

## Major Road Projects Victoria

# Mordialloc Freeway

## EPR T4 - EES VITM Model Performance Review

Reference

Revision 0 | 27 August 2024



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Arup Australia Pty Ltd | ABN 76 625 912 665

**Arup Australia Pty Ltd**  
Sky Park, One Melbourne Quarter  
699 Collins Street  
Docklands  
VIC, 3008  
Australia  
[arup.com](http://arup.com)

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		<b>Name</b>	Alexander Skill & Osh Kurukulasuriya	Tabitha Yeoh & Jeremy Yuen	Bruce Johnson
		<b>Signature</b>			
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		<b>Signature</b>			

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# Glossary

Acronym	Definition
ATC	Automatic tube count
DTP	Department of Transport and Planning
EES	Environmental Effects Statement
EPR	Environmental Performance Requirement
GEH statistic	Geoff E. Havers statistic
HV	Heavy vehicle
MRPV	Major Roads Projects Victoria
SCATS	Sydney Coordinated Adaptive Traffic System
VISTA	Victorian Integrated Survey of Travel and Activity
VITM	Victorian Integrated Transport Model
WFH	Work/working from home

# Executive Summary

Major Road Projects Victoria (MRPV) has engaged Arup to undertake a once off environment effects statement (EES) Victorian Integrated Transport Model (VITM) Model Performance Review for the Mordialloc Freeway Project.

The project is a four-lane freeway passing through the suburbs of Clayton South, Dingley Village, Braeside, Waterways, Aspendale Gardens, Chelsea Heights and Bangholme; that aimed to improve connectivity and reduce congestion on surrounding arterial roads. Construction of the Mordialloc Freeway commenced in October 2019, and the Project achieved Practical Completion on 21 November 2021.

Transport demand modelling using VITM to assess the expected transport network impacts and performance of the Project was completed in 2016, to inform the Mordialloc Freeway Business Case and economic assessment. A refresh to the strategic modelling was undertaken following updates to the future transport network assumptions in 2018 as part of the EES Transport Impact Assessment.

This report has been prepared to address Environmental Performance Requirement (EPR) T4, which was recommended in June 2019 as part of the Minister's assessment and *“requires the road operator to monitor and report on the performance of the regional road network to provide a comparison to, and validation of, the VITM model predictions provided in the EES”*.

The overall assessment is based on a comparison of observed 2022 traffic volumes at 27 locations and travel times along six key traffic routes within the study area, versus modelled forecasts of these same measures. As the Mordialloc Freeway EES modelling did not forecast a 2022 Project Case year, results for 2022 have been derived by interpolating between the EES VITM modelled 2021 Project Case and 2031 Project Case. The comparison has regard to strategic traffic model validation criteria as benchmarks in assessing the level of similarity between observed and modelled cases. These criteria set generally acceptable tolerance bounds of performance, in the context that traffic models are not expected to provide perfect matches to the real situation.

The key findings from the assessment are summarised below:

- Overall, the EES VITM models forecasted with sufficient accuracy the redistributed traffic demand across the surrounding road network and journey times along key traffic routes within the study area when the new link (Mordialloc Freeway) was introduced.
- There is a good correlation between 2022 modelled and observed traffic volumes. This is indicated by the  $R^2$  statistic (0.97) which exceeds the guideline criteria of 0.90, and the slope of the best-fit linear regression line being between guideline criteria of 0.9 and 1.1 for each of the AM peak, PM peak and daily time periods.
- Although there was good volume correlation, the EES VITM models overpredicted (within acceptable tolerance) the observed traffic demand across the study area, with total observed volumes up to 8% lower than modelled across AM, PM and daily time periods. This difference is likely attributed to the residual impacts of COVID-19, including slower population and employment growth during 2020 and 2021, and higher levels of working from home (WFH). At the time of preparing this report (2024), current versions of VITM have now been adjusted to account for increased WFH levels and changes to land use projections.
- Most average observed travel times for the routes considered are within  $\pm 15\%$  or one minute of the modelled travel times across both the AM and PM peak periods.

# 1. Introduction

## 1.1 Background

The Mordialloc Freeway Project – previously known as the Mordialloc Bypass (referred to as the Project) is a nine-kilometre freeway linking the Dingley Bypass in the north to the Mornington Peninsula Freeway in the south (see Figure 1-1). The project is a four-lane freeway passing through the suburbs of Clayton South, Dingley Village, Braeside, Waterways, Aspendale Gardens, Chelsea Heights and Bangholme; that aimed to improve connectivity and reduce congestion on surrounding arterial roads. Construction commenced in October 2019, and the Project achieved Practical Completion on 21 November 2021, four weeks ahead of schedule.

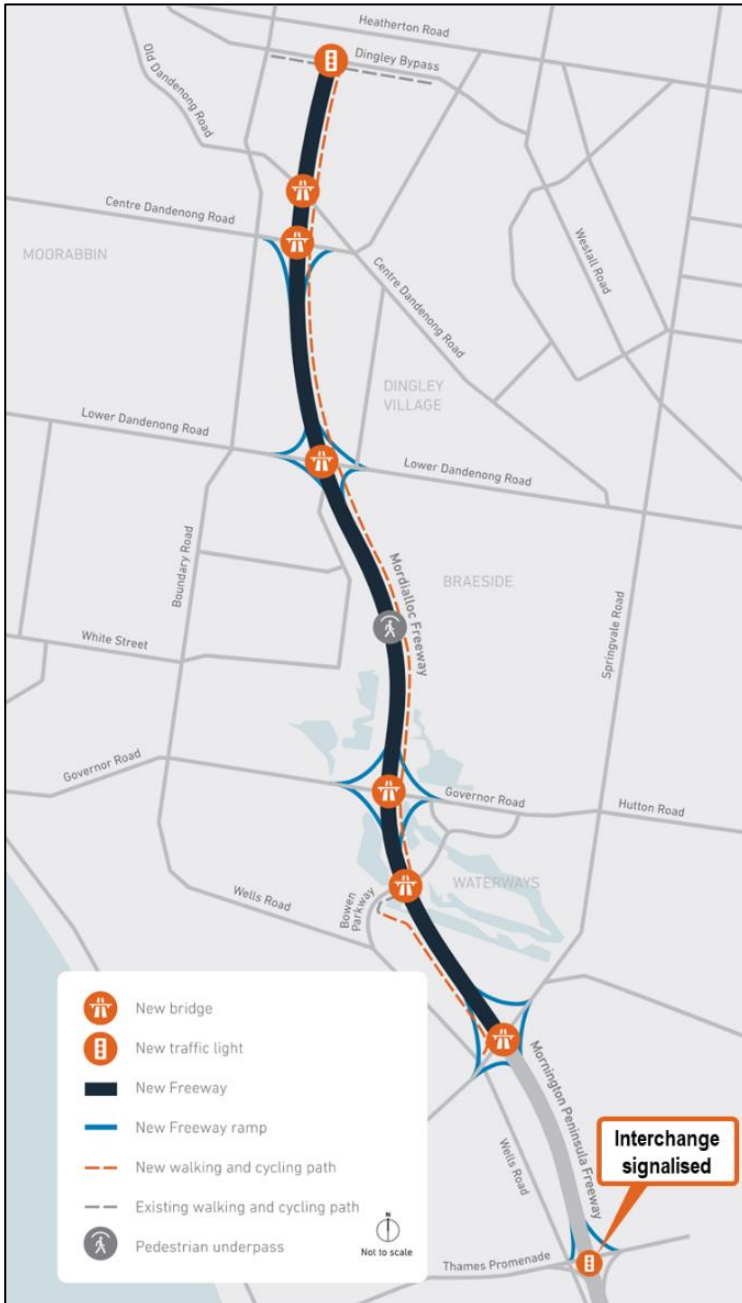


Figure 1-1: Mordialloc Freeway Project overview (Source: MRPV)

## 1.2 Mordialloc Freeway EES EPR T4

On 13 September 2017, following receipt of a referral from VicRoads under the Environment Effects Act 1978, the Minister for Planning decided that an environment effects statement (EES) was required for the project.

In June 2019, the *Mordialloc Bypass Minister's assessment of environmental effects* concluded that the project could proceed with acceptable environmental effects, subject to project modifications and an environmental management regime incorporating environmental mitigation, management and monitoring measures.

The EES proposed Environmental Performance Requirements (EPRs) to set relevant environmental standards, mechanisms and outcomes which MRPV and its contractors need to implement to mitigate or manage the environmental effects of the project.

As Victorian Integrated Transport Model (VITM) outputs are critical for selecting and designing Victorian future infrastructure projects to address congestion and other network issues, it is important to regularly test the performance of the model, so it remains a suitable tool. Therefore, an additional EPR (T4) was recommended as part of the Minister's assessment "*that requires the road operator to monitor and report on the performance of the regional road network to provide a comparison to, and validation of, the VITM model predictions provided in the EES*".

## 1.3 Purpose and report structure

To satisfy the additional EPR T4, Major Road Projects Victoria (MRPV) engaged Arup to undertake a once off EES VITM Model Performance Review for the Project.

This report has been prepared to review the performance of VITM by comparing its outputs (forecast volumes and travel times) against observations in 2022.

The structure of this report is as follows:

- Section 1 (this section) – Overview of Project background, purpose, report structure and references.
- Section 2 – Outlines key assumptions and limitations of the VITM modelling undertaken for the EES.
- Section 3 – Documents the EES VITM Model Performance Review assessment methodology and types of data assessed.
- Section 4 – Reports on the differences between the 2022 observed traffic volumes and travel times at selected locations/routes against (interpolated) VITM forecasts.
- Section 5 – Summary of key findings from this assessment.

## 1.4 References

This report has been prepared with reference to the following:

- Mordialloc Bypass (Freeway) Environment Effects Statement | Traffic and transport, Major Road Projects Authority, 2018.
  - Appendix A: Mordialloc Bypass Transport Impact Assessment, Major Road Projects Authority and WSP, 2018.
  - 2016 model calibration spreadsheet provided to Arup from WSP via email on 12 March 2024.
- Mordialloc Bypass Minister's assessment of environmental effects, Department of Environment, Land, Water and Planning, 2019.
- Mordialloc Freeway Project Evaluation Report – Benefit Assessment, Arup, 2024.
- 2023 Transport Reference Case Inputs documentation, Department of Transport and Planning (DTP), October 2023.
- Transport Insights | Weekly Roads Deep Dive, DTP (formerly Department of Transport), Tuesday, 7 June 2022.
- Transport Modelling Guidelines | Volume 2: Strategic Modelling, DTP (formerly VicRoads), 2012.



## 2. EES VITM model key assumptions and limitations

### 2.1 Overview

VITM is the State's primary strategic transport demand forecasting tool and is currently owned and managed by the Department of Transport and Planning (DTP). It is a multimodal four-step strategic transport model that uses future population and employment projections to forecast the future impacts of changes to the metropolitan and regional road and public transport networks.

Transport demand modelling using VITM to assess the expected transport network impacts and performance of the Project was completed in 2016, to inform the Mordialloc Freeway Business Case and economic assessment. A refresh to the strategic modelling was undertaken following updates to the future transport network assumptions by WSP for Major Road Projects Authority in 2018 as part of the EES Transport Impact Assessment.

### 2.2 EES modelling approach and key assumptions

Prior to undertaking Project modelling, the following validation checks and refinements were conducted to ensure that the version of VITM received from the State at the time was suitable for use:

- Validation checks included reviewing the original model's validation using data from 2011, and
- Comparing 2016 modelled against observed project area traffic volumes at numerous locations, and travel times along key routes.

The data used for model validation included mid-block survey, intersection and freeway counts, Sydney Coordinated Adaptive Traffic System (SCATS) and floating car survey data collected on key roads and routes within the Project study area in August 2016.

The model was determined to be appropriate for the Project as it met all the validation criteria specified in the VicRoads strategic modelling guidelines (see *Transport Modelling Guidelines | Volume 2: Strategic Modelling, DTP*).

The 2016 volume validation checks at individual count sites and presented as scatter plots were based on the following criteria:

- The slope of the best-fit linear regression line should be between 0.9 and 1.1.
- The coefficient of determination ( $R^2$ ) should be greater than or equal to 0.9.

The 2016 validation checks along five screenlines (referred to as M-North, M-South, M-NW, M-West and M-East) in both directions were based on percentage difference within bounds defined by the functions presented in Figure 3 in the VicRoads strategic modelling guidelines.

