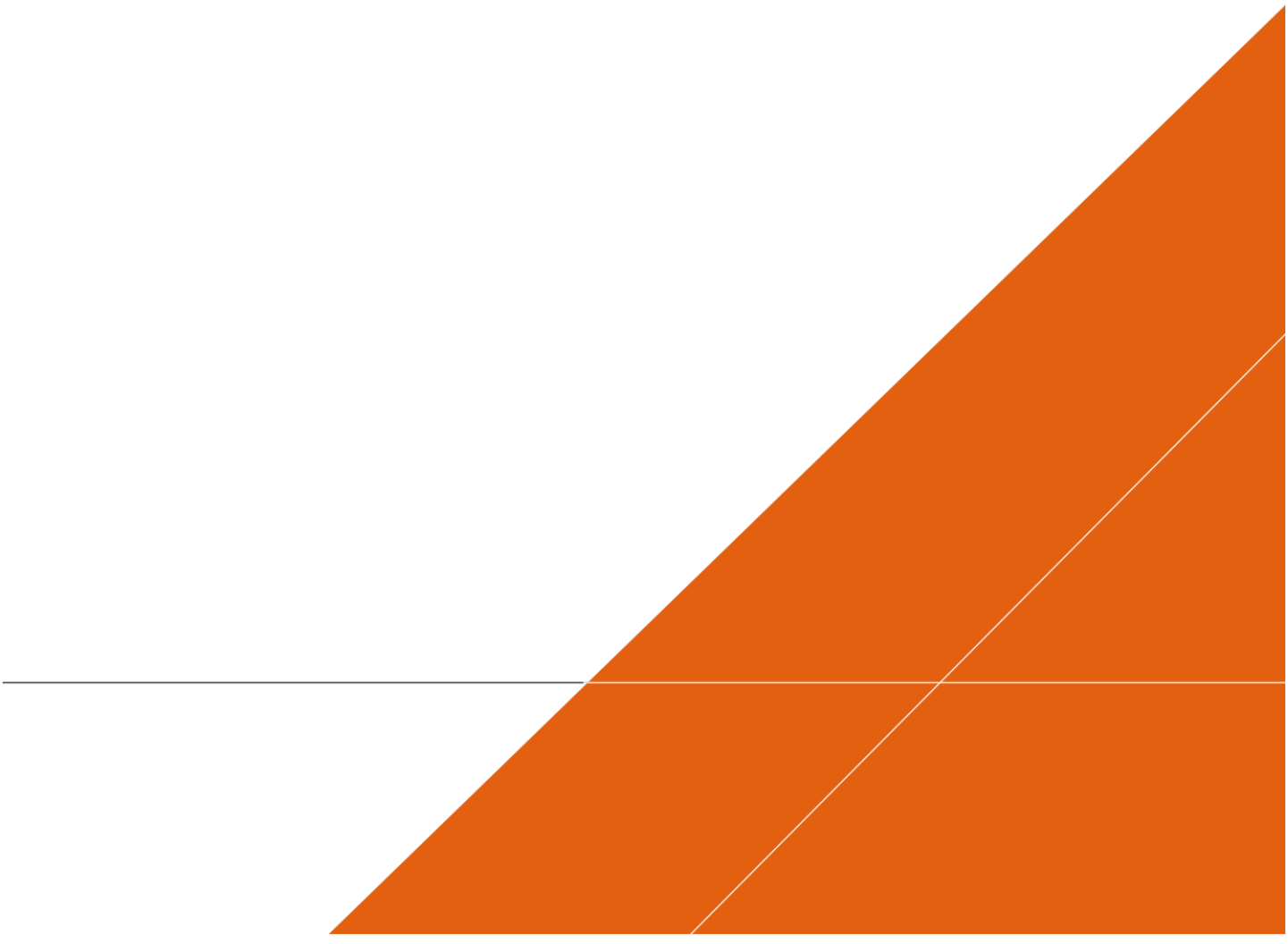
ARCADIS Design & Consultancy for natural and built assets

TECHNICAL REPORT
TRANSPORT IMPACT ASSESSMENT

Yan Yean Road Upgrade

Stage 2: Kurrak Road to Bridge Inn Road

16 JULY 2020



MAJOR ROAD PROJECT VICTORIA
YAN YEAN ROAD, STAGE 2 UPGRADE

Environment Effects Statement

Transport Impact Assessment

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Report No	001-10003997-VCR-TRA-007
Date	16/07/2020
Revision Text	G

REVISIONS

Revision	Date	Description	Prepared by	Approved by
A	11/07/19	Draft for MRPV	MB/CK	AB
B	13/08/19	Draft for MRPV Review 2	MB/CK	AB
C	11/10/19	Draft for MRPV Review 3	MB/CK	AB
D	22/11/19	Draft for MRPV Review 4 / TRG	MB/CK	AB
E	15/04/20	Draft for MRPV Review 5	MB/CK	AB
F	29/05/20	Final draft	MB/CK	AB
G	16/07/20	Final	MB/CK	AB

CONTENTS

APPENDICES

ABBREVIATIONS

AADT	Annual Average Daily Traffic
ATC	Automatic Tube Counts
AWT	Average Weekday Traffic
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water and Planning
DOT	Department of Transport
DoS	Degree of Saturation
EES	Environment Effects Statement
EMF	Environmental Management Framework
LoS	Level of Service
MRPV	Major Road Projects Victoria
MTIA	Major Transport Infrastructure Authority
NEIC	National Employment Innovation Cluster
PBN	Principal Bicycle Network
PFN	Principal Freight Network
PTV	Public Transport Victoria
SSA	Safe Systems Assessment
SRU	Suburban Road Upgrade (program)
SUP	Shared Use Path
TIA	Transport Impact Assessment
TRG	Technical Reference Group
VIF	Victoria in Future (2016)
VITM	Victorian Integrated Transport Model

EXECUTIVE SUMMARY

Purpose of this report

This Transport Impact Assessment assesses the transport network impacts associated with the construction and operation of the upgrade of Yan Yean Road, between Kurrak Road and Bridge Inn Road, in the suburbs of Yarrambat and Doreen (the Project). This assessment forms part of the Environment Effects Statement (EES) for the Project, addressing the transport related Scoping Requirements for the EES.

Overview

The Project is the proposed duplication from a two-lane undivided carriageway, to a four-lane divided carriageway along a 5.5-kilometre section of Yan Yean Road, between Kurrak Road and Bridge Inn Road, including intersection improvements at eight key locations. The Project connects with the recently completed Yan Yean Road Stage 1 Upgrade to the south and the proposed Bridge Inn Road Upgrade to the north (part of the Suburban Roads Upgrade Program).

Major Road Projects Victoria (MRPV) is the State Government agency within the Major Transport Infrastructure Authority (MTIA) responsible for developing the Project, obtaining planning and environmental approvals and community consultation.

On 14 October 2018, the Minister for Planning decided that an EES is required for the Project under the *Environment Effects Act 1978*. A range of technical assessments are required as part of the EES, and are to be prepared in accordance with Scoping Requirements released by the Minister for Planning in June 2019.

Arcadis Australia Pacific Limited (Arcadis) and WSP have been engaged by MRPV to prepare this Transport Impact Assessment as part of the EES. As part of this Transport Impact Assessment, WSP has undertaken the strategic modelling and traffic demand forecasting and Arcadis has undertaken assessment of the design impacts and operational traffic modelling.

Scoping Requirements

Scoping Requirements for the EES set out the specific matters to be investigated and documented in the EES and have informed the scope of the technical assessments. The Scoping Requirements include a series of evaluation objectives which identify the desired outcomes to be achieved by the Project.

The following evaluation objective for 'Transport capacity and connectivity' is relevant to this Transport Impact Assessment:

> *"To provide for an effective corridor through the northern outer suburbs of Melbourne, to improve travel efficiency, road safety and capacity".*

Key issues for the EES, relevant to transport capacity and connectivity, are identified within the Scoping Requirements, as are specific requirements regarding assessment of the existing environment, likely effects of the Project, design and mitigation measures and performance objectives.

The Scoping Requirements cover both the construction and operation phases of the Project and the vehicular, public transport and active transport modes.

Methodology

The methodology adopted in undertaking this Transport Impact Assessment comprised the following key stages:

- ***Review Project scope and context-*** define scope of the Project, key stages and the legislative and policy context of the Project.
- ***Existing conditions assessment-*** evaluate baseline transport network conditions for the Project based on data collection and key observations.
- ***'No Project' assessment-*** assessment of anticipated future conditions in the absence of the Project, based on network-wide strategic traffic forecasting, operational modelling for the Project corridor, and expected road safety and accessibility outcomes for all modes of transport.
- ***'With Project' assessment -*** assessment of anticipated conditions following implementation of the Project based on review of design impacts on access and connectivity, network-wide strategic traffic forecasting, operational modelling for the Project corridor and expected road safety and accessibility outcomes for all modes of transport.
- ***Construction traffic impact assessment -*** review of the expected construction staging approach, key impacts and traffic management considerations.
- ***Risk assessment-*** assessment of potential key environmental risks generated from the Project during the construction and operational phases and mitigation measures.

Existing conditions

The key findings of the existing conditions assessment are summarised below.

Transport network

- Yan Yean Road is a 12-kilometre section of declared main roadway, located along the eastern boundary of the North Growth Corridor. It provides connectivity between the growing areas of Doreen and Mernda, the townships of Plenty and Yarrambat and the established areas of Diamond Creek and Greensborough. It also connects these areas via key east-west arterials Bridge Inn Road, Kurrak Road and Diamond Creek Road, providing connectivity to the rest of the North Growth Area, the Metropolitan Ring Road, the future North East Link and Hume Freeway.
- Yan Yean Road is one of three north-south arterial routes, serving the northern suburbs. Along with Plenty Road and Epping Road, it provides an essential transport connection through the area.
- The Mernda railway line runs parallel to and just over three kilometres to the west of the Project route, with the recently constructed Mernda, Hawkstowe and Middle Gorge Stations providing the nearest points of rail access to Yan Yean Road. Peak services run at headways of approximately 6 to 8 minutes with a typical trip from Mernda to Flinders Street taking around 54 minutes.
- The Project corridor is served by bus routes 381 (Mernda Station to Diamond Creek Station) and 385, (Greensborough to Mernda North) with several bus stops providing bus access for the residential areas, schools and shops adjacent to Yan Yean Road.
- There are only short sections of footpath for pedestrians and (school aged) cyclists off road at discrete locations along Yan Yean Road. Footpaths are provided along around 25 percent of Yan Yean Road, generally only on one side of the road, meaning that Yan Yean Road is not well utilised by active transport modes. Several additional informal paths along Yan Yean Road are used occasionally by pedestrians, cyclists and horse riders.
- The northern section of the Project route between Bridge Inn Road and Jorgensen Avenue is part of the Principal Bicycle Network (PBN), providing connectivity north to Arthurs Creek and Yan Yean Reservoir and connecting to the east-west running PBN along Bridge Inn Road with access to Mernda Station. The Project route does not provide formal facilities for cycling on-road, even within the PBN section, and the narrow width of the road likely discourages its use by cyclists. Very few cyclists are observed along Yan Yean Road.

Traffic conditions

- Yan Yean Road typically carries between 20,000 to 24,000 vehicles per weekday (Monday to Friday average) through the Project area, depending on location. Traffic volumes are generally lower in the north, and steadily increase further south, capturing traffic movements from existing and growing residential areas.
- Through the busiest section of Yan Yean Road, to the north of Ironbark Road, approximately 7.5 percent of all traffic are heavy vehicles (1,825 of 24,180 vehicles per weekday).
- During the morning peak period, southbound travel along Yan Yean Road is dominant, peaking at approximately 1,200 vehicles per hour between 06:00 and 07:00. The key bottleneck for southbound travel occurs at Ironbark Road where the average speed drops to approximately 25 km/hr (and as low as 15 km/hr). The tail of the 'slow moving queue' is regularly observed as far back as Golf Links Drive (over 1,000 metres long) between 08:00 to 09:00, and occasionally as far back as Bannons Lane (over 1,500 metres long).
- During the afternoon peak period, northbound travel along Yan Yean Road becomes dominant, catering for 1,350 vehicles per hour between 17:00 and 18:00. The key bottleneck for northbound travel occurs at Bridge Inn Road, with observed queues extending as far back as Orchard Road (over 800 metres away). There are some minor delays at Ironbark Road.
- Yan Yean Road is currently at, or close to capacity during the peak periods in the dominant directions of travel.

IMPACT ASSESSMENT

'No Project' assessment

The key findings for the 'No Project' scenario, or "business-as-usual" are summarised below and are based on conditions forecast for the assessment year 2031.

- The population of the City of Whittlesea, to the north and west of the Project corridor, is expected to grow by close to 110,000 people or just over 50 percent between 2016 and 2031. This rate of population growth places Whittlesea amongst the five fastest growing municipalities in metropolitan Melbourne. More moderate growth is expected in Nillumbik Shire, to the eastern side of the Project corridor, as it sits outside of the urban growth boundary.
- The rate of land development sees significant growth in traffic volumes forecast for the year 2031 along key north-south routes through the City of Whittlesea, with the soon to be upgraded sections of Epping Road and Plenty Road seeing significant increases in traffic demand.
- Continued traffic growth is forecast on Yan Yean Road between Kurrak Road and Bridge Inn Road. Existing congestion levels will likely be exacerbated and capacity reached for longer periods of the day, meaning there is less capacity to accommodate growth seen on adjacent north-south routes like Plenty Road and Epping Road.
- The limited capacity available on Yan Yean Road results in traffic being forced down Plenty Road (which will have been upgraded) and more rural roads in the Shire of Nillumbik such as Doctors Gully Road, Hurstbridge-Arthurs Creek Road and Heidelberg Kinglake Road.
- The peak directions of travel along Plenty Road and Epping Road show a deterioration in travel speeds through key sections (even after being upgraded) between 2016 and 2031 due to additional traffic growth and demands for north-south travel.
- Traffic performance along Yan Yean Road is expected to deteriorate significantly by 2031, with the average travel speeds forecast to drop to 20 km/h in the peak direction of travel.
- Intersections are forecast to operate very poorly during the 2031 AM and PM peaks, with key intersections operating at LOS F. All priority-controlled intersections along the route are also expected to perform very poorly with motorists egressing these residential areas expected to encounter difficulty in finding suitable gaps in traffic along Yan Yean Road.

- The performance of bus travel is expected to deteriorate similarly to road-based travel. Bus travel times are likely to increase significantly, particularly during the peak periods and in the peak direction travel, with journey times becoming less reliable.
- With no infrastructure upgrades proposed for pedestrian, cyclists or horse-riders, conditions will likely deteriorate, particularly when crossing Yan Yean Road, and discourage active transport in the area.
- The forecast increases in traffic volumes and poor operational performance, combined with the many uncontrolled access points and substandard road infrastructure provisions is expected to bring about a deterioration in road safety along Yan Yean Road and increase the likelihood of crashes.

'With Project' assessment

A comparison of expected conditions with the Project in place to the 'No Project' scenario identified the following key impacts of the Project:

- The Project removes the high number of uncontrolled right turn access movements along the corridor through provision of continuous median safety barrier. Consistent with arterial road access management policies, access movements are redirected to a dedicated U-turn facility either at an intersection or at a mid-block facility as a safer alternative, lowering the risk of crashes.
- The Project generally provides a "like-for-like" replacement of all bus stops, in terms of general location and form. Bus stops are either indented midblock or utilise part of a left turn deceleration lane at intersections.
- The provision of a new 5.5 kilometre separated shared walking and cycling path on the west side, footpath on the east side and safe crossing points via new signalised intersections, will improve amenity and safety for active transport modes. These are currently limited, sporadic and generally of a poor quality. Improved walking and cycling facilities will promote active transport through the corridor for commuting and recreational activities and provide safer access for younger users travelling to school.
- The Project is expected to result in a reduction in traffic along alternate north-south routes. The most significant reductions in traffic are seen along Plenty Road to the west and Doctors Gully Road, Heidelberg-Kinglake Road and Broad Gully Road to the east of the Project as the closest north-south alternatives to Yan Yean Road.
- An increase in traffic volumes is forecast along Yan Yean Road with the Project in place as the improved capacity and travel speeds from the Project, results in traffic that was previously detouring via Plenty Road and roads to the east for north-south travel, now utilising Yan Yean Road.
- The key forecast travel speed improvements are along the Project route which is forecast to be heavily congested in 2031 without the Project in place.
- Operational modelling along the Project corridor for the year 2031 shows an improvement in the average operating speed in the peak direction of travel (both peaks) of between 20 and 30 km/h. Along the whole corridor (both directions) and including delays to side road traffic, average operating speeds are forecast to improve by a considerable 30 km/hr.
- In addition to the improvement along the Project corridor itself, average travel speeds for vehicle trips across the local road network are forecast to improve by around 2 km/hr or 6 percent in the AM peak and 3 km/hr or over 10 percent in the PM peak due to the alleviation of congestion on Yan Yean Road and adjacent routes.
- Forecast travel time improvements for the year 2031 show a significant improvement in accessibility to employment and other opportunities in key activity centres (Melbourne CBD, La Trobe National Employment and Innovation Cluster, Greensborough and Eltham) for residential communities using the Project.

- During both 2031 peak hour periods, intersections perform significantly more efficiently than the 'no Project' case, with Bridge Inn Road operating within the acceptable range at a LoS D, and all other intersections operating at a LoS C (or better). Intersections are forecast to meet accepted performance targets with the Project in place.
- A rapid Movement and Place assessment concluded that the Project "strongly addresses" key issues that were identified in comparing the current performance of the road to its strategic purpose.
- Austroads research suggests that divided carriageway roads (i.e. the Project) have significantly lower rates of fatality and injury crashes than single carriageway roads. For the Project corridor, the forecast improvement in operations, intersection upgrades, access control, safety infrastructure, cross section and provision for cyclists and pedestrians are expected to bring about an improvement in road safety compared to the 'no Project' scenario.

Construction impact assessment

The construction impact assessment found that:

- Construction staging will be key to maintaining traffic flow along Yan Yean Road. The Project design has been developed with the aim of being able to construct a majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. When complete, traffic would be switched to the second carriageway to allow upgrade of the old carriageway.
- Temporary closures to traffic may be required for constructing complicated intersections and would likely be carried out at off peak times to minimise disruption to the community.
- Staging would be expected to have impacts on local direct access at times and this would need to be carefully managed through consultation with impacted property owners.
- A number of other nearby transport projects may be under construction at the same time as the Project, for example North East Link and the Northern Roads Upgrade. Where works are occurring in parallel, there will likely be benefit in coordination of detour routes, closure times, signage and communications across the projects to minimise cumulative impacts of traffic management activities.

Risk assessment and Environmental Performance Requirements

An environmental risk assessment (ERA) was undertaken to identify potential environmental risks to the transport network associated with the construction, operation and maintenance phases of the Project.

Following the evaluation of risks and through consultation with MRPV, Environmental Performance Requirements (EPRs) were developed to manage residual risks identified in the EES throughout the Project phases. The EPRs are provided in Section 9.

1 INTRODUCTION

Major Road Projects Victoria (MRPV) proposes to duplicate Yan Yean Road from Kurrak Road to Bridge Inn Road as part of the Yan Yean Road (Stage 2) Upgrade (the Project).

On 14 October 2018, the Minister for Planning decided that an Environment Effects Statement (EES) is required under the *Environment Effects Act 1978* (EE Act) to assess the potential environmental effects of the Project. The EES process provides for identification and analysis of the potential environment effects of the Project and the means of avoiding, minimising and managing adverse effects. It includes public involvement and allows stakeholders to understand the likely environmental effects of the Project and how they will be managed.

This Transport Impact Assessment report has been prepared for the EES in accordance with the Scoping Requirements released by the Minister for Planning in June 2019.

1.1 Background

Yan Yean Road is a primary north-south arterial road and connects the growth suburb of Doreen, with major east west arterials such as Bridge Inn Road, Kurrak Road and Diamond Creek Road. The road runs through the townships of Yarrambat and Plenty and connects with established areas of Diamond Creek and Greensborough. There is a high demand for north-south travel from Doreen and surrounding towns to established northern suburbs for employment and services.

Stage 1 of the Yan Yean Road upgrade (Diamond Creek Road to Kurrak Road) was completed in 2019.

1.2 Project description

The Project would duplicate a 5.5km portion of Yan Yean Road between Kurrak Road and Bridge Inn Road increasing the existing two lanes to four lanes (comprising two lanes in each direction). The design speed and posted speed along Yan Yean Road is 70km/h, with the exception of north of Bridge Inn Road which is 80km/h. The design for the Project has 3.5 metre wide lanes with the majority of the Project using a 2.2 metre-wide central median. This cross section was adopted in design due to various constraints ranging from road safety issues, steep and rolling terrain, high cut and fill batters and subsequent retaining walls at certain locations, as well as seeking to limit impacts to existing properties, local accesses and trees along Yan Yean Road.

The Project will include:

- two new roundabouts (at Heard Avenue, and Youngs Road)
- five new signalised intersections (Bannons Lane, Jorgensen Avenue, North Oatlands, Orchard and Bridge Inn Roads)
- upgrades to one existing signalised intersection, including an additional right turn lane, left slip lane, and traffic island (Ironbark Road approach)
- new street lighting at all intersections, road signage and landscaping

The Project will also include a new 3-metre wide shared use path on the western side and 1.2-metre wide footpath on the eastern side of Yan Yean Road. The paths links Diamond Creek to Doreen and would improve safety and connectivity for pedestrians and cyclists.

Continuous safety barriers would run along the Project's length and are proposed in the median and behind outer kerbs along the mid-block sections of the carriageways.

The Project area and key project components are shown in Figure 1.1. The detailed project description can be found in Appendix A.

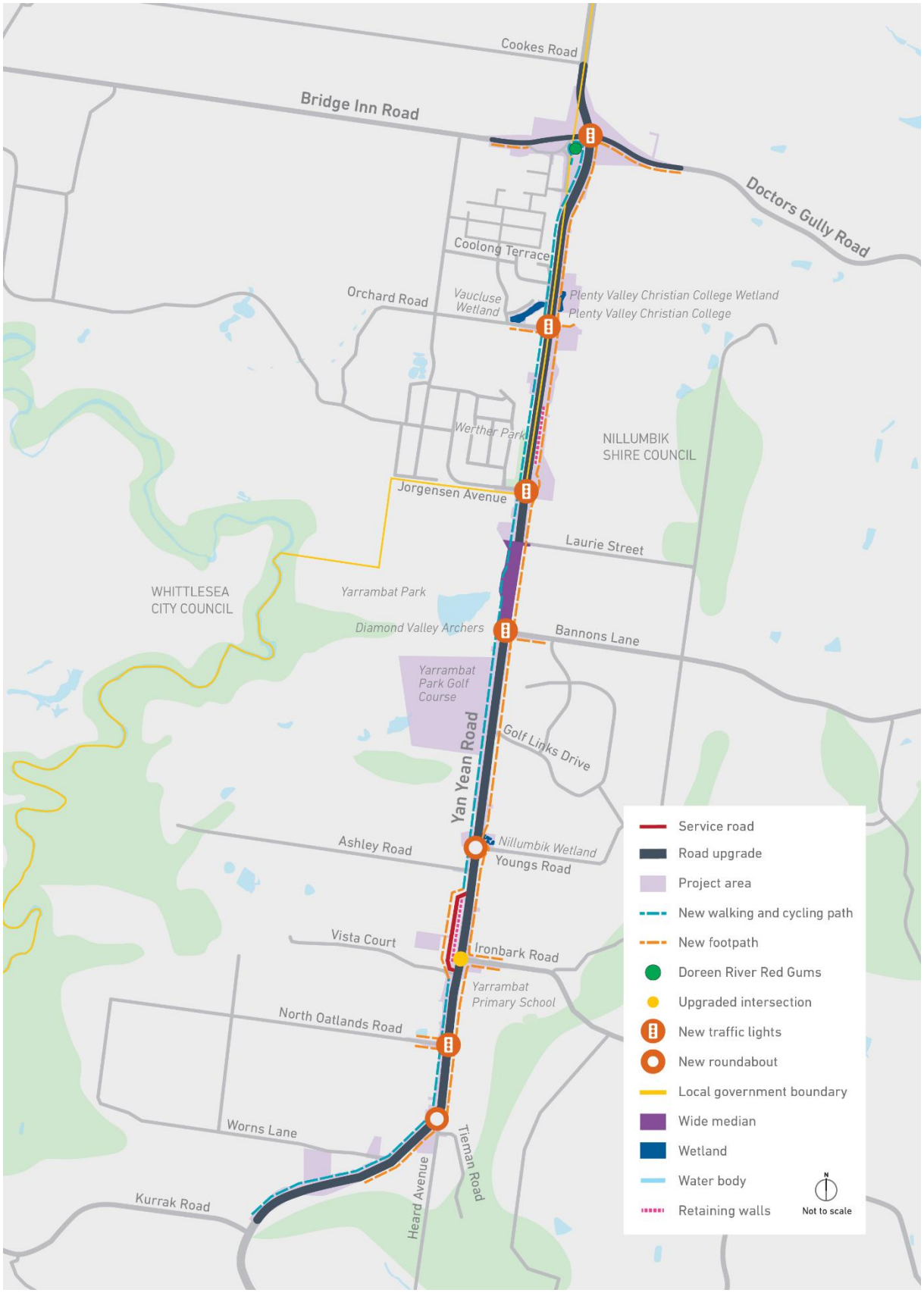


Figure 1.1 - Project area

1.2.1 Yan Yean Road / Bridge Inn Road / Doctors Gully Road Intersection

The Yan Yean Road/ Bridge Inn / Doctors Gully Road intersection has been designed to retain the two Doreen River Red Gums, General Store and Pet Supply/Stockfeed business situated adjacent to the current Doctors Gully and Yan Yean Road intersection by shifting the whole intersection to the north east (see Figure 1.2). This intersection design has been developed following community consultation and in response to arboriculture advice on the Doreen River Red Gums.

For illustrative purposes only and subject to change

Figure 1.2 - Yan Yean Road/Bridge Inn Road Intersection design

1.2.2 Construction activities

Proposed construction activities would likely be standard road construction activities to be undertaken in accordance with the Environmental Performance Requirements for the Project. These construction activities would include:

- tree clearance and vegetation lopping and removal
- establishment of construction site compounds
- clearing and grubbing, temporary sediment and erosion control works
- establishment of environmental and traffic controls

- earthworks, including:
    - remediation of any existing contamination and removal of any hazardous material
    - protecting and relocating services
    - widening of existing rock cuttings (approximately 750m of existing cut along the Project would be widened by approximately 20 metres)
    - new cuttings (approximately 1300m of new rock cut would be required to a width of approximately 5 metres along the Project)
    - bulk earthworks and haulage.
- civil and structure works, including:
    - roundabouts and intersection upgrades
    - shared use path and pedestrian path construction and connections
    - retaining walls
    - drainage works
    - pavement works.
- 30 to 36 metre high fence along the edge of the Yarrambat Park Golf Course to avoid golf ball collisions with pedestrians, cyclists and vehicles
- traffic management systems and landscaping.

1.3 Project objectives

The Project aims to improve travel times and reliability to and from growing residential areas in Doreen and Mernda, enhance north-south travel in the area, and improve safety along the corridor. The objectives of the Project are set out below:

- **To improve road safety**: The Project will achieve this by isolating road users from hazards and improving access control through signalised intersections. Congestion and the complex road environment (poor sight lines due to undulating linear / perpendicular grades and adjacent terrain) are presently contributing to the poor safety record on Yan Yean Road.
- **To improve the customer experience**: The Project will achieve this by improving access, improving network connectivity, opportunities for active transport, and providing more road capacity.
- **To improve network efficiency**: The Project will achieve improved traffic flow and a reduction in travel times by increasing road capacity and reducing congestion.
- **To maintain environmental and amenity values:** The Project will achieve this by managing environmental effects to acceptable levels and ensuring that impacts are avoided, minimised and mitigated to the extent practicable.

1.4 Report purpose

This Transport Impact Assessment assesses the potential transport network impacts associated with the operation and construction of the Project and forms part of the Environment Effects Statement (EES). In particular, the report addresses the scoping requirements for the EES (outlined in Section 2).

2 EES SCOPING REQUIREMENTS

The *Scoping Requirements for Yan Yean Road (Stage 2) Upgrade Environment Effects Statement* were issued by the Minister for Planning in June 2019. The Scoping Requirements set out the specific environmental matters to be investigated and documented in the EES, which informs the scope of the EES technical studies. The following aspects of the Scoping Requirements are relevant to this Transport Impact Assessment:

2.1 Overview

The Scoping Requirements are structured as follows:

- ***Evaluation Objectives -*** identify desired outcomes in the context of potential effects of the Project and relevant legislation. They provide a suitable framework to evaluate the Project's effects and outcomes.
- ***Key issues -*** identify the potential issues or risks that the Project poses.
- ***Existing environment -*** sets out the assessment requirements for baseline conditions and trends to characterise the significance and resilience of the environment impacted by the Project.
- ***Design and mitigation measures-*** consider and commit to design measures that could substantially avoid, mitigate or manage significant effects and risks.
- ***Assessment of likely effects -*** predicts or estimates potential and residual effects (after design and mitigation measures have been implemented) and evaluates the significance of those effects and risks.
- ***Performance objectives-*** describes monitoring and contingency measures that are proposed to ensure that effects are controlled if monitoring demonstrates more significant adverse effects than predicted or permitted.

2.2 Evaluation objective

The evaluation objective defined for 'Transport capacity and connectivity' in Section 4.1 of the Scoping Requirements document is relevant to the Transport Impact Assessment:

> *"To provide for an effective corridor through the northern outer suburbs of Melbourne, to improve travel efficiency, road safety and capacity".*

2.3 Key issues

The key scoping requirements relevant to the transport capacity and connectivity evaluation objective and Transport Impact Assessment are shown in Table 2.1 along with the location where these requirements have been addressed within this report.

Table 2.1 - Scoping requirements for the Transport Impact Assessment

Aspect	Scoping Requirements	Report Reference
Key issues	Contribution to an integrated and sustainable transport system, including active transport.	Section 8
	Transport connectivity and capacity across the northern outer suburbs of Melbourne, including network resilience and redundancy.	Section 8
	Effects of any redistribution of traffic and implications for residents, residential areas and businesses during construction and operation.	Section 8
	Connectivity of pedestrian and cycling networks across the northern outer suburbs of Melbourne and opportunities for future linkages.	Section 8.2.3
	Reliability of predictions of future travel behaviour and transport demand over time.	Section 8.5
Existing Environment	Describe both the broader and local transport network context for the Project.	Section 1.1
	Describe relevant policies, strategies and plans for transport in the vicinity of the Project.	Section 3
	Establish comprehensive baseline data on vehicular (freight, private motor vehicle, public transport) and active transport (pedestrian and bicycle movements) in the area affected by the Project.	Section 1.1
	Describe the elements of the road-based transport system (including private and commercial access to properties and cycling and pedestrian networks) that might be affected by the Project during the construction and operational phases of the Project.	Section 1.1, 8
	Undertake predictive modelling of local transport network traffic flows in the absence of the Project.	Section 7
Likely effects	Undertake predictive modelling of regional, local and Project transport network traffic flows following implementation of the Project.	Section 8
	Characterise the extent to which the Project will affect: - the overall geographic distribution of vehicles and magnitude of changes to travel times and accessibility for road users; - traffic management measures on local and arterial roads; - traffic safety, given the predicted transport network traffic flows following implementation of the Project; - local access of the community to residential areas, schools, stand-alone businesses, retail centres, activity centres, community facilities and open spaces; - accessibility and safety for pedestrians at road junctions and community facilities; - connectivity, accessibility, function, experience and safety for cyclists and pedestrians including use of existing and new shared use paths, and/or on-road bike paths; - consistency with transport and urban plans (e.g. VicRoads Movement and Place Framework, Victorian Cycling Strategy (2018-2028), Plan Melbourne (2017-2050)); and - interactions, including possible cumulative impacts with other relevant projects, for example, the Northern Suburban Roads Program.	Section 8
Design and mitigation measures	Describe the proposed transport network design features and approach to optimise and integrate the Project with the existing or modified transport network.	Sections 8.1, 8.2
	Describe the proposed transport network design features and approach to optimise and integrate the Project with the existing pedestrian and bicycle	Section 8.2.3

Aspect	Scoping Requirements	Report Reference
	network, including any proposed solutions to enhance pedestrian and bicycle access in the vicinity of the Project.	
	Describe traffic calming or other management tools during construction that could be used to modify travel behaviour on the Project and local roads.	Section 8.7
	Describe the proposed approach to managing transport network conditions during the Project's construction such as any staging proposed to maintain transport system function and the proposed nature and duration of diversions including for pedestrian and cycle links.	Section 8.7
Performance objectives	Describe and evaluate the approach to monitoring and subsequent contingency measures to be implemented in the event of adverse residual effects requiring further management.	Section 9

2.4 Environmental management framework

An Environmental Management Framework (EMF) is required as part of the EES to provide a transparent framework with clear accountabilities for management and monitoring the environmental effects associated with the construction and operational phases of the Project.

In accordance with the Scoping Requirements, the EMF must describe proposed objectives, indicators and monitoring requirements for the following project aspects relevant to the Transport Impact Assessment:

- *transport management including managing temporary disruption and changed accessibility during construction;*
- *traffic during construction.*

2.5 Related assessments

As outlined in Table 2.2, the analysis documented in this Transport Impact Assessment informs a number of other technical assessments developed as part of the EES.

Table 2.2 - Related assessments

Assessment Report	Related to Transport Impact Assessment
Air Quality and Greenhouse Gas Impact Assessment	Forecast traffic volumes for the Project study area have been used in the air quality assessment
Noise and Vibration Impact Assessment	Forecast traffic volumes for the Project study area have been used in the noise assessment.
Planning and Land Use Impact Assessment	Local access changes to the local road network.
Social Impact Assessment	Impacts to communities considered with regard to congestion increases and reduction during various stages of the Project.

3 LEGISLATION, POLICIES AND GUIDELINES

This section assesses the Project against the State legislation, policies and guidelines relevant to the Transport Impact Assessment.

3.1 State Legislation

Key legislation forms the regulatory framework for the development, construction and management of Victoria's transport network. Table 3.1 summarises key State legislation and their relevance to the Project.

Table 3.1 - Summary of relevant State legislation

Document	Summary
Transport Integration Act 2010	The *Transport Integration Act 2010* establishes a legislated policy framework for the provision of an integrated and sustainable transport system in Victoria that contributes to an inclusive and environmentally responsible State. The Act provides a framework for ensuring the various elements of the transport system are considered as a unified system and that land use planning and transport are integrated. The Act establishes the following six transport system objectives that contribute to meeting the above aspirations: — Social and economic inclusion — Economic prosperity — Environmental sustainability — Integration of transport and land use — Efficiency, coordination and reliability — Safety, health and wellbeing. The Act outlines a vision, key objectives and decision-making principles for transport planning and requires agencies to consider the potential impact of land use planning proposals on transport infrastructure. ***Relevance to the Project*** The Project integrates road, public and active transport provisions in responding to the growing transport demand of the area due to recent and ongoing land development. The Act provides the key principles which must be considered in order to achieve the State's aspirations for inclusivity and sustainability.
Road Management Act 2004	The *Road Management Act 2004* sets out the laws relating to working on roads within Victoria and specifies the relevant road manager for arterial and local roads within Victoria. Amongst a number of functions, the Act: — establishes a new statutory framework for the management of the road network which facilitates the coordination of the various uses of road reserves for roadways, pathways, infrastructure and similar purposes; — sets out certain rights and duties of road users; — establishes the general principles which apply to road management; — provides for the role, functions and powers of a road authority; — provides for the development of Codes of Practice to provide practical guidance in relation to road management; — provides for the construction, inspection, maintenance and repair of public roads; — sets out the road management functions and powers of road authorities. ***Relevance to the Project*** Provides the statutory framework for VicRoads and local councils to manage the road network including Yan Yean Road and surrounding local roads. Codes of practice are set out under the Road Management act to provide guidance for road authorities, works and infrastructure managers and various procedures will be implemented during the Project's construction and operation to ensure the requirements of road authorities are met.
Environment Effects Act 1978	The *Environment Effects Act 1978* provides a framework for the assessment of the potential environmental impacts of a proposed development to allow statutory decision-makers to determine whether a project with potentially significant environmental effects

Document	Summary
	should proceed. If the Minister for Planning decides that an Environment Effects Statement (EES) is required under the Act, the Project proponent is responsible for undertaking the necessary investigations and preparing the EES. Once the EES is completed and released for public comment, the Minister provides an assessment to relevant decision-makers. The Act also provides for opportunities for community involvement at various stages in the process. ***Relevance to the Project*** The Minister for Planning has determined that an assessment through an Environment Effects Statement under the Act is required for the Project.
Planning and Environment Act 1987	The *Planning and Environment Act 1987* establishes a framework for planning the use, development and protection of land in Victoria. The main functions of the Act are to: — set the broad objectives for planning in Victoria. — set the main rules and principles for how the Victorian planning system works. — set up the key planning procedures and legal instruments in the Victorian planning system. — define the roles and responsibilities of the Minister, councils, government departments, the community and other stakeholders. The Act is described as an 'enabling' legislation in that it is not intended to precisely define the scope of planning, how it should be done or detail rules that should apply. Rather these matters are captured within 'subordinate' instruments which receive their legal relevance under the Act such as the Victorian Planning Provisions, Planning Schemes, Regulations and Ministerial directions. ***Relevance to the Project*** The Project affects land within both the Whittlesea and Nillumbik municipalities and an amendment will be required to the planning schemes of these municipalities under the Act.

3.2 State Policy

State Government policy provides the strategic direction to be applied by decision-makers in the development, construction and ongoing management of Victoria's transport network. Table 3.2 summarises key State policy documents and their relevance to the Project.

Table 3.2 - Summary of relevant State policy

Document	Summary
Towards Zero 2016 - 2020	Through the Towards Zero 2016-2020 Road Safety Strategy and Action Plan, the State Government has set out a clear vision and strategy for improving the safety of Victorian roads. The immediate target of the Towards Zero initiative is to reduce lives lost on our roads to 200 people or fewer while also reducing serious injuries by 15 percent. Towards Zero has been supported with more than $1 billion in funding over five years which will be focussed on infrastructure improvements, engagement with the community, investment in police resources and improving vehicle safety. The Safe System philosophy is fundamental to Victoria's strategic approach to road safety and is arranged under the four core safety pillars of safer roads, safer speeds, safer vehicles and safer road users. The Safe System is based on the principle that road users will make mistakes but that no one should be killed or seriously injured when a crash occurs and used to guide road design and safety improvement initiatives. ***Relevance to the Project*** The Project has been designed using Safe System principles. The Project also incorporates a new shared use path to provide separation between cyclists and pedestrians and general traffic.

Document	Summary
Plan Melbourne 2017 - 2050	Plan Melbourne 2017-2050 sets out the Victorian Government's vision and planning strategy for Melbourne's growth to a city of 8 million people over the next 35 years. Plan Melbourne sets out a strategy for supporting jobs and growth by integrating long term land use, infrastructure and transport planning. The Plan is structured around 9 guiding principles, 7 outcomes to strive for and 32 directions for how the outcomes will be achieved, culminating in 90 policies to describe how the directions will be turned into actions. ***Relevance to the Project*** Outcome 3 sets out that following implementation of Plan Melbourne *'Melbourne has an integrated transport system that connects people to jobs and services and good to market'* which incorporates the following policies relevant to the Project: - *Improve arterial road connections across Melbourne for all road users (Policy 3.1.2)* - *Improve roads in growth areas and outer suburbs (Policy 3.2.1).* The Project provides improved connectivity for cyclists and pedestrians with a new shared use path in addition to the capacity improvement it provides for road traffic. The Project directly serves the rapidly expanding suburbs of Doreen, Plenty and Yarrambat areas as well as the wider City of Whittlesea which is one of the fastest growing municipalities in Melbourne. The Project route between Plenty River and Bridge Inn Road forms part of the Urban Growth Boundary, while the section south of Plenty River sits just outside (and to the east) of the Urban Growth Boundary. Plan Melbourne reaffirms that State's commitment to a permanent growth boundary to reduce urban sprawl and encourage increased metropolitan housing densities in planned areas (Policy 2.1.1). Plan Melbourne's 'Melbourne 2050 Plan' identifies a Metropolitan Activity Centre at Epping, potential future transport infrastructure projects in the Outer Metropolitan Ring Road/E6 and North East Link and the La Trobe National Employment and Innovation Cluster to the south of the Project.
Victorian Infrastructure Plan	The Victorian Infrastructure Plan was released in 2017 and outlines the State Government's intentions and long-term priorities across the nine sectors of Transport; Culture, Sport and Community; Digital Connectivity; Education and Training; Energy; Environment; Health and Human Services; Justice and Emergency Services; and Water. Regarding the Transport sector, the following four priorities are defined: 1. Making the most of existing assets – through upgrading existing network assets and improving maintenance. 2. Building for the future – through constructing new transport infrastructure to cater for growing needs. 3. Connecting regional Victoria – through new and upgraded transport infrastructure. 4. Developing smarter transport solutions – including intelligent transport systems and data gathering. The Victorian Infrastructure Plan was developed in response to Infrastructure Victoria's 30-year Infrastructure Strategy and outlines the State Government's funding commitments over the next 5 years in support of the four priority areas as well as its position on a series of longer term directions put forward by Infrastructure Victoria. ***Relevance to the Project*** The Plan outlines the State Government's funding commitment for completion of Stage 1 and 2 of the Yan Yean Road Upgrade as part of a suite of projects under Priority 1. More broadly, the Plan conveys the Government's in-principle support for longer term investment in improving walking and cycling links and upgrades to the arterial road network of the outer suburbs.

Document	Summary
Victorian Cycling Strategy 2018-2028	The Victorian Cycling Strategy 2018-2028 was developed by the State Government to provide a framework for increasing the number, frequency and diversity of Victorians cycling for transport. The Strategy includes a series of initiatives and strategic directions aimed at achieving the following two overarching goals: 1. *Invest in a safer, lower-stress, better-connected network* – through initiatives such as applying the Safe Systems approach to design, prioritising lower stress, separated facilities and incorporating new cycling infrastructure in major transport projects. 2. *Make cycling a more inclusive experience* – through education to improve awareness of cycling, implementing support programs to increase cycling amongst under-represented groups and supporting cycling in schools. The Strategy was developed by the then Department of Economic Development, Jobs, Transport and Resources (DEDJTR) in consultation with local councils, state government agencies, cyclists and the wider community as well as drawing on relevant research from around the world. ***Relevance to the Project*** The Yan Yean Road upgrade provides improved connectivity for cyclists and pedestrians with a new shared use path along the western side of the Project. The path will be separated from road traffic providing a lower stress cycling environment where there is currently a lack of formalised cycling facilities. The shared use path will provide connectivity with the Principal Bicycle Network (PBN) routes on Yan Yean Road, north of Jorgensen Avenue and along Bridge Inn Road.
North Growth Corridor Plan	Growth Corridor Plans were developed by the then Growth Areas Authority in 2012 to provide an integrated land use and transport strategy for the development of four of Melbourne's growth corridors over the coming decades. The Growth Corridor Plans are now managed by the Victorian Planning Authority (VPA) and provide an overarching framework for future development, providing for housing, jobs, transport, town centres, open space and key infrastructure across some of Melbourne's fastest growing suburbs. The Plans have been developed for the North, West, Sunbury and South East Growth Corridors and identify broad transport networks, industrial and employment zones, residential areas and recreation precincts for each corridor. The North Corridor Plan covers the area bounded by the Metropolitan Ring Road and the Urban Growth Boundary and is aimed at providing *'a diversity of housing, employment and lifestyle opportunities, supported by a high quality transport network that focuses on Broadmeadows, Epping and Donnybrook'.* The North Corridor is expected to accommodate a population of 260,000 people or more and capacity to provide for 83,000 jobs with the Broadmeadows Central Activity Centre, the Outer Metropolitan Ring Road and Beveridge Intermodal Freight Terminal (BIFT) identified as key features. ***Relevance to the Project*** The North Corridor Plan identifies Yan Yean Road as an arterial road. Key features of the Plan in the area surrounding the Project include the proposed future Principal Public Transport Network routes on Kurrak Road and the southern end of Yan Yean Road and Major Town Centres located at Mernda and South Morang.

3.3 Local Policy

A number of strategies and plans relevant to the local transport network have been developed by City of Whittlesea to guide upgrades and expansion of the transport network to meet the growing needs of the area. Table 3.3 summarises key local policy documents and their relevance to the Project.

Table 3.3 - Summary of relevant local policy

Document	Summary
City of Whittlesea Road and Public Transport Plan	The City of Whittlesea developed a Road and Public Transport Plan in 2017 aimed at guiding Council's approach to advocacy for future investment in roads and public transport. The Plan provides an outline of key issues, actions and potential solutions to address the transport issues experienced in the municipality now and into the future. Yan Yean Road is described in the Plan as one of three north-south corridors (along with Plenty Valley Corridor and Epping Road-High Street corridor) for which capacity currently falls short of accommodating Whittlesea's existing traffic demands during peak travel periods. Transport modelling provided in the Plan identified that projected population growth and changes to land use would result in significantly more traffic congestion on these routes. ***Relevance to the Project*** The duplication of Yan Yean Road between Kurrak Road and Bridge Inn Road (and urbanisation to Arthurs Creek Road) is described in the Plan as a 'very high' priority for Council, providing Doreen and Mernda residents with improved access to employment and transport opportunities at Greensborough and Eltham. Upgrading the intersection of Yan Yean Road and Bridge Inn Road is also separately identified as a 'very high' priority to ease traffic congestion and provide for pedestrian crossing opportunities. The Project will deliver duplication between Kurrak Road and Bridge Inn Road and the upgrade of the Yan Yean Road/Bridge Inn Road intersection, supporting two of City of Whittlesea's highest road network priorities.
City of Whittlesea Integrated Transport Strategy	The City of Whittlesea developed an Integrated Transport Strategy in 2014 to provide a set of principles, action areas and priority actions required to meet the transport challenges of the growing municipality over the coming 20 years. While the focus of the Strategy was longer term, the associated action plan was aimed at providing a suite of actions for Council, the State Government and other agencies to take over the 5 years to 2019 to position the municipality to meet the needs of its residents and businesses. ***Relevance to the Project*** Though the Project isn't mentioned specifically, the delivery of walking and cycling facilities via the proposed shared use path and crossing facilities and upgraded road link aligns with Council's following key action areas: - *Walking needs to be incorporated into all capital works projects, redevelopment of existing areas and in the planning of new growth areas (Action Area W3)* - *Bicycle needs will be incorporated into all transport network development and land use planning (Area C2)* - *Essential road links will be progressed by Council, State Government and developers (Area RF 1).*
Mernda Strategy Plan	The Mernda Strategy Plan builds upon the previous Plenty Valley Strategic Plan and conveys the overall vision for the development of new communities in Melbourne's outer north, aimed at meeting future housing needs, economic development, environmental preservation and social progress. Released in 2008, The Mernda Strategy Plan forms the primary policy document to guide the preparation of development plans and subdivision plans within the Mernda growth area. The Plan covers Mernda and Doreen, taking in the

Document	Summary
	growing suburbs on either side of Bridge Inn Road between Yan Yean Road and just west of Plenty Road. As outlined in the Plan, the Mernda Town Centre located near the intersection of Bridge Inn Road and Plenty Road will include a range of local business and employment opportunities and the recently opened Mernda Railway Station. Bridge Inn Road between Yan Yean Road and Plenty Road will form the key east-west transport route for those commuting from east of Plenty Road to Mernda Town Centre. ***Relevance to the Project*** As one of two north-south corridors servicing the area covered by the Plan the development of the area is expected to increase traffic demands on Yan Yean Road. The Mernda Strategy Plan outlined the following upgrade needs for Yan Yean Road which the Project will deliver: - *On Plenty Road, Bridge Inn Road, the E6 and Yan Yean Road, a dedicated off-pavement cycle lane should be provided (Section 3.2.4)* - *'Widen roadway to provide auxiliary turning and passing lanes' (Table 3.2)*

4 METHODOLOGY

4.1 Overview

Figure 4.1 summarises the process adopted to assess the potential transport impacts associated with the Project.

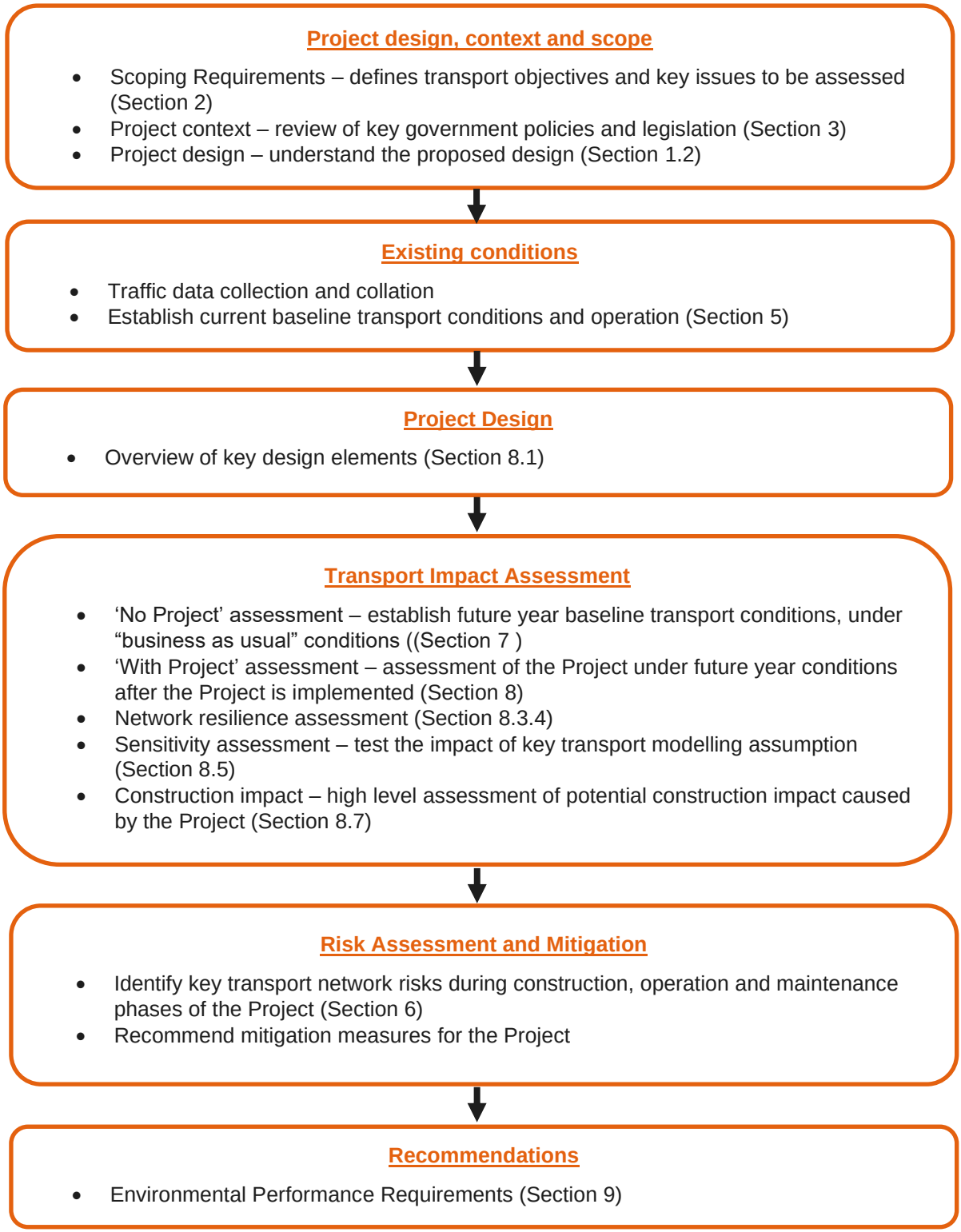


Figure 4.1 - Transport impact assessment process

4.2 Study Area

The general study area for this assessment in shown in Figure 4.2. The extents of the study area have been informed by strategic transport modelling on the extent of transport network impacts due to the Project.

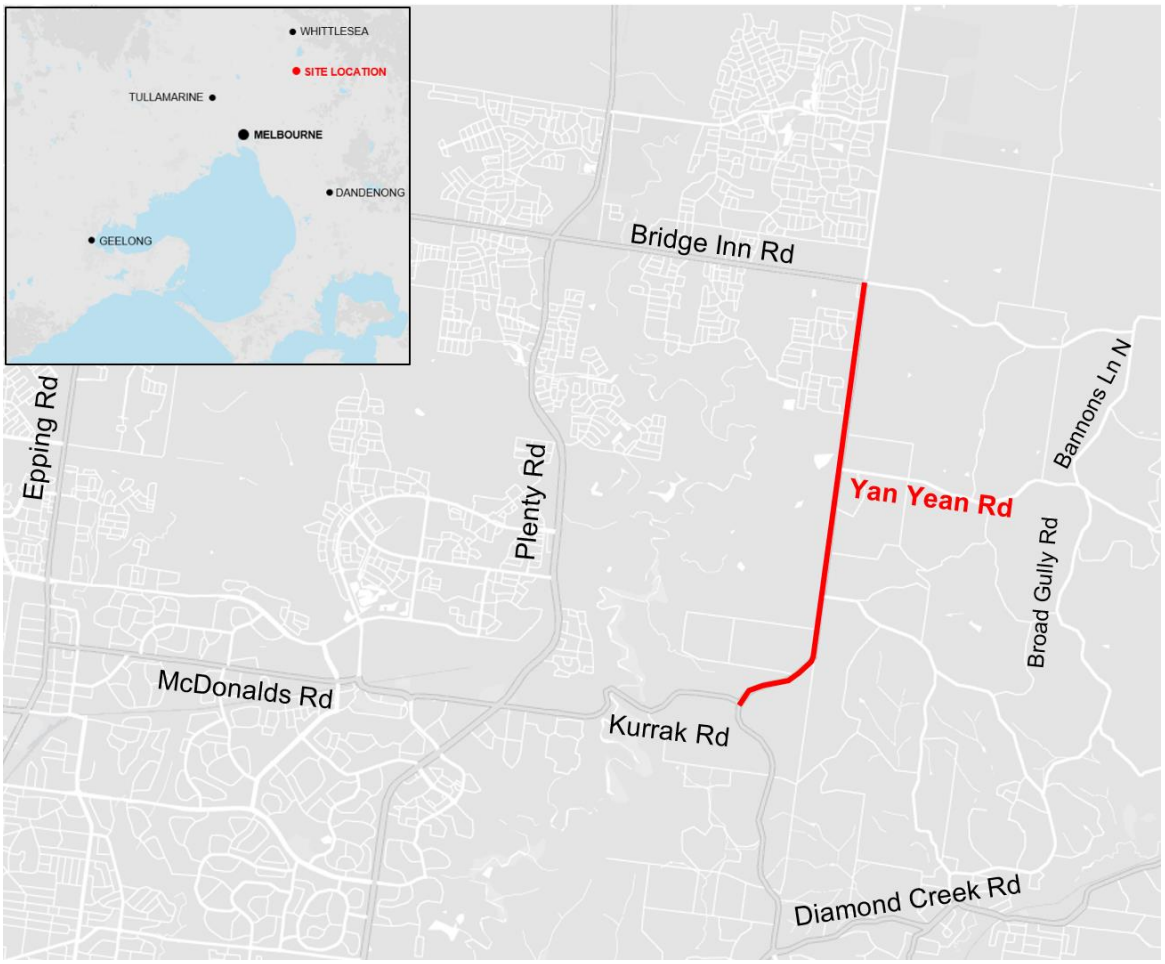


Figure 4.2 - Study area

4.3 Technical Investigations

The Transport Impact Assessment focuses on two key future year scenarios, namely:

- 2031 'no Project' case, or "business as usual"
- 2031 'with Project' case

The 2031 'no Project' case sets a baseline of expected traffic conditions, from which the 'with Project' case can be assessed and compared against.

To undertake this primary *impact assessment* task, several technical investigations were required (Figure 4.3), including:

- Existing conditions assessment
- Strategic traffic forecasting
- Peer Review
- Traffic operations modelling
- Sensitivity assessments

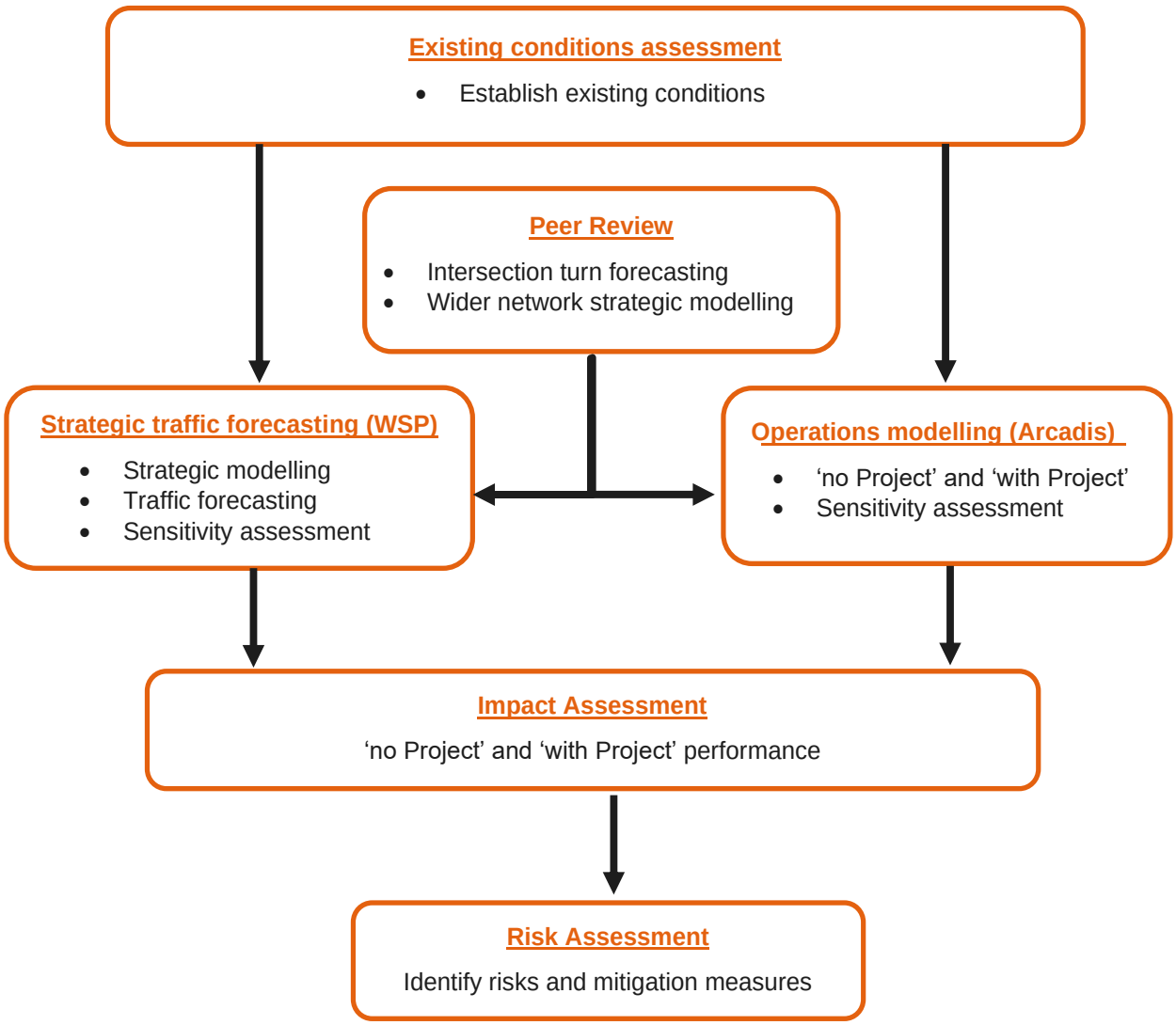


Figure 4.3 - Technical investigations

4.4 Existing conditions assessment

Understanding the existing transport conditions and operation through the study area is key to establishing a baseline from which the Project performance can be assessed.

Available traffic data was sourced from VicRoads and local Councils, and supplemented with additional data collection undertaken in 2017, including:

- Midblock traffic volumes (Automatic Tube Counts)
- Intersection turning movement counts (video, manual)
- Travel time surveys (floating car)
- Crash statistics (VicRoads database)

Existing traffic data is also important in the validation and interpretation of the strategic modelling outputs.

Table 4.1 - Traffic data (Yan Yean Road, Stage 2)

Data type	Days / Period	Location(s)
Automatic Tube Counts (ATC)	28th April to 4th May 2017	Yan Yean Rd, various midblock locations
		Plenty Rd, various midblock locations
	16th to 22nd October 2017	Bridge Inn Rd, various midblock locations
	9th to 15th October 2017	Epping Rd, various midblock locations
	19th to 25th June 2019	At the following midblock locations; - Hurstbridge-Arthurs Creek Rd - Doctors Gully Rd - Bannons Ln - Ironbark Rd - Broad Gully Rd - Bannons Ln N - Elation Blvd - Fitzwilliam Dr - Williamsbrook Ave - Garden Rd
Journey time surveys	16th to 18th May 2017	Yan Yean Rd between Bridge Inn Rd and Kurrak Rd
		Plenty Rd between Bridge Inn Rd and Gorge Rd
	1st to 2nd November 2017	Bridge Inn Road between Plenty Rd and Yan Yean Rd
		Epping Rd between Craigieburn Rd E and Findon Rd
Turning movement counts* (TMC)	16th to 18th May 2017	18 sites along Yan Yean Rd (Stage 2) including the key intersections: - Bridge Inn Road - Orchard Road - Jorgensen Avenue - Ironbark Road
Crash data	2004 to 2018	Between Bridge Inn Road and Kurrak Road

* Additional turning movement count undertaken for Plenty Valley Christian College (June 2019) to consider 2018 opening of "Plenty Kids Early Learning Centre" on the site.

Traffic volume estimates for freeways and arterial roads are made publicly available by VicRoads via the Victorian Government's open source data portal. It is noted that the AADT information presented for Yan Yean Road (at 19 June 2019) was inaccurate and not considered as part of this study (after confirmation by VicRoads at the time).

4.5 Strategic traffic forecasting

4.5.1 Overview

Strategic traffic forecasting has been undertaken by WSP to assess the scale of local and network-wide impacts of the Project. The Victorian Integrated Transport Model (VITM) has been used to inform the strategic traffic forecasting process.

The VITM is the State's primary strategic transport demand forecasting tool and is owned and maintained by the Department of Transport (DOT). As a multi-modal, 'four-step' model covering the whole of metropolitan Melbourne, the VITM provides a platform for assessing the impacts of transport projects on travel patterns and resulting demand for road and public transport both locally and across the broader network. The VITM provides the ability to assess the impact of transport projects to future

forecasting horizons based on underlying projections for how land use, demographics and transport network will change over time across Melbourne. In this way the VITM aligns with the strategic planning vision of the Victorian State Government and accounts for the cumulative impact of the Yan Yean Road duplication and other projects in the area.

The geographic area covered by VITM is shown in Figure 4.4. The time periods modelled in VITM include Weekday AM peak, Inter-peak, PM peak, Off-peak and Daily. VITM has been developed to replicate traffic volumes and travel times at the regional level based on underlying travel behaviour data from the Victorian Integrated Survey of Travel and Activity (VISTA). The VITM has been through a validation process and provided for use by DOT.

Key aspects of the strategic traffic forecasting work undertaken are summarised in the following sections with full details provided in the WSP report "*Yan Yean Road Upgrade Stage 2 – Traffic Forecasting Report"* provided in Appendix B.

Figure 4.4 - VITM metropolitan geographic coverage

4.5.2 Scenarios modelled

The following transport network scenarios have been modelled in VITM to characterise future conditions without the Project and following implementation of the Project:

- 2016 base year
- 2031 'no Project'
- 2031 'with Project'.

The following scenarios have been modelled to provide an understanding of the Project's contribution to local network resilience and redundancy:

- 2031 AM peak, 'no Project', with lane closures on Yan Yean Road in the southbound direction

- 2031 AM peak, 'with Project', with lane closures on Yan Yean Road in the southbound direction
- 2031 AM peak 'no Project', with lane closures on Plenty Road in the southbound direction of travel
- 2031 AM peak 'with Project', with lane closures on Plenty Road in the southbound direction of travel

As discussed further in Section 4.7.2, sensitivity tests on VITM's land use inputs and traffic forecasts were also undertaken to provide an understanding of the sensitivity of modelled outcomes to changes in key variables.

4.5.3 Application of strategic modelling results

Strategic transport models such as VITM offer significant capabilities in assessing the impacts of transport infrastructure projects, providing the ability to assess impacts on mode and route choice and network performance, as well as capturing the effects of land use change and other planned projects in the surrounding area. As the DOT's main strategic transport demand forecasting tool, VITM is commonly used in assessing the impacts of Victorian transport projects. Like all strategic transport models, however, VITM is subject to certain limitations and uncertainties which should be considered in the analysis and application of strategic modelling results.

Strategic modelling outputs are used in this report to assess the impacts of the Project by comparing 'no Project' and 'with Project' conditions at two levels:

- The 'network' assessment - which examines forecast network conditions such as traffic volumes, speeds, travel times and in accessibility across the wider network study area expected to be impacted by the Project; and
- The 'corridor' assessment -which looks at more detailed traffic operations impacts along the Project corridor itself including the performance of intersections along the route under forecast demands.

One limitation of strategic models is that, in capturing the changes in travel demands across a large study area, they are accordingly calibrate and validated to a regional level rather than to the smaller scale individual intersection and level. They are also focused on higher order collector and arterial roads, rather than modelling local roads and on the impacts of travel demand changes rather than detailed operational analysis which is generally undertaken at a much smaller scale.

Recognising VITM's strong capabilities in testing the effects of different transport network scenarios across future forecasts horizons at the regional level and in consideration of its accuracy at the discrete level, the network assessment has been carried out by utilising forecasting outputs that provide a comparative assessment of one scenario relative to another (e.g. future conditions 'with Project' compared to 'no Project'). In this way VITM has been used provide an understanding of the forecast relative change in transport network conditions as a result of the Project as opposed to relying on it to provide highly accurate absolute values for wider network assessment purposes. Outputs such traffic volume difference plots, speed difference plots, travel time differences along routes and overall network statistics such as average travel speeds have been used to characterise the network wide impacts of the Project as required by the Scoping Requirements.

In order to account for limitations in VITM's abilities to produce forecasts to the smaller intersection and local road level as needed for the corridor assessment, a further detailed assessment of forecast intersection turn volumes was made to produce a set of 'design volumes' for key intersections along the Project route. The adjustment process, which is discussed further in section 4.5.7, applies a pivoting procedure to VITM's forecast peak period turning movements to adjust for how closely VITM predicts base observed turning movements; incorporate local roads not included in the strategic model and take account of midblock capacity constraints and flow balancing between intersections. The refined intersection turning volumes were then used in operational analyses of the Project corridor using the software package SIDRA Intersection under both the 'no Project' and 'with Project' scenarios to provide detailed intersection performance outputs not available in the strategic model.

VITM's forecasts are based on a series of underlying assumptions regarding how land use and the transport network will change into the future. As with any traffic forecast, inevitably some assumptions

used to develop the forecasts will not be realised and unanticipated events and circumstances may occur which could change the actual traffic outcomes. To understand the influence of these inherent uncertainties, sensitivity tests have also been undertaken to understand how sensitive the findings are to changes in key assumptions. Both a 'lower land use change scenario' (i.e. slower rate of population and employment growth) and a 'higher land use scenario' (i.e. higher rate of population and employment growth) have been carried out to assess the anticipated level of sensitivity of traffic changes at both the network and corridor level to this key input. This process is discussed further in section 4.7.2.

