number of key cross arterial roads branching off the M1, serving areas to the north and south of the corridor, including:

- Warrigal Road;
- Springvale Road;
- EastLink (M3);
- Stud Road;
- South Gippsland Freeway;
- Belgrave Hallam Road; and
- Narre Warren-Cranbourne Road.

The corridor is also serviced by the Packenham-Cranbourne and Glen Waverley railway lines, and local and orbital bus routes.

A map showing the Monash Freeway and the surrounding road network is presented in Figure 60 overleaf.

Figure 60 – The south eastern transport corridor



8. 2014 and 2031 base case

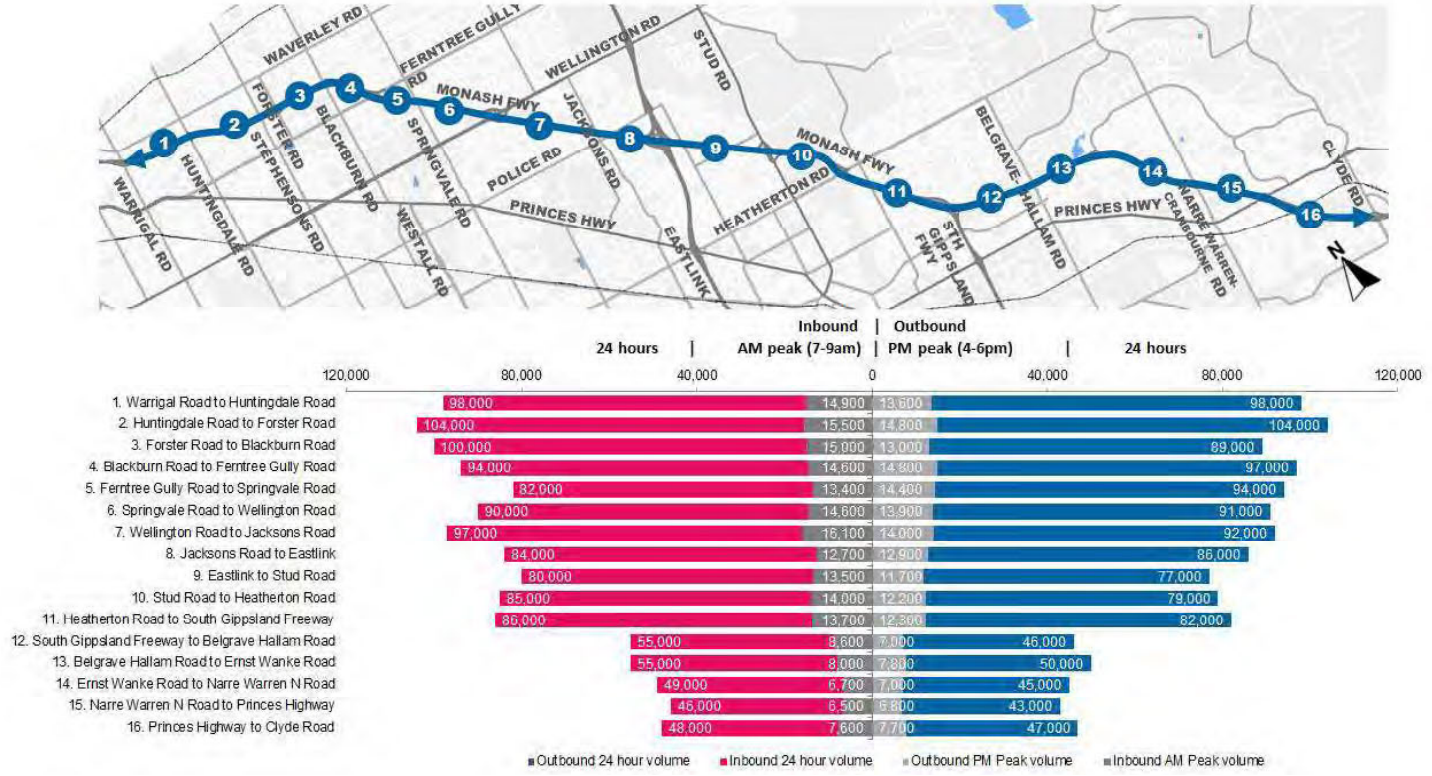
8.1 Traffic volumes and performance

The Monash Freeway between Warrigal Road and Clyde Road carries over 200,000 vehicles per day along its busiest sections and approximately 30,000 vehicles during the AM peak period (7 am to 9 am).

Traffic volumes are highest between the South Gippsland Freeway and Warrigal Road, carrying between 160,000 and 210,000 vehicles per day, with lower volumes east of the South Gippsland Freeway interchange (approximately 100,000 vehicles per day).

The average weekday traffic volumes during the AM peak and over a 24 hour period are presented in Figure 61 overleaf. The average weekday traffic volumes show the heavy reliance on the Monash Freeway with it operating close to capacity in the peak direction in the peak periods.

Figure 61 – 2014 average weekday volumes – 24 hour, AM peak and PM peak



By 2031, daily traffic volumes are expected to increase across the entire length of the Monash Freeway by approximately 10 to 30 per cent. Growth is expected to be lower in the peak direction during the AM peak, due to existing capacity constraints. Growth in the AM peak is forecast to be highest between Clyde Road and the South Gippsland Freeway interchange.

V/C ratios indicate that the Monash Freeway will be over-capacity during the AM peak in 2031. Congestion at the Monash Freeway – EastLink interchange is reflected in the low V/C ratio between EastLink and Jacksons Road.

The projected volumes in the 2031 base case for the AM peak and 24 hour are presented in Table 11 (inbound) and Table 12 (outbound).

Table 11 – Monash Freeway 2014 and 2031 base case volumes (inbound)

Road segment	Average weekday volume (24 hours)		AM Peak volume - (7 am – 9 am)		PM Peak volume - (4 pm – 6 pm)	
	2014	2031 base case	2014	2031 base case	2014	2031 base case
Clyde Road to Princes Highway	48,000	63,000	7,600	9,000	5,100	7,100
Princes Highway to Narre Warren N Road	46,000	56,000	6,500	7,200	5,100	7,100
Narre Warren N Road to Ernst Wanke Road	49,000	56,000	6,700	7,400	5,500	7,600
Ernst Wanke Road to Belgrave Hallam Road	55,000	61,000	8,000	8,900	6,100	8,200
Belgrave Hallam Road to South Gippsland Freeway	55,000	60,000	8,600	9,500	6,000	8,100
South Gippsland Freeway to Heatherton Road	86,000	100,000	13,700	14,900	9,700	11,500
Heatherton Road to Stud Road	85,000	100,000	14,000	15,200	9,400	11,200
Stud Road to Eastlink	80,000	94,000	13,500	14,600	9,000	10,800
Eastlink to Jacksons Road	84,000	98,000	12,700	13,300	9,200	10,600
Jacksons Road to Wellington Road	97,000	112,000	16,100	16,800	10,500	12,000
Wellington Road to Springvale Road	90,000	104,000	14,600	15,100	10,400	11,800
Springvale Road to Ferntree Gully Road	82,000	95,000	13,400	13,800	9,300	10,700
Ferntree Gully Road to Blackburn Road	94,000	121,000	14,600	16,000	11,200	15,000
Blackburn Road to Forster Road	100,000	124,000	15,000	16,000	12,200	15,800
Forster Road to Huntingdale Road	104,000	125,000	15,500	16,200	13,400	16,900
Huntingdale Road to Warrigal Road	98,000	119,000	14,900	15,600	12,100	15,600

Table 12 – Monash Freeway 2014 and 2031 base case volumes (outbound)

Road segment	Average weekday volume (24 hours)		AM Peak volume - (7 am – 9 am)		PM Peak volume - (4 pm – 6 pm)	
	2014	2031 base case	2014	2031 base case	2014	2031 base case
Clyde Road to Princes Highway	47,000	64,000	4,800	5,900	7,700	11,200
Princes Highway to Narre Warren N Road	43,000	54,000	4,600	5,500	6,800	9,900
Narre Warren N Road to Ernst Wanke Road	45,000	52,000	4,900	5,600	7,000	10,400
Ernst Wanke Road to Belgrave Hallam Road	50,000	57,000	5,200	5,800	7,800	11,200
Belgrave Hallam Road to South Gippsland Freeway	46,000	53,000	4,700	5,300	7,000	10,100
South Gippsland Freeway to Heatherton Road	82,000	94,000	9,900	11,000	12,300	15,200
Heatherton Road to Stud Road	79,000	92,000	9,400	10,600	12,200	14,900
Stud Road to Eastlink	77,000	90,000	9,200	10,400	11,700	14,100
Eastlink to Jacksons Road	86,000	99,000	10,100	11,600	12,900	14,100
Jacksons Road to Wellington Road	92,000	105,000	10,400	11,900	14,000	15,000
Wellington Road to Springvale Road	91,000	104,000	10,300	11,800	13,900	14,700
Springvale Road to Ferntree Gully Road	94,000	107,000	11,300	13,200	14,400	15,100
Ferntree Gully Road to Blackburn Road	97,000	123,000	12,300	16,800	14,800	16,600
Blackburn Road to Forster Road	89,000	110,000	10,900	14,400	13,000	14,100
Forster Road to Huntingdale Road	104,000	124,000	13,800	17,800	14,800	15,600
Huntingdale Road to Warrigal Road	98,000	118,000	12,700	16,900	13,600	14,300

8.2 Travel times

The average weekday vehicle speeds during the peak periods, in the peak direction, are presented in Table 13. This shows that vehicles are travelling below the posted speed limit in the peak periods, with the lowest speeds recorded east of the EastLink interchange indicating higher levels of congestion and longer travel times. Data has also shown that there is a high variability in travel times along the corridor due to the high levels of congestion and the impact of incidents on traffic flow.

Table 13 - Existing travel time and vehicle speeds

Peak	Direction	Section	Distance	Travel Time (2014)	Speed
AM Peak (7-9am)	Inbound	Clyde Road to South Gippsland Freeway	9.9 km	16 min	42 km/hr
		South Gippsland Freeway to EastLink	7.6 km	11 min	47 km/hr
		EastLink to Warrigal Road	12.6 km	14 min	57 km/hr
PM Peak (4-6pm)	Outbound	Warrigal Road to EastLink	12.3 km	13 min	58 km/hr
		EastLink to South Gippsland Freeway	8.3 km	12 min	45 km/hr
		South Gippsland Freeway to Clyde Road	9.4 km	13 min	49 km/hr

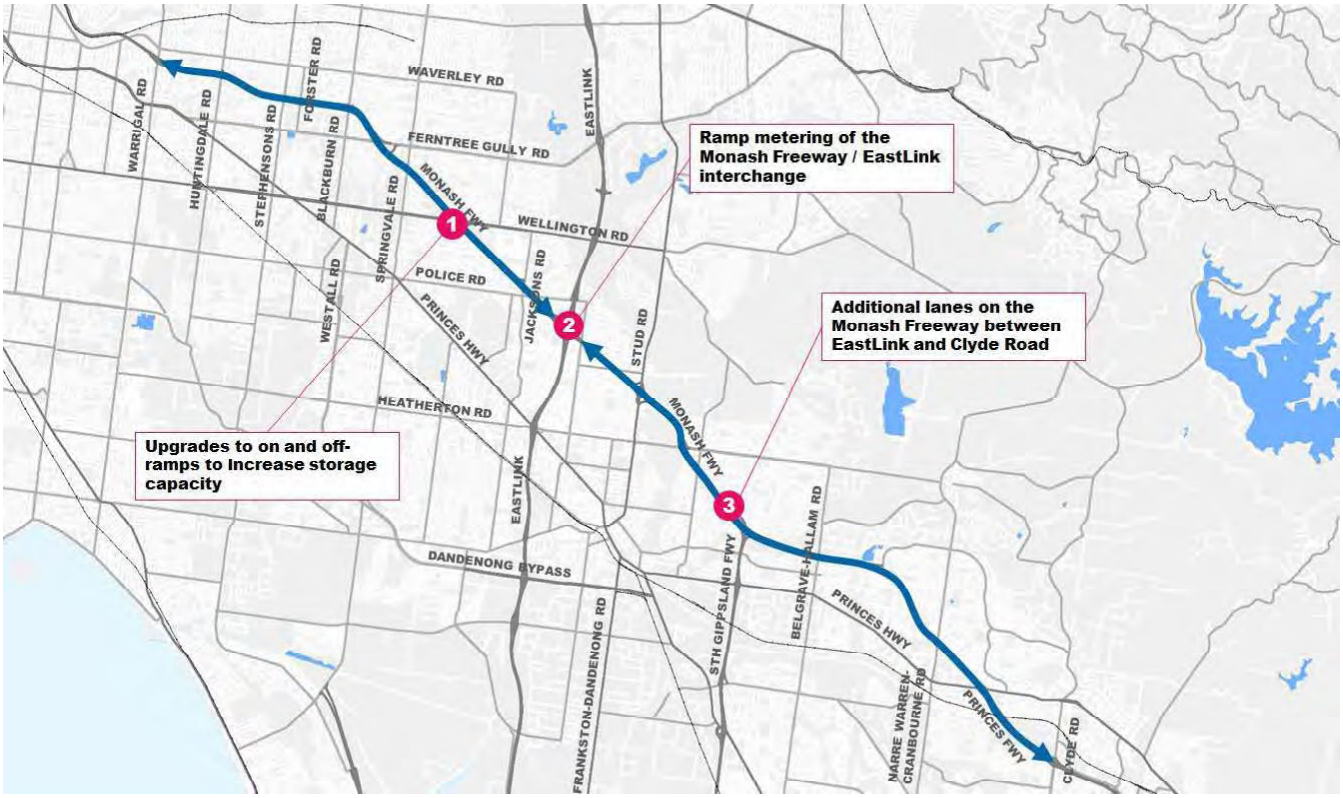
9. Proposed project

The Monash Freeway works comprise of three components:

- Additional traffic lanes – one in each direction – on the Monash Freeway between the EastLink interchange and Clyde Road in the south-east
- New ramp metering installations on the Monash Freeway from Koo Wee Rup Road to Clyde Road inbound, along Hallam Bypass outbound and on the EastLink connections to the Monash Freeway, including new and upgraded mainline and ramp detection
- Increase the storage capacity on existing entry ramps along the Monash Freeway between Warrigal Road and Clyde Road
- Increased on-road incident response services.

The proposed Monash Freeway works are presented in Figure 62.

Figure 62 – South-East Corridor – State preferred concept

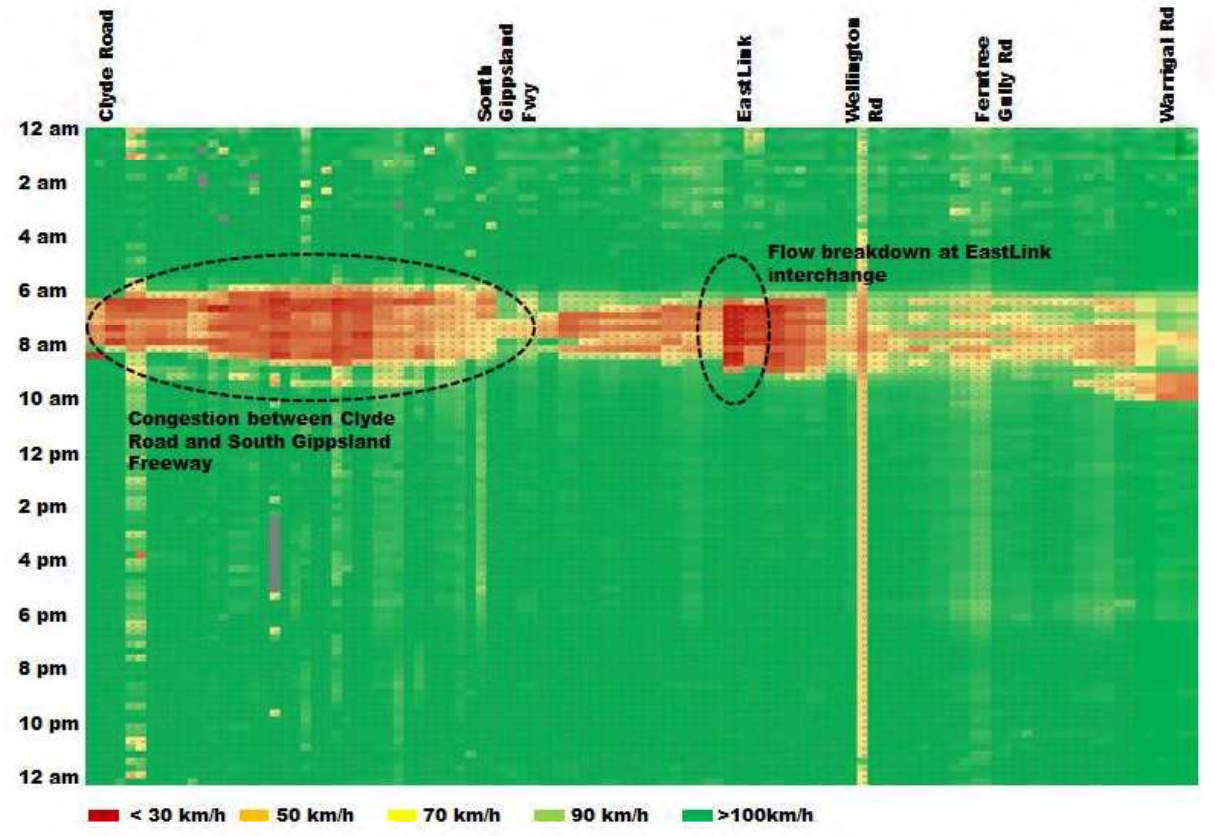


9.1 M1 – M3 ramp metering

The interchange with EastLink on the Monash Freeway is a location with high levels of congestion, with traffic flow often breaking down during the AM and PM peak periods. This is largely due to the fact that there are high volumes of traffic coming off EastLink and merging onto the Monash Freeway.