The latest VITM Reference Case at the time was used to establish the transport networks for the 2021, 2031 and 2051 Base Case (i.e. without Project) and Project Case (i.e. with Project<sup>1</sup>).

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<sup>1</sup> The Project Case scenarios featured a 100km/h four-lane freeway with a divided median, grade-separated full diamond interchanges at Springvale Road, Governor Road and Lower Dandenong, a grade-separated half diamond interchange at Centre Dandenong Road, an at-grade signalised intersection at Dingley Bypass and north-facing ramps at Mornington Peninsula Freeway and Thames interchange; which aligns with the final design that was actually built.

A summary of the key Mordialloc Freeway EES modelling details is provided below:

- The geographic area covered by VITM is shown below in Figure 2-1.
- The model zone system consists of 3,164 zones, 3,098 of which are internal zones.
- A summary of the key land use assumptions for all modelled years is provided in Table 2-1.
- Future transport infrastructure projects included in the Reference Case included:
  - Monash Freeway Upgrade Stage 1 (by 2021)
  - Monash Freeway Upgrade Stage 2 (by 2021)
  - Dingley Bypass (by 2021)
  - Mordialloc Bypass (by 2021)
  - West Gate distributor (i.e. West Gate Tunnel) (by 2021)
  - Westall Road Extension (by 2031)
  - North East Link (by 2031)
  - Eastern Freeway widening (by 2031)
  - Outer Metropolitan Ring Road (2051)
  - Arterial road and local road upgrades in growth areas.
  - Melbourne Metro rail tunnel (by 2031)
  - Mernda Rail Extension (by 2021)
  - Other tram and bus network enhancements around Melbourne.
- The modelled time periods include:
  - Weekday AM peak (AM): 7:00 – 9:00am
  - Weekday Inter peak (IP): 9:00 – 3:00pm
  - Weekday PM peak (PM): 3:00 – 6:00pm
  - Weekday Off peak (OP): 6:00pm – 7:00am
  - Average weekday (Daily): 24-hour
- The vehicle types modelled are cars, light commercial vehicles and heavy commercial vehicles.



**Figure 2-1: Mordialloc Freeway EES modelling 2018 – Geographical area covered by VITM**

**Table 2-1: Mordialloc Freeway EES modelling 2018 – VITM Reference Case population and employment projections**

Year	Population	Number of jobs
2016	4,558,056	2,325,667
2021	5,007,948	2,567,010
2031	5,898,548	3,072,522
2051	7,737,817	4,145,841
Growth from 2016 to 2051	+3,179,761	+1,820,174

Source: Department of Economic Development, Jobs, Transport and Resources (DEDJTR) VITM Land use and demographic inputs (28 April 2017)

## 2.3 Key EES modelling limitations

Following the EES VITM modelling, there are several factors in the present day (2024) which are likely to have impacted the demand forecast results from 2018. **This is critical to note/consider as part of this EES VITM Model Performance Review.**

In general, *any* demand forecasts are subject to uncertainties and may not be achieved in reality. For instance, some assumptions (e.g. transport network, land use) may not be realised in the forecast year as unanticipated circumstances may have occurred.

On this basis, a summary of the key Mordialloc Freeway EES modelling limitations that have now become apparent are described below:

- The Monash Freeway Upgrade Stage 2 project was only completed in mid to late 2022, and the West Gate Tunnel project is still under construction. As a result, it is likely that the VITM 2021 Base Case and Project Case traffic forecasts on these links, as well on feeder links (e.g. Warrigal Road, Clayton Road, Springvale Road, EastLink) are overestimated.
- The impacts of COVID-19 and its associated effect on reduced travel demand due to lockdown restrictions and enduring higher levels of working from home is likely to have resulted in the 2021 and potentially 2031 Base Case and Project Case traffic forecasts across the entire network being significantly overestimated relative to these new circumstances. It is also possible that changed macroeconomic circumstances associated with COVID-19 has contributed to different levels of development growth (population and jobs) being realised than those forecast in 2018.
- It is important to note that VITM was updated in 2022 to consider the impacts of COVID-19. Therefore, if the Mordialloc Freeway project scenarios were rerun using the present day VITM Reference Case (2023), the forecasts will likely be different to the original EES forecast, and potentially more accurate in aligning with 2022 observed conditions.
  - In line with the current evidence that working from home (WFH) will continue to persist, the 2023 Reference Case forecasts include WFH levels that are materially higher than pre-COVID-19 in all forecast years (DTP, 2023).
- The WFH impacts in forecast years were considered in VITM by decreasing the number of work commute trips (i.e. home-based work trips) and redistributed some non-home-based trips previously made from workplaces. The trip generation rates applied to each travel zone will differ depending on the zone's location and demographic makeup (i.e. age and size of household, employment status, and car ownership status) (DTP, 2023).

## 3. EES VITM model assessment methodology

### 3.1 Assessment approach summary

The overall assessment is based on a comparison of observed 2022 traffic volumes and travel times versus modelled forecasts of these same measures. A summary of the overall approach and key assumptions that were employed in undertaking the Mordialloc Freeway EES VITM Model Performance Review is provided below.

#### Due Diligence / Identify appropriate locations for assessment

- The traffic volume locations and travel time routes included in this assessment are based on a review of the demand forecast results reported in the *Mordialloc Freeway EES Traffic and Transport chapter*, and *EES Appendix A: Mordialloc Bypass Transport Impact Assessment* (Table B.4 to Table B.8, Table B.10 and Table B.11) (refer to Section 3.2 for further details).

SCATS sites closest (or most appropriate) to the identified traffic volume location were used to calculate the 2022 observed two-way traffic volumes (refer to Section 3.2 for further details).

- Based on a review of the 2016 model calibration spreadsheet<sup>2</sup>, flag any traffic volume locations which are potentially inappropriate due to poor VITM validation (refer to Section 3.2 for further details).

#### 1. Forecast year interpolation

In alignment with the *Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024)*, 2022 has been selected as the comparison year between model and observed. However, as the Mordialloc Freeway EES modelling did not forecast a 2022 Project Case year, results for 2022 have been derived by interpolating between the EES VITM modelled 2021 Project Case and 2031 Project Case (refer to Appendix A.1 for demand forecast results representing an average weekday).

- **Traffic volumes:** Annual compound growth has been assumed for the change in forecast traffic volumes between 2021 and 2031. Note that only the total number of vehicles will be considered in this assessment. Traffic volumes disaggregated by individual vehicle type (i.e. heavy commercial vehicles) are not assessed.

It is assumed that the modelled AM and PM peak traffic volumes represent the average two-hour volume between 7:00 – 9:00am and 3:00 – 6:00pm respectively.

- **Travel times:** Interpolation assumes a constant rate. Note that this can be challenging for comparison as an interpolated travel time may not follow a constant rate (i.e. travel times may be subject to a wide range of factors beyond traffic volumes); and is therefore another key limitation of this assessment.

It is assumed that the modelled AM and PM peak travel times represent the average travel time for each route across 7:00 – 9:00am and 3:00 – 6:00pm respectively.

#### 2. Data collection

- **Traffic volumes:** Extract from each selected SCATS site and for the relevant detector(s) (at 15-minute intervals across a 24-hour period) from data.vic between 1 January 2022 to 31 December 2022.

These observed volumes are based on an average weekday in 2022 (i.e. excludes weekends, public and school holidays, and dates with faulty/no data for each site).

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<sup>2</sup> Arup was provided the 2016 model calibration spreadsheet from WSP via email on 12 March 2024 for the purpose of identifying traffic volume locations which are potentially inappropriate due to poor VITM validation only. Arup only reviewed the model calibration results and did not undertake any further modelling to inform the outcome of this assessment.

Note that some of the selected SCATS sites had missing and/or shared lane detectors which will make it difficult to accurately ascertain the observed two-way volumes. Where possible, high-level assumptions were applied (refer to Appendix A.2 for further details).

- Note that for assessed locations along the Mordialloc Freeway, automatic tube count (ATC) data collected in November to December 2022 that was used to inform the Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024) were used (refer to Appendix A.3 for details).
- **Travel times:** Extract average travel time data from TomTom for each travel time route assessed<sup>3</sup> (at hourly intervals between 6:00 – 10:00 am and 2:00 – 6:00 pm) between 1 January 2022 to 31 December 2022.

These observed travel times will be based on an average mid-weekday in 2022 (i.e. excludes Mondays, Fridays, weekends, public and school holidays).

Note that TomTom data outputs are based on the ‘full traversal’ method. This only registers a vehicle travel time if it completes a specified route (i.e. vehicles entering route midway are not counted).

### 3. Model versus observed data comparison

Comparison between the modelled and observed traffic volumes and travel times.

#### Traffic volumes

The following strategic model validation criteria were used as a benchmark to illustrate the scale of difference between modelled and observed traffic volumes:

- Scatter Plots – Shows the relationship between the observed and modelled traffic volumes at locations within the study area. The following measures represent good model reflection to observed conditions:
  - Slope of best-fit regression line between 0.9 and 1.1; and
  - R<sup>2</sup> greater than or equal to 0.90.
- GEH (Geoff E. Havers) statistic – An alternative measure to scatter plots based on one-hour equivalent volumes<sup>4</sup>. A good GEH statistic for strategic modelling (**GEH < 10**) indicates that the model is producing volumes with either low absolute errors on roads with small volume counts, or low percentage errors on roads with large volume counts. The GEH is defined as:

$$GEH_a = \sqrt{\frac{(M_a - C_a)^2}{\frac{1}{2}(M_a + C_a)}}$$

Where:

M<sub>a</sub> = modelled volume on link ‘a’

C<sub>a</sub> = surveyed volume on link ‘a’

<sup>3</sup> TomTom data extracted for the Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024) was used to calculate the 2022 observed travel times for four of the described five travel time routes assessed. Average travel times instead of median were reported for this assessment due to several route extents being adjusted. 2022 observed 25<sup>th</sup> and 75<sup>th</sup> percentile travel times are reported for context only.

<sup>4</sup> If not being modelled or extracted, the one-hour peak volume was assumed to equal 0.5 of the two-hour peak volume or 0.1 of the daily volume.

## Travel Times

A  $\pm 15\%$  or one minute (whichever is greater) was used to illustrate the scale of difference between modelled and observed travel times.

**DISCLAIMER:** While the above measures are usually applied as part of validating a base transport model in strategic modelling, this assessment does not designate whether the model has met criteria.

Instead, the stated measures are considered as **guideline criteria** for contextual purposes only as there is no formalised set of criteria to meet for this assessment (i.e. post forecasting review application). As such, even though the measures are guideline only, it is reasonable to expect less stringent criteria would apply to the current application.

## 3.2 Traffic volumes

### 3.2.1 Locations assessed

Table 3-1 summarises the traffic volume locations considered for this assessment and the associated data sources for observed 2022 average weekday traffic volumes. Figure 3-1 shows a map of the assessed traffic volume locations while Figure 3-2 shows the corresponding SCATS locations.