A key outcome of the intersection analyses undertaken in the corridor assessment is the intersection configuration required to achieve acceptable intersection performance levels. That is, the number of lanes needed at intersections which influences the geometric footprint of the design. To understand how uncertainty and variation in traffic demands could impact intersection footprints, a series of 'stress tests' were undertaken whereby forecast traffic volumes were scaled upwards and downwards respectively to assess traffic increase that could necessitate an additional turning lane, and conversely the reduction in traffic that would allow a reduction in lanes to satisfactory intersection performance. It is noted that opportunities to decrease the intersection footprints, however, are limited, with the majority of intersections providing the minimum lane configuration of two through lanes with single left and right turning lanes. The intersection 'stress testing' carried out is discussed further in section 4.7.2.

4.5.4 Capturing cumulative effects

VITM incorporates road (light and heavy vehicle traffic) and public transport (rail, bus and tram) networks across Melbourne, giving it the capability to capture forecast changes in travel demand and operating conditions across these modes. As a network-wide model that includes base assumptions for how the road and public transport network will change into the future, VITM captures the cumulative travel demand effects of proposed nearby projects on the Yan Yean Road upgrade corridor and the impacts of the Yan Yean Road upgrade on nearby projects.

This feature of the modelling approach is particularly relevant for the northern suburbs of Melbourne given the range of transport network projects which are currently planned for completion over the coming years, including the Northern Suburban Roads upgrade, Plenty Road Stage 2 Upgrade and the North East Link. Further information on the assumptions regarding changes to the surrounding transport network captured in VITM are discussed in Section 7.2.

4.5.5 Induced demand

Induced demand is the additional demand for travel that is generated by improvements to infrastructure or policy changes. In the case of this project, the main induced demand consideration is the expected increase in traffic diverting from other routes as a result of the congestion relief and increased capacity of the road upgrade.

The strategic forecasting undertaken captures this impact through VITM's traffic assignment process which iteratively assigns traffic to the lowest travel cost route (considering travel time, distance, tolls etc) between their origin and destination zones. As shown in the traffic volume difference plots in Section 8.3.1, an increase in traffic on Yan Yean Road is expected with the Project in place, which is diverted from adjacent routes.

4.5.6 Base model performance

A series of model validation checks of VITM's performance in terms of traffic volumes and travel times are detailed in the strategic traffic forecasting report in Appendix B.

4.5.7 Peak hour Intersection turn forecasts

The following process was adopted to derive intersection turning forecasts that have been used in the Project corridor operational analysis.

1. Intersection turning movement count surveys were undertaken across multiple days during non-holiday periods to capture a representative average weekday AM and PM peak (two-hour) intersection turning count for key intersections along the Project corridor.
2. Modelled intersection turning movement volumes were extracted from the VITM model runs undertaken for the base year 2016 for key intersections along the Project corridor captured in VITM.
3. Forecast traffic volumes for the year 2031 'with Project' and 'no Project' scenarios were extracted from the VITM model for the same intersections.
4. Growth in the VITM intersection turning movement forecasts between 2016 and 2031 was applied to surveyed counts using the pivot method to arrive at a forecast average weekday AM and PM peak intersection turning forecast for 2031 'no Project' and 2031 'with Project' at key intersections captured in the VITM.
5. Two-hour peak period forecasts were converted to one-hour peak hour forecasts for analysis purposes based on observed data
6. Intersection turning movement forecasts were reviewed and manually refined where necessary to produce a set of 'design volumes' suitable for detailed operational analysis. Where necessary, typical refinements at this stage included:
    a. Addition of turn forecasts for intersections and intersection approaches not included in the VITM model network based on surveyed counts and forecast land use change
    b. Review of growth forecasts on side roads for consistency with expected scale of land development change including population and employment increase. Due to the limitations discussed above in VITM's coverage of smaller areas, in a small number of locations, turns from minor side roads were adjusted to better reflect expected growth.
    c. Minor adjustments at selected locations to balance approach and departure flows between adjacent intersections
    d. Redistribution of turns being altered by the proposed road design, for example, the redistribution of a right turning traffic being banned due to median works, to the nearest alternate route.

4.5.8 Sensitivity testing

In order to test the impact of varying the assumptions underlying the traffic forecasting, sensitivity testing for the forecast year 2031 'with Project' based on alternate transport network assumptions (i.e. network upgrade projects and the year in which they are expected to be completed) and land use projections (i.e. the rate of development) were considered. Given most of the transport projects near

the Project corridor (such the Northern Suburban Roads Upgrade, Plenty Road upgrade and North East Link) are committed and expected to be open by 2031, the sensitivity tests developed focussed on the land use projections. The following sensitivity tests were carried out:

- A 'low land use' scenario in which the rate of land development was assumed to be less than that currently projected. Population and employment projections for 2021 were applied in the 2031 'with Project' model.
- A 'high land use' scenario in which the rate of land development was assumed to be faster than that currently projected. Population and employment projections for 2036 were applied in the 2031 'with Project' model.

The impact of the scale of change in traffic forecast under these land use scenarios on intersection performance along with a number of other scenarios was also tested for the Project corridor.

4.6 Peer Review

A Peer Review of the strategic traffic forecasting applied in this TIA was carried out by Dr Craig McPherson of Transport Analytics Pty Ltd. The Peer Review was carried out in two stages:

1. Review of intersection turn forecasting methodology used in traffic analysis to inform the design of intersection configurations for the Project.
2. Review of strategic traffic forecasting of network wide impacts of the Project in response to the EES scoping requirements.

A summary of the peer review including the process, findings and endorsement of the Peer Reviewer is provided in Appendix C.

4.7 Traffic operations modelling

Traffic operations along Yan Yean Road corridor were modelled using the software package SIDRA INTERSECTION 8.0 (Network), a micro-analytical traffic evaluation tool endorsed by Austroads and commonly used in Australia and around the world.

In particular, SIDRA was used to assess the intersection performance of the following future year scenarios:

- 2031 No Project, which represents "business as usual", to establish a basis from which to assess the Project performance
- 2031 With Project

The assessment was based on the AM and PM commuter peak hour performance, using the traffic forecasts derived from the strategic modelling and traffic forecasting processes.

Traffic performance metrics considered for this corridor assessment includes:

- Operating speed statistics, based on SIDRA route and network output
- Intersection performance, based on degree of saturation, level of service and turn lane queueing (95th percentile)

4.7.1 Intersection performance

The intersection performance targets adopted for the Project includes:

- A degree of saturation (DoS) of 0.9 or lower
- An overall intersection level of service (LoS) D or better
- 95th percentile queue lengths that are generally contained within the proposed turn lanes.

Degree of Saturation (DoS) is the demand to capacity ratio for each traffic movement, with the overall intersection DoS defined as the highest DoS of all individual movements calculated at the intersection. DoS ratings are defined in Table 4.2 below**.**

Level of Service (LoS) was based on the average vehicle time delay and its corresponding level of service (LOS) as shown in Table 4.3.

95th Percentile Queue is the length (in metres) below which 95 percent of all observed cycle queues lengths fall. In other words, this queue length is expected to be exceeded only for 5 percent of observed queues. The 95th percentile queue is often interpreted as a *design queue* and is used to determine the desirable turn lane and storage lengths.

Table 4.2 - Degree of Saturation ratings (SIDRA)

Degree of Saturation (DoS)	Rating
DoS < 0.6	Excellent
0.6 < DoS < 0.7	Very good
0.7 < DoS < 0.8	Good
0.8 < DoS < 0.9	Acceptable
0.9 < DoS < 1.0	Poor
DoS > 1.0	Very poor

Table 4.3 - LOS Criteria for Intersection Capacity Analysis

Level of Service	Average Delay (d) per Vehicle (sec/veh)		
	Give Way/Priority	Traffic Signals	Roundabouts
A	d ≤ 10	d ≤10	d ≤ 10
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 < d ≤ 55	35 < d ≤ 50
E	35 < d ≤ 50	55 < d ≤ 80	50 < d ≤ 70
F	50 < d	80 < d	70 < d

Source: Austroads (2017)

4.7.2 Sensitivity testing

Two sensitivity assessments were undertaken, namely:

1. A low and high land use demand scenario, based on the strategic modelling (Section 4.5.8)
2. An intersection “stress test”, to understand the relationship between growth rate and intersection footprint.

Low and high land use demand scenarios were based on the strategic modelling demand sensitivities as detailed in Section 8.5. Based on the findings, a range of +/- 10 percent around the base traffic forecasts.

The intersection “stress test” was undertaken to assess the growth rate range which would result in an increase or decrease in intersection footprint.

4.8 Risk and impact assessment

An environmental risk assessment (ERA) has been completed to identify environmental impacts associated with construction and operation of the Project. The risk-based approach, shown in Figure 4.5, is integral to the EES as required by Sections 3.1 and 4 of the Scoping Requirements and the *Ministerial guidelines for assessment of the environmental effects under the Environment Effects Act 1978*. The summary of the transport risk register is provided in section 6 with the full risk register provided in Appendix D.

Primary environmental impact pathways were identified for transport and initial risk ratings were assessed by considering likelihood and consequence categories (Table 4.5, Table 4.6 and Table 4.7) and applying the risk significance matrix (Table 4.4). The initial risk ratings were assessed assuming the implementation of standard controls. Standard controls include compliance with legislative requirements and best practice requirements typically incorporated into the construction contracts for the delivery of road projects. The standard controls do not include any project-specific controls or requirements.

Environmental Performance Requirements (EPRs) have been informed by the ERA, to set the minimum outcomes necessary to avoid, mitigate or manage environmental impacts and reduce environmental risks during delivery of the Project. The development of the proposed EPRs was an iterative process with input from the technical specialists and MRPV. Section 9 provides further detail of the specific EPR’s developed for transport.

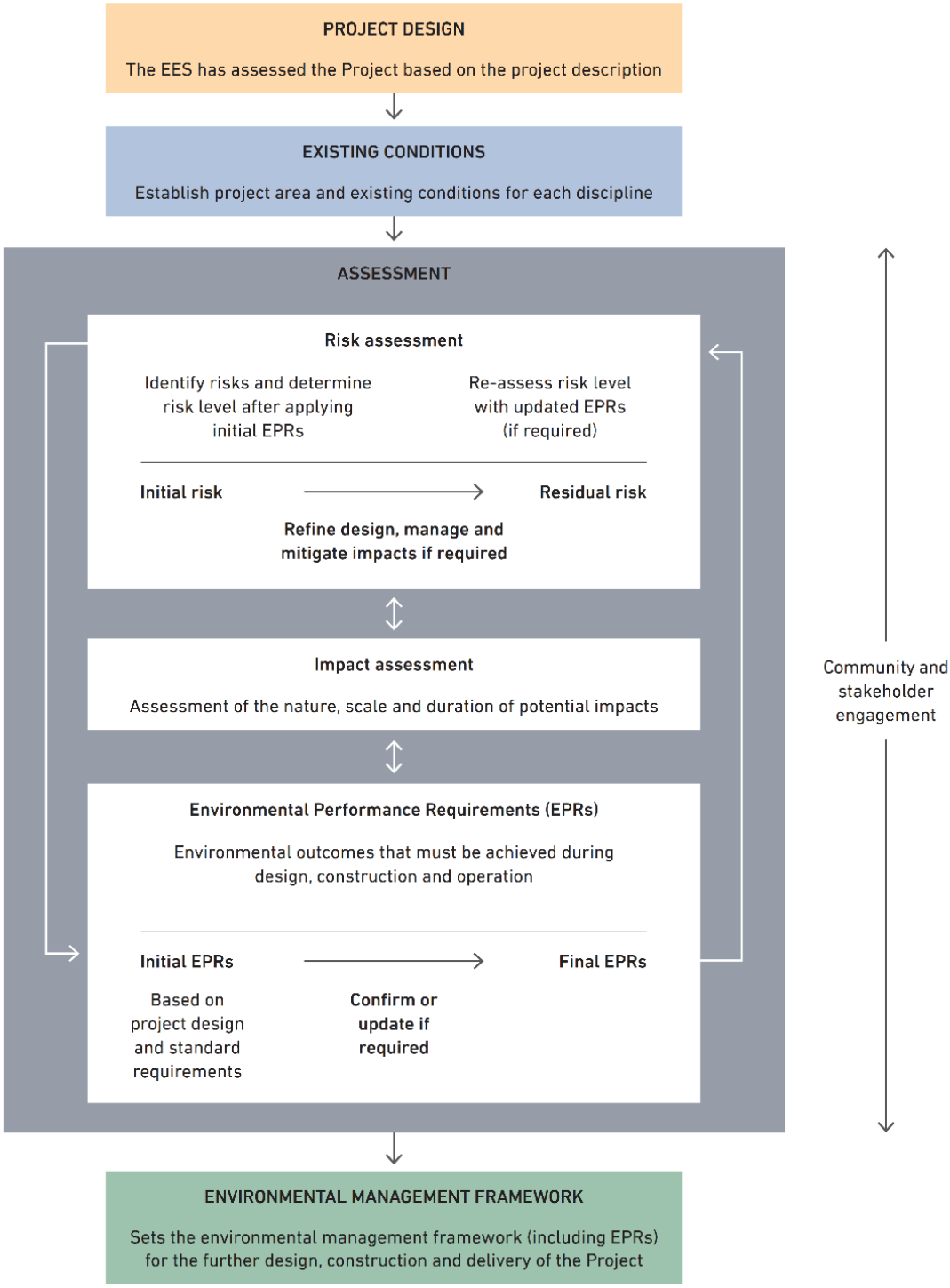


Figure 4.5 - Environmental risk process

4.8.1 Risk assessment process

The ERA has guided the environmental studies for the Project. The objectives of the ERA are to:

- identify primary environmental risks that relate to the construction and operation of the Project
- guide the level and extent of investigation and data gathering necessary for accurately characterising the existing environment and assessing the Project's environmental effects
- help identify performance requirements to avoid, minimise and mitigate environmental risks
- inform assessment of likely residual effects that are expected to be experienced after standard controls and proposed EPRs have been implemented.

The risk assessment process for the EES incorporates risk management requirements as detailed in MRPV's Environmental Risk Management Guideline. The process includes:

- an approach to environmental management which is aligned with *ISO 31000 Risk Management – Guidelines*
- systems used to manage environmental risk and protect the environment, and how these are implemented at different stages of road construction, operation and maintenance
- tools and reporting requirements which provide guidance in managing environmental issues throughout the Project.

The ERA identifies impact events for each relevant element of the environment, details the primary risks and has informed the level and range of technical reporting required to address predicted impacts. The ERA utilises a risk matrix approach where likelihood and consequence of an event occurring are considered (Table 4.4, Table 4.5, Table 4.6 and Table 4.7). Throughout the preparation of the EES, the likelihood and consequence categories were updated to ensure currency, as required.

Table 4.4 - Risk significance matrix

Likelihood	**Consequence level**				
	Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
Almost Certain	Medium	Significant	High	High	High
Likely	Medium	Medium	Significant	High	High
Possible	Low	Medium	Medium	Significant	High
Unlikely	Low	Low	Medium	Medium	Significant
Rare	Low	Low	Low	Medium	Medium

Likelihood and generic consequence criteria, informed by the MRPV corporate risk matrix, are shown in Table 4.5, Table 4.6 and Table 4.7.

Risk ratings were then reassessed following risk evaluation and risk treatment to generate a 'residual' risk rating. Both initial and residual risk ratings are documented in the risk register attached in Appendix D.

Table 4.5 - Likelihood categories

Likelihood	Description
Almost certain	76-99% Has occurred before and is expected to occur again Is expected to occur each year or more frequently All of the controls associated with the risk are extremely weak/non-existent. Without control improvement there is almost no doubt that the risk will eventuate
Likely	51-75% Has occurred before with a chance of it occurring again Has occurred several times at the Department, Group, Division, Program or Project before The majority of the controls associated with the risk are weak. Without control improvement it is more likely than not that the risk will eventuate
Possible	26-50% Has occurred before with a chance of occurring again Has occurred at the Department, Group, Division, Program or Project once before There are some controls that need improvement, however unless there is improvement the risk may eventuate
Unlikely	6-25% Has occurred elsewhere before, therefore a small chance of occurring The majority of controls are strong with no control gaps. The strength of this control environment means that is likely that the risk eventuating would be caused by external factors not known to the organisation
Rare	0-5% Has never occurred but may occur Is expected to occur 1/100 or more years All controls are strong with no control gaps. The strength of this control environment means that if this risk eventuated, it is most likely as a result of external circumstances outside of the control of the organisation

Table 4.6 - Generic consequence criteria

Consequence	Description
Critical	A critical degree of impact on an environmental asset, value or use of moderate or higher significance
Major	A high degree of impact on an environmental asset, value or use of moderate or higher significance
Moderate	A moderate degree of impact on an environmental asset, value or use of moderate or higher significance
Minor	A low degree of impact on an environmental asset, value or use
Insignificant	A very low degree of impact on an environmental asset, value or use

Table 4.7 - Transport consequence categories

RISK EVENT	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CRITICAL
Transport	Negligible adverse impact on traffic and transport conditions.	Detectable adverse changes in traffic and transport condition (decrease in Level of Service) at one or two locations at any one point in time.	Detectable adverse change in traffic and transport conditions (decrease in Level of Service) at multiple locations.	Traffic and transport congestion and delays exceed acceptable levels at multiple locations.	Traffic and transport congestion and delays severely restrict the efficiency of the transport network.

4.9 Environmental performance requirements

Following the evaluation of risk and through consultation with MRPV, Environmental Performance Requirements (EPRs) were developed to manage residual risks identified in the EES throughout the Project phases. The mitigation measures identified during the risk assessment process were used to inform the EPRs and also specify the means by which the EPRs are to be satisfied. The EPRs for transport are included in Section 9.

5 EXISTING CONDITIONS

5.1 Background

The *existing conditions assessment* describes the existing transport network's characteristics and performance, focusing on Yan Yean Road and the surrounding local area, and is summarised in the following sections:

- Study area – an overview of the regional and local study area, local demographics and other nearby road projects
- Road transport network– a description of the road network and environment
- Road transport operation and performance – a summary of existing traffic operations based on traffic data collected for the study
- Public Transport – a description of local public transport facilities and provision
- Active transport – a description of existing pedestrian and bicycle provision
- Existing and growing need for the Project – a comparison of existing traffic conditions through the Project corridor against other road duplication projects, demonstrating the relative need for an upgrade.

5.2 Study Area

5.2.1 Regional context

The Project is located approximately 25 kilometres north-east of Melbourne's CBD and forms the eastern boundary of the North Growth Corridor (Figure 5.1).

Regionally, Yan Yean Road supports Plenty Road and Epping Road, serving as part of the important north-south arterial road connections through to the City of Whittlesea, one of the fastest growing municipalities in Melbourne.

Yan Yean Road is a 12-kilometre section of declared main roadway, located along the eastern boundary of the North Growth Corridor, providing connectivity between the growing areas of Doreen and Mernda, the townships of Plenty and Yarrambat and the established areas of Diamond Creek and Greensborough. It also connects these areas with key east-west arterials of Bridge Inn Road, Kurrak Road and Diamond Creek Road, the Metropolitan Ring Road, Hume Freeway and future North East Link.

The next major north-south road is Plenty Road, located approximately 3.5 kilometres west of Yan Yean Road. Plenty Road is a primary arterial road, 27 kilometres in length, connecting the areas of Whittlesea in the north to Darebin and Banyule council areas to the south, with direct access to the Metropolitan Ring Road. Most of the road is divided carriageway with varying numbers of lanes, although it is an undivided carriageway to the north of Riverdale Boulevard.

Epping Road is located around 5.5 kilometres west of Plenty Road. It is predominately an undivided two-lane primary arterial (one lane per direction).

The wider north-south corridor (Yan Yean Rd, Plenty Rd and Epping Rd) is connected via the east-west oriented Bridge Inn Road to the north, and Kurrak Road - Gorge Road - McDonalds Road to the south.

Bridge Inn Road is an undivided two-lane carriageway, connecting Epping Road to the west to Yan Yean Road to the east. The road is classified as a secondary arterial between Yan Yean Road and Plenty Road, and as a (major) local road to the west of Plenty Road.

Kurrak Road - Gorge Road - McDonalds Road is an approximate 8.5 kilometres long east-west route, connecting Epping Road (High Street) and Yan Yean Road, and is generally an undivided two-lane road.

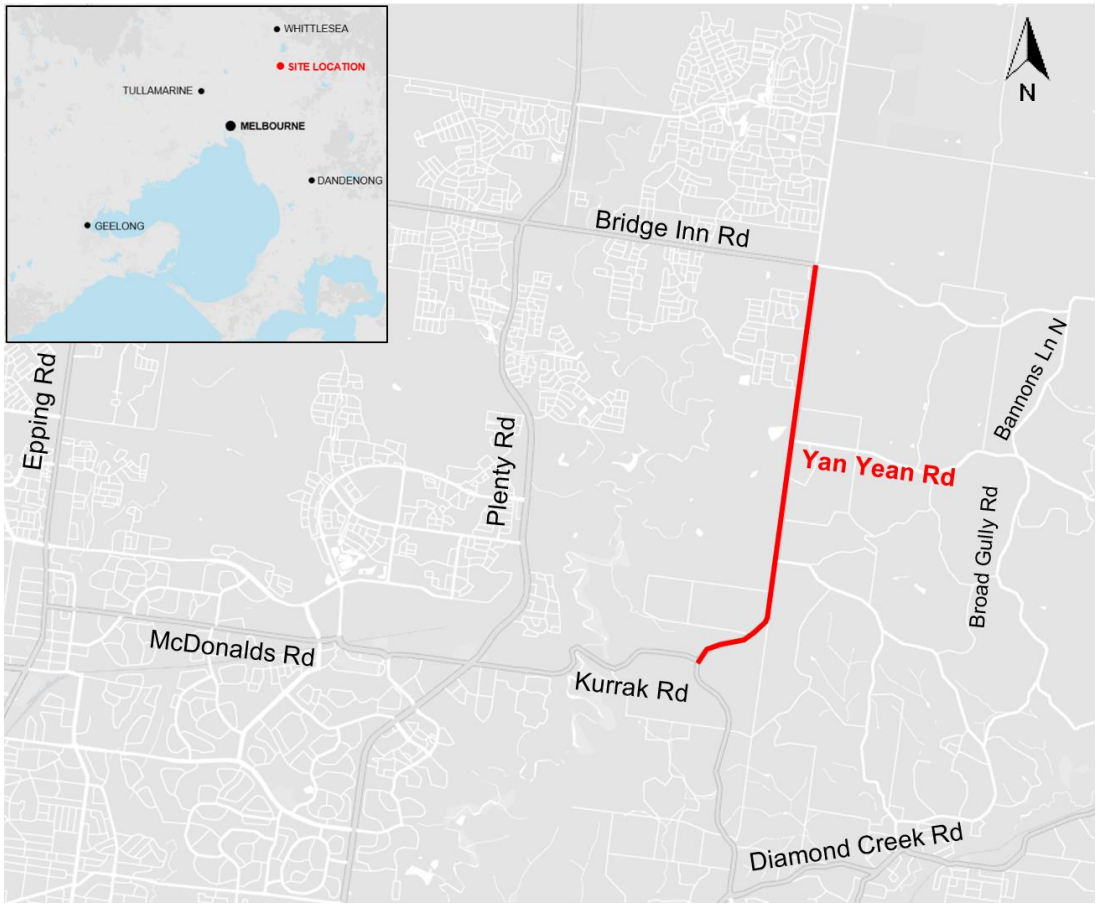


Figure 5.1 - Regional context

5.2.2 Project corridor

The 5.5-kilometre section of Yan Yean Road, from just north of Kurrak Road to Bridge Inn Road forms the Project corridor (Figure 5.2).

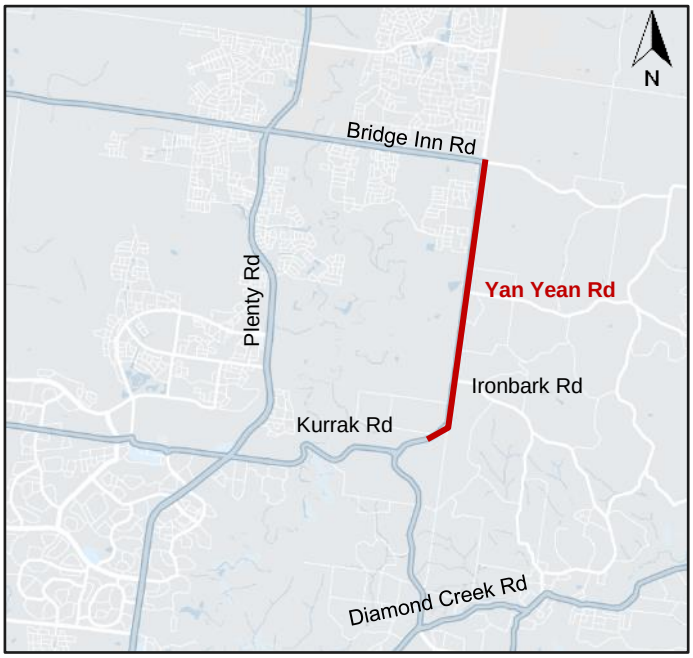


Figure 5.2 - Local study area

5.2.3 Land use

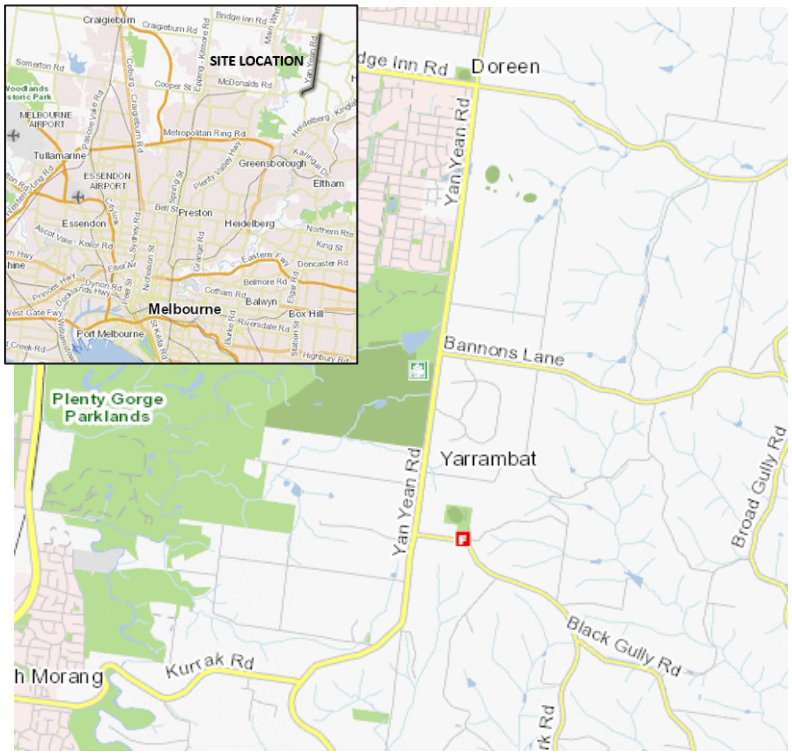
The Project is in a predominantly low density residential and rural living area within the metropolitan Green Wedge. The predominant land uses in the local study area include (Figure 5.3):

- A small number of commercial premises (mixed use zone), near Bridge Inn Road
- A general residential area, located to the south west of the Bridge Inn Road intersection (City of Whittlesea)
- Education facilities such as Plenty Valley Christian College, Yarrambat Primary School, a childcare centre and kindergarten
- Yarrambat Parklands and other recreational facilities, including a golf course, horse and pony club, pistol club, archery club and model aircraft club
- Low density residential areas
- Rural conservation zones

The northern and western end of the Project is within the Urban Growth Boundary (UGB) on the eastern boundary of the North Growth Corridor and Whittlesea Growth Corridor where land use is changing rapidly from rural living to residential (general residential area).

Residential land in the area south of Jorgensen Avenue are located within the Green Wedge, characterised by large blocks with built form setback from the road with large landscaped gardens and border trees, with the exception of 18 parcels between Bannons Lane and Laurie Street. Residential land in the area north of Jorgensen Avenue and to the west of Yan Yean Road are characterised by conventional residential blocks, and on the east side they are typified by very large rural allotments (low density residential and rural conservation zones).

Ironbark Road also provides access to several other community services to the east of Yan Yean Road, including Ironbark Christian School, the CFA fire station, a kindergarten, general store, post office, café and low-density residential properties.



Source: Department of Environment, Land, Water and Planning

Figure 5.3 - Surrounding land uses

5.2.4 Demographics

Table 5.1 summarises the 2016 population and employment demographics for the local suburbs nearest to the Project and the wider Local Government Areas of Whittlesea and Nillumbik.

Table 5.1 - Population and employment data (2016)

Area	Population[1]	Employment[2]
Local area		
Doreen	21,801	2,612
South Morang	25,233	3,530
Mernda	17,171	1,395
Plenty-Yarrambat	9,794	1,930
Combined	*73,999*	*9,467*
Wider area		
City of Whittlesea	207,058	53,144
Nillumbik Shire Council	64,174	13,315

Source: Australian Bureau of Statistic, Census 2016 (for Statistical Area Level 2 and Local Government Area)

[1] Based on Estimated Resident Population

[2] Based on Journey to Work totals by Place of Work

5.2.5 Other transport projects

There are several other transport network projects that have recently been completed or are planned to be completed in the coming years in the surrounding area, including:

- Yan Yean Road, Diamond Creek Road to Kurrak Road (Stage 1) – completed in 2019
- Hurstbridge Rail Upgrade
- Mernda Rail Line Extension (completed in 2018)
- M80 Upgrade
- Plenty Road Upgrade (Stage 1 completed in 2019)
- Northern Roads Upgrade
- North East Link

Yan Yean Road Upgrade, Stage 1

Stage 1 of the Yan Yean Road upgrade between Kurrak Road and Diamond Creek Road, immediately south of the Project.

The Stage 1 upgrade:

- Widened Yan Yean Road from one to two lanes in each direction
- Upgraded intersections at Diamond Creek Road, River Avenue, Memorial Lane. Browns Lane, Kurrak Road and Nillumbik Recycling and Recovery Centre
- Installed safety improvements including a centre safety barrier
- Provided new shared walking and cycling paths along the western side of the road.

The Stage 1 upgrade interfaces with the Project north of the Yan Yean Road/Kurrak Road intersection which has been converted from a roundabout to signalised intersection as part of Stage 1 works.

Hurstbridge Line Upgrade

The Hurstbridge Line Upgrade is duplicating sections of rail track and removing level crossings to allow more train services to operate on the line. The upgrade is being delivered by the Level Crossing Removal Project.

Stage 1 was completed in mid-2018 and included the following works:

- Duplication of a 1.2-kilometre section of track between Heidelberg and Rosanna
- Removal of level crossings at Grange Road in Alphington and Lower Plenty Road in Rosanna
- A new station at Rosanna
- New substation at Eaglemont
- Three substation upgrades at MacLeod, Fairfield and Preston

Planning for Stage 2 is currently underway with construction expected to begin in 2020 and to be completed by 2022. The second stage of the upgrade is expected to include:

- Construction of a new station at Greensborough
- Duplication of 3 kilometres of track between Greensborough and Montmorency and
- Duplication of 1.5 kilometres of track between Diamond Creek and Wattle Glen.

The Hurstbridge rail line services the areas of Hurstbridge, Wattle Glen and Diamond Creek, approximately 5 to 6 kilometres south-east of Yan Yean Road. The Hurstbridge Line upgrade does not directly interface with the Project.

Mernda Rail Extension Project

The Mernda rail extension project involved extending the South Morang line to Mernda, providing an additional 8 kilometres of new rail line and three new stations.

The Mernda Rail Extension provided an expansion of the South Morang rail line to Mernda to service the growing residential communities in this part of Melbourne. The extension, which opened to rail services in August 2018, included the following works:

- 8 kilometres of new rail track between South Morang and Mernda
- A new rail station at Mernda and two new stations in South Morang (Hawkstowe and Middle Gorge)
- Station facilities including over 2,000 car spaces, bicycle storage facilities and new walking and cycling paths.

The Project was delivered by the Level Crossing Removal Project.

The Mernda Rail Line runs parallel with Yan Yean Road, around 3.5 kilometres to the west of the Project. Mernda Station is the nearest point of rail service access from the Project and accessible from Bridge Inn Road.

M80 Upgrade Project

The M80 Upgrade will widen the freeway, widen the entry and exit ramps and install a new freeway management system along the 38 km of freeway from Laverton North to Greensborough. Upgrade works commenced in circa 2009 with many sections already completed. The section between Sydney Road and Edgars Road is expected to be built by 2023, while the section between Plenty Road and Greensborough Road will be upgraded in conjunction with the North East Link project.

Northern Roads Upgrade

The Northern Roads Upgrade will add additional lanes and upgrade intersections, active and public transport infrastructure on six arterial roads in Melbourne's northern suburbs. The road upgrades are aimed at alleviating congestion, improving road safety and catering for the transport demands of the growing northern suburbs.

The Northern Roads Upgrade includes the upgrades of:

- Childs Road in Mill Park, between Mindoro Crescent and Prince of Wales Avenue.
- Sunbury Road in Sunbury between Powlett Street and Bulla-Diggers Rest Road.
- Epping Road in Epping between Craigieburn Road East and Memorial Avenue.
- Bridge Inn Road in Doreen between Plenty Road and Yan Yean Road.
- Craigieburn Road between Hume Highway and Mickleham Road.
- Intersections along Fitzsimons Lane in Templestowe and the installation of traffic signals at the Main Road/Leane Drive intersection in Eltham.

The upgrades of Epping Road and Childs Road lie just over 9 kilometres to the west and south west of Yan Yean Road respectively while the upgrade of Bridge Inn Road directly interfaces with the Yan Yean Road upgrade at the Yan Yean Road/Bridge Inn Road intersection.

The Northern Roads Upgrade will be delivered as a Public Private Partnership and includes a 20-year maintenance period as part of the contract. The road upgrades are due to be completed by the end of 2025 and will be delivered by the Major Road Projects Victoria.

Plenty Road Upgrade

The Plenty Road Upgrade is providing additional lanes, upgraded intersections and pedestrian and cycling facilities between McKimmies Road in Mill Park and Bridge Inn Road in Mernda.

The Project is being undertaken in two stages:

- Stage 1 – McKimmies Road to Bush Boulevard in Mill Park
- Stage 2 – Bush Boulevard to Bridge Inn Road in Mernda.

The first stage was completed in mid-2019 and included:

- Widening works to provide an additional lane in each direction
- The upgrade of five major intersections
- New traffic signals at Rivergum Drive
- New sections of cycling paths and cycling lanes.

Construction of the second stage is due to be completed in 2021 and includes:

- Widening from 4 to 6 lanes between Bush Boulevard and Riverdale Boulevard
- Widening from 2 to 4 lanes between Riverdale Boulevard and Bridge Inn Road
- Upgrades to 12 intersection including major intersections at Bridge Inn Road, Waterview Drive and Francesca Drive.
- Improved cycling and walking facilities.

Construction of both stages is being delivered by Major Road Projects Victoria.

Plenty Road runs parallel and approximately 4 kilometres west of Yan Yean Road and is the nearest north-south running arterial route to the Project.

North East Link

The North East Link is a new freeway connection between the current terminus of the Metropolitan Ring Road (M80) at Greensborough Bypass and an upgraded Eastern Freeway. The Project is aimed at creating an orbital connection of Melbourne's freeway system, alleviating congestion in the north-eastern suburbs, improving travel times and removing trucks from local roads.

The North East Link includes the following works:

- *M80 Ring Road to Lower Plenty Road:*
  Above, below and at surface road sections, with new road interchanges at M80 and Greensborough Bypass, Grimshaw Street and Lower Plenty Road.
- *Tunnels:*
  From the northern tunnel portal located just north of Lower Plenty Road to south of Manningham Road, twin tunnels would travel under residential areas, Banyule Flats and the Yarra River with a new interchange located at Manningham Road. The tunnels would be the longest twin road tunnels on Victoria's freeway network.
- *Bridge Street to Eastern Freeway:*
  Open cut and bored or mined tunnel with the southern tunnel portal located south of the Veneto Club. Surface road and viaduct structures would connect to the Eastern Freeway via a new interchange.
- *Eastern Freeway upgrades:*
  Upgrades to the Eastern Freeway would include widening to accommodate future traffic volumes, provision of new dedicated bus lanes for rapid bus services and associated works. Eastern Freeway upgrade works would be carried out between Springvale Road in the east and Hoddle Street in the West.

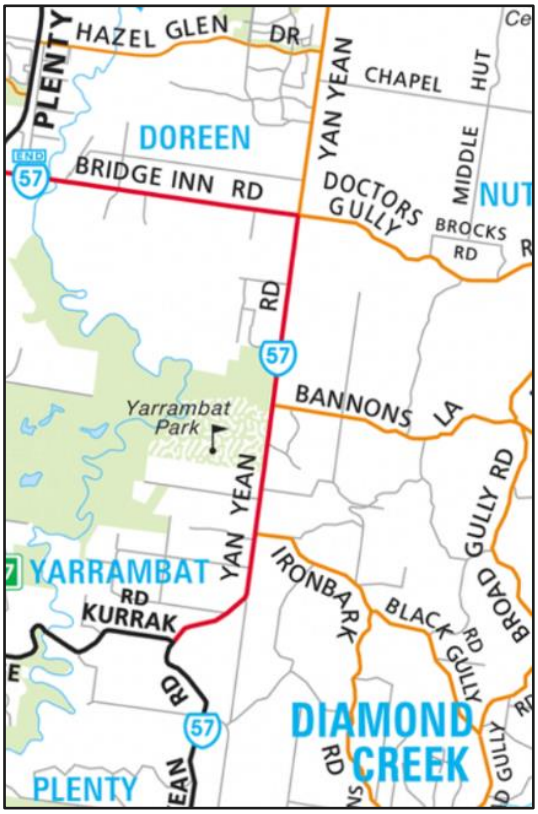
North East Link Project is overseeing the Project on behalf of the Victorian Government. Construction works are expected to commence in 2020 and be open to traffic in 2027.

The northern end of the North East Link lies around 8 kilometres south of the Project and will be accessible from the study area via Yan Yean Road and Diamond Creek Road-Greensborough Bypass.

5.3 Road Transport

5.3.1 Road network

The local study area (Figure 5.4) comprises of a mixture of declared roads, local roads, local streets and accesses into private properties and other land uses.



Source: Melways online

Figure 5.4 - Yan Yean Road and surrounding road network

Declared roads (VicRoads controlled)

The Project, Yan Yean Road between just north of Kurrak Road and Bridge Inn Road, is a secondary arterial road, running in a north-south direction. It is a two-way, two lane road (one lane per direction), and has a posted speed limit of 70 km/h, with exception of two 40 km/h school zones located near Orchard Road and Ironbark Road.

Bridge Inn Road is an east-west secondary arterial road, which intersects with Yan Yean Road at the northern boundary as a roundabout control. Bridge Inn Road currently provides one lane in each direction with auxiliary turn lanes at key traffic signals and channelised right and left turning treatment at priority-controlled intersections. The posted speed limit is 80 km/h.

Kurrak Road is an east-west primary arterial road and intersects with Yan Yean Road just south of the study area. It has one lane in each direction with localised access to driveways and abutting land uses. The posted speed limit is 70 km/h.

Local 'collector' roads (council controlled)

Doctors Gully Road is a local road and an extension of Bridge Inn Road, to the east of Yan Yean Road. It comprises a single traffic lane in each direction, and operates at 80 km/h. Doctors Gully Road provides access for private residential dwellings and the Doreen Primary School.

Bannons Lane is an east-west local road and forms a priority-controlled T-intersection with Yan Yean Road. It extends east of Yan Yean Road to Haleys Gully Road, provides a single traffic lane in both directions and has a posted speed limit of 60 km/h (to approximately 600 metres east of Yan Yean Rd) and 80 km/h further east. Bannons Lane primarily provides access to private residential dwellings.

Ironbark Road is an east-west local road, commencing at the signalised intersection with Yan Yean Road and continuing east to connect to Black Gully Road and Broad Gully Road. Immediately east of Yan Yean Road, it is undivided with a single traffic lane in both directions. It has a posted speed limit of 60 km/h, with exception during school speed zone operating hours. Ironbark Road currently provides access educational facilities (i.e. Primary schools, preschools) as well as other commercial and private land uses.

Orchard Road and **Jorgensen Avenue** are also considered local 'collector' roads, both providing access between Yan Yean Road and the growing residential area of Doreen, located south-west of the Bridge Inn Road / Yan Yean Road intersection. Orchard Road connects with Yan Yean Road as a roundabout control, while Jorgensen Avenue intersects as a priority-controlled T-intersection.

Local streets (council controlled)

A number of local streets intersect with Yan Yean Road, including Activity Way, Laurie Street, Golf Links Drive, Youngs Road, Ashley Road, Vista Court, North Oatlands Road, Worns Lane and Heard Avenue. The connections primarily provide access to residential areas adjoining Yan Yean Road.

Direct access

There are approximately 100 direct access points along the Project, ranging from access from residential properties to schools to recreational facilities (i.e. Yarrambat Park, the golf course).

5.3.2 Road environment and intersection control

Yan Yean Road is currently an undivided two-lane road (one lane in each direction), consisting of sections with very steep grades and poor sight lines. The cross section is typically rural in nature, with unsealed shoulders, adjacent open table drains, and existing trees close to the road's edge (Figure 5.5).

North of Heard Avenue

North of Bannons Lane

North of Ironbark Road

North of Laurie Street

Figure 5.5 - Yan Yean Road, various cross sections (looking northbound)

Direct access to abutting land use is generally uncontrolled, and the majority of intersections are priority controlled via "give way" or "stop" control.

Figure 5.6 summarises the existing intersection controls along the Project corridor. In summary,

- Bridge Inn Road (secondary arterial) and Orchard Road (local collector road) are the only two intersections with a roundabout control

- Ironbark Road (local 'collector' road) is the sole signal control item
- All other intersections are priority controlled, with very few turn bans
- Direct accesses are generally unrestricted (i.e. no turn bans to or from properties).

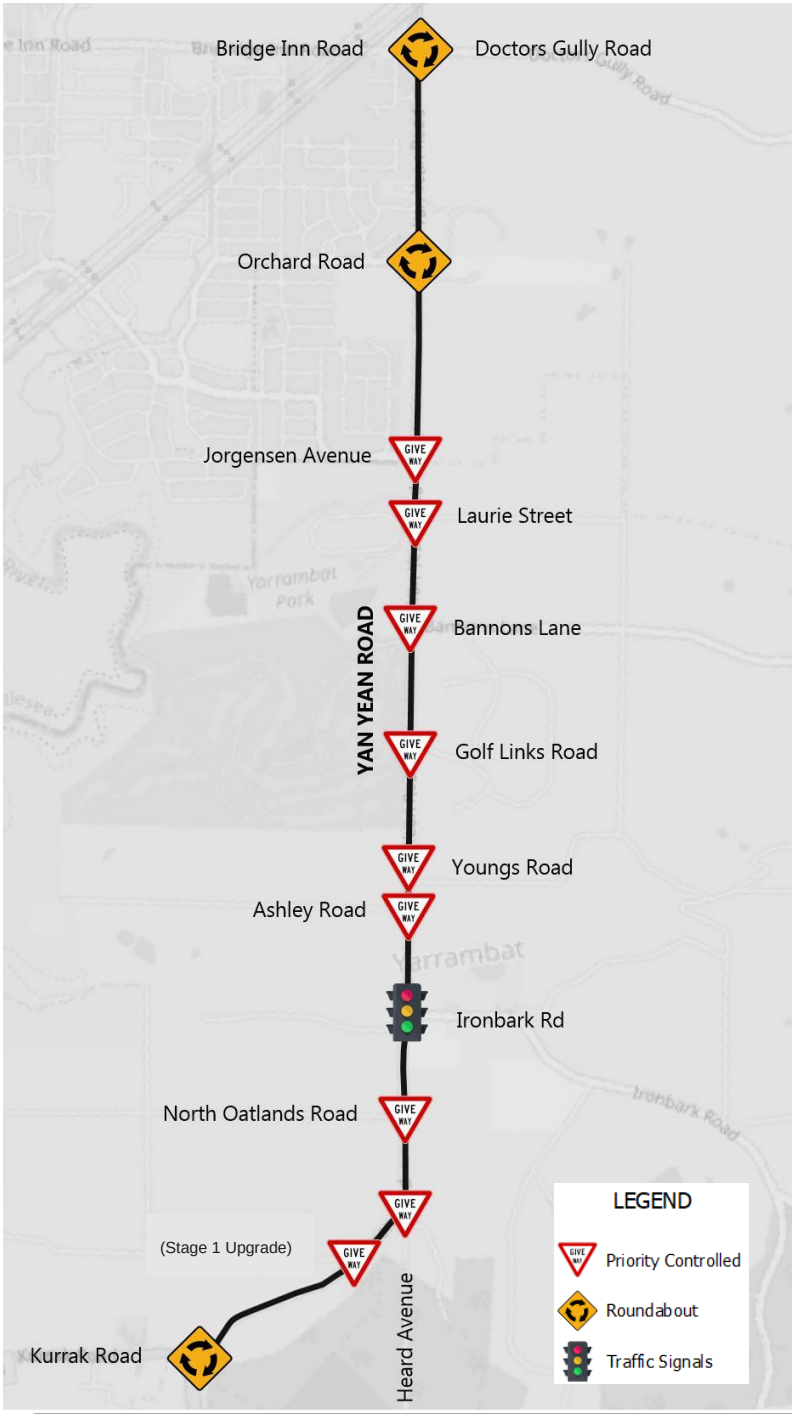


Figure 5.6 - Existing intersection controls

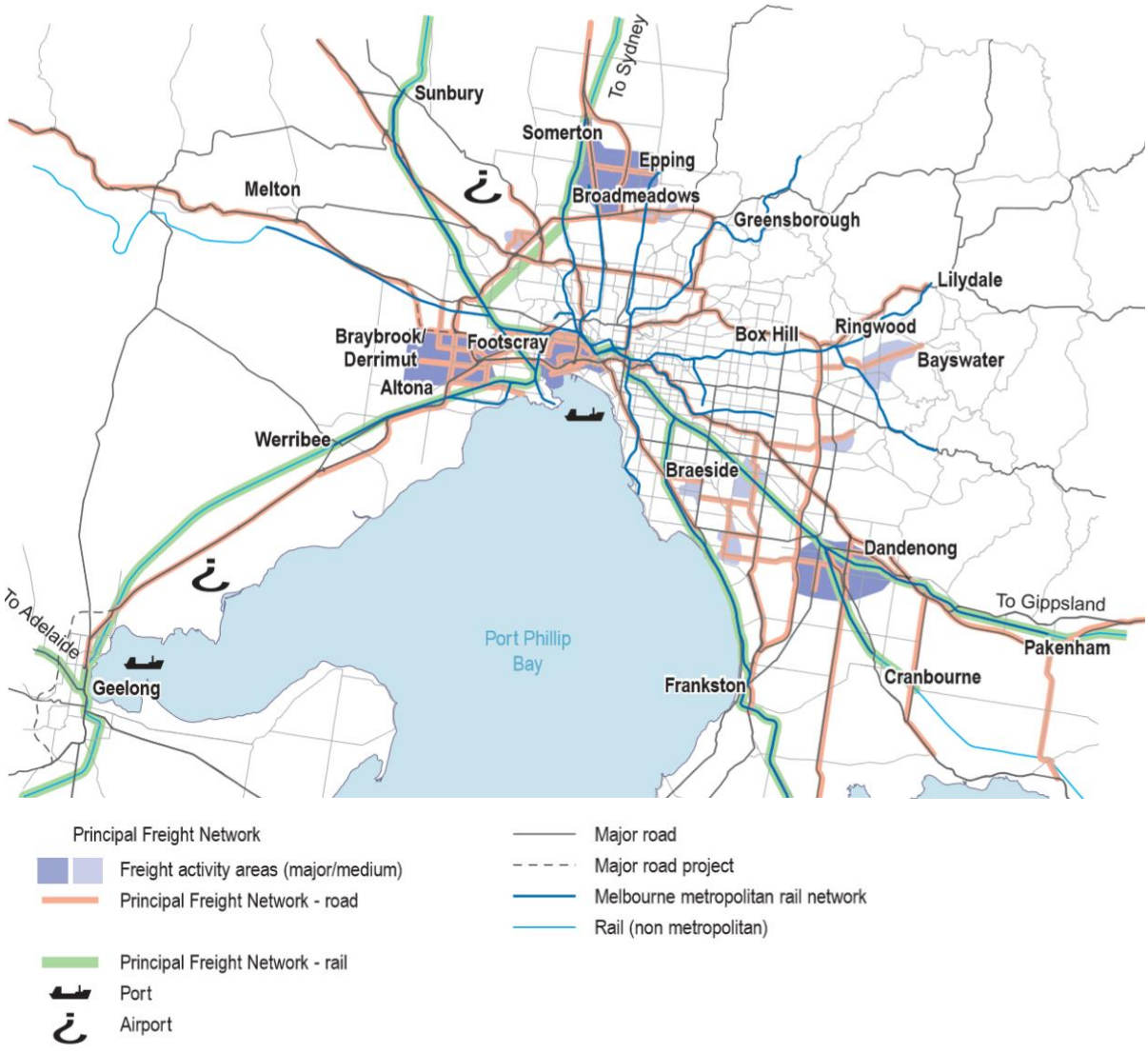
5.3.3 Freight

Regional Context

The movement of freight through Melbourne's north east is predominantly undertaken via the freeway and arterial road network.

The metropolitan road Principal Freight Network (PFN) connects major Freight Activity Centres using higher order roads (Figure 5.7). Yan Yean Road is not part of the PFN, with the closest connections being:

- Hume Freeway
- Metropolitan Ring Road
- Dalton Road
- Cooper Street.



Source: Freight Futures, Victoria Freight Network Strategy

Figure 5.7 - The Principal Freight Network - Metropolitan

Local Freight Movement

The VicRoads gazetted B-Double Network surrounding the Yan Yean Road corridor (Figure 5.8) identifies all arterial roads within the local area as approved routes for B-double vehicles.

Yan Yean Road is an approved B-Double route, and in conjunction with Plenty Road, Epping Road and the other arterial roads, facilitates freight movement through this north eastern corridor.

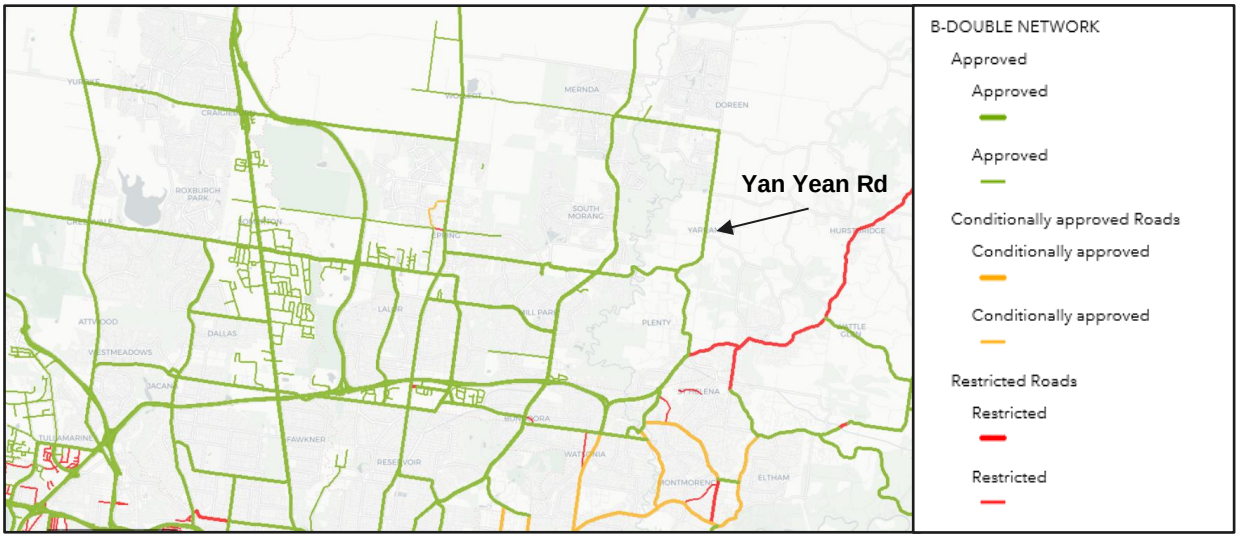


Figure 5.8 - B-Double Network (Source: VicRoads)

5.4 Road Network Operation and Performance

5.4.1 Traffic volumes

Regional traffic movements

Figure 5.9 summarises the daily traffic volumes on a typical weekday, indicating general traffic movements through the area.

Focusing on travel through the wider north-south corridor, measured using a screen line just north of Ironbark Road, the data demonstrates the regional importance that Yan Yean Road plays in servicing the northern suburbs, catering for around 29 percent of arterial road traffic crossing the screen line. Epping Road caters for around 23 percent of arterial road traffic, with Plenty Road (four lanes at the screen line) catering for 48 percent.

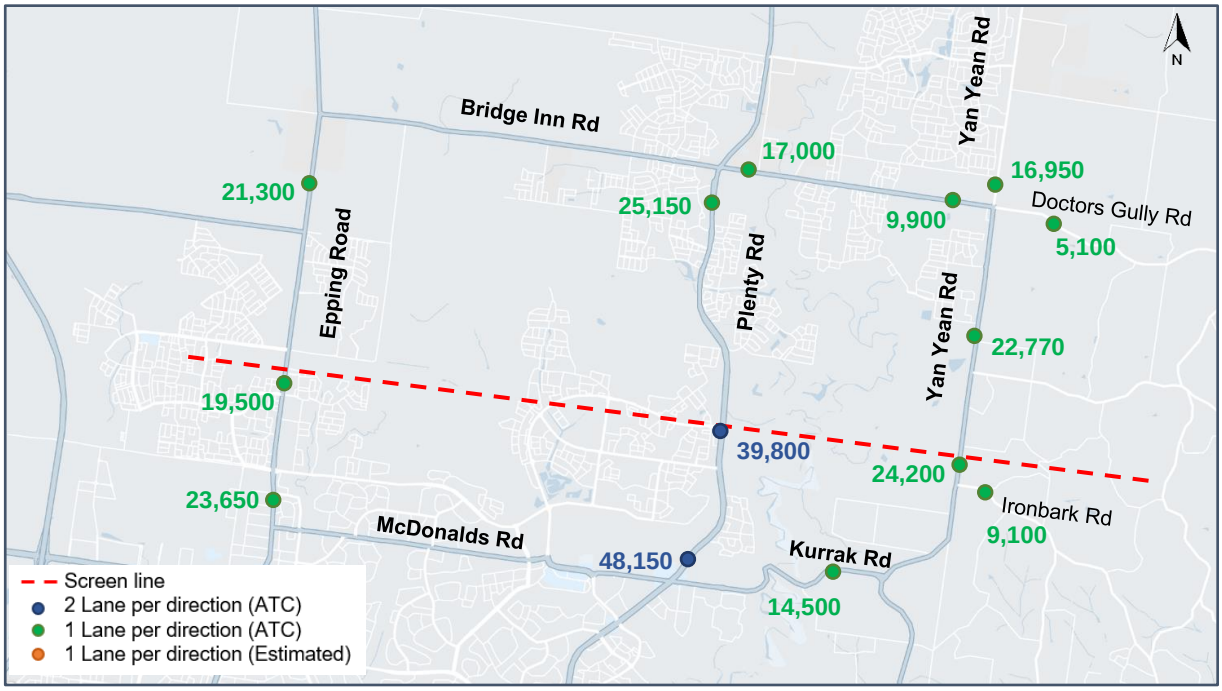


Figure 5.9 - Regional average weekday traffic volumes (Source: Automatic tube counts, Section 4.4)

Local traffic movements

Traffic volume data was collected for a seven-day period at various midblock locations within the Yan Yean Road corridor. The tube count data provides a continuous 24-hour count of traffic passing through midblock locations in which vehicle counts, speeds and classification are collected. The daily volumes as well as heavy vehicle percentages for each of the tube count locations are summarised in Figure 5.10.

Typically, Yan Yean Road carries between 20,000 to 24,000 vehicles per weekday (Monday to Friday average) through the Project area, depending on location. Traffic volumes are generally lower in the north, and steadily increase further south, capturing traffic movements from existing and growing residential areas.

At the northern boundary of the Project corridor, just south of Bridge Inn Road, the daily traffic volume along Yan Yean Road is approximately 19,500 per weekday, made up of traffic to/from:

- Further north, where Yan Yean Road still carries around 17,000 vehicles per weekday, catering for the growing residential area
- Bridge Inn Road (west), which accommodates around 10,000 vehicles per weekday
- Doctors Gully Road (east), which has a daily volume of around 5,000.

South of Jorgensen Avenue, daily volumes increase to approximately 23,000 vehicles per weekday, the increase being due to the additional traffic generated by the rapidly developing residential area within Doreen and the City of Whittlesea (i.e. west side of Yan Yean Road).

The section of roadway between Ironbark Road and Youngs Road is the busiest, catering for over 24,000 vehicles per weekday, suggesting that the road is very busy for long periods during the day. Volumes as high as 25,000 vehicles per day were recorded on both Thursday and Friday of this dataset.

Ironbark Road caters for approximately 9,000 vehicles per weekday, with a strong traffic movement to/from Yan Yean Road (north). Accordingly, to the south of Ironbark Road, the daily traffic volumes decrease to approximately 20,500 vehicles per weekday.

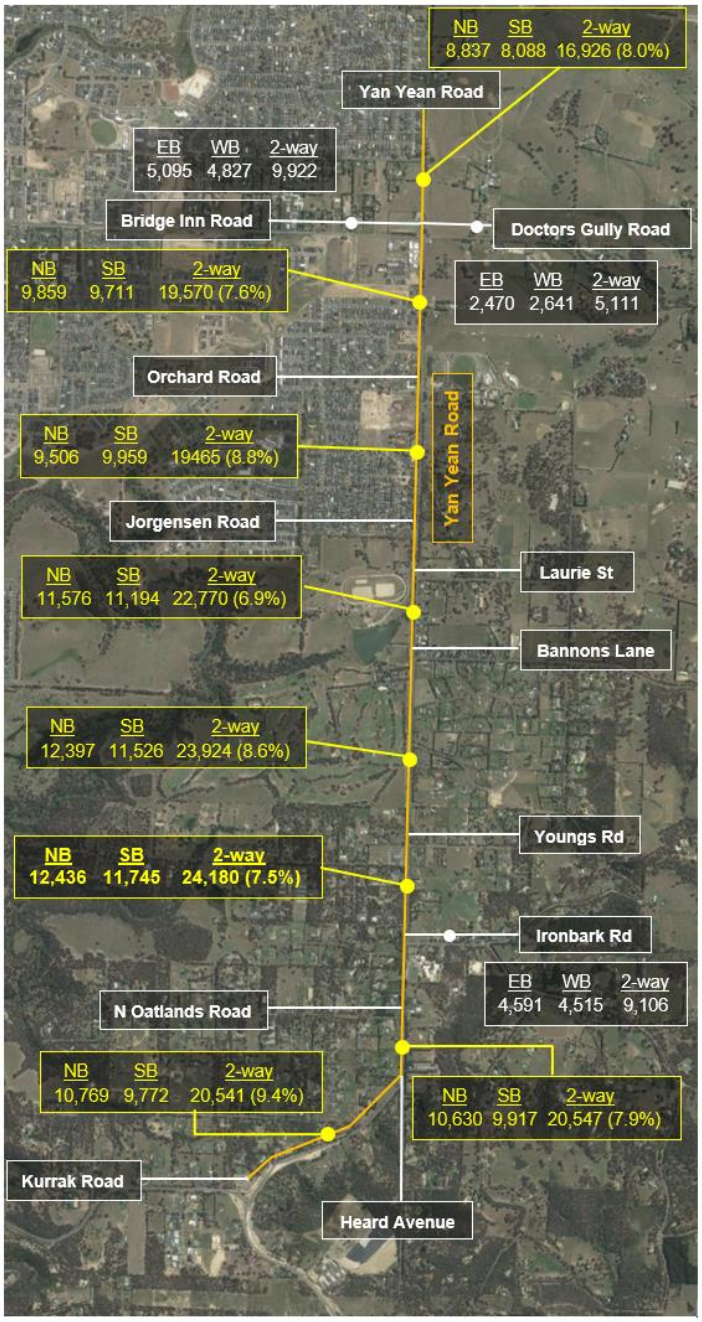


Figure 5.10 - Average weekday traffic volumes (Source: Automatic tube counts, Section 4.4)

5.4.2 Vehicle composition

Figure 5.11 summarises the average weekday heavy vehicle volumes and the proportion of all traffic (Figure 5.10) through the wider area.

All arterial roads in the area are gazetted as being suitable for B-doubles (Section 5.3.3) and carry reasonable numbers of heavy vehicles.

Across the northern screen line:

- Yan Yean Road carries around 1,830 trucks per weekday (24 percent of the screen line total)
- Plenty Road carries around 4,370 trucks per weekday (56 percent)
- Epping Road carries around 1,560 trucks per weekday (20 percent)

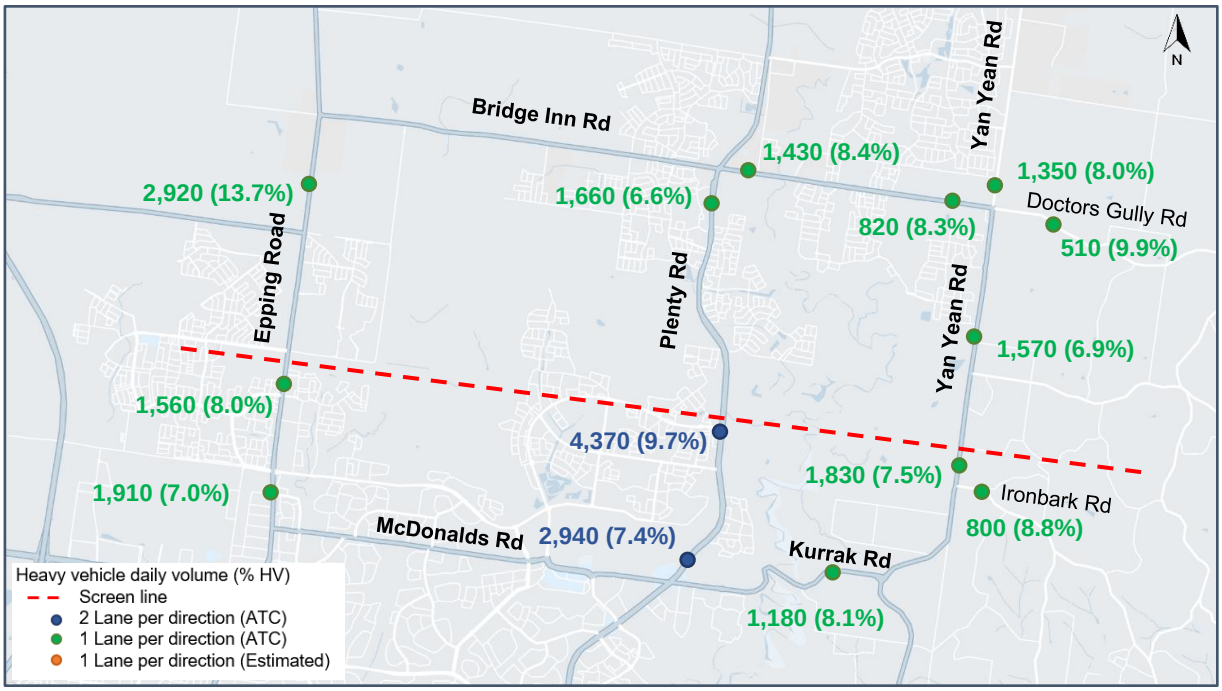


Figure 5.11 - Heavy vehicle composition (regional), (Source: Automatic tube counts, Section 4.4)

Through the busiest section of Yan Yean Road, to the north of Ironbark Road, approximately 7.5 percent of all traffic are heavy vehicles (1,825 of 24,180 vehicles per weekday).

Of the heavy vehicles (Figure 5.12), 72 percent are small rigid trucks, 21 percent are medium sized rigid trucks and 7 percent are large articulated trucks.

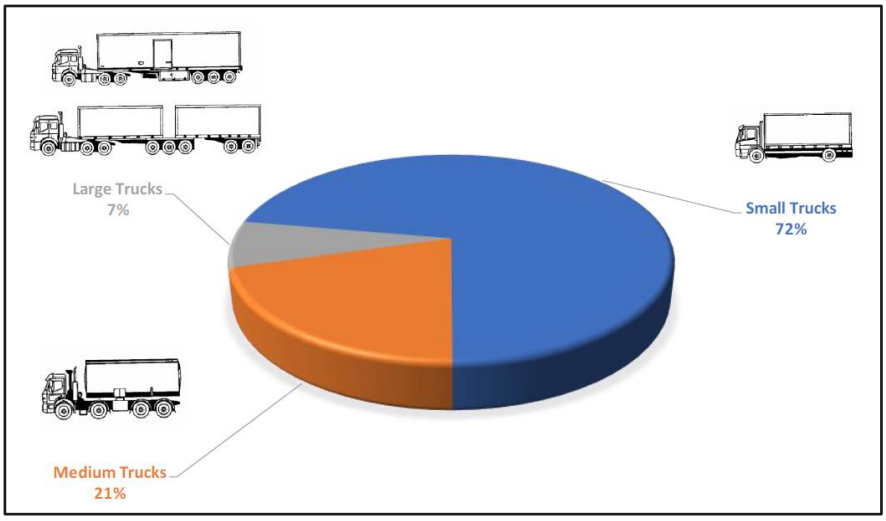


Figure 5.12 - Yan Yean Road, Heavy Vehicle Composition

5.4.3 Traffic profile

Hourly traffic profile data identifies a road's busiest times of the day by direction of travel.

Table 5.2 summarises the traffic profiles for the key north-south routes through the area, measured across the north-south screen line, with hourly volumes expressed as a percentage of the daily traffic. Generally,

- The morning commuter peak period commences earlier than inner urban suburbs, from around 6am (or earlier), and continues to 9am, with a southbound peak direction of travel.
- For the returning PM commuter peak, northbound travel is dominant, particularly along Plenty Road and Yan Yean Road where traffic volumes increase sharply from around 3 pm (school pickup) before dropping after around 7 pm.
- Epping Road has a much flatter hourly profile, with less variation between peak and interpeak periods

Table 5.3 summarises the traffic profiles for the key east-west routes through the area. In summary,

- Bridge Inn Road (just west of Yan Yean Road) carries less traffic than Bridge Inn Road (just east of Plenty Road)
- The peak direction of travel along Bridge Inn Road is biased by the proximity to Yan Yean Road and Plenty Road. The peak direction of travel during the AM peak is towards these roads, and during the PM peak, away from these roads.
- Kurrak Road and Bridge Inn Road (just west of Yan Yean Road) have similar peak directional profiles, albeit Kurrak Road carries more traffic.