Figure 63 shows the average speeds between Clyde Road and Warrigal Road on October 14, 2014 over a 24 hour period. It can be seen that there is a reduction in speed between 6 am and 8 am, with a significant reduction in speed at the EastLink interchange. The dark red cells in the figure at EastLink represent speeds of approximately 20 to 30 kilometres per hour.

Figure 63 – Average speed profile between Clyde Road and Warrigal Road (inbound)



It is proposed that the ramps on the interchange from north to east (northbound on EastLink to eastbound on the Monash Freeway) and from south to west (southbound on EastLink to westbound on the Monash Freeway) be metred.

Ramp metering on the two ramps will protect the flow of traffic along the Monash Freeway by controlling the volume of vehicles merging at any one time, which will improve traffic flows through the interchange.

9.2 Ramp upgrades

In addition to metering of the EastLink interchange, it is proposed that ramp metering be installed on all remaining unsignalised ramps on the Monash Freeway between Warrigal Road and Clyde Road. Ramp metering will protect the mainline flow by limiting the volume of cars merging onto the Monash Freeway at any one time.

9.3 M1 freeway widening

Between 2014 and 2013, traffic volumes along the Monash Freeway are expected to grow the most between EastLink and Clyde Road, with average daily weekday growth of up to 36 per cent. This section of the M1 is projected to be significantly over-capacity by 2031, with AM peak V/C ratios over 1.0 near the South Gippsland Freeway interchange.

For this reason, it is proposed that the Monash Freeway between Eastlink and Clyde Road be widened to accommodate one additional traffic lane in each direction.

10. Future network 2031 (with project)

10.1 Traffic volumes and performance

The proposed works on the Monash Freeway will provide additional capacity between Clyde Road and EastLink. As a result, it is expected that traffic volumes in the 2031 project case will increase along this section of the M1 compared to a 2031 base (do nothing) scenario. Parallel and surrounding roads are expected to benefit from the widening works, with a redistribution of traffic towards the Monash Freeway.

The differences in volumes and performance between the 2031 base and project cases are presented in Table 14 and Table 15.

Table 14 – Monash Freeway 2031 base case vs project case (inbound) traffic volume growth

Road segment	2031 base (no project)			2031 project vs 2031 base % difference*		
	AM peak	PM peak	24 hours	AM peak	PM peak	24 hours
Clyde Road to Princes Highway	9,000	7,100	63,000	24%	18%	18%
Princes Highway to Narre Warren N Road	7,200	7,100	56,000	36%	28%	28%
Narre Warren N Road to Ernst Wanke Road	7,400	7,600	56,000	46%	31%	35%
Ernst Wanke Road to Belgrave Hallam Road	8,900	8,200	61,000	39%	30%	32%
Belgrave Hallam Road to South Gippsland Freeway	9,500	8,100	60,000	36%	30%	31%
South Gippsland Freeway to Heatherton Road	14,900	11,500	100,000	17%	10%	10%
Heatherton Road to Stud Road	15,200	11,200	100,000	14%	9%	8%
Stud Road to Eastlink	14,600	10,800	94,000	13%	8%	8%
Eastlink to Jacksons Road	13,300	10,600	98,000	3%	2%	2%
Jacksons Road to Wellington Road	16,800	12,000	112,000	3%	2%	2%
Wellington Road to Springvale Road	15,100	11,800	104,000	2%	2%	1%
Springvale Road to Ferntree Gully Road	13,800	10,700	95,000	2%	2%	1%
Ferntree Gully Road to Blackburn Road	16,000	15,000	121,000	1%	1%	1%
Blackburn Road to Forster Road	16,000	15,800	124,000	1%	1%	0%
Forster Road to Huntingdale Road	16,200	16,900	125,000	1%	1%	0%
Huntingdale Road to Warrigal Road	15,600	15,600	119,000	0%	1%	0%

**Percentage increase in the 2031 project case compared to the 2031 base case*

Table 15 – Monash Freeway 2031 AM peak base case vs project case (outbound)

Road segment	2031 base (no project)			2031 project vs 2031 base % difference*		
	AM peak	PM peak	24 hours	AM peak	PM peak	24 hours
Clyde Road to Princes Highway	5,900	11,200	64,000	12%	22%	16%
Princes Highway to Narre Warren N Road	5,500	9,900	54,000	16%	36%	25%
Narre Warren N Road to Ernst Wanke Road	5,600	10,400	52,000	17%	43%	31%
Ernst Wanke Road to Belgrave Hallam Road	5,800	11,200	57,000	16%	37%	28%
Belgrave Hallam Road to South Gippsland Freeway	5,300	10,100	53,000	17%	37%	27%
South Gippsland Freeway to Heatherton Road	11,000	15,200	94,000	6%	17%	10%
Heatherton Road to Stud Road	10,600	14,900	92,000	6%	14%	8%
Stud Road to Eastlink	10,400	14,100	90,000	6%	13%	8%
Eastlink to Jacksons Road	11,600	14,100	99,000	1%	4%	3%
Jacksons Road to Wellington Road	11,900	15,000	105,000	1%	3%	2%
Wellington Road to Springvale Road	11,800	14,700	104,000	1%	2%	2%
Springvale Road to Ferntree Gully Road	13,200	15,100	107,000	1%	2%	2%
Ferntree Gully Road to Blackburn Road	16,800	16,600	123,000	1%	2%	1%
Blackburn Road to Forster Road	14,400	14,100	110,000	1%	1%	1%
Forster Road to Huntingdale Road	17,800	15,600	124,000	1%	1%	0%
Huntingdale Road to Warrigal Road	16,900	14,300	118,000	1%	0%	0%

**Percentage increase in the 2031 project case compared to the 2031 base case*

10.2 Travel times

The proposed works on the Monash Freeway are expected to reduce travel times and increase vehicle speeds between Clyde Road and EastLink during the AM peak and PM peak periods, with no changes in travel time or vehicle speeds between EastLink and Warrigal Road. A summary of the changes in travel times are presented in . The proposed works are forecast to reduce travel time by approximately four minutes in the AM peak period for inbound vehicles and five minutes for outbound vehicles in the PM peak period.

The installation of ramp metering from EastLink to Clyde Road will assist in reducing flow breakdown along the freeway, maintaining vehicle speeds and reducing travel time variability. That means the project will make it less likely that travel times will be significantly higher than the average travel time on a given day.

A summary of the changes in travel times are presented in Table 16.

Table 16 – 2031 base case vs project case travel times

Peak	Direction	Section	Distance	Travel Time (2014)	Travel time (2031 base)	Travel time (2031 project)
AM Peak (7-9am)	Inbound	Clyde Road to South Gippsland Freeway	9.9 km	16 min	26 min	23 min
		South Gippsland Freeway to EastLink	7.6 km	11 min	16 min	15 min
		EastLink to Warrigal Road	12.6 km	14 min	17 min	17 min
PM Peak (4-6pm)	Outbound	Warrigal Road to EastLink	12.3 km	13 min	16 min	16 min
		EastLink to South Gippsland Freeway	8.3 km	12 min	18 min	17 min
		South Gippsland Freeway to Clyde Road	9.4 km	13 min	22 min	18 min

Appendices

Appendix A - VLC Report - Base Case Model Development

Appendix B – VLC Report – Local Area Model Validation

Appendix C – Cook Street upgrade traffic modelling report

VicRoads

Cook Street to Western Link Direct Connection
VISSIM Assessment

November 2015

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Figure index

1. Introduction

1.1 Purpose of this report

The purpose of this report is to outline the VISSIM assessment of the proposed Cook Street to Western Link Direct Connection in Port Melbourne.

1.2 Scope and limitations

This report: has been prepared by GHD for VicRoads and may only be used and relied on by VicRoads for the purpose agreed between GHD and the VicRoads as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than VicRoads arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by VicRoads and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.3 Assumptions

The following have been assumed in the preparation of this report:

- Existing traffic survey data collected by VicRoads is representative of typical existing weekday traffic volumes in the study area.
- ZENITH strategic modelling volumes are indicative of existing and future traffic volumes in the study.
- Aerial photography is correct and representative of current roadway layouts.

1.4 Report Layout

This report is structured as follows:

- Section 2 discusses the study area characteristics;
- Section 3 details the traffic data sources used to construct the VISSIM model;
- Section 4 outlines the VISSIM model preparation;
- Section 5 discusses the calibration and validation of the VISSIM base models;

- Section 6 outlines the steps taken to create future year traffic matrices; and
- Section 7 summarises the results of the option testing undertaken.

2. Study Area

2.1 Introduction

This section provides an overview of the existing road infrastructure and land uses in the study area.

2.2 Road Network

The study area for this project is based principally in Port Melbourne and consists of the following roads:

- West Gate Freeway;
- Cook Street;
- Todd Road;
- Salmon Street;
- Cook Street on-ramp to West Gate Freeway;
- Ramp M to CityLink northbound; and
- Bolte Bridge.

Figure 1 provides an overview of the study area with the purple roads indicating the modelled road network.

2.3 Land Uses

The following are the main current land uses:

- Port of Melbourne Webb Dock;
- Larger industrial premises such as General Motors;
- Light industrial units on Cook Street; and
- An eastbound service centre.

Future land use changes in the area includes the rezoning of the Fishermans Bend area to residential and commercial as well as a new service centre on Cook Street.

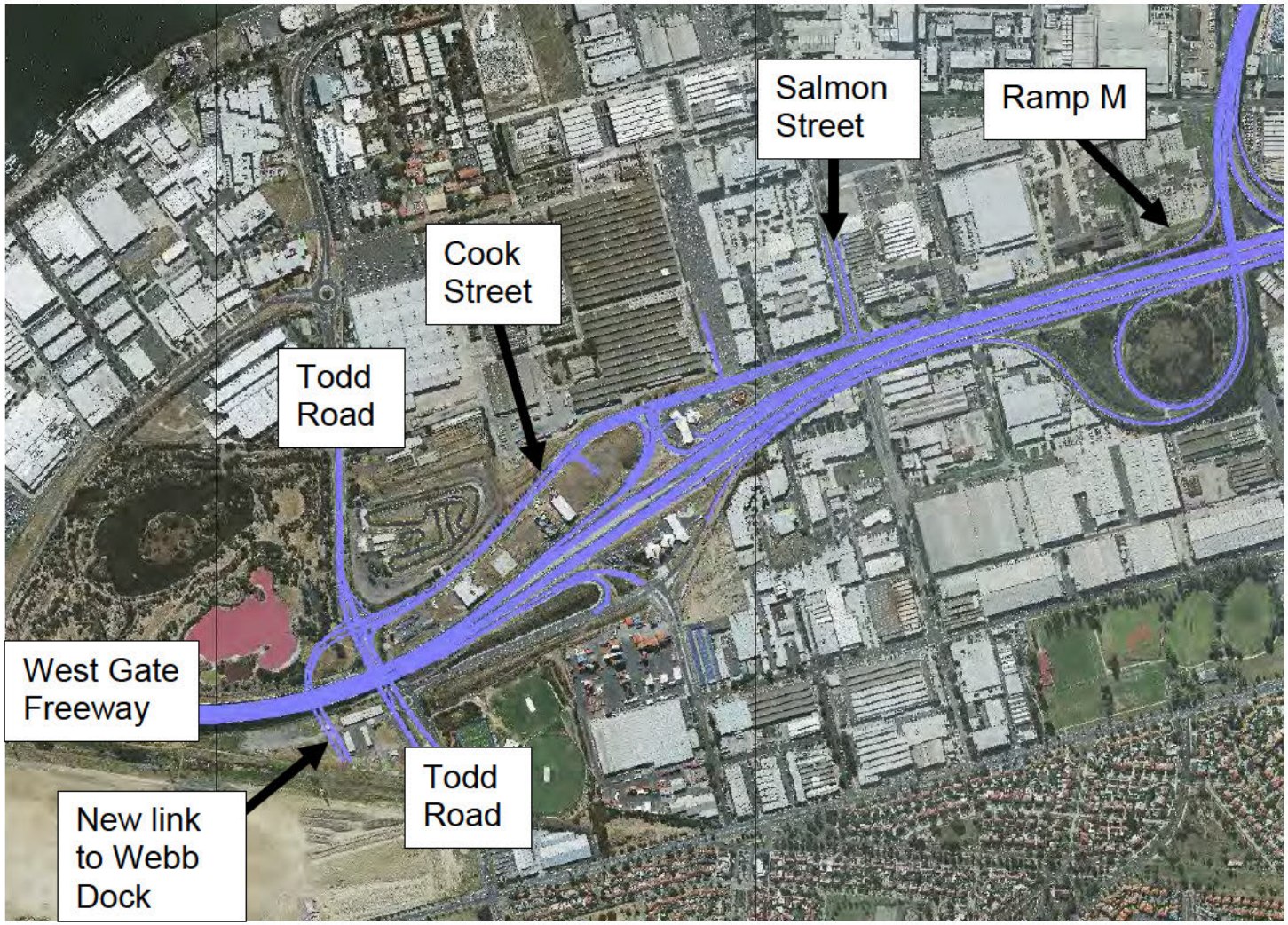


Figure 1 Study area

3. Traffic data preparation

3.1 Introduction

This section outlines the process used to generate traffic trip matrices for the purposes of the VISSIM assessment.

3.2 Data Sources

A number of data sources were used to construct the VISSIM models. Table 1 presents a summary of these sources.

Table 1 Data Sources

Data Item	Location	Source
Freeway volumes and speed	Midblock and ramps on the West Gate Freeway	VicRoads Freeway Analysis Tool
SCATS	Cook Street off-ramp and Cook Street intersection	VicRoads
Intersection turning movements	Cook Street and Todd Road	Aurecon study
	Cook Street and Salmon Street intersection	VicRoads commissioned survey
Origin-destination survey data	Cook Street on-ramp and Ramp M	VicRoads commissioned survey
Manual classified freeway counts	Midblock locations on the West Gate Freeway	VicRoads commissioned survey

3.3 Preparation of traffic matrices

Data shown in Table 1 was checked for consistency and to identify any underlying issues or trends. The bulk of data supplied by VicRoads was for the end of March 2015 time period. Reviews of data from this period against other time periods showed that this was a suitable and comparable period from which data could be used.

Freeway traffic data was broken down into 15 minute periods in order to capture the peaking of traffic movements. Other data sources were then used to proportion traffic movements on the non-freeway road network (principally Cook Street and Todd Road).

3.4 Freeway volumes and speeds

Figure 2 presents average weekday freeway volumes over a 24 hour period at each site in the study area split by 15 minute period.

Figure 3 presents average weekday freeway speeds over a 24 hour period at each site in the study area split by 15 minute period.