**Table 3-1: Mordialloc Freeway EES VITM Model Performance Review traffic volume locations considered**

ID	Road	Location	Observed data source and ID		Included or Excluded
1	Mornington Peninsula Freeway	East of Springvale Road	ATC surveys	ATC Site 5	Included
2	<b>Springvale Road</b>	<b>North of Mornington Peninsula Freeway</b>	<b>SCATS</b>	<b>500</b>	<b>Included – FLAGGED</b>
3	Springvale Road	South of Mornington Peninsula Freeway	SCATS	280	Included
4	Springvale Road	North of Westall Road	NA	NA	Excluded
5	Wells Road	West of Springvale Road	SCATS	309	Included
6	<b>Wells Road</b>	<b>East of Springvale Road</b>	<b>SCATS</b>	<b>542 &amp; 101</b>	<b>Included – FLAGGED</b>
7	Governor Road	West of Mordialloc Freeway	SCATS	3715	Included
8	Governor Road	East of Mordialloc Freeway	SCATS	1169	Included
9	Lower Dandenong Road	West of Mordialloc Freeway	SCATS	3147	Included
10	Lower Dandenong Road	East of Mordialloc Freeway	SCATS	944	Included
11	Boundary Road	South of Lower Dandenong Road	SCATS	4638	Included
12	<b>Boundary Road</b>	<b>South of Governor Road</b>	<b>SCATS</b>	<b>3715</b>	<b>Included – FLAGGED</b>
13	Centre Dandenong Road	West of Mordialloc Freeway	SCATS	1952	Included
14	Centre Dandenong Road	East of Mordialloc Freeway	SCATS	1952	Included
15	Old Dandenong Road	East of Boundary Road	SCATS	3203	Included
16	Tootal Road	South of Dingley Bypass	SCATS	1700	Included
17	<b>Kingston Road</b>	<b>West of Dingley Bypass</b>	<b>SCATS</b>	<b>1699</b>	<b>Included – FLAGGED</b>
18	Warrigal Road	North of Dingley Bypass	SCATS	3695	Included
19	South Road	West of Warrigal Road	SCATS	3696 & 3695	Included
20	South Road	West of East Boundary Road	SCATS	3643	Excluded
21	Westall Road	West of Springvale Road	SCATS	441	Included
22	Westall Road	North of Heatherton Road	SCATS	4704	Included
23	Mordialloc Freeway	Springvale Road and Governor Road	ATC surveys	ATC Site 4	Included
24	Mordialloc Freeway	North of Governor Road	ATC surveys	ATC Site 3	Included
25	Mordialloc Freeway	North of Lower Dandenong Road	ATC surveys	ATC Site 2	Included
26	Dingley Bypass	East of Boundary Road	NA	NA	Excluded
27	Thames Promenade	West of Wells Road	SCATS	510	Excluded
28	Thompson Road	East of Mornington Peninsula Freeway	NA	NA	Excluded
29	Thompson Road	West of Mornington Peninsula Freeway	NA	NA	Excluded
30	Nepean Highway	North of White Street	SCATS	2332	Included
31	Nepean Highway	North of South Road	SCATS	2322	Included
32	Nepean Highway	North of Centre Dandenong Road	SCATS	2328 & 2327	Included
33	White Street	West of Boundary Road	SCATS	2353 & 3651	Included



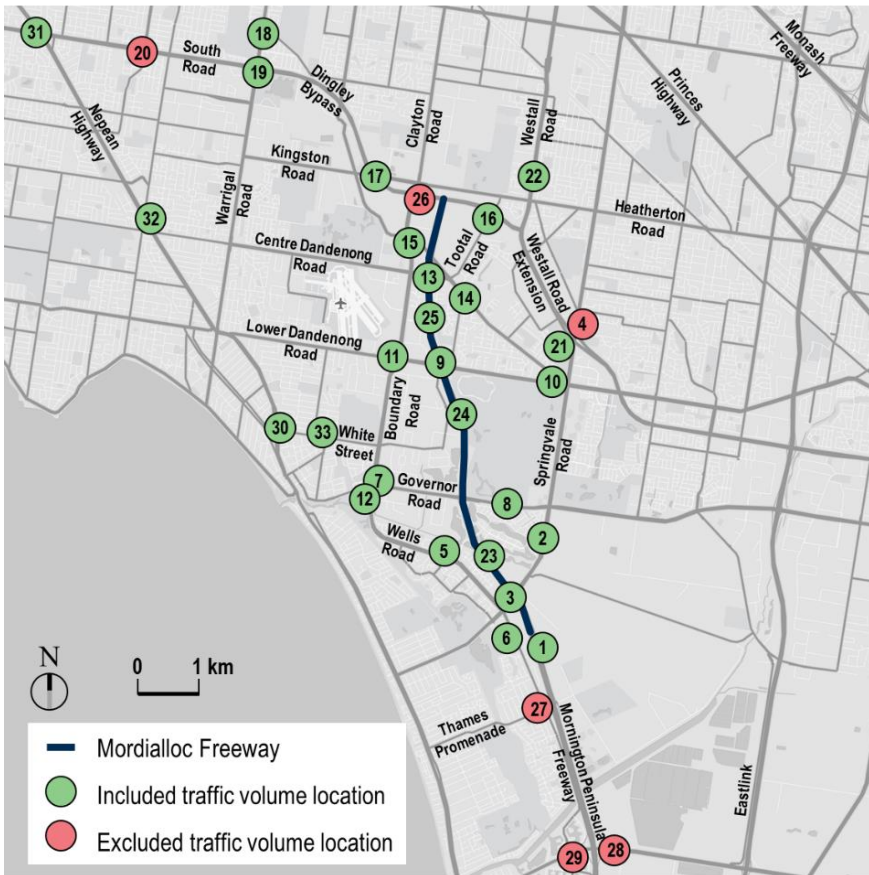


Figure 3-1: Mordialloc Freeway EES VITM Model Performance Review – traffic volume locations considered

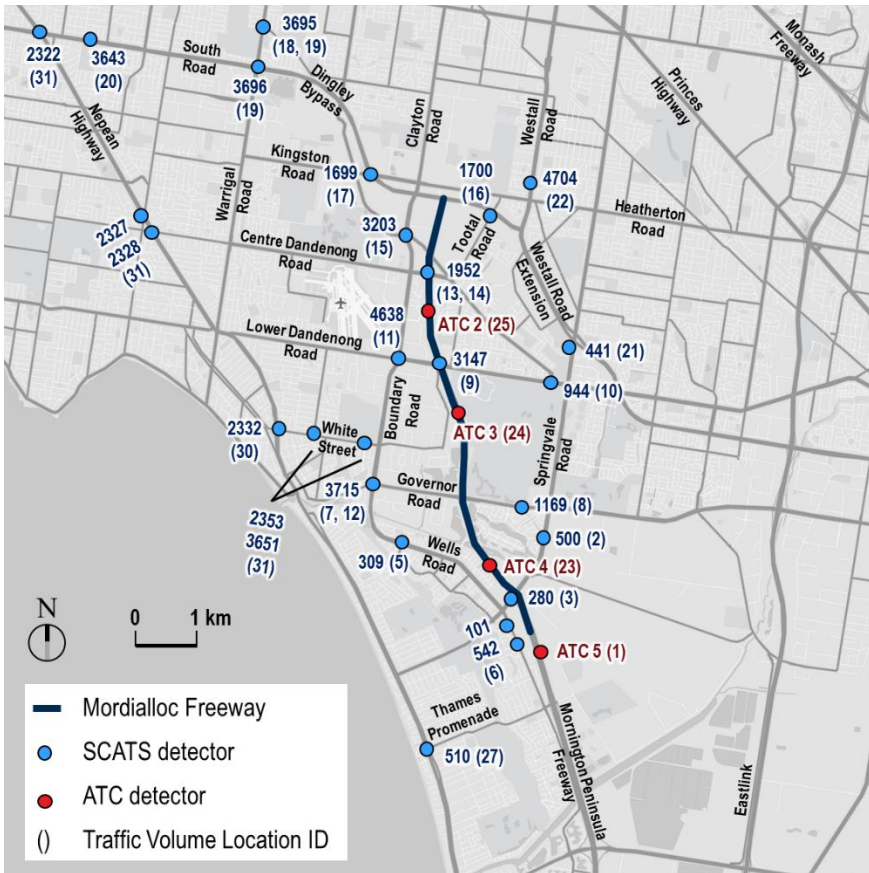


Figure 3-2: Mordialloc Freeway EES VITM Model Performance Review – traffic volume data extraction

### 3.2.1.1 Excluded locations

Of the 33 locations considered (see Table 3-1), four (4) locations have been excluded from this assessment as only 2031 Project Case daily volumes were reported in the EES at locations 4, 26, 28 and 29 (i.e. the 2021 Project Case across all time periods and 2031 Project Case AM and PM peak traffic volumes were not available). Therefore, the modelled 2022 Project Case traffic volumes were not able to be calculated through interpolation at these four (4) locations.

Following a preliminary review, valid corresponding SCATS data was either unavailable or insufficient for two (2) locations:

- Location 20: South Road (west of East Boundary Road) – analysis of corresponding SCATS site 3637 revealed a poor sample size within the assessment period, therefore SCATS site 3643 was instead initially selected as the nearest comparable site.
- Location 27: Thames Promenade (west of Wells Road) – analysis of SCATS site 1575 and the adjacent closest site 293 both output invalid results for the whole assessment period, therefore, SCATS site 510 located to the west was instead initially selected as the closest valid site.

It was found that the alternative SCATS site described above did not have appropriate observed volumes for comparison against modelled volumes, and therefore these two locations (2) have also been excluded from this assessment.

### 3.2.1.2 Poorly validated locations

Upon reviewing the 2016 model calibration spreadsheet<sup>5</sup>, and using the GEH statistic as an alternative to the scatter plot checks, only four (4) locations across all time periods (i.e. AM, PM and daily) relevant to this assessment were flagged as poorly validated:

- Location 2: Springvale Road (north of Mornington Peninsula Freeway).
- Location 6: Wells Road (west of Springvale Road).
- Location 12: Boundary Road (south of Boundary Road).
- Location 17: Kingston Road (west of Dingley Bypass).

While only the M-NW and M-West (eastbound direction only) screenlines during the PM peak had percentage differences falling outside the bounds of the functions presented in Figure 3 in the VicRoads strategic modelling guidelines, none of the sites along both screenlines are relevant to this assessment.

### 3.2.2 Periods assessed

Figure 3-3 depicts the average daily traffic profile across all SCATS sites assessed (based on the average total intersection volume) which was used to confirm whether the 2022 observed peak time periods align with the modelled peak time periods. To provide an appropriate comparison between modelled and observed traffic volumes during peak periods:

- The observed two-hour traffic volume between 7:00 – 9:00am was extracted at each site to reflect the AM peak.

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<sup>5</sup> Upon reviewing the 2016 calibration spreadsheet the exact list of sites used to generate the scatter plots provided in the EES is unclear. For this review, it was assumed that sites with data available across the AM, PM and Daily periods and that have been grouped under the M-North, M-NW, M-South, M-West, M-East, Individual and Mordialloc Select Links categories were considered in the previous validation checks (equating to 98 sites in total).

- The observed two-hour traffic volume between 3:00 – 5:00pm was extracted at each site to reflect the PM peak, given that the two-hour volume between 3:00 – 5:00pm appears to be higher than between 4:00 – 6:00pm.

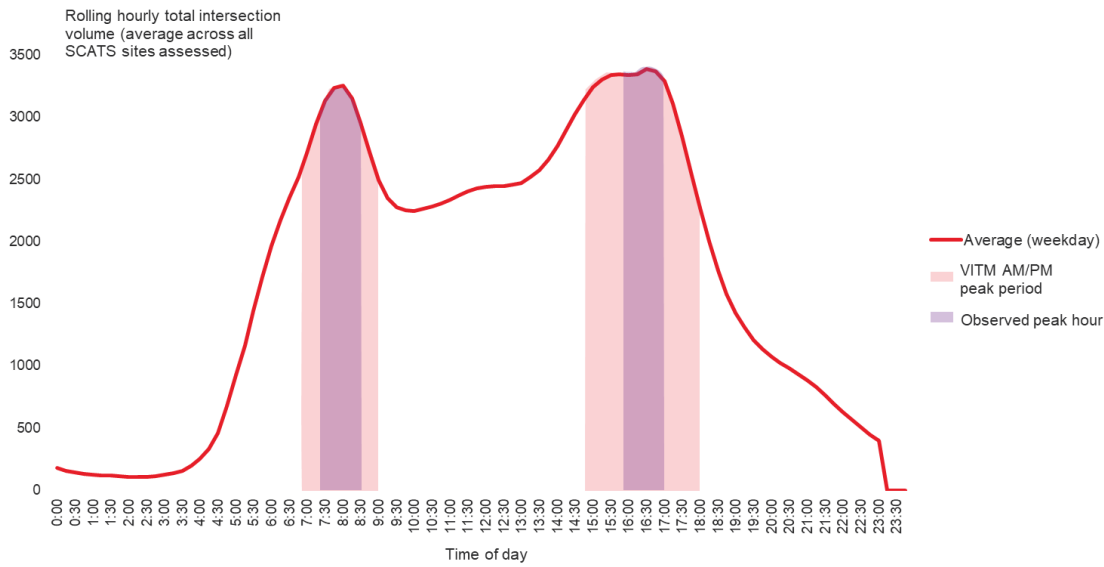


Figure 3-3: Daily profile of rolling hourly total intersection volume – averaged across all SCATS sites assessed

### 3.3 Travel time routes

Figure 3-4 shows the six travel time routes that were assessed.