Table 5.2 – Average weekday traffic profile (north-south routes)

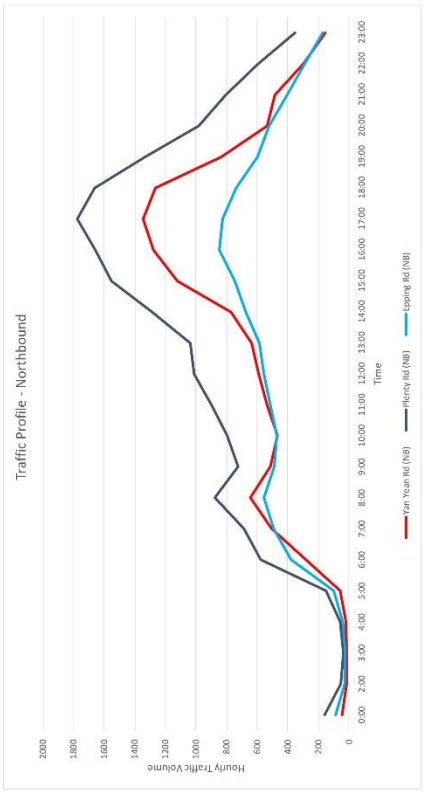
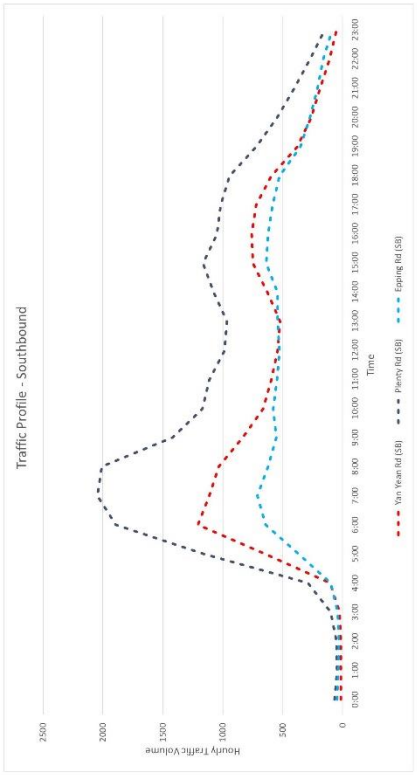
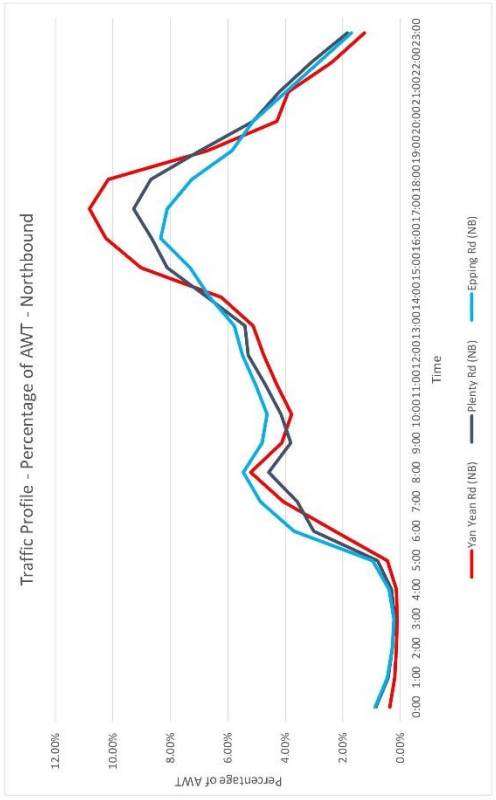
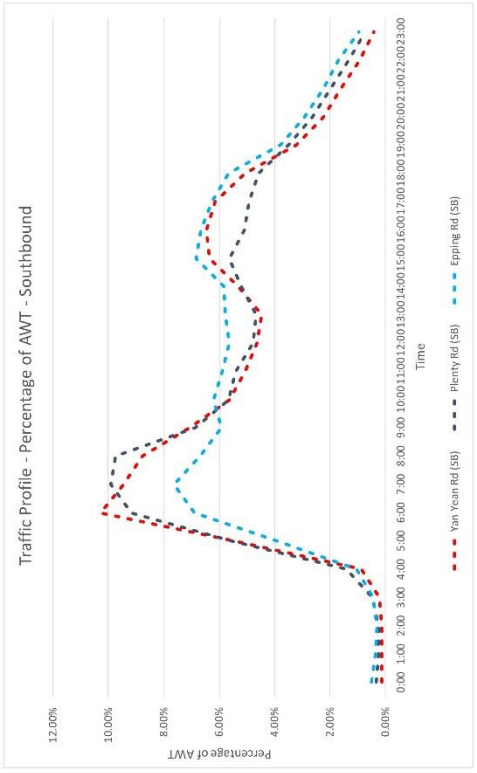
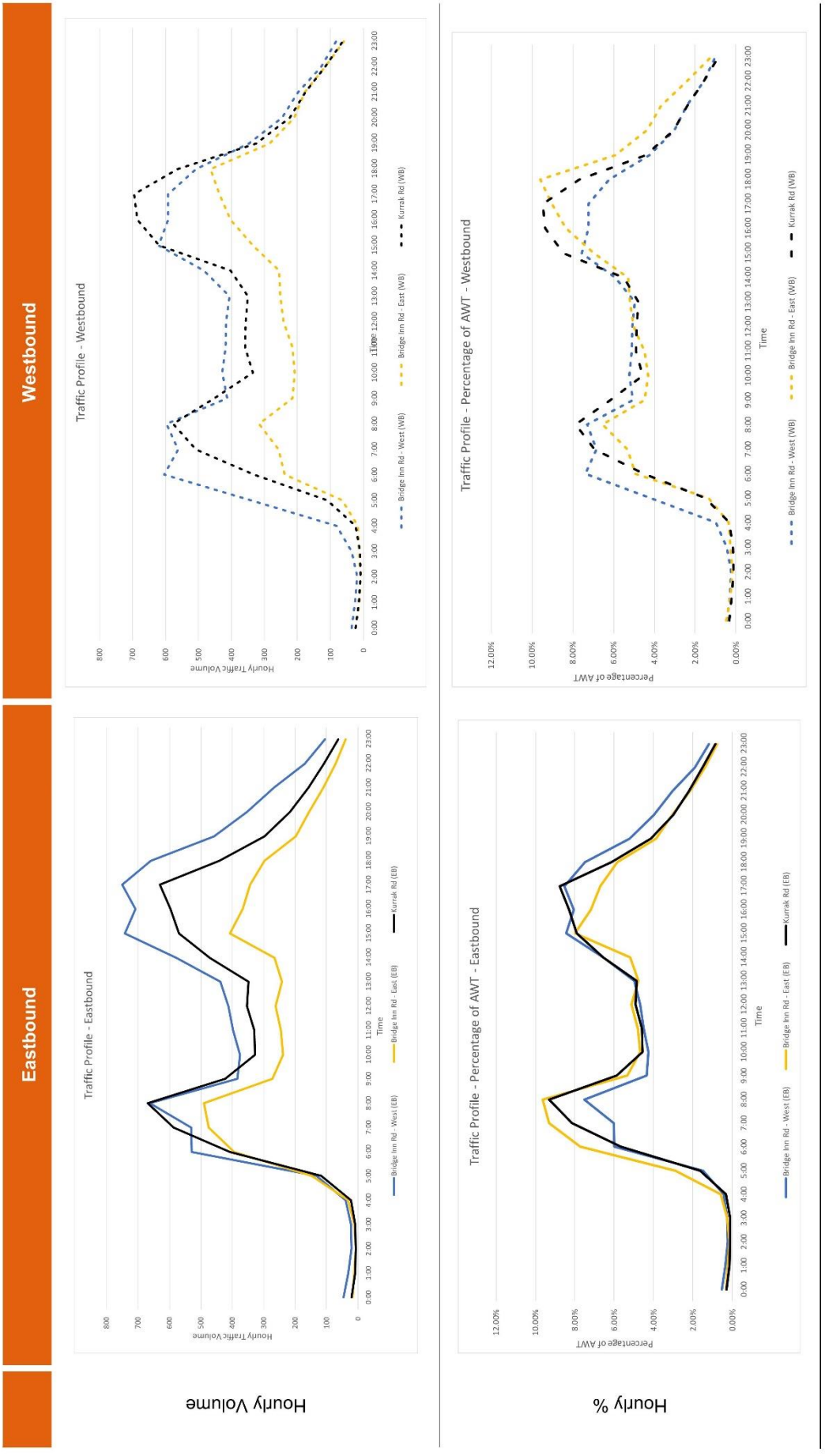
	Northbound	Southbound
Hourly Volume		
Hourly %		

Table 5.3 – Average weekday traffic profile (east-west routes)



Yan Yean Road - Traffic Profile

The *average weekday* traffic profile on Yan Yean Road across a 24-hour period, based on data collected approximately 330 metres north of Ironbark Road, is summarised in Figure 5.13. The hourly volume profile presented at this location is similar to the trends at other sites along Yan Yean Road, although it is noted that this section is the busiest observed.

During the morning peak period, southbound travel along Yan Yean Road is dominant, catering for over 1,000 vehicles per hour for each hour between 06:00 and 09:00 and peaking at approximately 1,200 vehicles per hour between 06:00 and 07:00. The early peak hour is due to the geographic location relative to the city (i.e. commuters travelling longer distances commence their journey earlier). This trend is usual for outer suburban growth areas.

During the afternoon peak period, northbound travel along Yan Yean Road becomes dominant, catering for over 1,000 vehicles per hour over a longer period (15:00 and 19:00) and peaking at approximately 1,350 vehicles per hour between 17:00 and 18:00. The early start to the PM peak period commences at school pickup and extends to 19:00, catering for returning commuter trips.

In both peak periods, the non-dominant traffic flow is a little over half of the dominant direction of travel.

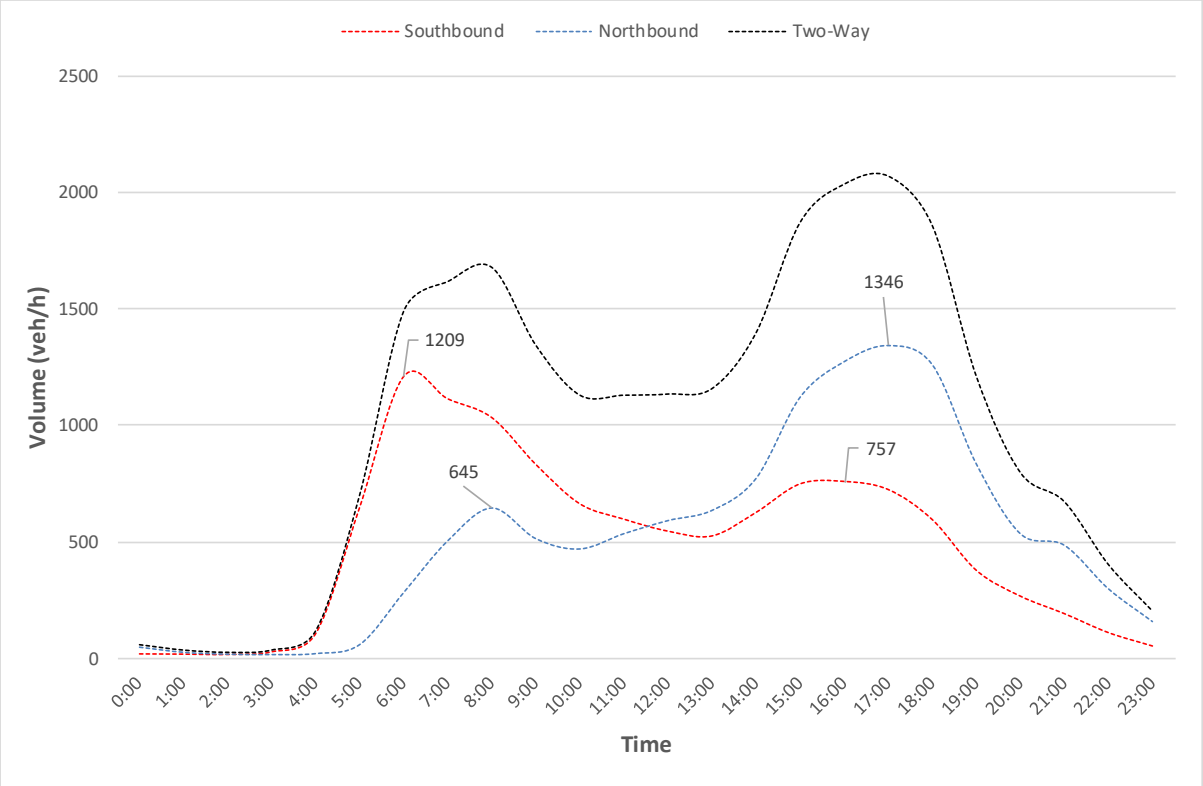


Figure 5.13 - Yan Yean Road (north of Ironbark Rd), average weekday 24-hour traffic profile

5.4.4 Travel Times

Journey Time (or travel time) surveys were undertaken along the 5.6-kilometre section of Yan Yean Road (Kurrak Avenue to Bridge Inn Road) in May 2017 during peak period times. The purpose of travel time surveys is to provide an understanding of locations of congestion as well as variability of travel time in peak periods.

Table 5.4 summarises the fastest, slowest and average journey times observed across the three survey days. The statistics provided include survey runs that coincide with the two school speed zones near Orchard Road and Ironbark Road being operational during part of the survey period.

Variation (or spread) is the difference between the slowest and fastest survey runs, providing an understanding of journey time reliability.

Average delay is estimated by the difference between the fastest run (from both peaks, used to estimate a relatively free flow speed) and the average journey time.

During the AM peak period, the average journey time in the dominant southbound direction is approximately 10 minutes at an average speed of 35 km/hr. These motorists experience relatively high delays through the corridor (approximately 4.5 minutes over 5.6 kilometres of travel) and poor journey reliability with journey time variation (or spread) of over 7.5 minutes.

Similar trends are experienced for the return commuter trips in the PM peak (i.e. for northbound travel).

Table 5.4 - Yan Yean Road (Kurrak Ave to Bridge Inn Rd), Journey Time Summary

	Travel Time* (mm:ss)			
	AM Peak (06:30 to 9:30)		PM Peak (15:30 to 18:30)	
	NB	SB	NB	SB
Fastest Run	5:11	6:16	5:59	5:16
Slowest Run	7:02	13:54	13:55	9:24
Average	6:04	9:57	9:37	6:17
Variation**	1:51	7:38	7:56	4:08
Average Delay***	0:53	4:41	4:26	1:01

* Sample size – 46 journey time runs per period, per direction
** Variation (or "spread") is the difference between the fastest and slowest journey time runs
*** Average delay is an estimate, based on the difference between the fastest run (free flow estimate) recorded (from both peaks) and the average journey time

The journey time-distance plots for each peak period and each direction are summarised in Figure 5.14; each individual survey run is presented (in grey) along with the average journey time run +/- one standard deviation (in red). The standard deviation provides a measure of variation, with +/- one SD (around the average) making up around two-thirds of the entire data set.

In summary,

- The peak directions of travel (southbound in the AM and northbound in the PM) yield the highest variation in journey time along the route
- The counter-peak directions show considerably less variation, with a smaller standard deviation around the mean
- During the AM peak, much of the journey time delay and variation for *southbound* traffic appears to occur at Ironbark Road, and to a lesser extent at Orchard Road
- During the PM peak, a majority of the journey time delay and variation for *northbound* traffic appears to occur at Bridge Inn Road, and to a lesser extent at Ironbark Road, and
- The slowest journey times recorded generally coincide with the school drop off and/or pickup periods.

The key bottlenecks along the route are difficult to isolate from the journey-time plots alone. The average speed–distance plots (Section 5.4.5) explore these in more detail.

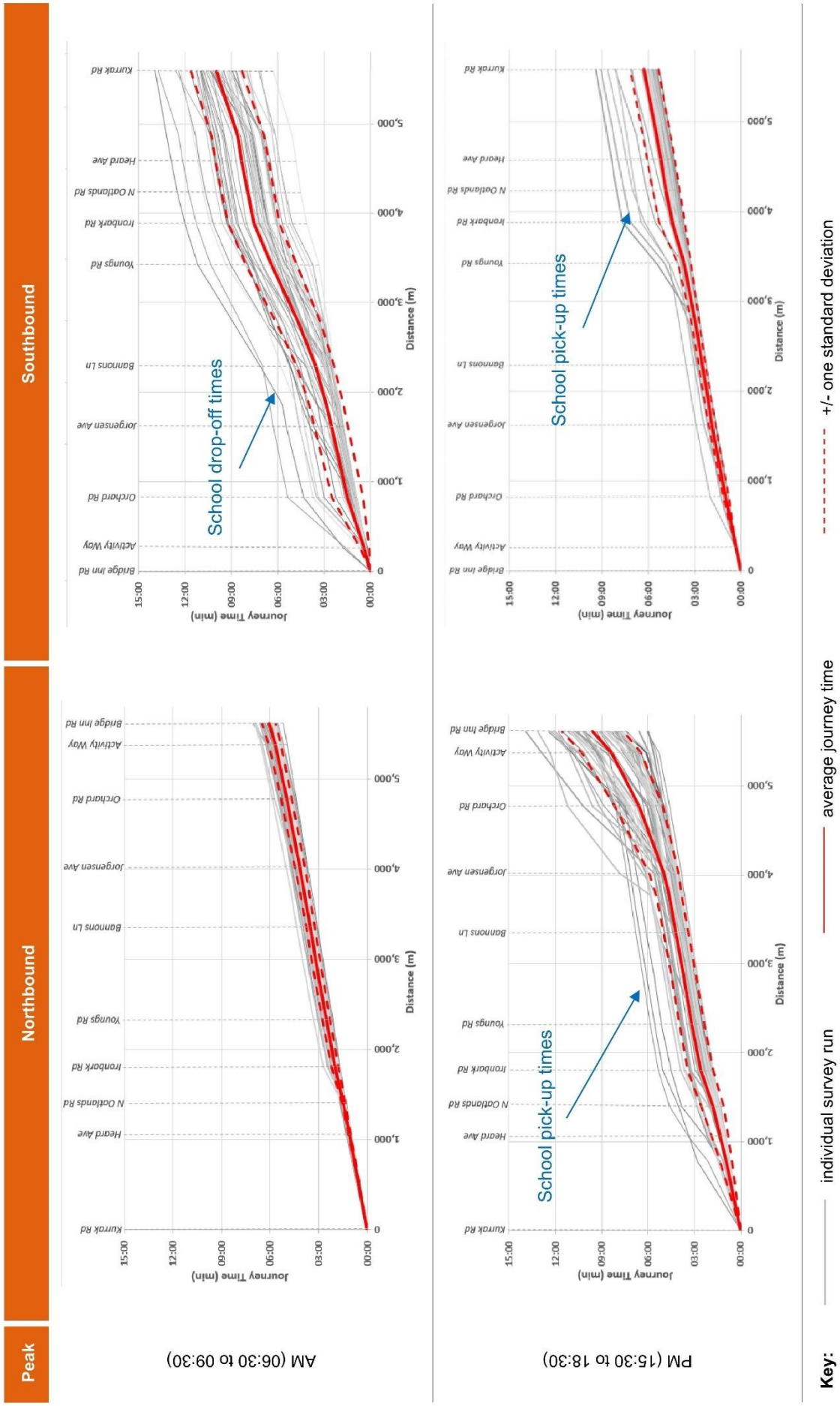


Figure 5.14 - Yan Yean Road, journey time-distance plots (per peak, per direction)

5.4.5 Operating Speeds

Regional operating speeds

The morning and evening peak hour operating speeds through the wider area are based on available travel time data and summarised in Table 5.5, Figure 5.15 and Figure 5.16.

The network operating speeds are generally slower in the AM peak than the PM peak hour. The average speeds along Epping Road, Yan Yean Road and Bridge Inn Road (all two-lane, two-way roads) are very slow, ranging between 15 to 30 km/h in the AM peak hour in the peak direction of travel. Plenty Road however, which includes sections of two-lanes and four-lanes, operates much better with average network speeds of around 40 km/h (both peaks, both directions of travel).

Table 5.5 - Journey Speed Summary (Regional)

	Operating Speed Summary							
Route	**Epping Rd**		**Plenty Rd**		**Yan Yean Rd**		**Bridge Inn Rd**	
Direction	NB	SB	NB	SB	NB	SB	EB	WB
Between	Findon Rd and Craigieburn Rd E		Gorge Rd & Bridge Inn Rd		Kurrak Rd & Bridge Inn Rd		Plenty Rd & Yan Yean Rd	
Length (m)	3,300	3,300	6,095	6,095	5,611	5,611	3,800	3,800
Posted Speed (km/h)	60	60	80	80	70	70	80	80
AM Slowest speed (km/h)	23	13	29	30	48	24	22	11
AM Fastest speed (km/h)	34	26	51	46	57	37	45	37
AM Average speed (km/h)	29	16	40	41	53	30	33	21
PM Slowest speed(km/h)	16	33	30	33	27	48	35	48
PM Fastest speed (km/h)	35	39	48	56	43	61	59	59
PM Average Speed (km/h)	26	36	36	43	34	55	49	50

AM – 08:00 to 09:00
PM – 17:00 to 18:00

Figure 5.15 - Network average operating speed (AM Peak, 08:00 to 09:00)

Figure 5.16 - Network average operating speed (PM Peak, 17:00 to 18:00)

Yan Yean Road - operating speeds

The operating speed has been estimated from the journey time survey data and is directly correlated with the journey time information presented in Section 5.4.4 above.

The average journey speed along the entire length of Yan Yean Road (Stage 2) for the three-hour AM and three-hour PM peak period is summarised in Table 5.6 below.

In summary,

- For context, the posted speed limit was 70 km/h, with two 40 km/h school zones at Orchard Rd and Ironbark Rd;
- The free flow speed (FFS) along the length of Yan Yean Road is approximately 65 km/h in each direction (based on the fastest survey runs);
- In the peak direction of travel (southbound for the AM peak, northbound for the PM peak), the average speed drops significantly to around 35 km/h, or around 30 km/h slower than and only 53 percent of the FFS;
- The slowest trips recorded experienced an average journey speed of 24 km/h across the 5.6 kilometres section of Yan Yean Road in both directions. This is around 40 km/hr slower than and 37 percent of the estimated FFS.

Table 5.6 - Yan Yean Road (Kurrak Ave to Bridge Inn Rd), Journey Speed Summary

Journey speed metric	Journey speed (km/h)			
	AM Peak (06:30 to 09:30)		PM Peak (15:30 to 18:30)	
	NB	SB	NB	SB
Fastest run (free flow speed)	65	54	56	64
Slowest run	48	24	24	36
Average	56	35	37	55
Average: Free Flow Ratio		0.53	0.56	

Figure 5.17 summarises the average travel speed during the AM peak period, for the dominant southbound movement along Yan Yean Road. The heat map has been prepared from the raw journey time survey data and is provided as an *indicative* average speed along the route for the dominant peak direction (i.e. AM peak for southbound travel). The heat map can also be used to identify the approximate back of queue.

During the AM peak, it is apparent that:

- the key bottleneck for the southbound travel occurs at Ironbark Road where the average speed drops to approximately 25 km/hr (and as low as 15 km/hr)
- at Ironbark Road, north approach, the tail of the 'slow moving queue' was regularly observed as far back as Golf Links Drive (over 1,000 metres long) between 08:00 to 09:00, as occasionally as far back as Bannons Lane (over 1,500 metres long)
- there is some minor turbulence around Orchard Road, particularly during school drop off times

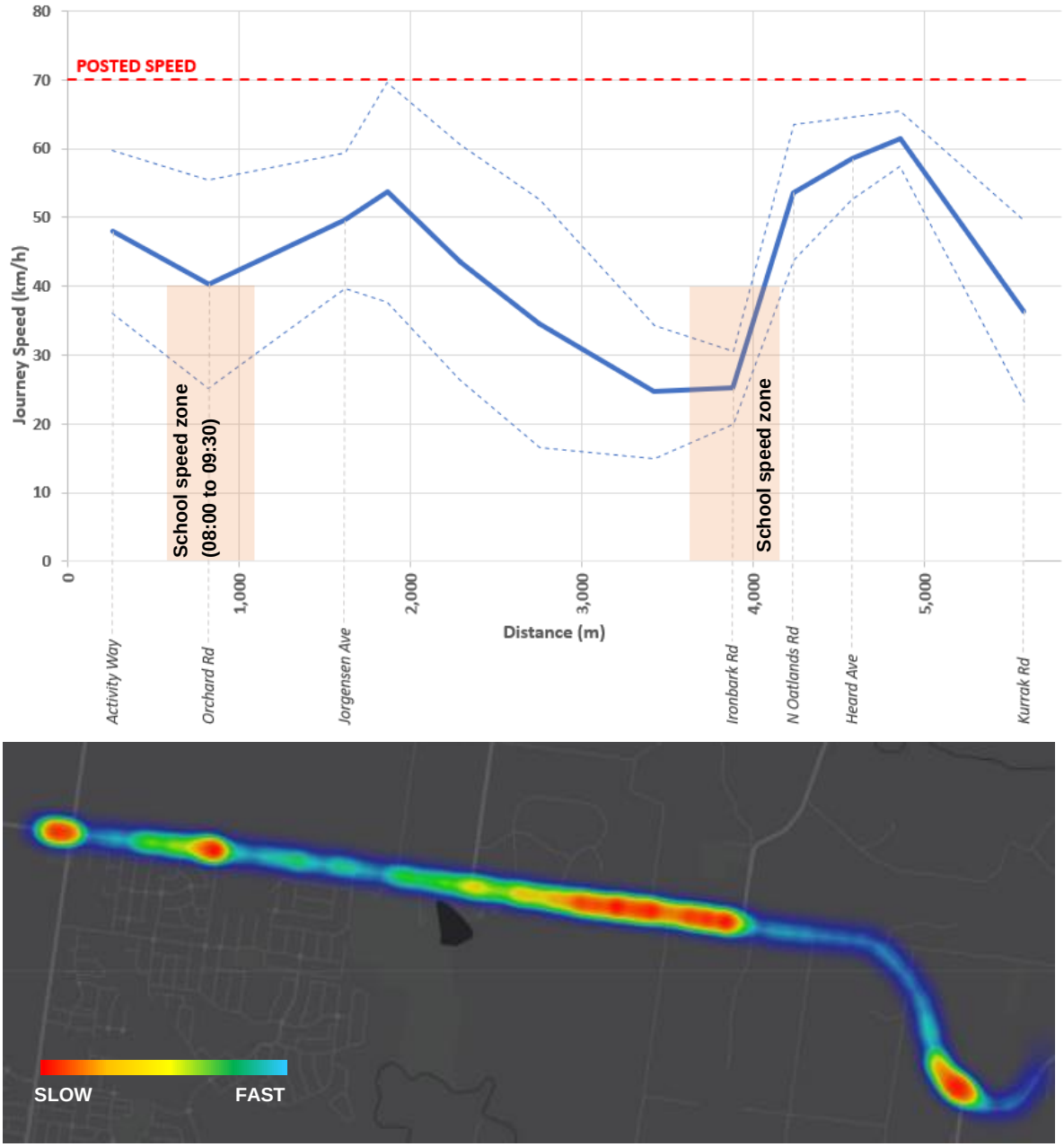


Figure 5.17 - Yan Yean Road, journey speed-distance plot (AM, 06:30 to 9:30 Southbound)

Figure 5.18 summarises the average travel speed during the PM peak period for the dominant northbound direction along Yan Yean Road. In summary:

- the key bottleneck for northbound travel occurs at Bridge Inn Road, with observed queues extending as far back as Orchard Road (over 800 metres away)
- there are some minor delays at Ironbark Road

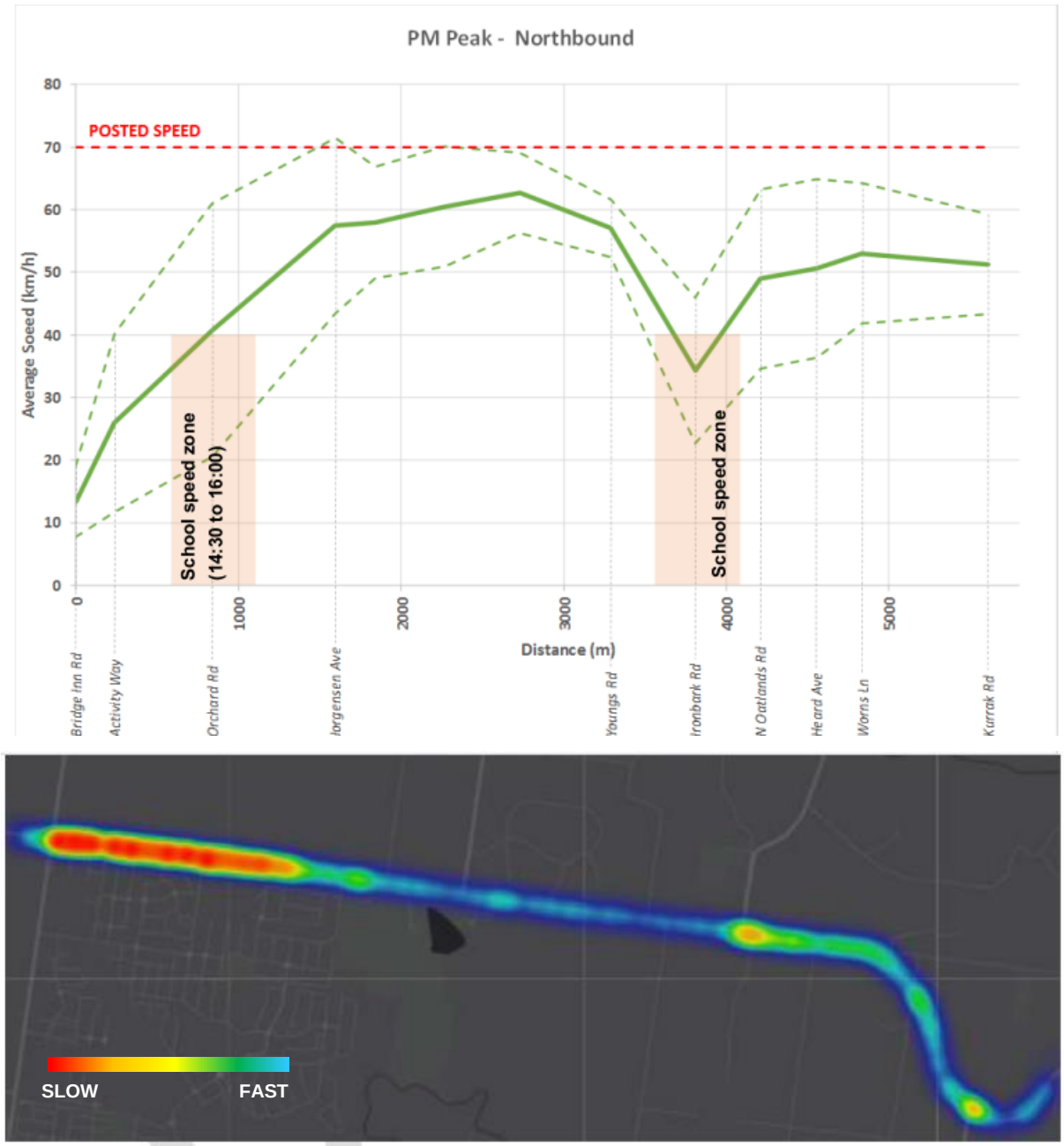


Figure 5.18 - Yan Yean Road, journey speed-distance plot (PM, 15:30 to 18:30 Northbound)

5.4.6 Road Safety

Crash statistics along Yan Yean Road (Bridge Inn Road to Kurrak Road) were sourced from VicRoads Crash Stats database.

Figure 5.19 summarises the number of crashes per annum recorded between 2006 and 2018, by severity, suggesting an upward trend in both the number and severity of crashes over this period.

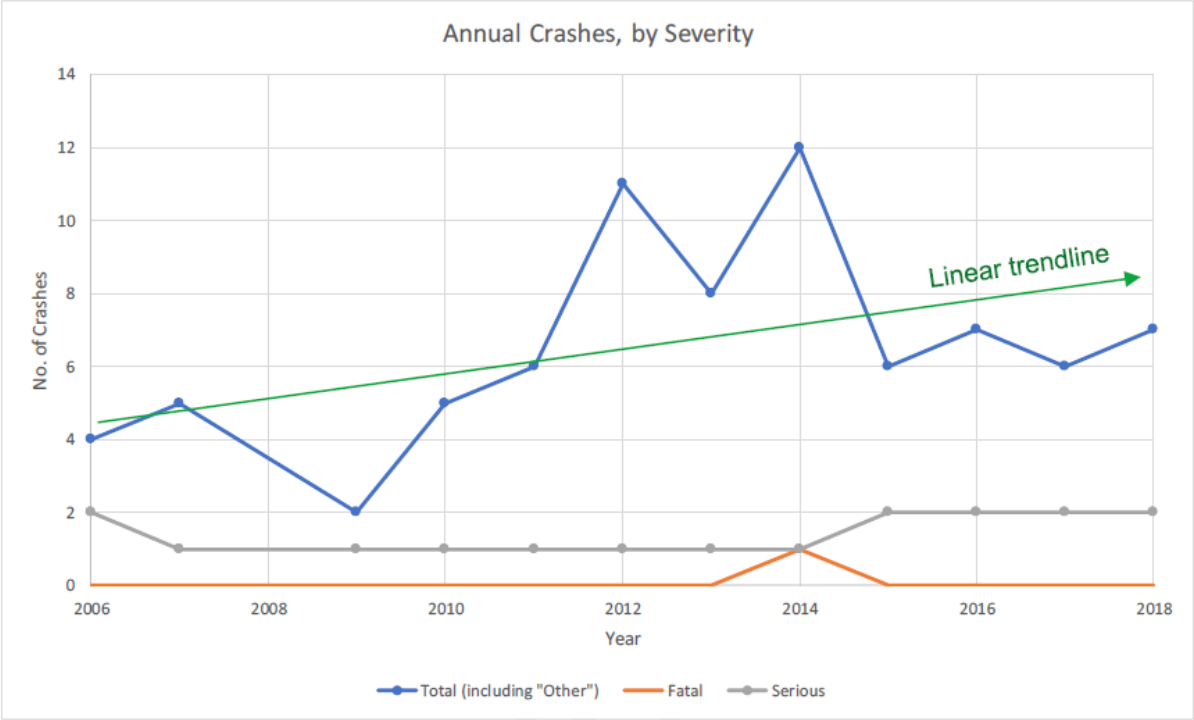


Figure 5.19 - Number of crashes on Yan Yean Road (2006 to 2018)

The most recent 5-year period (2014 to 2018 inclusive) of data was further interrogated, with a total of 38 crashes recorded, including 1 fatal crash and 9 serious injury crashes. A fatal head on collision occurred just north of Jorgensen Avenue in 2014. The intersection at Jorgensen Avenue qualified for upgrade funding under the Federal Blackspot Program in 2015-2016.

Locations of crashes occurring during the 5-year period is shown in Figure 5.20. Of note:

- 63 percent of crashes occurred at an intersection, with 37 percent occurring at various mid-block locations;
- The roundabout at the intersection of Yan Yean Road and Kurrak Road was the site of most recorded crashes (5 crashes), followed by the roundabout at Bridge Inn Road (4 crashes), noting that the Kurrak Road intersection was part of the Stage 1 upgrade.

The accident types recorded during the period are shown in Figure 5.21. Rear-end crashes were the most dominant type, representing 42 percent of all crashes (16 of 38), and are (generally) more prevalent in congested situations. 'Right near' and 'Right through' crashes between right turners and through traffic were the next most prevalent accident type at 8 percent each (3 of 38).

Figure 5.20 - Crash location map (2014 to 2018)

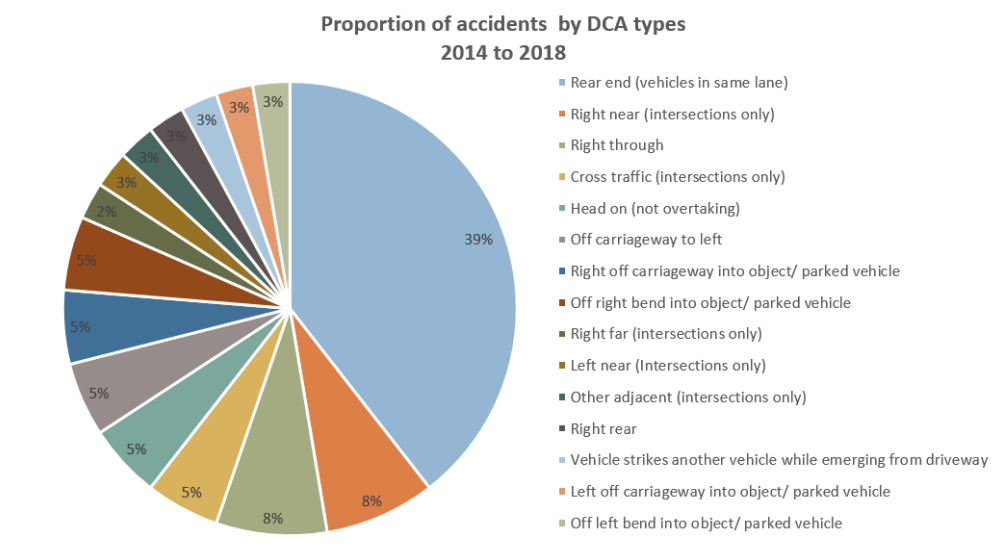


Figure 5.21 - Accident types recorded (2014 to 2018)

5.5 Public Transport

The area surrounding the Project is served by a series of bus routes and the Mernda and Hurstbridge metropolitan railway lines as shown in Figure 5.22. Key features of the local public transport network are discussed in the following sections.

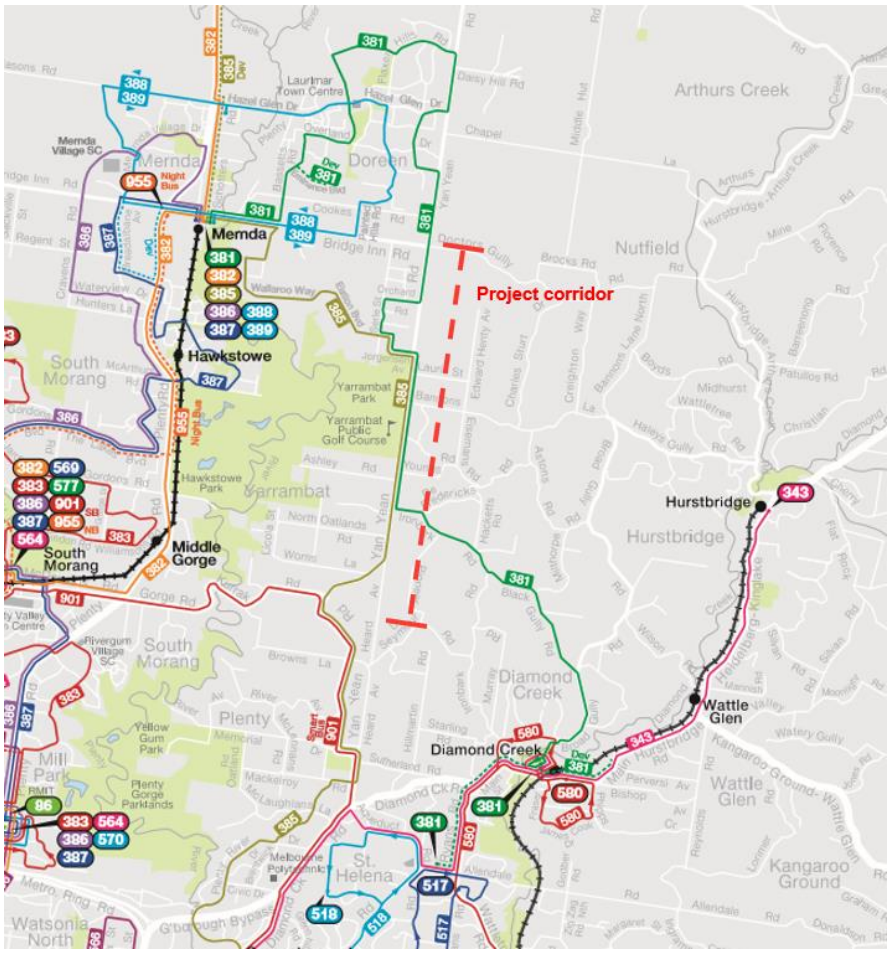


Figure 5.22 - Local public transport network

5.5.1 Rail Network

The two closest railway lines to the Project are the Mernda and Hurstbridge Metropolitan railway lines Figure 5.23).

The Mernda railway line runs parallel to and just over three kilometres to the west of the Project route, with the recently constructed Mernda, Hawkstowe and Middle Gorge stations providing the nearest points of rail access.

Peak services run at headways of approximately 6 to 8 minutes with a typical trip from Mernda to Flinders Street taking around 54 minutes. The bus route 381 and 385 provide public transport connectivity between the Project route and Mernda Station while access to Mernda Station by private vehicle is most directly gained via Bridge Inn Road at the northern end of the Project route.

The Hurstbridge railway line runs approximately 5 kilometres east of Yan Yean Road, with the line terminating approximately adjacent to the Ironbark Road intersection. The nearest stations (to the southern end of the Project) are Wattle Glen and Hurstbridge.

The frequency of the rail services on the two railway lines is summarised in Table 5.7.

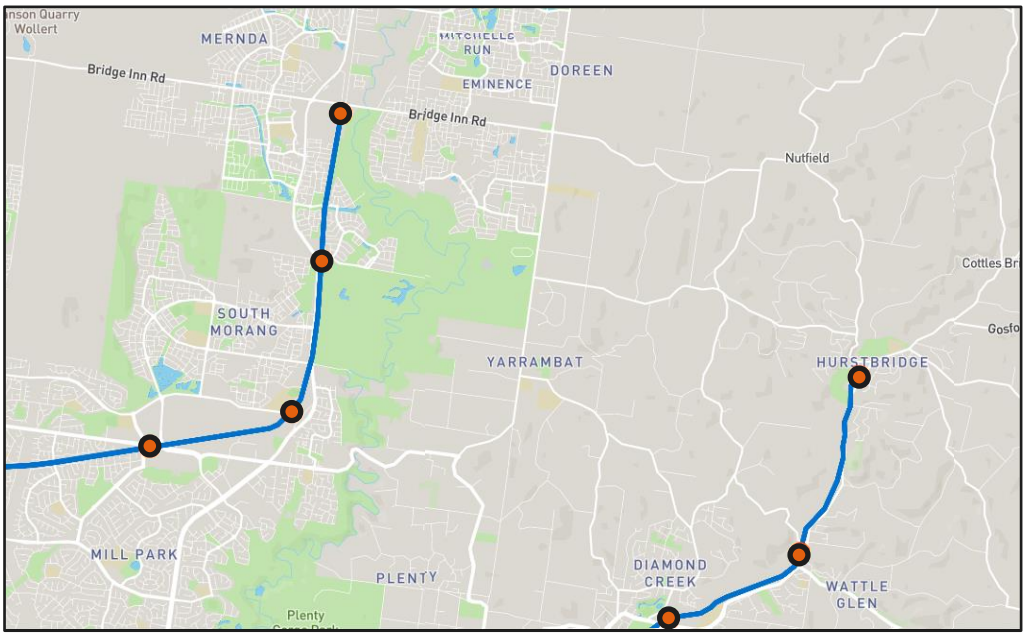


Figure 5.23 - Rail network

Table 5.7 - Rail Services and Frequency (Source: Public Transport Victoria Timetables, May 2019)

Line	Nearest Station	Direction	Number of Services[1]			
			AM Peak	PM Peak	Inter Peak	Off Peak
Hurstbridge	Diamond Creek	Southbound (to city)	4	2	11	11
		Northbound (from city)	2	4	12	15
Mernda	Mernda	Southbound (to city)	14	11	24	27
		Northbound (from city)	12	10	27	29

[1] AM Peak – 7 to 9AM, PM Peak – 4 to 6 PM, Interpeak – 9 AM to 4 PM, Off Peak – 6 PM to 7AM

5.5.2 Bus Network

The Project corridor is currently served by two public bus routes providing connectivity to Mernda, Diamond Creek Station and Greensborough:

- 381, Mernda Station to Diamond Creek Station; and
- 385, Greensborough to Mernda North

Several bus stops are located along Yan Yean Road providing access to bus services for the adjacent residential areas and schools as shown in Figure 5.24. Bus stops are generally indented (sealed, gravel, part of a left turn deceleration lane) and clear of traffic lanes.

During the morning and evening peaks, buses run along the corridor at a combined headway of around 15 to 20 minutes. The frequency of bus services and typical journey times from the Project corridor to the route destination are summarised in Table 5.8 below.

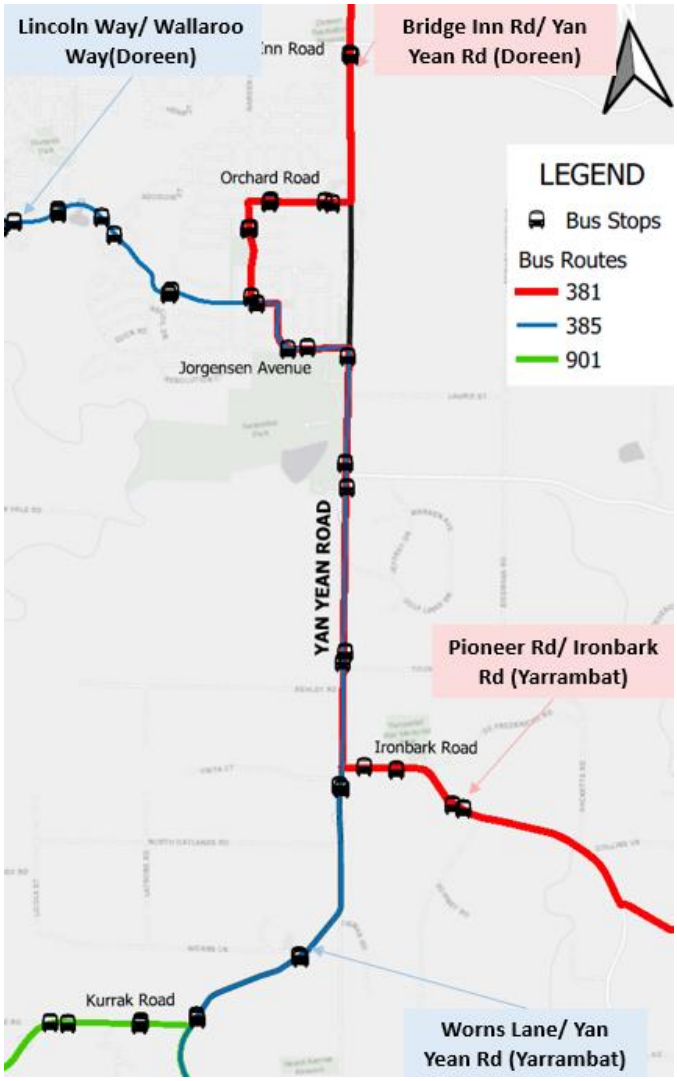


Figure 5.24 - Bus Stop Locations, Yan Yean Road

Table 5.8 - Bus Service frequency and journey time (Source: Public Transport Victoria Timetables, July 2019)

Route Number	Route Name	Direction	Number of Weekday Services				Journey time from Project corridor to end destination (mins)*
			AM Peak	PM Peak	Inter Peak	Off Peak	
381	Mernda Station to Diamond Creek Station	**Southbound** (to Diamond Creek Station)	3	3	10	9	16
		Northbound (to Mernda Station)	4	2	12	8	38
385	Greensborough to Mernda North	**Southbound** (to Greensborough)	6	7	12	12	25
		Northbound (to Mernda)	3	4	11	5	12

**Approximate journey time from Yan Yean Road, Bannons Lane bus stop, based on timetable*

5.6 Active Transport

5.6.1 Pedestrian Environment

Footpath Provision

There are only short sections of footpath for pedestrians and (school aged) cyclists off road at discrete locations along Yan Yean Road.

The short lengths of formal footpath are generally found in the vicinity of Plenty Valley Christian College (i.e. Orchard Road to Bridge Inn Road) and Yarrambat Primary School (i.e. around Ironbark Road, between North Oatlands Road and Youngs Road), typically to provide access to local bus stops and local residential areas.

Formal footpaths are provided along around 25 percent of Yan Yean Road, generally only on one side of the road, meaning that Yan Yean Road is not well utilised by active transport modes.

Informal paths

Additionally, there are several informal paths along Yan Yean Road (Figure 5.25), used occasionally by pedestrians, cyclists, and horse rider.

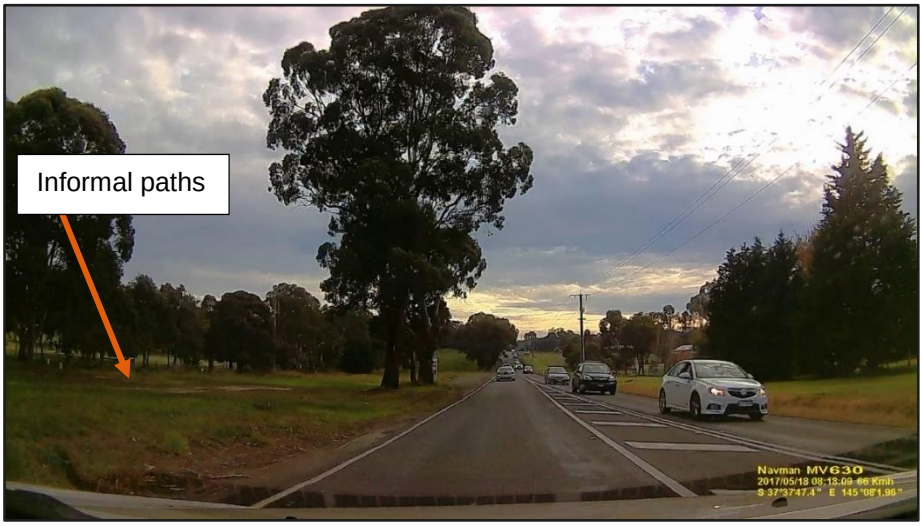


Figure 5.25 - Informal path, near Golf Links Drive

Pedestrian Crossings

There are limited formal pedestrian crossing points along Yan Yean Road, with:

- A school crossing located north of Orchard Road, serving Plenty Valley Christian College
- Pedestrian crossings on the south and east sides of the Yan Yean Road / Ironbark Road signalised intersection.

A school crossing is also located on Ironbark Road, approximately 120 metres east of Yan Yean Road.

5.6.2 Bicycle Network

Principal Bicycle Network

The Principal Bicycle Network (PBN) is a network of bicycle routes that provide access to major destinations in the Melbourne metropolitan area, developed by VicRoads in conjunction with local councils to guide investment in bicycle infrastructure and support cycling as a mode of transport.

As shown in Figure 5.25 below, the section of the Project route between Bridge Inn Road and Jorgensen Avenue is part of the PBN and provides connectivity north to Arthurs Creek and Yan Yean Reservoir and connects to the east-west running PBN along Bridge Inn Road with access to Mernda Station.

The Project route does not provide formal facilities for cycling on-road, even within the PBN section, and the narrow width of the road likely discourages its use by cyclists. Very few cyclists were observed along Yan Yean Road.

There is currently no connection of the PBN along the Yan Yean Road route (between Kurrak Road and Bridge Inn Road).

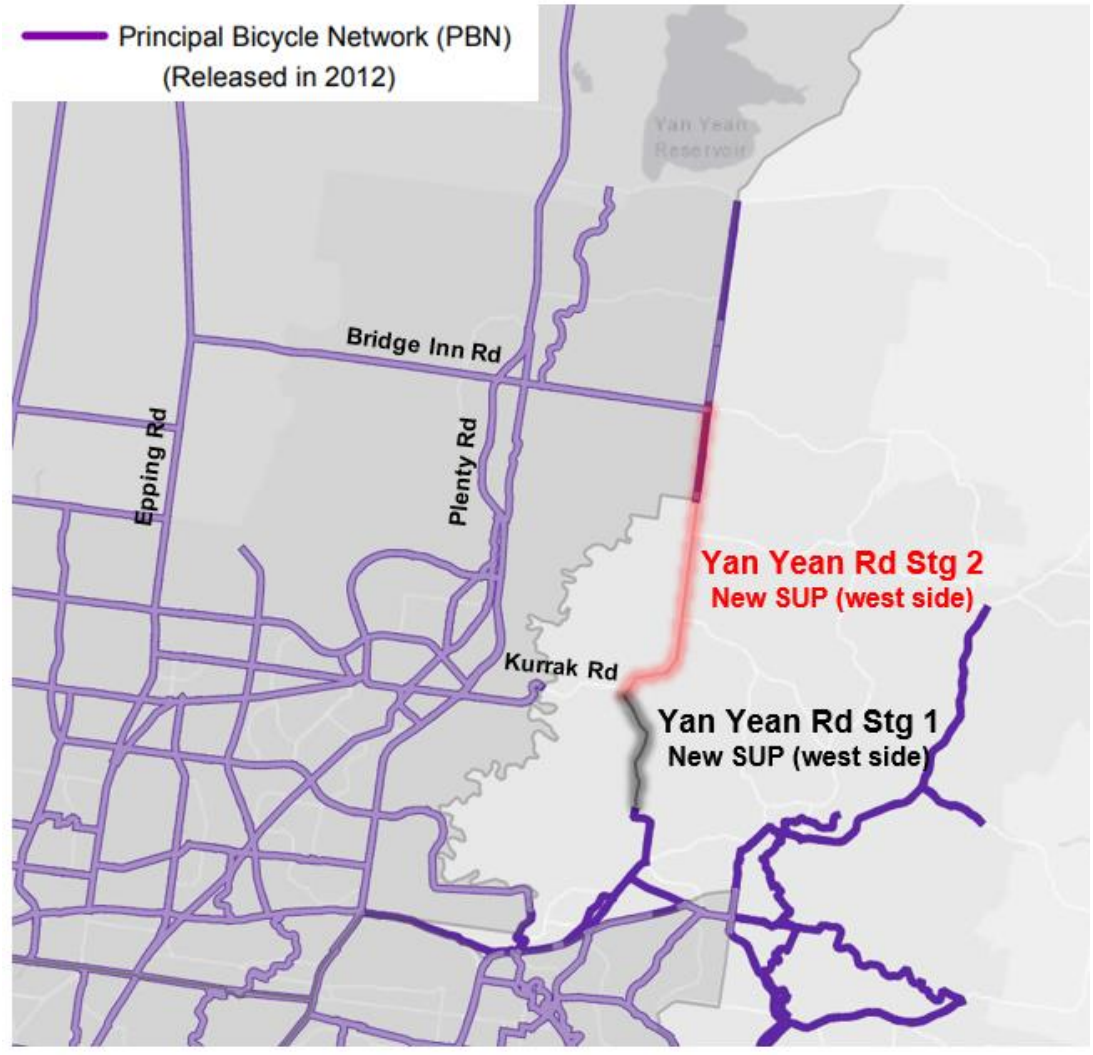


Figure 5.26 - Principal Bicycle Network (Source: VicRoads)

5.7 Movement and Place

The Movement and Place framework is utilised by VicRoads to assign future strategic vision to the transport network based on state-level transport and land use planning strategies.

Under Movement and Place, the road network is divided into transport links, with each link assigned a movement and place network classification that defines the strategic vision for that link. The various modes of transport are also assigned a category to define the role of the road for each mode. Place classifications are assigned to key activity nodes along the road as defined by State-level planning strategies and represent the future vision for a place.

Under the Movement and Place framework (Figure 5.27), Yan Yean Road is classified as an M3 road for "*Moderate movement of people and/or goods within a municipality*". Table 5.9 and Table 5-10 define the Modal and Place classifications along Yan Yean Road and how well each aligns with the current conditions along the route, based on a *rapid* Movement and Place assessment undertaken by MRPV.

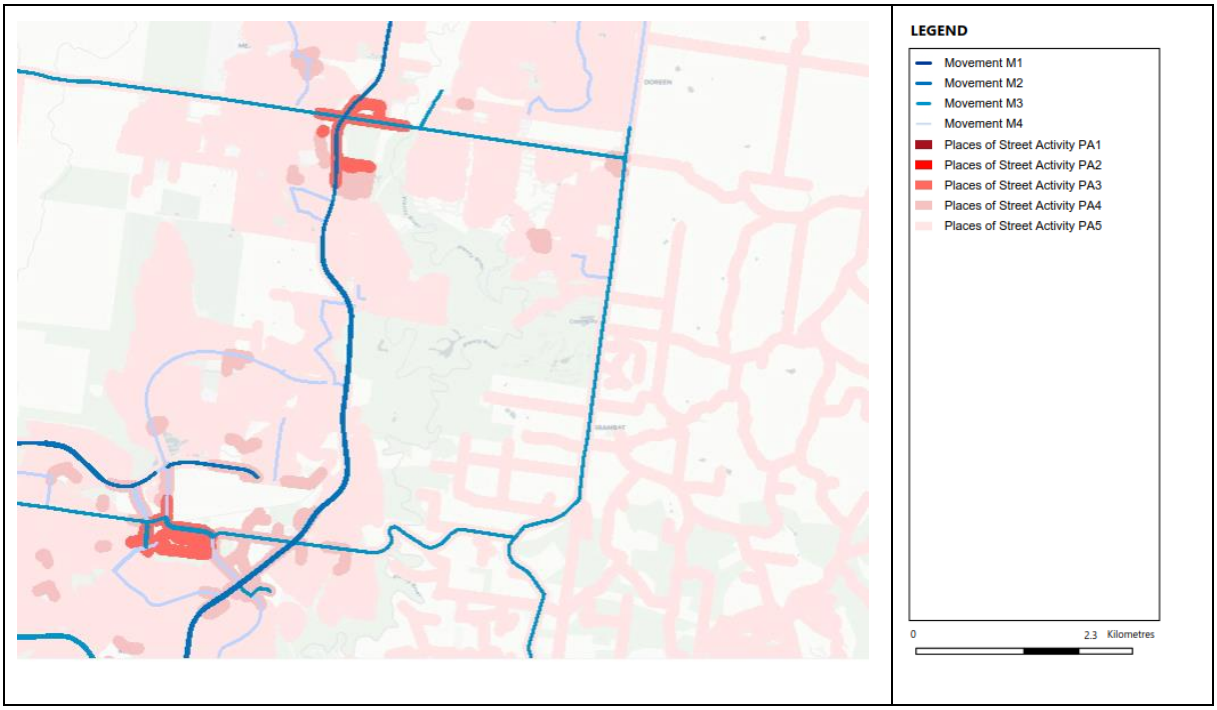


Figure 5.27 – Movement and Place Classification (Source: VicRoads VMaps mapping portal)

Table 5.9 - Modal classification along Yan Yean Road

Mode	Classification	Function	Alignment with function
General Traffic	GT3	Moderate movement of people on routes connecting municipalities.	Significant congestion noted at peak times.
Freight	F3	Freight access routes where provision for freight vehicles is important however freight is not a priority movement.	Significant congestion noted at peak times. Direct access and Right turns possible along length of route.
Buses	B2 / B3	Significant movement of people at moderate frequency. / Movement of people at lower frequency that provides primarily provides access to lower order places.	Significant congestion noted at peak times.

Mode	Classification	Function	Alignment with function
Cyclists	C2 (northern Section of Yan Yean Road Only)	Routes for cyclists that provide access to destinations and support cycling as transportation.	No separate cycling infrastructure present, no connectivity to shared use path currently under construction on Yan Yean Road south of Kurrak Road.

Table 5-10 - Place classification along Yan Yean Road

Classification	Land Use and Function	Place Objectives
P4 – Place of Neighbourhood importance People will travel from the adjacent community to access this place.	Convenience centre at intersection of Bridge Inn Road and Yan Yean Road, with food outlets and petrol station. A place of off-street activity.	Road environment should support access to this place, including via active transport. Road environment should align with the convenience centre's character and council's long-term vision for the site.
P5 – Place of Local importance	Residential land uses, the road is a destination for people accessing adjacent property.	Road environment should support access to residential properties. Road environment should include footpaths and cycling facilities to allow for access to properties and facilitate local connectivity. Road environment should align with local character.

5.8 Existing and growing transport need for the Project

5.8.1 Recent growth

Rapid population growth

Rapid recent population growth through the Northern Growth Corridor, and in particular through the City of Whittlesea and nearby suburbs, has led to the poor travel conditions experienced along Yan Yean Road, to the extent where the road is now at or exceeding capacity, and journey times are increasing and becoming more unreliable.

Table 5.11 summarises the rapid population growth over the past 10 years (to 2016) through nearby suburbs, the City of Whittlesea and for context, across Greater Melbourne.

The rapid expansion of suburbs served directly by Yan Yean Road, were key contributors to traffic growth along Yan Yean Road, with Doreen, South Morang and Mernda seeing a combined growth of nearly 50,000 people or 200 percent. Further, population growth in the wider Whittlesea community (+61 percent) was another key contributor to traffic growth.

Table 5.11 - Recent population growth

Area	2006	2016	Population Increase (%)
Local area			
Doreen	2,733	21,801	19,068 (698%)
South Morang	12,573	25,233	12,660 (101%)
Mernda	783	17,171	16,388 (2093%)
Plenty-Yarrambat	8,722	9,794	1,072 (12%)
Combined	*24,811*	*73,999*	*+ 49,188 (+198%)*
Wider area			
Nillumbik Shire	61,515	64,174	2,659 (+4%)
City of Whittlesea	128,491	207,058	78,567 (61%)
Greater Melbourne	3,760,760	4,714,387	953,627 (25%)

Source: Australian Bureau of Statistics, Regional Population Growth (Estimated Residential Population for ASGS Statistical Area Level 2, Local Government Area and Greater Capital City Statistical Area)

Recent traffic growth

The dramatic impact of population growth on traffic demands along Yan Yean Road is demonstrated in the historical traffic count data shown in Figure 5.28. The counts taken just south of Bridge Inn Road show a consistent upward trend between 2006 and 2017, with traffic volumes increasing by more than 150 percent from around 8,000 vehicles per day in 2006 to nearly 20,000 in 2017.

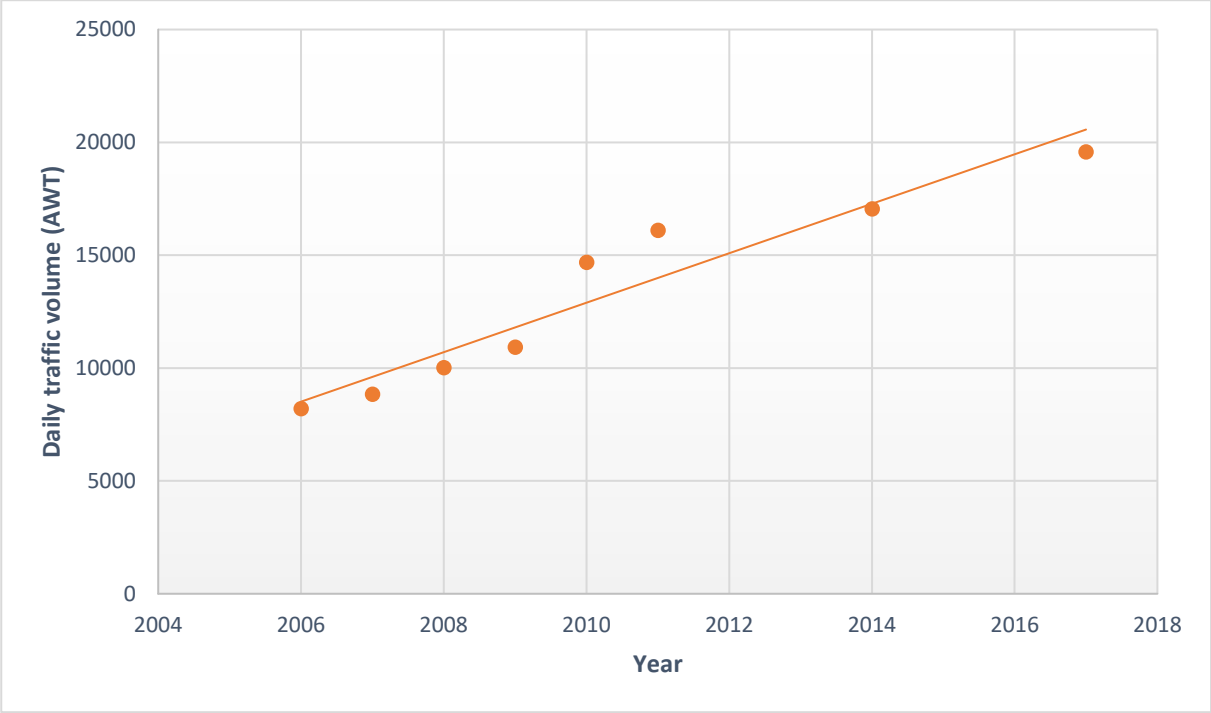


Figure 5.28 - Historical average weekday traffic, Yan Yean Road, south of Bridge Inn Road (Source: Whittlesea Council, MRPV)

5.8.2 Comparison against other duplication projects

To provide context surrounding the existing traffic conditions for the Project, it is useful to compare and rank key traffic data to other road duplication projects across the Melbourne metropolitan area, including:

- Daily traffic volumes
- Peak period operating speeds.

Comparing the Project to other duplication projects also provides a means of demonstrating the *relative* need for road improvements, based solely on existing conditions.

Daily traffic volumes

Table 5.12 compares the average weekday traffic volume of the Project against other previous and current road duplication projects (two-lane, undivided). The comparison considers the busiest single section from each project, excluding road segments with four or more lanes (i.e. which are not comparable to Yan Yean Road).

The Project exhibits one of the highest weekday volumes observed compared to all other equivalent sections of road duplication projects, suggesting that there is an existing need to improve the road, particularly when compared against other road duplication projects.

Table 5.12 - Average weekday volume comparison (recent road duplication projects)

Region	Road	Section	AWT (veh/day)
SE	Koo Wee Rup Rd	Green Hills Rd to Deep Creek	15,044
SE	Lathams Rd	Stephenson Rd to M'ton Peninsula Fwy	15,200
N	Craigieburn Rd	Mickleham Rd to Vantage Blvd	16,210
N	Bridge Inn Rd	Plenty Rd to Cookes Rd	16,999
SE	Lathams Rd	Titan Dr to Frankston-Dandenong Rd	17,575
N	Sunbury Rd	North of Batey Crt	18,080
W	Derrimut Rd	Dohertys Rd to Leakes Rd	20,989
SE	Koo Wee Rup Rd	Princes Freeway to Livestock Way	21,116
W	Leakes Rd	Palmers Rd to Fitzgerald Rd	21,276
W	Dunnings and Palmers Rd	The Strand to Princes Fwy	22,597
N	Epping Rd	Lyndarum Dr to Harvest Home Rd	23,642
W	Palmers Rd	North of Boundary Rd	23,870
SE	Thompsons Road	West of Lesdon Ave	23,964
N	***The Project***	***Yan Yean Rd, Ironbark Rd to Youngs Rd***	24,180
N	Plenty Road	South of Bridge Inn Road	25,134
N	Yan Yean (Stage 1)	Memorial Drive and Heard Ave	25,693

Peak period operating speeds

The average journey speed along Yan Yean Road was compared against other projects with comparable journey speed data. Comparisons using average speeds may be more subjective, but it does provide a useful means of comparing congestion and travel conditions.

Table 5.13 compares the average journey speed observed along Yan Yean Road, against other projects[1]. It demonstrates congestion along Yan Yean Road is as poor as many of the other locations, further highlighting a need for road improvements.

Table 5.13 - Average journey speed comparison

Duplication Project	Posted Speed (km/h)	Average Journey Speed (km/h)	
		AM (06:30 to 09:30)	PM (15:30 to 18:30)
Derrimut Rd (West)	60/80	44.5	27.0
Narre Warren Cranbourne Rd (SE)	60/70	41.3	32.1
Craigieburn Rd (North)	80	44.4	44.3
Bridge Inn Rd (North)	80	32.8	44.3
Koo Wee Rup Rd (SE)	80/90	76.2	71.5
The Project (Yan Yean Rd)	70	34.7	36.7
Sunbury Rd (North)	80/100	77.9	77.7
Lathams Rd (SE)	70	40.7	56.5
Epping Road (N)	60	20.9	23.2
Plenty Road (N)	80	48.8	38.1

Notes
* The average speed is based on the dominant direction of travel in each peak period
** Craigieburn Road summary is based on travel between Mickleham Road and Bridgewater Road

[1] Available data were filtered to exclude route lengths less than 2 kilometres and data significantly affected by road works and/or traffic management activities.