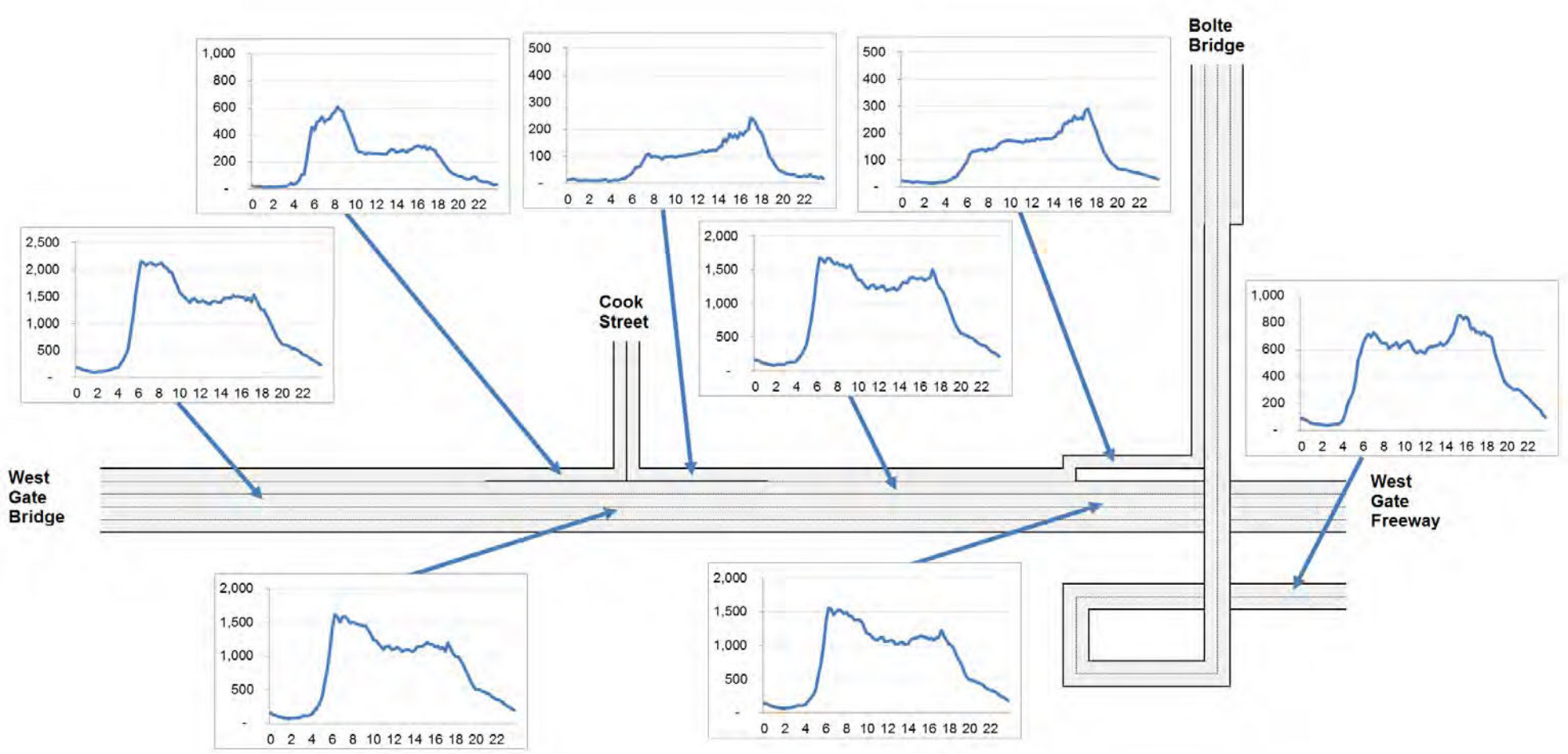


Figure 2 Daily Freeway Traffic Volumes (split by 15 minute interval)

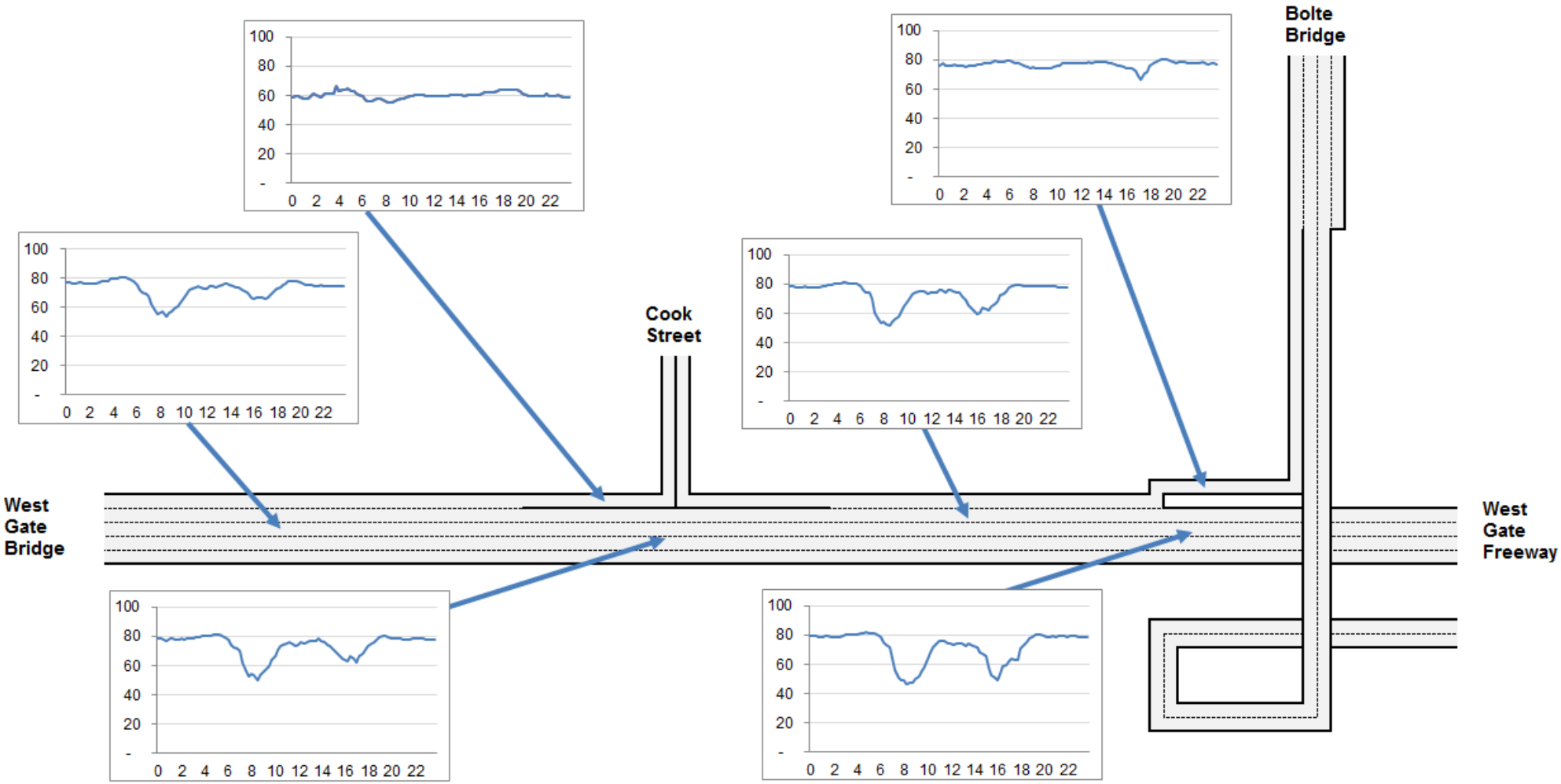


Figure 3 Daily Freeway Traffic Speeds (split by 15 minute interval)

3.5 Cook Street and Ramp M Weave Volumes

Traffic weave movements between the Cook Street on-ramp and Ramp M to CityLink have been collated and are presented in Figure 4 for the AM Peak period and Figure 5 for the PM Peak Period respectively.

Figure 4 shows for the AM Peak that:

- 96% of cars on the West Gate Freeway are destined for the city and only 4% are destined for Ramp M;
- 41% of cars on the Cook Street Ramp are destined for the city and 59% are destined for Ramp M; and
- On Ramp M 38% of cars originated from the Cook Street Ramp and 62% originated from the West Gate Freeway.

Figure 5 shows for the PM Peak that:

- 92% of cars on the West Gate Freeway are destined for the city and only 8% are destined for Ramp M;
- 41% of cars on the Cook Street Ramp are destined for the city and 59% are destined for Ramp M; and
- On Ramp M 60% of cars originated from the Cook Street Ramp and 40% originated from the West Gate Freeway.

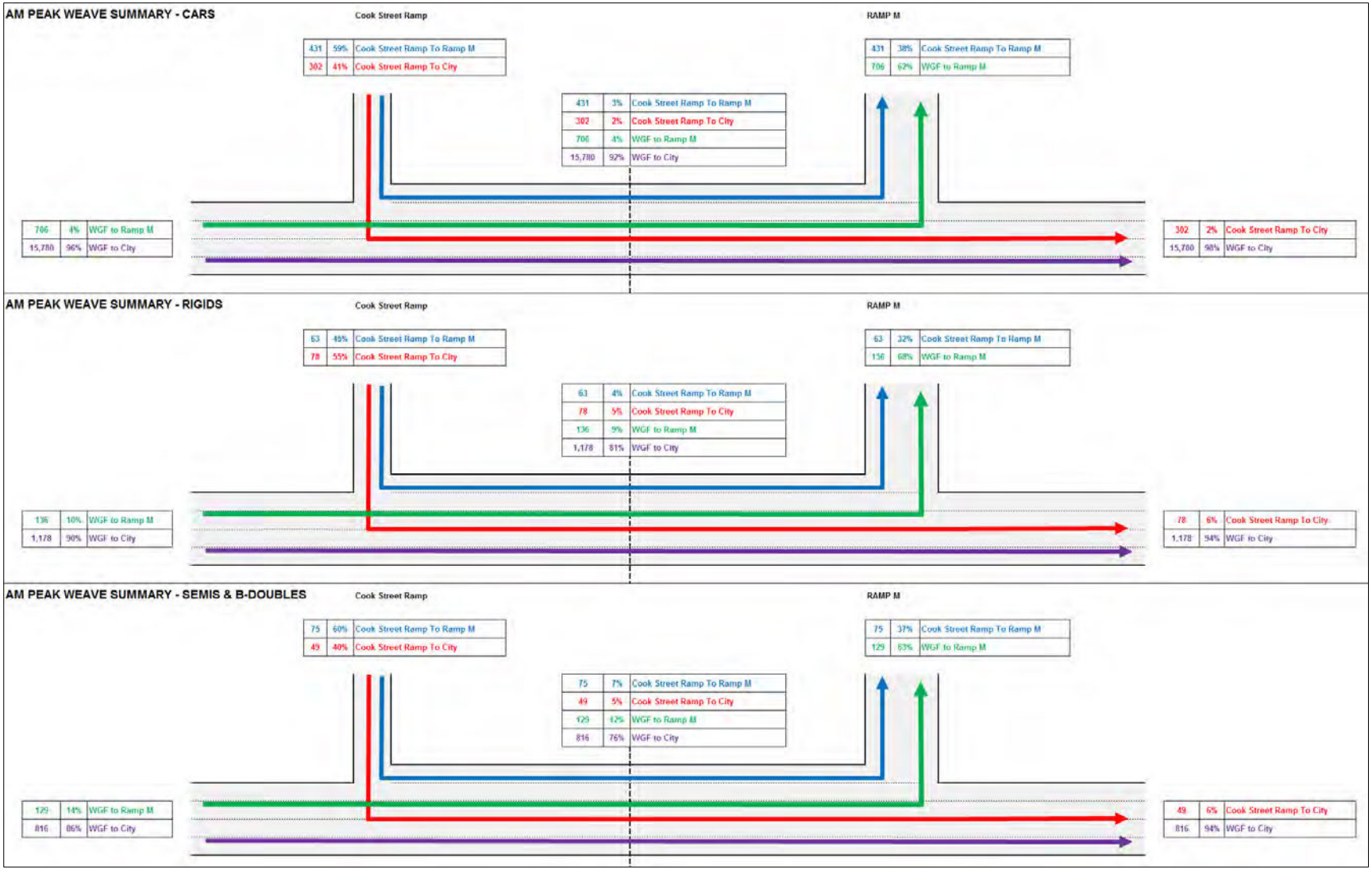


Figure 4 Cook Street to Ramp M AM Peak Weave Volumes (6am-9am)

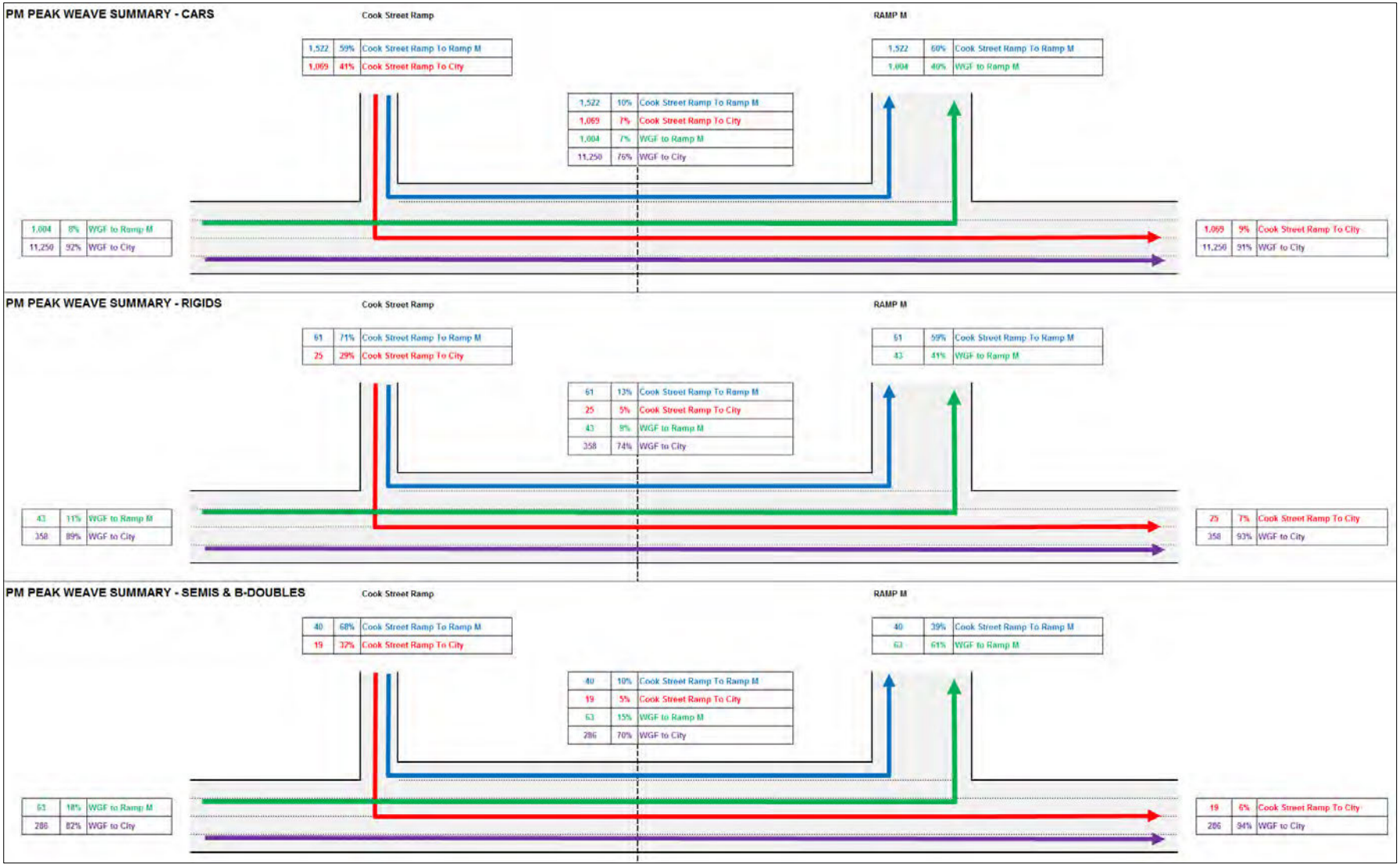


Figure 5 Cook Street to Ramp M PM Peak Weave Volumes (4pm-7pm)

4. Development of VISSIM Base Model

4.1 Introduction

This section outlines the key steps taken to construct the VISSIM base model.

4.2 Model Files

Due to the short timescales GHD made use of existing VISSIM models used on previous projects of the study area. The coding of these models was previously approved by VicRoads and thus these models are deemed suitable to be used on this project. The models were developed using VISSIM 5.40.