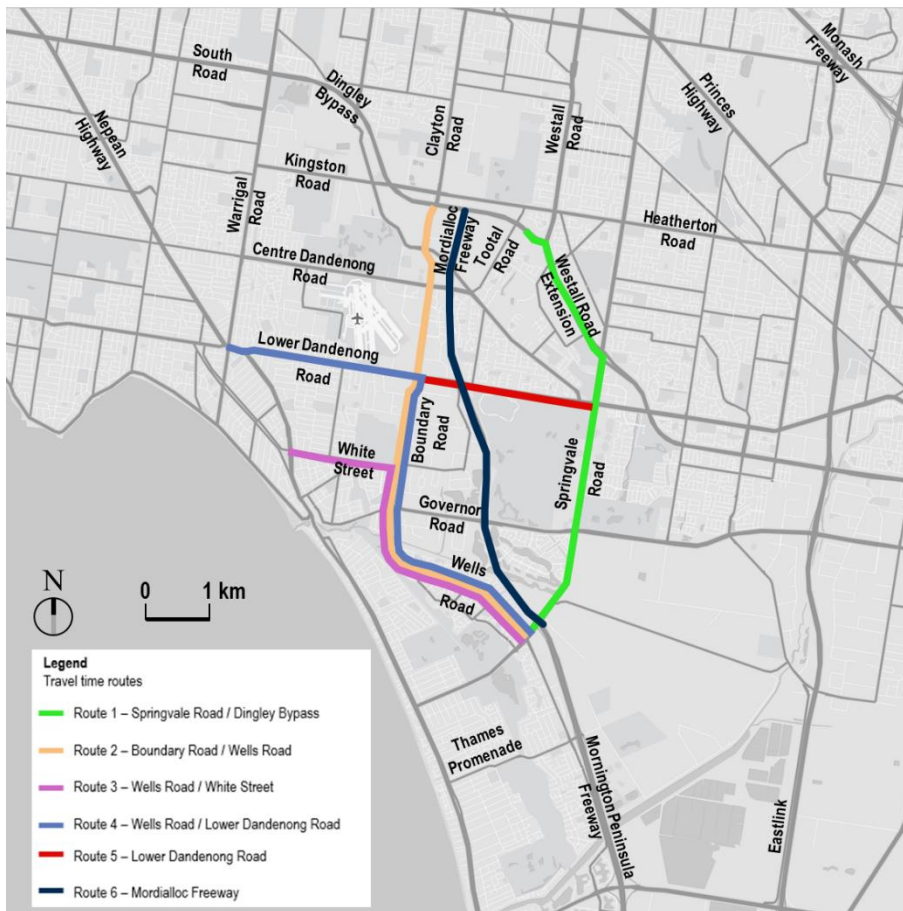


Figure 3-4: Mordialloc Freeway EES VITM Model Performance Review – travel time routes assessed

# 4. Results

## 4.1 Traffic volumes

Modelled and observed traffic volumes were compared across the overall study area (i.e. across all assessed locations) and along multiple screenlines as shown in Figure 4-1, during the AM and PM peak periods and across an entire weekday (see scatterplots from Figure 4-2 to Figure 4-4). Based on the scatter plots and in accordance with the validation guideline criteria described in Section 3.1, there is a good correlation between 2022 modelled and observed traffic volume datasets, as indicated by the  $R^2$  statistic exceeding 0.90 and the slope of the best-fit linear regression line ( $y$  statistic) being between 0.9 and 1.1.

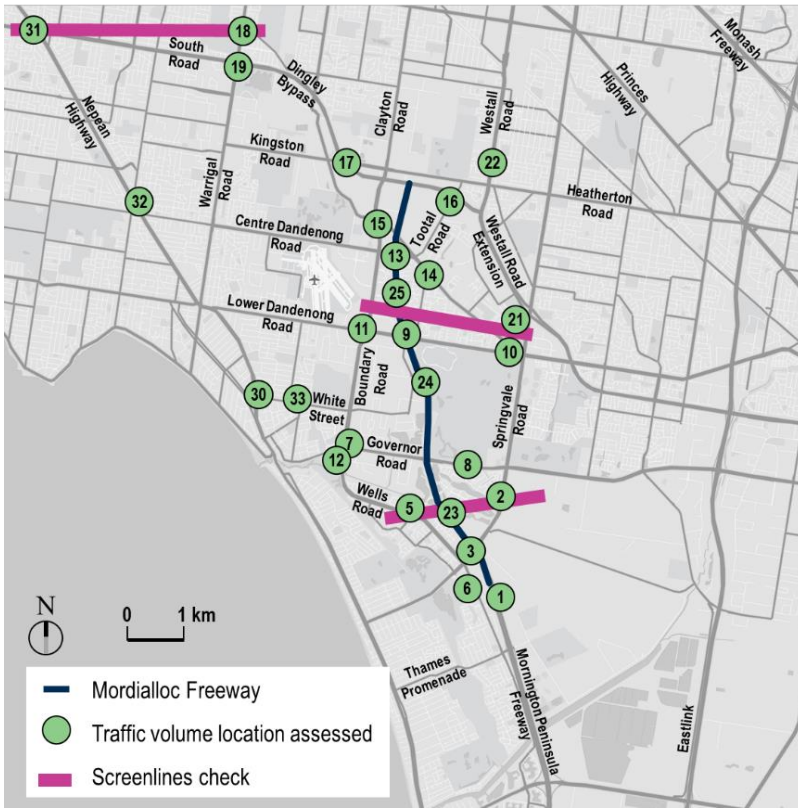


Figure 4-1: Mordialloc Freeway EES VITM Model Performance Review – traffic volume locations and screenlines

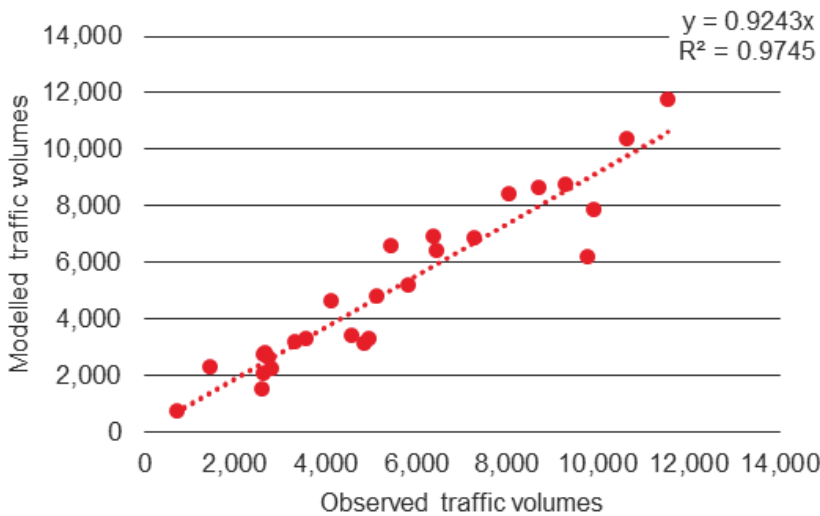
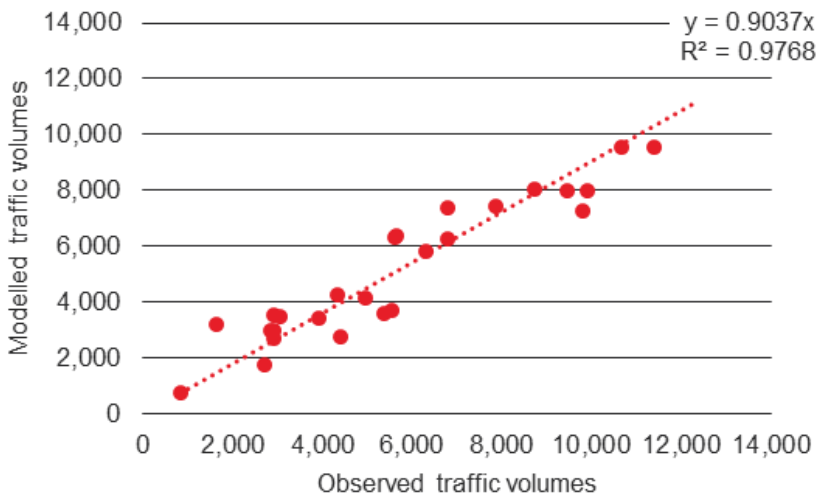
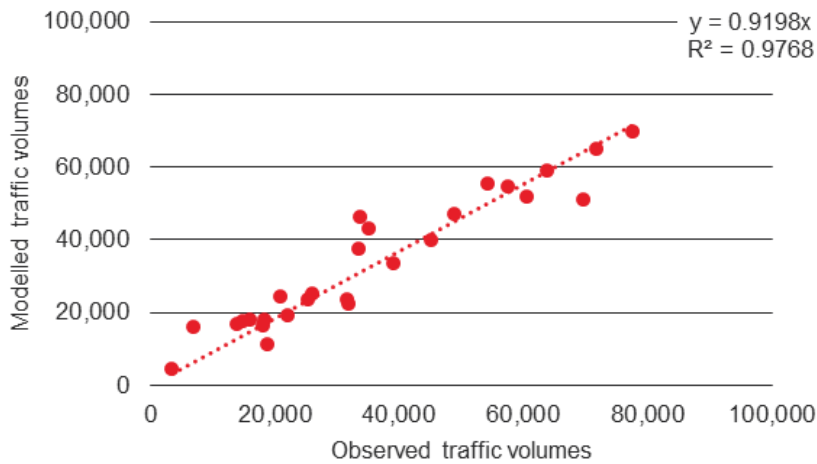


Figure 4-2: 2022 modelled VS. observed average weekday AM peak (7:00 – 9:00am) two-way two-hour volumes



**Figure 4-3: 2022 modelled VS. observed average weekday PM peak (3:00 – 6:00pm) two-way two-hour volumes**



**Figure 4-4: 2022 modelled VS. observed average weekday (24-hour) two-way two-hour volumes**

In general though, it was found that the EES VITM models overpredicted (within acceptable tolerance) traffic demands across the area, as indicated by the y statistic for all time periods being less than 1.0, and the comparisons of total volumes across all site locations where total study area observed volumes are up to 8% lower than modelled across AM, PM and daily time periods (refer to the ‘All locations’ row in Table 4-1). Both Mordialloc Freeway and other arterial roads’ (i.e. Lower Dandenong Road, Boundary Road, Springvale Road) observed volumes are lower than modelled across AM, PM and daily time periods (refer to Table 4-1).

Note that some of the selected SCATS sites had missing and/or shared lane detectors which will make it difficult to accurately calculate the observed two-way volumes. Where possible, high-level assumptions were applied (refer to Appendix A.2 for further details).

The exceptions are Wells Road and Westall Road where observed volumes were higher than modelled across AM, PM, daily time periods. The comparison of every assessed location is detailed from

Table 4-2 to Table 4-4. As described in Section 3.1, a GEH < 10 guideline criteria have been shown (any location exceeding this guideline criteria has been highlighted **red**) for contextual purposes only.

**Table 4-1: Difference between 2022 modelled and observed volumes across all locations and screenlines**

Location	AM Peak (7:00 – 9:00am)			PM Peak (3:00 – 6:00am)			Daily		
	Modelled	Observed	Difference	Modelled	Observed	Difference	Modelled	Observed	Difference
<b>All locations</b>	<b>147,690</b>	<b>137,081</b>	<b>-10,609 (-7%)</b>	<b>159,490</b>	<b>146,202</b>	<b>-13,288 (-8%)</b>	<b>959,340</b>	<b>911,074</b>	<b>-48,266 (-5%)</b>
Screenline 1 (Sites 2, 5, 23)	16,620	16,142	-478 (-3%)	18,010	16,909	-1,101 (-6%)	104,810	106,232	1,422 (+1%)
Screenline 2 (Sites 10, 11, 21, 25)	25,680	23,923	-1,757 (-7%)	27,890	24,764	-3,126 (-11%)	163,420	153,562	-9,858 (-6%)
Screenline 3 (Sites 18, 31)	15,210	12,790	-2,420 (-16%)	15,540	14,365	-1,175 (-8%)	103,500	97,236	-6,264 (-6%)