6 TRANSPORT RISK ASSESSMENT

The residual environmental risks identified for transport are provided in . The residual risk ratings consider the standard controls and proposed EPRs. The proposed EPRs are set out in Table 9.1 in Section 9.

The summary risk table displayed below illustrates the residual risks that rated as medium or higher after implementation of standard controls. The full Transport risk assessment is provided in Appendix D.

Table 6.1 – Transport environmental risk assessment register

RISK NO.	ASPECT	IMPACT PATHWAY	MITIGATION MEASURES TO INFORM ENVIRONMENTAL PERFORMANCE REQUIREMENT	EPR	RESIDUAL RISK RATING
CONSTRUCTION - SITE ESTABLISHMENT					
17	Transport - Active Users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders.	- To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails ○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users ○ Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Medium
18	Transport - Road Users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses).	- To mitigate impacts associated with construction activities on road traffic users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails ○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Medium

RISK NO.	ASPECT	IMPACT PATHWAY	MITIGATION MEASURES TO INFORM ENVIRONMENTAL PERFORMANCE REQUIREMENT	EPR	RESIDUAL RISK RATING
19	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections.	- A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions ○ Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. ○ At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Maintain community engagement with advance warning of changed access conditions	EPR TP2	Medium
CONSTRUCTION- EARTHWORKS					
37	Transport - Active Users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders.	- To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails ○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users ○ Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Medium

RISK NO.	ASPECT	IMPACT PATHWAY	MITIGATION MEASURES TO INFORM ENVIRONMENTAL PERFORMANCE REQUIREMENT	EPR	RESIDUAL RISK RATING
38	Transport - Road Users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses).	- To mitigate impacts associated with construction activities on road traffic users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails ○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users ○ Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Medium
39	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections.	- A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions ○ Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. ○ At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Maintain community engagement with advance warning of changed access conditions	EPR TP2	Medium
CIVILS AND STRUCTURES					
57	Transport - Active Users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders.	- Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on active transport users where possible. - To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails	EPR TP2	Medium

RISK NO.	ASPECT	IMPACT PATHWAY	MITIGATION MEASURES TO INFORM ENVIRONMENTAL PERFORMANCE REQUIREMENT	EPR	RESIDUAL RISK RATING
			○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users ○ Maintain community engagement with advance warning of changed traffic conditions.		
58	Transport - Road Users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses).	- Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on road users where possible. - To mitigate impacts associated with construction activities on road traffic users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders ○ Consider impacts on both formal and informal pedestrian access, paths and trails ○ At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. ○ Consider the needs of horse riders, in consultation with the Pony Club ○ Provide detour routes for affected active transport users ○ Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Medium
59	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections.	- Optimise the design in consultation with the appropriate road management authorities to allow construction completed in stages and reduce impacts on access where possible. - A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions ○ Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. ○ At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements ○ Maintain community engagement with advance warning of changed access conditions.	EPR TP2	Medium

RISK NO.	ASPECT	IMPACT PATHWAY	MITIGATION MEASURES TO INFORM ENVIRONMENTAL PERFORMANCE REQUIREMENT	EPR	RESIDUAL RISK RATING
REINSTATEMENT					
79	Transport - Road Users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections.	- Optimise the design in consultation with the appropriate road management authorities to allow construction completed in stages and reduce impacts on access where possible. - A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: ○ Minimise access restrictions ○ Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. ○ Consider crossing routes for kangaroos to avoid entrapment on the roadway and collision with vehicles ○ Include planned haulage routes for construction equipment and materials and where possible schedules these movements to occur at times that minimise impacts on other road users	EPR TP2	Medium
OPERATIONS					
99	Transport - Active Users	Local access movements are adversely impacted by the Project due to the design layout such as changes in permanent access to adjacent businesses, residential properties and local roads.	- To minimise the impact on road users, optimise the design in consultation with appropriate road management authorities, Nillumbik Shire Council and Whittlesea City Council to: ○ Design the road elements to meet relevant road and transport authority requirements ○ Where existing traffic movements are altered by the Project, ensure that alternative movements are incorporated into the design to the satisfaction of relevant road authorities.	EPR TP1	Medium

7 'NO PROJECT' IMPACT ASSESSMENT

This chapter outlines the forecast transport network performance in 2031 without the Yan Yean Road Stage 2 upgrade. The anticipated land use change (population and employment growth), transport network changes in the surrounding area and forecast traffic growth, travel speeds and functionality of Yan Yean Road are discussed in the following sections.

7.1 Land use change

The VITM land use projections are based on the Victorian State Government's official projections sourced from Victoria in Future (VIF) 2016 prepared by the Department of Environment, Land, Water and Planning (DELWP).

As outlined in Table 7.1, the population of the City of Whittlesea, to the north and western sides of the Project corridor, is expected to grow by close to 110,000 people or just over 50 percent between 2016 and 2031. This rate of population growth places Whittlesea amongst the five fastest growing municipalities in metropolitan Melbourne both in terms of actual population growth and annual pace of growth. Supporting this population growth, jobs within Whittlesea are similarly projected to grow at a rapid rate with over 47,000 created between 2016 and 2031, an increase of over 80 percent.

In contrast, more moderate growth is expected in Nillumbik Shire, to the eastern side of the Project corridor, as it sits outside of the urban growth boundary. Nillumbik's population is expected to grow by around 4,500 people or 7 percent between 2016 and 2031 with employment in the area growing by just over 3,000 jobs or 20 percent.

Table 7.1 - Projected population growth 2016 to 2031 by locality (VITM)

Locality	Change in Population 2016 to 2031	Change in Employment 2016 to 2031
City of Whittlesea	+ 107,400 (52%)	+47,300 (82%)
Nillumbik Shire	+4,600 (7%)	+3,100 (20%)
Metropolitan Melbourne	+1,404,500 (31%)	+851,100 (37%)

The growth in population for the region around the Project is shown Figure 7.1 based on the VITM travel zone structure. These projections highlight the extensive continued residential growth expected to occur in the suburbs of Doreen, Yarrambat, Mernda and South Morang which lie immediately adjacent to the north and west of the Project. A significant pocket of development is also expected further west in Wollert and Epping North.

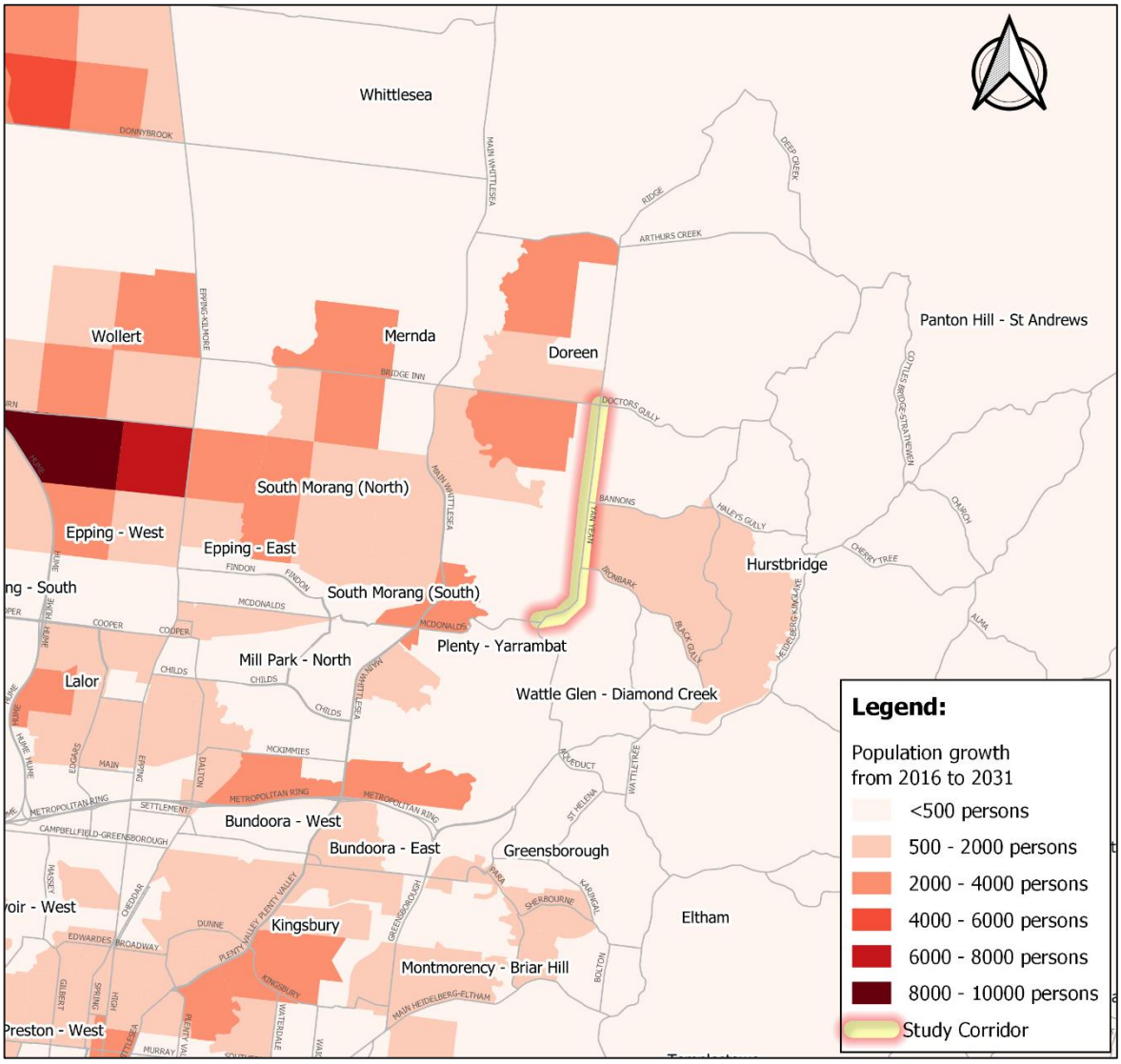


Figure 7.1 - Projected population growth between 2016 and 2031 (VITM)

The employment change heatmap shown in Figure 7.2 shows growth in employment in the local area most heavily concentrated on the Melbourne Market site and industrial land along Cooper Street in Epping and the La Trobe National Employment and Innovation Cluster in Bundoora and Heidelberg. Lower levels of employment growth are expected throughout the suburbs surrounding the Project including Doreen, Mernda and South Morang.

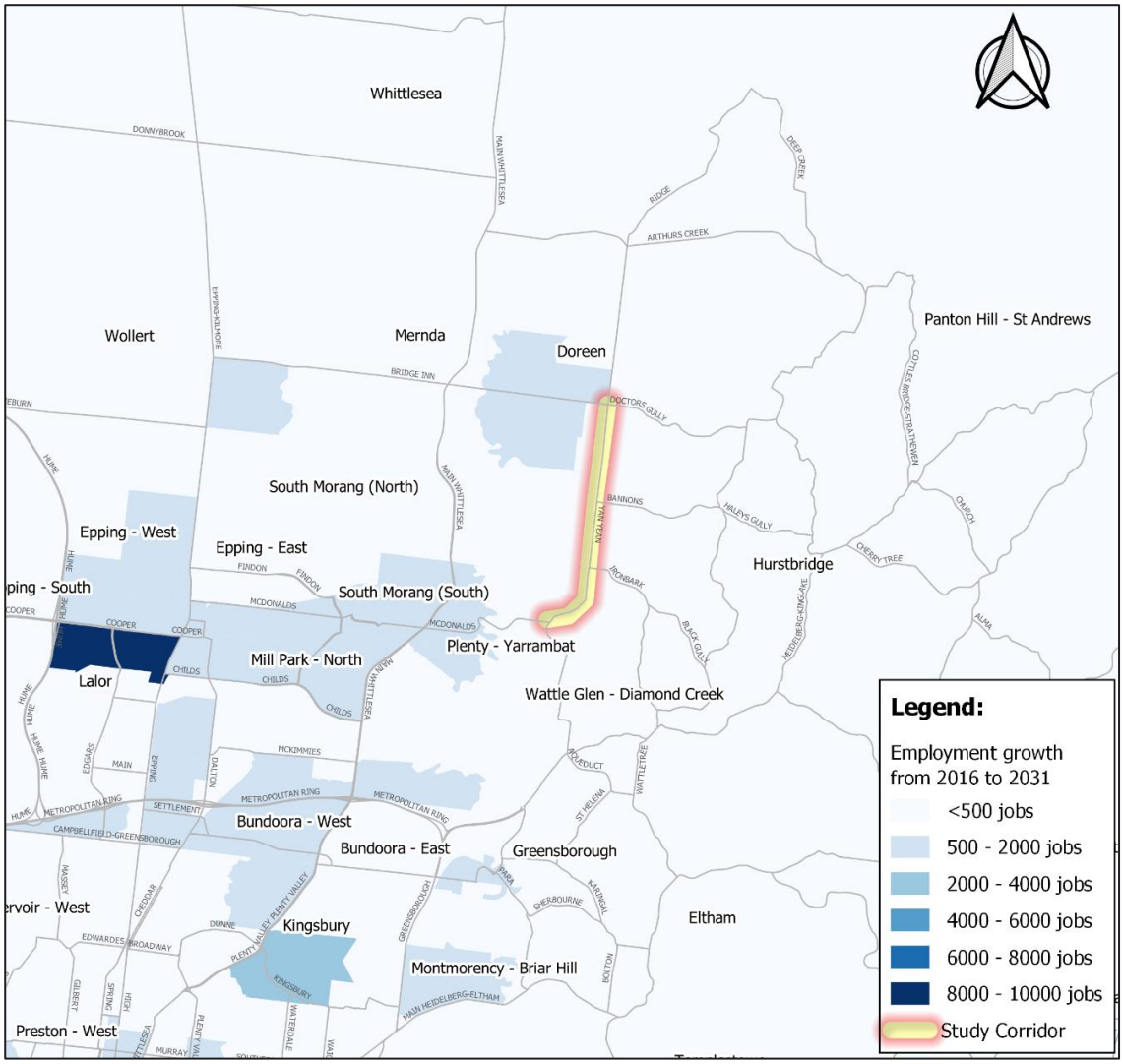


Figure 7.2 - Projected employment growth between 2016 and 2031 (VITM)

7.2 Changes to the transport network

Several network upgrades for the northern suburbs of Melbourne are assumed to occur between the base year of 2016 and 2031 and are included in the reference case transport networks in VITM. Some of these have recently been completed or been the subject of State Government commitments, while others are considered likely to occur in the timeframe. Key network changes in the area surrounding the Project shown in Figure 7.3, including:

- Widening to provide additional lanes on Childs Road in Mill Park, Epping Road in Epping and Bridge Inn Road in Mernda and Doreen as part of the Northern Roads Upgrade project
- Upgrade to Findon Road including widening between Epping Road and Ferres Boulevard and extension to Plenty Road.
- Stage 1 and Stage 2 widening to provide additional lanes on Plenty Road between McKimmies Road and Bridge Inn Road.
- The Stage 1 widening of Yan Yean Road to provide additional lanes between Diamond Creek Road and Kurrak Road (Opened in 2019).
- Mernda Rail Extension including extension of the railway line between South Morang and Mernda and new stations at Middle Gorge, Hawkstowe and Mernda (Opened in 2018).
- Hurstbridge Rail Line upgrade.
- M80 Upgrade.
- North East Link which will provide a freeway standard link between the M80 Ring Road terminus at Greensborough Highway and the Eastern Freeway including twin tunnels.

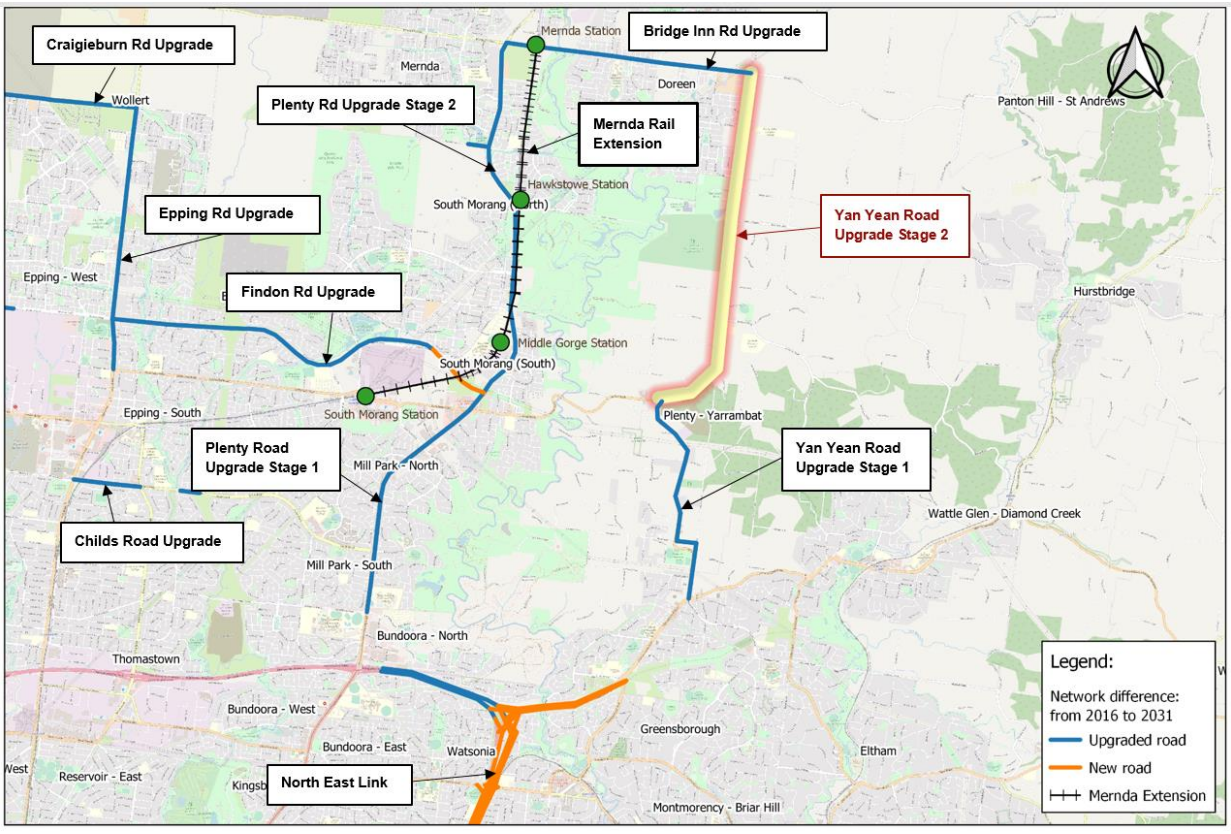


Figure 7.3 - Transport network changes between 2016 and 2031 (VITM)

7.3 Network assessment

A series of traffic forecasting outputs have been extracted from VITM to understand the anticipated impact of population growth, land use development and surrounding projects on local transport network traffic flows in the absence of the Project (i.e. Yan Yean Road to remain with a single lane in each direction between Kurrak Road and Bridge Inn Road but other projects to continue as planned).

7.3.1 Traffic volumes

The traffic volume difference plot in Figure 7.4 shows graphically the forecast traffic growth throughout the transport network between 2016 and 2031 ‘no Project’.

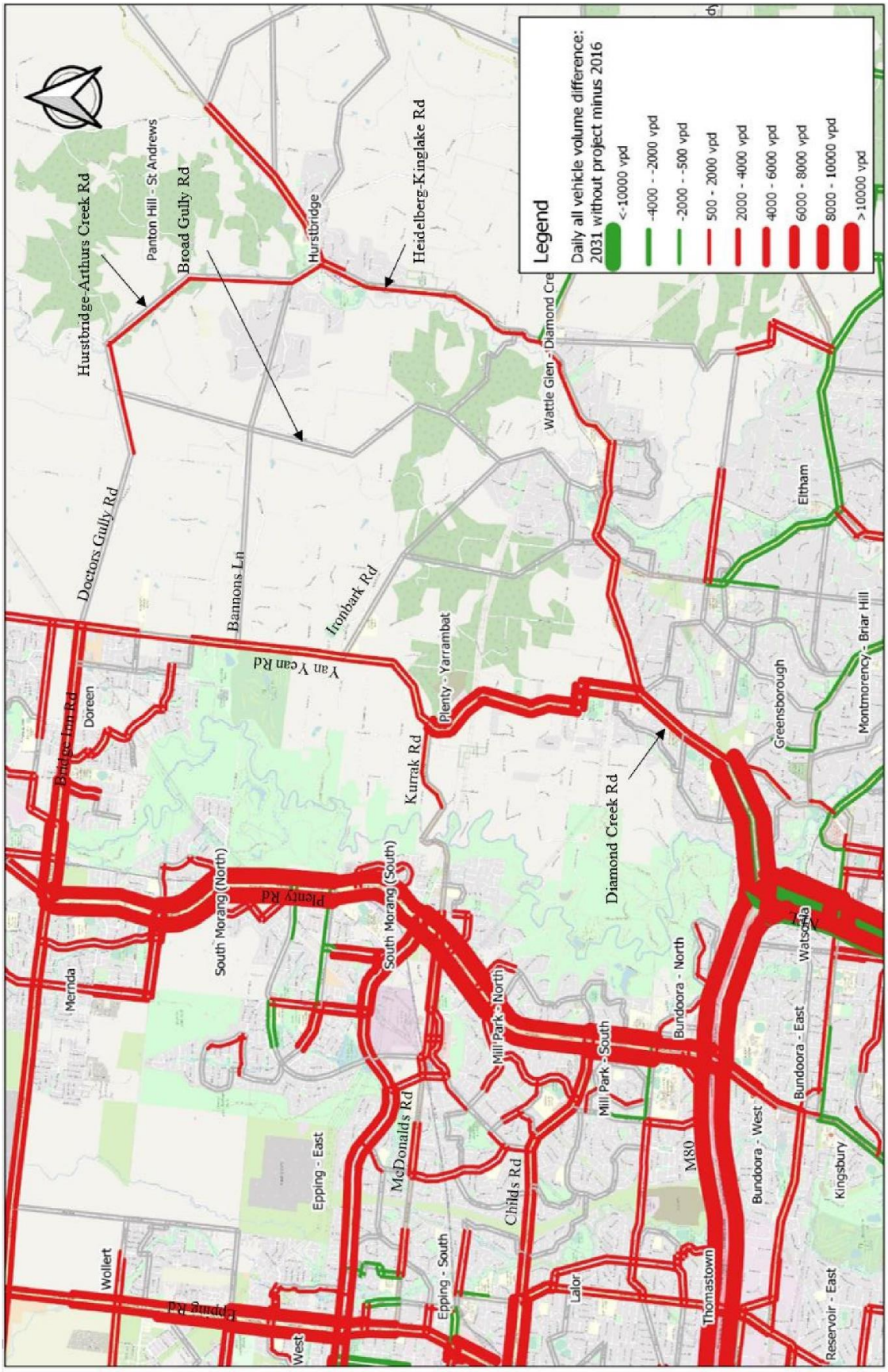


Figure 7.4 - Modelled change in daily traffic volumes between 2016 and 2031 without Project (VITM)

The forecast change in traffic volumes to the year 2031 (without the Project in place) demonstrates a significant increase in traffic throughout the local region with the following notable effects:

- The rate of land development sees significant growth in traffic volumes forecast along key north-south routes through the City of Whittlesea, with the upgraded sections of Epping Road and Plenty Road attracting significant traffic increases for north-south travel.
- Similarly, the attractiveness of the upgraded section of Yan Yean Road south of Kurrak Road (i.e. Stage 1 upgrade) shows a significant increase in traffic as traffic routes around the congested section to the north via Kurrak Road and Plenty Road to take advantage of the additional capacity and improved travel times through this section.
- Continued traffic growth is forecast on Yan Yean Road between Kurrak Road and Bridge Inn Road. Existing congestion levels are exacerbated and capacity is reached through peak travel demand periods meaning there is less capacity to accommodate growth seen on adjacent north-south routes like Plenty Road and Epping Road.
- The limited capacity available on Yan Yean Road results in traffic being forced down Plenty Road and more rural roads in the Shire of Nillumbik such as Doctors Gully Road, Hurstbridge-Arthurs Creek Road and Heidelberg Kinglake Road.
- Development of Mernda and Doreen sees east-west traffic increases along Bridge Inn Road
- Notable traffic increases are forecast along the upgraded Metropolitan Ring Road, Greensborough Highway and Diamond Creek Road as traffic accesses the North East Link to continue southward towards the Eastern Freeway.

7.3.2 Use of Yan Yean Road

Select link analysis is a demand analysis technique used in transport modelling to provide information on the origin and destination of traffic that uses a section of road. The select link analysis plot shown in Figure 7.5 below provides a graphical representation of the origins and destination of modelled AM peak vehicle trips passing through the Project corridor under the 2031 ‘no Project’ scenario. The thickness of the blue line represents the relative magnitude of vehicle trips along each route.

As outlined above, the existing congestion levels currently experienced along Yan Yean Road are expected to be exacerbated due to continued population growth under forecast 2031 ‘no Project’ conditions and there is limited capacity available for traffic growth. The select link analysis shows that Yan Yean Road is forecast to predominately be used by residents within the surrounding suburbs of Doreen, Mernda and South Morang. The corridor is shown to provide those residents with access to the Metropolitan Ring Road, North East Link and employment opportunities at Greensborough, Bundoora and the La Trobe NEIC. The Project corridor is also utilised for access to and from Ironbark Road for its connectivity to Ryans Road, Wattletree Road and Eltham activity centre.

Figure 7.5 - Select Link Analysis (Yan Yean Road Project corridor), 2031 without Project – AM peak (VITM)

7.3.3 Network performance

Network travel speeds for the road network surrounding the Project have been extracted from VITM to provide an understanding of the forecast level of congestion expected by the year 2031. Figure 7.6 and Figure 7.7 show the modelled change in travel speed on the arterial network between 2016 and 2031 ‘no Project’ for the AM and PM peaks respectively.

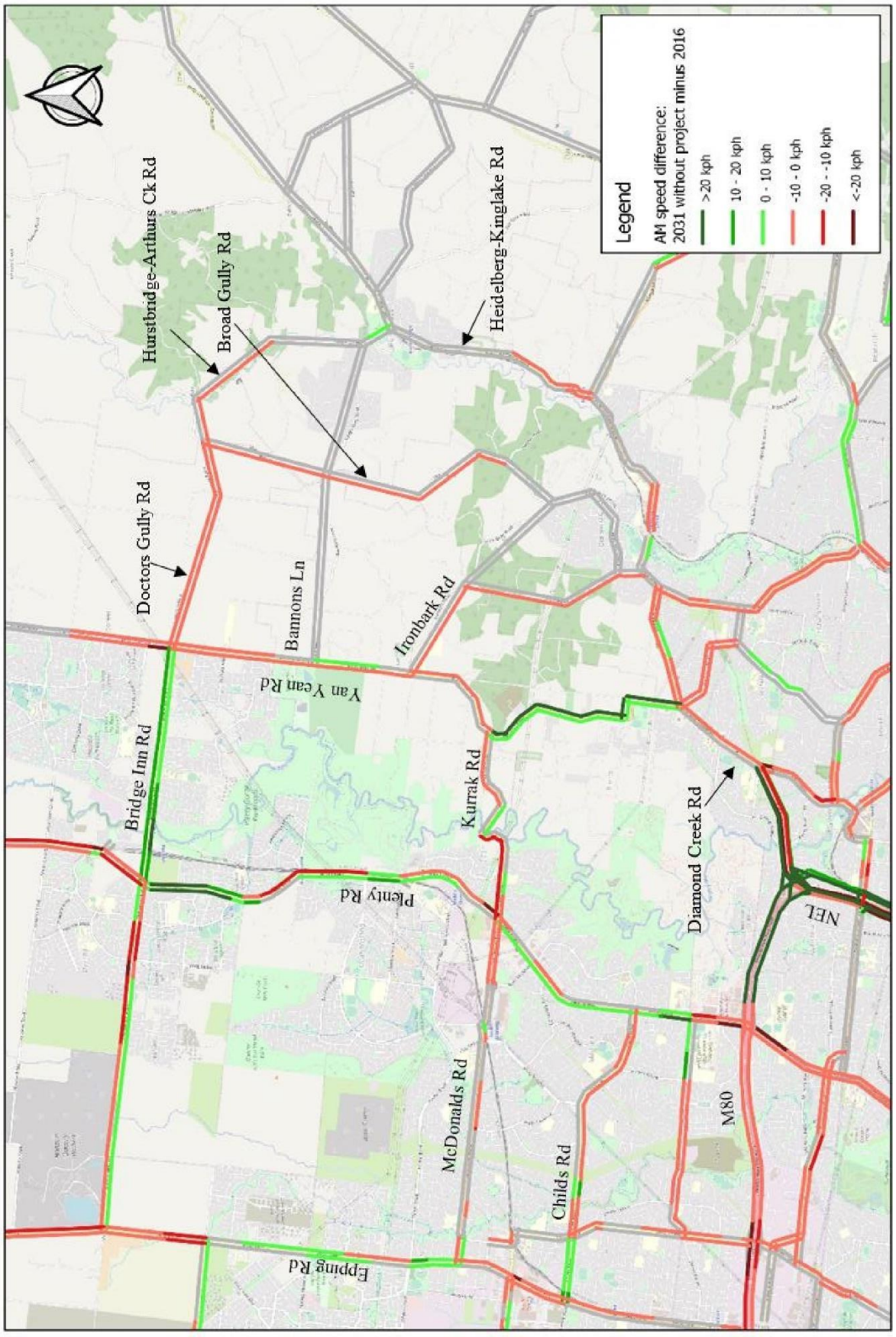


Figure 7.6 - Modelled change in travel speed between, 2016 and 2031 without Project– AM peak (VITM)

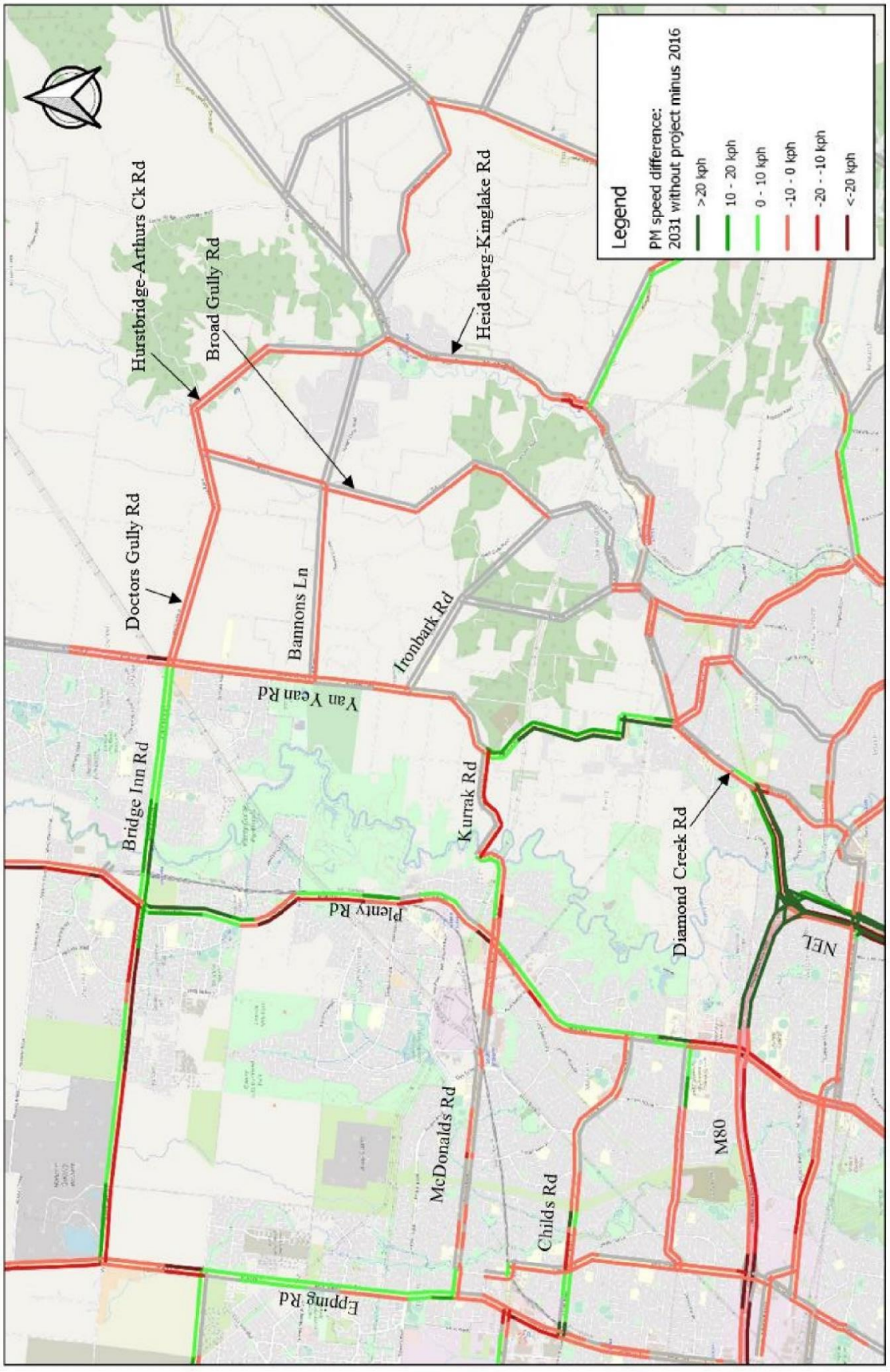


Figure 7.7 - Modelled change in travel speed between, 2016 and 2031 without Project– PM peak (VITM)

The following key observations can be made from the forecast travel speed data:

- The travel speed change plots shown in Figure 7.6 and Figure 7.7 incorporate the effects of the surrounding road network upgrades outlined in Section 7.2 above and an improvement in speeds is seen on upgraded routes including Yan Yean Road Stage 1, Bridge Inn Road and the area around the Metropolitan Ring Road and North East Link.
- The non-peak direction of alternate north-south routes in Plenty Road and Epping Road see an improvement in travel speeds with upgrades to these routes in place. The peak directions, however, (i.e. southbound in the AM peak and northbound in the PM peak) show a deterioration in travel speeds through key sections between 2016 and 2031 due to additional traffic growth and demands for north-south travel.
- A deterioration in travel speeds is notable along the Project corridor in both directions, even with improved capacity on alternative north-south routes. Further detail on the performance of the Yan Yean Road corridor in terms of level of service and delay under the 2031 ‘no Project’ scenario is provided below based on intersection performance analysis.

7.4 Corridor assessment

7.4.1 Forecast volumes

Table 7.2 summarises the existing and the forecast traffic demand volumes under the 2031 'no Project' scenarios, for the AM and PM peak hours. Along the busiest section of the corridor, north of Ironbark Road, the traffic demand is expected to increase by between 30 to 40 percent in the peak direction of travel, and by 20 to 30 percent in the counter-peak direction. In reality, and as demonstrated in the intersection performance analysis results below, the forecast traffic demand under the 'no Project' scenario is constrained by the existing infrastructure in place.

Table 7.2 - 'No Project' forecast volumes and traffic growth

Midblock Section (Traffic Scenario)	AM peak hour		PM peak hour	
	NB	SB	NB	SB
Bridge Inn Road				
2017 Existing	693	840	806	753
2031 No Project*	927	1,170	1,271	917
Orchard Road				
2017 Existing	712	862	945	718
2031 No Project*	767	1,306	1,251	882
Jorgensen Ave				
2017 Existing	674	1,043	1,247	806
2031 No Project	792	1,541	1,696	987
Bannons Lane				
2017 Existing	663	1,069	1,326	768
2031 No Project	789	1,527	1,747	979
Growth Factor	1.19	1.43	1.32	1.27
Ironbark Road				
2017 Existing	608	881	1,231	632
2031 No Project	785	1,215	1,581	779
North Oatlands Road				
2017 Existing	598	843	1,213	644
2031 No Project	716	1,261	1,486	762
Project boundary, north of Kurrak Road				

7.4.2 Traffic operation

To assess the Project corridor performance in more detail, a SIDRA model was developed for the 2031 'no Project' scenario. SIDRA is a micro-analytical traffic evaluation tool which models intersection delay at an individual intersection level.

The assessment was based on two traffic measures, namely:

- Operating speeds along the corridor
- Intersection performance, based on the average time delay experienced by each vehicle

Operating speeds

Table 7.3 summarises the estimated operating speeds for all road-based travel under the 2031 'No Project' peak hour scenario. Existing conditions survey data from 2017 is provided for context. There are several important considerations required when interpreting these modelling results, namely:

- The northbound and southbound route summaries are based on throughput, and not the total demand and may therefore be an overestimate of travel speeds
- The "corridor" estimate is based on SIDRA "network" results and considers both directions of travel plus delays experienced at all side roads modelled. While not directly comparable to data that can be surveyed on site, this performance measure has been included to provide an appreciation of the overall performance of the road for all traffic (including side roads) which can be compared against the Project case in section 8.4.2.

Traffic performance is expected to deteriorate significantly under this demand scenario, with the average travel speeds likely to drop to or below 20 km/h in the peak direction of travel. In the counter-peak directions, average speeds are likely to decrease by around 10 to 20 km/h on average.

Table 7.3 - Average operating speeds ('No Project', AM and PM peak hour)

Direction	AM Average Speed (km/hr)		PM Average Speed (km/hr)	
	2017 Survey	2031 'No Project'	2017 Survey	2031 'No Project'
Northbound	50	41	34	21
Southbound	30	18	52	26
Corridor*	-	14	-	14

* Corridor estimate based on SIDRA "network" results, and considers delays on side road

Intersection performance

Intersection operation is one of the governing factors in overall network performance and is key to understanding the average operating speeds described above.

Intersection operational performance was based on the *average vehicle delay* and summarised using the corresponding Level of Service (LoS), using the Austroads definitions outlined in Table 7.4. Level of Service categories range from a LoS A, representing excellent conditions with minimal delays, to a LoS F, representing oversaturated conditions where the road is over capacity.

For the purpose this assessment, the average delay LoS is reported for each approach and for the intersection as a whole (i.e. the average of all approaches).

Table 7.4 - Intersection level of service definition

Level of Service	Average Delay per Vehicle (sec/veh)		
	Give Way/Priority	Traffic Signals	Roundabouts
A	d ≤ 10	d ≤10	d ≤ 10
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 < d ≤ 55	35 < d ≤ 50
E	35 < d ≤ 50	55 < d ≤ 80	50 < d ≤ 70
F	50 < d	80 < d	70 < d

Source: Austroads (2017)

Figure 7.8 summarises the 2031 AM and PM peak intersection performance with 'no Project' based on "networked" intersection models, to represent the impacts of bottlenecks along the route which may constrain the traffic volumes passing through to downstream intersections.

During the AM peak, with the dominant direction of travel being southbound, key intersections at Bridge Inn Road and Ironbark Road are forecast to operate very poorly and over capacity, at a LoS F.

Priority-controlled intersections along the route are also expected to perform poorly. For example, the minor approach of Jorgensen Avenue, is expected to operate at a LoS F, suggesting motorists egressing these residential areas will find it difficult to find suitable gaps in traffic along Yan Yean Road. This applies to all local roads and connections, including access to the golf course and Yarrambat Park.

During the PM peak, with the dominant direction of returning commuter trips being northbound, each of the key three intersections (i.e. the two roundabouts and the traffic signals) are forecast to operate very poorly. The intersections of Yan Yean Road with Bridge Inn Road and Ironbark Road are estimated to operate over capacity, at a LoS F. The Orchard roundabout is expected to perform poorly overall (LoS F), with the dominant movement on the south approach operating at a LoS F; this is significant in itself, given that this movement is not opposed by much traffic.

Egress from local side roads via priority-controlled intersections will continue to be difficult during the PM peak, even though the overall number of egressing trips are generally expected to be lower than the AM peak.

Jorgensen Avenue will become more attractive for "rat-running", as commuters attempt to avoid some of the congestion along Yan Yean Road (regardless of whether or not the intersection is upgraded under the blackspot program).

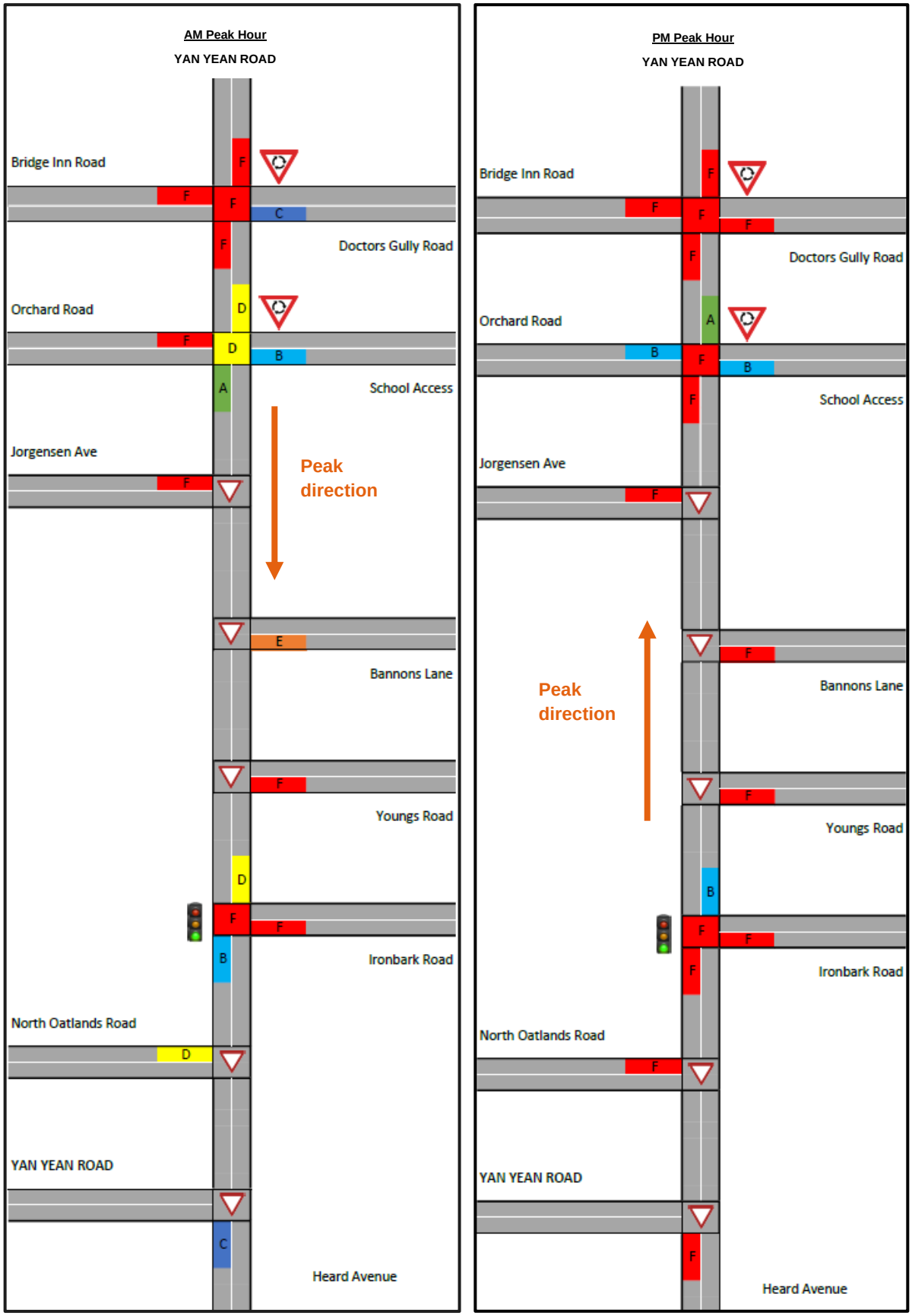


Figure 7.8 - Intersection performance, 2031 AM, PM 'No Project' scenario

7.4.3 Public transport impact

Bus travel is the primary form of public transport along Yan Yean Road, providing transport to local schools and to metropolitan rail services, and wider transport between Greensborough and Mernda.

Under the “business-as usual” or ‘no Project’ scenario, there are no upgrades proposed for bus travel. Accordingly, the performance of bus travel is expected to deteriorate similarly to road-based travel. Bus travel times are likely to increase significantly, particularly during the peak periods and in the peak direction travel, with journey times becoming more variable. This is likely to adversely impact bus operations, timetabling, frequency and performance objectives.

7.4.4 Active transport impact

Existing provision for active transport along Yan Yean Road is poor, with very limited pedestrian or cycling infrastructure provided. Movements across Yan Yean Road are generally uncontrolled, except around schools.

Under the ‘no Project’ scenario, with no infrastructure upgrades proposed for pedestrian, cyclists or equestrians, conditions will likely deteriorate, particularly when crossing Yan Yean Road, and discourage active transport in the area.

7.4.5 Road safety

Road safety is likely to decline under the 2031 ‘no Project’ scenario for the following reasons:

- As outlined in Section 7.4.2, forecast increases in traffic are expected to bring about a deterioration in intersection performance along the corridor. For road-based transport, an increase in traffic volumes and congestion may lead to increase in crashes at the many priority-controlled intersections and local accesses along the corridor, particularly where right turning vehicles accept less appropriate gaps in traffic.
- An increase in the number of accidents is also likely at the Bridge Inn Road and Orchard Road roundabouts, also caused by motorists accepting less appropriate gaps in opposing traffic flows where heavy congestion occurs.
- The prevalence of rear-end type collisions, already the most common type of accident in the corridor, would also be expected to increase with generally higher levels of congestion and stop-start conditions.
- The lack of barriers, shoulders, auxiliary lanes, provisions for over-taking on a roadway used by increasing volumes of traffic increases the likelihood of the more serious head-on and run-off road type crashes
- As the area continues to develop, increasing volumes of pedestrians would be expected attempt to cross the road at various locations. The lack of controlled crossing points and increased traffic volumes will make crossing movements increasingly difficult to make safely.
- For the small number of on-road cyclists, the high volume of traffic and increased congestion coupled with the poor infrastructure (i.e. no bicycle lanes, the narrow or non-existent road shoulders) may result in an increase in the number of collisions.

8 'WITH PROJECT' IMPACT ASSESSMENT

This chapter assesses the impacts of the Project at the broader transport network level and along the Project corridor. In line with the Scoping Requirements, the network assessment considers geographic change in traffic volumes, changes to travel times and accessibility by comparing modelled conditions under the 'with Project' and 'no Project' scenarios. The corridor assessment examines the operational performance of the design, changes to access for the local community, road safety and connectivity for pedestrians and cyclists.

8.1 Project design

The Project consists of a road duplication between just north of Kurrak Road to Bridge Inn Road (Figure 8.1), including significant intersection improvements at eight key locations.

It connects with the recently completed Yan Yean Road Stage 1 Upgrade to the south, and the Bridge Inn Road Upgrade to the north and west (part of the Northern Roads Upgrade Program).

Figure 8.1 - The Project scope (Source: https://your.roadprojects.vic.gov.au/yan-yean-road-stage-2 (amended))

The current design has evolved to reduce the overall design footprint thereby:

- reducing environmental impacts, vegetation removal and land acquisition
- reducing the impact to abutting properties, whilst
- meeting safe system principles.

Key features of the proposed upgrade include:

- A design and posted speed of 70 km/h (V70)
- A cross section (Figure 8.2) that generally matches and ties in with the cross section for Stage 1 (Diamond Creek Road to Kurrak Road)
- A narrow 2.2-metre painted central median with a continuous safety barrier running along its entire length
- Safety barriers on the outer side of both carriageways where applicable
- Intersection upgrades at eight key locations

- A new Shared User Path (SUP) on the west side and a new footpath on the east side
- Auxiliary lanes for left turns (and where relevant, right turns) into all intersections, including minor, priority-controlled intersections which addresses the safe system approach considerations. Separating turning traffic from through movements helps to reduce the number of rear end collisions by allowing turning vehicles to decelerate away from the through lane, whilst maintaining the road capacity.

Direct access to abutting properties is generally controlled to prohibit right turns in or out. U-turn facilities have been provided for at key intersections.

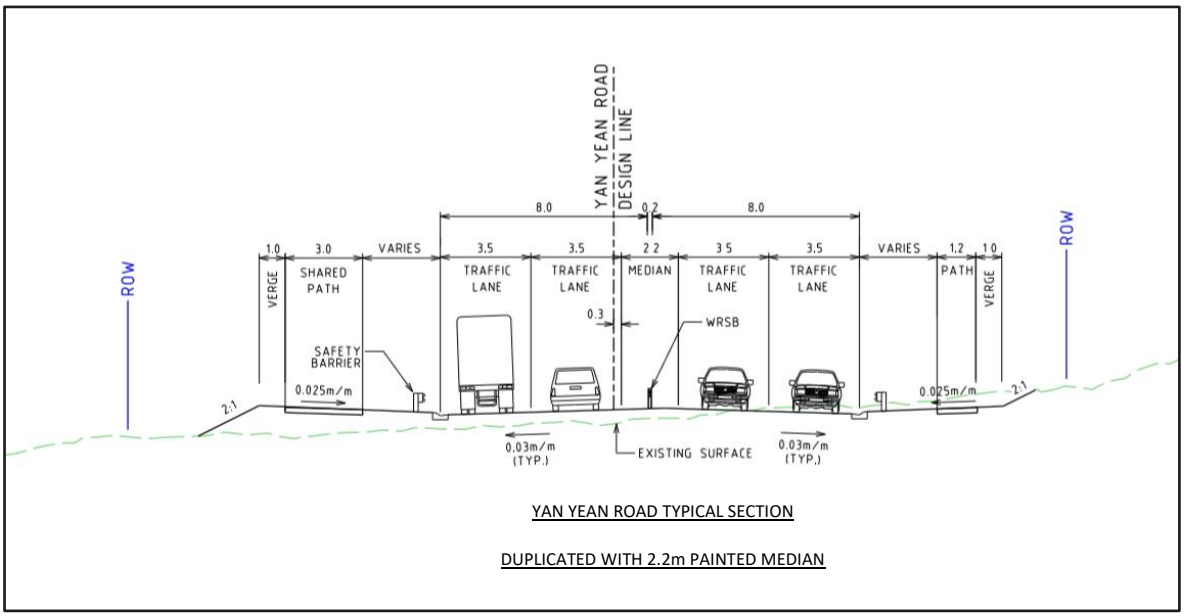


Figure 8.2 - Yan Yean Road Upgrade, typical cross section

8.2 Access impact assessment

8.2.1 Local access impact

Road duplication projects improve the safety and efficiency of traffic movements, through appropriate levels of access control, acknowledging the needs and use of adjacent land.

The Safe Systems approach requires, amongst many other elements, a continuous safety barrier in the central median, along the length of the corridor. The central safety barrier improves safety, but also affects local access by prohibiting uncontrolled right turning movements.

Accordingly, the predominant access impact of the Project is an increase in travel distance and time incurred by local traffic, by limiting direct property access and local road access to left in and left out traffic movements only. Most existing right turn movements (banned under the Project) will be redirected to use a U-turn facility either at an intersection or at one of the mid-block facilities provided, or via an alternative route.

The provision of U-turn facilities is key for access to adjacent land and local roads. Signalised intersections provide opportunities for passenger cars, while roundabouts are suitable for rigid and articulated vehicles (semi-trailers).

Table 8.1 summarises the Project provisions for U-turning movements, including suitability for various types of vehicles.

Table 8.1 summarises:

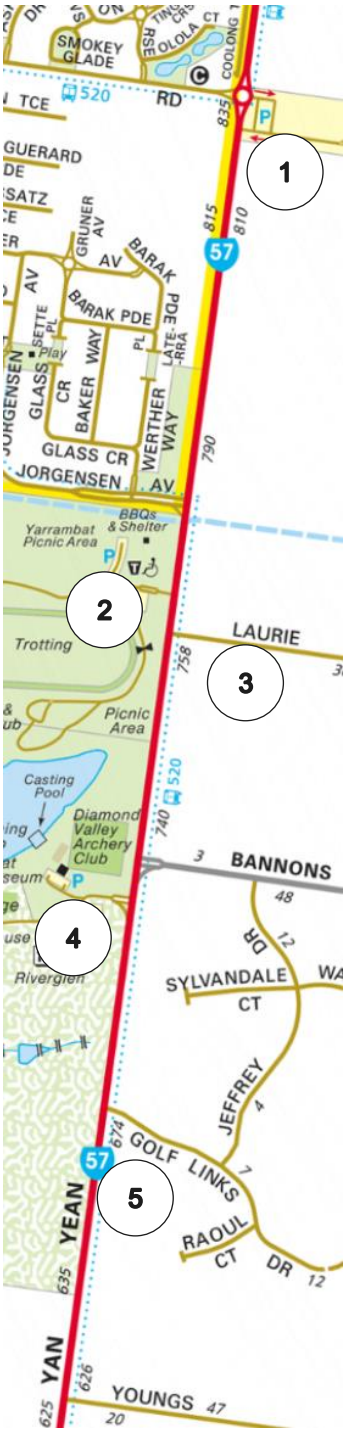
- the key local accesses and movements affected by the Project
- the number of existing traffic movements affected during the peak periods
- the corresponding distance to the next U-turn facilities required to undertake the restricted movement.

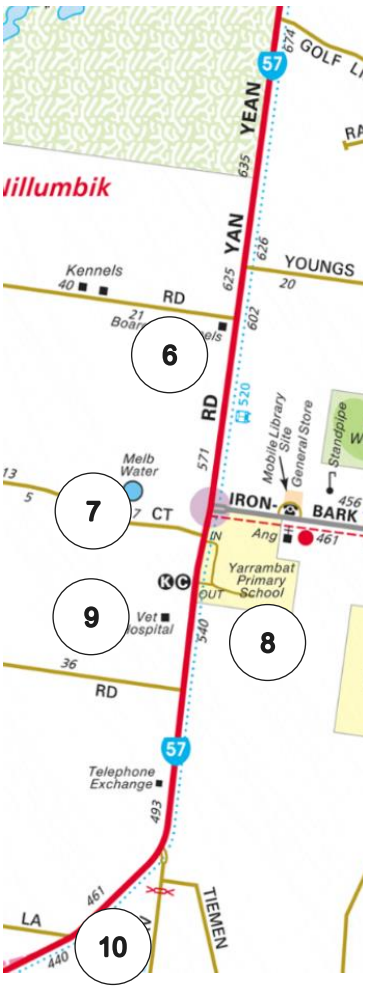
Direct access to land will also be affected, with right turn movements generally prohibited.

Table 8.1 - Project U-turn Provision

U-turn facility	Approach	Suitable for	Distance to next U-turn opportunity
Bridge Inn Rd Signals	North	Cars only	800m (Orchard Rd)
	South	Cars only	400m (via Cookes Rd)
Orchard Rd Signals	North	Cars only	730m (Jorgensen Ave)
	South	Cars only	800m (Bridge Inn Rd)
Jorgensen Ave Signals	North	Cars only	650m (Bannons Lane)
	South	Cars only	730m (Orchard Rd)
Bannons Lane Signals	North	Cars only	980m (Youngs Rd)
	South	Cars only	650m (Jorgensen Ave)
Youngs Rd Roundabout	North	• Cars • Cars + trailer / horse floats • Rigid trucks (8.8m) • Semi-trailer (19m)	520m (Ironbark Rd)
	South		980m (Bannons Lane)
Ironbark Rd Signals	North	Cars only	380m (North Oatlands Rd)
	South	Cars only	520m (Youngs Rd)
N Oatlands Rd Signals	North	Cars only	350m (Heard Ave)
	South	Cars only	380m (Ironbark Rd)
Heard Ave Roundabout	North	• Cars • Cars + trailer / horse floats • Rigid trucks (8.8m) • Semi-trailer (19m)	980m (Kurrak Rd)
	South		350m (North Oatlands Rd)

Table 8.2 - Restricted movement and redirection Summary

Access impact	Location
1. Plenty Valley Christian College carpark Secondary egress, left out only **Restricted movement:** right turn out AM Volume = 11, PM Volume = 19 *Redirection:* • Nil (by using internal school roads to access Orchard Rd) • 700m to Jorgensen Ave	
2. Yarrambat Park (Harness Track/ Diamond Valley Pistol Club/ Model Aircraft Club) Local access, left in / left out Pony Club Events (source: MRPV, 2019) • Monthly meets – 50 to 60 horse floats attend a single day event (weekend, twice a month) • Larger events – 100 to 200 horse floats attend a larger single day event (weekend, twice a year) • Annual event – up to 500 horse floats attend an annual, 2-day event (weekend, October) **Restricted movement:** right turn out AM Volume = 5, PM Volume = 13 *Redistribution:* • 170m to Jorgensen Ave traffic signals (cars only) **Restricted movement:** right turn in AM Volume = 4, PM Volume = 6 *Redistribution* • 470m to Bannons Lane traffic signals (cars only) • 1500m to Youngs Road (suitable for all vehicles, up to a 19 m semi-trailer)	
3. Laurie Street Local street, left in / left out **Restricted movement:** right turn out AM Volume = 11, PM Volume = 12 *Redistribution* • 400m to Bannons Lane traffic signals (cars only) • 1500m to Youngs Road (suitable for all vehicles, up to a 19 m Semi-trailer) **Restricted movement:** right turn in AM Volume = 4, PM Volume = 7 *Redistribution* • 230m to Jorgensen Ave traffic signals (cars only)	
4. Yarrambat Park Golf Course Local access, left in / left out **Restricted movement:** right turn out AM Volume = 2, PM Volume = 14 *Redistribution* • 60m to Bannons Lane traffic signals (cars only) • 750m to Jorgensen Ave traffic signals (cars only) **Restricted movement:** right turn in AM Volume = 23, PM Volume = 4 *Redistribution* • 940m to Youngs Road (suitable for all vehicles, up to a 19 m semi-trailer)	
5. Golf Links Drive Local street, left in / left out **Restricted movement:** right turn out AM Volume = 9, PM Volume = 3 *Redistribution* • 550m to Youngs Road (suitable for all vehicles, up to a 19 m semi-trailer) **Restricted movement:** right turn in AM Volume = 4, PM Volume = 19 *Redistribution* • 450m to Bannons Lane traffic signals (cars only) • 1130m to Jorgensen Ave traffic signals (cars only)	

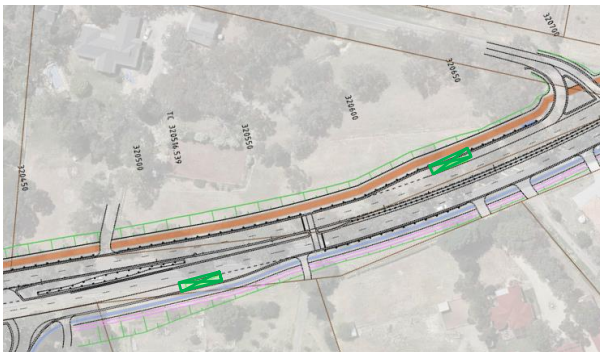
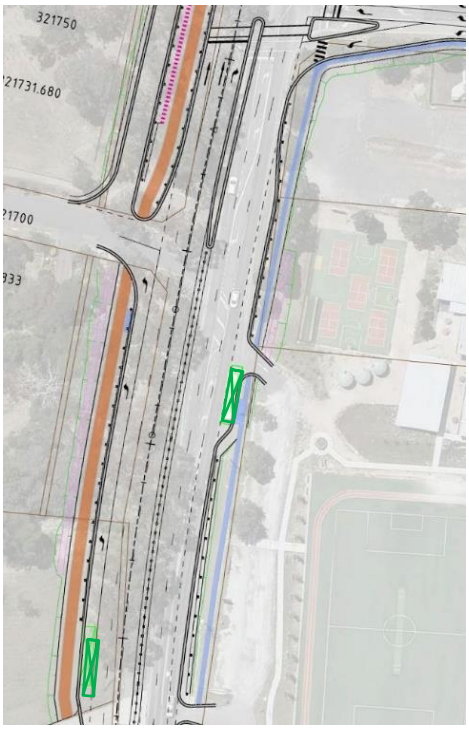
Access impact	Location
6. Ashley Road Local street, left in / left out **Restricted movement:** right turn out AM Volume = 24, PM Volume = 18 *Redistribution* • 100m to Youngs Road (suitable for all vehicles, up to a 19 m semi-trailer) **Restricted movement:** right turn in AM Volume = 12, PM Volume = 8 *Redistribution* • 400m to Ironbark Road traffic signals (cars only)	
7. Vista Court Local street, left in / left out **Restricted movement:** right turn out AM Volume = 10, PM Volume = 15 *Redistribution* • 60m to Ironbark Road traffic signals (cars only) • 600m to Youngs Road (suitable for all vehicles, up to a 19 m semi-trailer)	
8. Yarrambat Primary School Local access, left in / left out **Restricted movement:** right turn in AM Volume = 69, PM Volume = 63 *Redistribution* • 80m to Ironbark Road traffic signals (cars only)	
9. Veterinary Hospital and Childcare access Local access, left in / left out **Restricted movement:** right turn out AM Volume = 4, PM Volume = 2 *Redistribution* • 180m to Ironbark Road traffic signals (cars only) **Restricted movement:** right turn in AM Volume = 39, PM Volume = 32 *Redistribution* • 200m to North Oatlands Rd traffic signals (cars only)	
10. Worns Lane Local street, left in / left out **Restricted movement:** right turn out AM Volume = 22, PM Volume = 15 *Redistribution* • 220m to Heard Avenue roundabout (suitable for all vehicles, up to a 19 m Semi-trailer) **Restricted movement:** right turn in AM Volume = 6, PM Volume = 14 *Redistribution* • 700m to Kurrak Rd traffic signals	

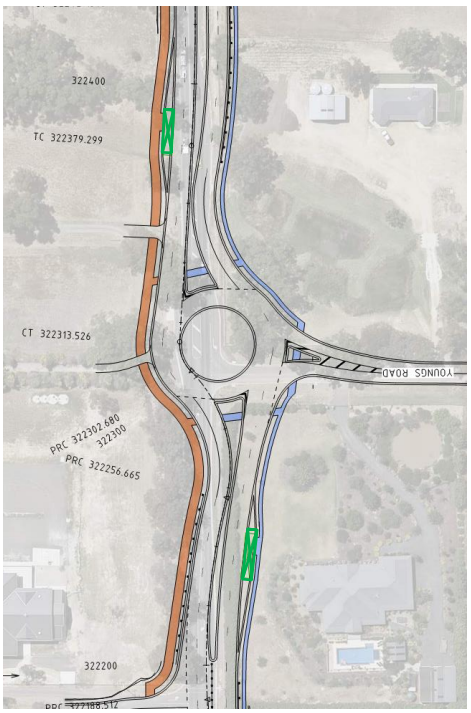
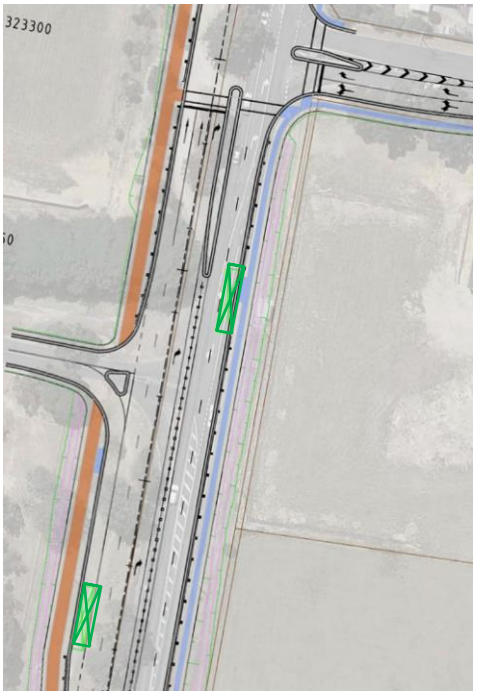
8.2.2 Public transport impact

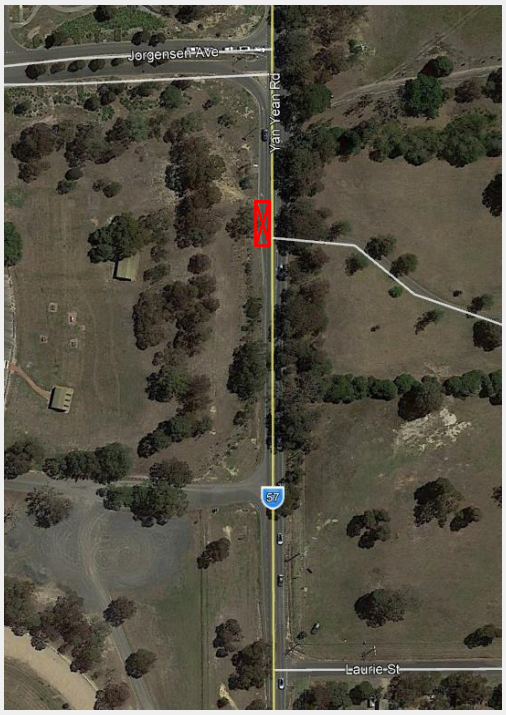
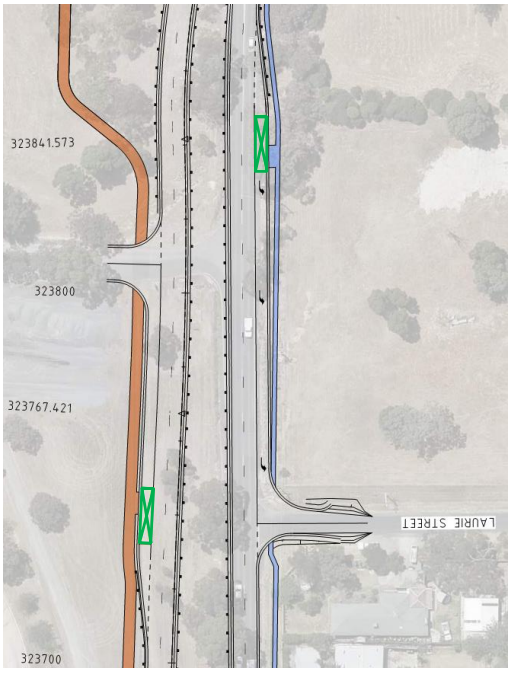
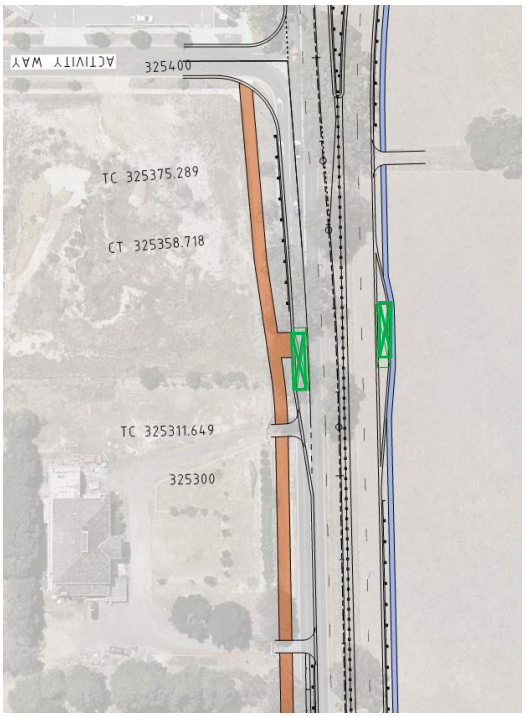
The Project generally provides a “like-for-like” replacement of all bus stops, in terms of general location and form. Bus stops are either indented midblock or utilise part of left turn deceleration lane at intersections.