4.3 Backgrounds

Aerial photography supplied by VicRoads was used for the purposes of updating the VISSIM models.

4.4 Time Periods

Time periods were based on the peak periods shown in Figure 2 and to provide consistency with previous VISSIM modelling:

- AM Peak: 6am – 10am; and
- PM Peak: 3pm – 7pm.

4.5 Vehicle Classes

Vehicle classes and types coded in the previous models were used in this project, split as follows:

- Cars;
- LGVs; and
- HGVs (composition of semi-articulated trucks and B-double trucks).

4.6 Traffic Signal Timing

4.6.1 Intersections

VicRoads IDM data showing signal phasing sequences at the Cook Street and Cook Street off-ramp intersection was reviewed. The data showed a relatively high level of consistency (i.e. green times allocated to each signal phase were similar over the course of each peak period). As such it was agreed with VicRoads to apply a fixed time signal phasing plan for this intersection.

At the proposed new service centre on Cook Street, fixed time traffic signals were coded with the principal aim to minimise disruption to traffic exiting from the West Gate Freeway. These were linked to the adjacent Cook Street and Cook Street off-ramp intersections to ensure progression for the major traffic movements.

At the proposed new signalised intersection at Todd Road and Cook Street, fixed time traffic signals were installed based on estimates of likely green time required for each movement.

4.6.2 Ramp Meters

Ramp meter phasing data supplied by VicRoads was interrogated to ascertain signal cycle patterns in both the AM and PM peak periods.

Signal timings were then modified slightly during the validation and calibration phase to ensure that the ramp meter stop line throughput and queue length trends were representative of typical conditions.

5. Calibration and Validation

5.1 Introduction

This section outlines the process undertaken to calibrate and validate the AM and PM peak period models.

5.2 Calibration and Validation Criteria

Given the tight timeframes a high level calibration and validation process was undertaken:

- Check of freeway volumes and speeds over 15 minute periods during the peak periods;
- GEH check of freeway volumes for core peak periods;
- Check of traffic signal programming; and
- Visual check of vehicle behaviour including lane changing, merging and weaving.

5.3 Comparison of 15 minute volumes and speeds

The following figures provide a comparison of 15 minute volumes and speeds:

- Figure 6 summarises AM Peak freeway volumes;
- Figure 7 summarises AM Peak freeway speeds;
- Figure 8 summarises PM Peak freeway volumes; and
- Figure 9 summarises PM Peak freeway speeds.

It is noted from Figure 6 and Figure 8 that traffic volumes are broadly consistent between the observed and modelled data. However, Figure 8 and Figure 9 show that there are some discrepancies between modelled and observed traffic speeds, in particular modelled speeds are generally higher than observed speeds in the AM Peak period. The reasons for this are because the model covers a relatively small area and does not take in account wider congestion impacts on both the local and arterial road network. These can cause upstream network performance issues around Cook Street.

However, given the complexity and the difficulty of modelling these interactions under short timeframes and the focus on Ramp M, it was agreed with VicRoads that downstream congestion would not be modelled.

Figure 6 AM Peak Modelled and Observed Freeway Volumes

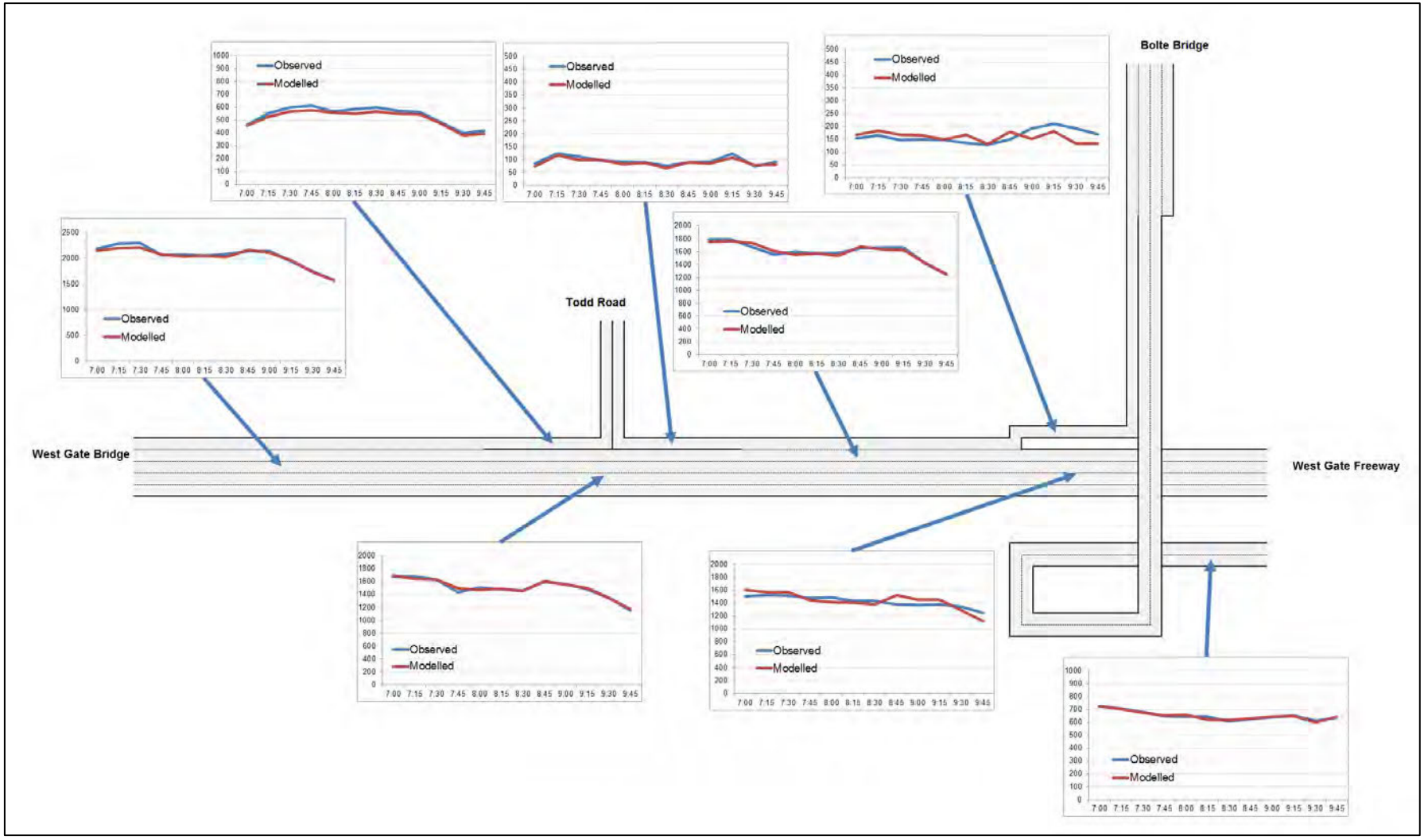


Figure 7 AM Peak Modelled and Observed Freeway Speeds

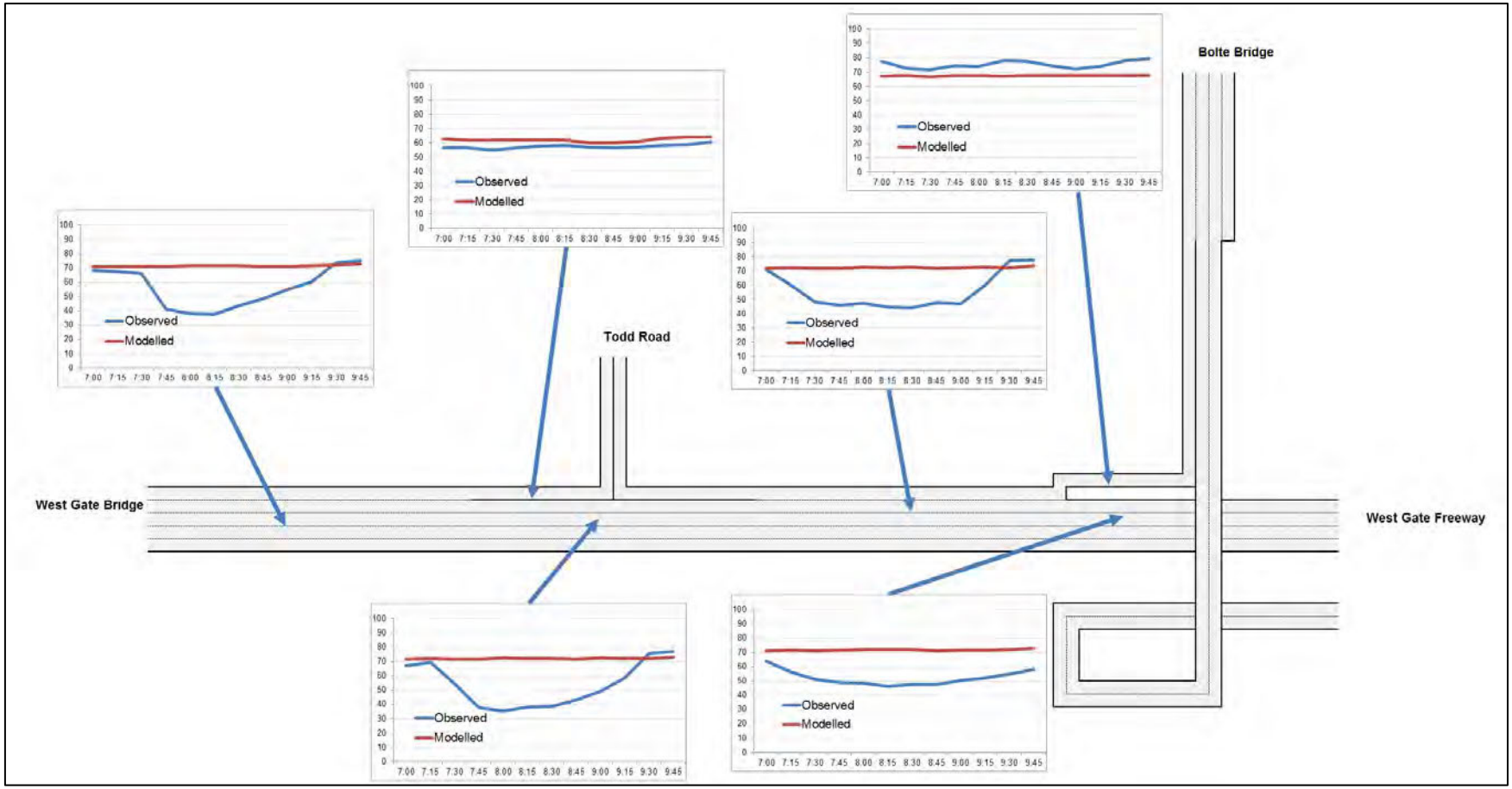


Figure 8 PM Peak Modelled and Observed Freeway Volumes

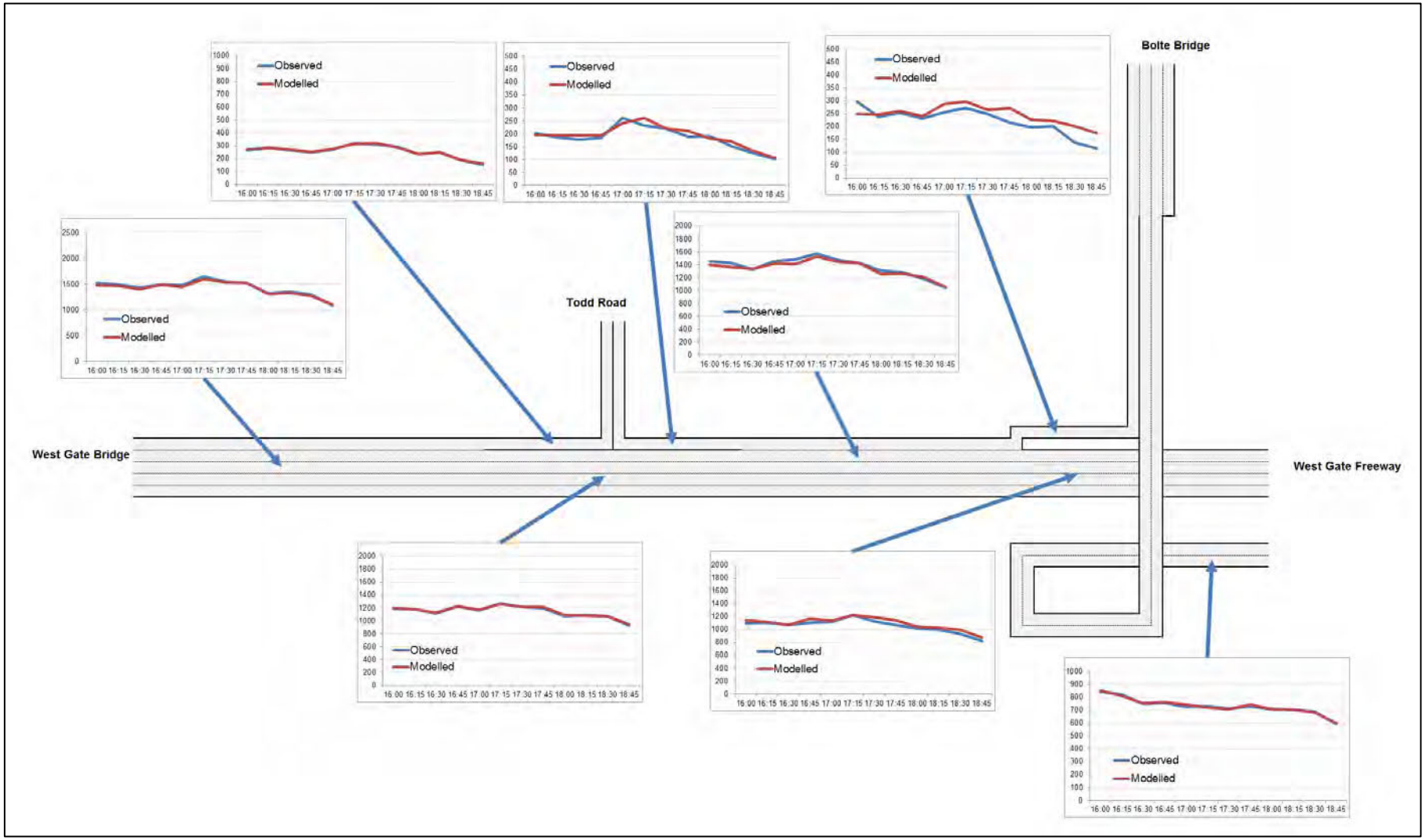
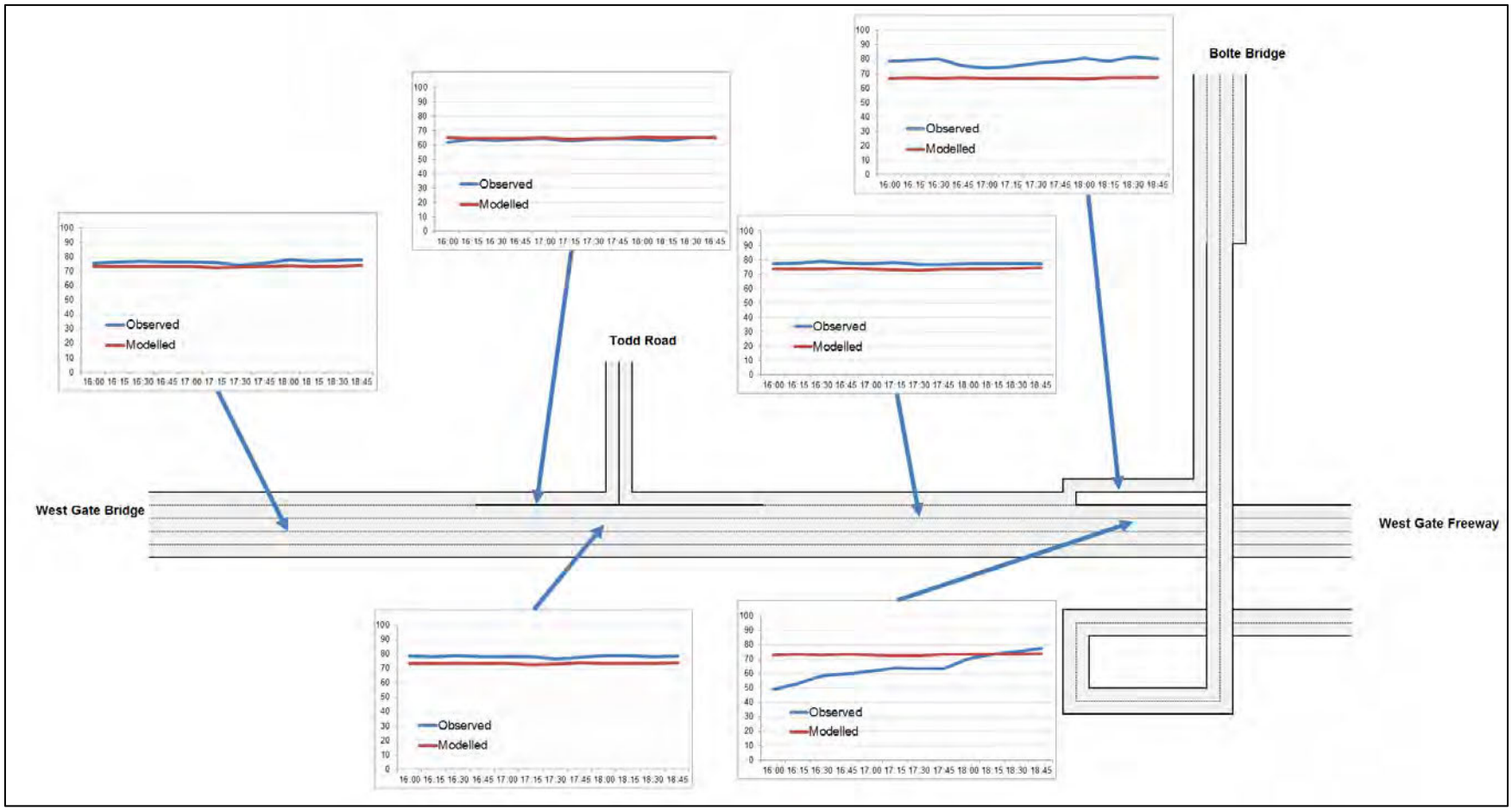


Figure 9 PM Peak Modelled and Observed Freeway Speeds



5.4 Freeway Volume GEH Results

In addition to the comparison of 15 minute freeway volumes and speeds GHD has undertaken a GEH analysis of hourly observed and modelled volumes at key points on the freeway network.