**Table 4-2: 2022 modelled VS. observed average weekday AM peak two-way two-hour volumes on key roads**

ID	Road	Location	AM Peak (7:00 – 9:00am) Two-way two-hour volumes			
			Modelled	Observed	Difference	GEH
1	Mornington Peninsula Fwy	East of Springvale Road	11,530	11,758	<b>228 (+2%)</b>	<b>1.5</b>
2	Springvale Road	North of Mornington Peninsula Fwy	4,550	3,445	<b>-1,105 (-24%)</b>	<b>12.4</b>
3	Springvale Road	South of Mornington Peninsula Fwy	3,540	3,321	<b>-219 (-6%)</b>	<b>2.6</b>
5	Wells Road	West of Springvale Road	1,440	2,314	<b>874 (+61%)</b>	<b>14.3</b>
6	Wells Road	East of Springvale Road	2,810	2,225	<b>-585 (-21%)</b>	<b>8.2</b>
7	Governor Road	West of Mordialloc Freeway	4,110	4,661	<b>551 (+13%)</b>	<b>5.9</b>
8	Governor Road	East of Mordialloc Freeway	2,740	2,667	<b>-73 (-3%)</b>	<b>1.0</b>
9	Lower Dandenong Road	West of Mordialloc Freeway	6,420	6,440	<b>20 (0%)</b>	<b>0.2</b>
10	Lower Dandenong Road	East of Mordialloc Freeway	5,800	5,223	<b>-577 (-10%)</b>	<b>5.5</b>
11	Boundary Road	South of Lower Dandenong Road	4,850	3,123	<b>-1,727 (-36%)</b>	<b>19.3</b>
12	Boundary Road	South of Governor Road	2,640	2,783	<b>143 (+5%)</b>	<b>1.9</b>
13	Centre Dandenong Road	West of Mordialloc Freeway	4,940	3,308	<b>-1,632 (-33%)</b>	<b>18.0</b>
14	Centre Dandenong Road	East of Mordialloc Freeway	2,610	2,104	<b>-506 (-19%)</b>	<b>7.4</b>
15	Old Dandenong Road	East of Boundary Road	710	753	<b>43 (+6%)</b>	<b>1.1</b>
16	Tootal Road	South of Dingley Bypass	2,600	1,539	<b>-1,061 (-41%)</b>	<b>16.5</b>
17	Kingston Road	West of Dingley Bypass	3,320	3,215	<b>-105 (-3%)</b>	<b>1.3</b>
18	Warrigal Road	North of Dingley Bypass	5,440	6,580	<b>1,140 (+21%)</b>	<b>10.4</b>
19	South Road	West of Warrigal Road	8,030	8,409	<b>379 (+5%)</b>	<b>3.0</b>
21	Westall Road	West of Springvale Road	6,360	6,929	<b>569 (+9%)</b>	<b>4.9</b>
22	Westall Road	North of Heatherton Road	7,260	6,894	<b>-366 (-5%)</b>	<b>3.1</b>
23	Mordialloc Freeway	Springvale Road & Governor Road	10,630	10,382	<b>-248 (-2%)</b>	<b>1.7</b>
24	Mordialloc Freeway	North of Governor Road	9,260	8,759	<b>-501 (-5%)</b>	<b>3.7</b>
25	Mordialloc Freeway	North of Lower Dandenong Road	8,670	8,648	<b>-22 (0%)</b>	<b>0.2</b>
30	Nepean Highway	North of White Street	5,130	4,793	<b>-337 (-7%)</b>	<b>3.4</b>
31	Nepean Highway	North of South Road	9,770	6,210	<b>-3,560 (-36%)</b>	<b>28.2</b>
32	Nepean Highway	North of Centre Dandenong Road	9,910	7,860	<b>-2,050 (-21%)</b>	<b>15.4</b>
33	White Street	West of Boundary Road	2,620	2,737	<b>117 (+4%)</b>	<b>1.6</b>

**Table 4-3: 2022 modelled VS. observed average weekday PM peak two-way two-hour volumes on key roads**

ID	Road	Location	PM Peak (3:00 – 6:00pm) Two-way two-hour volumes			
			Modelled	Observed	Difference	GEH
1	Mornington Peninsula Fwy	East of Springvale Road	12,230	13,008	<b>778 (+6%)</b>	<b>4.9</b>
2	Springvale Road	North of Mornington Peninsula Fwy	4,970	4,153	<b>-817 (-16%)</b>	<b>8.6</b>
3	Springvale Road	South of Mornington Peninsula Fwy	4,340	4,261	<b>-79 (-2%)</b>	<b>0.9</b>
5	Wells Road	West of Springvale Road	1,640	3,220	<b>1,580 (+96%)</b>	<b>22.7</b>
6	Wells Road	East of Springvale Road	2,920	3,534	<b>614 (+21%)</b>	<b>7.6</b>
7	Governor Road	West of Mordialloc Freeway	4,410	2,737	<b>-1,673 (-38%)</b>	<b>19.8</b>
8	Governor Road	East of Mordialloc Freeway	2,850	2,975	<b>125 (+4%)</b>	<b>1.6</b>
9	Lower Dandenong Road	West of Mordialloc Freeway	6,800	6,269	<b>-531 (-8%)</b>	<b>4.6</b>
10	Lower Dandenong Road	East of Mordialloc Freeway	6,300	5,792	<b>-508 (-8%)</b>	<b>4.6</b>
11	Boundary Road	South of Lower Dandenong Road	5,360	3,603	<b>-1,757 (-33%)</b>	<b>18.6</b>
12	Boundary Road	South of Governor Road	3,040	3,469	<b>429 (+14%)</b>	<b>5.3</b>
13	Centre Dandenong Road	West of Mordialloc Freeway	5,530	3,718	<b>-1,812 (-33%)</b>	<b>18.8</b>
14	Centre Dandenong Road	East of Mordialloc Freeway	2,910	2,676	<b>-234 (-8%)</b>	<b>3.1</b>
15	Old Dandenong Road	East of Boundary Road	820	773	<b>-47 (-6%)</b>	<b>1.2</b>
16	Tootal Road	South of Dingley Bypass	2,700	1,753	<b>-947 (-35%)</b>	<b>14.2</b>
17	Kingston Road	West of Dingley Bypass	3,910	3,413	<b>-497 (-13%)</b>	<b>5.8</b>
18	Warrigal Road	North of Dingley Bypass	5,640	6,398	<b>758 (+13%)</b>	<b>6.9</b>
19	South Road	West of Warrigal Road	8,720	8,044	<b>-676 (-8%)</b>	<b>5.2</b>
21	Westall Road	West of Springvale Road	6,780	7,388	<b>608 (+9%)</b>	<b>5.1</b>
22	Westall Road	North of Heatherton Road	7,860	7,454	<b>-406 (-5%)</b>	<b>3.3</b>
23	Mordialloc Freeway	Springvale Road & Governor Road	11,400	9,537	<b>-1,863 (-16%)</b>	<b>12.9</b>
24	Mordialloc Freeway	North of Governor Road	9,810	7,266	<b>-2,544 (-26%)</b>	<b>19.5</b>
25	Mordialloc Freeway	North of Lower Dandenong Road	9,450	7,980	<b>-1,470 (-16%)</b>	<b>11.1</b>
30	Nepean Highway	North of White Street	5,630	6,322	<b>692 (+12%)</b>	<b>6.3</b>
31	Nepean Highway	North of South Road	9,900	7,967	<b>-1,933 (-20%)</b>	<b>14.5</b>
32	Nepean Highway	North of Centre Dandenong Road	10,660	9,528	<b>-1,132 (-11%)</b>	<b>8.0</b>
33	White Street	West of Boundary Road	2,910	2,965	<b>55 (+2%)</b>	<b>0.7</b>

**Table 4-4: 2022 modelled VS. observed average weekday two-way volumes on key roads**

ID	Road	Location	Two-way 24-hour volumes			
			Modelled	Observed	Difference	GEH
1	Mornington Peninsula Fwy	East of Springvale Road	77,650	69,709	-7,941 (-10%)	9.3
2	Springvale Road	North of Mornington Peninsula Fwy	26,060	25,057	-1,003 (-4%)	2.0
3	Springvale Road	South of Mornington Peninsula Fwy	20,870	24,308	3,438 (+16%)	7.2
5	Wells Road	West of Springvale Road	7,020	16,060	9,040 (+129%)	26.6
6	Wells Road	East of Springvale Road	14,960	17,514	2,554 (+17%)	6.3
7	Governor Road	West of Mordialloc Freeway	25,340	23,631	-1,709 (-7%)	3.5
8	Governor Road	East of Mordialloc Freeway	14,020	16,817	2,797 (+20%)	7.1
9	Lower Dandenong Road	West of Mordialloc Freeway	45,220	39,833	-5,387 (-12%)	8.3
10	Lower Dandenong Road	East of Mordialloc Freeway	38,990	33,477	-5,513 (-14%)	9.2
11	Boundary Road	South of Lower Dandenong Road	31,910	22,252	-9,658 (-30%)	18.6
12	Boundary Road	South of Governor Road	16,020	18,136	2,116 (+13%)	5.1
13	Centre Dandenong Road	West of Mordialloc Freeway	31,720	23,453	-8,267 (-26%)	15.7
14	Centre Dandenong Road	East of Mordialloc Freeway	18,020	16,383	-1,637 (-9%)	3.9
15	Old Dandenong Road	East of Boundary Road	3,460	4,457	997 (+29%)	5.0
16	Tootal Road	South of Dingley Bypass	18,810	11,147	-7,663 (-41%)	19.8
17	Kingston Road	West of Dingley Bypass	21,980	19,412	-2,568 (-12%)	5.6
18	Warrigal Road	North of Dingley Bypass	33,760	46,208	12,448 (+37%)	19.7
19	South Road	West of Warrigal Road	54,290	55,534	1,244 (2%)	1.7
21	Westall Road	West of Springvale Road	35,080	43,265	8,185 (+23%)	13.1
22	Westall Road	North of Heatherton Road	48,880	47,228	-1,652 (-3%)	2.4
23	Mordialloc Freeway	Springvale Road & Governor Road	71,730	65,114	-6,616 (-9%)	8.0
24	Mordialloc Freeway	North of Governor Road	60,510	52,041	-8,469 (-14%)	11.3
25	Mordialloc Freeway	North of Lower Dandenong Road	57,440	54,567	-2,873 (-5%)	3.8
30	Nepean Highway	North of White Street	33,580	37,440	3,860 (+11%)	6.5
31	Nepean Highway	North of South Road	69,740	51,029	-18,711 (-27%)	24.1
32	Nepean Highway	North of Centre Dandenong Road	63,880	58,959	-4,921 (-8%)	6.3
33	White Street	West of Boundary Road	18,400	18,041	-359 (-2%)	0.8

Lower than predicted observed demand in 2022 across the overall study area can be attributed to the residual impacts of COVID-19 including:

- Slower overall State population growth, and consequently slower overall employment growth, during 2020 and 2021 due to less overseas immigration and increased interstate emigration. Note that later versions of VITM have also adjusted land use projections to account for this dip in growth (DTP, 2023).
- Higher levels of WFH in 2022 compared to pre-COVID-19. Based on a comparison of the 2021 and 2023 Ipsos surveys, of the full-time employees with jobs suited to WFH, they worked at home on average an additional 1.3 days per week. It is noted that the assumed number of additional days worked from home differed depending on workplace location and the mode of transport used to travel to work (DTP, 2023). Later versions of VITM have now adjusted for trip generation that accounts for increased WFH levels (see Table 4-5).