Table 8.3 summarises the existing and provisional bus stop locations along Yan Yean Road. The location, form and bus shelter requirements will be finalised during detailed design in consultation with Public Transport Victoria (PTV), MRPV and other stakeholders.

Table 8.3 - Project Bus Stop Location (provisional)

Existing	Project
Worns Lane (Indented) 	Bus stop to be accommodated within auxiliary left turn lanes 
South of Ironbark Road (Indented) 	Bus stop to be accommodated within auxiliary left turn lane (NB) and indented bus bay (SB) 

Existing	Project
North of Youngs Road (Indented) 	Bus stops to be accommodated with indented bus bays 
South of Bannons Lane (off shoulder) 	Bus stop to be accommodated within auxiliary left turn lane (NB) and on-road bus stop (SB) 

Existing	Project
South of Jorgensen Avenue (Left Turn Lane) 	Bus stop to be accommodated within auxiliary left turn lane 
South of Bridge Inn Road (Indented) 	Bus stop to be accommodated within auxiliary left turn lane (NB) and indented bus bay (SB) 

8.2.3 Pedestrian and cyclist impact

The Project includes provision of:

- a new 5.5-kilometre shared walking and cycling path (i.e. a Shared Use Path, SUP) on the west side and a new upgraded 5.5-kilometre footpath on the east side
- Safe crossing points between both footpaths, via six traffic signals located between North Oatlands Road and Bridge Inn Road.

This infrastructure will considerably improve the amenity and safety for active transport modes, which currently are limited, sporadic and generally poor quality.

Improved walking and cycling facilities will promote active transport through the corridor for commuting and recreational activities and provide safer access for younger users travelling to school.

Principal Bicycle Network

The SUP will connect and form the missing section of the PBN along Yan Yean Road between Orchard Road and Kurrak Road, and match in with the SUP recently constructed as part the Stage 1 Upgrade (Kurrak Road to Diamond Creek Road) as shown in Figure 8.3.

Stage 1 and Stage 2 of the Yan Yean Road Upgrade will include the SUP on the west side of the road.

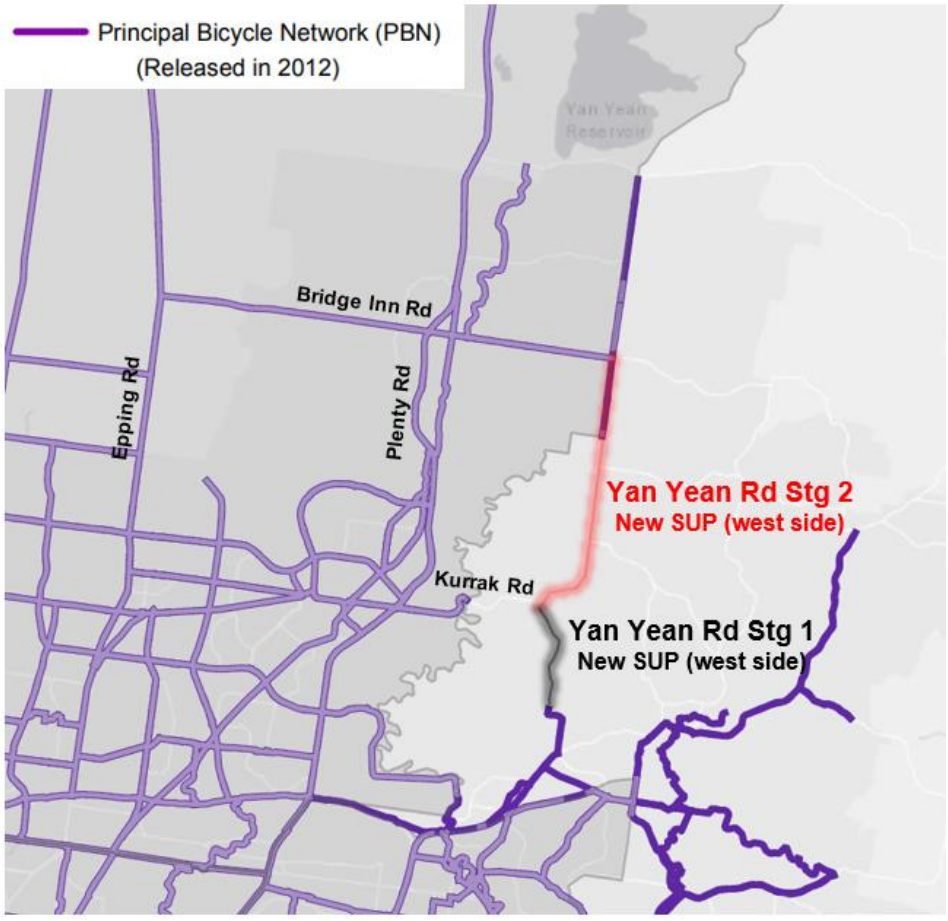


Figure 8.3 – Principal Bicycle Network Improvements

8.3 Network assessment

In order to assess the impact of the Project at the transport network level, a series of traffic forecasting outputs were generated to compare traffic volumes, network conditions and travel time and connectivity with and without the Project in the year 2031. In line with the Scoping Requirements, key aspects considered in this section include:

- Changes in traffic volumes over the impacted transport network area
- Network performance improvement in terms of travel speeds on key routes
- Changes in travel times on key routes
- Changes in accessibility to key activity centres
- Network resilience effects of the Project.

8.3.1 Traffic volumes

The forecast change in total daily traffic volumes between 2031 'with Project' and 2031 'no Project' is shown in Figure 8.4. The comparison of forecast daily traffic volumes with and without the Project indicates the following:

- The Project results in a reduction in traffic along alternate north-south routes. The most significant reductions in traffic are seen along Plenty Road to the west and Doctors Gully Road, Heidelberg-Kinglake Road and Broad Gully Road to the east of the Project as the closest north-south alternatives to Yan Yean Road.
- An increase in traffic volumes along Yan Yean Road as the improved capacity and travel speeds from the Project results in traffic that was previously detouring via Plenty Road and roads to the east for north-south travel, now utilising Yan Yean Road.
- A reduction in traffic volumes on local roads in the residential areas east and west of Plenty Road as traffic previously avoiding sections of congestion on Plenty Road by travelling through the local network, re-routes to Plenty Road due to its improved conditions.
- A moderate increase in traffic along Bridge Inn Road as traffic through the Mernda area elects to utilise Yan Yean Road for north-south travel rather than Plenty Road. A reduction in traffic of a similar magnitude is seen on Kurrak Road as traffic now uses the full length of Yan Yean Road rather than travelling down Plenty Road and Kurrak Road to get to the upgraded Stage 1 section.
- A moderate reduction in traffic along Plenty Road south of Kurrak Road and the Metropolitan Ring Road with an increase of similar magnitude along Diamond Creek Road as improved travel times sees traffic using the length of Yan Yean Road to access North East Link and Greensborough and Bundoora activity centres rather than Plenty Road and Metropolitan Ring Road route.
- A moderate increase in traffic along Ironbark Road, which is utilised for its connectivity to Ryans Road and Wattletree Road and Eltham activity centre.

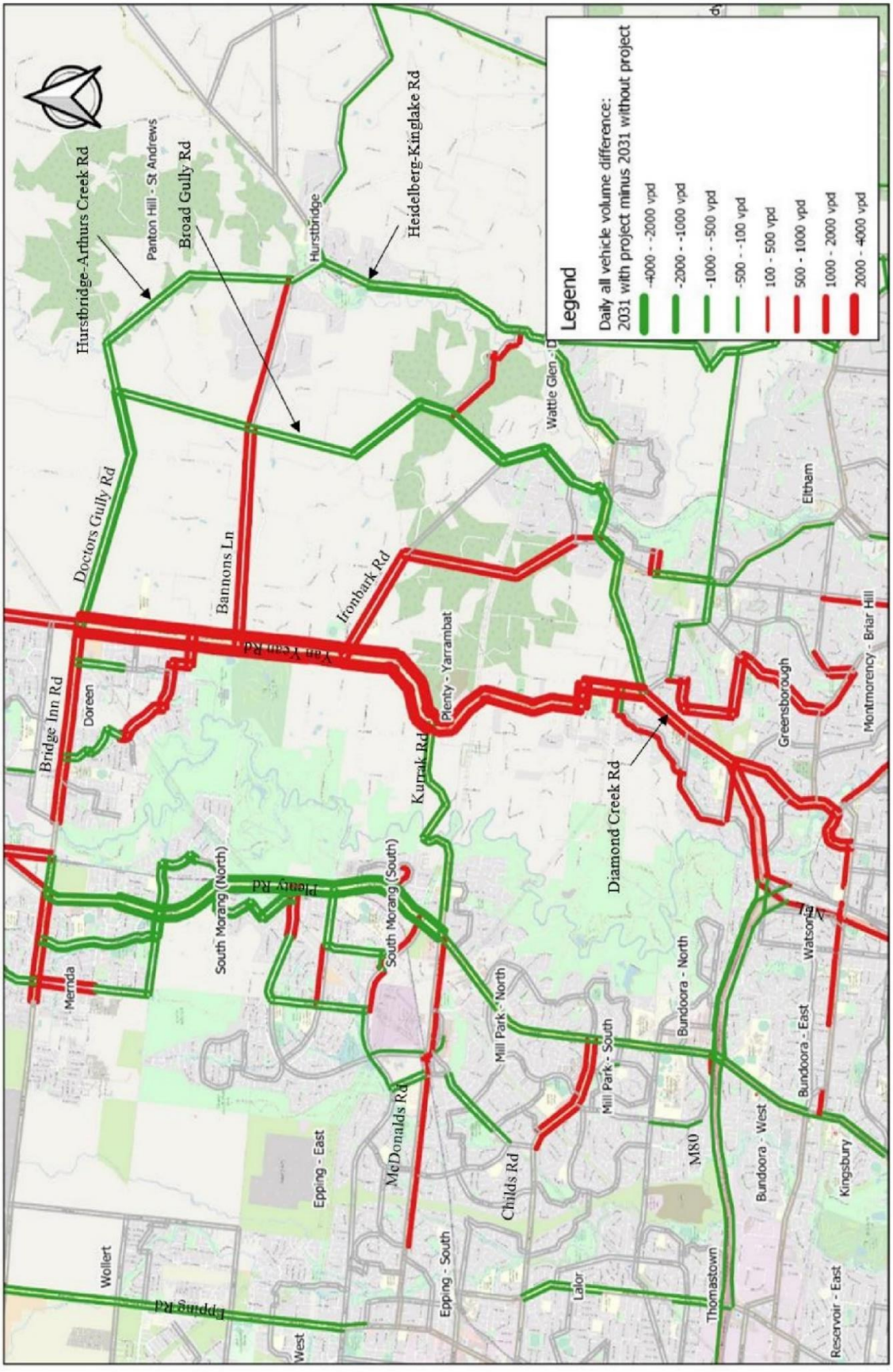


Figure 8.4 - Modelled change in daily traffic volumes between 2031 'with Project' compared to 2031 'no Project' (VITM)

8.3.2 Network performance

Travel speeds on key roads

The forecast change in travel speeds between the 2031 'with Project' and 2031 'no Project' scenarios for the AM and PM peak periods are shown in Figure 8.5 and Figure 8.6 respectively to provide an understanding of the impact of the Project on network performance.

The following is evident from the modelled travel speeds:

- The change in travel speed is consistent with the traffic volume impacts discussed at the daily level above, in that roads experiencing reductions in traffic show an improvement in travel speed while roads with an increase in traffic show a decrease in travel speed. The exception is the Project corridor for which the upgrade provides improved travel speeds despite an increase in traffic.
- As may be expected, the key travel speed improvements are along the Project route which is forecast to be heavily congested in 2031 'no Project'. AM peak travel speeds are forecast to improve by more than 20 km/hr in the peak southbound direction and more than 10 km/hr in the northbound direction. Similarly, in the PM peak northbound travel speeds are forecast to improve by more than 20 km/hr in the southern section of the Project and more than 10 km/hr in other sections. It is noted that travel speeds along Yan Yean Road 'with Project' and 'no Project' are considered in more detail in Section 8.4 by considering the operational performance of intersections under future traffic demands.
- Travel speed improvements along Plenty Road of 10-20km/hr are forecasts in some sections and up to 10 km/hr in other sections.
- Reduced traffic along roads to the east such as Heidelberg-Kinglake Road and Broad Gully Road generally bring about travel speed improvements of up to 10 km/hr as do sections of Bridge Inn Road and Epping Road to the west of the Project
- A moderate reduction in travel speeds is forecast along Yan Yean Road south of the Project which was recently upgraded, as more traffic uses the length of Yan Yean Road for north-south travel. Travel speeds are forecast to reduce by 10-20km/hr in the southbound direction in the AM peak and northbound direction in the PM peak.
- Similarly, the moderate increases in traffic demand along Ironbark Road and Wattletree Road and Diamond Creek Road south of Yan Yean Road bring about moderate decreases in travel speeds, forecast at up to 10km/hr.

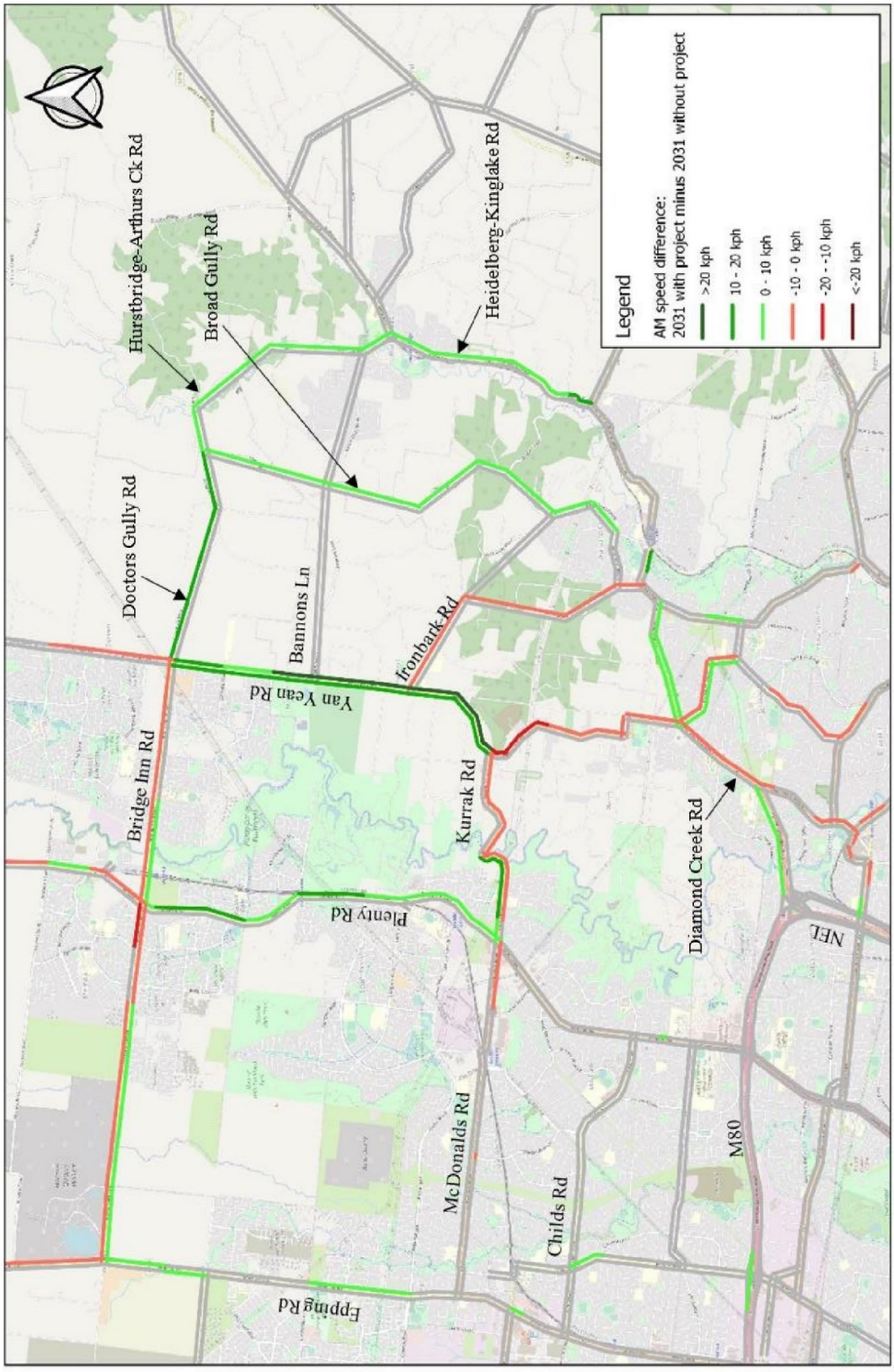


Figure 8.5 - Forecast change in travel speed 2031 with Project compared to 2031 without Project – AM peak (VITM)

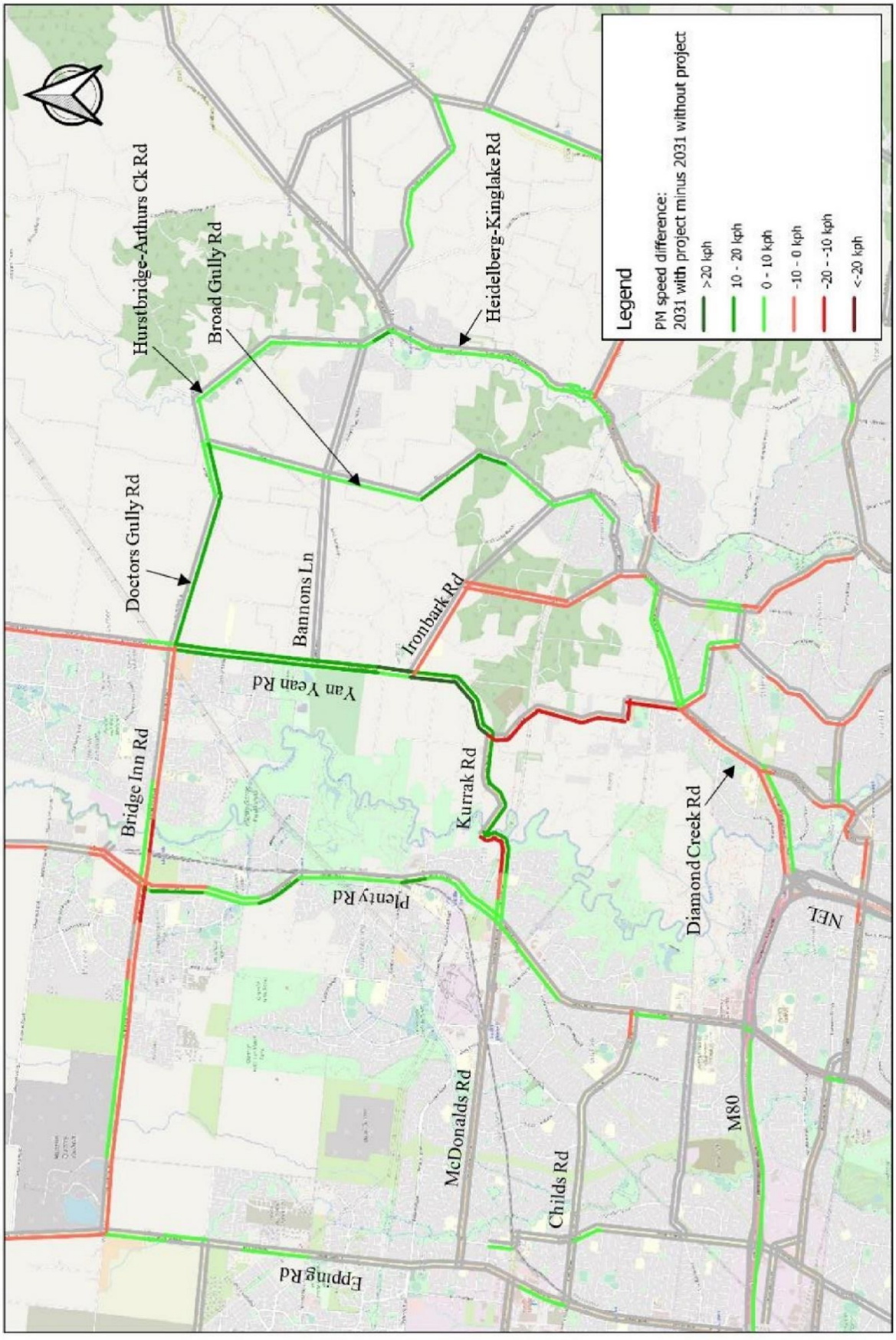


Figure 8.6 - Forecast change in travel speed 2031 with Project compared to 2031 without Project – PM peak(VITM)

Overall network statistics

The Project brings about travel speed improvements along key routes through the local network, particularly where traffic volumes are reduced, along with some more moderate reduction in travel speeds where traffic has selected new travel routes to take advantage of the travel time improvements along Yan Yean Road.

To provide a measure of the overall improvement in performance across the network, key AM and PM peak statistics were extracted from VITM to assess the change in travel speed for all trips in the local study area shown in Figure 8.7.

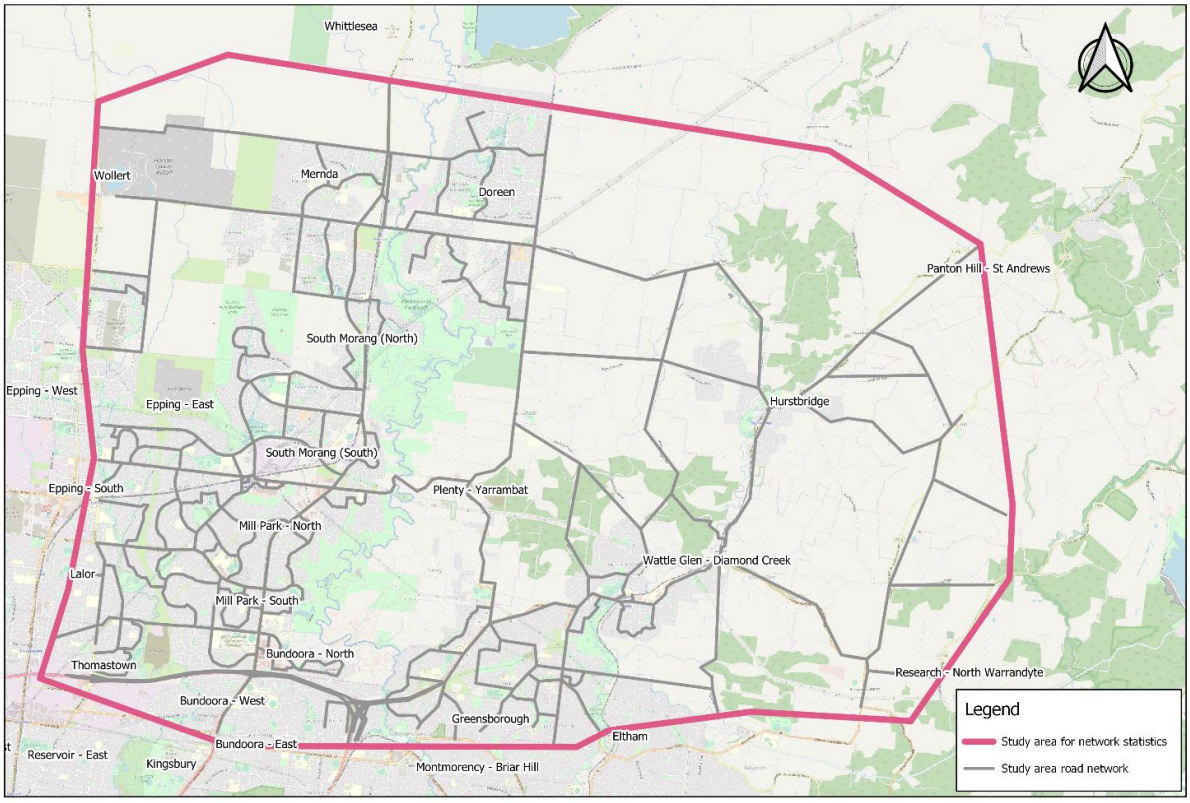


Figure 8.7 - Road network study area for network statistics

As shown in Table 8.4, with the Project in place, average travel speeds for all trips across the large area of road network shown in Figure 8.7 are forecast improve by around 2 km/hr or 6 percent in the AM peak and 3 km/hr or over 10 percent in the PM peak due to the alleviation of congestion on Yan Yean Road and adjacent routes.

Table 8.4 - Forecast average speed through study area (VITM)

Scenario	AM peak Average network speed (km/hr)	PM peak Average network speed (km/hr)
2031 'no Project'	33	29
2031 'with Project'	35	32
Change	2	3
% Change	+6.1%	+10.3%

8.3.3 Travel times and accessibility

Travel times on key routes

In order to assess the impacts of the Project on travel times, forecast travel times changes along a series of key arterial routes through the local network were compared for the 2031 'with Project' and 'no Project' scenarios. The travel time routes considered include Yan Yean Road, Plenty Road, Bridge Inn Road, Epping Road and Kurrak Road as shown in Figure 8.8.

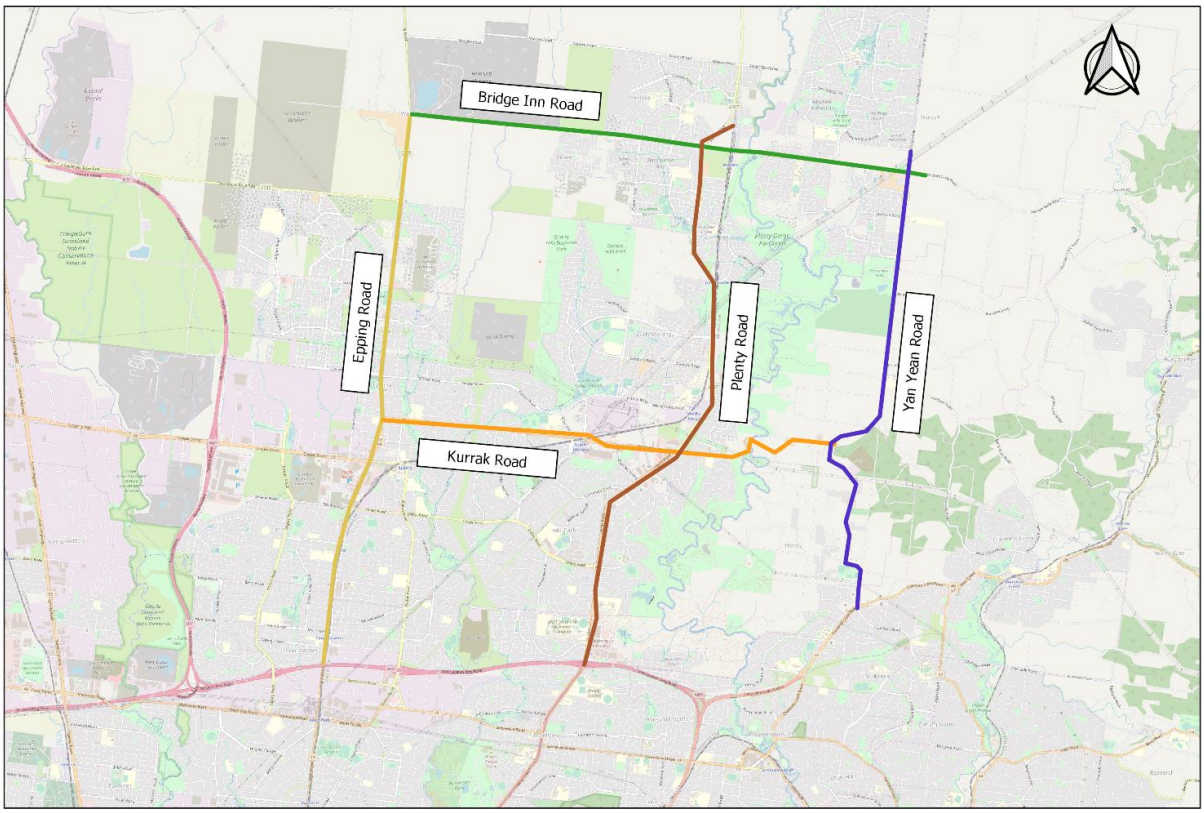


Figure 8.8 - Travel time routes

Figure 8.9 shows the forecast change in travel times along each route under the 2031 'with Project' and 'no Project' scenarios for the AM and PM peak periods respectively. The following observations can be made of travel times along key routes:

- Travel times along Yan Yean Road are most significantly improved with the Project in place, as may be expected. This is particularly evident in the peak southbound direction in the AM peak and northbound direction in the PM peak which are forecast to be heavily congested in 2031 without the Project in place. It is noted that travel time improvements along Yan Yean Road

'with Project' and 'no Project' are considered in more detail in Chapter 8 below, by considering the operational performance of intersections under future traffic demands.

- Travel times along adjacent routes in Plenty Road and Epping Road are also expected to see improvement with the Project in place, particularly in the peak travel direction. As the closest adjacent north-south route, travel time improvements are highest during the peak periods on Plenty Road. Travel times along Epping Road are expected to reduce but at a more moderate rate.
- Travel times in the non-peak directions, northbound in the AM peak and southbound in the PM peak, on Plenty Road and Epping Road are expected to remain largely unchanged reflecting the lower levels of congestion for travel against the peak flow. Yan Yean Road sees a moderate improvement of a few minutes in the non-peak travel directions.
- Small travel time changes are forecast along Kurrak Road and Bridge Inn Road as traffic seeks to access Yan Yean Road for north-south travel rather than Plenty Road.

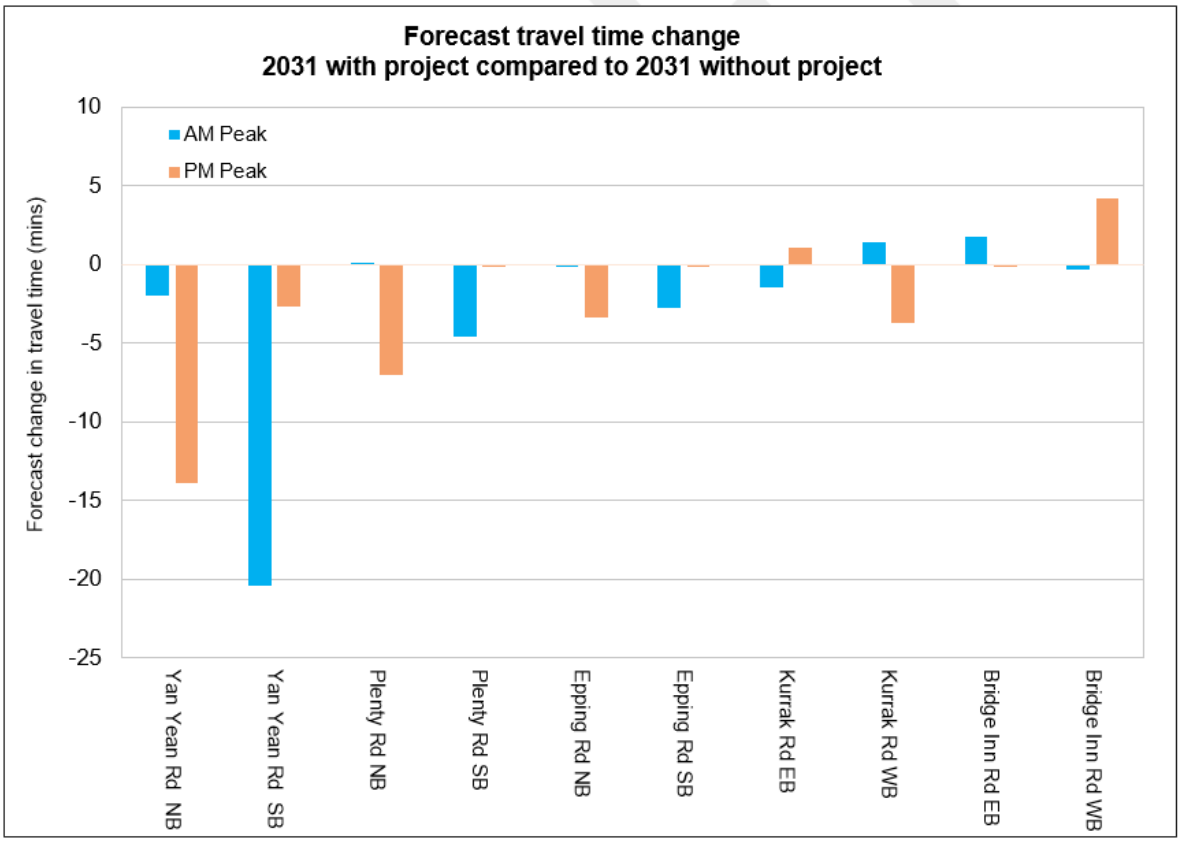


Figure 8.9 - Forecast AM and PM peak travel time change on key routes, 2031 'no Project' and 'with Project'(VITM)

Access to key activity centres

The impact of the Project on accessibility for road users was assessed by considering forecast travel time changes to key activity centres. For the purposes of the assessment, the residential community of Doreen, at the northern end of the Project was considered a typical starting point for travel, with the Melbourne CBD, La Trobe National Employment and Innovation Cluster (NEIC), Greensborough Activity Centre and Eltham Activity Centre considered some typical key destinations for employment, shopping and recreational activities. The origin and destinations considered in the assessment are shown in Figure 8.10.

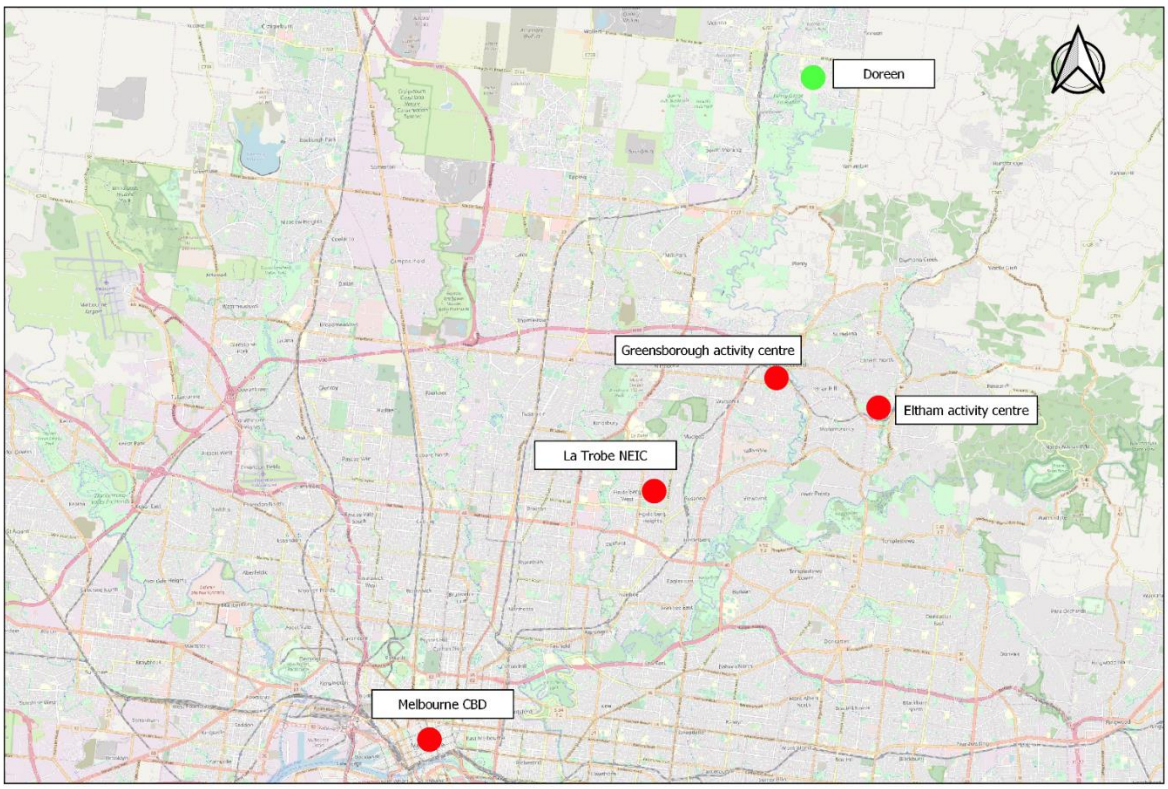


Figure 8.10 - Trip origin and key destinations for accessibility assessment

The forecast AM peak change in travel time from Doreen to each key activity centre under the 2031 'no Project' and 'with Project' scenarios are compared in Figure 8.11. As discussed previously, in the 2031 'no Project' scenario, traffic is forecast to use alternate routes to Yan Yean Road due to the congestion levels and impacts on travel time. In the 2031 'no Project' case, local traffic may at times use alternate routes to Yan Yean Road impacting travel time and accessibility while under the 2031 'with Project' case traffic was found to utilise Yan Yean Road as the optimal route.

The change in travel times with the Project in place shows a significant improvement in accessibility between Doreen and each of the key activity centres. The following key observations are made:

- Accessibility to each of the key activity centres is improved with the Project in place providing residents with improved access to employment and other opportunities.
- Trips to the closer activity centres such as Greensborough and Eltham see the most significant relative improvement in travel times as the Project route is a more significant component of the overall trip distance.
- Travel time improvements of around 15 percent are forecast to the La Trobe NEIC which is planned to be major suburban centre for employment in the Health, Education and Research fields.

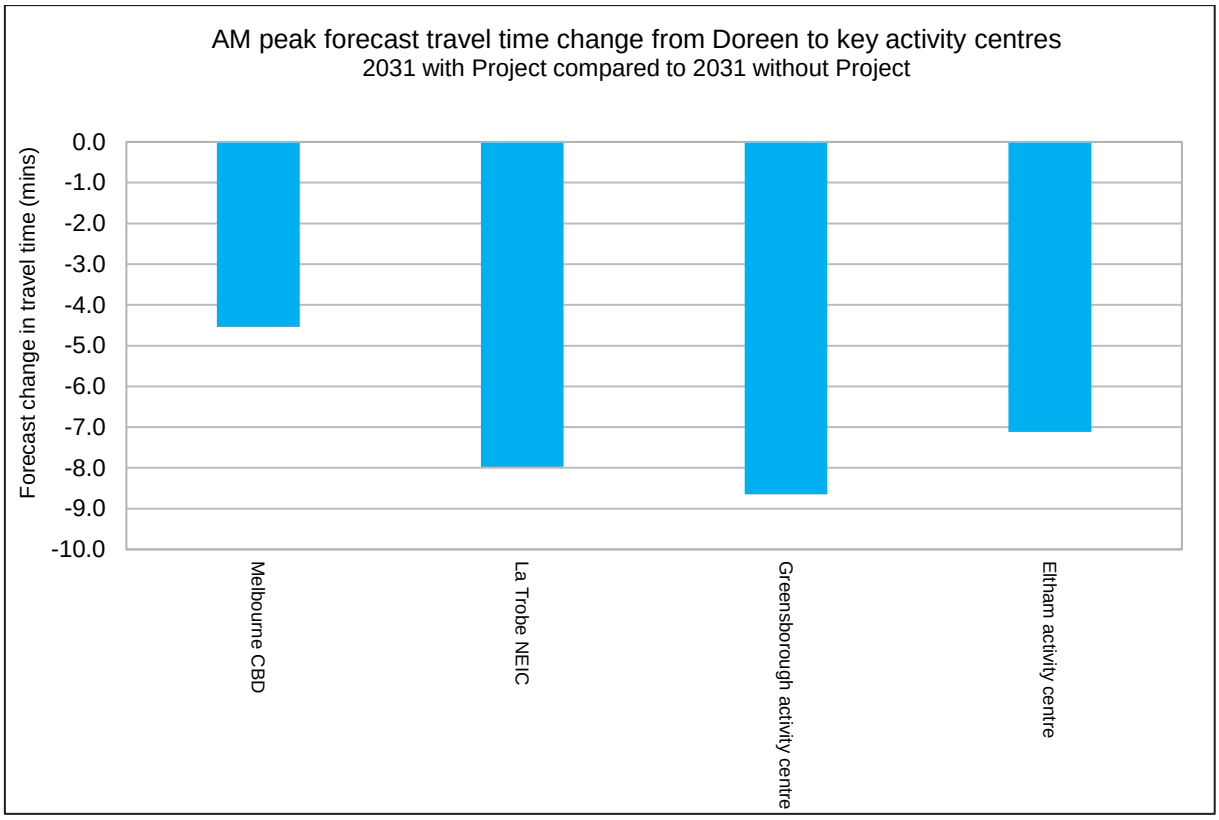


Figure 8.11 - AM peak travel time change from Doreen to key activity centres (VITM)

8.3.4 Network resilience

In order to examine the Project's contribution to resilience and redundancy in the local road network, several scenarios were modelled in VITM to simulate an incident occurring in the peak direction of travel on either Plenty Road or Yan Yean Road, both with and without the Project in place. The following scenarios were modelled:

1. 2031 AM peak, 'no Project', with lane closures on Yan Yean Road in the southbound direction
2. 2031 AM peak, 'with Project', with lane closures on Yan Yean Road in the southbound direction
3. 2031 AM peak 'no Project', with lane closures on Plenty Road in the southbound direction of travel
4. 2031 AM peak 'with Project', with lane closures on Plenty Road in the southbound direction of travel

As outlined in the following sections, comparing the forecast traffic flows for each scenario to its base scenario (either with Project or without Project) provides an understanding of the extent of impact mitigation that occurs as a result of the Project.

8.3.5 Reduction in lanes on Yan Yean Road

The number of lanes on Yan Yean Road (between Bridge Inn Road and Kurrak Road) was reduced by one lane in the southbound direction in the AM peak for the 2031 'no Project' and 'with Project' scenarios to compare how differently the network would perform if an incident was to occur on Yan Yean Road. In the 'no Project' case, the Project corridor has only a single lane in each direction, so a lane closure effectively closes the road in the southbound direction. In the 'with Project' case, two lanes are provided in each direction within the Project corridor so the incident modelled would reduce Yan Yean Road to a single lane southbound.

The difference in AM peak forecast traffic volumes (and percentage change) between the 2031 'no Project' with Yan Yean Road lane closure and 2031 'no Project' is shown in Figure 8.12. The same is

shown for 2031 ‘with Project’ with Yan Yean Road lane closure versus 2031 ‘with Project’ in Figure 8.13.

The forecasts suggest that without the Project in place, the closure of Yan Yean Road southbound forces traffic to use a lengthy diversion east via Doctors Gully Road to Broad Gully Road and Heidelberg Kinglake Road to continue southward. Traffic also diverts to Plenty Road via Bridge Inn Road, which would be expected to exacerbate the congestion forecast in pockets of this route in the 2031 ‘no Project’ scenario.

With the Project in place, the network area impacted by the lane closure on Yan Yean Road is smaller with some traffic still able to utilise the single lane available along Yan Yean Road. Forecast traffic volumes diverting through Nillumbik Shire are lower as are forecast increases along Plenty Road, substantially limiting the extent of delays and disruptions brought about by the simulated incident. In this way, the network can be said to be more resilient to incidents of this nature with the Project in place.

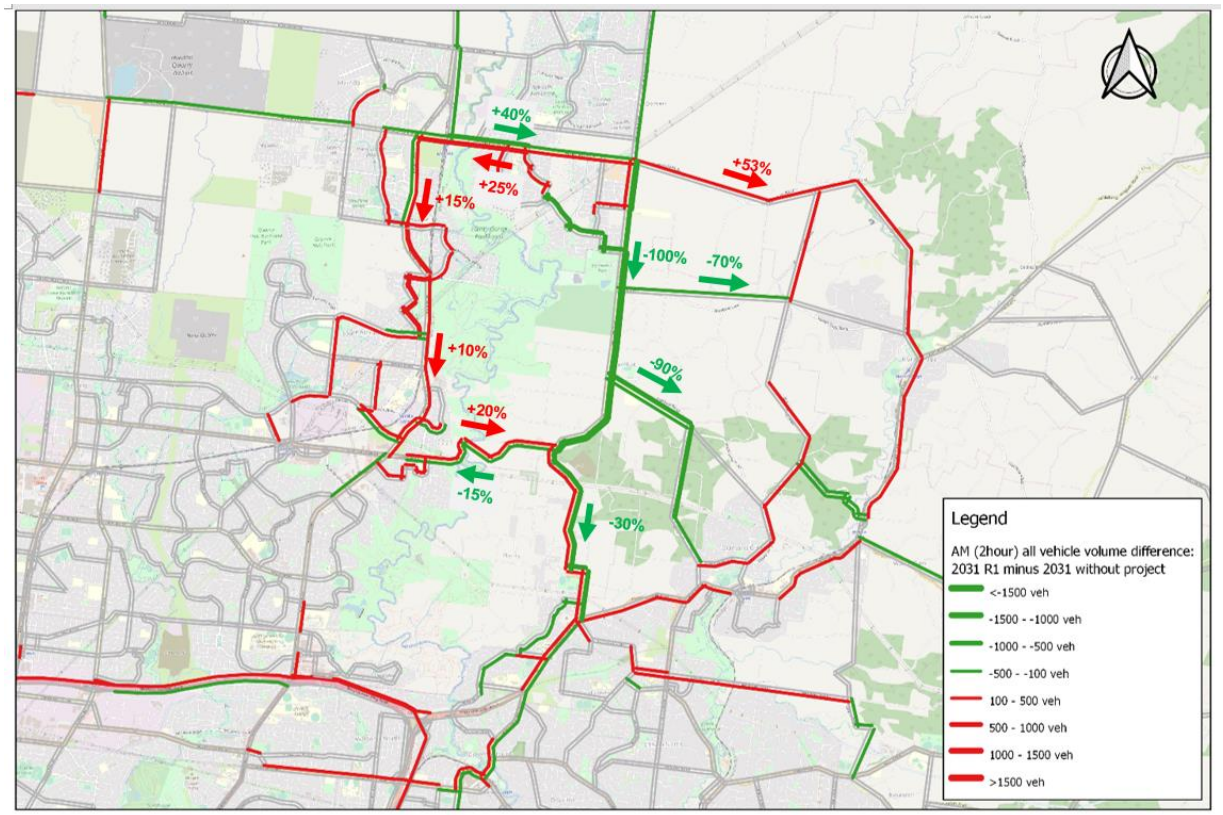


Figure 8.12 - 2031 Base Case (with Yan Yean Road SB closed) vs 2031 Base Case – AM peak total volume difference (VITM)

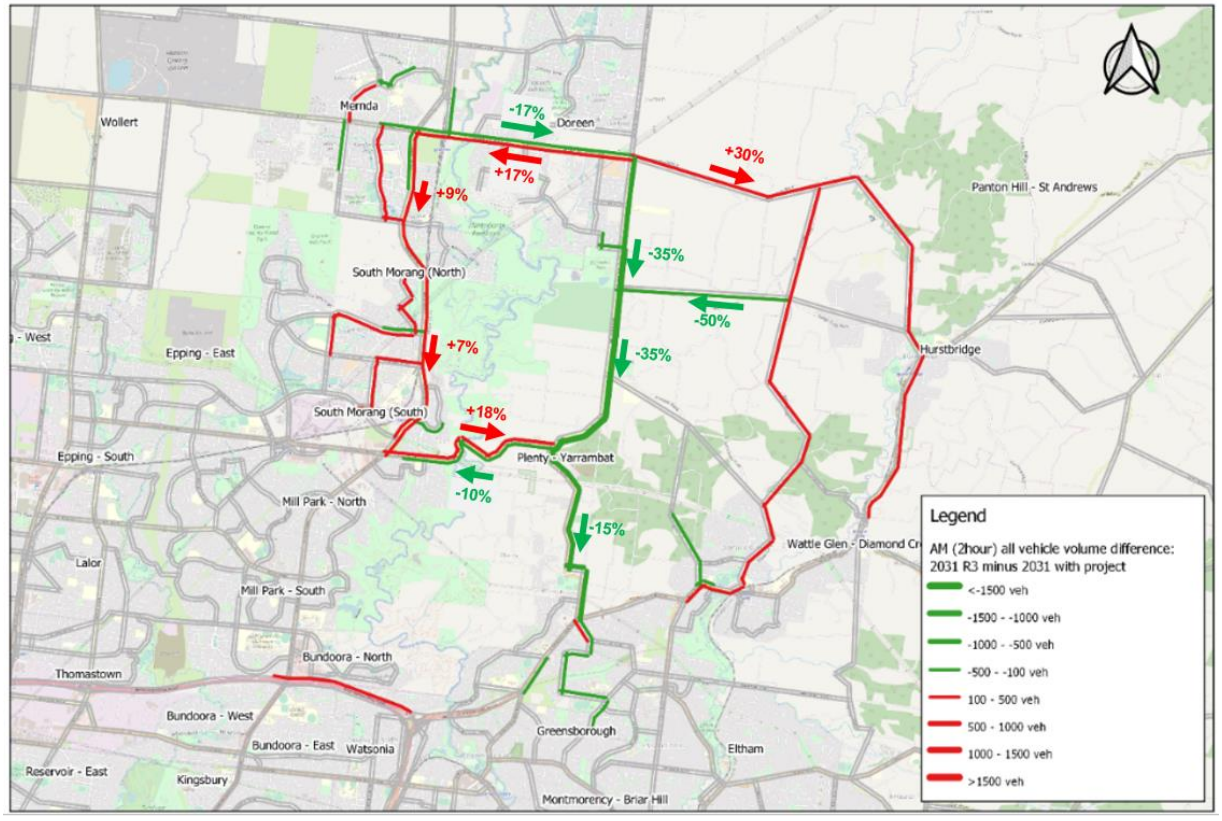


Figure 8.13 - 2031 Project Case (with one lane on Yan Yean Road SB closed) vs 2031 Project Case – AM peak total volume difference

8.3.6 Reduction in lanes on Plenty Road

A similar resilience test was carried out for Plenty Road in which the number of lanes on Plenty Road (between Bridge Inn Road and Kurrak Road) was reduced by one lane in the southbound direction in the AM peak for the 2031 'no Project' and 'with Project' scenarios.

The difference in AM forecast traffic volumes (and percentage change) between the 2031 'no Project' with Plenty Road lane closure and 2031 'no Project' is shown in Figure 8.14. The same is shown for 2031 'with Project' with Plenty Road lane closure versus 2031 'with Project' in Figure 8.15.

The forecasts suggest that without the Project in place, the closure of Plenty Road southbound, combined with the heavy congestion forecast along Yan Yean Road see traffic impacts occurring as far east as Doctors Gully Road, Broad Gully Road and Heidelberg Kinglake Road and as far west as Epping Road. Despite the congestion levels without the Project, Yan Yean Road still sees an increase of 10 to 17 percent on 2031 'no Project' levels, which would be expected to worsen the heavy congestion expected to be occurring through the corridor. In contrast, with the Project in place, the additional capacity available on Yan Yean Road allows it to take additional traffic demands, confining the major changes in traffic to the two adjacent north-south corridors. The network is more resilient to an incident occurring along Plenty Road that closes a lane, with the Project in place compared to without the Project.

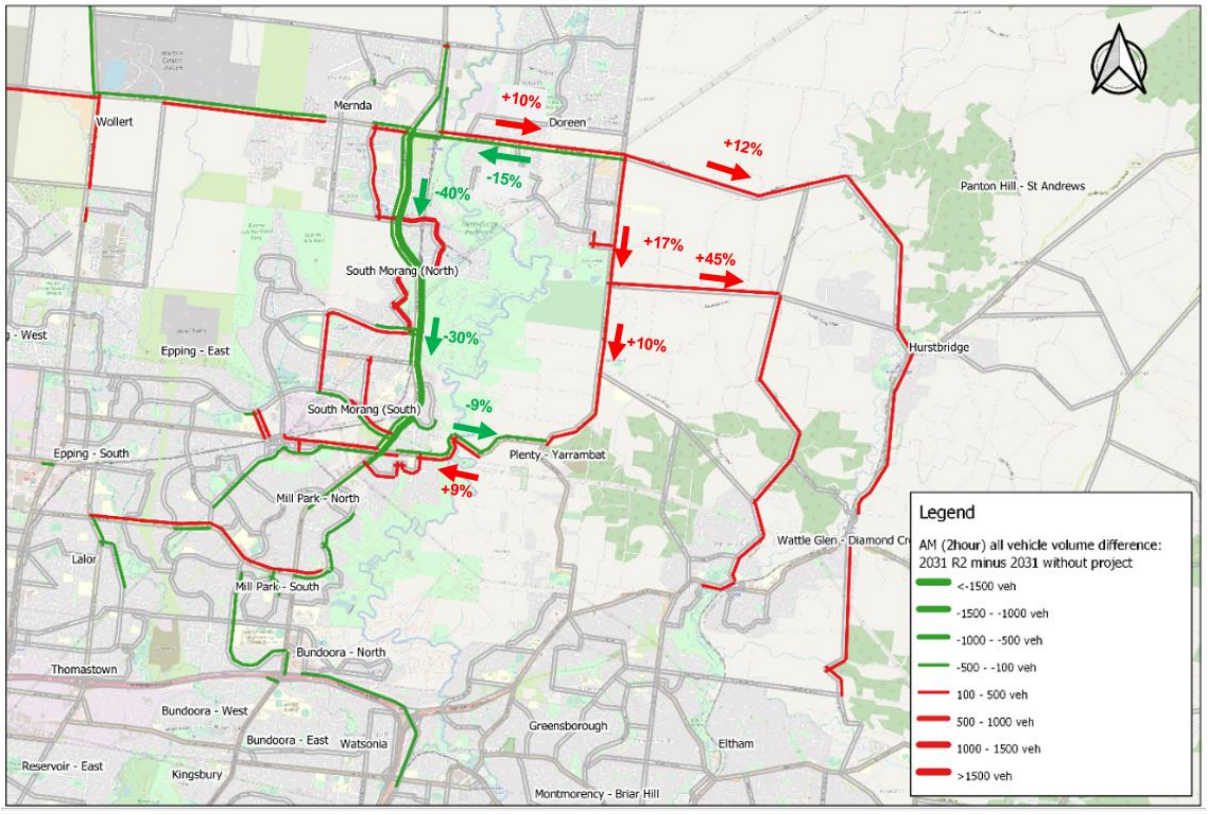


Figure 8.14 - 2031 Base Case (with one lane reduced on Plenty Road SB) vs 2031 Base Case – AM peak total volume difference (VITM)

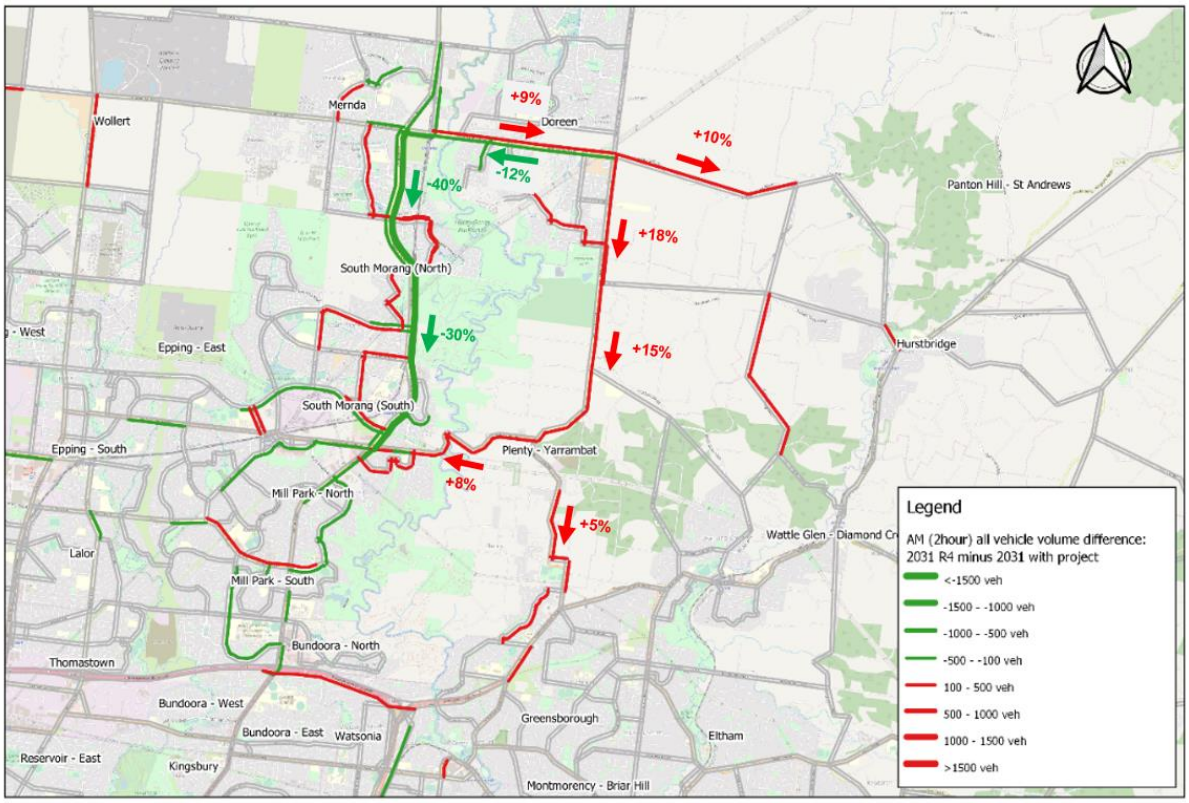


Figure 8.15 - 2031 Project Case (with one lane reduced on Plenty Road SB) vs 2031 Project Case – AM peak total volume difference (VITM)

8.4 Corridor assessment

8.4.1 Forecast volumes ('with Project')

summarises the existing and the forecast traffic volumes under the 2031 'with Project' scenarios, for the AM and PM peak hours. Along the busiest section of the corridor, north of Ironbark Road, the traffic demand is expected to double in the peak direction of travel and increase by 30 to 40 percent in the counter-peak direction.

The difference between the 'no Project' and 'with Project' traffic forecasts highlights the level of supressed traffic demand likely under the 'no Project' scenario. For instance, in the peak direction of travel (both peaks), the traffic demand is forecast to double 'with Project' (2,400 to 2,600 veh/hr) but only increase by 30 to 40 percent with 'no Project' (1,100 to 1,300 veh/hr). This suggests a suppressed demand of at least 1,300 veh/hr in the peak direction of travel.

Table 8.5 - 'With Project' forecast volumes and traffic growth

Midblock Section (Traffic Scenario)	AM peak hour		PM peak hour	
	NB	SB	NB	SB
Bridge Inn Road				
2017 Existing	693	840	806	753
2031 With Project	1004	1835	2038	1018
Orchard Road				
2017 Existing	712	862	945	718
2031 With Project	863	2001	2024	1020
Jorgensen Ave				
2017 Existing	674	1043	1247	806
2031 With Project	874	2265	2453	1110
Bannons Lane				
2017 Existing	663	1069	1326	768
2031 With Project	863	2369	2590	1092
Growth Factor	1.30	2.22	1.95	1.42
Ironbark Road				
2017 Existing	608	881	1231	632
2031 With Project	866	2144	2405	929
North Oatlands Road				
2017 Existing	598	843	1213	644
2031 With Project	793	2035	2296	909
Project boundary, north of Kurrak Road				

8.4.2 Traffic operation ('with Project')

To assess the Project corridor performance in more detail, a SIDRA model was developed for the 2031 'with Project' scenario.

The impact assessment 'with Project' was based on a comparison of the *operating speed* and *intersection performance* against the 'no Project' scenario. The intersection performance was also assessed against operational targets adopted for the Project.

Operating speeds

Table 8.6 summarises the forecast average operating speeds under the 'no Project' and 'with Project' peak hour scenarios. Relative to the 'no Project' case, the 'with Project' operation is expected to:

- Improve the average operating speed in the peak direction of travel (both peaks) by between 20 to 30 km/h
- Improve the average operating speed in the counter-peak direction of travel (both peaks) by between 5 to 20 km/h
- Improve the average operating speed throughout the corridor (both directions of travel, including delays incurred at side roads) by a considerable 30 km/h.

When compared against existing conditions as outlined in Section 7.4.2 (page 91), the Project is forecast to perform:

- At an average operating speed 10 to 15 km/h faster in the peak direction of travel (both peaks)
- At a similar speed in the counter-peak direction.

Table 8.6 - Average operating speeds (2031 'No Project vs. "With Project', AM and PM peak hour)

Direction	2031 AM Average Speed (km/hr)		2031 PM Average Speed (km/hr)	
	'No Project'	'With Project'	'No Project'	'With Project'
Northbound	41	47	21	48
Southbound	18	43	26	49
Corridor*	14	42	14	45

* Corridor estimate based on SIDRA "network" results, and considers delays on side road

Intersection performance (project targets)

When planning a road duplication project, intersection performance targets are adopted to help guide and inform the design. For the Project, the following targets were adopted for peak hour intersection performance:

- A *practical* degree of saturation of 0.9 or lower for each movement (i.e. the demand to capacity ratio)
- A level of service D (or better) for the intersection as a whole, based on the average vehicle delay
- 95th percentile queue lengths that are contained within the proposed turn lanes

These targets represent a reasonable level of operation, whilst ensuring a small amount of spare capacity for future growth, after 2031.

Table 8.7 summarises the Project intersection performance, based on SIDRA "network" model results. In summary:

- Each intersection operates at a DoS close to the target 0.9 during either the AM or PM peak hour, suggesting that each has been designed appropriately
- Each intersection operates at a LoS D or better
- All 95th percentile queues are contained with the turn lanes provided

Three intersections marginally exceed one of the three performance targets (DoS) adopted for the Project; Orchard Road, Bannons Lane and Ironbark Road.

The critical movement for Orchard Road is the right turn (S to E) during the AM peak hour. Although the DoS is higher than desirable, it is due to the signal coordination modelling assumptions made for southbound travel. Importantly, the 95th percentile queues are contained within the storage provided. In the other two cases, the DoS is only marginally over 0.9 during one peak only. On balance, given that each intersection operates at a LoS C, and all queues are contained within storage provided, this

is considered a reasonable outcome, particularly given the environmental implications of increasing the intersection footprint.

Table 8.7 - Summary of intersection performance (2031 "With Project', peak hours)

Intersecting Road	Peak	Intersection Volume (veh/hr)	DoS[1]	LoS[2]	95% Queue[3] (Y/N)	Targets achieved?
Bridge Inn Road	AM	3,985	0.84	D	Y	✓
	PM	4,200	0.90	D	Y	✓
Orchard Road	AM	3,585	0.91	C	Y	ok
	PM	3,344	0.86	B	Y	✓
Jorgenson Avenue	AM	3,222	0.89	C	Y	✓
	PM	3,622	0.81	B	Y	✓
Bannons Lane	AM	3,380	0.84	B	Y	✓
	PM	3,834	0.93	C	Y	ok
Youngs Road	AM	3,286	0.73	A	Y	✓
	PM	3,779	0.80	A	Y	✓
Ironbark Road	AM	3,628	0.72	C	Y	✓
	PM	4,061	0.91	C	Y	ok
North Oatlands Road	AM	3,007	0.79	B	Y	✓
	PM	3,434	0.87	B	Y	✓
Heard Avenue	AM	2,890	0.65	A	Y	✓
	PM	3,300	0.82	A	Y	✓

1. Degree of saturation, critical movement
2. Level of service, overall intersection
3. 95th percentile queue contained within turn lane

Intersection performance (comparative assessment)

Figure 8.16 and Figure 8.17 summarise the intersection LoS performance for the 2031 AM and PM peak, 'no Project' and 'with Project' cases respectively. The results are based on "networked" intersection models.

During both peak hour periods, the Project clearly performs more efficiently than the 'no Project' case, with Bridge Inn Road operating at a LoS D, and all other intersections operating at a LoS C (or better).

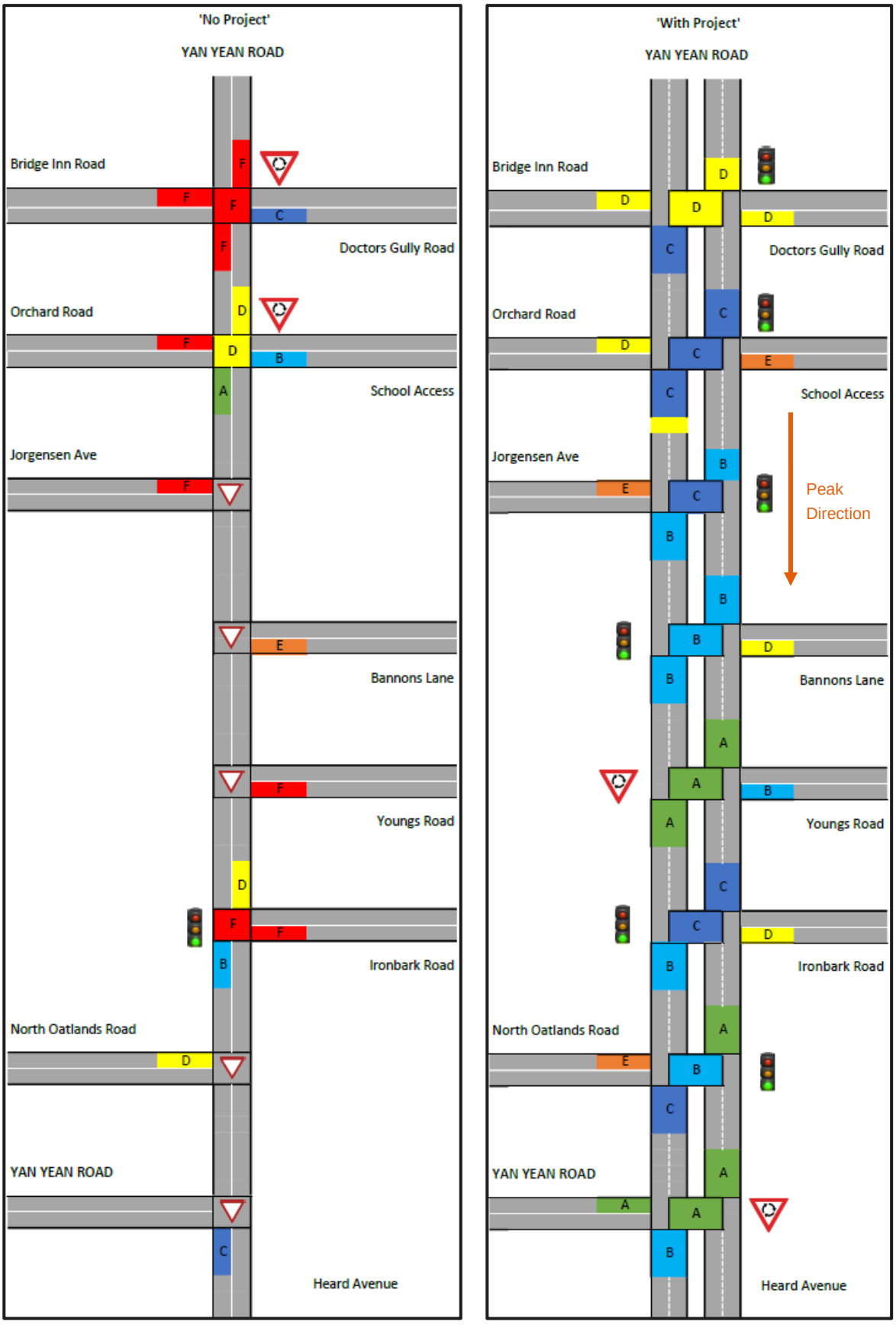


Figure 8.16 - Intersection performance, 2031 'No Project' vs. 'With Project (AM peak hour)

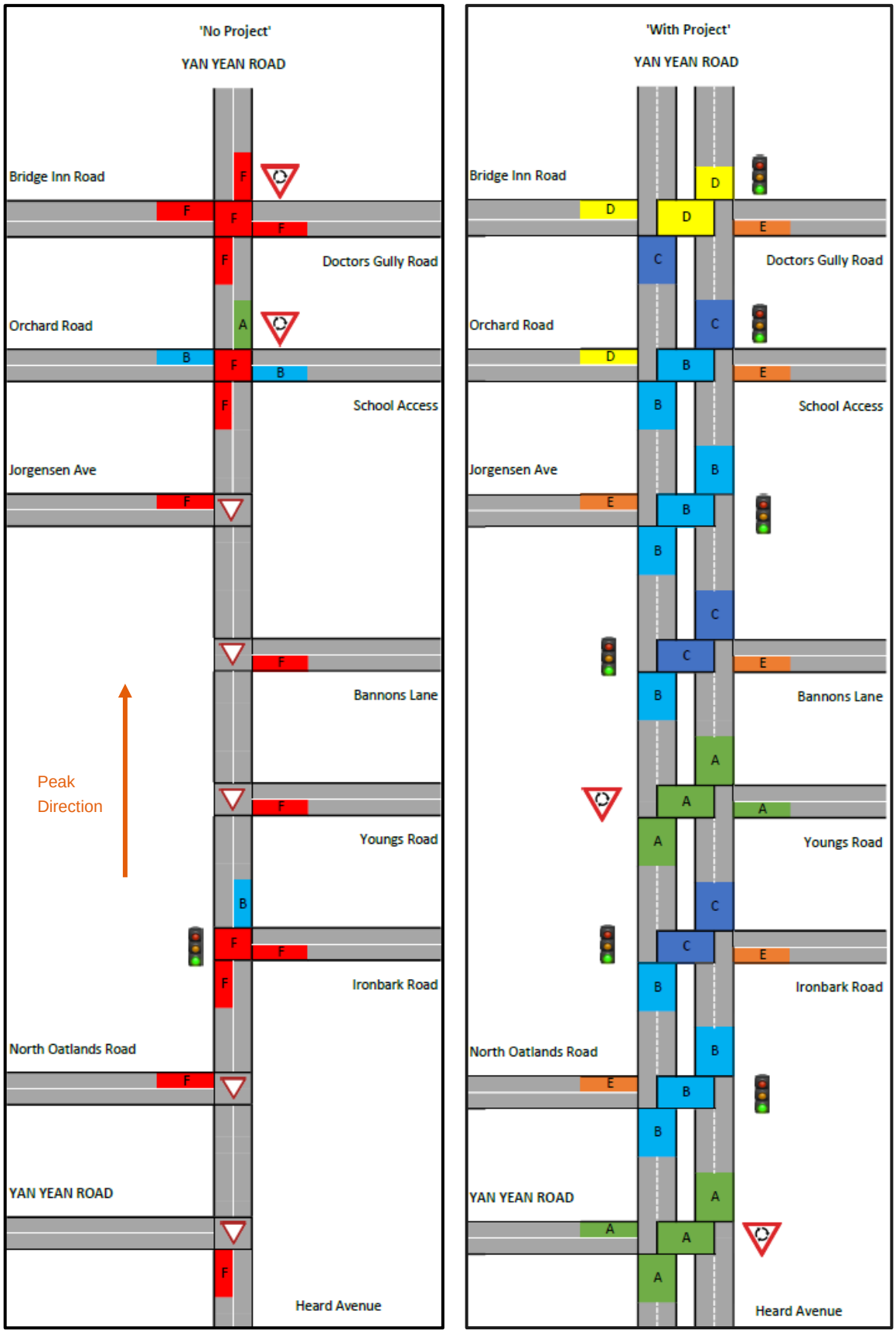


Figure 8.17 - Intersection performance, 2031 'No Project' vs. 'With Project (PM peak hour)

8.5 Sensitivity tests

Strategic transport demand forecasting is based on a series of underlying assumptions regarding how land use and the transport network will change into the future and how the population will make decisions about travel and interact with the transport network. Departures from these assumptions could have the potential to change the findings of this assessment.