These results are summarised in Table 2 for the AM Peak and Table 3 for the PM Peak.

Table 2 AM Peak GEH Results

Location	0700-0800			0800-0900			0900-1000		
	Mod	Obs	GEH	Mod	Obs	GEH	Mod	Obs	GEH
West Gate Freeway EB 300m west of Todd Road	8,583	8,797	2.3	8,244	8,306	0.7	7,334	7,342	0.1
West Gate Freeway Exit to Cook Street	2,129	2,224	2.0	2,221	2,323	2.1	1,795	1,863	1.6
West Gate Freeway EB near Service Station	6,471	6,417	0.7	6,008	6,037	0.4	5,568	5,529	0.5
West Gate Freeway near Salmon St overpass	6,855	6,794	0.7	6,332	6,396	0.8	5,923	5,972	0.6
Ramp M Western Link exit	687	616	2.8	631	565	2.7	601	767	6.3
West Gate Freeway Mainline near Western Link overpass	6,182	6,019	2.1	5,720	5,730	0.1	5,324	5,353	0.4
Cook Street On-Ramp	386	414	1.4	324	343	1.0	346	378	1.7
West Gate Freeway WB Ramp to Bolte	2,761	2,764	0.0	2,526	2,527	0.0	2,538	2,540	0.0

Table 3 PM Peak GEH Results

Location	1600-1700			1700-1800			1800-1900		
	Mod	Obs	GEH	Mod	Obs	GEH	Mod	Obs	GEH
West Gate Freeway EB 300m west of Todd Road	5,819	5,933	1.5	6,080	6,183	1.3	5,001	5,042	0.6
West Gate Freeway Exit to Cook Street	1,086	1,073	0.4	1,207	1,204	0.1	845	831	0.5
West Gate Freeway EB near Service Station	4,730	4,714	0.2	4,869	4,843	0.4	4,181	4,161	0.3
West Gate Freeway near Salmon St overpass	5,502	5,650	2.0	5,806	5,943	1.8	4,768	4,809	0.6
Ramp M Western Link exit	998	1,022	0.8	1,122	995	3.9	828	655	6.4
West Gate Freeway Mainline near Western Link overpass	4,502	4,380	1.8	4,696	4,539	2.3	3,947	3,775	2.8
Cook Street On-Ramp	773	748	0.9	934	903	1.0	591	570	0.9
West Gate Freeway WB Ramp to Bolte	3,178	3,172	0.1	2,916	2,898	0.3	2,693	2,692	0.0

6. Future Year Traffic Volumes

6.1 Introduction

This section outlines the steps taken to estimate future year traffic volumes used to test a future direction connection from Cook Street to Ramp M.

6.2 Strategic modelling data

Traffic volumes were sourced from the Veitch Lister Consulting ZENITH Strategic Transport Model. These are provided in two hour formats for the following user classes:

- Cars;
- Light commercial vehicles; and
- Heavy commercial vehicles.

6.3 Estimation of future year volumes

6.3.1 Step 1 – Estimation of 2015 strategic model volumes

The first step was to convert 2011 VLC strategic traffic volume data into 2015 VLC strategic volume data. The reason for this is that real traffic data is sourced from March 2015 and thus a consistent base is needed from which future volumes can be factored.

This was achieved by calculating a growth factor by dividing 2015 freeway data by 2011 freeway data (supplied by VicRoads) and then multiplying VLC 2011 traffic volumes by the resultant growth factor.

This process is shown in Equation 1.

$$VLC\ 2015 = VLC\ 2011 \times (2015\ Freeway\ Data\ /\ 2011\ Freeway\ Data)$$

Equation 1 Estimation of 2015 VLC Volumes

The derived volumes are shown in Table 4.

Table 4 2011 and 2015 West Gate Freeway Volumes

	2011 Average West Gate Freeway Traffic Volumes	2015 Average West Gate Freeway Traffic Volumes	2011-2015 Percentage Difference
Total	69,196	78,730	14%
6am-10am	21,159	23,653	12%
3pm-7pm	16,180	17,907	11%

6.3.2 Step 2 – Estimation of future year traffic volumes

The next step was to estimate future year traffic volumes for each origin-destination pair. This was undertaken by dividing 2031 VLC traffic volumes by estimated 2015 VLC traffic volumes and then multiplying the traffic volume for each origin-destination pair by this factor.

This was undertaken for the 2031 Do Nothing and 2031 Future Year scenarios split by cars, light commercial vehicles and heavy commercial vehicles.

This calculation is shown in Equation 2:

$$Existing\ traffic\ volume \times \frac{VLC\ 2031\ traffic\ volume}{VLC\ 2015\ traffic\ volume}$$

Equation 2 Estimation of future year volumes

6.4 Example calculation

In order to show the future year traffic volume calculation process, Table 5 presents the steps undertaken for the origin-destination movement between the West Gate Bridge and West Gate Freeway (towards Melbourne CBD) under the 2031 Do Nothing scenario.

Table 5 Calculation of future year traffic volume example

Step		Data Source	Traffic Volume
Step 1	A	VLC 2011 Traffic Volume (7am-9am)	10,771
	B	2011 Freeway Data (6am-10am)	21,159
	C	2015 Freeway Data (6am-10am)	23,653
	D	Estimated 2015 VLC Volume (A*C/B)	12,040
Step 2	A	Existing traffic volume (08:00am-08:15am)	1,267
	B	Estimated 2015 VLC Volume	12,040
	C	2031 VLC Future Year Volume	[redacted]
	D	Estimated future year volume used in VISSIM (A*C/B) for 08:00-08:15	[redacted]

6.5 Future Year Volume Scenarios

Using the steps outlined above the following future year scenario volumes were calculated:

- 2031 With Western Distributor – assumes the Western Distributor is fully operational
- 2031 Without Western Distributor – assumes that there is no Western Distributor

In addition to the above tests a sensitivity test was undertaken on truck volumes associated with the Webb Dock precinct. This was conducted using estimated future truck volume data from a VISSIM model developed by Aurecon. These were then added to the '2031 With Western Distributor' scenario volumes.

6.6 Summary of estimated future year traffic volumes

Table 6 summarises the estimated future year traffic volumes for the key movements:

- Cook Street area to Ramp M
- Cook Street area to West Gate Freeway (towards Melbourne CBD)
- West Gate Bridge to Ramp M
- West Gate Bridge to West Gate Freeway (towards Melbourne CBD)

Table 6 summarises AM Peak Hour VISSIM traffic volumes for each of these key movements (for all vehicle types). Table 7 then summarises PM Peak Hour VISSIM traffic volumes.

Table 6 AM Peak Hour VISSIM Future Year Traffic Volumes

	2015	2031 With Western Distributor	2031 Without Western Distributor	2031 PoMC Sensitivity Test
Cook Street area to Ramp M	154	[redacted]	[redacted]	[redacted]
Cook Street area to West Gate Freeway (towards Melbourne CBD)	95	[redacted]	[redacted]	[redacted]
West Gate Bridge to Ramp M	468	[redacted]	[redacted]	[redacted]
West Gate Bridge to West Gate Freeway (towards Melbourne CBD)	5,642	[redacted]	[redacted]	[redacted]

Table 7 PM Peak Hour Modelled Future Year Traffic Volumes

	2015	2031 With Western Distributor	2031 Without Western Distributor	2031 PoMC Sensitivity Test
Cook Street area to Ramp M	530	[redacted]	[redacted]	[redacted]
Cook Street area to West Gate Freeway (towards Melbourne CBD)	325	[redacted]	[redacted]	[redacted]
West Gate Bridge to Ramp M	576	[redacted]	[redacted]	[redacted]
West Gate Bridge to West Gate Freeway (towards Melbourne CBD)	4,337	[redacted]	[redacted]	[redacted]

7. Option Testing

7.1 Introduction

This section outlines the option tests undertaken for this project.

7.2 Options Tested

Table 8 summarises options tested in this project.

Table 8 Summary of Options Tested

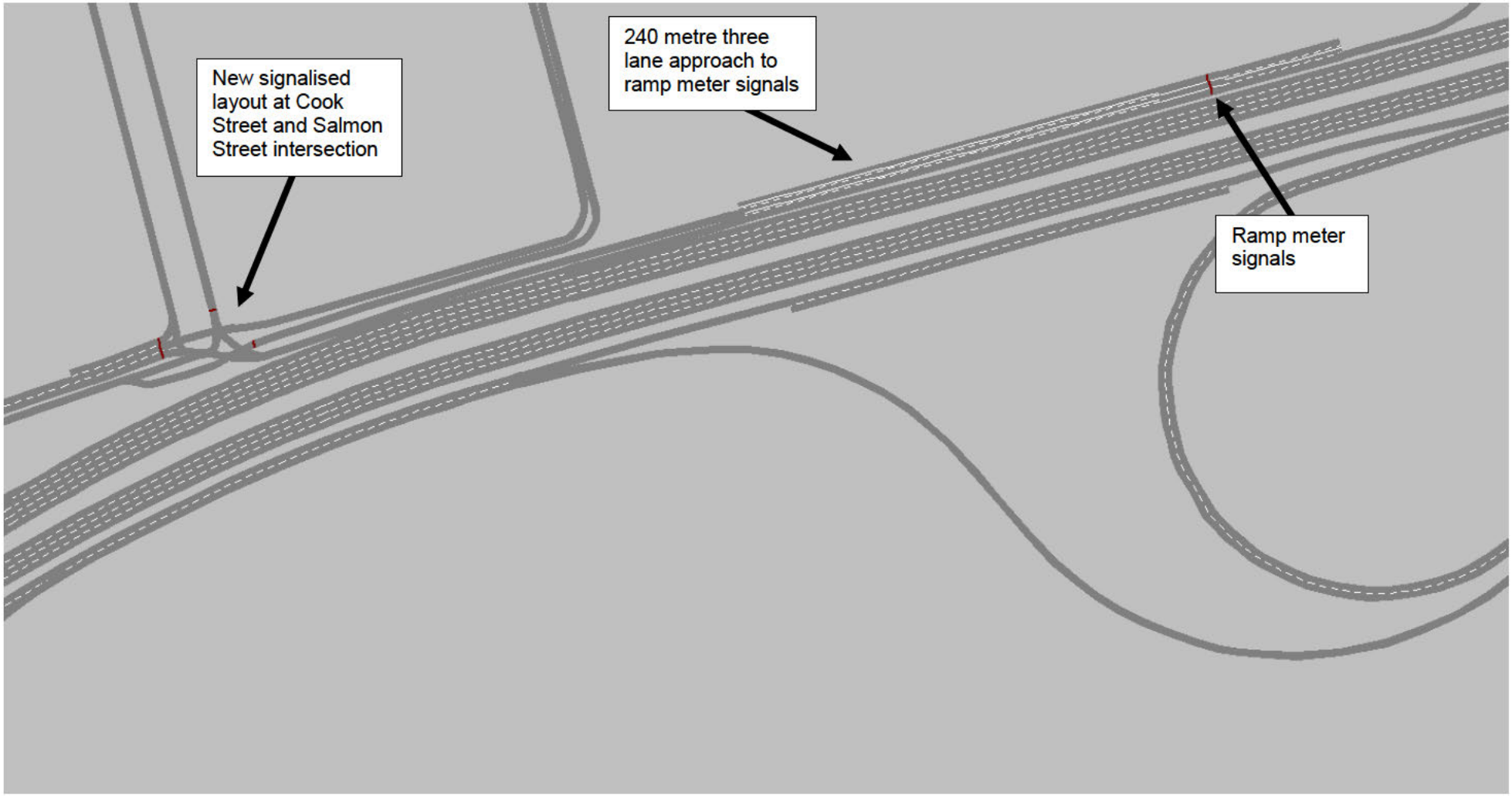
Option	Summary of Option
2015 Base Model	Existing traffic network and 2015 traffic volumes
2031 Do Nothing	Existing traffic network with '2031 Without Western Distributor' traffic volumes.
2031 Webb Dock Access With Western Distributor	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 With Western Distributor' traffic volumes, which assumes the Western Distributor scheme is built.
2031 Webb Dock Access Without Western Distributor	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 Without Western Distributor' traffic volumes
2031 Webb Dock Access With Western Distributor (PoMC Sensitivity Test)	Modified traffic network to include new connection between Cook Street and Ramp M. This used estimated '2031 With Western Distributor' traffic volumes, which assumes the Western Distributor scheme is built as well as additional Webb Dock truck volumes.

7.3 Webb Dock Access Layout

Figure 10 shows the new Webb Dock Access ramp layout. In summary it has the following features:

- A new signalised traffic signal layout at the Cook Street and Salmon Street intersection;
- Ramp meter signals; and
- Three lanes of storage on approach to the ramp meter signals.

Figure 10 Webb Dock Access Ramp Layout



7.4 Ramp Metering Methodology

It was agreed with VicRoads to used fixed time traffic signals to test the new ramp meter signals on Ramp M for the PM Peak only. In reality any ramp meter signals installed at this location would be linked to the wider freeway management systems employed by VicRoads and Transurban and it was decided that it was unlikely that the ramp meter would be turned on in the AM Peak period. The use of freeway management systems would mean that the ramp meter signal cycle length would vary depending on network traffic conditions as well as on the ramp itself.

GHD's approach with the ramp meter was to estimate hourly throughput on Ramp M per lane and apply a suitable signal cycle time from the VicRoads Freeway Ramp Signals Handbook. The model was visually assessed to ensure that traffic did not block back onto arterial roads, particularly the West Gate Freeway. Small changes in the signal cycle length were made in order to minimise queuing risks.

Table 9 summarises the signal cycle lengths used in each of the models.

Table 9 Summary of Options Tested

Option	PM Peak Cycle Length
2031 Webb Dock Access With Western Distributor	7.5
2031 Webb Dock Access Without Western Distributor	7
2031 Webb Dock Access With Western Distributor (PoMC Sensitivity Test)	7.5

7.5 Travel Time Results

Travel time results were extracted from each of the models to assess model performance. Four routes were chosen, shown in Figure 11:

- Route 1 – West Gate Freeway from Todd Road underpass to Ramp M;
- Route 2 – West Gate Freeway from Todd Road underpass to Western Link Overpass;
- Route 3 – Cook Street from Todd Road intersection to Ramp M; and
- Route 4 – Cook Street from Todd Road intersection to Western Link Overpass.