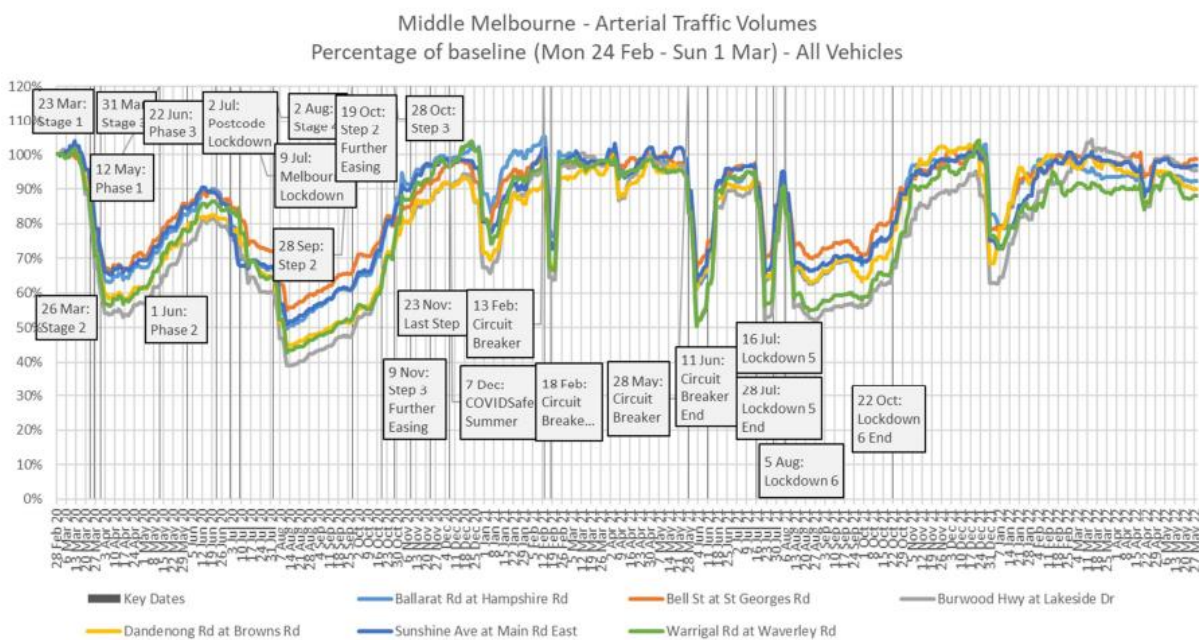


**Table 4-5: VITM 2023 Reference Case working from home (WFH) assumptions**

Of workers with jobs suited to WFH	WFH days per week (average full-time worker with WFH suited job)		
	Pre-COVID-19	2022 Reference Case (2021 Ipsos survey)	2023 Reference Case (2023 Ipsos survey)
Average across all modes and locations	~0.5 to 1 day	<b>+1.1 days</b> (~1.6 to 2.1 days)	<b>+1.3 days</b> (~1.8 to 2.3 days)
Public transport commuters to CBD/inner city workplaces	~0.5 to 1 day	<b>+1.4 days</b>	<b>+1.6 days</b>
Public transport commuters to non-CBD workplaces			
Car commuters to CBD/inner city workplaces		<b>+0.9 days</b>	<b>+1.0 days</b>
Car commuters to non-CBD workplaces			<b>+1.3 days</b>

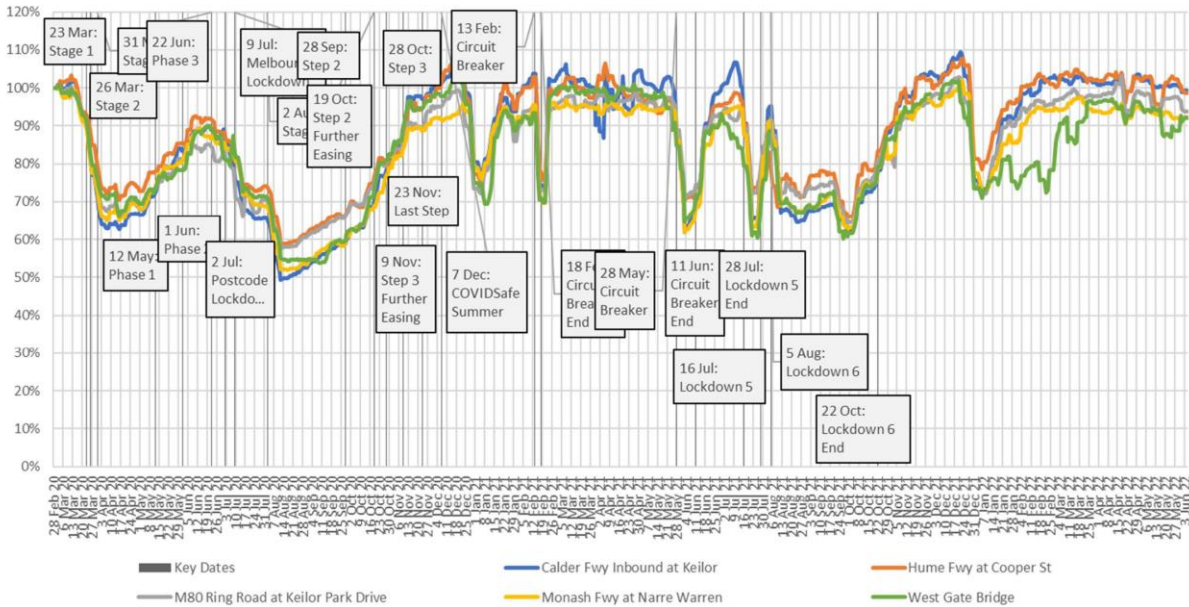
Source: DTP, 2023

Based on traffic volume statistics collected across the network and reported on a weekly basis by DTP between February 2020 and mid-2022, weekday traffic volumes on arterial roads in middle Melbourne (e.g. Dandenong Road and Warrigal Road in the south-east) and on the metropolitan Melbourne freeway network at multiple locations including the Monash Freeway were around 10% lower compared to pre-COVID-19 (see Figure 4-5 and Figure 4-6 respectively) (DTP, 2022).



**Figure 4-5: Weekday arterial road traffic volumes by hour at select locations in Middle Melbourne – weekday rolling 7-day percentage of pre-COVID-19 baseline (Monday 24 February 2020 to Sunday 1 March 2020) (Source: DTP, 2022)**

Metropolitan Melbourne - Percentage of baseline (Mon 24 Feb - Sun 1 Mar) - All Vehicles



**Figure 4-6: Metropolitan Melbourne freeway volumes at select locations – weekday rolling 7-day percentage of pre-COVID-19 baseline (Monday 24 February 2020 to Sunday 1 March 2020) (Source: DTP, 2022)**

Higher than predicted demand in 2022 on some arterial roads in the study area (e.g. Wells Road around Springvale Road, and Westall Road west of Springvale Road) potentially indicates that these roads were:

- Less impacted by WFH changes, with industrial activity (less suitable for WFH conditions) being concentrated in Braeside and Clayton South. Note that only approximately 31% of jobs in Victoria enable work to be carried out from home on a regular basis (DTP, 2023).
- Still preferred traffic routes over the Mordialloc Freeway.

Overall, the traffic volumes comparison demonstrates that the EES VITM models forecasted with sufficient accuracy the redistributed traffic demand across the surrounding road network when the new link (Mordialloc Freeway) was introduced.

## 4.2 Travel times

Table 4-6 summarises the 2022 modelled versus observed average travel times during the AM and PM peak periods. The observed 25<sup>th</sup> percentile and 75<sup>th</sup> percentile travel times have also been included to better indicate how well the modelled travel times compare with the observed data.

As described in Section 3.1:

- As the 2021 Project Case travel times along Mordialloc Freeway itself were not available in the EES modelling report, its corresponding 2022 travel times cannot be interpolated and compared with observed freeway travel time.
- A  $\pm 15\%$  or one minute (whichever is greater) guideline criteria has been adopted for each route and any location exceeding this guideline criteria has been highlighted **red** for contextual purposes only.

**Table 4-6: Mordialloc Freeway EES VITM Model Performance Review – 2022 modelled VS. observed average travel time**

Route	Direction	Average travel time (mm:ss)		25%ile observed travel time	75%ile observed travel time	Difference (mm:ss)
		Modelled	Observed			
<b>AM Peak Period (7:00 – 9:00am)</b>						
Route 1 – Springvale Road and Dingley Bypass	NB	08:45	07:49	07:09	08:25	<b>-00:57 (-11%)</b>
	SB	08:06	08:20	07:40	08:58	<b>00:14 (+3%)</b>
Route 2 – Boundary Road and Wells Road	NB	09:49	11:03	10:06	11:51	<b>01:14 (+13%)</b>
	SB	10:00	10:20	09:36	11:10	<b>00:20 (+3%)</b>
Route 3 – Wells Road and White Street	NB	11:16	08:02	07:08	08:44	<b>-03:14 (-29%)</b>
	SB	10:25	07:11	06:16	07:52	<b>-03:14 (-31%)</b>
Route 4 – Wells Road and Lower Dandenong Road	NB	15:05	11:41	10:20	12:43	<b>-03:25 (-23%)</b>
	SB	14:13	10:31	09:30	11:20	<b>-03:41 (-26%)</b>
Route 5 – Lower Dandenong Road	EB	03:25	03:59	03:32	04:22	<b>00:34 (+17%)</b>
	WB	04:32	03:57	03:26	04:22	<b>-00:35 (-13%)</b>
<b>PM Peak Period (3:00 – 6:00pm)</b>						
Route 1 – Springvale Road and Dingley Bypass	NB	08:13	07:53	07:11	08:32	<b>-00:20 (-4%)</b>
	SB	08:45	08:15	07:28	08:55	<b>-00:30 (-6%)</b>
Route 2 – Boundary Road and Wells Road	NB	09:42	11:08	10:25	11:56	<b>01:26 (+15%)</b>
	SB	10:13	11:04	10:05	11:57	<b>00:51 (+8%)</b>
Route 3 – Wells Road and White Street	NB	10:49	08:16	07:17	09:04	<b>-02:32 (-23%)</b>
	SB	11:48	07:38	06:38	08:22	<b>-04:10 (-35%)</b>
Route 4 – Wells Road and Lower Dandenong Road	NB	14:26	11:45	10:27	12:48	<b>-02:41 (-19%)</b>
	SB	16:01	11:25	10:02	12:23	<b>-04:36 (-29%)</b>
Route 5 – Lower Dandenong Road	EB	04:57	04:16	03:37	04:45	<b>-00:41 (-14%)</b>
	WB	03:43	03:53	03:24	04:20	<b>00:11 (+5%)</b>

Based on the above findings:

- Most average observed travel times for the routes considered are within  $\pm 15\%$  or one minute (whichever is greater) of the modelled travel times across both the AM and PM peak periods.
- Only routes 3 and 4 involved observed travel times up to 35% shorter than the modelled travel times across both the AM and PM peak periods.

Observed average travel times are between 16% to 49% faster on the Mordialloc Freeway (see Table 4-7) than observed average times along parallel arterial routes (i.e. routes 1 and 2 with travel times shown in Table 4-6). Despite not being able to compare 2022 observed travel times to 2022 modelled travel times along the new link, the faster observed travel times along the freeway compared to routes 1 and 2 demonstrates the attractiveness of using the Mordialloc Freeway for trips between the Mornington Peninsula Freeway and Dingley Bypass.

**Table 4-7: Mordialloc Freeway – 2022 observed average travel times**

Route	Direction	Observed average travel time (mm:ss)	
		AM Peak Period (7:00 – 9:00am)	PM Peak Period (3:00 – 6:00pm)
Route 6 – Mordialloc Freeway between Dingley Bypass and Mornington Peninsula Freeway (south of Springvale Road)	NB	06:27	05:30
	SB	06:27	06:43

Source: Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024)

Shorter observed travel times across most routes and directions can likely be attributed to the residual impacts of COVID-19 and increased WFH levels reducing demands from originally forecast levels. Lower than predicted demand across the study area results in less congestion, shorter journey times, as well as improvements to overall amenity. Faster travel times along routes 3 and 4 are also potentially a result of post-Project adjustments to the timing of traffic lights at the Springvale Road / Wells Road intersection that were made as a response to the opening of the Mordialloc Freeway (VicRoads, 2023)<sup>6</sup>.

As described in Section 3.1, travel times for a 2022 Project Case year were calculated by interpolating between the EES VITM modelled 2021 Project Case and 2031 Project Case. This approach assumes a constant rate of change and can be challenging for comparison as travel times may be subject to a wide range of factors beyond traffic volumes.

Overall, the travel times comparison demonstrates that the EES VITM models fairly reliably forecasted the average weekday peak period vehicle journey times along key traffic routes within the study area when the new link (Mordialloc Freeway) was introduced.

<sup>6</sup> Source: Mordialloc Freeway two years on: Better connections for smoother traffic flow, DTP (formerly VicRoads), 18 December 2023 <https://smarterroads.vic.gov.au/vicroads/smarter-roads/updates?pvview=5b9fd79e-0d8d-4248-be6f-5e8f13821cff>

## 5. Summary

As part of the *Mordialloc Bypass Minister's assessment of environmental effects* (June, 2019), an additional Environmental Performance Requirement (EPR) was recommended, EPR T4. This required the road operator to monitor and report on the performance of the regional road network to provide a comparison to, and validation of, the Victorian Integrated Transport Model (VITM) model predictions provided in the Environmental Effects Statement (EES).

To satisfy this EPR T4 within the Minister's assessment, this report (prepared by Arup on behalf of MRPV), documents a once off EES VITM Model Performance Review which compares the modelled forecast (interpolated) average weekday traffic volumes and journey times relative to 2022 observed conditions.

Overall, the findings:

- document the types and levels of differences in forecast versus observed demands that have occurred,
- have identified some reasons for why such differences occur, principally associated with unforeseen changes in circumstances linked to the COVID-19 pandemic; and
- demonstrated that the EES VITM models forecasted with sufficient accuracy the redistributed traffic demand across the surrounding road network and journey times along key traffic routes within the study area when the new link (Mordialloc Freeway) was introduced.