To consider the scale of sensitivity of the outcomes of this assessment to potential variations in traffic forecasting outcomes, sensitivity testing has been undertaken at two levels. The first was at the strategic forecasting level, to understand the impact of varying land use change assumptions on the findings of the network assessment for 2031. The second was to understand how sensitive the intersection designs developed along the Project corridor are to changes in traffic forecasts.

8.5.1 Strategic traffic forecasting inputs

Two of the key input assumptions in strategic modelling are projections for how land use will change and how the transport network will change over coming years.

In order to test the impact of varying the assumptions underlying the strategic model, sensitivity testing for the forecast year 2031 'with Project' based on alternate transport network assumptions (i.e. network upgrade projects and the year in which they are expected to be completed) and land use projections (the rate of development) were considered. Given the majority of the transport projects proximate to the Project such the Northern Suburban Roads Upgrade, Plenty Road upgrade, and North East Link are either underway or committed and expected to be opened by 2031, the sensitivity tests developed focussed on the land use projections.

The following sensitivity tests were carried out:

- A 'low land use' scenario in which the rate of land development was assumed to be less than that currently projected. Population and employment projections for 2026 were applied in the 2031 'with Project' model.
- A 'high land use' scenario in which the rate of land development was assumed to be faster than that currently projected. Population and employment projections for 2036 were applied in the 2031 'with Project' model.

The impact on forecast daily vehicle volumes for a selection of roads in the study area is shown in Table 8.8 below.

Table 8.8 - Low and high land use scenario sensitivity test results (impact on traffic volumes)

Road name	Section	Low Land Use Sensitivity Test	High Land Use Sensitivity
Yan Yean Road	Cookes Road to Bridge Inn Road	-3%	3%
	Bridge Inn Road to Bannons Lane	-8%	9%
	Bannons Lane to Ironbark Road	-8%	7%
	Ironbark Road to Kurrak Road	-9%	7%
	Kurrak Road to Diamond Creek Road	-5%	4%
Bridge Inn Road	Plenty Road to Resort Boulevard	-4%	2%
	Resort Boulevard to Yan Yean Road	-6%	3%
Doctors Gully Road	East of Yan Yean Road	-10%	-2%
Kurrak Road/Gorge Road	Yan Yean Road to Plenty Road	-3%	6%
McDonalds Road	High Street to Civic Drive	-10%	7%
	Civic Drive to Plenty Road	-4%	3%
Diamond Creek Road	Yan Yean Road to Greensborough Bypass	-2%	2%
Plenty Road	Hazel Glen Drive to Bridge Inn Road	-3%	-1%
	Bridge Inn Road to Waterview Drive	-4%	1%
	Waterview Drive to The Lakes Boulevard	-5%	2%
	The Lakes Boulevard to Gorge Road	-4%	2%
	Gorge Road/McDonalds Road to Childs Road	-3%	1%

Road name	Section	Low Land Use Sensitivity Test	High Land Use Sensitivity
	Childs Road to Metropolitan Ring Road	-3%	1%
Epping Road/High Street	Bridge Inn Road/Boundary Road to Harvest Home Road	-18%	13%
	Harvest Home Road to O'Herns Road/Findon Road	-10%	7%
	O'Herns Road/Findon Road to Memorial Avenue	-7%	5%
	Memorial Avenue to Cooper Street	-7%	6%
	Cooper Street to Childs Road	-7%	7%
	Childs Road to Metropolitan Ring Road	-7%	9%
Heidelberg-Kinglake Rd	North of Main Hurstbridge Rd	-2%	6%
Kangaroo Ground-St Andrews Rd	North of Kangaroo Ground-Wattleglen Rd	-5%	2%
Main Hurstbridge Rd	At Diamond Creek	-2%	-1%

The sensitivity test results show that the change in land use has a relatively low impact across the local network. Under the 'low land use' scenario, 2031 forecast daily traffic volumes would generally reduce by less than 10 percent compared to the standard 2031 'with Project' traffic forecasts. Similarly, under the 'high land use' scenario, 2031 daily traffic forecasts were found to increase by less than 10 percent generally. The northern end of Epping Road appears to be more sensitive to changes in land use, perhaps owing to sharp increase in land development to the west of the Project in the base land use projections, though this doesn't materially impact the Project corridor. Plenty Road traffic appears to be less sensitive to changes in land use projections, with daily traffic forecasts varying by only 5 percent under both scenarios.

This scale of change is not expected to have a major impact on the network assessment findings of this assessment. Nonetheless, as outlined below, the impact of changes of this scale on the performance of the intersection configurations developed for the Project has been assessed.

8.5.2 Corridor sensitivity

Sensitivity scenarios

The Peer Review findings helped guide the sensitivity analysis undertaken for the corridor modelling for the 'with Project' scenario. Two sensitivity assessments were undertaken, namely:

- A low and high land use demand scenario, based on the strategic modelling
- An intersection "stress test", to understand the relationship between growth rate and intersection footprint.

The low and high land use demand scenario was based on the strategic modelling demand sensitivities as detailed in Section 8.5.1. For the purposes of this assessment, the range was simplified to a conservative +/- 10 percent around the base 2031 traffic forecasts.

The intersection "stress test" was undertaken to assess the growth rate range which would result in an increase or decrease in intersection footprint.

All sensitivity assessments were based on SIDRA *isolated* site analysis.

Land use sensitivity assessment

Table 8.9 summarises the low and high sensitivity assessment for each intersection under the 'with Project' scenario.
As expected, all intersections perform more efficiently under the *low land use* scenario (base demand -10 percent), with intersections operating (worst peak) at around 80 percent capacity (DoS of 0.8).

Under the *high land use* scenario (base demand +10 percent), intersections are forecast to operate much closer to capacity, with several intersections reaching capacity (DoS of 1).

This assessment suggests that a reasonable balance between intersection footprint and performance has been achieved under the Project design.

Table 8.9 - Intersection high and low land use sensitivity assessment

Intersecting Road	Peak	Intersection Volume (veh/hr)	DoS[1]			LoS[2]		
			-10%	Base	+10%	-10%	Base	+10%
Bridge Inn Road	AM	3,985	0.79	0.81	0.92	D	D	D
	PM	4,200	0.86	0.89	0.94	D	D	D
Orchard Road	AM	3,585	0.82	0.91	1.00	C	D	E
	PM	3,344	0.76	0.80	0.90	C	C	C
Jorgenson Avenue	AM	3,222	0.82	0.86	0.95	C	C	D
	PM	3,622	0.75	0.86	0.98	B	B	D
Bannons Lane	AM	3,380	0.79	0.81	0.90	B	B	C
	PM	3,834	0.83	0.89	0.98	B	C	D
Youngs Road	AM	3,286	0.66	0.73	0.81	A	A	A
	PM	3,779	0.72	0.80	0.88	A	A	A
Ironbark Road	AM	3,628	0.68	0.77	0.85	C	C	C
	PM	4,061	0.82	0.89	0.98	C	C	D
North Oatlands Road	AM	3,007	0.73	0.75	0.86	B	B	C
	PM	3,434	0.81	0.86	0.94	B	B	C
Heard Avenue	AM	2,890	0.58	0.65	0.72	A	A	A
	PM	3,300	0.68	0.76	0.84	A	A	A

1. Degree of saturation, critical movement
2. Level of service, overall intersection

Intersection stress test

An intersection “stress test” was undertaken to assess the growth rate range which would result in an increase or decrease in intersection footprint, namely the number of approach lanes required.

The stress test was separated into two parts:

- An “increased footprint assessment”, to estimate the high growth rate at which additional traffic lanes are required. For the purposes of this assessment, this point is defined as when the intersection degree of saturation exceeds 1.0.
- A “decreased footprint assessment”, to estimate the low growth rate at which less traffic lanes are required. For the purpose of this assessment, this point is defined as when the reduced configuration achieves a degree of saturation of 0.9.

The intersection *increase footprint assessment* was undertaken for all intersections.

Table 8.10 summarises the growth from the base forecast which would trigger the need for a larger footprint at each intersection. This analysis confirms the general findings of the high land use sensitivity, in that during the critical peak, an additional 8 percent to 14 percent of traffic would result in most intersections reaching capacity.

Table 8.10 - Increase footprint assessment

Intersecting Road	Peak	Base Volume (veh/hr)	Base DoS	Critical volume (% change) DoS of 1
Bridge Inn Road	AM	3,985	0.81	5,101 (+28%)
	PM	4,200	0.89	4,872 (+16%)
Orchard Road	AM	3,585	0.91	3,944 (+10%)
	PM	3,344	0.80	4,080 (+22%)
Jorgenson Avenue	AM	3,222	0.86	3,738 (+16%)
	PM	3,622	0.86	4,129 (+14%)
Bannons Lane	AM	3,380	0.81	4,056 (+20%)
	PM	3,834	0.89	4,217 (+10%)
Youngs Road	AM	3,286	0.73	4,403 (+34%)
	PM	3,779	0.80	4,686 (+24%)
Ironbark Road	AM	3,628	0.77	4,571 (+26%)
	PM	4,061	0.89	4,548 (+12%)
North Oatlands Road	AM	3,007	0.75	3,789 (+26%)
	PM	3,434	0.86	3,915 (+14%)
Heard Avenue	AM	2,890	0.65	4,335 (+50%)
	PM	3,300	0.76	4,224 (+28%)

The intersection *decrease footprint assessment*, was limited to locations that provide more than the minimum intersection approach configuration of 2 through lanes plus a single left turn lane plus a single right turn lane, namely Ironbark Road.

Ironbark Road, reduced footprint assessment

The reduced footprint selected for this sensitivity assessment at Ironbark Road is summarised in Figure 8.18; the removal of the third through lane on the north approach (N to S).

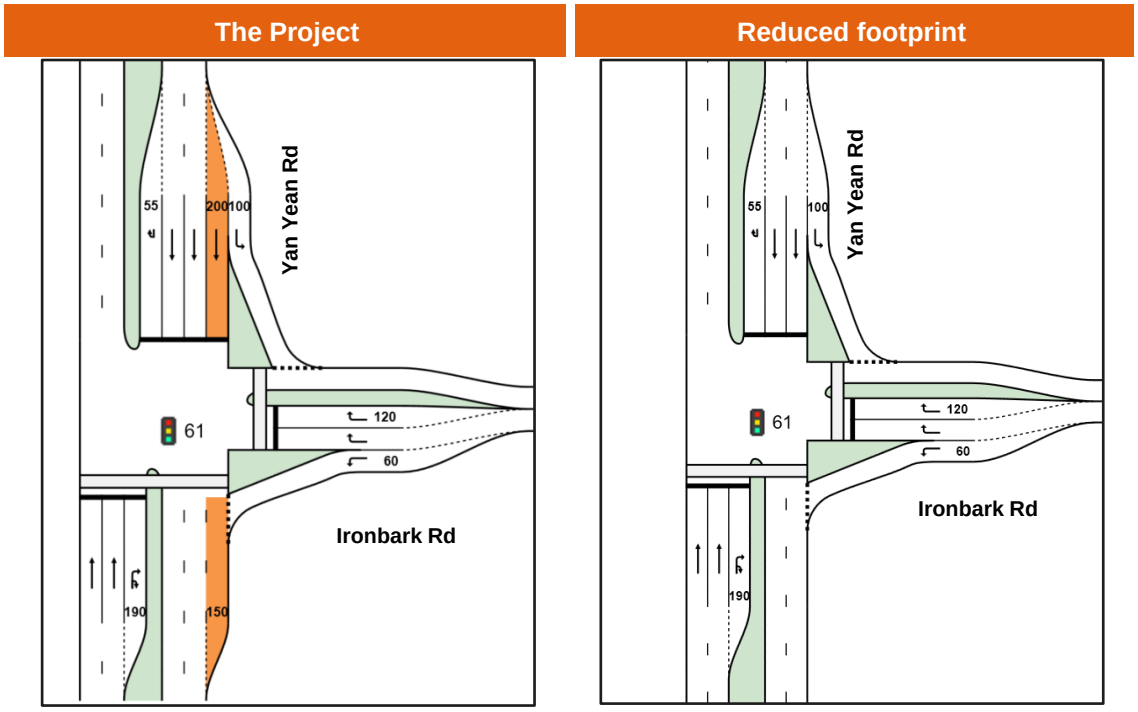


Figure 8.18 – Ironbark Road, reduced footprint sensitivity

Table 8.11 summarises the performance of Ironbark Road intersection, under a reduced footprint arrangement, where the traffic demand is reduced to a level where the revised layout operates at a DoS 0.9.

In summary,

- The AM peak hour is the most critical when considering removal of the third through lane (N to S), coinciding with the southbound peak
- Under the base case demand scenario, the reduced intersection is forecast to operate at capacity during the AM peak (DoS of 1)
- To achieve a DoS of 0.9, the traffic volumes would need to be 8 percent lower than forecast, similar to the low land use scenario
- The revised layout performs reasonably well under the 2031 PM peak hour base demand.
- Under the high land use scenario (+ 10 percent), the intersection is expected to operate at a DoS 1.1 and a LoS F under the more critical AM peak hour.

Table 8.11 - Reduced footprint assessment, Ironbark Road Intersection

Demand	Peak	Volume (veh/hr)	DoS	LoS	% Change
2031 Base Case	AM	3628	1.00	E	-
	PM	4061	0.91	C	-
2031 Low Case*	AM	3338	0.90	C	-8%
(-8%)	PM	3980	0.89	C	-2%
2031 High Case (+10%)	AM	3991	1.11	F	+10%
	PM	4467	1.00	E	+10%

Cycle time of 120s

* Low case – sensitivity test to determine demand reduction required to achieve a DoS 0.9

The analysis of the Ironbark Road intersection demonstrates how sensitive the intersection performance is to relatively small changes in traffic volumes. At the Ironbark Road intersection:

- Under the forecast volumes, the Project is expected to operate at the desired DoS of 0.9
- Under the high land use sensitivity (+10 percent), the Project is expected to operate very close to capacity (DoS 0.98, PM peak)
- PM traffic volumes 12 percent higher than the base forecast, would result in the Project operating at or close to capacity (DoS 1)
- Under the low land use scenario, however, the Project reduced layout (removal of the third southbound through lane) would function adequately during the critical AM peak hour.

8.6 Movement and Place

As outlined in Section 5.7, the Movement and Place framework assigns a future strategic vision to the transport network based on state-level transport and land use strategies. Movement and Place recognises that our roads and streets support the transport needs of a diverse set of users and are also places for people to live, work and enjoy. By defining which modes of transport have priority on roads, Movement and Place seeks to ensure that projects developed are cognisant of the competing interests for limited road space.

Movement and Place assessments evaluate how closely a proposed transport project aligns with the Movement and Place framework. The assessment considers existing conditions, the road's Movement and Place classifications, relationship with current issues and likely changes following the Project. Outlined below are the key findings of a Movement and Place rapid assessment that was undertaken during the Project development phases.

Refer to Section 5.7 for discussion on the current Movement and Place classifications for Yan Yean Road.

8.5.3 Issues identification

The following key issues were identified when comparing the current performance of the road to the strategic purpose.

- Traffic congestion along Yan Yean Road results in delays to all road users including general traffic, buses and freight.
- Poor road safety outcomes on Yan Yean Road.
- Lack of cycling infrastructure along Yan Yean Road does not support the use of active transport along the corridor.

8.5.4 Design assessment

A simple assessment methodology was carried out to test how well the proposed design for the Project performs relative to identified issues and land uses (Table 8.12, Table 8.13).

	Addresses issue well / strong alignment with land use
	Addresses issue moderately well / moderate alignment with land use
	Addresses issue / aligns with land use
	Does not address issue / does not align with land use
	Cannot assess without further information.

The design objective should be to ensure all issues are at least met.

Table 8.12 - Movement and Place assessment against key issues

Issue	Assessment
Traffic congestion along Yan Yean Road results in delays to all road users including general traffic, buses and freight.	**Addresses issue well** - Duplication of Yan Yean Road will reduce congestion by increasing capacity. The design caters for current volumes and the rapid anticipated growth in the area.
Poor road safety outcomes on Yan Yean Road.	**Addresses issue well** - Design significantly reduces the number of uncontrolled right turns along the road and improves horizontal and vertical geometry compared to existing conditions. - Separation of traffic and inclusion of safety barrier significantly reduces the potential for head on collisions.
Lack of cycling infrastructure along Yan Yean Road does not support the use of active transport along the corridor.	**Addresses issue well** - Provision of shared use path along the length of the route will encourage active transport and provide connectivity to Bridge Road and Yan Yean Road south of Kurrak Road.

Table 8.13 - Movement and Place alignment with adjacent land uses

Land use alignment	Assessment
Residential land use	**Aligns with land use** - Typical access to residential property is now left-in left out. Drivers typically have to travel no more than an 800m round trip to access property. - All residential property will have access to a continuous footpath / shared use path. - Landscape and urban design guidelines to recognise existing rural character and align design accordingly.
Convenience centre	**Strong alignment with land use** - Improved access to centre via active transport through continuous footpath and shared use path along Yan Yean Road. - Improved access to centre for general traffic as a result of reduced congestion. - Landscape and urban design guidelines to align with convenience centre character and align with council vision for site.
Schools	**Strong alignment with land use** - Improved access via active transport through continuous footpath and shared use path along Yan Yean Road. - Improved access to schools for general traffic and buses as a result of reduced congestion.

8.5.5 Conclusion

The following were the conclusions of the Movement and Place rapid assessment:

- The upgrade of Yan Yean Road between Bridge Inn Road and Kurrak Road will reduce congestion along the route by increasing capacity and improve road safety through the provision of road safety infrastructure and changes to access arrangements. It will also improve active transport connectivity by providing continuous footpaths and shared use paths along the road.
- This section of Yan Yean Road primarily serves users within its immediate vicinity rather than the broader Melbourne road network, and its upgrade should be targeted to meet the needs of these users.
- The proposed Project design strongly addresses the following issues:
    - Traffic congestion along Yan Yean Road results in delays to all road users including general traffic, buses and freight.
    - Poor road safety outcomes on Yan Yean Road.
    - Lack of cycling infrastructure along Yan Yean Road does not support the use of active transport along the corridor.
- It is noted that the proposed design reduces access to residential land uses by making typical access left in left out, on balance this is still seen to align with access requirements as regular provision of U-turn locations results in road users not being significantly inconvenienced.
- The design assessed does not include landscaping and urban design. The finalised design must comply with the landscape and urban design guidelines in order to ensure that it aligns with the character of the area.

8.6 Road safety

During the design development phase of the Project, Safe System Assessments and Road Safety Audits were carried out to enhance the road safety outcomes of the design. Safe System Assessments are a tool that measures the extent to which a road project aligns with Victoria's Safe Systems design principles which are based on development of a road system that is forgiving of driver error and seeks to eliminate fatalities and serious injuries.
A road safety audit is a review of the design and site conditions to identify potential road safety issues and opportunities to improve road safety through the design process.

In general terms, the upgrade of a roadway from a single carriageway to a divided carriageway, as is occurring in the 'with Project" scenario would be expected to bring about improvements in road safety. According to research carried out by Austroads across Australia, divided carriageway roads have a substantially improved road safety record compared to single carriageway road in terms of fatal crashes and injury crashes. As shown in Table 8.14, experience in Victoria for urban and rural roads suggests divided carriageway roads have a crash rate (number of crashes per 100 million vehicle kilometres travelled) involving a fatality or serious injury that is around 40 percent lower than single carriageways.

Table 8.14 - Crash rates by carriageway type (Victoria)

Carriageway	Fatality crash rate (per 100M VKT)	Injury crash rate (per 100M VKT)	Fatality + Injury crash rate (per 100M VKT)
Single	0.78	26.26	27.04
Divided	0.37	16.52	16.89

Source: Austroads Road Safety Engineering Risk Assessment Part 7: Crash Rates Database

More specifically to the Project, the key design elements expected to improve safety include:

- Kerbside safety barriers – to protect roadside hazards such as trees, and minimise the severity of run-of-road crashes
- Median safety barriers – to reduce the potential for head-on crashes, and minimise severity of crashes
- Two-lane carriageway – increase in road capacity reduces congestion, reduces the likelihood of rear-end type crashes and provides for over-taking opportunities without crossing into on-coming traffic.
- Intersection control – upgrade from priority-controlled intersections (give-way) to more-controlled forms (traffic signals, roundabouts) improves safety for turning movements, and in particular right turning movements. Traffic signals also provide for a safer crossing opportunity for pedestrians and cyclists
- Access management –restricting local access to left in / left out movements only, by diverting traffic to U-turning facilities at traffic signals.

8.7 Construction traffic impacts

Project construction is expected to have a number of temporary transport impacts, caused by

- Traffic management required to safely construct the road duplication
- Increased truck activity required to transport spoil and fill, and construction equipment
- Timing and coordination with other projects, including the diversion of traffic flow during road closure periods.

This section summarises a high-level assessment of potential construction traffic impacts.

8.7.1 Traffic management

Traffic management during construction is key to minimising disruption to the community while providing a safe roadside work environment and is usually guided by the construction staging requirements.

Traffic Management Plans must be prepared in accordance with road authority requirements and all relevant standards, policies and guidelines, prior to the commencement of any construction activities.

Traffic Management Plans should clearly outline traffic control measures that:

- Minimise access restrictions and disruption to all road users
- At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements
- Provide detour routes for restricted movements
- Maintain property accesses
- Maintain community engagement with advance warning of changed traffic conditions.

8.7.2 Increased truck activity

Construction of the Project will require increased truck activity, primarily for the transport of fill, removal of spoil and transport of construction materials and equipment.

As temporary construction sites are created, traffic management is key for the safe access and egress of construction vehicles, particularly when fully laden.

High level “cut and fill” estimates for the Project suggest that there will be substantial excess of spoil material (“cut”). It is envisaged that spoil material cut from the Project will be used as “fill” as required, with the excess spoil hauled off-site (either to other projects or for disposal).

Haulage routes have not been formally defined for the Project and will likely be influenced by the timing of other road projects in the area, and the haulage destination. It is envisaged however, that:

- Haulage to the north (i.e. to Hume Freeway), could occur via:
  - Kurrak Road, McDonalds Road, Cooper Street
  - Kurrak Road, Plenty Road, M80
  - Yan Yean Road (Stage 1), Diamond Creek Road, M80
- Haulage to the west (i.e. to the M80 Metropolitan Ring Road), could occur via:
  - Kurrak Road, Plenty Road, M80
  - Yan Yean Road (Stage 1), Diamond Creek Road, M80
- Haulage to the south, could occur via:
  - Yan Yean Road (Stage 1), Diamond Creek Road, Greensborough Highway

8.7.3 Construction staging

Construction staging is key to maintaining traffic flow along Yan Yean Road while under construction. The design development has considered, at a high level, possible construction staging.

The key principle of staging is to maintain one carriageway (two lanes, one per direction) for traffic for most of the time unless detours can be provided. This is achieved by:

- Constructing as much of the new carriageway as possible offline, while maintaining traffic flow on the existing carriageway (Refer to Figure 8.19 for schematic of existing and proposed new carriageway alignment).
- Switching all traffic to new sections carriageway, establishing temporary intersection controls as required
- Upgrading the old carriageway offline
- Upgrading intersections which may be driven by additional staging requirements to maintain all critical movements during construction

The staging will have temporary impacts on local direct access, however this will be managed through community consultation.

Staging may also require temporary closure of the road, particularly when constructing complicated intersections. To minimise impacts to the local community and general traffic, such activities are typically limited to off peak times (for example, overnight or on a weekend). The contractor should minimise the number and length of road closures, managing the process through thorough community consultation.

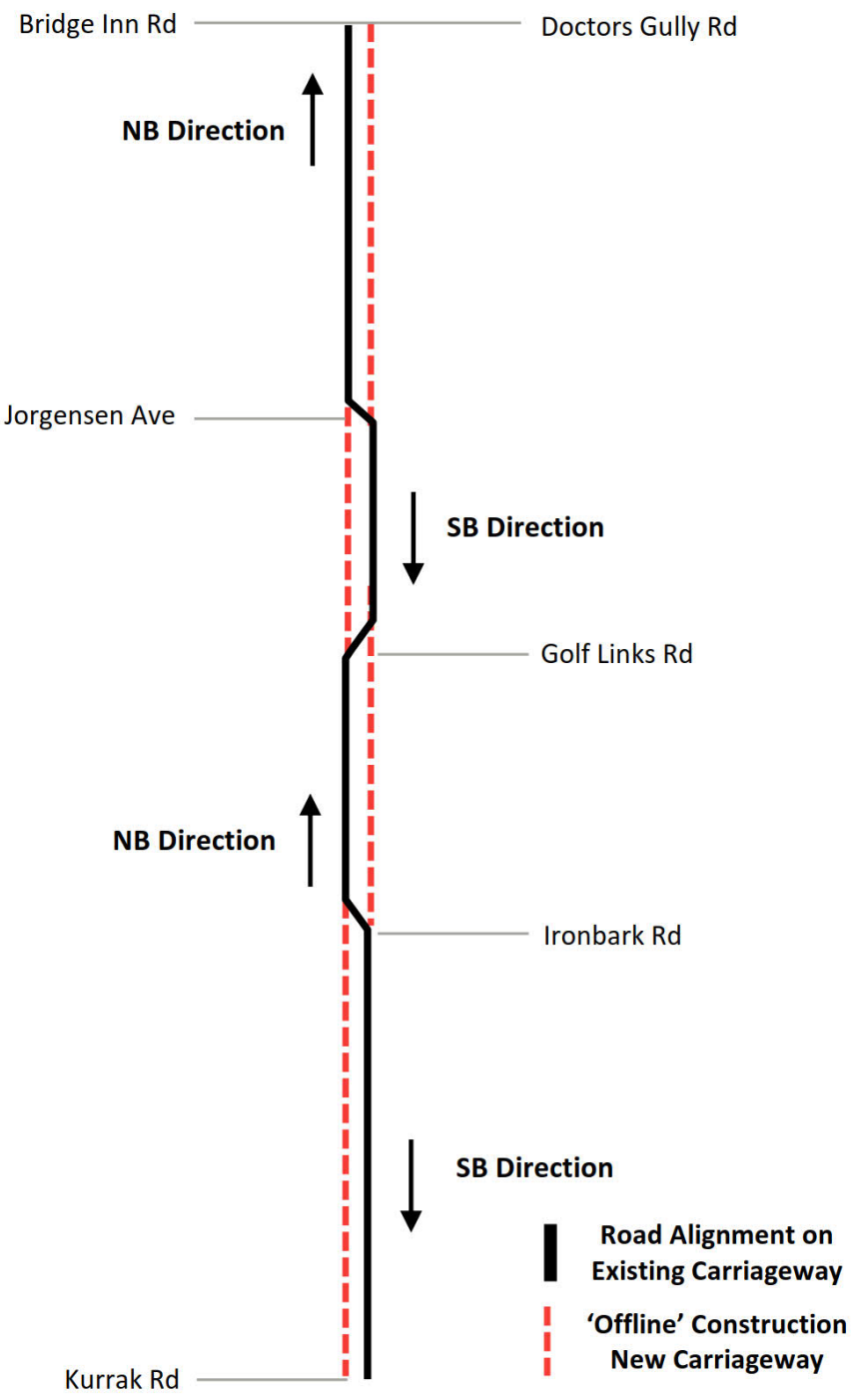


Figure 8.19 – Project carriageway summary

8.7.4 Coordination with other transport projects

As outlined in Section 5.2.5, construction works on other transport projects are expected to occur throughout the outer northern suburbs over the coming years. Depending on the timing of construction works, seeking to coordinate construction traffic management activities impacting the same areas where practicable may be an important means of traffic impact mitigation. The current understanding of construction timeframes for other transport projects in the area and potential for cumulative traffic impacts are summarised in Table 8.15, while the geographic location of the Projects is shown in Figure 8.20.

Table 8.15 – Construction timeframes and potential impacts – other projects

Project	Expected construction timeframe	Potential impacts
Hurstbridge Line Upgrade Stage 2	Expected to begin in 2020 and be completed by 2022.	Most works will be carried out within the rail reservation and not expected to have a major impact on the road network. The Mernda Rail Line is the closest railway line to Yan Yean Road and will likely be more heavily utilised during any required occupations.
North East Link	Construction expected to commence in 2020 and be completed in 2027.	Potential for construction works for North East Link to be occurring at the same time as the Project. Majority of haulage and major traffic management works will take place well south of Yan Yean Road. North East Link EES[3] notes short sections of Edgars Road, High Street and Plenty Road between Metropolitan Ring Road and Bell Street may be used for haulage but not expected to have a major impact on the Project corridor.
Northern Roads Upgrade	The Northern Roads Upgrade package or road projects are currently expected to be completed by the end of 2025. Staging of individual roads upgrades not currently known.	Potential for upgrades to Bridge Inn Road and Epping Road and road maintenance works on the Project maintenance network to be occurring at same time as the Project. Where concurrent works are occurring, there is likely to be a need for coordination between contractors, NRU, the Project and road authorities
M80 Upgrade	Construction expected to commence on the Sydney Road to Edgards Road section in 2020 and be completed by 2023.	Potential for construction works for M80 Upgrade works to occur at the same time as the Project. Where concurrent works are occurring, there is likely to be a need for coordination between contractors, M80 Upgrade, the Project and road authorities.
Plenty Road Upgrade Stage 2	Upgrade works between Bush Boulevard to Bridge Inn Road are currently underway and expected to be completed in mid-2021	The potential for Plenty Road Stage 2 works to be occurring at same time as the Project is unlikely due to the timing of the Project.

[3] Environment Effects Statement, Technical Report A Traffic and Transport, April 2019, Smedley Technical and Strategic

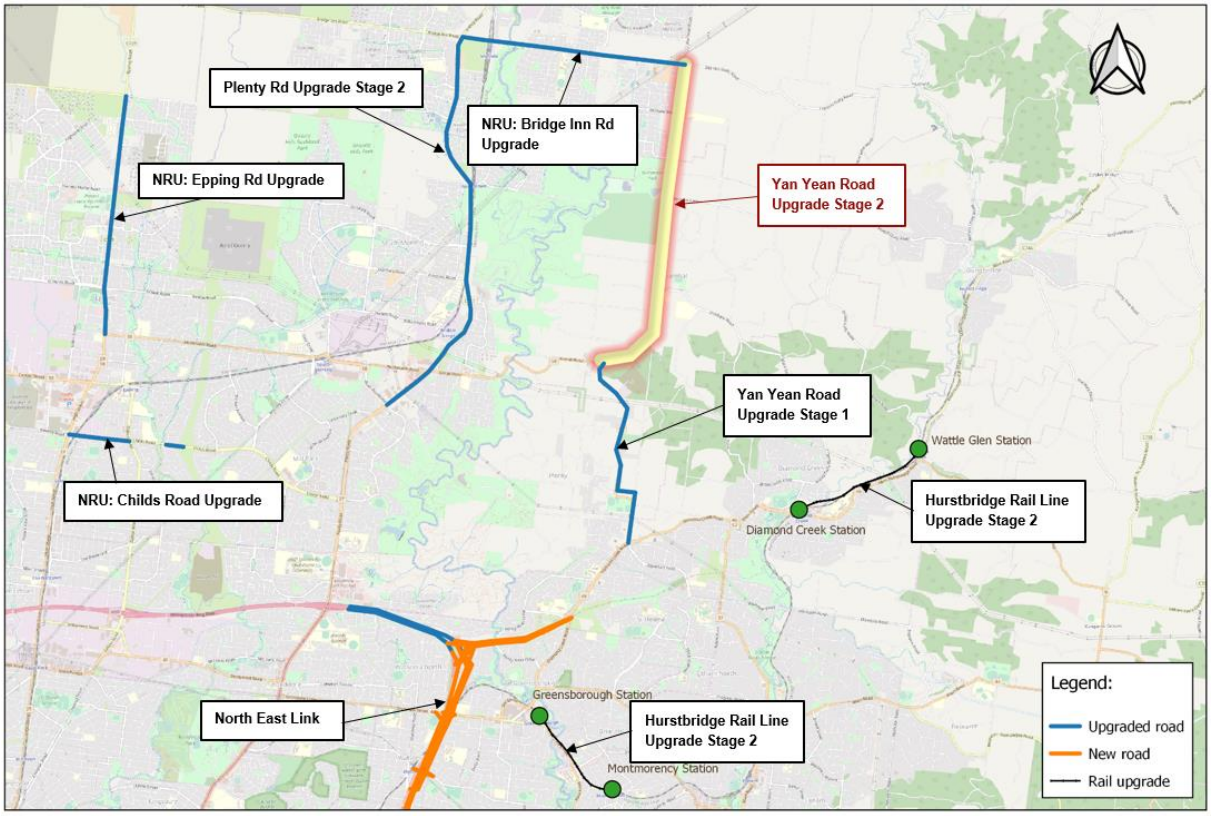


Figure 8.20 – Other transport construction projects

Where works on multiple nearby roads are occurring concurrently, it is anticipated that coordination of traffic management considerations such as the following would assist in mitigating traffic impacts where practicable:

- ***Sequencing of works –*** such that works on parallel arterial roads are managed to provide sufficient options for road users, particularly over extended periods of time. Including attempting to avoid works on dependent or alternate routes at the same time.
- ***Detour routes –*** avoid establishing detour routes via other roads which also have traffic impacting works underway. Also consider establishing alternate routes that spread traffic load across the network.
- ***Haulage routes –*** coordinate haulage routes where relevant to avoid unduly impacting particular sections of road and spread heavy vehicle traffic loads across the network.
- ***Interface points*** – where concurrent works between two separate projects physically interface (e.g. Bridge Inn Road intersection) coordinate traffic management plans to ensure traffic management plans for the same zone don't conflict.
- ***Communications*** establishing consistent, central points of communication where road users wish to obtain information about traffic management. Coordinate communications strategy across projects to avoid confusion amongst affected residents and business.
- ***Signage -*** Coordinate VMS and road signage messages and placements on the network amongst projects for legibility and to avoid inconsistencies and confusion for road users.

9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

To manage the potential impacts assessed for transport, MRPV proposes to implement Environmental Performance Requirements (EPRs) for the Yan Yean Road Upgrade – Stage 2. EPRs will form the parent environmental controls that feed into the EMF for the EES.

Table 9.1 lists the recommended EPRs relevant to the transport impact assessment. EPR's for transport were developed by the technical authors in conjunction with MRPV and are based on the expected environmental impacts during the construction, maintenance and operational phases of the Project.

Table 9.1 - EPRs applicable to the Yan Yean Road Upgrade – Stage 2

Performance objective	Applicable legislation policy and guideline	EPR Code	Risk no.	Environmental Performance Requirement	Project phase
Transport (active users and road users) To provide for an effective corridor through the northern outer suburbs of Melbourne, to improve travel efficiency, road safety, and capacity	*Transport Integration Act 2010* *Road Management Act 2004* *Planning and Environment Act 1987*	TP1	97, 98, 99	**Optimise design for active and road users** Optimise the design in consultation with appropriate road management authorities, Shire of Nillumbik and City of Whittlesea to: - Minimise adverse impact on travel times for all transport modes, including walking and cycling - Maintain, and where practicable, enhance the traffic movements at intersections within the project area - Design the road, walking and cycling elements and other recreation activities to meet relevant road and transport authority requirements - Where existing traffic movements are altered by the Project, ensure that alternative movements are incorporated into the design - Maintain, and where practicable, enhance pedestrian movements, bicycle connectivity, and walking and cycling paths, including access to public open space and reserves.	Design

Performance objective	Applicable legislation policy and guideline	EPR Code	Risk no.	Environmental Performance Requirement	Project phase
		TP2	17, 18, 19, 37, 38, 39, 57, 58, 59, 77, 78, 79, 117, 118,119	**Traffic Management Plan** The Project should be constructed in stages to minimise impact on road users and prior to commencement of relevant works, a Traffic Management Plan (TMP) must be developed and implemented to minimise disruption during construction in accordance with AS1742.3-2009 and in consultation with relevant authorities including Department of Transport, Shire of Nillumbik and City of Whittlesea. The TMP will clearly outline measures to: - Minimise road closures, access restrictions and disruption to all road users, public transport users and active users, including pedestrians, cyclists and horse riders - Minimise impacts on local streets such as from 'rat running' during construction closures - Provide for safe construction practices in accordance with road authority requirements - Provide alternative routes for affected road users, public transport users and active users where practicable - Maintain property accesses during construction where practicable or provide alternative access - Potential routes for construction haulage and construction vehicles travelling to and from the project, recognising sensitive receptors and avoiding the use of local streets where practicable - Maintain community safety through appropriate measures such as providing convenient and safe access across Yan Yean Road at all bus stops, activity nodes and places of community significance - Suitable measures, developed in consultation with emergency services, to ensure emergency service access is not inhibited as a result of project construction activities - Ensure affected community is notified in advance (in accordance with EPR S2) of changed traffic conditions.	Construction

10 CONCLUSIONS

This report has provided a Transport Impact Assessment for the operation and construction of the upgrade of Yan Yean Road between Kurrak Road and Bridge Inn Road in Melbourne's outer northern suburbs ('the Project'). This assessment forms part of the Environment Effects Statement (EES) for the Project.

The following evaluation objective for 'Transport capacity and connectivity', identified in the EES Scoping Requirements for the Project, is relevant to this Transport Impact Assessment:

> *"To provide for an effective corridor through the northern outer suburbs of Melbourne, to improve travel efficiency, road safety and capacity".*

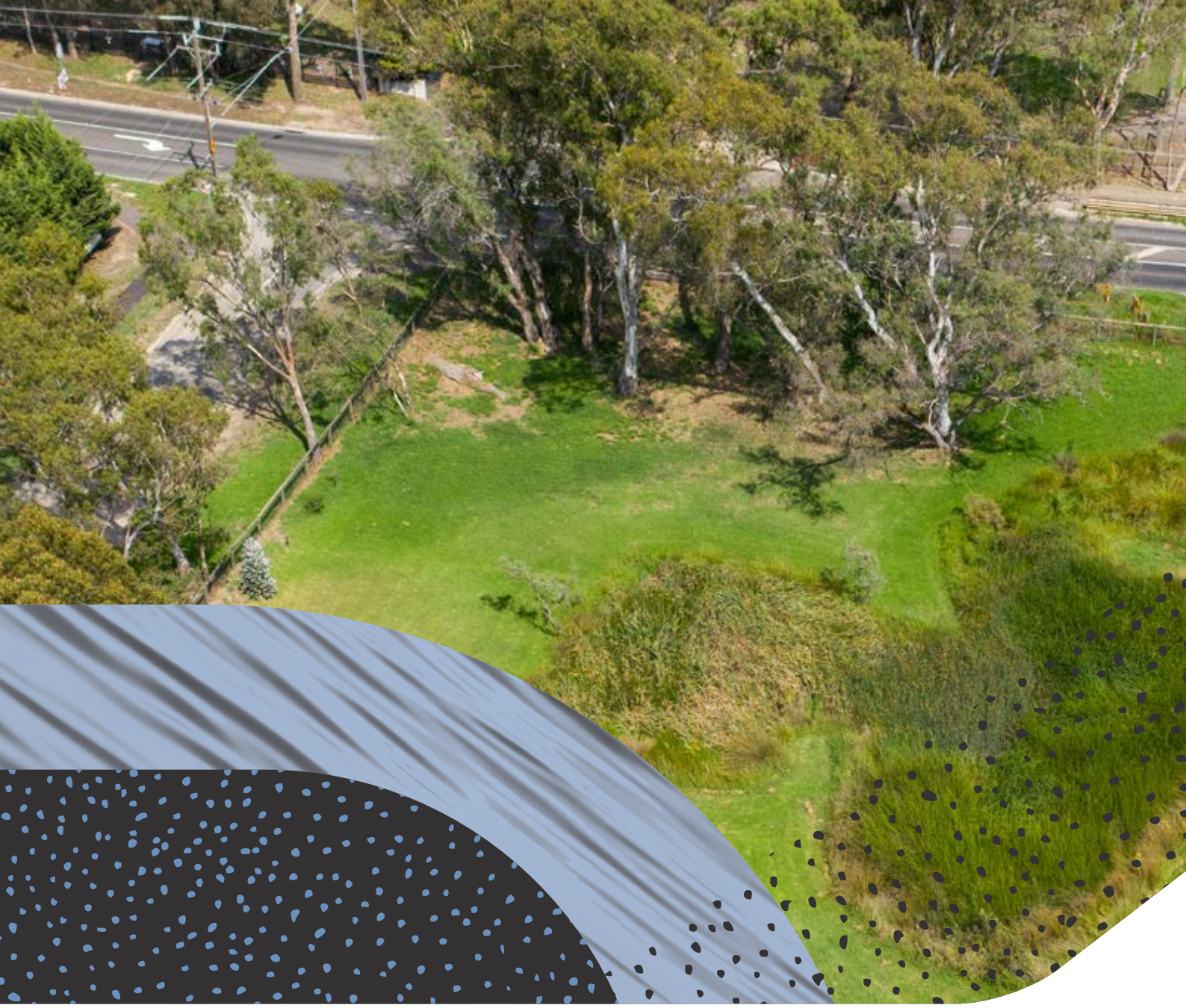
The Scoping Requirements handed down by the Minister for Planning set out specific requirements regarding assessment of the existing environment, likely effects of the Project, design and mitigation measures and performance objectives that have guided the preparation of the assessment. The Scoping Requirements cover both the operational and construction phases of the Project and the road traffic, public transport and active transport modes.

The key findings of the assessment are summarised as follows.

- Yan Yean Road is currently heavily congested during the commuter peak periods with extensive queues observed on the northern approach to Ironbark Road in the morning peak and on the southern approach to Bridge Inn Road in the evening peak. Average travel speeds drop to approximately 25 km/hr and minimum average speeds are as low as 15 km/hr in the peak directions of travel.
- There is currently a lack of provisions for pedestrians and cyclist paths along the Project corridor meaning it is not well utilised by pedestrians or cyclists.
- Extensive land development across the City of Whittlesea is forecast to result in a significant increase in traffic throughout the local region. Significant growth in traffic is expected along key north-south routes.
- In the absence of the Project:
    - Travel efficiency across the local network is forecast to decline by 2031 with increased traffic demands exacerbating congestion and increasing travel times.
    - Intersections along the Project corridor are expected to operate poorly with Level of Service F reached at key locations, meaning traffic demands are exceeding intersection capacities resulting in unacceptable delays.
    - Motorists egressing residential areas via side roads are expected to encounter difficulty in finding suitable gaps in traffic along Yan Yean Road.
    - Bus travel times are likely to increase significantly, particularly during the peak periods and in the peak direction travel, with journey times becoming less reliable.
    - With no infrastructure upgrades proposed for pedestrian, cyclists or horse-riders, conditions will likely deteriorate, particularly when crossing Yan Yean Road, further discouraging active transport in the area.
    - The forecast increases in traffic volumes and poor operational performance, combined with the many uncontrolled access points and substandard road infrastructure provisions is expected to bring about a deterioration in road safety along Yan Yean Road and increase the likelihood of crashes.
- The Project is expected to have the following effects:
    - Improved safety and efficiency of access management as the high number of uncontrolled access movements along the corridor are redirected to dedicated U-turn facilities either at an intersection or at a mid-block facility.
    - Improved amenity and safety for active transport modes through provision of a new 5.5-kilometre shared use path, encouraging walking and cycling through the corridor.

  - Additional capacity to cater for traffic growth across the local network which will significantly improve speeds and travel times on Yan Yean Road, as well as other key north-south routes in the study area.
  - Significantly improved capacity and more efficient intersection performance along the Project corridor, with the intersection at Bridge Inn Road operating at a LoS D, and all other intersections operating at a LoS C (or better) based on 2031 traffic forecasts.
  - Enhanced accessibility to key activity and employment centres including Melbourne CBD, La Trobe National Employment and Innovation Cluster, Greensborough activity centre and Eltham activity centre for residents of the growing communities adjacent to Yan Yean Road.
  - Additional resilience in the local road network by limiting the scale of traffic impacts occurring if capacity reductions were to occur on Yan Yean Road and Plenty Road such as due to roadworks, breakdowns or other incidents.
  - Improved road safety outcomes and a lower likelihood of crashes due to improved operating conditions, intersection upgrades and access control, additional safety infrastructure and provisions for cyclists and pedestrians.
- During the construction phase of the Project it is expected that:
  - Works will be staged to maintain traffic flow along Yan Yean Road for the majority of the construction program. The road design has been developed with the aim of being able to construct the second carriageway off-line while maintaining traffic flow on the existing carriageway. When complete, traffic would be switched to the second carriageway to allow upgrade of the old carriageway.
  - Temporary closures to traffic may be required for constructing complicated intersections and these would be carried out at off peak times to minimise disruption to the community.
  - Staging may have impacts on local direct access at times and this would need to be carefully managed through consultation with impacted property owners.
  - A number of other projects may be under construction on the surrounding road network at the same time including North East Link, the Northern Roads Upgrade and M80 upgrade. Where works are occurring in parallel, there will likely be benefit in coordination of detour routes, closure times, signage and communications across the Projects to mitigate to cumulative impact of traffic management procedures on multiple projects in the area.

APPENDIX A – PROJECT DESCRIPTION



PART 1 INTRODUCTORY CHAPTERS

5 Project Description

5.1 Introduction

This chapter describes the proposed design, construction and operation of the duplication of Yan Yean Road between Kurrak Road and Bridge Inn Road (the Project). The chapter should be read in conjunction with Attachment VI *Map Book*, which contains detailed plans and drawings of key elements of the Project.

This Project description has been developed to provide an understanding of all components, processes and development stages of the Project to enable assessment of the Project's potential environmental effects. The description includes specific design elements to address the potential for the Project to generate adverse environmental effects and impacts.

5.2 Project overview

Yan Yean Road is a significant north-south arterial road servicing the Shire of Nillumbik and the City of Whittlesea, providing connectivity for the City of Whittlesea's growing suburbs of Doreen and Mernda to the townships of Plenty and Yarrambat. Yan Yean Road connects with major east-west arterials such as Bridge Inn Road, Kurrak Road and Diamond Creek Road and also provides a connection to employment and services in established neighbouring suburbs such as Greensborough and Diamond Creek.

Stage 1 of the Yan Yean Road upgrade (Diamond Creek Road to Kurrak Road) was completed in 2019, and construction on Stage 2 (the subject of this EES) is scheduled for completion by 2025.

The Project seeks to upgrade an existing road in hilly terrain, largely within the existing road reserve. The surrounding environment is characterised by low density residential and rural living areas such as farmland and agricultural areas, with the suburb of Doreen experiencing rapid change from rural living to higher density residential developments. The Project alignment and immediate surrounds intersect a range of land uses including residential, open space, rural living, commercial and education.

Key land uses along the alignment include Yarrambat Park and the Yarrambat Park Golf Course, Plenty Valley Christian College, Yarrambat Primary School, St Macarius Coptic Orthodox Church and the Doreen business precinct.

Terms used in this project description

Carriageway: lanes where traffic would be travelling, plus shoulders and auxiliary lanes

Cross section: shows the width of the road with the position and number of traffic lanes, medians, walking and cycling paths and footpaths

Cutting: ground excavation that is required to create a smooth base for construction of a road

Land parcel: the smallest unit of land able to be transferred within Victoria's cadastral system

Median: the area between two opposing carriageways

Mid-block: a section of road between key intersections

Outer edge / shoulder: the area next to a roadway that provides clearance between the roadway and roadside

Road reserve: all the area of land that is within the boundaries of a road

Roadside: any land that is within the boundaries of a road (other than the shoulders of the road) which is not a roadway or pathway

Roadway: the area of the public road that is open to or used by members of the public and is developed by a road authority for the driving or riding of motor vehicles

Signalised intersections: intersections controlled by traffic lights

The Project would duplicate a 5.5 kilometre section of Yan Yean Road between Kurrak Road and Bridge Inn Road, increasing the existing two lanes to four lanes (comprising two lanes in each direction). The design speed along Yan Yean Road within the extent of the project area is 70 kilometres per hour, with the exception of north of Bridge Inn Road where the design speed is 80 kilometres per hour. This is consistent with existing speed limits. The design for the Project assessed in this EES has 3.5-metre-wide lanes, with the majority of the Project using a central 2.2 metre-wide median. This design was adopted due to various constraints: road safety issues, steep and rolling terrain, high cut and fill batters and subsequent retaining walls at certain locations.

The design also seeks to limit impacts to existing properties, local accesses and trees along Yan Yean Road. The existing road alignment has been retained due to constraints around the topography and land uses adjacent to the road corridor. The exception is at the Bridge Inn Road intersection, which would be shifted to the north east to retain two River Red Gums (referred to as the Doreen River Red Gums) and two businesses. The project area is shown in Figure 5.1 and key components of the Project are shown in Figure 5.2.

The Project includes:

- Two new roundabouts: one at Heard Avenue and one at Youngs Road
- Five new signalised intersections at Bannons Lane, Jorgensen Avenue, North Oatlands Road, Orchard Road and Bridge Inn Road
- Upgrades to one existing signalised intersection at Ironbark Road, including an additional right-hand turning lane, slip lane and traffic island
- New street lighting at all intersections, road signage and landscaping
- A new walking and cycling path on the western side and a footpath on the eastern side of Yan Yean Road, linking Diamond Creek to Doreen and improving safety and connectivity for pedestrians and cyclists
- Continuous safety barriers running along the Project's length, proposed in the median and behind outer kerbs along the mid-block sections of the carriageways
- A wide median between Bannons Lane and Jorgensen Avenue to provide for additional landscaping opportunities and potential avoidance of existing biodiversity values and large trees.

Figure 5.1 Project area

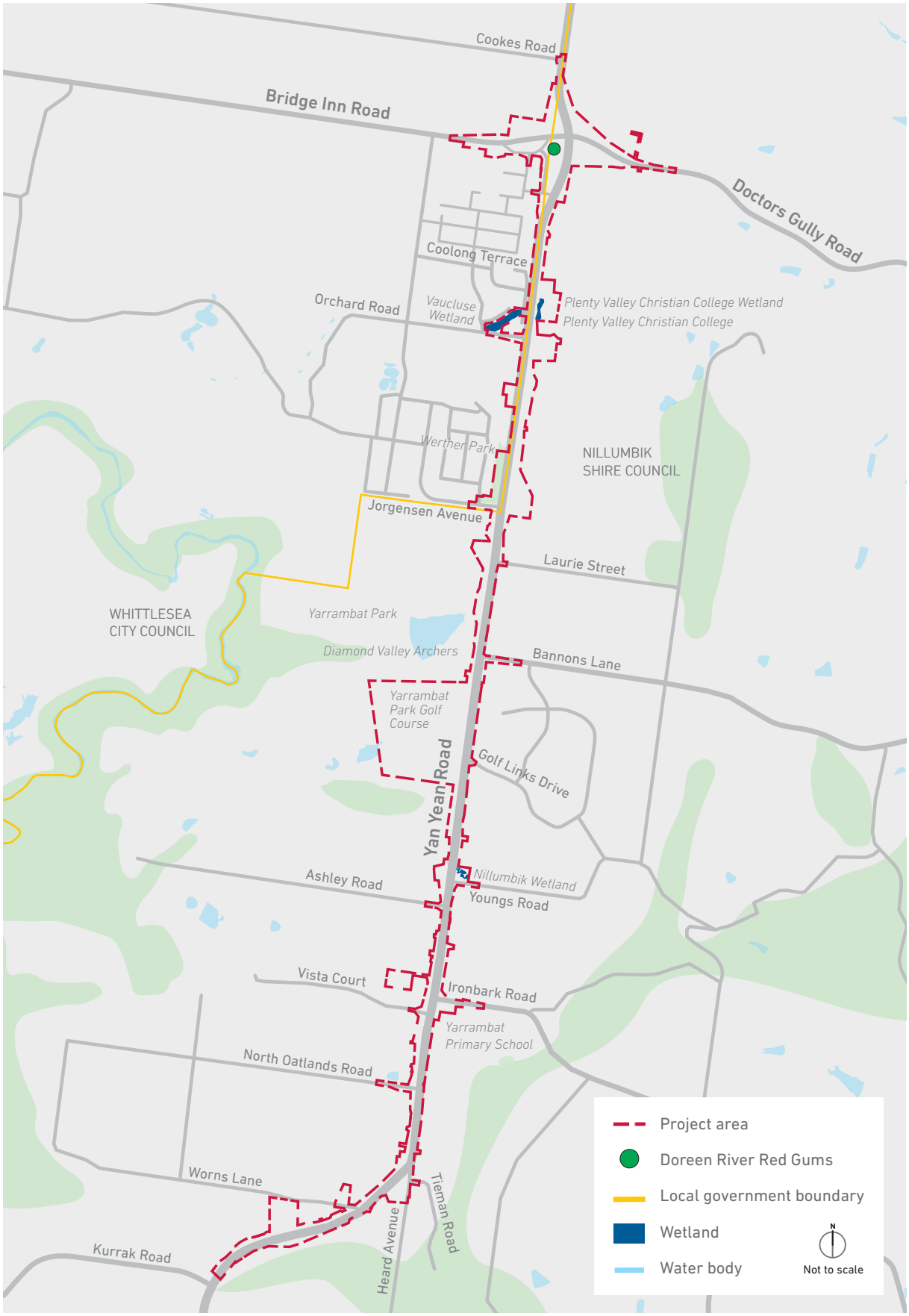
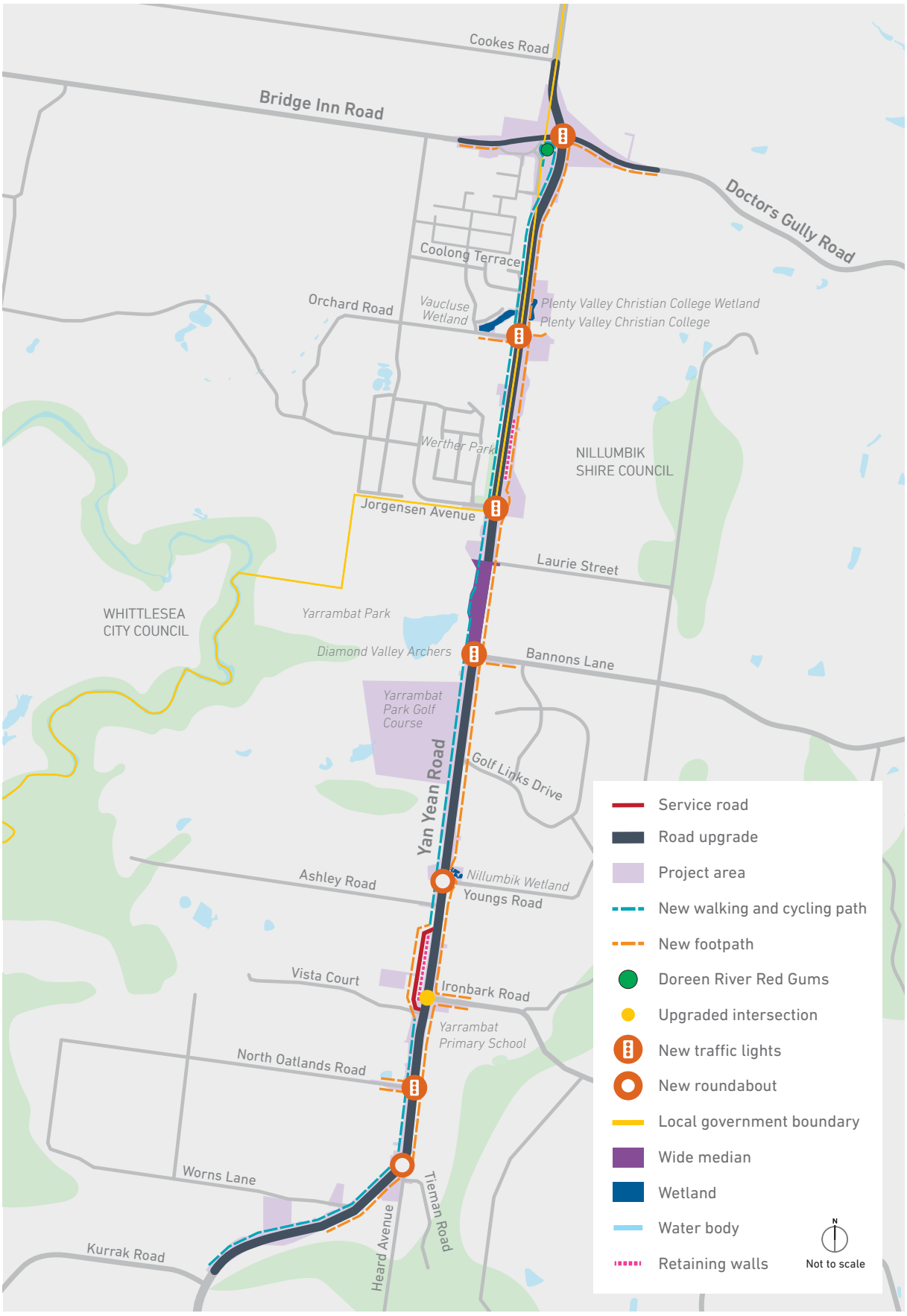


Figure 5.2 Key components of the Project



5.3 Project design

5.3.1 Road design

There are a number of elements to the road design of Yan Yean Road:

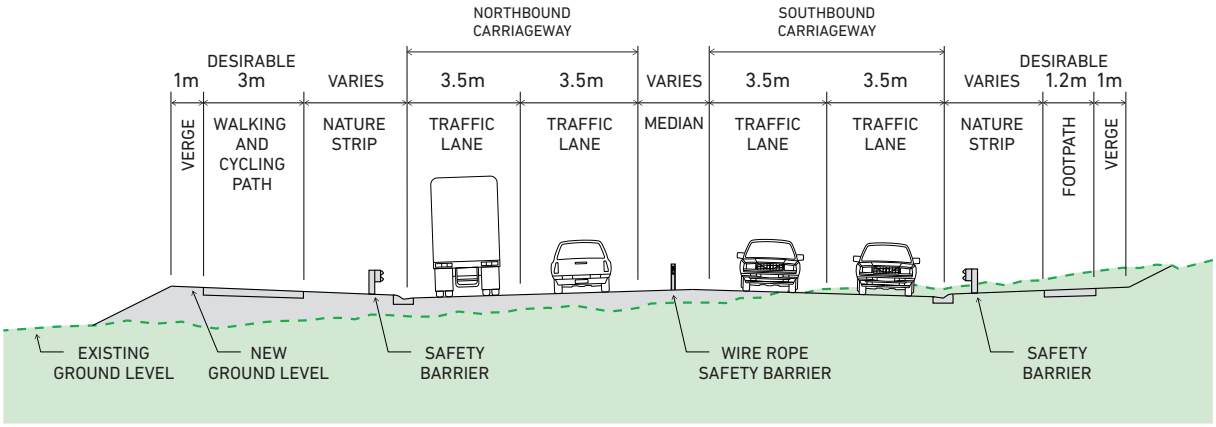
- Typical cross section
- Intersections
- Access
- Wide median
- Safety barriers
- Retaining walls
- Fencing
- Car parks
- Bus facilities.

Typical cross section

The following diagram indicates the typical cross section of the road design for the Project. At some locations along the alignment, such as intersections or roundabouts, this cross section would be slightly different and wider. Figure 5.3 shows the preferred mid-block cross section design, which allows for duplication with a 2.2 metre median with safety barriers.

The installation of safety barriers provides opportunities for tree planting in closer proximity to the road carriageway than would be otherwise permissible, in accordance with the Project's Landscape Strategy (Technical Report G). The total road reserve width along most of the proposed design is 24.2 metres increasing to 33 metres between Bannons Lane and Jorgensen Avenue to accommodate the widened median at this location. The current typical roadway width is eight metres.

Figure 5.3 Yan Yean Road preferred cross section design



For illustrative purposes only.

Intersection design

The scope of the Project includes modifications to a number of intersections. Signalised intersections are proposed to improve safety, provide U-turn opportunities and increase the capacity of existing intersections, and roundabouts are proposed to improve safety and provide larger U-turn opportunities. Intersection works include:

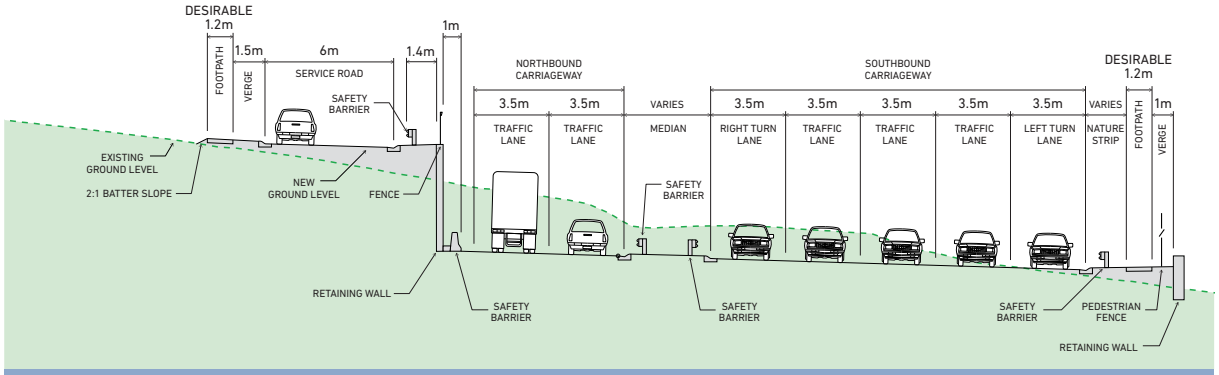
- Signalised intersections at North Oatlands Road, Ironbark Road (refer to Figure 5.4), Bannons Lane, Jorgensen Avenue, Orchard Road and Bridge Inn Road (refer to Figure 5.5)
- Roundabouts at Heard Avenue and Youngs Road
- Proposed left in / left out arrangements at all other intersections, including:
  - Yan Yean Road / Activity Way
  - Yan Yean Road / Laurie Street
  - Yan Yean Road / Golf Links Drive
  - Yan Yean Road / Ashley Road
  - Yan Yean Road / Service Road A exit (left out only)
  - Yan Yean Road / Vista Court
  - Yan Yean Road / Worns Lane
  - Yan Yean Road / 807 Yan Yean Road access
  - Yan Yean Road / Service Road B (between Kurrak Road and Worns Lane)
  - Residential properties and businesses along the alignment
- Auxiliary lanes provided for all left turns (and where applicable, right turns) from Yan Yean Road into key intersections to separate turning traffic from the main traffic flow to reduce collisions and improve the road capacity.

The project design at Bridge Inn Road would retain the two Doreen River Red Gums situated adjacent to the Bridge Inn Road and Yan Yean Road T-intersection and the General Store / former post office and Pet Supplies and Stockfeeds Store on the corner of Doctors Gully Road. It proposes shifting the whole intersection to the north-east corner of Yan Yean Road / Bridge Inn Road with two lanes in each direction.

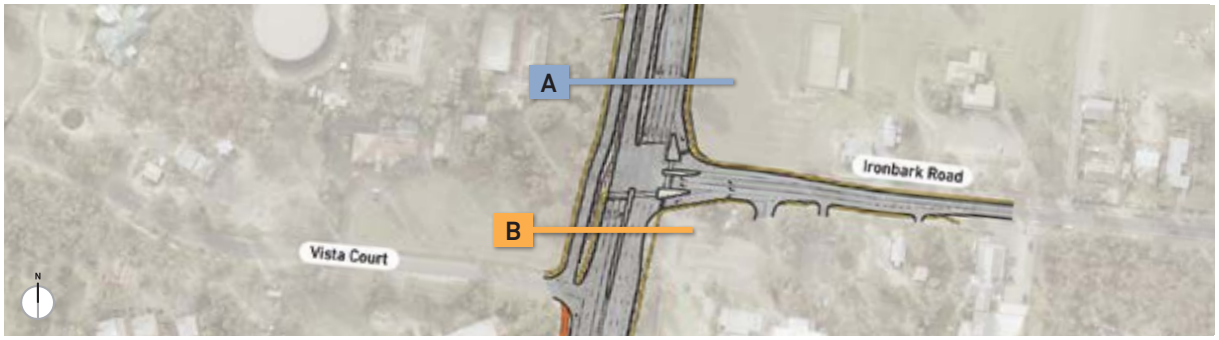
The design at Bridge Inn Road has been refined following community consultation and in response to additional arboriculture advice on the Doreen River Red Gums, which are situated south-west of the proposed intersection (refer to Figure 5.5).