Figure 11 Travel Time Routes

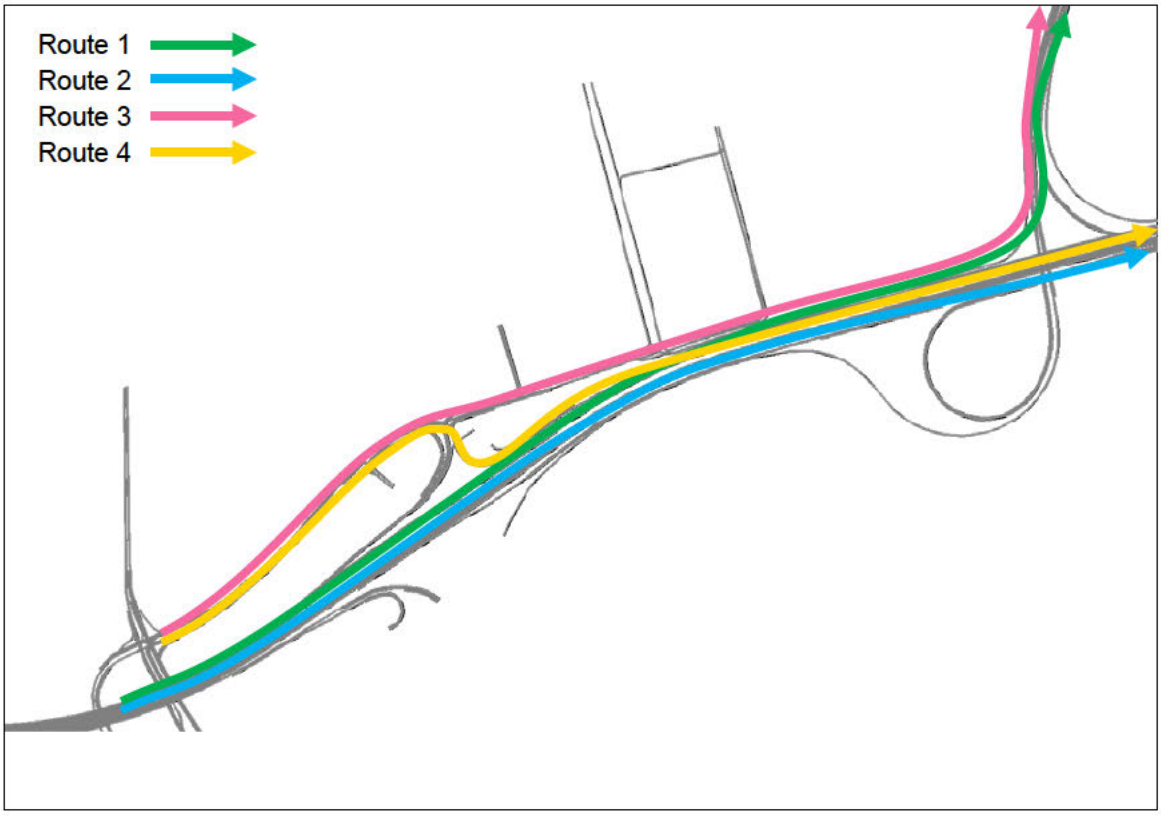


Figure 12 summarises AM Peak travel times for each of these routes. It can be seen that:

- In Route 1 it can be seen that there is an increase in travel time in the Webb Dock Access models. This is because of the ramp meters installed in these options;
- In Route 2 there are very minor differences in travel times across each of the options relative to the 2015 Base and 2031 Do Nothing model;
- In Route 3 there are small increases in travel time in each option test relative to the 2015 Base. However, there is little difference between these options and the 2031 Do Nothing Model; and
- In Route 4 there are minor differences between the 2015 Base Model and the option tests. However, the option test travel times are quicker than the 2031 Do Nothing model – the reason for this is that in the option tests traffic travelling from Cook Street to Ramp M no longer uses the same ramp, thereby reducing congestion on the Cook Street ramp.

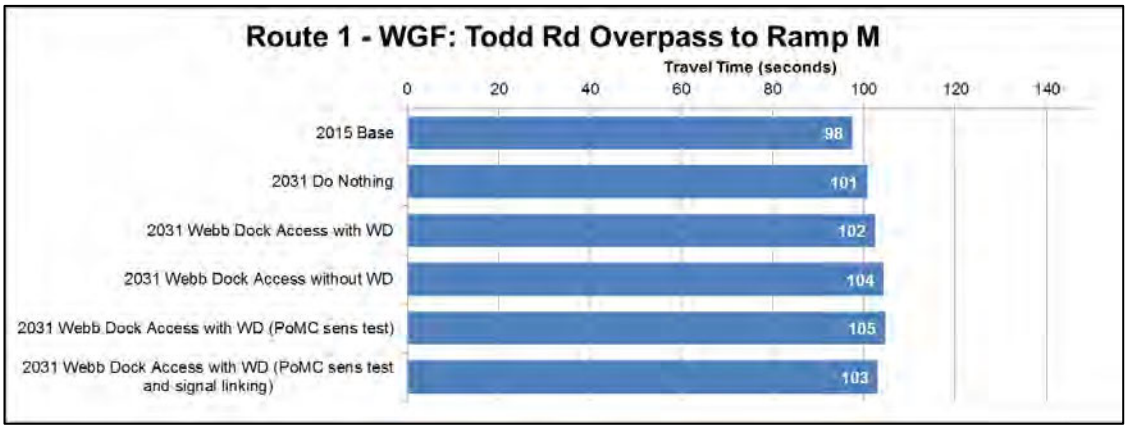
Figure 14 summarises PM Peak travel times for each of these routes. It can be seen that:

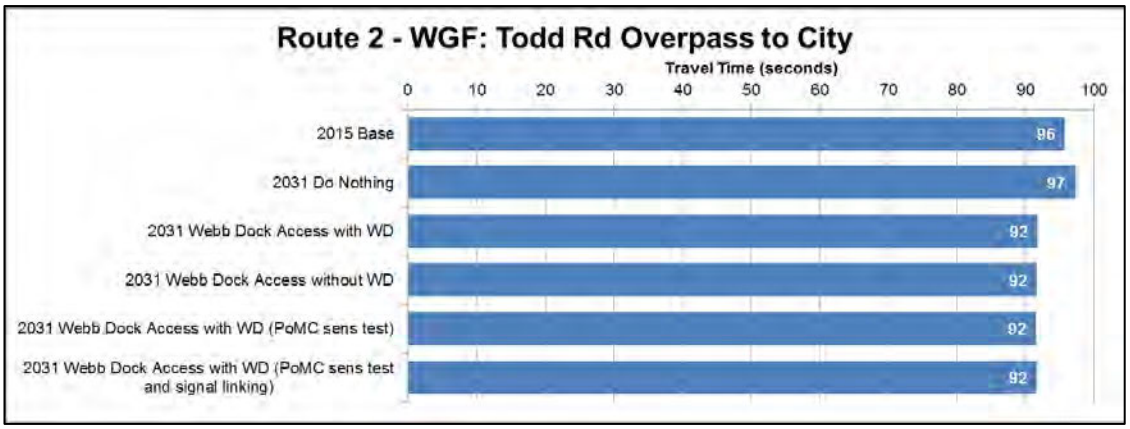
- In Route 1 it can be seen that there is an increase in travel time in the Webb Dock Access models. This is because of the ramp meters installed in these options. It is noted that the '2031 Webb Dock Access without Western Distributor' model has a quicker travel time compared to the other options. This is because of a slightly shorter cycle time in this option model as it was observed that traffic did queue on occasions back onto the West Gate Freeway with a 7.5 second ramp meter cycle length;
- In Route 2 there are very minor differences in travel times across each of the options relative to the 2015 Base and 2031 Do Nothing model;
- In Route 3 there are increases in travel time in each option test relative to the 2015 Base with the exception of the '2031 Webb Dock Access without Western Distributor' model.

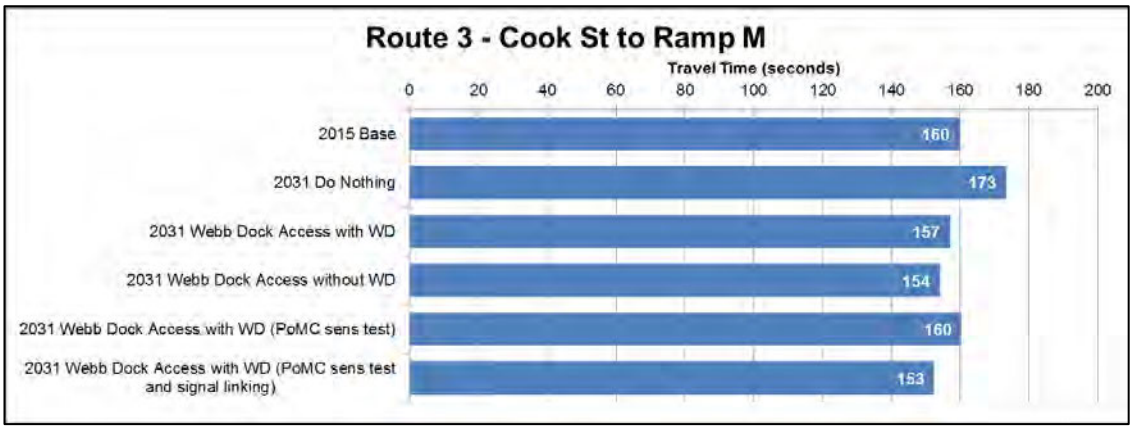
As observed for Route 1 this is because of a slightly shorter ramp meter cycle time in this model to mitigate queues, leading to an overall improved travel time; and

- In Route 4 there are improvements in the travel time between the option models and the 2015 Base model and the 2031 Do Nothing model. The reason for this is that in the option tests traffic travelling from Cook Street to Ramp M now uses a dedicated ramp, thereby reducing traffic volumes on the Cook Street ramp.

Figure 12 AM Peak Travel Times - Cars







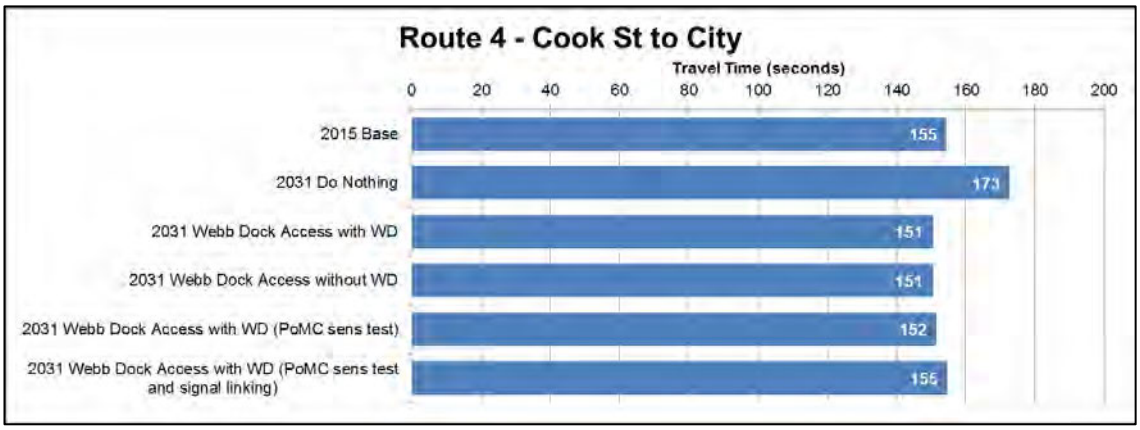
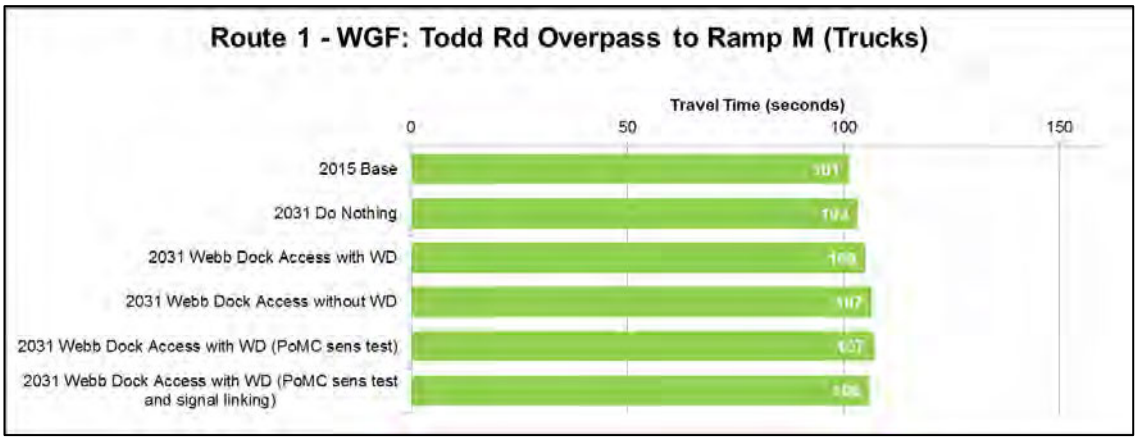
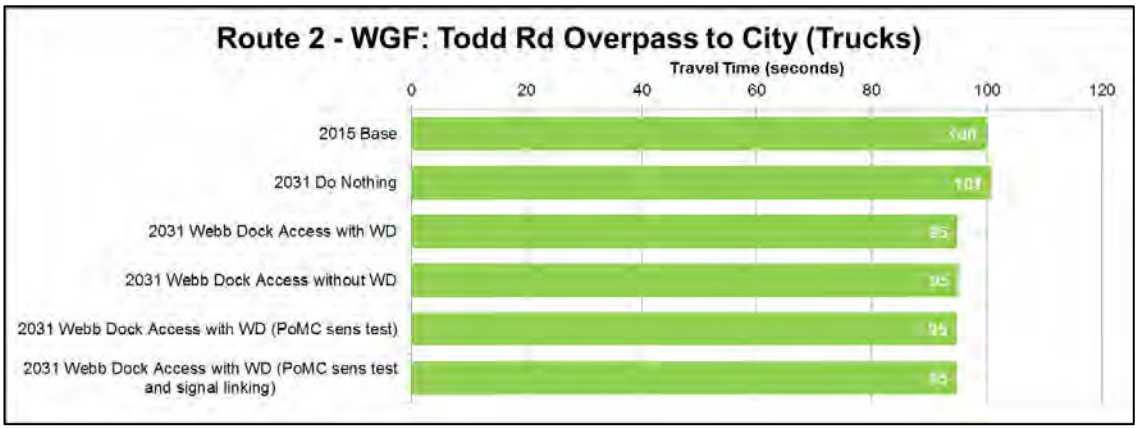
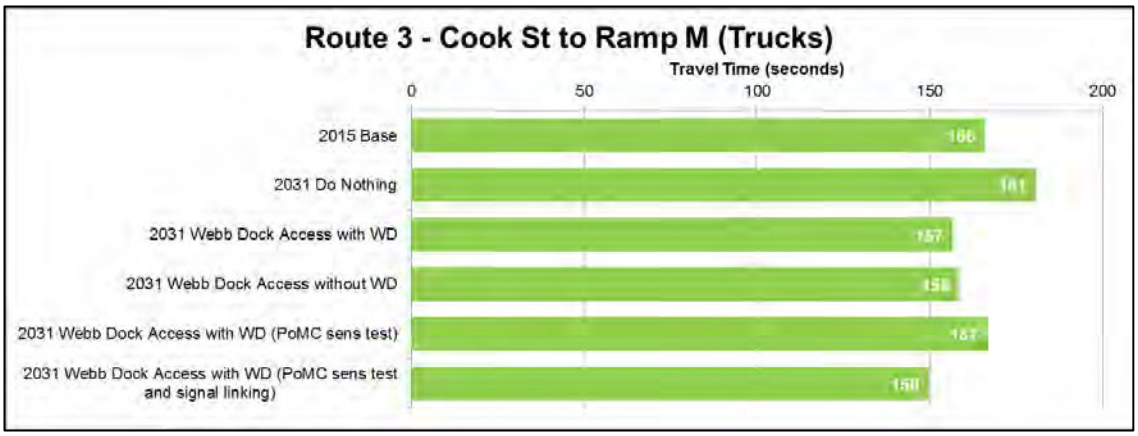