Specific findings from this assessment found that:

- There is a good correlation between 2022 modelled and observed traffic volumes, as indicated by the  $R^2$  statistic exceeding the guideline criteria of 0.90 and the  $y$  statistic being between 0.9 and 1.1.
- The EES VITM models overpredicted (within acceptable tolerance) the observed traffic demand across the study area, with total observed volumes up to 8% lower than modelled across AM, PM and daily time periods. This difference is likely attributed to the residual impacts of COVID-19, including slower population and employment growth during 2020 and 2021, and higher levels of WFH. At the time of preparing this report (2024), current versions of VITM have now adjusted to account for increased WFH levels and changes to land use projections.
- Most average observed travel times for the routes considered are within  $\pm 15\%$  or one minute (whichever is greater) of the modelled travel times across both the AM and PM peak periods.

## A.1 Mordialloc Freeway EES 2021 and 2031 Project Case Demand Forecast Results

The tables below summarise the Mordialloc Freeway EES modelling 2021 and 2031 Project Case demand forecast results for the locations and routes considered in this assessment.

**Table A. 1: Average weekday two-way two-hour AM/PM peak and two-way daily traffic volumes – 2021 Project Case**

ID	Road	Location	AM	PM	Daily
1	Mornington Peninsula Freeway	East of Springvale Road	11,500	12,200	77,100
2	Springvale Road	North of Mornington Peninsula Freeway	4,500	4,900	25,800
3	Springvale Road	South of Mornington Peninsula Freeway	3,500	4,300	20,700
5	Wells Road	West of Springvale Road	1,400	1,600	6,900
6	Wells Road	East of Springvale Road	2,800	2,900	14,900
7	Governor Road	West of Mordialloc Freeway	4,100	4,400	25,100
8	Governor Road	East of Mordialloc Freeway	2,700	2,800	13,800
9	Lower Dandenong Road	West of Mordialloc Freeway	6,400	6,800	45,000
10	Lower Dandenong Road	East of Mordialloc Freeway	5,800	6,300	38,900
11	Boundary Road	South of Lower Dandenong Road	4,800	5,300	31,600
12	Boundary Road	South of Governor Road	2,600	3,000	15,900
13	Centre Dandenong Road	West of Mordialloc Freeway	4,900	5,500	31,400
14	Centre Dandenong Road	East of Mordialloc Freeway	2,600	2,900	17,900
15	Old Dandenong Road	East of Boundary Road	700	800	3,400
16	Tootal Road	South of Dingley Bypass	2,600	2,700	18,700
17	Kingston Road	West of Dingley Bypass	3,300	3,900	21,800
18	Warrigal Road	North of Dingley Bypass	5,400	5,600	33,600
19	South Road	West of Warrigal Road	8,000	8,700	54,000
21	Westall Road	West of Springvale Road	6,300	6,700	34,600
22	Westall Road	North of Heatherton Road	7,200	7,800	48,200
23	Mordialloc Freeway	Springvale Road and Governor Road	10,600	11,300	71,200
24	Mordialloc Freeway	North of Governor Road	9,200	9,700	60,000
25	Mordialloc Freeway	North of Lower Dandenong Road	8,600	9,300	56,800
30	Nepean Highway	North of White Street	5,100	5,600	33,400
31	Nepean Highway	North of South Road	9,800	9,900	69,700
32	Nepean Highway	North of Centre Dandenong Road	9,900	10,600	63,500
33	White Street	West of Boundary Road	2,600	2,900	18,300

**Table A. 2: Average weekday two-way two-hour AM/PM peak and two-way daily traffic volumes – 2031 Project Case**

ID	Road	Location	AM	PM	Daily
1	Mornington Peninsula Freeway	East of Springvale Road	11,800	12,500	82,800
2	Springvale Road	North of Mornington Peninsula Freeway	5,000	5,600	28,500
3	Springvale Road	South of Mornington Peninsula Freeway	3,900	4,700	22,500
5	Wells Road	West of Springvale Road	1,800	2,100	8,200
6	Wells Road	East of Springvale Road	2,900	3,100	15,500
7	Governor Road	West of Mordialloc Freeway	4,200	4,500	27,600
8	Governor Road	East of Mordialloc Freeway	3,100	3,300	16,200
9	Lower Dandenong Road	West of Mordialloc Freeway	6,600	6,800	47,300
10	Lower Dandenong Road	East of Mordialloc Freeway	5,800	6,300	39,800
11	Boundary Road	South of Lower Dandenong Road	5,300	5,900	34,800
12	Boundary Road	South of Governor Road	3,000	3,400	17,100
13	Centre Dandenong Road	West of Mordialloc Freeway	5,300	5,800	34,700
14	Centre Dandenong Road	East of Mordialloc Freeway	2,700	3,000	19,100
15	Old Dandenong Road	East of Boundary Road	800	1,000	4,100
16	Tootal Road	South of Dingley Bypass	2,600	2,700	19,800
17	Kingston Road	West of Dingley Bypass	3,500	4,000	23,700
18	Warrigal Road	North of Dingley Bypass	5,800	6,000	35,200
19	South Road	West of Warrigal Road	8,300	8,900	57,000
21	Westall Road	West of Springvale Road	6,900	7,500	39,700
22	Westall Road	North of Heatherton Road	7,800	8,400	55,500
23	Mordialloc Freeway	Springvale Road and Governor Road	10,900	12,300	76,700
24	Mordialloc Freeway	North of Governor Road	9,800	10,900	65,300
25	Mordialloc Freeway	North of Lower Dandenong Road	9,300	10,900	63,500
30	Nepean Highway	North of White Street	5,400	5,900	35,200
31	Nepean Highway	North of South Road	9,500	9,900	70,100
32	Nepean Highway	North of Centre Dandenong Road	10,000	11,200	67,400
33	White Street	West of Boundary Road	2,800	3,000	19,300

**Table A. 3: Average weekday AM/PM peak travel times (minutes) – 2021 Project Case**

ID	Route	Direction	AM	PM
1	Springvale Road between Mornington Peninsula Freeway and Dingley Bypass	Northbound	08:42	08:12
		Southbound	08:06	08:42
2	Boundary Road between Mornington Peninsula Freeway and Dingley Bypass	Northbound	09:48	09:42
		Southbound	10:00	10:12
3	Wells Road – White Street between Mornington Peninsula Freeway and Nepean Highway	Northbound	11:12	10:48
		Southbound	10:24	11:42
4	Wells Road – Lower Dandenong Road between Mornington Peninsula Freeway and Nepean Highway	Northbound	15:00	14:24
		Southbound	14:12	15:54
5	Lower Dandenong Road between Springvale Road and Boundary Road	Eastbound	03:24	04:54
		Westbound	04:30	03:42

**Table A. 4: Average weekday AM/PM peak travel times (minutes) – 2031 Project Case**

ID	Route	Direction	AM	PM
1	Springvale Road between Mornington Peninsula Freeway and Dingley Bypass	Northbound	09:18	08:18
		Southbound	08:06	09:18
2	Boundary Road between Mornington Peninsula Freeway and Dingley Bypass	Northbound	09:54	09:42
		Southbound	10:00	10:18
3	Wells Road – White Street between Mornington Peninsula Freeway and Nepean Highway	Northbound	11:48	10:54
		Southbound	10:36	12:42
4	Wells Road – Lower Dandenong Road between Mornington Peninsula Freeway and Nepean Highway	Northbound	15:54	14:42
		Southbound	14:18	17:06
5	Lower Dandenong Road between Springvale Road and Boundary Road	Eastbound	03:30	05:24
		Westbound	04:48	03:48



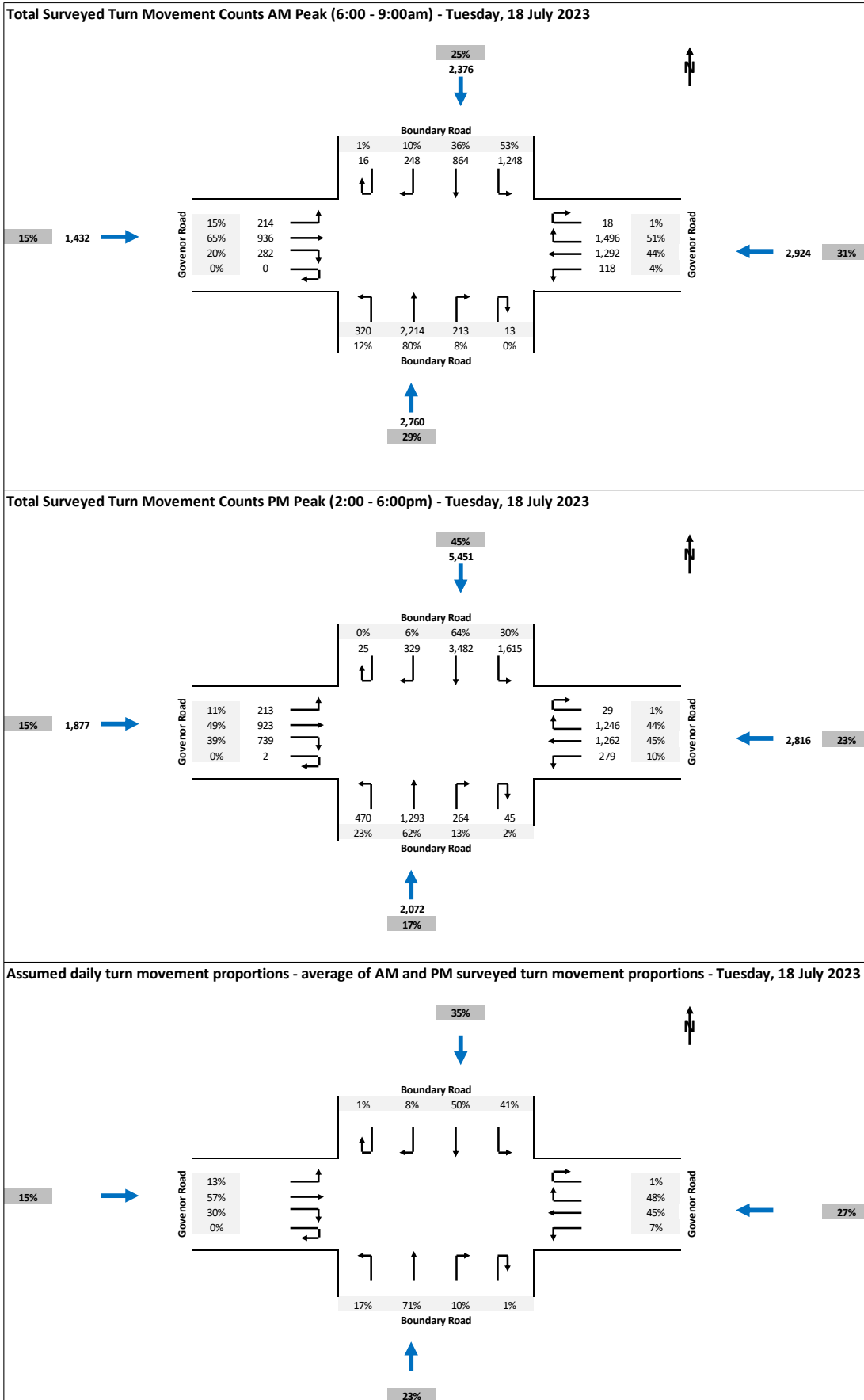


ID	Road	Location	SCATS site ID	SCATS site location	Detector map and midblock count location	Applicable detectors	Calculation assumptions
8	Governor Road	East of Mordialloc Bypass (Freeway)	1169	Governor Road / Burdekin Boulevard		EB: 4, 5, 8, 9 WB: 1, 2, 3	NA – All movements accounted for.
9	Lower Dandenong Road	West of Mordialloc Bypass (Freeway)	3147	Lower Dandenong Road / Mordialloc Freeway / Mornington Peninsula Freeway		EB: 11, 12, 13, 14, 15, 16, 17, 18 WB: 21, 2, 3, 4, 5, 25, 26	Assumed 95% of traffic on lane with detector no. 25 are turning right on to Lower Dandenong Road (and not back onto freeway in the other direction).  Excluded bus detectors 27 and 28 to avoid double counting of buses at this intersection.
10	Lower Dandenong Road	East of Mordialloc Bypass (Freeway)	944	Lower Dandenong Road / Centre Dandenong Road		EB: 5, 6, 7 WB: 1, 2, 3, 9	No detector on EB left turn lane into the minor road at this intersection (Centre Dandenong Road). Assumed this volume equates to 50% of traffic on lane with detector no. 5.  No detector on EB right turn lane. Assumed 0 vehicles per day undertake this movement (back of house entrance to golf course).  Assumed 100% of traffic on lane with detector no. 9 are turning right into Lower Dandenong Road.  Assumed 100% of traffic on lane with detector no. 1 are travelling straight through.  Note that the operation sheet for SCATS site 3149 immediately to the west is out of date. Additionally, traffic volumes cannot be calculated from other adjacent SCATS sites due to sites being located too far from the location.
11	Boundary Road	South of Lower Dandenong Road	4638	Lower Dandenong Road / Boundary Road		NB: 1, 2, 3, 4, 5, 6 SB: 13, 8, 9, 10, 21, 22	NA – All movements accounted for.
12	Boundary Road	South of Governor Road	3715	Governor Road / Boundary Road		NB: 3, 4, 5 SB: 1	Used surveyed the turning movement count survey conducted on 18 July 2023 (used to inform the Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024)) to estimate the proportion/number of turning movements along lanes with no detectors.  <b>Refer to the figure below which summarises the observed peak period turning movement volumes and proportions, as well as the estimated turning movement proportions across an entire day.</b>