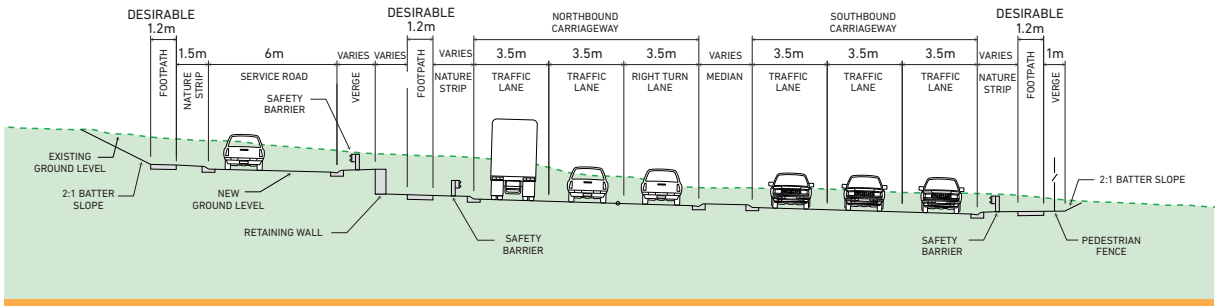
The project design at Bridge Inn Road would retain the two Doreen River Red Gums situated adjacent to the Bridge Inn Road – Yan Yean Road T-intersection and the General Store.

Figure 5.4 Typical signalised intersection cross section – Ironbark Road (northbound)



A: IRONBARK ROAD INTERSECTION DEPARTURE

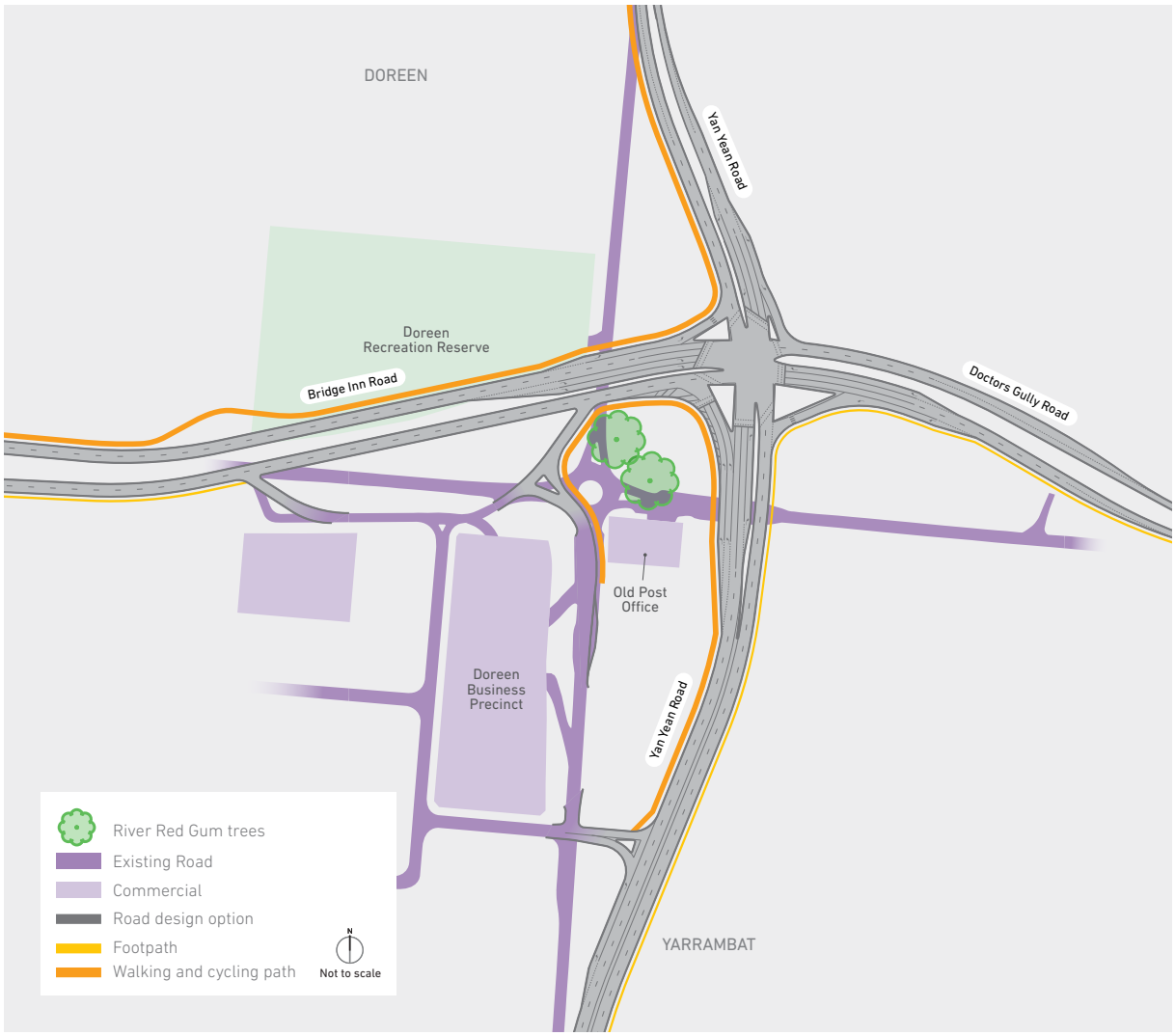




B: IRONBARK ROAD INTERSECTION APPROACH

For illustrative purposes only.

Figure 5.5 Bridge Inn Road intersection design



For illustrative purposes only.

Access design

All existing accesses would be changed to left in / left out arrangements to allow for the installation of a centre median and safety barriers. U-turn lanes would be provided at the following locations to allow for the safe turning of vehicles wishing to travel in the opposite direction:

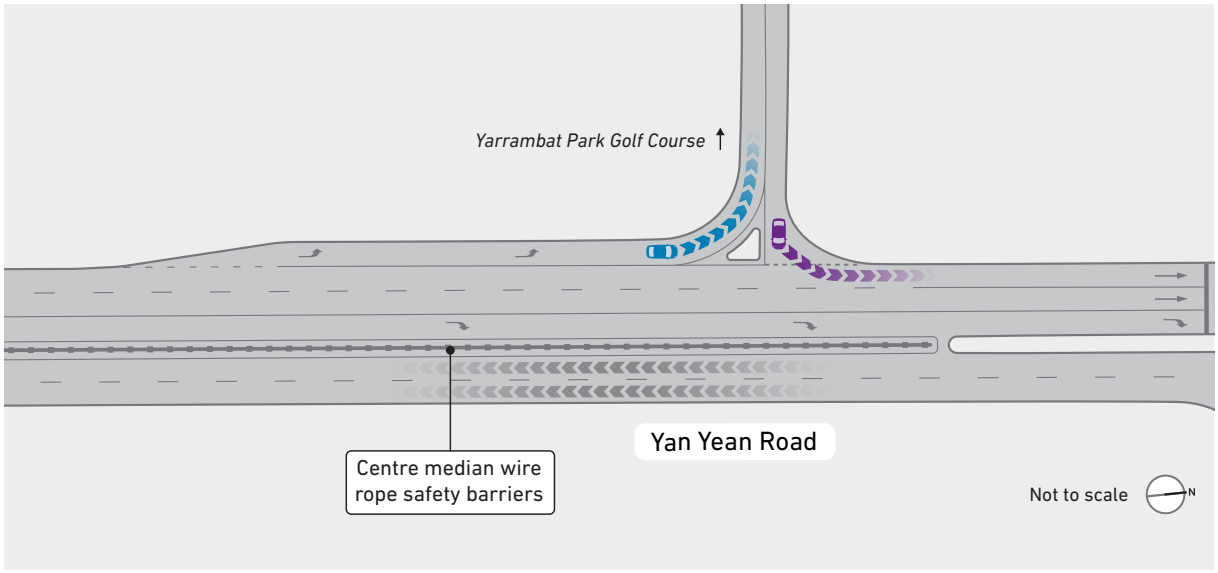
- Bridge Inn Road signalised intersection (cars only)
- Orchard Road signalised intersection (cars only)
- Jorgensen Avenue signalised intersection (cars only)
- Bannons Lane signalised intersection (cars only)
- Youngs Road roundabout (cars, cars with trailers / horse floats, semi-trailers and trucks)
- Ironbark Road signalised intersection (cars only)
- North Oatlands Road signalised intersection (cars only)
- Heard Avenue roundabout (cars, cars with trailers / horse floats, semi-trailers and trucks).

All existing Council approved property access and driveways are proposed to be maintained with minor tie-in works. Access for properties at the western side of Yan Yean Road from Vista Court to Ashley Road would be via a service road due to the steep grade and level differences between properties and Yan Yean Road (refer to Figure 5.4 and Attachment VI *Map Book*).

Access conditions at Yarrambat Primary School and Plenty Valley Christian College would be revised due to intersection upgrades impacting existing access and carpark arrangements.

The proposed design includes a left in / left out arrangement (refer to Figure 5.6) to the Yarrambat Park Golf Course.

Figure 5.6 Left in / left out arrangement – Access to Yarrambat Park Golf Course



For illustrative purposes only.

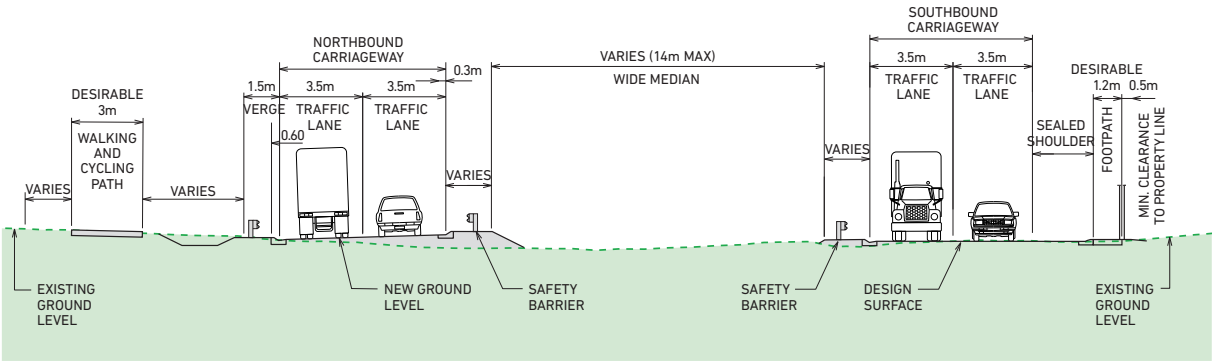
Wide median

A divided carriageway (boulevard design) increases the median width of Yan Yean Road from 2.2 metres to approximately 14 metres by realigning the northbound carriageway between Bannons Lane and Jorgensen Avenue (refer to Figure 5.7). The maximum road reserve width at this point would be approximately 33 metres, although the cross section would taper at either end to tie back into the standard cross section of 24.2 metres, as described above. A wider median at this location would provide for additional landscaping opportunities and potential avoidance of existing biodiversity values (including Matted Flax-lily) and large trees in accordance with the Project's Landscape Strategy (Technical Report G).

The southbound carriageway is aligned to follow the existing carriageway edge to retain the existing separation distance between driveways, residences and Yan Yean Road.

The wide median section of the road design tapers back to the standard cross section width at Bannons Lane. This allows the safe tapering of the road back to the standard road width while avoiding private land acquisition further south of the golf course.

Figure 5.7 Wide median cross section design



For illustrative purposes only.

Safety barrier design

Continuous safety barriers are proposed in the median and behind most outer kerbs (where there are not intersections). Safety barriers would be installed at various setbacks from the kerb ranging from 0.6 to 1 metre, depending on factors such as speed limit, topography and barrier type. Safety barriers require a cleared area behind them to maintain the integrity of their effectiveness. This includes clearance from walking and cycling paths, as well as footpaths. Proposed safety barriers include guardrail, wire rope and concrete barriers if deemed required.

Retaining walls design

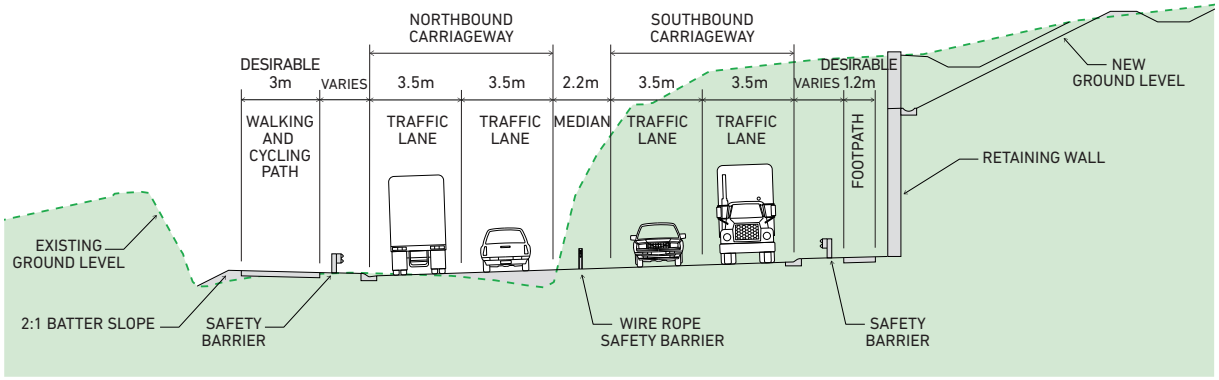
Retaining walls have been proposed at selected locations along Yan Yean Road to minimise the extent of land acquisition on adjacent properties, provide access to properties abutting Yan Yean Road, maximise the retention of existing trees and reduce the extent of cut earthworks. The design of retaining walls would be carried out in accordance with guidelines in the Project's Landscape Strategy (Technical Report G). Retaining walls are likely to be installed at the following locations (refer to Figure 5.8 and Figure 5.9):

- Between Service Road A and Yan Yean Road: a 270 metre long wall with an approximate maximum height of 3.6 metres. This retaining wall has been proposed to retain access to existing properties abutting Yan Yean Road and minimise impacts to existing trees
- At the north-east corner of Ironbark Road: a 230 metre long wall with an approximate maximum height of 2.4 metres. This retaining wall has been proposed to minimise the extent of land acquisition at the adjacent property
- North of North Oatlands Road along the western verge of Yan Yean Road: a 50 metre long wall with an approximate maximum height of 1.1 metres. This retaining wall has been proposed to minimise the extent of land acquisition at the adjacent property and minimise the impact to the existing driveway arrangement
- North of Jorgensen Avenue along the eastern verge of Yan Yean Road: a 220 metre long wall with an approximate maximum height of 8 metres. This retaining wall has been proposed to avoid impacting the existing telecommunication tower on the abutting property, maintain access to the adjacent property and telecommunication tower, maximise the retention of existing trees and reduce the extent of cut works.

Figure 5.8 Retaining wall locations

For illustrative purposes only.

Figure 5.9 Retaining wall cross section – north of Jorgensen Avenue intersection (northbound)



For illustrative purposes only.

Fencing design

The Project is required to ensure adequate safety measures are in place so that golf balls from Yarrambat Park Golf Course do not land on the walking and cycling path or road. This EES assumes that a 30-36 metre-high and 360 metre long fence along the edge of the golf course is included in the design to avoid golf ball collisions with pedestrians, cyclists or vehicles.

The proposed fence would incorporate elements to increase its visibility to Swift Parrot and other bird species. The alternative option to building a fence is to reconfigure golf course holes 1, 10 and 18 to increase their distance from the road and reduce the risk of golf balls landing on the new road and walking and cycling path to an acceptable level. This would not reduce the number of holes at the golf course.

A 1.8 metre timber paling fence has been designed to mitigate the risk of arrows from the Diamond Valley Archers facility affecting the road or walking and cycling path.

Plenty Valley Christian College and Yarrambat Primary School

Access to Plenty Valley Christian College and Yarrambat Primary School directly adjacent to the project area would be maintained during the Project's construction and operation. Some temporary arrangements may be required during construction to manage roadworks adjacent to the schools.

The Project would reconfigure and reinstate an existing car park at Plenty Valley Christian College. This includes a new access road to tie into the existing road. The dam at Plenty Valley Christian College would also require reconfiguration. This would be completed in collaboration with the school.

Land currently used by Yarrambat Primary School for informal car parking would require reconfiguration.

To facilitate these changes, partial land acquisition would be required along the frontage of both schools. This would be limited in extent and would not result in a long-term change to the existing land use; however, it would result in a permanent reduction in the land area on both school sites (refer to Attachment VI *Map Book*).

Bus facilities

Existing bus stops are proposed to be reinstated at the same location or within close proximity, in consultation with the Department of Transport and Public Transport Victoria. The project area allows for indentations around bus stops along the alignment if required.

5.3.2 Active transport design elements

Walking and cycling path and footpath

The design provides a walking and cycling path on the western side of Yan Yean Road in the following locations (refer to Figure 5.2):

- Adjacent to the northbound carriageway of Yan Yean Road from Kurrak Road to Bridge Inn Road, connecting to the existing walking and cycling path at both ends
- Adjacent to the eastbound carriageway of Bridge Inn Road, to be connected to existing walking and cycling paths.

Between Bannons Lane and Jorgensen Avenue, the walking and cycling path is realigned through Yarrambat Park and Shire of Nillumbik land to avoid the removal of more trees on the western side of Yan Yean Road. The walking and cycling path north of Jorgensen Avenue follows the existing footpath for the same purpose. The walking and cycling path would generally be three metres wide and would reduce slightly in width at various locations to allow the retention of trees.

In addition, a footpath, generally 1.2 metres wide, is proposed on the eastern side of Yan Yean Road in the following locations (refer to Figure 5.2):

- Adjacent to the southbound carriageway of Yan Yean Road from Bridge Inn Road to Kurrak Road to connect into the existing footpath
- Adjacent to the northbound carriageway of Yan Yean Road, along Service Road A from Vista Court to Ashley Road to connect to the proposed walking and cycling path extents
- Along Doctors Gully Road to Yan Yean Road to connect into the existing footpath.

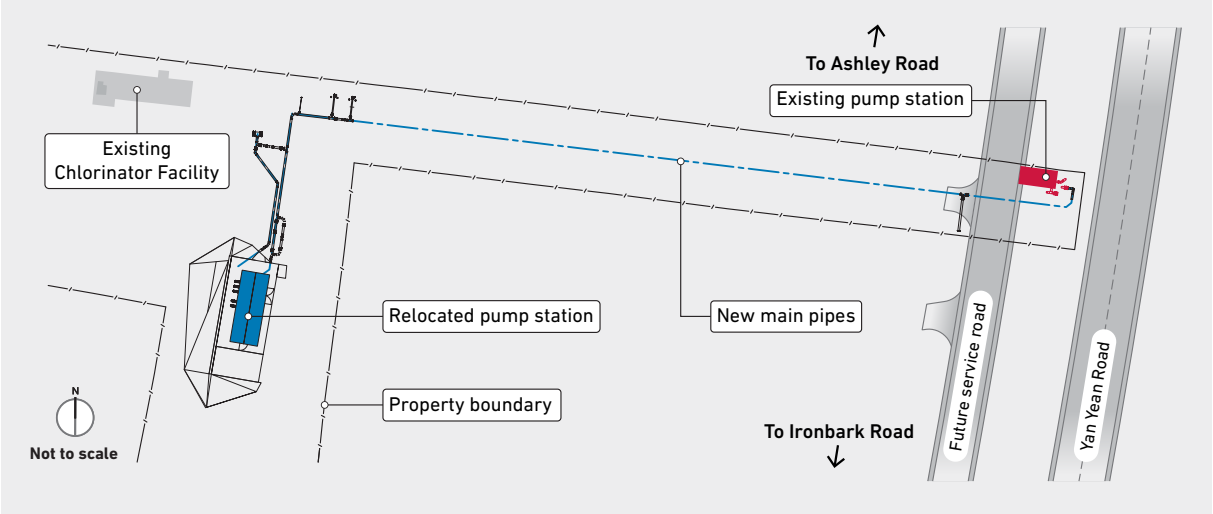
5.3.3 Utilities

New utility service upgrades, relocations and protection works may be required along the length of the Project. Where utility services cannot be avoided, protection / relocation / diversion works would occur adjacent to the proposed road pavement. Relocation of power lines along the alignment is anticipated to involve a combination of above ground and underground power. Works associated with existing water mains, sewer, gas and telecommunications assets may also require relocation and/or diversion adjacent to the road pavement. As such, a minimum allowance of five metres from the outermost construction extent (toe / top of batter, retaining wall, etc.) has been made to allow for potential utility upgrades and service relocations within the project area.

Relocation of Yarra Valley Water pump station

The project area includes a Yarra Valley Water pump station, near Ironbark Road on the western side of the existing Yan Yean Road, which the Project may be required to relocate. The tank may be re-located and new connecting infrastructure installed, all on existing Yarra Valley Water land. Refer to Figure 5.10 for the indicative relocation plan. MRPV continue to investigate design opportunities that could avoid the requirement to relocate the pump station.

Figure 5.10 Yarrambat pump station relocation indicative plan



For illustrative purposes only.

5.3.4 Drainage design

New drainage works, upgrades and relocations would occur along the length of the Project. Drainage along the alignment has been developed based on a flood model and expected outfall locations (which were determined by existing topography); however, the Project is also required to comply with water sensitive urban design (WSUD) requirements from Melbourne Water. This approach aims to make better use of stormwater in urban areas and reduce the harm it causes to the natural water cycle, rivers and creeks. Meeting Melbourne Water's requirements is likely to comprise grassed swale drains (where practicable), detention basins and water treatment basins.

The project area provides for a minimum 10 metres offset from the top of each drainage swale to allow for construction. In areas where drainage swales are not required, a minimum allowance of five metres from the outermost construction extent (toe / top of batter, retaining wall, etc.) has been provided in the project area to allow adequate construction space. The Project would coordinate closely with local schools to ensure the functionality of existing car parks and outdoor playing fields is maintained if these areas are impacted by drainage works.

Detention basin sites for surface water management have also been allowed for within the project area in proximity to Worns Lane, Heard Avenue, Youngs Road, Orchard Road (Melbourne Water wetland) and Bridge Inn Road.

5.3.5 Landscaping and urban design

A Landscape Strategy (Technical Report G) has been developed in consultation with Councils and other key stakeholders to ensure that the Project fits sensitively into the built, natural and cultural environment of Doreen and Yarrambat. The strategy would ensure that landscaping undertaken as part of the Project is well designed and contributes to the character and functioning of the Yan Yean Road corridor and the surrounding area, as well as to the accessibility and connectivity of people within the wider region and community. The Project would provide new and reinstated landscapes that are appropriate to the local conditions and consistent with the existing varied character of the area. Wherever possible, the Project would provide opportunities to increase canopy cover and improve amenity in the public realm.

The Landscape Strategy provides overarching principles to guide the Project landscape design, with a particular focus on minimising impacts on trees along the road corridor. Planting typologies have been considered to enhance the experience of drivers, pedestrians and cyclists, provide visual interest, screen infrastructure elements, improve habitat values and provide subtle wayfinding clues. Planting adjacent to the shared path would provide shelter and shade to improve user amenity. The activation of remnant open space would be explored to provide increased amenity to the local community where feasible.

5.3.6 Sustainability and climate change

MRPV is committed to delivering projects that optimise social, economic and environmental outcomes over the long term. To fulfil this commitment, MRPV would ensure:

- Sustainability risks and opportunities are identified and refined into project-appropriate performance objectives and requirements
- Delivery partners are monitored to ensure achievement of sustainability performance objectives and requirements
- Project sustainability performance is measured, verified and publicly reported on.

Key sustainability opportunities for the Project include:

- Ensuring the Project is resilient to the challenges of climate change by preparing and implementing a climate risk assessment and adaptation plan
- Optimising the use of recycled content in infrastructure materials
- Reducing greenhouse gas emissions, material lifecycle impacts and waste generation during the Project's construction and operation
- Protecting and enhancing the built, natural and cultural environment within and adjacent to the project area.

5.3.7 Land acquisition

The existing road corridor is not of sufficient width to accommodate the duplication and supporting infrastructure such as service roads, walking and cycling path and drainage. The Project would require the partial or full acquisition of 96 parcels of land. In most cases, partial acquisition of the land would be required along the frontages of landholdings.

This acquisition would be limited in extent and would not result in a long-term change in the existing land use, but it would result in a permanent reduction in the land area on those land parcels.

The land acquisition process would be undertaken in accordance with the *Land Acquisition and Compensation Act 1986* and would include consultation with affected landowners. Compensation would be provided for all land acquired for the Project. Refer to Attachment VI *Map Book* for the proposed Public Acquisition Overlay (PAO).

The landowner status of proposed land acquisition for the Project includes:

- Shire of Nillumbik: 24 land parcels
- City of Whittlesea: four land parcels
- Private: 60 land parcels
- Public Authorities / State: eight land parcels.

5.4 Project construction

5.4.1 Construction activities

Construction details would be subject to further refinement as the Project progresses; however, any changes to the activities and requirements outlined below would need to be in accordance with the Environmental Performance Requirements (EPRs) set out in Chapter 12 *Environmental Management Framework*.

Proposed construction activities would be standard road construction activities to be undertaken in accordance with the EPRs for the Project.

Site establishment would involve tree clearance and vegetation lopping and removal within the project area, establishment of construction site compounds, clearing and grubbing, temporary sediment and erosion control works, and establishment of environmental and traffic controls.

Earthworks would involve remediation of any existing contamination and removal of any hazardous material, as appropriate, protecting and relocating services, widening of existing rock cuttings (approximately 750 metres of existing cut along the Project would be widened by approximately 20 metres), new cuttings (approximately 1,300 metres of new rock cut would be required to a width of approximately five metres along the Project), and bulk earthworks and haulage. Some of the cutting locations would require retaining walls. Refer to Figure 5.8 for the location of proposed retaining walls in the Project and Figure 5.9 for a representative retaining wall cross section.

Civil and structure works would involve construction of infrastructure, including intersection upgrades, walking and cycling paths, retaining walls, drainage works and pavement works.

Reinstatement would involve implementing traffic management systems and landscaping in accordance with the Landscape Strategy (Technical Report G) for the Project.

5.4.2 Construction laydown areas

To minimise disruption at and around the Project site, one or more separate site compounds (or 'laydown areas') would be established for site offices, storage of materials and plant, amenities for workers, secure container storage, short-term storage for waste and potentially workforce parking. The laydown area(s) would be required to be in use for the full duration of Project construction.

Construction laydown areas have not yet been identified for the Project, other than those included in the project area. Following the engagement of a contractor, they would identify one or more sites that are suitable for this purpose on the basis of minimal environmental impact. Depending on the site(s) selected, a separate planning approval process may be required which would need to be informed by site investigation and consultation.

The project area has allowed for a site on the western side of Yan Yean Road in close proximity to the Yarrambat Horse and Pony Club, which is currently being used as laydown area by Yarra Valley Water. The Project may also utilise the existing Department of Transport owned land at 423-437 Yan Yean Road Yarrambat at the southern end of the project area. Vegetation removal would avoid the no-go zones identified in Attachment VI *Map Book*.

The laydown area(s) would be reinstated following works to their pre-Project condition, or as agreed with the landholder. The nature of reinstatement and any improvement works would be agreed with the landowner and any other relevant stakeholders, potentially Council and the Department of Transport.

5.4.3 Construction method

The construction methods adopted would seek to develop the Project in discrete stages to the extent practicable. This would assist with localising construction impacts for each stage of works. Maintaining traffic flow throughout the Project would be a key component of the construction methodology. Constructing new lanes 'offline' would be integral to maintaining traffic flow, including diverting traffic into new lanes as staged sections were completed. As traffic is diverted into newly constructed lanes, old lanes would be upgraded to assist in maintaining traffic flow.

Temporary road closures and diversions would be required for the construction of intersections. Road closures and diversions would be managed through community consultation and detailed traffic management plans.

Spoil is defined as waste soil or rock resulting from excavation activities. Spoil generated by construction activities would be managed in accordance with EPA requirements applicable at the time of construction.

The final spoil disposal strategy would be developed in accordance with EPA Victoria requirements, particularly in regard to managing any contamination entrained within the soil, and whether spoil would be stockpiled or taken immediately to landfill. Haulage routes would be constrained to arterial roads, including Yan Yean Road. Where roads other than Yan Yean Road or designated arterials are required to be used, this would be done in consultation with the Department of Transport and the relevant local authority, with appropriate notice given to any affected residents.

5.4.4 Working hours

Construction work for the Project would be undertaken in accordance with EPA requirements applicable at the time of construction. Standard construction work hours are:

- Monday to Friday, 7am to 6pm
- Saturday, 7am to 1pm.

Construction outside standard hours might occur at discrete stages to enable particular tasks to be undertaken more safely than could otherwise be achieved. Night works would also be required to minimise impacts on traffic or nearby stakeholders. Works proposed for outside standard hours would need to be approved in advance by MRPV, following consultation with all relevant stakeholders.

5.5 Project operation and maintenance

When complete, Yan Yean Road would be owned by the Department of Transport and operated in accordance with its environmental management approach. Ongoing monitoring and associated management and mitigation measures set out in the EPRs would be implemented during operation of the Project by the relevant organisation.

Maintenance of the infrastructure would be undertaken by Department of Transport, or local Councils for pathways and service roads, in accordance with the *Road Management Act 2004 – Code of Practice*.

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APPENDIX B - STRATEGIC TRAFFIC FORECASTING REPORT

Design
for a better
future /

MAJOR ROAD PROJECTS VICTORIA

YAN YEAN ROAD (STAGE 2) UPGRADE

TRAFFIC FORECASTING REPORT

JULY 2020

Question today
Imagine tomorrow
Create for the future

Yan Yean Road (Stage 2) Upgrade
Traffic Forecasting Report

Major Road Projects Victoria

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REV	DATE	DETAILS
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EXECUTIVE SUMMARY

WSP and its sub-consultant Arcadis Australia Pacific Limited (Arcadis) have been engaged by Major Road Projects Victoria (MRPV) to carry out the necessary assessments for the Yan Yean Road (Stage 2) Upgrade Environment Effects Statement (EES). The scope of works for Yan Yean Road (Stage 2) Upgrade currently includes duplication of 5.5 km of Yan Yean Road, between Kurrak Road (Yarrambat) and Bridge Inn Road (Doreen) from two to four lanes. This report details the strategic traffic forecasting undertaken to respond to the Scoping Requirements of the EES.

The Victorian Integrated Transport Model (VITM) is the State's official strategic forecasting model, owned and maintained by the Department of Transport (DoT), formerly the Department of Economic Development, Jobs, Transport and Resources (DEDJTR). This model together with existing traffic survey data has been used to develop traffic forecasts that address the EES requirements. The key inputs to the VITM traffic forecasts include land use projections and future network assumptions, both of which are based on the reference case assumptions provided by DoT.

Traffic forecasting has been undertaken for a Base Case (without Yan Yean Road (Stage 2) Upgrade) and Project Case (with Yan Yean Road (Stage 2) Upgrade) in the future year 2031. Overall, the forecast results indicate that:

- there is likely to be a significant increase in traffic throughout the local region in the future Base Case when compared to 2016, with significant growth in traffic along key north-south routes through the City of Whittlesea
- speeds on most roads in the study area will deteriorate in the future Base Case when compared to 2016, suggesting that the local road network will not have sufficient capacity to support the growth in demand
- speeds in the peak direction (i.e. southbound in the AM and northbound in the PM) on Yan Yean Road, are expected to improve significantly in the future with the project in place
- Yan Yean Road (Stage 2) Upgrade will be able to cater for more traffic on Yan Yean Road and provide an overall capacity improvement for the local network. It will significantly improve speeds and travel times on Yan Yean Road, as well as other key north-south routes in the study area (i.e. Plenty Road and Epping Road). The Project will also improve accessibility for local residents to key activity centres including Melbourne CBD, La Trobe NEIC, Greensborough Activity Centre, the Eltham Activity Centre and the Mernda Town Centre.

1 INTRODUCTION

WSP and its sub-consultant Arcadis Australia Pacific Limited (Arcadis) have been engaged by Major Road Projects Victoria (MRPV) to carry out the necessary assessments for the Yan Yean Road (Stage 2) Upgrade Environment Effects Statement (EES). This report details the strategic traffic forecasting undertaken to respond to the Scoping Requirements of the EES.

1.1 PROJECT DESCRIPTION

Yan Yean Road between Kurrak Road, Yarrambat and Bridge Inn Road, Doreen (Yan Yean Road (Stage 2) Upgrade) is a north-south arterial road located on the eastern border of the Northern Growth Corridor and connects the east-west arterials of Bridge Inn Road, Kurrak Road and Diamond Creek Road. It lies between the Local Government Areas of City of Whittlesea and Nillumbik Shire, and provides connectivity between the suburbs of Greensborough, Diamond Creek, South Morang, Yarrambat, Doreen and Plenty.

The scope of works for Yan Yean Road (Stage 2) Upgrade currently includes:

- duplication of 5.5 km of Yan Yean Road, between Kurrak Road (Yarrambat) and Bridge Inn Road (Doreen) from two to four lanes
- two new roundabouts (at Heard Avenue and Youngs Road) and five new signalised intersections (Bannons Lane, Jorgensen Avenue, North Oatlands, Orchard and Bridge Inn Roads)
- upgrades to the signalised intersection at Ironbark Road
- construction of a shared use path on one side and a footpath on the other side for the entire length of the upgrade
- installation of continuous safety barriers, which would run along both sides of the road and in the centre median for protection against tree and car collisions.

1.2 MODELLING PURPOSE

Based on the EES Scoping Requirements, strategic traffic forecasting is needed to cover several areas including (though not necessarily limited to) the following in a Transport Impact Assessment (TIA):

- *Undertake predictive modelling of local transport network traffic flows in the absence of the project.*
- *Undertake predictive modelling of regional, local and project transport network traffic flows following implementation of the project.*
- *Characterise the extent to which the project will affect the overall geographic distribution of vehicles and magnitude of changes to travel times and accessibility for road users.*
- *Interactions, including possible cumulative impacts with other relevant projects, for example, the Northern Suburban Roads Program.*

Traffic forecasts are also a key input into noise and air quality assessments carried out as part of the EES.

1.3 THIS REPORT

This report forms part of the supporting documentation to the TIA and other noise and air quality assessments carried out as part of the EES. This report presents:

- an overview of the modelling undertaken
- traffic validation checks
- key modelling inputs
- a description of the scenarios modelled
- demand forecasting results.

2 MODELLING OVERVIEW

2.1 MODELLING APPROACH

The Victorian Integrated Transport Model (VITM) is the State's official strategic transport demand forecasting model, owned and maintained by the Department of Transport (DoT), formerly the Department of Economic Development, Jobs, Transport and Resources (DEDJTR). This model has been previously adopted for forecasting traffic volumes for Yan Yean Road (Stage 2) Upgrade, to establish a set of intersection turn volumes (separately for private and heavy vehicles) for the AM and PM commuter peak hours to assess and inform the development of the Reference Design.

It has been agreed with MRPV that:

- the modelling approach will involve updating the VITM previously used to develop intersection turning forecasts with the latest inputs and assumptions
- the 2031 model year will remain as the adopted forecast year for the project: The latest 2051 land use projections have been compared to the latest 2031 land use projections to understand the likely impact on traffic volumes under a 'fully built out scenario'. A comparison of the 2051 vs 2031 employment and population projections are included in Appendix A. These comparisons suggest that there is unlikely to be a significant increase in land use adjacent to Yan Yean Road between 2031 and 2051, and therefore there is unlikely to be a significant change in traffic volumes on Yan Yean Road between 2031 and 2051. As such, the 2031 model year can be considered an appropriate horizon to use for this project.

Key components of the modelling approach are described below:

- update the VITM version used to develop intersection turn forecasts with the most recent land use projections and network assumptions (refer to Section 4 for further details)
- undertake a full 4-step model run for the future (2031) with Yan Yean Road (Stage 2) Upgrade in place (referred to as the Project Case)
- undertake a highway assignment only model run for the future (2031) without Yan Yean Road (Stage 2) Upgrade in place (referred to as the Base Case). The Base Case will therefore have the same demand matrix as the Project Case. This is considered appropriate given that Yan Yean Road (Stage 2) Upgrade is only a short section of upgrade and is therefore unlikely to impact the trip matrix
- undertake resilience and sensitivity testing (refer to Section 5 for further details).

2.2 VITM

VITM is a multimodal, four-step strategic transport model that uses population and employment projections to forecast the future impacts of changes to the Melbourne road and public transport networks. The model is a powerful strategic planning tool commonly used by DoT, and formerly by the Transport for Victoria (TfV) and VicRoads, to help plan Victoria's road and public transport infrastructure, particularly to compare likely impacts of scenarios under different land use and/or transport network assumptions.

2.2.1 COVERAGE

The geographic area covered by the VITM is shown below in Figure 2.1, while the time periods modelled in the VITM include:

- Weekday AM peak (AM): 7:00 am – 9:00 am
- Weekday Inter peak (IP): 9:00 am – 3:00 pm
- Weekday PM peak (PM): 3:00 pm – 6:00 pm
- Weekday Off peak (OP): 6:00 pm – 7:00 am
- Average weekday (Daily): 24-hour.

The vehicle types modelled in VITM include cars, light commercial vehicles (LCV) and heavy commercial vehicles (HCV).

Figure 2.1 Geographic area covered by VITM

2.2.2 LIMITATIONS

As a strategic-level model, the following limitations should be noted in the use of traffic forecasts developed using VITM:

- VITM is calibrated/validated to a base year at the screenline level and does not explicitly model intersection capacities and delays. VITM's reliability at the individual road and intersection level is therefore not known.
- VITM's forecasts are based on a series of assumptions regarding how the transport network and land use is forecast to change into the future. As with any traffic forecast, inevitably some assumptions used to develop the forecasts will not be realised and unanticipated events and circumstances may occur which could materially change the actual traffic outcomes realised.

3 MODEL VALIDATION CHECKS

The validation process is known to present some significant challenges throughout the outer growth areas of Melbourne, as the zone structure and road network in the outer growth areas are relatively coarse in the strategic model. Furthermore, the land use throughout the northern area is expected to change dramatically between now and 2031, as employment and population in these areas grow (refer to Table 4.1). As such, calibration/validation of the model to existing conditions was of less importance, as travel patterns and demand is expected to change significantly from current conditions.

Nevertheless, the base model performance has been checked against existing survey data to gain an understanding of how the model is performing and confirm adjustments to be made. These checks included:

- screenline traffic volume check
- traffic flows scatter plot check
- travel time check.

3.1 DATA USED FOR VALIDATION CHECKS

Data used for the validation checks is summarised in Table 3.1.

Table 3.1 Data used for validation checks

DATA TYPE	SURVEY DATES	SURVEY TIMES
Midblock surveys	One week over various months (i.e. March 2017 to May 2017, and October 2017 to December 2018)	24 hours, classified
Travel time surveys	16–18 May 2017	— 6:30 am to 9:30 am — 3:30 pm to 6:30 pm

3.2 SCREENLINE TRAVEL VOLUME CHECK

A screenline across three north-south roads in the northern area was prepared (refer to Figure 3.1 for screenline location). The screenline included Yan Yean Road as well as two routes to the west of Yan Yean Road (i.e. Plenty Road and Epping Road), which were considered as the main alternative north-south routes to Yan Yean Road.

Results from the screenline check are presented in Table 3.2. Results show that the model is underestimating the total vehicle trips on all three roads crossing the screenline, in both directions during the two-hour AM and PM peak, compared to existing conditions. The only exception is for Epping Road in the southbound direction during the AM peak, where the model volumes are higher than existing conditions. Epping Road is of less relevance than Plenty Road however, as it is further away from Yan Yean Road.

In general, the results suggest that there is no material impact from traffic route choice (i.e. traffic routing) on the future forecasts, as base year volumes are consistently low across parallel routes. The results also suggest that future forecasts from the model will need to be interpreted carefully taking account of the underestimation.

Table 3.2 Screenline check

ROAD	COUNT LOCATION	DIR	2HR AM (TOTAL VEHICLES)			2HR PM (TOTAL VEHICLES)		
			Survey	Model	% Diff	Survey	Model	% Diff
Epping Road	Bridge Inn Road/Boundary Road to Lehmanns Road/ Craigieburn Road (E)	NB	1,049	757	-28%	1,672	1,594	-5%
		SB	1,334	1,557	17%	1,201	1,054	-12%
Plenty Road	Riverdale Boulevard to McArthurs Road/ Hawkstowe Parade	NB	1,812	1,625	-10%	4,053	2,899	-28%
		SB	4,276	3,108	-27%	2,293	2,022	-12%
Yan Yean Road	Jorgensen Avenue to Bannons Lane	NB	1,133	921	-19%	2,605	1,758	-33%
		SB	2,044	1,755	-14%	1,374	1,232	-10%
Total		**NB**	**3,994**	**3,303**	**-17%**	**8,330**	**6,251**	**-25%**
		SB	**7,654**	**6,420**	**-16%**	**4,868**	**4,308**	**-12%**

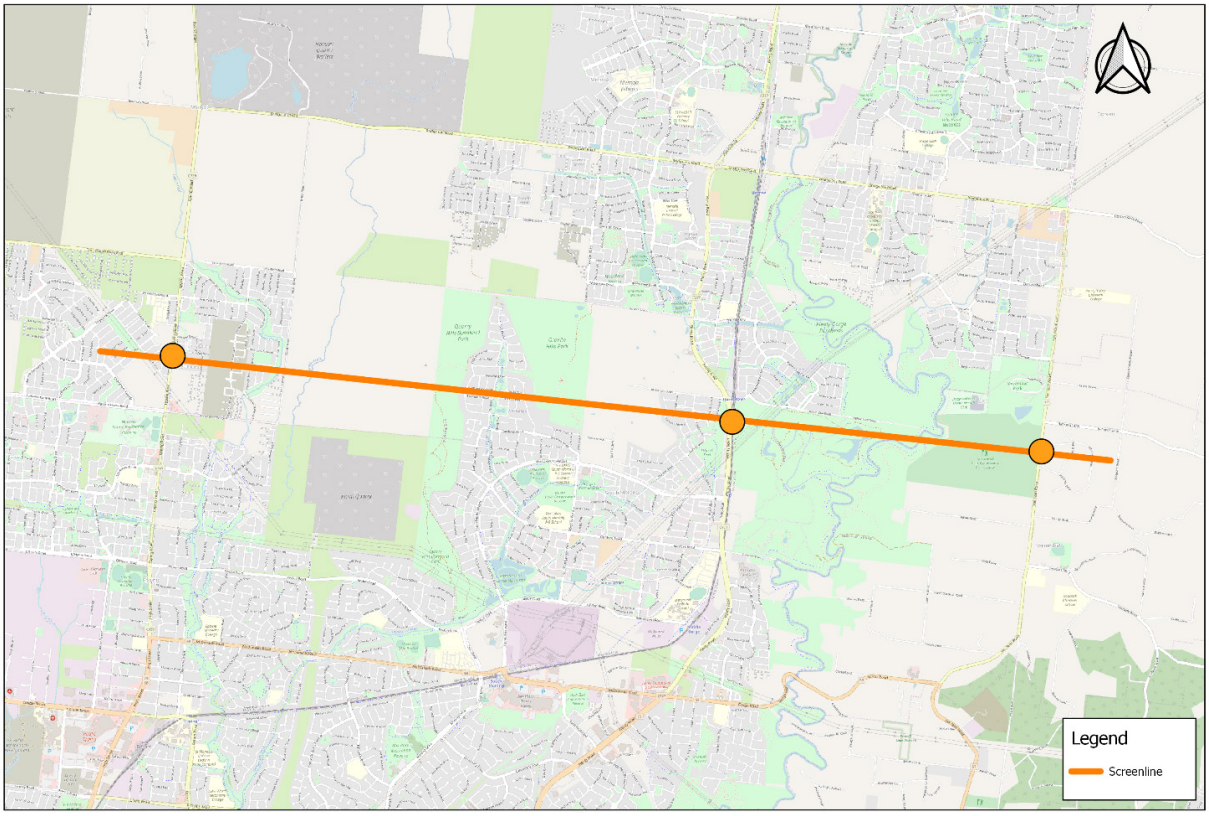

Figure 3.1 Screenline location

3.3 TRAFFIC FLOWS SCATTER PLOT CHECK

Modelled and observed volumes were compared over several sites in the project area (refer to Figure 3.3 for sites), for all time periods across an entire weekday. The scatter plot of modelled and observed volumes across all count sites over the day is shown in Figure 3.2, while scatter plots for AM and PM are included in Appendix B. Overall there is a strong correlation between the modelled and observed data sets, although the VITM appears to underestimate the traffic by 20% over the day. As shown in the scatter plots in Appendix B , VITM underestimates traffic volumes by around 10% during the two-hour AM and PM peaks though the correlation (R^2) isn't quite as strong.

The validation criteria as defined in VicRoads' Transport Modelling Guidelines (Volume 2: Strategic Modelling) relating to scatter plots were reviewed to provide an understanding of how well the model compared to the required criteria. Target criteria as specified in the Guidelines are:

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

Both the AM and PM peak fall outside the required coefficient of determination (i.e. 0.80 for AM and 0.79 for PM), but meets the slope and the best-fit linear regression (i.e. 0.93 for AM and 0.90 for PM).

The percent root mean square errors (%RMSE) was also reviewed as this provides a good indication of the percentage difference between surveyed and modelled traffic volumes. The target criteria for %RMSE as specified in the VicRoads' Transport Modelling Guidelines is less than 30%. A summary of the %RMSE for the AM and PM peak is provided in Table 3.3. Overall, the AM and PM peak meet the %RMSE criteria, however for lower volume bands (less than 2000), both the AM and PM peak falls outside the required criteria.

Table 3.3 %RMSE summary – AM and PM peak

1 WAY VOLUME	RMSE	
	AM	PM
<1000	47.2%	51.4%
1000 – 2000	34.8%	34.6%
2000 – 5000	22.5%	23.0%
5000 – 1000	28.6%	29.7%
>=10000	0.0%	0.0%
Total	**29.8%**	**29.0%**

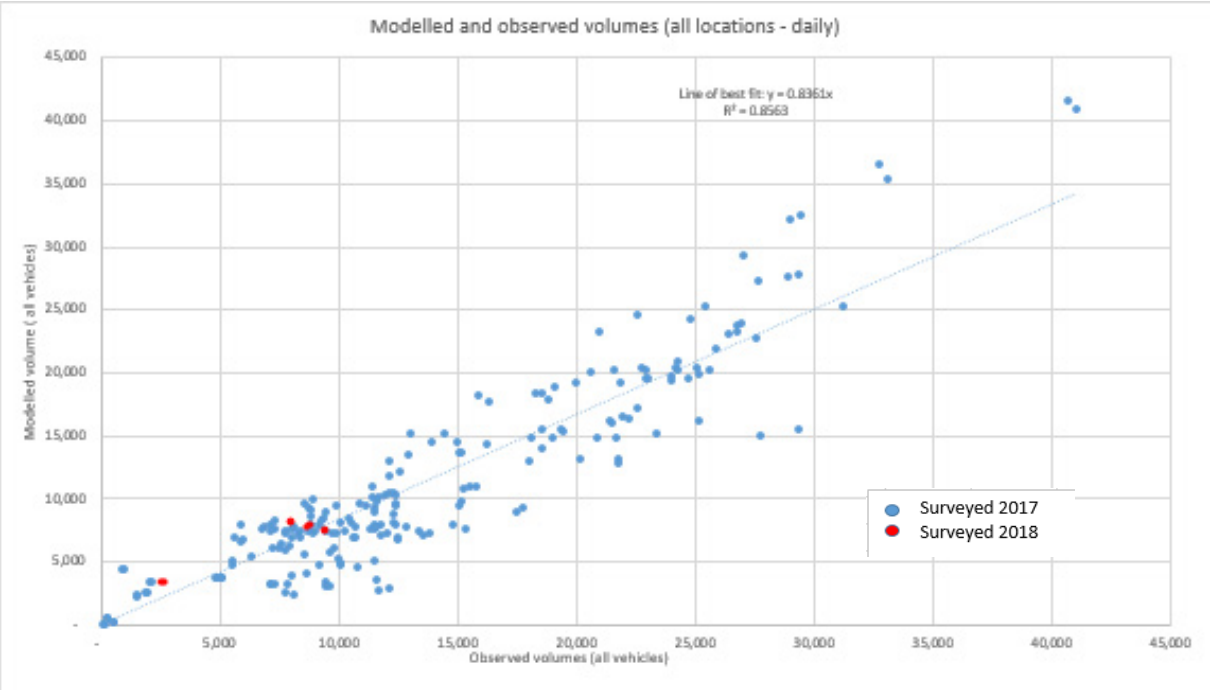

Figure 3.2 Comparison of 2016 modelled and observed 24-hour link volume (weekday)

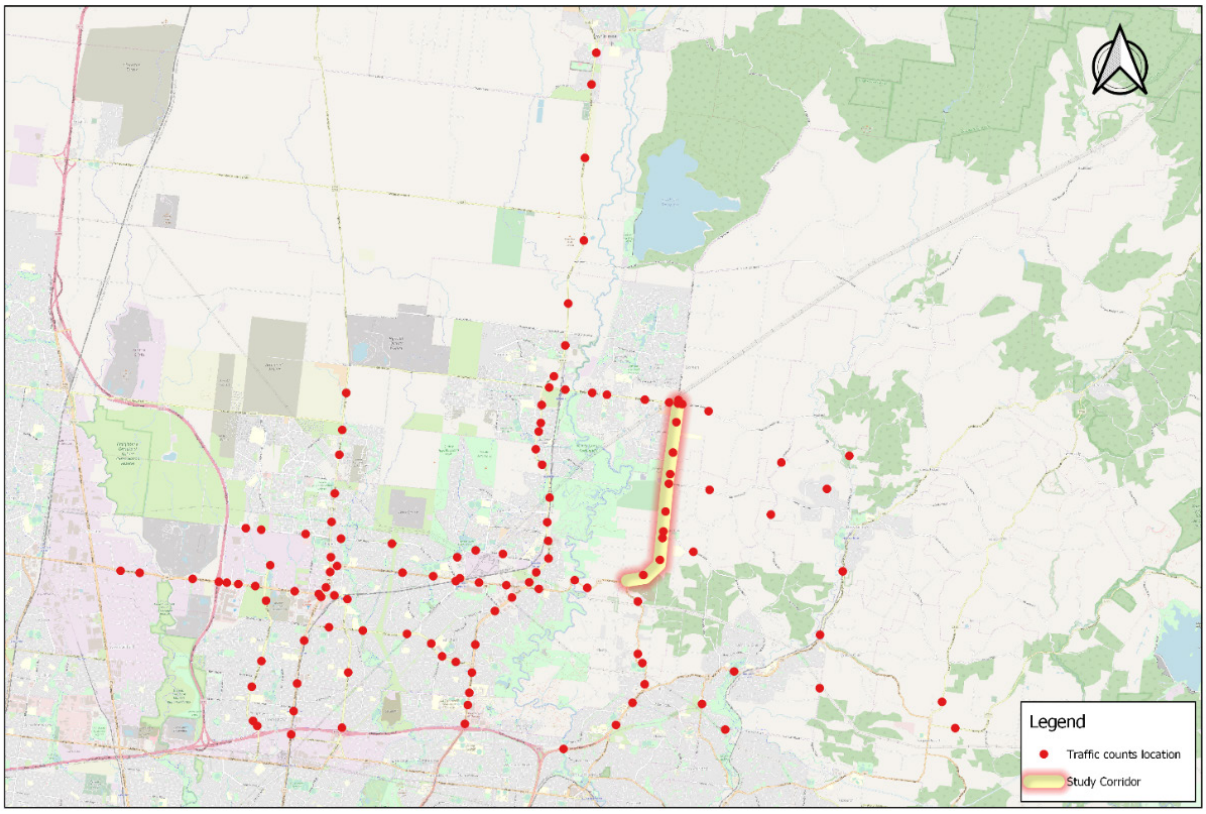

Figure 3.3 Traffic count locations

3.4 TRAVEL TIME CHECK

Travel time surveys undertaken in May 2017 along Yan Yean Road (between Nillumbik Recycling & Recovery Centre access and Flaxen Hills Road) and the main competing route, Plenty Road (between McDonalds Road and Station Road) were compared to travel times in the strategic model (refer to Figure 3.6 for travel time routes). A summary of the travel time comparisons is provided in Figure 3.4 and Figure 3.5 for the AM and PM peak, respectively. In general, the comparisons show that modelled travel times along Yan Yean Road and Plenty Road both tend towards the maximum travel times observed in the peak direction, and the average travel times observed in the non-peak direction. These results suggest that there is unlikely to be any significant bias towards one route over another, as both routes represent congested conditions in the peak direction.

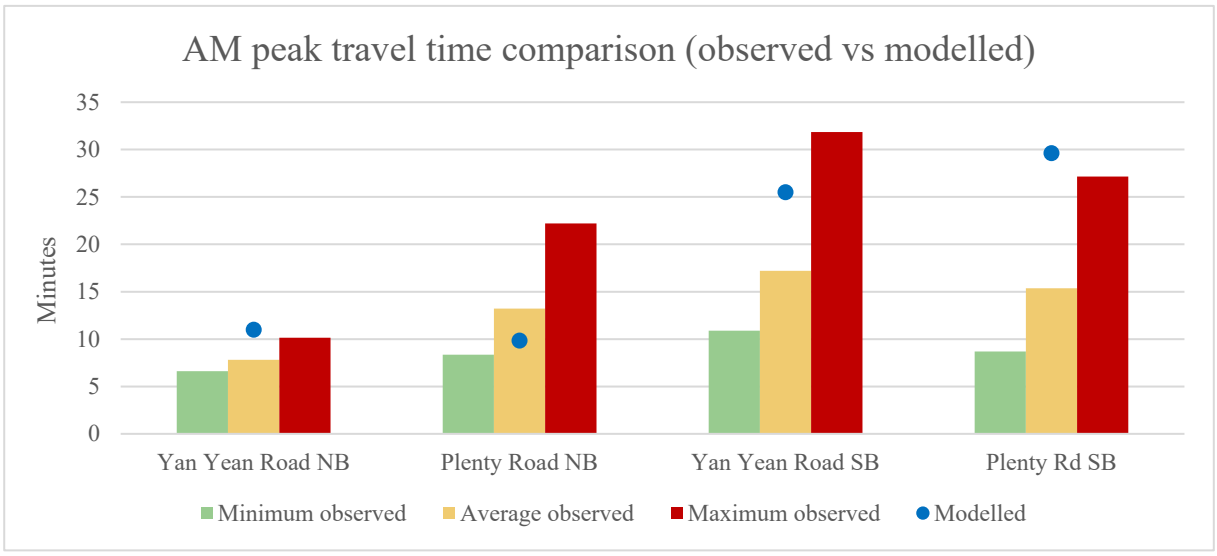

Figure 3.4 AM peak travel time comparison – observed vs modelled

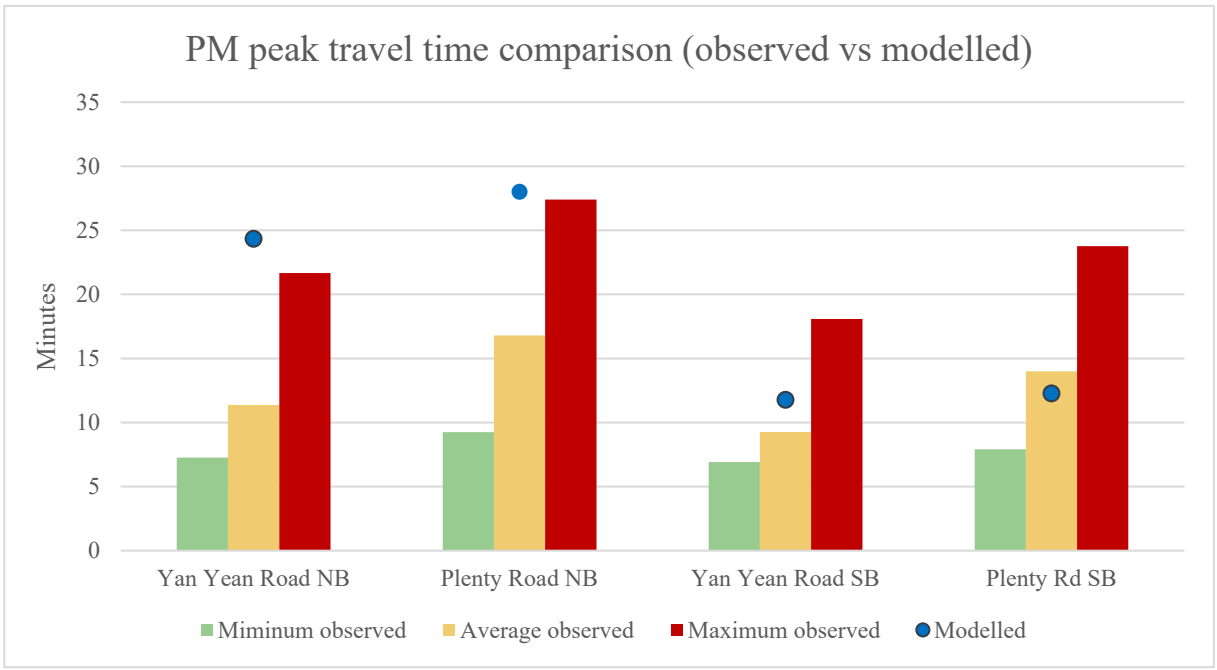

Figure 3.5 PM peak travel time comparison – observed vs modelled

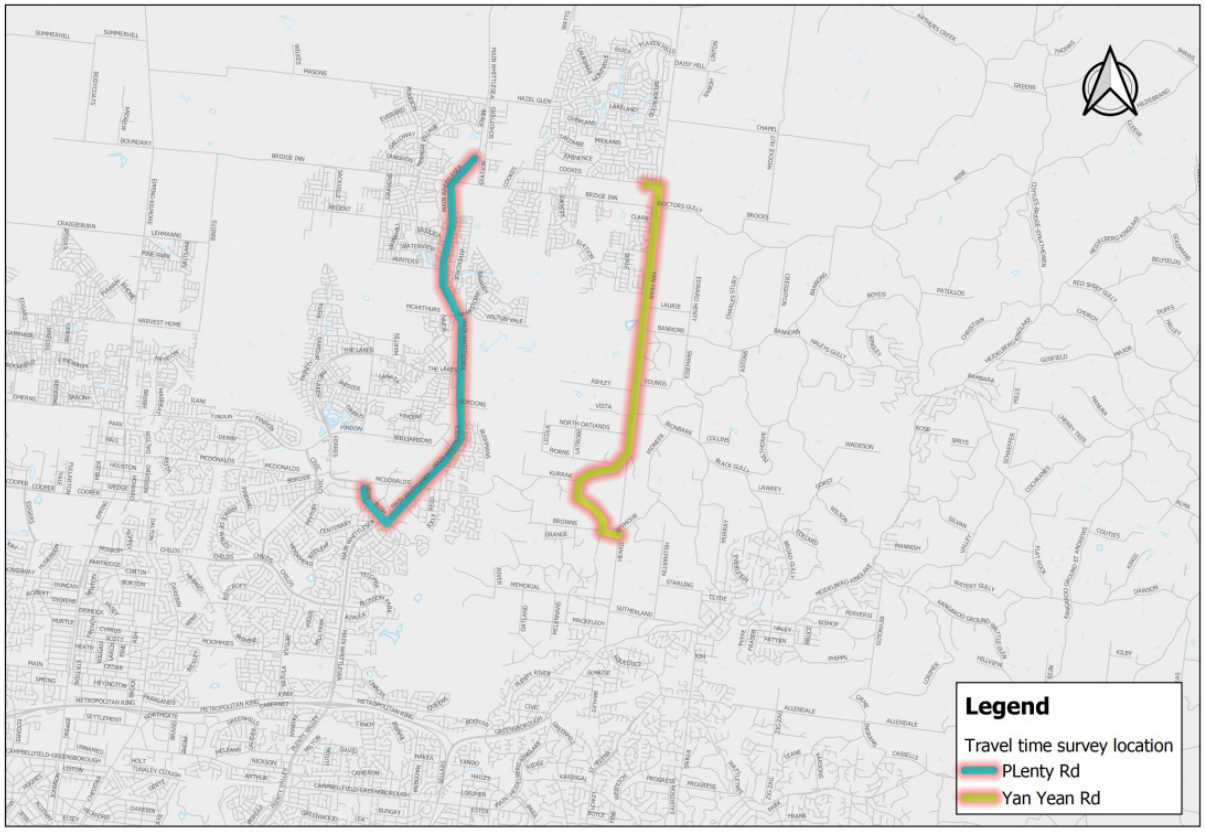

Figure 3.6 Travel time routes

4 KEY INPUTS

4.1 LAND USE PROJECTIONS

Land use forecasts are developed at the VITM travel zone level covering Melbourne only. The latest land use assumptions for 2031 were released by the DoT in March 2018 and have been adopted in this modelling exercise.

Table 4.1 shows a comparison of the population and employment for metropolitan Melbourne, City of Whittlesea and Nillumbik Shire between 2016 and 2031. As outlined in Table 4.1, the population of the City of Whittlesea, to the north and west of the Project, is expected to grow by around 110,000 people or just over 50% between 2016 and 2031. In contrast, little population growth (about 7%) is currently planned during the same period within Nillumbik Shire, on the eastern side of the project, as it sits outside of the urban growth boundary. Similarly, the employment in the City of Whittlesea is expected to grow by significantly more within City of Whittlesea than the Nillumbik Shire (47,000 jobs compared to 3,000 jobs, respectively).

Spatial growth in population and employment between 2016 and 2031 (based on the VITM travel zone structure) in Melbourne's north is also shown in Figure 4.1 and Figure 4.2, respectively. These projections highlight the extensive continued residential growth expected to occur in the suburb of Doreen, Mernda and South Morang which lie immediately adjacent to the north and west of the Project. Employment growth adjacent to the Project is not expected to be as significant however, with growth in employment most heavily concentrated on the Melbourne Market and industrial land along Cooper Street in Epping and the La Trobe National Employment and Innovation Cluster in Bundoora/Heidelberg.

Table 4.1 Population and employment projection summary (2016 and 2031)

YEAR	METROPOLITAN MELBOURNE		WHITTLESEA		NILLUMBIK	
	Population	Employment	Population	Employment	Population	Employment
2016	4,556,783	2,325,667	206,585	57,676	63,165	15,739
2031	5,961,245	3,176,791	313,993	105,014	67,716	18,835
Growth from 2016 to 2031	1,404,462	851,124	107,408	47,338	4,551	3,096
% Growth from 2016 to 2031	31%	37%	52%	82%	7%	20%

Source: DoT VITM Land use and demographic input (March 2018)

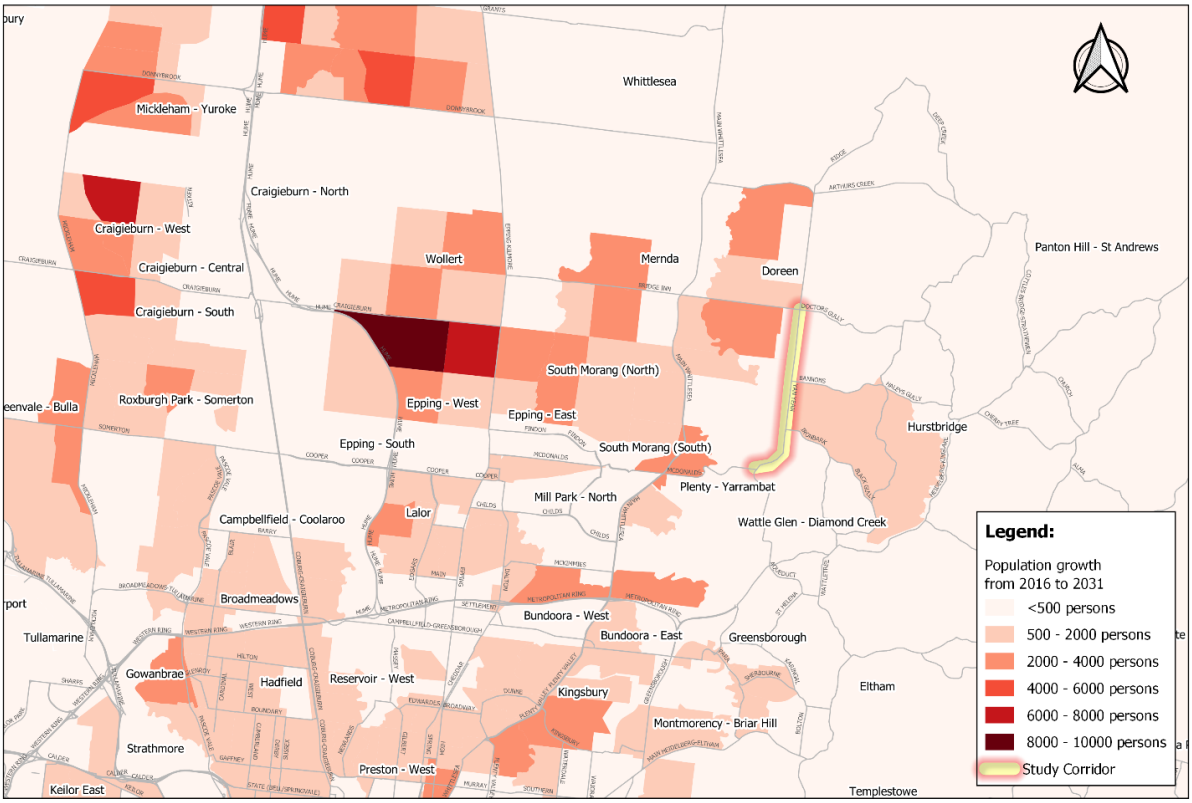

Figure 4.1 Change in population between 2016 and 2031

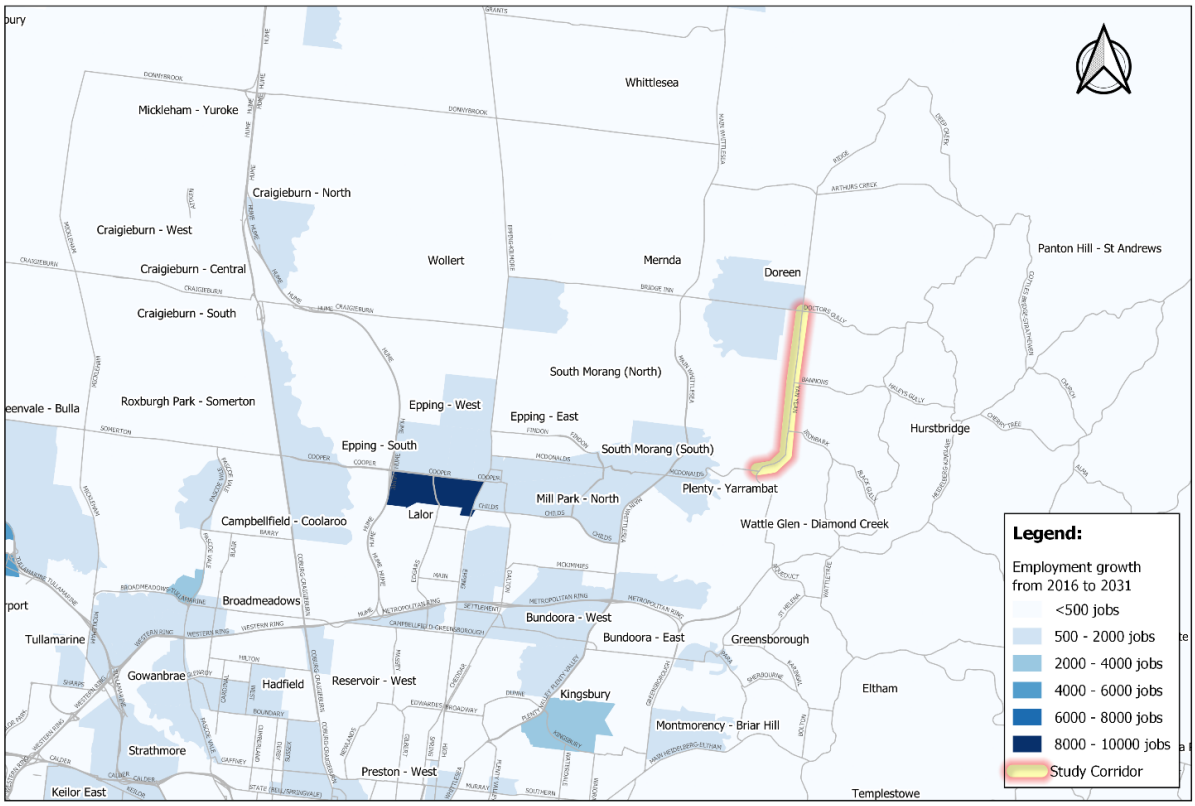

Figure 4.2 Change in employment between 2016 and 2031

4.2 REFERENCE CASE

The Reference Case transport networks include future road projects and public transport services to reflect the likely future road network capacity as well as public transport services and frequency.