Figure 13 AM Peak Travel Times - HGVs







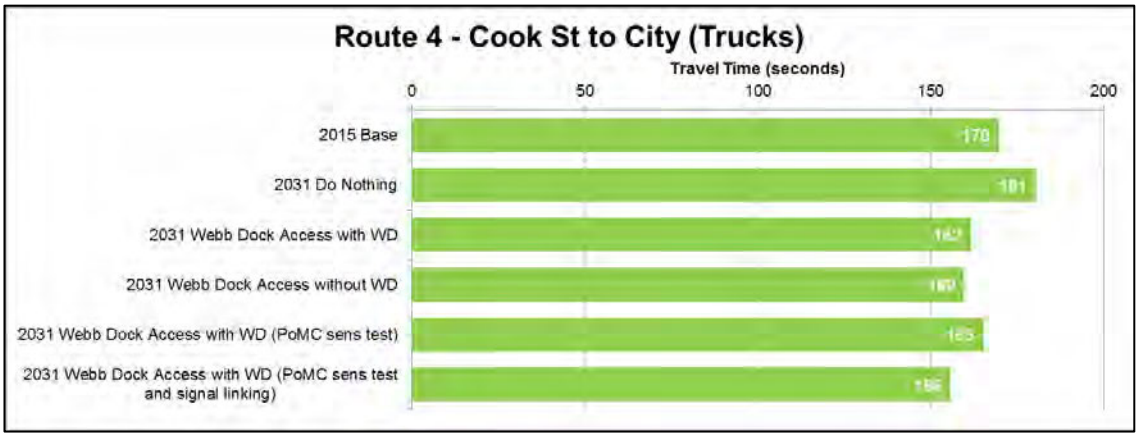
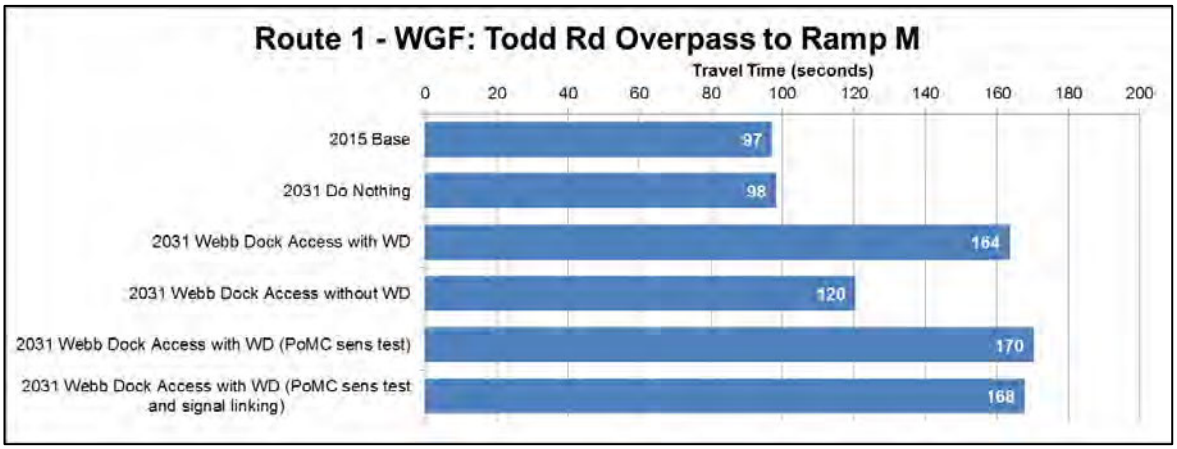
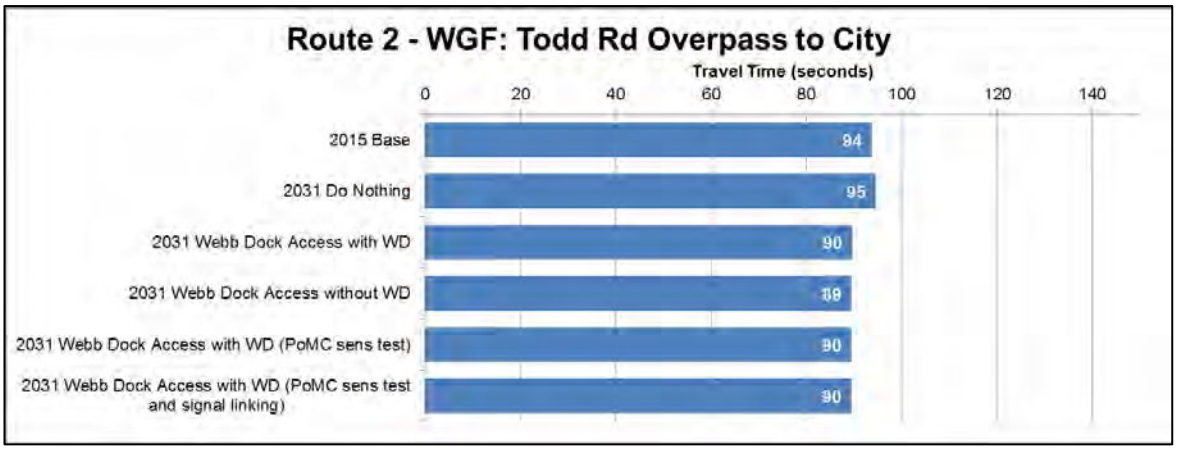
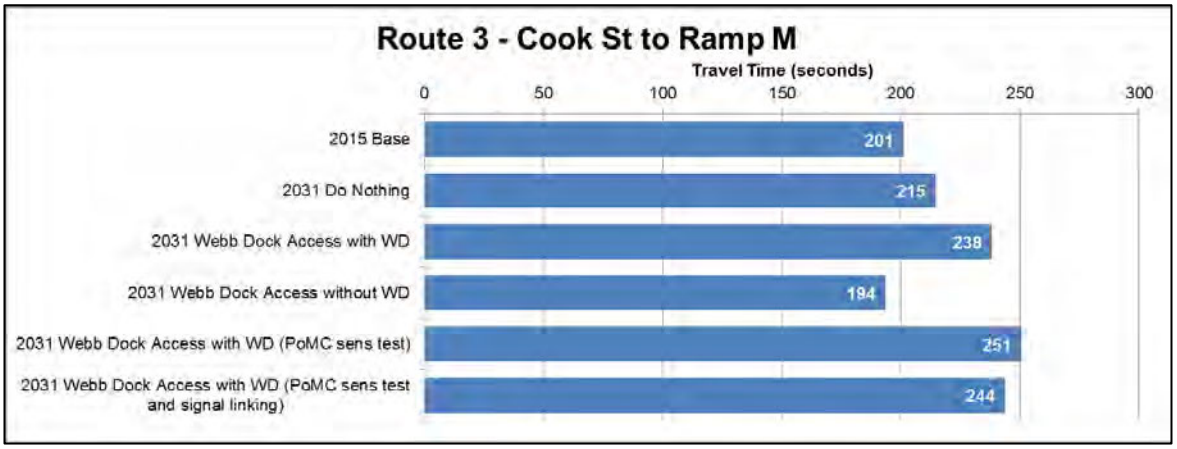


Figure 14 PM Peak Travel Times - Cars







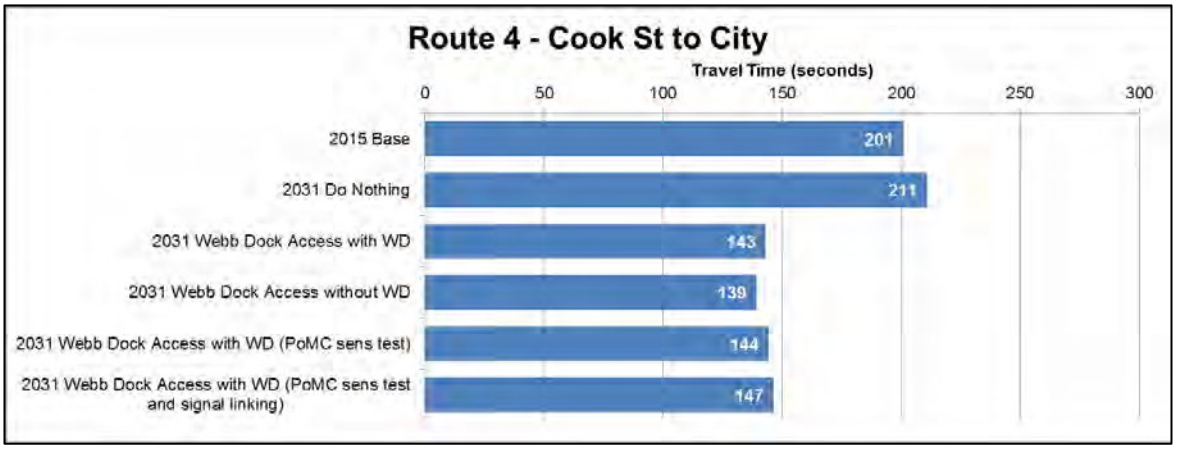
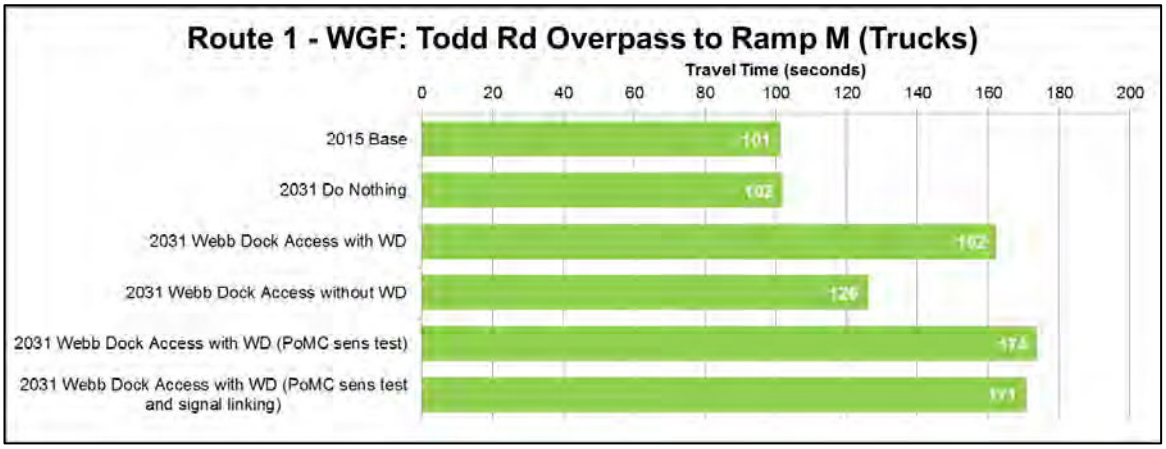
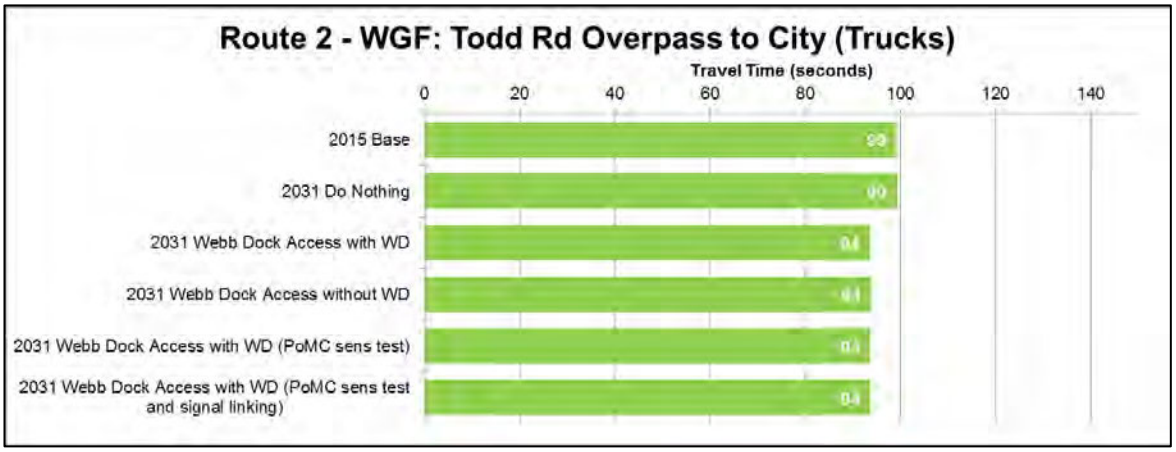
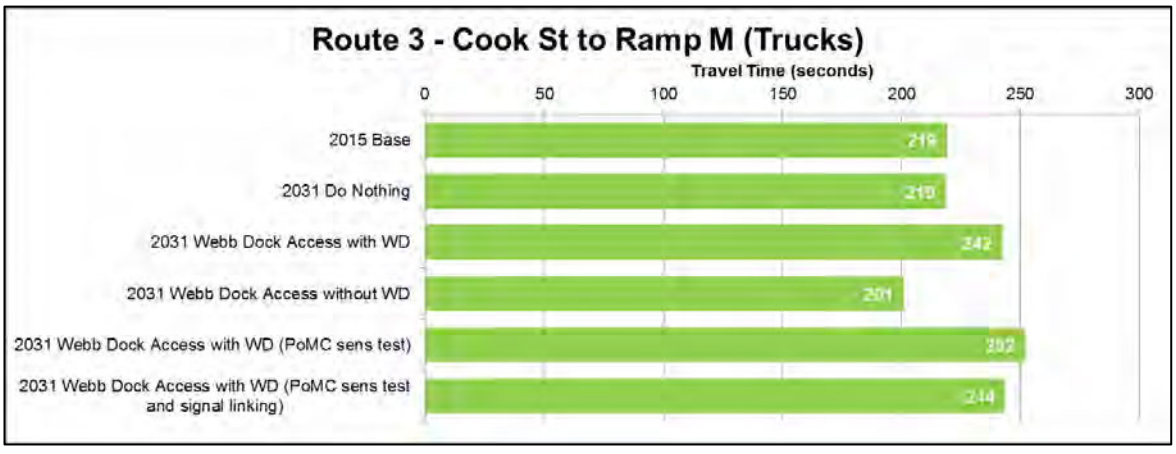
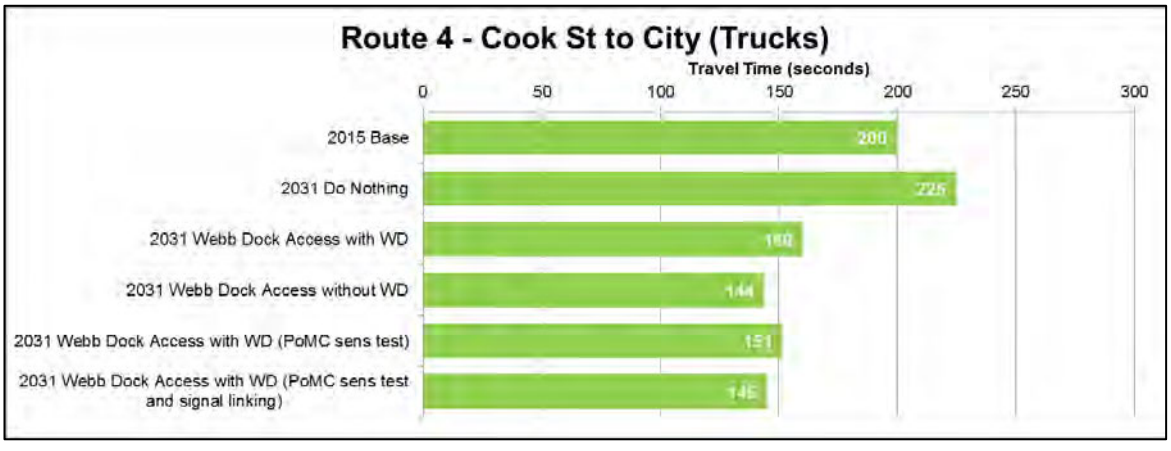


Figure 15 PM Peak Travel Times - HGVs









7.6 Intersection Level of Service Results

Average delay results have been extracted from each of the VISSIM Models on the Cook Street corridor to assess the performance of each intersection as follows:

- Todd Road/Cook Street and Webb Dock entrance;
- Cook Street and off-ramp from West Gate Freeway; and
- Cook Street and Salmon Street.

Level of Service has also been calculated according to the thresholds shown in Table 10.