ID	Road	Location	SCATS site ID	SCATS site location	Detector map and midblock count location	Applicable detectors	Calculation assumptions
13	Centre Dandenong Road	West of Mordialloc Bypass (Freeway)	1952	Centre Dandenong Road / Mornington Peninsula Freeway		EB: 5, 15, 6, 7, 8, 9 WB: 10, 11, 2, 14, 3, 4	NA – All movements accounted for.
14	Centre Dandenong Road	East of Mordialloc Bypass (Freeway)	1952	Centre Dandenong Road / Mornington Peninsula Freeway		EB: 5, 6, 7, 12, 13 WB: 1, 2, 3, 4	NA – All movements accounted for. Excluded bus detectors 14 and 15 to avoid double counting of buses at this intersection.
15	Old Dandenong Road	East of Boundary Road	3203	Old Dandenong Road / Boundary Road		EB: 5, 13, 4 WB: 10, 11, 12	No detector on WB left turn lane. Assumed this volume equates to 50% of traffic on lane with detector no. 10. Traffic volumes cannot be calculated from other adjacent SCATS sites due to sites being located too far from the location.
16	Tootal Road	South of Dingley Bypass	1700	Tootal Road / Dingley Bypass		NB: 13, 14, 15, 16 SB: 1, 18, 19, 11, 12	NA – All movements accounted for.
17	Kingston Road	West of Dingley Bypass	1699	Kingston Road / Dingley Bypass		EB: 9, 10, 11, 12, 13 WB: 1, 15, 16	NA – All movements accounted for.
18	Warrigal Road	North of Dingley Bypass	3695	Warrigal Road / Old Dandenong Road		NB: 1, 2, 3, 4 SB: 6, 7, 8	No detector on SB left turn lane into the major road at this intersection (Warrigal Road). Assumed this volume equates to 50% of traffic on lanes with detector nos. 9 and 10. Traffic volumes cannot be calculated from adjacent SCATS site 3696 due to no detectors on some lanes.

ID	Road	Location	SCATS site ID	SCATS site location	Detector map and midblock count location	Applicable detectors	Calculation assumptions
19	South Road	West of Warrigal Road	3696 & 3695 (see above)	South Road / Dingley Bypass / Warrigal Road		EB: 19, 20, 21, 22, 23, 24 WB: 13, 14, 15, 16, 11, 12	No detector on EB left turn lane. Assumed this volume equates to sum of detectors 1,2,3,4 at site 3695 minus detectors 2,3,4,17,18 at this site.  No detector on WB left turn lane into the major road at this intersection (Dingley Bypass). Assumed this volume equates to 80% of traffic on lanes with detector nos. 9 and 10.  Traffic volumes cannot be calculated from adjacent SCATS site 3703 due to no detectors on some lanes.
20	South Road	West of East Boundary Road	3643	South Road / College Entrance (TAFE Access)		EB: 4, 5, 6, 8, 9 WB: 1, 2, 3	Assumed 50% of traffic are turning right onto South Road on lane with detector no. 8.  Traffic volumes cannot be calculated from SCATS site 3637 due to low sample size of SCATS data across 2022.
21	Westall Road	West of Springvale Road	441	Westall Road / Dingley Arterial / Springvale Road		EB: 16, 17, 18, 19, 20 WB: 22, 11, 12, 13, 23, 24	No detector on EB left turn lane into major road at this intersection (Springvale Road) from Dingley Bypass. Assumed this volume equates to 50% of traffic on lanes with detector nos. 16 and 17.  Traffic volumes cannot be calculated from adjacent SCATS site as it is not relevant.
22	Westall Road	North of Heatherton Road	4704	Westall Road near Erica Street		NB: 8, 9, 10 SB: 5, 6, 7	NA – All movements accounted for.
27	Thames Promenade	West of Wells Road	510	Nepean Highway / Avondale Avenue / Station Street / Thames Promenade		EB: 11, 19, 10 WB: 14, 15	Assumed 50% of traffic on lane with detector no. 19 are travelling straight through onto Thames Promenade from Avondale Avenue or Nepean Highway.  Note that valid data was not available for adjacent or more closely located SCATS sites including 1575 and 293 to the east.
30	Nepean Highway	North of White Street	2332	Nepean Highway / White Street		NB: 1, 2, 7, 8 SB: 9, 4, 5	No detector on northbound shared left and through lane on major road at this intersection (Nepean Highway). Assumed that most traffic (80%) on lane with detector no. 1 are travelling straight through.  Shared detector on the west approach/minor road (White Street). Assumed 50% of traffic on lanes with detector no. 8 turn left onto the major road (Nepean Highway).  No detector on southbound leftmost through lane on the major road at this intersection. Assumed that the through volume on this lane equates to 100% of traffic on lane with detector no. 4.  No detector on southbound right turn lane on the major road at this intersection. Assumed that the right turn volume into the minor road on

ID	Road	Location	SCATS site ID	SCATS site location	Detector map and midblock count location	Applicable detectors	Calculation assumptions
							<p>this lane equates to 20% of traffic on lane with detector no. 5.</p> <p>Traffic volumes cannot be calculated from adjacent SCATS site 2331 due to no detectors on some lanes.</p>
31	Nepean Highway	North of South Road	2322	Nepean Highway / South Road		<p>NB: 3, 4, 17, 18, 19, 14, 15, 16</p> <p>SB: 5, 6, 7, 8, 21, 22</p>	<p>Assumed 50% of traffic on lane with detector no. 19 are turning left into Nepean Highway.</p>
32	Nepean Highway	North of Centre Dandenong Road	2328 & 2327	Nepean Highway / Centre Dandenong Road & Nepean Highway / Chesterville Road		<p>NB: 1, 2, 3, 4, 5, 6 (site 2327)</p> <p>SB: 15, 14, 5, 6, 7, 8 (site 2328)</p>	<p>NA - All movements accounted for.</p>
33	White Street	West of Boundary Road	2353 & 3651	White Street / Treeby Boulevard & White Street near Warren Road		<p>EB: 3, 4 (site 2353) or 2 (site 3651)</p> <p>WB: 1 (site 3651)</p>	<p>NA - All movements accounted for.</p>



**Figure A. 1: Surveyed AM and PM turning movement counts at Boundary Road / Governor Road and estimated daily turning movement proportions**

## A.3 Mordialloc Freeway Automatic Tube Count (ATC) Survey Data Scaling Approach

Between Thursday, 24 November 2022 and Wednesday, 7 December 2022, automatic tube count (ATC) survey data along the Mordialloc Freeway was collected by Matrix to inform the Mordialloc Freeway Project Evaluation Report – Benefit Assessment (Arup, 2024).

Traffic volume data in each direction was collected between Monday to Friday across a period of 24 hours and vehicles were classified according to the Austroads Vehicle Classifications Table.

The ATC survey sites are listed in the table and figure below.

**Table A. 6: ATC site descriptions**

ATC Site	Location	Available direction
1	Mordialloc Freeway - North of Old Dandenong Rd	Both
2	Mordialloc Freeway - North of Lower Dandenong Rd	Both
3	Mordialloc Freeway - South of Lower Dandenong Road	Both
4	Mordialloc Freeway - South of Bowen Parkway	Both
5	Mornington Peninsula Freeway - North of Thames Promenade	Southbound only



**Figure A. 2: ATC site locations**

It was found that the northbound direction for ATC site 5 (south of Springvale Road) failed to collect data during the surveyed period. Consequently, traffic volumes for the northbound direction were estimated from sites 4, given that traffic volumes for all vehicle types were generally found to increase southbound on the Mordialloc Freeway towards Thames Promenade.

The table below summarises the average AM, PM and daily car, heavy vehicle (HV) and total vehicle volumes recorded between Thursday, 24 November 2022 and Wednesday, 7 December 2022.

**Table A. 7: Average weekday traffic volumes at ATC sites on the Mordialloc Freeway between Thursday, 24 November 2022 and Wednesday, 7 December 2022**

ID	Site	Direction	Average weekday 2-hour volume (Nov – Dec 2022)						Average weekday daily volume (Nov – Dec 2022)		
			AM (7:00 – 9:00am)			PM Peak (3:00 – 6:00pm)			Cars	HV	Total
			Cars	HV	Total	Cars	HV	Total			
ATC 1	Mordialloc Freeway - North of Old Dandenong Rd	NB	4,835	256	5,091	3,145	179	3,324	25,332	1,663	26,994
		SB	1,353	121	1,474	2,089	123	2,212	12,071	940	13,011
ATC 2	Mordialloc Freeway - North of Lower Dandenong Rd	NB	5,947	304	6,250	3,875	213	4,088	30,861	1,949	32,810
		SB	3,061	260	3,320	4,508	236	4,743	25,658	1,918	27,576
ATC 3	Mordialloc Freeway - South of Lower Dandenong Road	NB	6,782	380	7,162	4,098	240	4,338	33,717	2,344	36,060
		SB	2,335	196	2,532	3,520	184	3,703	20,083	1,447	21,530
ATC 4	Mordialloc Freeway - South of Bowen Parkway	NB	7,395	358	7,752	4,156	210	4,365	36,093	2,085	38,178
		SB	3,480	257	3,737	5,984	204	6,188	32,055	1,824	33,879
ATC 5	Mornington Peninsula Fwy - North of Thames Promenade	NB	8,229*	529*	8,758*	5,509*	484*	5,992*	37,582*	3,298*	40,880*
		SB	3,873	380	4,253	7,933	470	8,403	33,378	2,885	36,263

\* Estimated traffic volumes using data recorded at ATC site 4.



To ensure that the Matrix ATC data is representative of typical weekday conditions across the entire year, a seasonality assessment has been undertaken.

The seasonality assessment analysed the SCATS total intersection volume data across all of 2022 at:

- Springvale Road / Governor Road / Hutton Road (site number 283).
- Lower Dandenong Road / Woodlands Drive (site number 3147).
- Mornington Peninsula Freeway / Springvale Road (site number 280).

These intersections were considered appropriate to represent the traffic volume profile across a year based on their proximity to ATC sites 2 to 5.

A summary of the total intersection volumes for each day surveyed and representing an average weekday across 2022 (excluding public and school holidays), as well as a seasonality adjustment factor for each site is provided in the table below.

**Table A. 8: Total intersection volumes at SCATS sites 283, 3147 and 280 across 2022**

Date	Daily intersection volume		
	Site 3147	Site 283	Site 280
Thursday 24/11	61,037	41,686	54,666
Friday 25/11	63,801	41,679	54,687
Monday 28/11	56,809	38,420	53,175
Tuesday 29/11	59,129	No data due to faulty SCATS detector(s).	52,642
Wednesday 30/11	59,169	41,266	51,116
Thursday 1/12	59,842	41,178	47,682
Friday 2/12	61,429	43,309	50,075
Monday 5/12	56,316	39,045	44,951
Tuesday 6/12	58,653	40,951	49,244
Wednesday 7/12	59,111	41,577	52,102
<b>Average of ATC surveyed days</b>	59,530	41,012	51,034
<b>Average weekday across 2022 (excluding public and school holidays)</b>	55,453	38,311	43,138
<b>Seasonality adjustment factor*</b>	0.845	0.932	0.934
<b><u>Average seasonality adjustment factor adopted across all ATC sites</u></b>	<b><u>0.904</u></b>		

\* A seasonality adjustment factor for each SCATS site was calculated by dividing the average weekday volume across 2022 by the average weekday volume across ATC surveyed days.