Table 10 Level of Service Definitions

Level of Service	Delay
A	≤ 10 seconds
B	10-20 seconds
C	15-25 seconds
D	25-35 seconds
E	35-50 seconds
F	≥ 50 seconds

Table 11 and Table 12 present average delay results for the AM and PM peak respectively. These results are also shown in Level of Service format in Figure 16 and Figure 17

Table 11 AM Peak Average Delay Results

Intersection	Leg	AM 2015 Base	AM 2031 Do Nothing	AM 2031 Webb Dock Access with WD	AM 2031 Webb Dock Access without WD	AM 2031 Webb Dock Access (PoMC Sensitivity Test)	AM 2031 Webb Dock Access (PoMC Sensitivity Test and signal linking)
Cook Street and Todd Street	Webb Dock	21	40	36	36	38	35
	Todd Road South	27	32	30	30	32	34
	Cook Street East	35	31	33	31	36	28
	Todd Road North	26	25	29	25	34	34
	Total	**32**	**31**	**32**	**30**	**35**	**31**
Cook Street Off Ramp Interchange	Cook Street West	27	29	28	25	28	15
	Cook Street Off Ramp	13	12	12	12	12	19
	Cook Street East	20	20	21	22	22	15
	Total	**14**	**15**	**15**	**15**	**15**	**18**
Cook Street and Salmon Street	Cook Street West	3	3	10	8	10	15
	Salmon Street North	2	2	36	37	40	31
	Cook Street East	0	0	43	44	43	33
	Total	**3**	**2**	**15**	**15**	**16**	**18**

Table 12 PM Peak Average Delay Results

Intersection	Leg	PM 2015 Base	PM 2031 Do Nothing	PM 2031 Webb Dock Access with WD	PM 2031 Webb Dock Access without WD	PM 2031 Webb Dock Access (PoMC Sensitivity Test)	PM 2031 Webb Dock Access (PoMC Sensitivity Test and signal linking)
Cook Street and Todd Street	Webb Dock	37	38	33	36	34	40
	Todd Road South	33	33	33	31	33	39
	Cook Street East	20	18	20	18	21	19
	Todd Road North	19	17	21	17	21	23
	Overall	**22**	**21**	**23**	**21**	**24**	**25**
Cook Street Off Ramp Interchange	Cook Street West	26	26	24	22	24	21
	Cook Street Off Ramp	11	18	16	16	15	21
	Cook Street East	17	17	19	20	19	38
	Overall	**15**	**19**	**18**	**17**	**17**	**23**
Cook Street and Salmon Street	Cook Street West	1	4	21	28	21	30
	Salmon Street North	2	12	55	49	55	48
	Cook Street East	1	1	83	63	82	68
	Overall	**1**	**4**	**35**	**36**	**35**	**38**

Figure 16 AM Peak Level of Service Results

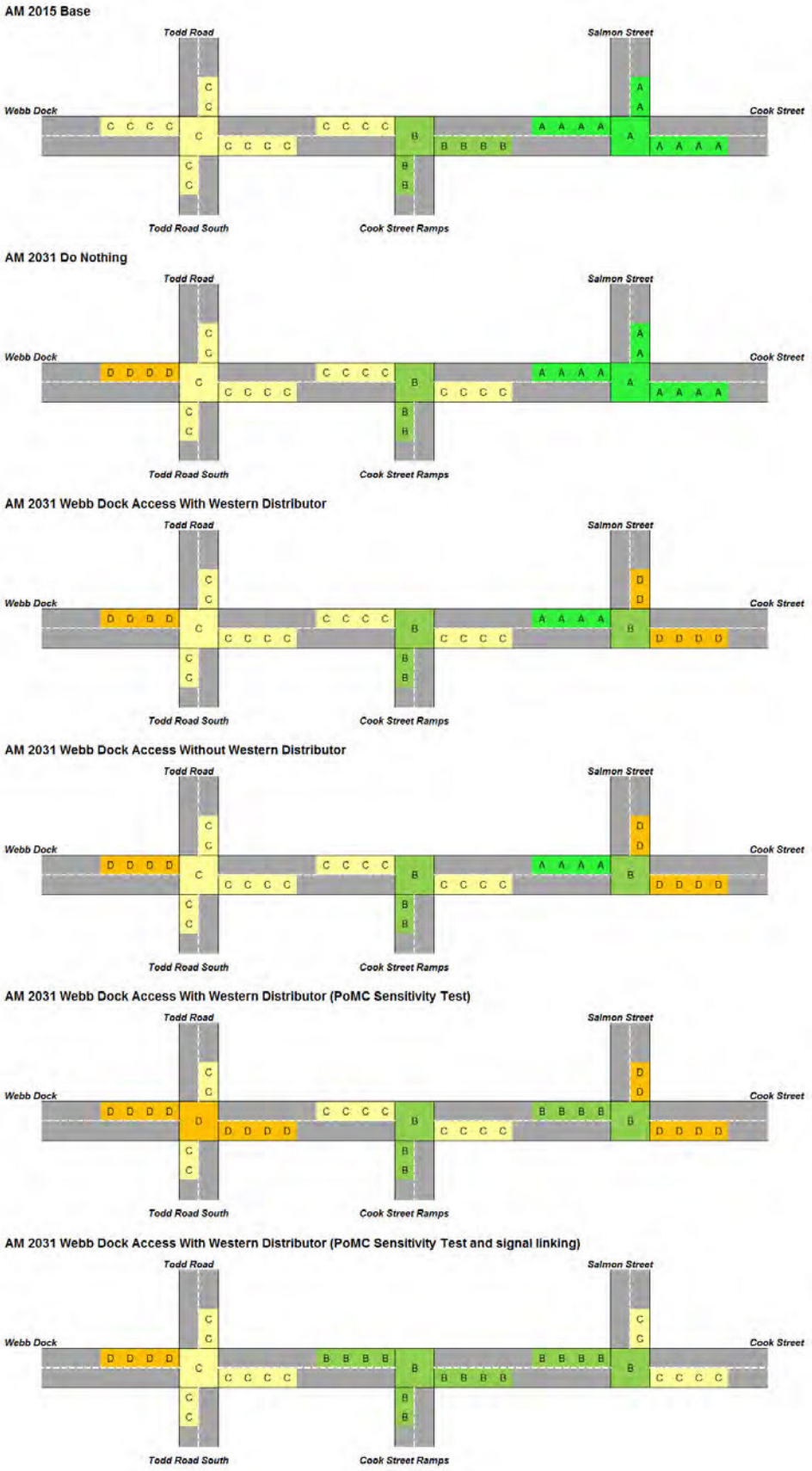
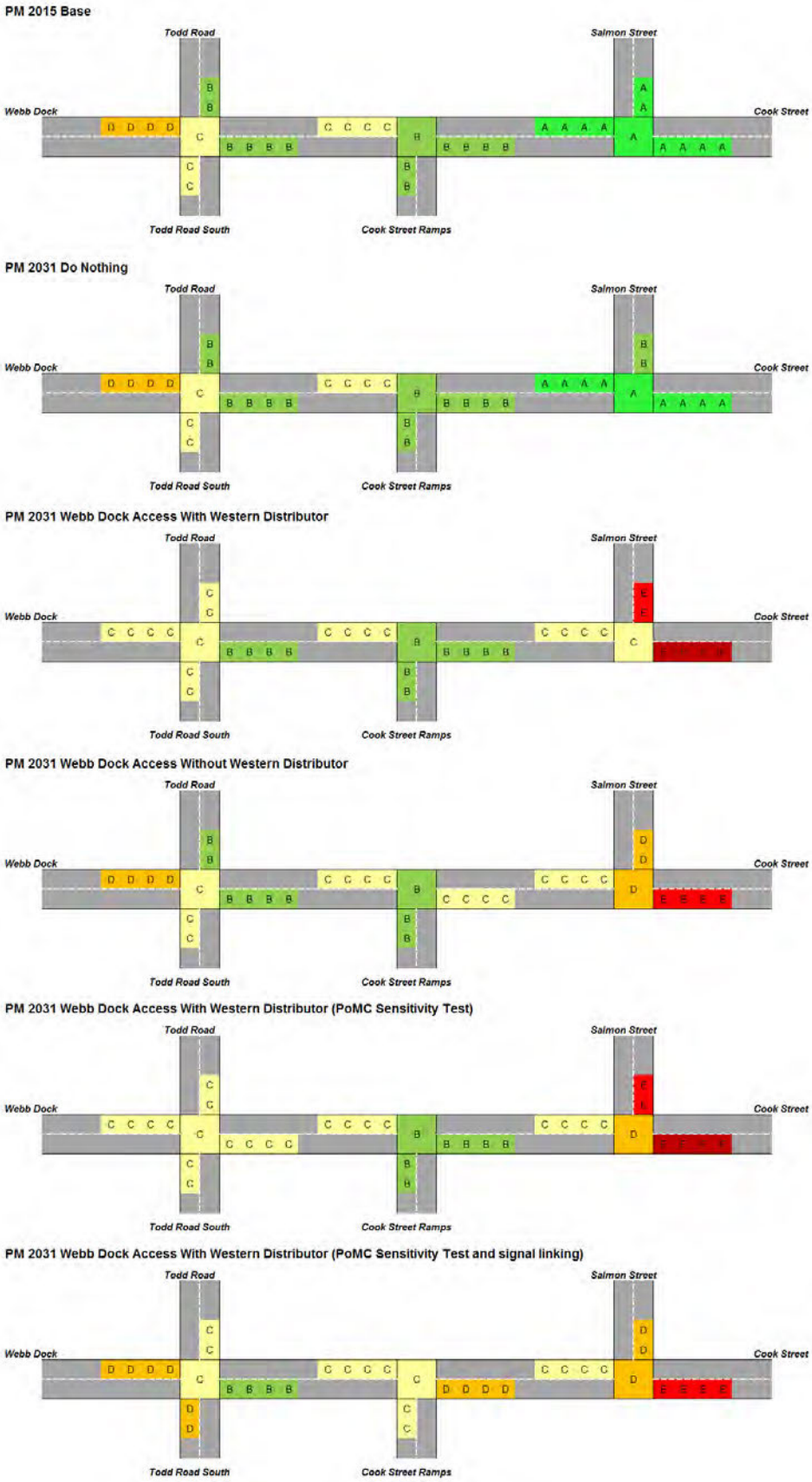


Figure 17 PM Peak Level of Service Results



7.7 Intersection Queue Lengths

Average queue length results have been extracted from the Cook Street corridor for each scenario and are presented in Table 11 and Table 12 for the AM and PM peak periods respectively.

Table 13 AM Peak Average Queue Length Results

Intersection	Movement	Movement	AM 2015 Base	AM 2031 Do Nothing	AM 2031 Project with WD	AM 2031 Project without WD	AM 2031 Project (PoMC Sensitivity Test)	AM 2031 Project (PoMC Sensitivity Test and signal linking)
Cook Street and Todd Street	Webb Dock	L	5	5	12	3	3	18
		T	5	5	12	3	3	18
	Todd Road South	T	5	7	4	7	7	5
		R	5	18	10	13	13	11
	Cook Street East	L	18	29	12	28	28	13
		T	24	6	20	6	6	43
		R	35	27	31	28	27	30
	Todd Road North	L	2	5	5	5	5	8
		T	2	5	5	5	5	8
		R	2	5	5	5	5	8
Cook Street Off Ramp Interchange	Cook Street West	T	1	3	9	8	8	10
		R	4	8	7	5	5	9
	Cook Street Off Ramp	L	7	6	5	6	5	6
		R	14	15	15	15	15	13
	Cook Street East	L	1	3	3	4	3	3
		T	1	1	1	0	1	0
Cook Street and Salmon Street	Cook Street West	L	0	0	11	8	7	12
		R	0	0	11	8	7	12
	Salmon Street North	L	0	0	10	9	9	11
		R	0	0	10	9	9	11
	Cook Street East	T	0	0	10	9	9	11
		R	0	0	7	7	8	7

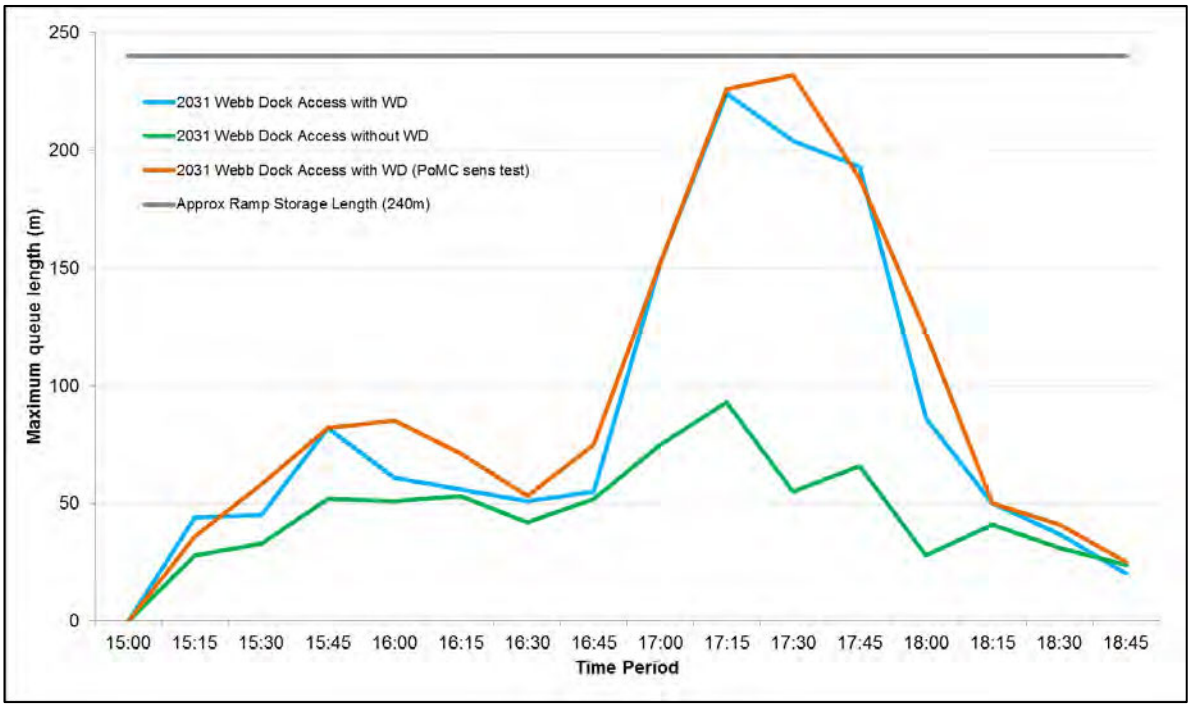
Table 14 PM Peak Average Queue Length Results

Intersection	Movement	Movement	PM 2015 Base	PM 2031 Do Nothing	PM 2031 Project with WD	PM 2031 Project without WD	PM 2031 Project (PoMC Sensitivity Test)	PM 2031 Project (PoMC Sensitivity Test and signal linking)
Cook Street and Todd Street	Webb Dock	L	3	4	3	3	5	6
		T	3	4	3	3	5	6
	Todd Road South	T	0	2	1	2	1	2
		R	8	14	9	9	9	11
	Cook Street East	L	8	11	8	10	8	6
		T	8	3	8	3	15	13
		R	1	1	1	1	1	1
	Todd Road North	L	8	8	11	8	11	12
		T	8	8	11	8	11	12
		R	8	8	11	8	11	12
Cook Street Off Ramp Interchange	Cook Street West	T	0	3	10	12	13	9
		R	7	8	5	3	5	5
	Cook Street Off Ramp	L	4	3	2	2	3	4
		R	6	32	24	26	22	36
	Cook Street East	L	2	3	3	4	3	6
		T	5	4	2	1	2	6
Cook Street and Salmon Street	Cook Street West	L	0	0	49	99	53	101
		R	0	0	49	99	53	101
	Salmon Street North	L	0	2	42	34	42	37
		R	0	2	42	34	42	37
	Cook Street East	T	0	2	42	34	42	37
		R	0	0	27	16	27	21

7.8 Ramp Meter Queue Lengths

Queue lengths on approach to the Ramp M ramp meter stopline were analysed to ensure that traffic did not queue back onto either the West Gate Freeway or Cook Street. The modelling methodology assumed that the ramp meter would not be turned on in the AM Peak. Therefore results for the AM Peak were not collected. Figure 18 summarises queue lengths in the PM Peak model. It can be seen that queue lengths are kept within the ramp meter storage area in both periods.

Figure 18 PM Peak Ramp Meter Queue Lengths



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