Some of the future road projects included in the Reference Case used are as follows:

- North East Link (by 2031)
- Eastern Freeway widening (by 2031)
- Dingley Bypass (by 2021)
- Mordialloc Freeway (by 2021)
- Westall Road Extension (by 2031)
- West Gate distributor (by 2021)
- arterial road and local road upgrades in growth areas.

Future public transport projects included in the Reference Case used are as follows:

- Melbourne Metro rail tunnel (by 2031)
- Mernda Rail Extension (by 2021)
- other tram and bus network enhancements around Melbourne.

4.2.1 INITIAL REFINEMENTS TO REFERENCE CASE

The road network and public transport (PT) input files in the 2031 Reference Case were initially reviewed and updated as part of the previous modelling undertaken when developing the intersection turn forecasts. This resulted in a 'refined Reference Case'.

4.2.2 UPDATED REFERENCE CASE

4.2.2.1 ROAD NETWORK

The road network in the 2031 'refined Reference Case' were reviewed and compared against the latest Reference Case road network released by DoT in March 2018 in the vicinity of Yan Yean Road, with some discrepancies between the two sets of road networks identified. For discrepancies which were considered likely to have an impact on volumes in the northern area, the VITM road network was updated to match the latest Reference Case road network. Updates to the 2031 road networks are summarised in Table 4.2. A comparison between the updated 2031 road network and the 2016 road network in the vicinity of Yan Yean Road is also presented in Figure 4.3. The inclusion of key projects in the vicinity of Yan Yean Road which are part of the Suburban Road Upgrade Northern Package were also checked. These included:

- Child Road duplication from Beaumont Crescent to Prince of Wales Avenue
- Epping Road duplication from Craigieburn Road East to Memorial Avenue
- Bridge Inn Road duplication from Plenty Road to Yan Yean Road
- Craigieburn Road duplication from Mickleham Road to the Hume Highway.

Table 4.2 Updates to 2031 road network

ROAD	UPDATE
Yan Yean Road (Stage 2)	Changed from 80kph to 70kph
Plenty Road Stage 1	Additional land in each direction between McKimmies Road and Bush Boulevard
North East Link, north of Lower Plenty Road	Changed from 4 to 3 lanes in each direction
Intersection design at North-East Link (NEL), M80 and Greensborough Bypass	Functionality updated to match latest road network
Metropolitan Ring Road, east of Plenty Road	Changed from 2 to 4 lanes in each direction
Greensborough Bypass, south of M80	Activated
Hume Freeway – O'Herns ramp	Activated
Edgars Rd extension	Changed from 2 to 3 lanes in each direction
Additional lanes Eastern Freeway, east of NEL	4 lanes in each direction

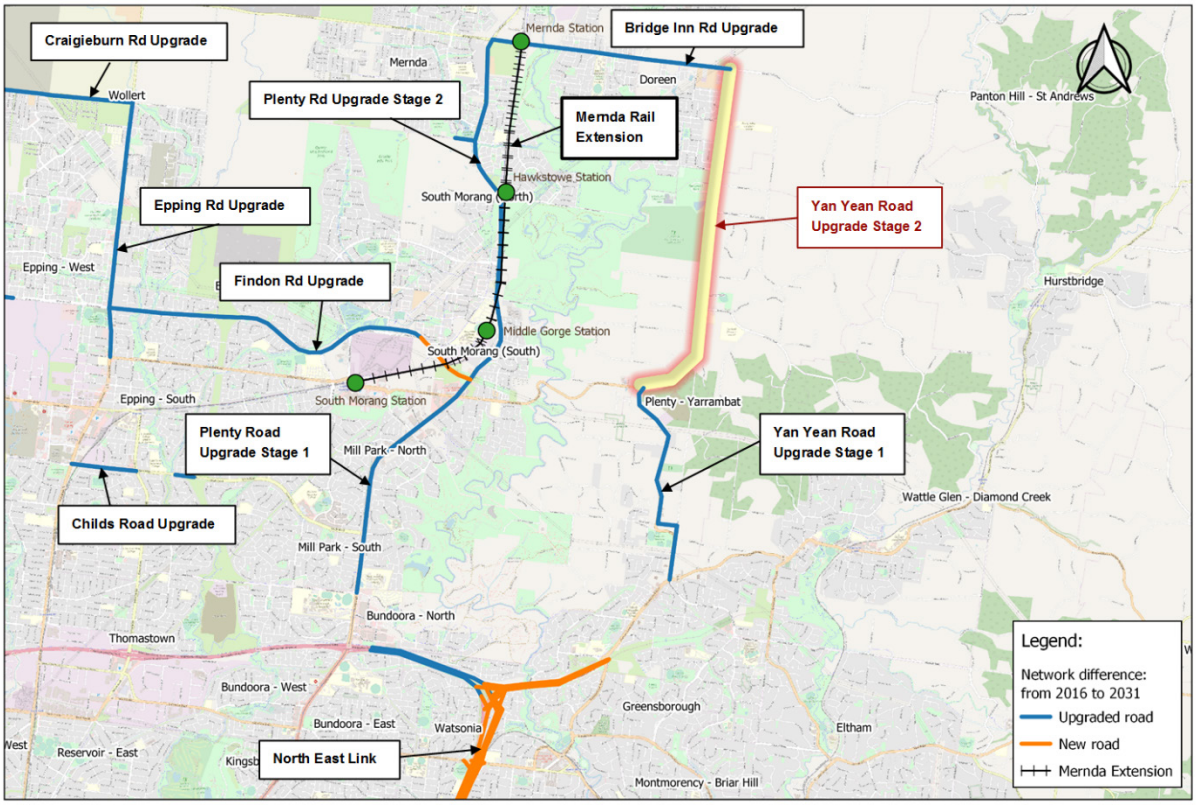

Figure 4.3 2031 vs 2016 road network difference

4.2.2.2 PUBLIC TRANSPORT (PT)

The PT network in the 2031 'refined Reference Case' was reviewed and compared against the latest Reference Case PT network released by DoT in March 2018 in the vicinity of Yan Yean Road. The only update required was the addition of bus lanes along the Eastern Freeway, and the subsequent update of bus routes to utilise the bus lanes.

4.2.2.3 TOLLS

The toll files for the NEL in VITM were reviewed and compared to the latest toll files in the VITM released by DoT in March 2018. The latest toll files for NEL were applied where discrepancies existed.

5 SCENARIOS MODELLED

5.1 BASE CASE AND PROJECT CASE

The updated VITM Reference Case (as described in Section 4.2.2) was used to represent the 2031 Project Cases for Yan Yean Road (Stage 2) Upgrade. The Base Case was then developed by downgrading Yan Yean Road to existing conditions. Details of how the Base Case and Project Case differ, in terms of the attributes of Yan Yean Road (Stage 2) Upgrade, are provided in Table 5.1.

Table 5.1 Comparison of Base Case and Project Case modelled

ATTRIBUTE OF YAN YEAN ROAD (STAGE 2) UPGRADE	BASE CASE	PROJECT CASE
Lanes	1 lane in each direction	2 lanes in each direction
Speed	70 kph	70 kph
Capacity in passenger car units per lane per hour (pcu/lane/hr)	850 pcu/lane/hr	1000 pcu/lane/hr

5.2 RESILIENCE TESTING

A set of resilience tests in 2031 were undertaken to understand the impact of lane closures (e.g. due to an incident or road works) on Yan Yean Road and Plenty Road in the peak periods in both the base case and project case. A summary of the resilience tests undertaken is provided in Table 5.2.

Table 5.2 Summary of resilience tests

RESILIENCE TEST	STARTING MODEL	TIME PERIOD	LANES			
			YAN YEAN RD (BRIDGE INN TO KURRAK)		PLENTY RD (BRIDGE INN TO GORGE/KURRAK)	
			Northbound	Southbound	Northbound	Southbound
Resilience Test 1	2031 Base Case (Yan Yean Road Stage 1 in place only, Plenty Road Stage 1 and 2 in place)	AM peak	No change	**Reduce by 1 lane**	No change	No change
		PM peak	**Reduce by 1 lane**	No change	No change	No change
Resilience Test 2		AM peak	No change	No change	No change	**Reduce by 1 lane**
		PM peak	No change	No change	**Reduce by 1 lane**	No change

RESILIENCE TEST	STARTING MODEL	TIME PERIOD	LANES			
			YAN YEAN RD (BRIDGE INN TO KURRAK)		PLENTY RD (BRIDGE INN TO GORGE/KURRAK)	
			Northbound	Southbound	Northbound	Southbound
Resilience Test 3	2031 Project Case (Yan Yean Road Stage 1 and 2 in place, Plenty Road Stage 1 and 2 in place)	AM peak	No change	**Reduce by 1 lane**	No change	No change
		PM peak	**Reduce by 1 lane**	No change	No change	No change
Resilience Test 4		AM peak	No change	No change	No change	**Reduce by 1 lane**
		PM peak	No change	No change	**Reduce by 1 lane**	No change

5.3 SENSITIVITY TESTING

Two sensitivity tests were undertaken in 2031 to understand how sensitive the results were to a change in land use. These sensitivity tests included:

- lower growth scenario (i.e. land development slower than anticipated): 2031 Project Case with 2026 land use projections
- high growth scenario (i.e. land development faster than anticipated): 2031 Project Case with 2036 land use projections.

A comparison of the land use in 2026, 2031 and 2036 is provided in Table 5.3 below and shows:

- in 2026, the population and employment is approximately 10% less than in 2031 for metropolitan Melbourne and Whittlesea, and approximately 5% less than in 2031 for Nillumbik
- in 2036, the population and employment is approximately 10% more than 2031 for metropolitan Melbourne and Whittlesea, and approximately 5% more than 2031 for Nillumbik.

Table 5.3 Population and employment projection comparison (2026, 2031 and 2036)

YEAR	METROPOLITAN MELBOURNE		WHITTLESEA		NILLUMBIK	
	Population	Employment	Population	Employment	Population	Employment
2026	5,496,520	2,862,438	278,841	91,993	65,887	17,785
2031	5,961,245	3,176,791	313,993	105,014	67,716	18,835
2036	6,422,419	3,475,135	343,514	116,904	69,976	19,733
% Change from 2031 to 2026	-8%	-10%	-11%	-12%	-3%	-6%
% Change from 2031 to 2036	+8%	+9%	+9%	+11%	+3%	+5%

6 DEMAND FORECASTING RESULTS

6.1 OVERVIEW

Demand forecasting results presented in this section have been developed to respond to the EES Scoping Requirements and include:

- traffic volumes on key roads in the study area (refer to Figure 6.1 for VITM road network)
- average speeds on key roads in the study area
- travel times on key routes in the study area (refer to Figure 6.2 for travel time routes)
- travel time between Doreen and key activity centres as listed below:
  - Melbourne CBD
  - La Trobe National Employment and Innovation Cluster (NEIC)
  - Greensborough Activity Centre
  - Eltham Activity Centre.

It should be noted that traffic volumes reported are taken from VITM without any adjustments, and therefore will need to be interpreted carefully as noted in Section 3.2. It should also be noted that traffic volumes reported represent an average weekday (i.e. average of Monday to Friday).

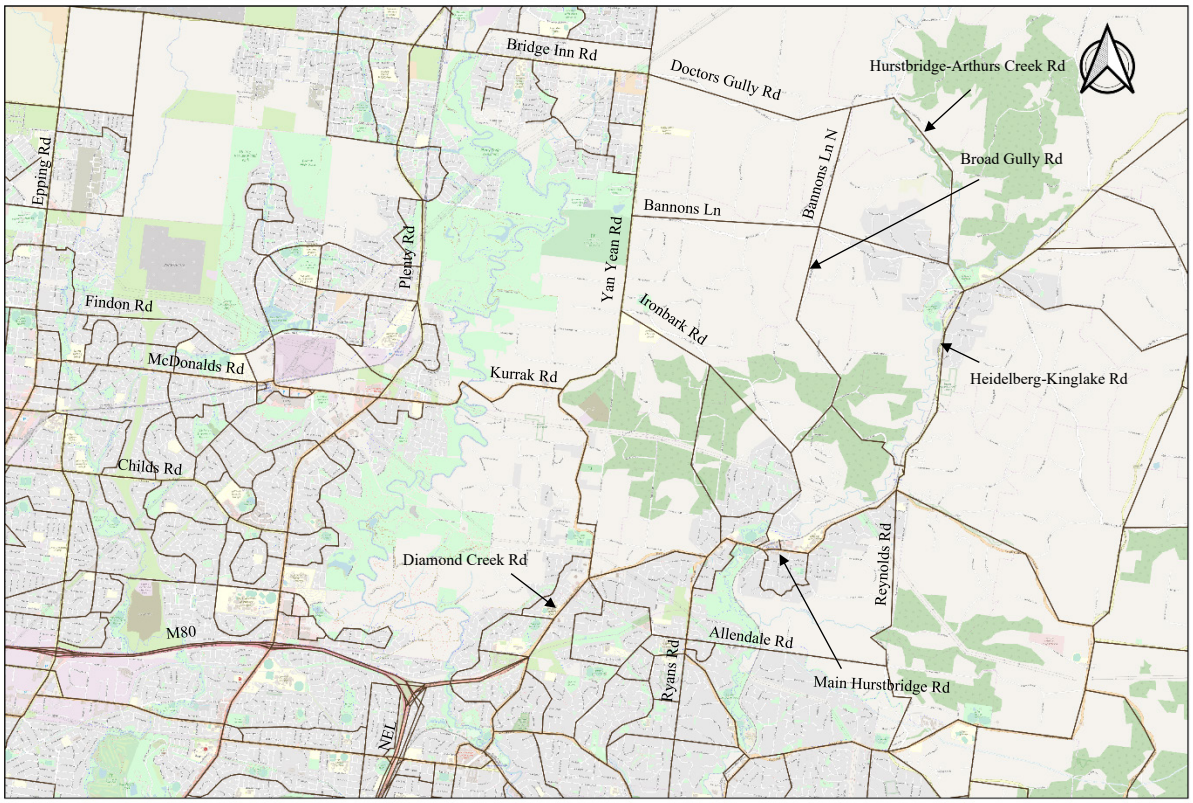

Figure 6.1 VITM road network

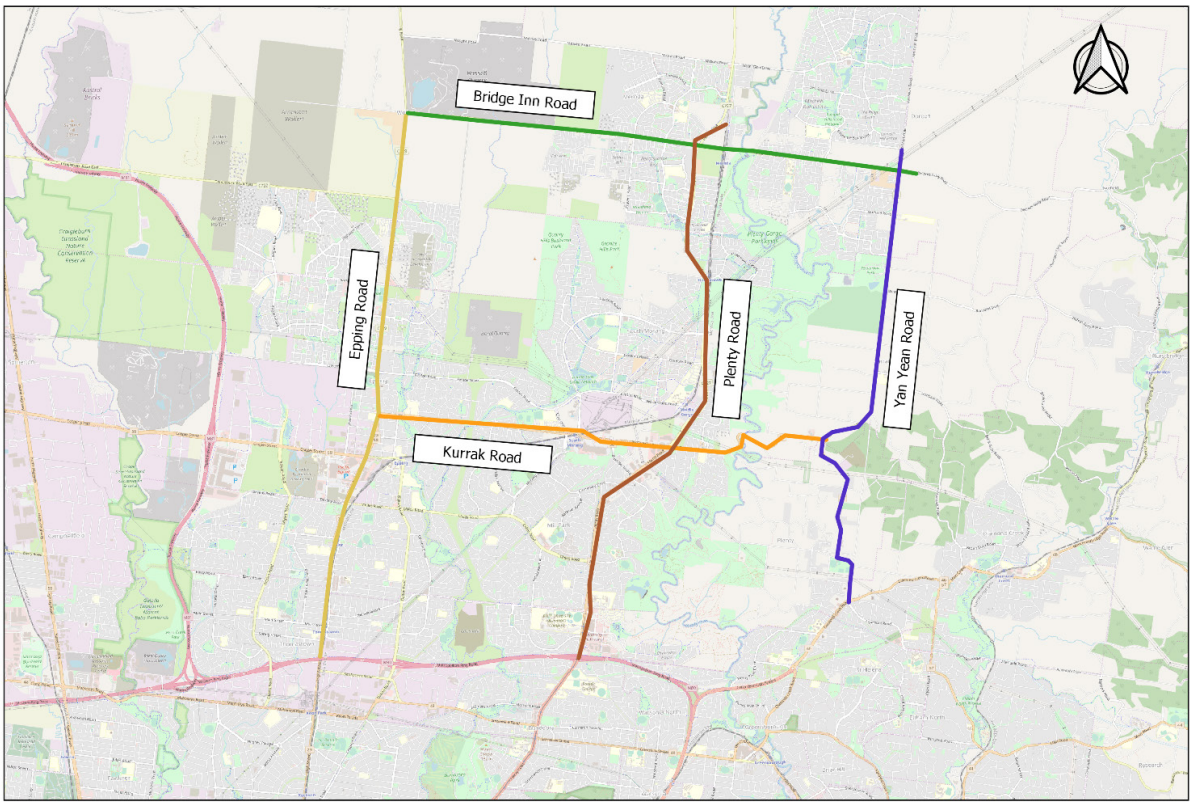

Figure 6.2 Key travel time routes

6.2 FUTURE TRAFFIC CONDITIONS (BASE CASE)

6.2.1 TRAFFIC VOLUMES

The forecast change in total daily traffic volumes between the 2031 Base Case and 2016 is shown in Figure 6.3 as modelled in VITM (the change in total AM and PM peak traffic volumes between the 2031 Base Case and 2016 are provided in Appendix C).

In general, the modelling suggests that there is likely to be a significant increase in traffic throughout the local region, with the following notable effects:

- significant growth in traffic along key north-south routes through the City of Whittlesea, particularly on Epping Road and Plenty Road
- more moderate growth on Yan Yean Road between Bridge Inn Road and Kurrak Road, while growth between the upgraded section of Yan Yean Road (south of Kurrak Road) is more significant
- some minor growth on rural roads in the Shire of Nillumbik such as Heidelberg-Kinglake Road, likely due to limited capacity on other more direct routes including Yan Yean Road
- increases in traffic along the major east-west corridors such as Bridge Inn Road and Findon Road, likely due to population and employment growth and the upgrades of these routes
- more substantial increases in traffic along the Metropolitan Ring Road and Greensborough Highway, as traffic access the North East Link to continue southward towards the Eastern Freeway.

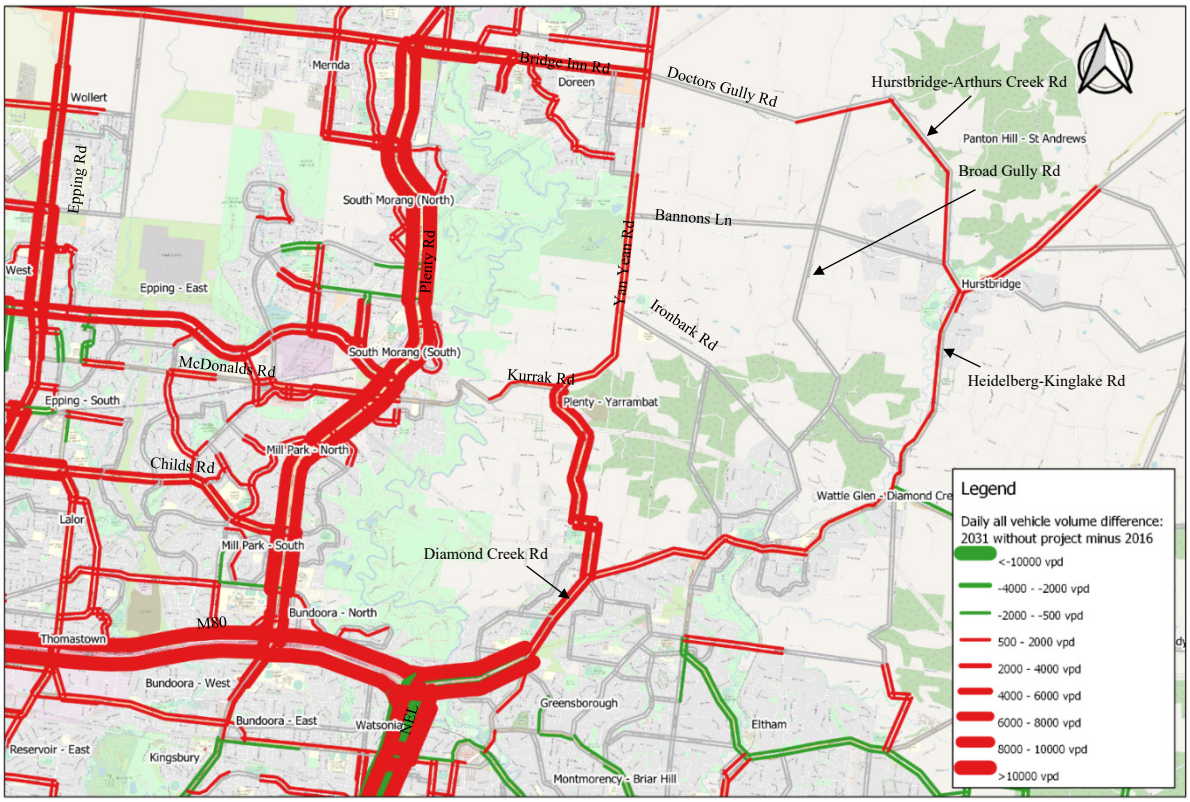

Figure 6.3 2031 Base Case vs 2016 – Daily total volume difference (from VITM)

6.2.2 AVERAGE SPEED

6.2.2.1 AVERAGE SPEED ON KEY ROADS

Network travel speeds for the road network surrounding the project have been extracted from VITM to provide an understanding of the change in the level of congestion expected by the year 2031. Figure 6.4 and Figure 6.5 show the change in travel speed between 2016 and 2031 Base Case for the AM and PM peaks, respectively.

The following key observations can be made from the forecast travel speed data:

- Most of the road network experiences a reduction of speed of between 0 and 10 km/hr, with speeds dropping to between 20 and 40km/hr in both the AM and PM peak. This is likely due to the additional traffic growth between 2016 and 2031.
- There is an improvement in speeds on the upgraded section of Yan Yean Road (Yan Yean Road (Stage 1) Upgrade, south of Kurrak Road) in both directions, in both the AM and PM peak. There is also an improvement in speeds on other upgraded routes in the study area including Bridge Inn Road, Plenty Road and Epping Road.
- Despite upgrades to some north-south routes in the study area, travel speeds in the peak direction (i.e. southbound in the AM and northbound in the PM) on Epping Road, Plenty Road and Yan Yean Road are still below 20 km/hr.
- Travel speeds on rural roads in the Shire of Nillumbik are beginning to reduce, with speeds dropping to below 40 km/hr. This therefore suggests that drivers would use these roads as a north-south alternative route when Yan Yean Road becomes very congested.

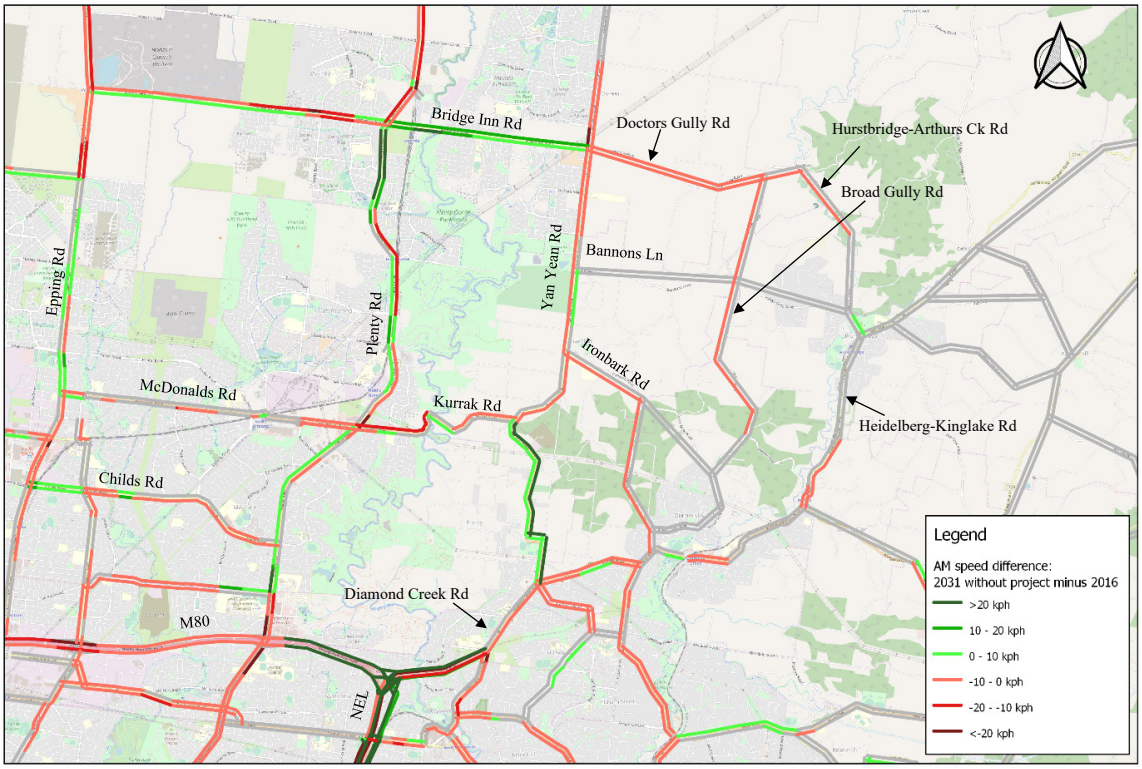

Figure 6.4 2031 Base Case vs 2016 – Two-hour AM peak average speed difference

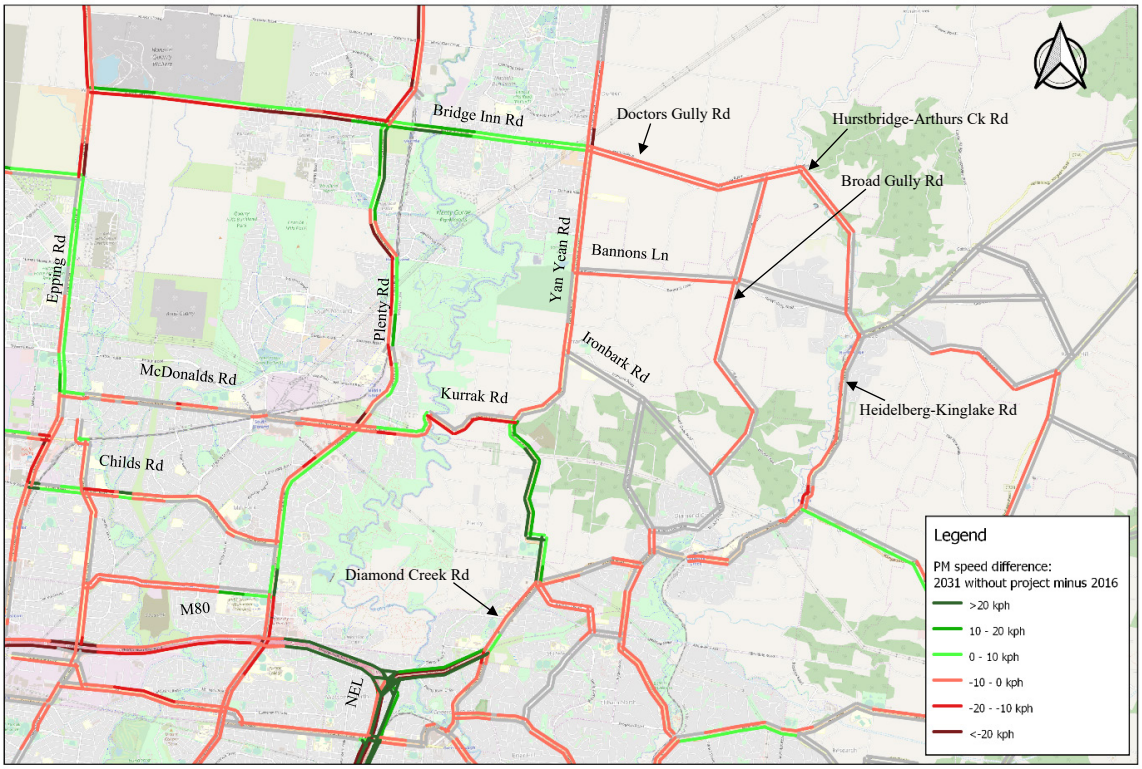

Figure 6.5 2031 Base Case vs 2016 – Two-hour PM peak average speed difference

6.2.3 TRAVEL TIMES

6.2.3.1 TRAVEL TIMES ON KEY ROUTES

Figure 6.6 illustrate the expected change in travel time during the AM and PM peak, between 2016 and the 2031 Base Case for the key routes in the study area.

In general, the modelling suggests that travel times remain unchanged or will increase in 2031 compared to 2016. Other key observations are noted as follows:

- Travel times in the non-peak direction (i.e. northbound in the AM and southbound in the PM) on Yan Yean Road, Plenty Road and Epping Road are not expected to change significantly.
- Travel times on Yan Yean Road and Epping Road in the peak direction (i.e. southbound in the AM and northbound in the PM) experience a noticeable increase, however travel times on Plenty Road remain similar or reduce because it has been fully upgraded.
- Travel times for traffic travelling westbound on Bridge Inn Road in the AM peak and eastbound on Bridge Inn Road in the PM peak both reduce, as this is the non-peak direction and capacity on Bridge Inn Road has been improved due to the upgrade.

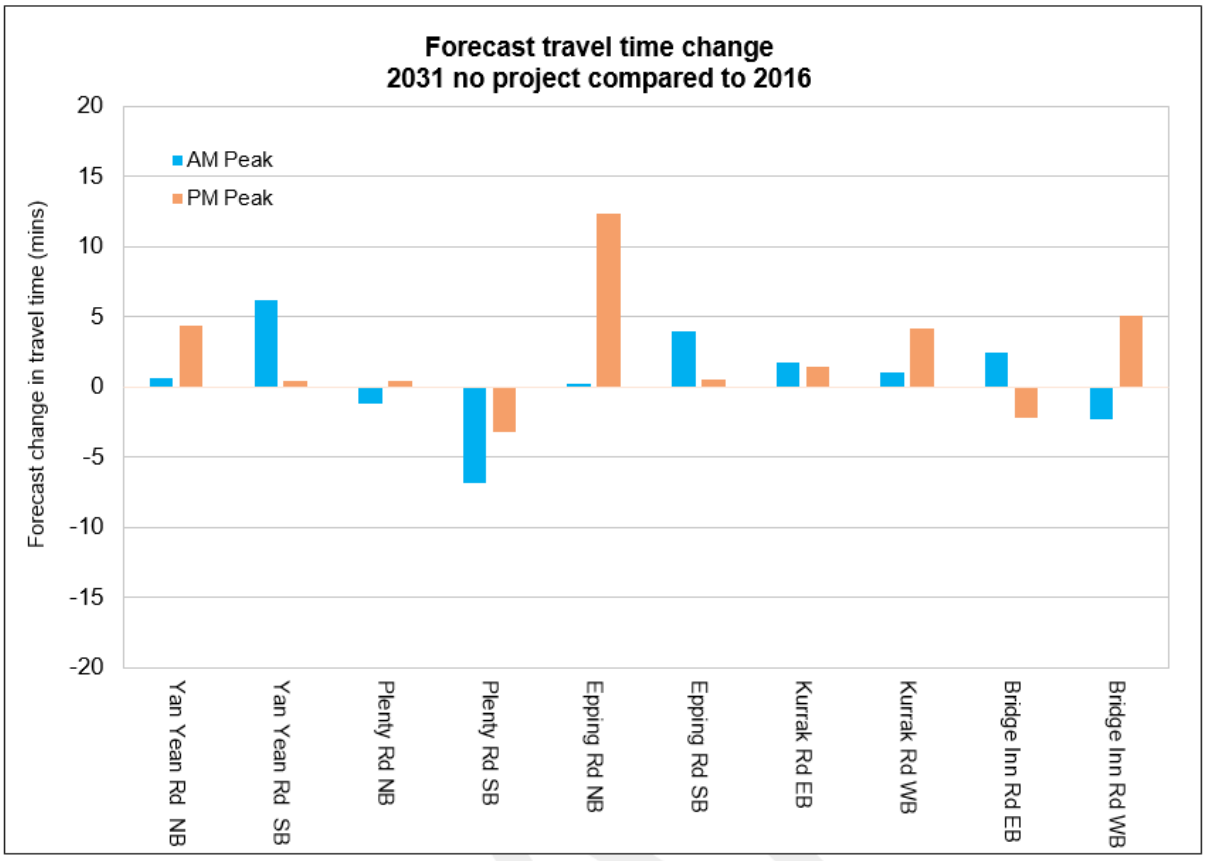

Figure 6.6 AM and PM peak travel time comparison – 2016 vs 2031 Base Case

6.2.4 FUNCTIONALITY OF YAN YEAN ROAD

The origin and destination of traffic using any part of Yan Yean Road between Bridge Inn Road and Kurrak Road in the 2031 Base Case (AM peak) has been mapped using a select link analysis, with results shown in Figure 6.7.

In general, modelling suggests that in the 2031 Base Case, Yan Yean Road will predominately be used by the growing surrounding suburbs of Doreen, Mernda and South Morang, and providing connectivity between these suburbs and the Metropolitan Ring Road, NEL and employment opportunities at Greensborough, Bundoora and the La Trobe NEIC. Yan Yean Road will also be utilised for access to and from Ironbark Road for its connectivity to Ryans Road and Wattletree Road and the Eltham Activity Centre. The origin and destination of trips using Yan Yean Road in the future is unlikely to change significantly from the current year. The analysis has shown that trips may, however, reduce their reliance on Kurrak Road and Plenty Road, opting instead to use the upgraded section of Yan Yean Road (south of Kurrak Road) to access the M80.

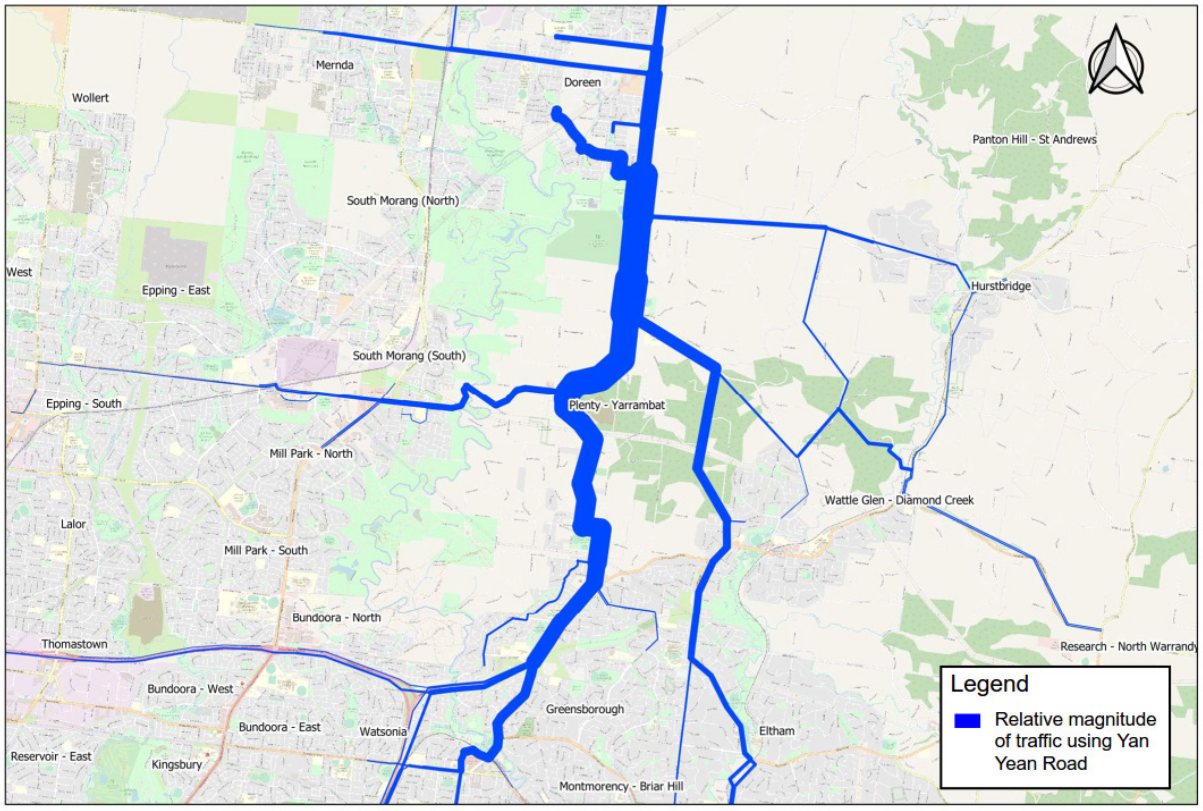

Figure 6.7 2031 Base case select link analysis – Two-hour AM peak total volume

6.3 PROJECT CASE PERFORMANCE

6.3.1 TRAFFIC VOLUMES

The change in total daily traffic volumes between the 2031 Project Case and 2031 Base Case is shown in Figure 6.8.

In general, the modelling suggests that the project will result in:

- a significant increase in volumes on Yan Yean Road (Stage 2) Upgrade (as well as Stage 1) and reduction in volumes on Plenty Road (particularly between Bridge Inn Road and Gorge Road/Kurrak Road), which is the main alternative north-south road to Yan Yean Road. This is an expected effect of road upgrades, where traffic on heavily congested roads may shift to nearby roads with more capacity
- some minor reductions on rural roads in the Shire of Nillumbik such as Bannons Lane North, Broad Gully Road and Hurstbridge-Arthurs Creek Road, likely due to the increased capacity on Yan Yean Road
- some increase in traffic on roads connecting to Yan Yean Road, including Ironbark Road and Bridge Inn Road
- some reduction in traffic on roads connecting Yan Yean Road to other alternative north-south routes, including Doctors Gully Road and Gorge Road/Kurrak Road.

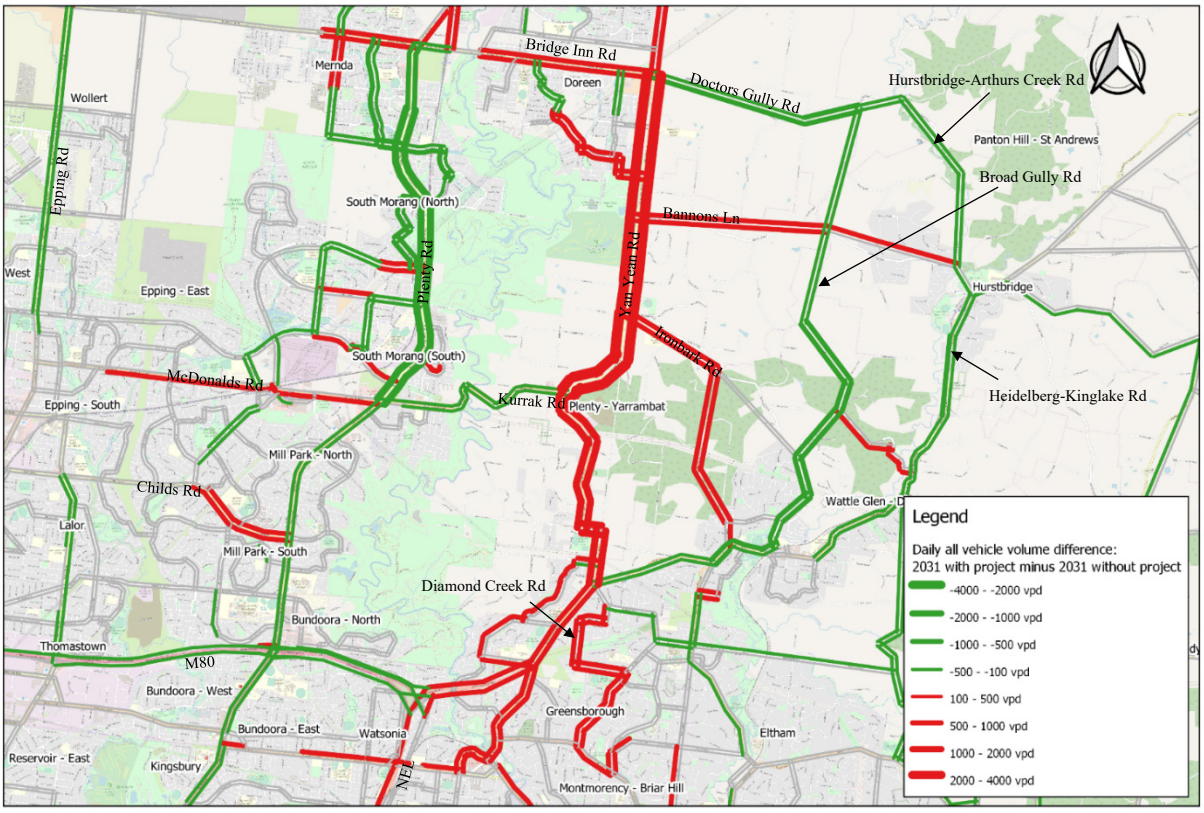

Figure 6.8 2031 Project Case vs 2031 Base Case – Daily total volume difference

6.3.2 AVERAGE SPEED

6.3.2.1 AVERAGE SPEED ON KEY ROADS

Figure 6.9 and Figure 6.10 show the change in travel speed between 2031 Base Case and 2031 Project Case for the AM and PM peaks, respectively.

The following key observations can be made from the forecast travel speed data:

- Most of the road network experiences an increase in speed of between 0 and 10 km/hr.
- There is an improvement in speeds on Yan Yean Road (between Bridge Inn Road and Kurrak Road), in both directions, in both the AM and PM peak. The most significant increase is seen in the peak directions i.e. southbound in the AM and northbound in the PM), where travel speeds increase by more than 20 km/hr in some sections.
- The project relieves pressure on other key north-south routes in the study area (i.e. Epping Road and Plenty Road), with travel times for these routes also improving. Similarly, travel speeds on rural roads in the Shire of Nillumbik begin to increase, as Yan Yean Road becomes more attractive.
- Key roads connecting to Yan Yean Road (Stage 2), appear to reduce in travel speed due to an increase in volume. These include Ironbark Road and Bridge Inn Road.

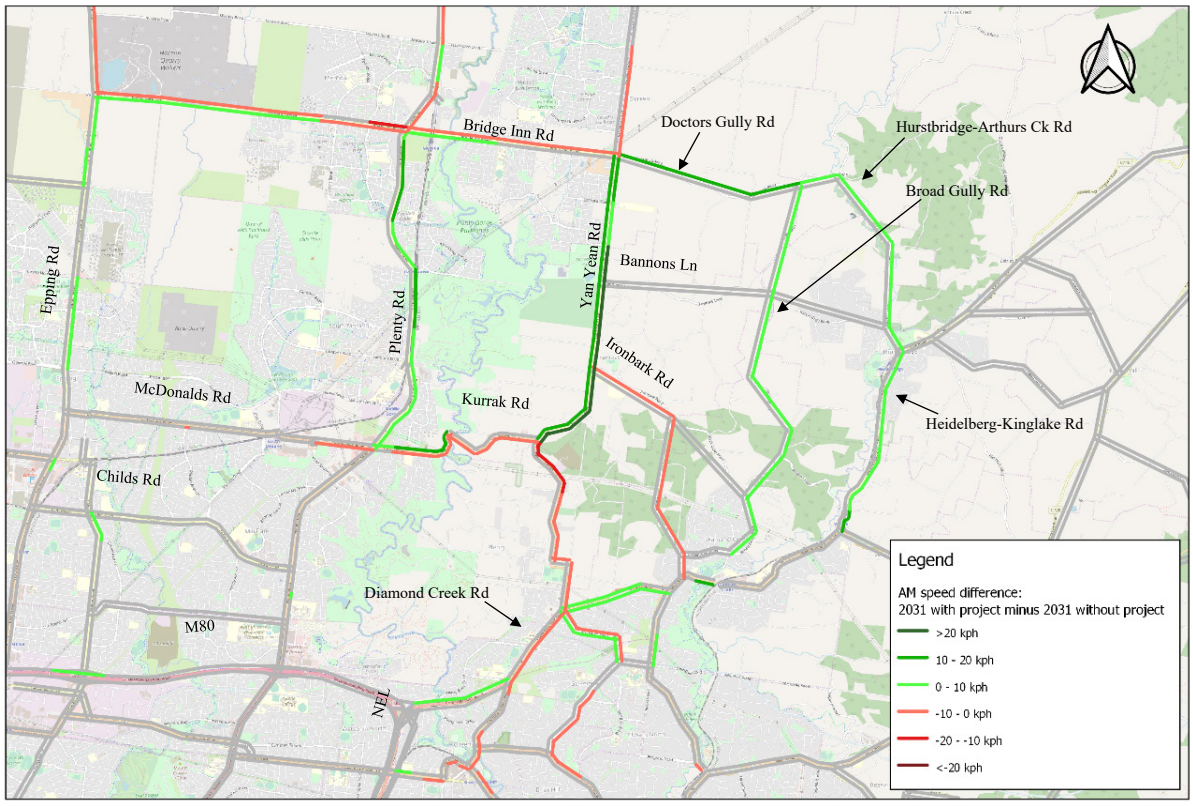

Figure 6.9 2031 Project Case vs 2031 Base Case - AM peak average speed difference

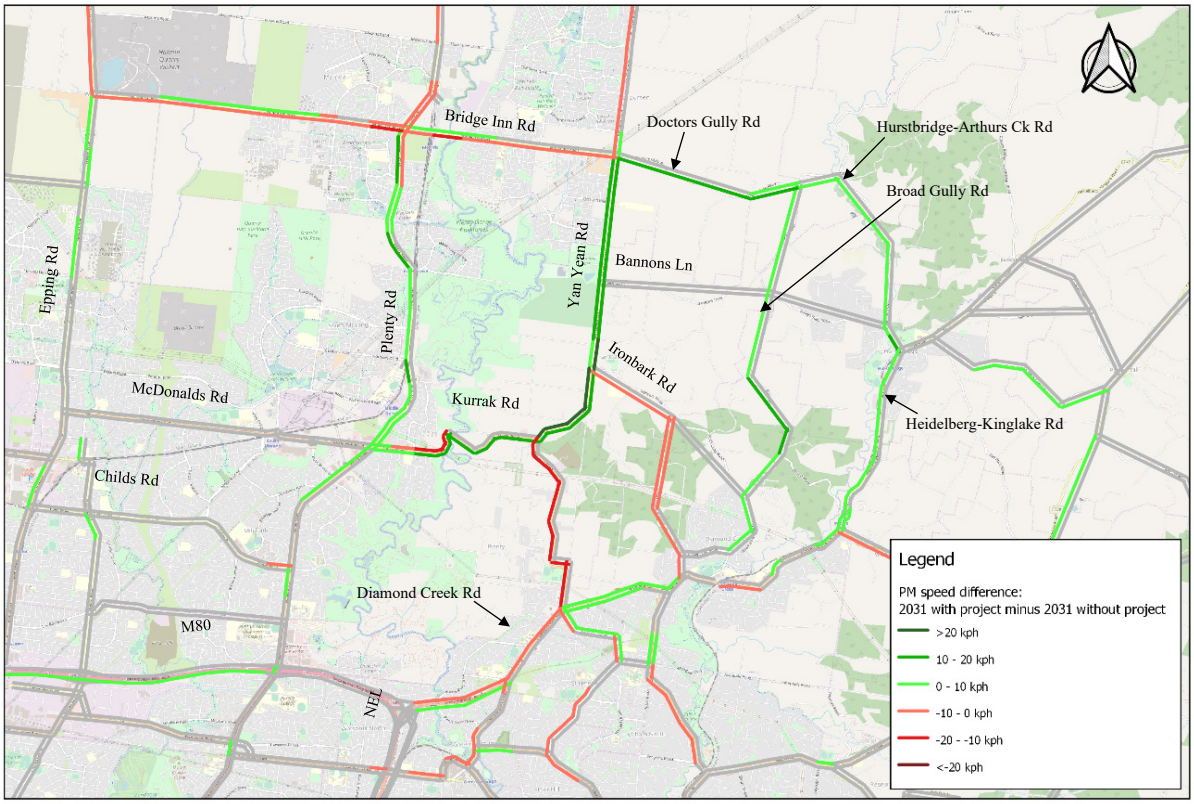

Figure 6.10 2031 Project Case vs 2031 Base Case – PM peak average speed difference

6.3.2.2 AVERAGE NETWORK SPEED

The average network speed was extracted for the study area (as defined in Figure 6.11) for the 2031 Base Case and 2031 Project Case AM and PM peak, with results presented in Table 6.1. In general, modelling suggests that the project has increase the average network speed by 2 km/hr or 6% in the AM peak, and 3 km/hr or over 10% in the PM peak due to the alleviation of congestion on Yan Yean Road and adjacent routes.

Table 6.1 Average network speed – 2031 Base Case and 2031 Project Case

SCENARIO	AVERAGE NETWORK SPEED (KM/H)	
	Two-hour AM peak	Two-hour PM peak
2031 Base Case	33	29
2031 Project Case	35	32

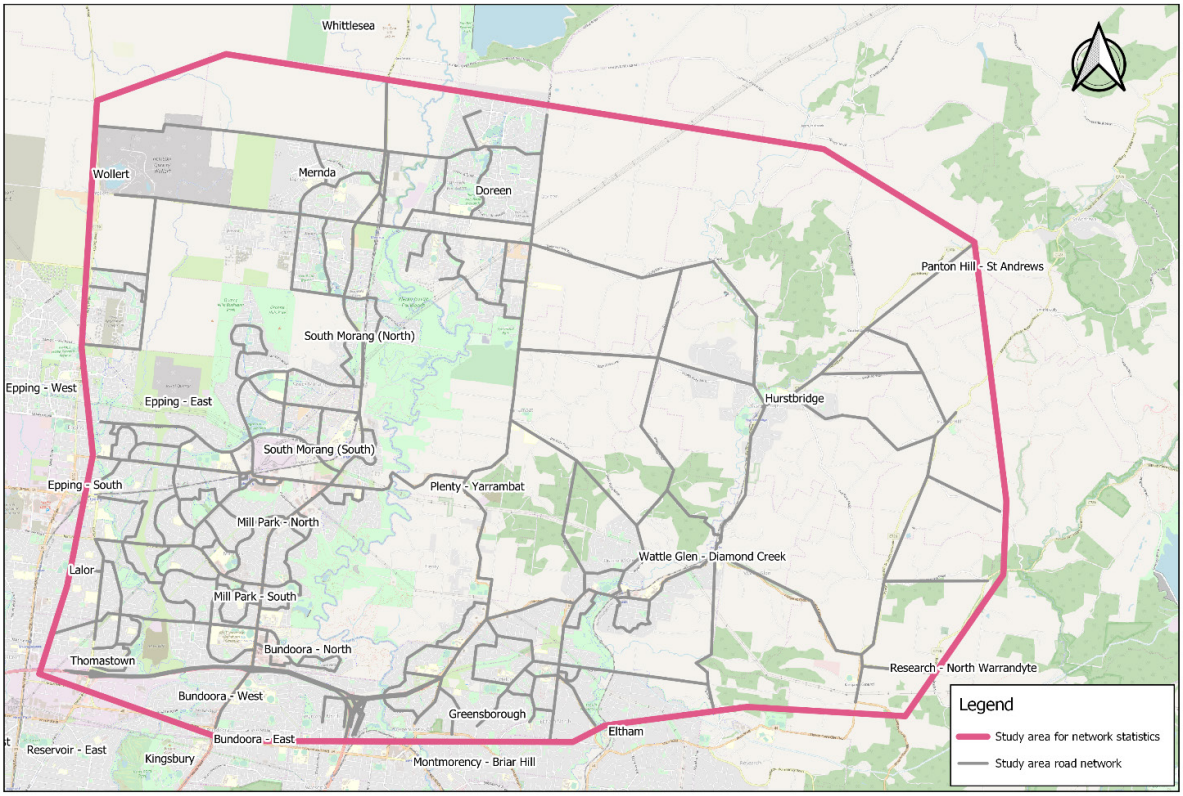

Figure 6.11 Study area and road network for network statistics

6.3.3 TRAVEL TIMES

6.3.3.1 TRAVEL TIMES ON KEY ROUTES

Figure 6.12 illustrates the modelled change in travel time during the AM and PM peak, between the 2031 Project Case and the 2031 Base Case for the key routes in the study area.

In general, the modelling suggests that travel times remain unchanged or will reduce in the Project Case compared to Base Case. Other key observations are noted as follows:

- Travel times in the peak direction (i.e. southbound in the AM and northbound in the PM) on Yan Yean Road, are expected to reduce significantly with the project in place. Travel times in the peak direction on Plenty Road and Epping Road will also reduce due to reduced traffic volumes but to a lesser degree.
- Travel times in the non-peak direction (i.e. northbound in the AM and southbound in the PM) on Yan Yean Road reduce slightly, while travel times on Plenty Road and Epping Road are likely to remain largely unchanged.
- An increase in travel times is forecast along Bridge Inn Road and Kurrak Road. This may be due an increase in traffic from Plenty Road or Yan Yean Road turning onto Bridge Inn Road after the project.

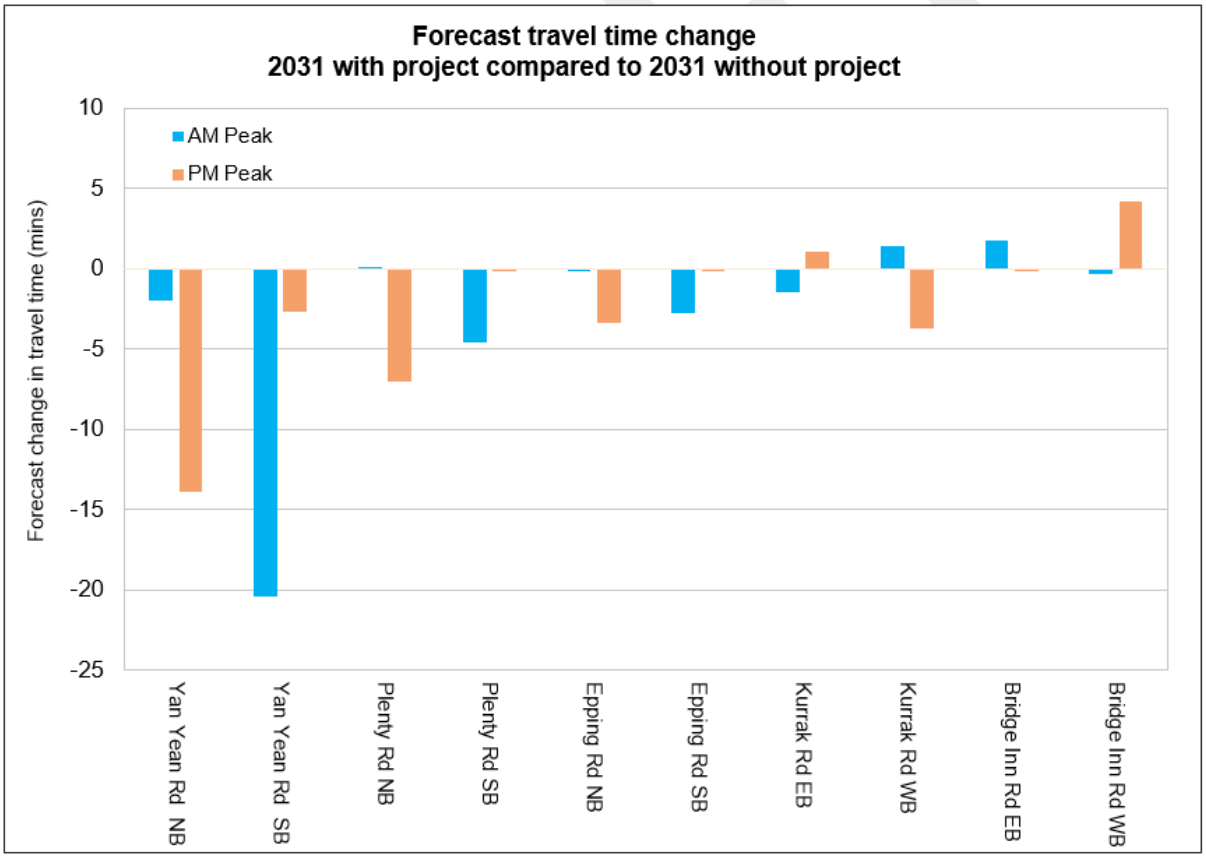

Figure 6.12 AM and PM peak travel time comparison – 2031 Project Case vs 2031 Base Case

6.3.3.2 TRAVEL TIMES TO KEY ACTIVITY CENTRES

To gain a better understanding of the impact the project has on accessibility for the local residential communities, a comparison of the AM peak travel times from Doreen to key activity centres in Melbourne between the 2031 Base Case and Project Case has been made, with results shown in Figure 6.14. The key activity centres considered are shown in Figure 6.13 and include Melbourne CBD, La Trobe NEIC, Greensborough Activity Centre and the Eltham Activity Centre. In general, modelling suggests that travel times to all key activity centres will improve with the project, and that travel times to activity centres closer to Doreen will improve more than travel times to the Melbourne CBD.

A comparison of the AM peak travel times from Plenty to Mernda Town Centre (refer to Figure 6.13 for location) between the 2031 Base Case and Project Case has also been made to understand how accessibility has improved in the non-peak direction. Model results suggest that the travel time from Plenty to Mernda Town Centre will also improve by just over a minute after the project.

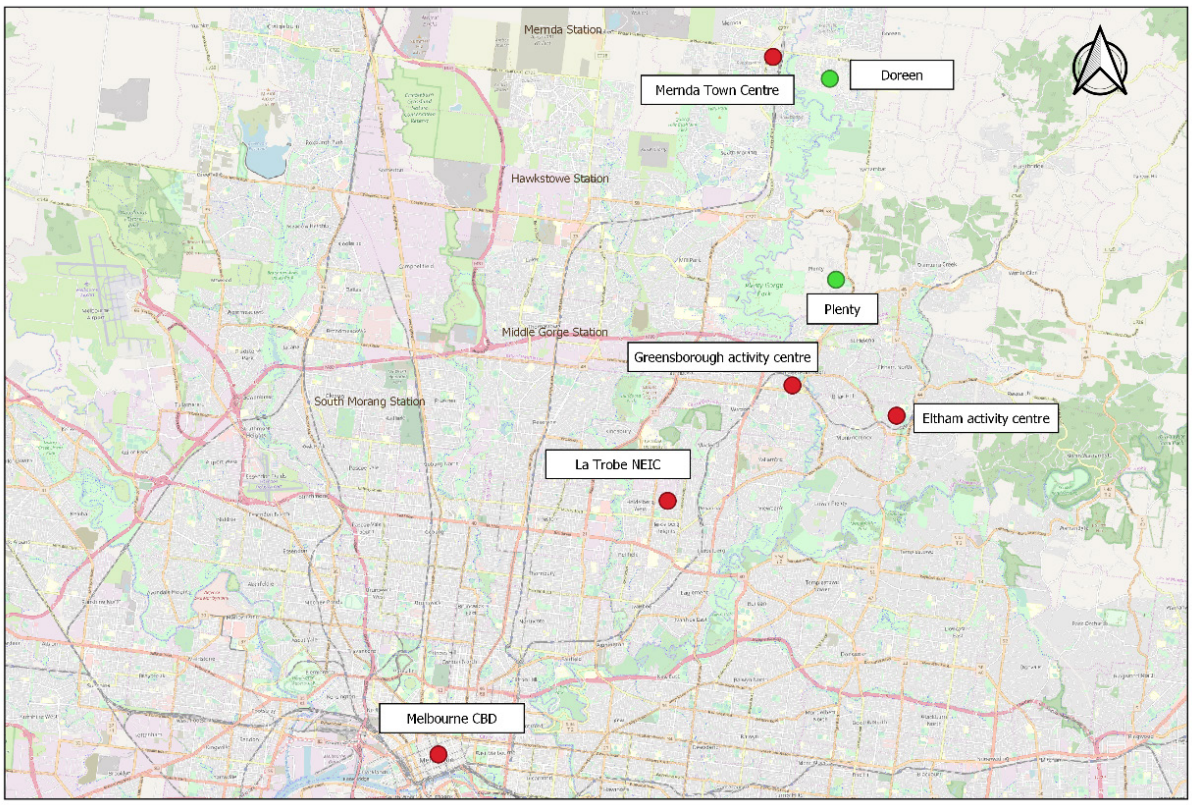

Figure 6.13 Location of key activity centres (highlighted in red)

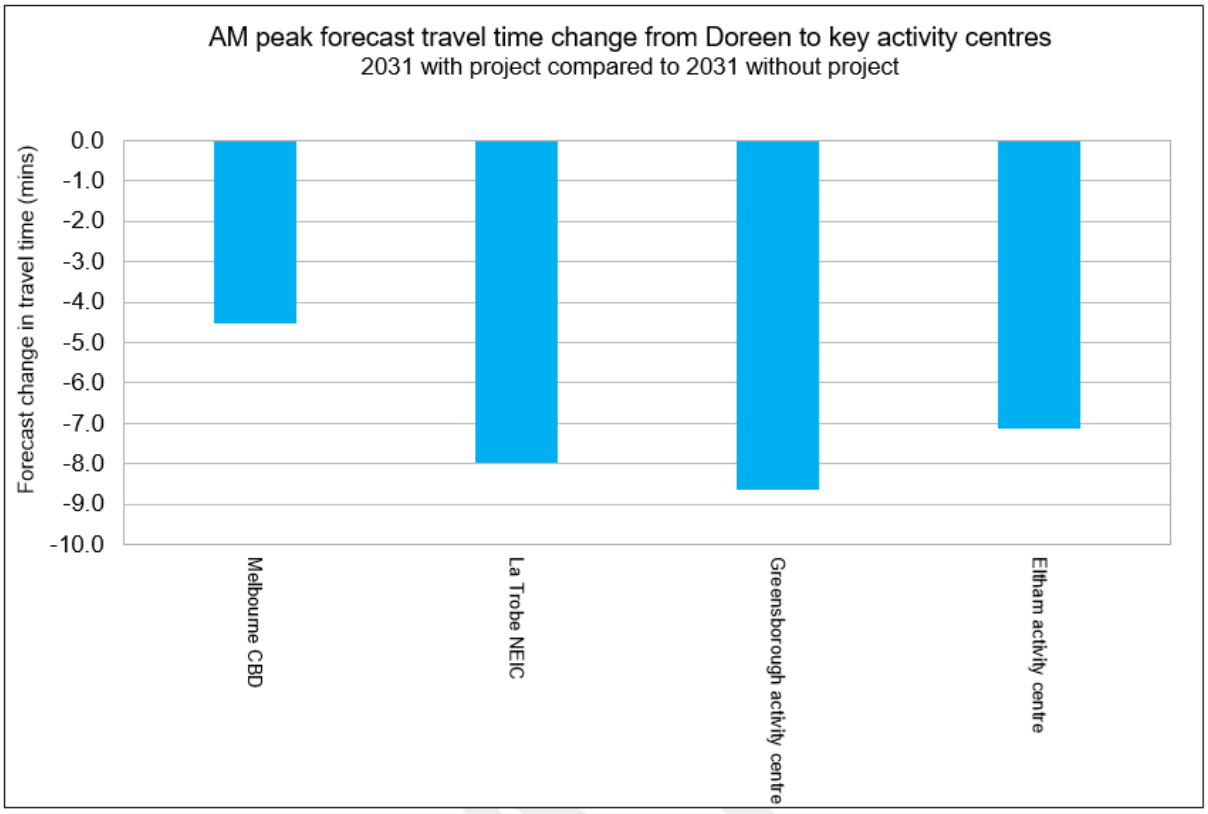

Figure 6.14 AM peak travel time change from Doreen to key activity centres – 2031 Project Case vs 2031 Base Case

6.4 RESILIENCE TESTING

6.4.1 REDUCTION IN LANES ON YAN YEAN ROAD

The number of lanes on Yan Yean Road (between Bridge Inn Road and Kurrak Road) was reduced by one lane in the peak direction in the 2031 Base Case and 2031 Project Case to gain an understanding of how the network would perform if an incident was to occur on Yan Yean Road without and with Yan Yean Road (Stage 2) Upgrade.

The change in the AM peak total traffic volume between the 2031 Base Case (with Yan Yean Road southbound closed) and the 2031 Base Case is shown in Figure 6.15, while the change between the 2031 Project Case (with one lane on Yan Yean Road southbound) and the 2031 Project Case is shown in Figure 6.16. In general, modelling suggests that if an incident occurred on Yan Yean Road, more traffic would divert to Plenty Road without Yan Yean Road (Stage 2) Upgrade (i.e. volumes on Plenty Road would increase by 12% without the project, and only 8% with the project, in the peak direction). A similar result was found for the PM peak.

The change in the AM peak average speed between the 2031 Base Case (with Yan Yean Road southbound closed) and the 2031 Base Case is also shown in Figure 6.17, while the change between the 2031 Project Case (with one lane on Yan Yean Road southbound) and the 2031 Project Case is shown in Figure 6.18. Results show that when there is an incident on Yan Yean Road, speeds on Plenty Road are likely to reduce more without Yan Yean Road (Stage 2) Upgrade, with a reduction in speed of up to 20km/hr for most of the Plenty Road between Bridge Inn Road and George Road. This is consistent with the increase in volumes being experienced on Plenty Road. A similar result was found for the PM peak.

The overall network speed reduction for the study area (as shown Figure 6.11) in the base case is 2.7 km/hr in the AM Peak and 3.21 km/hr in the PM peak. The speed reduction in the project case is less, 1.5 km/hr in the AM peak and 1.5 km/hr in the PM peak.

The AM peak total traffic volume and the AM peak average speed between the 2031 Project Case (with one lane on Yan Yean Road southbound) and the 2031 Base Case (with Yan Yean Road southbound closed) were also compared and are shown in Figure 6.19 and Figure 6.20, respectively. In the Project Case (with one lane on Yan Yean Road southbound), traffic on north-south corridors such as Plenty Road, Broad Gully Road and Arthurs Road are likely to be less than in the Base Case (with Yan Yean Road southbound closed) and have improved speeds, because traffic is now able to use Yan Yean Road. This indicates that there is likely to be less impacts to the surrounding road network with Yan Yean Road Stage 2 in place, than without it, when a major disruption occurs on Yan Yean Road. A similar result was found for the PM peak.

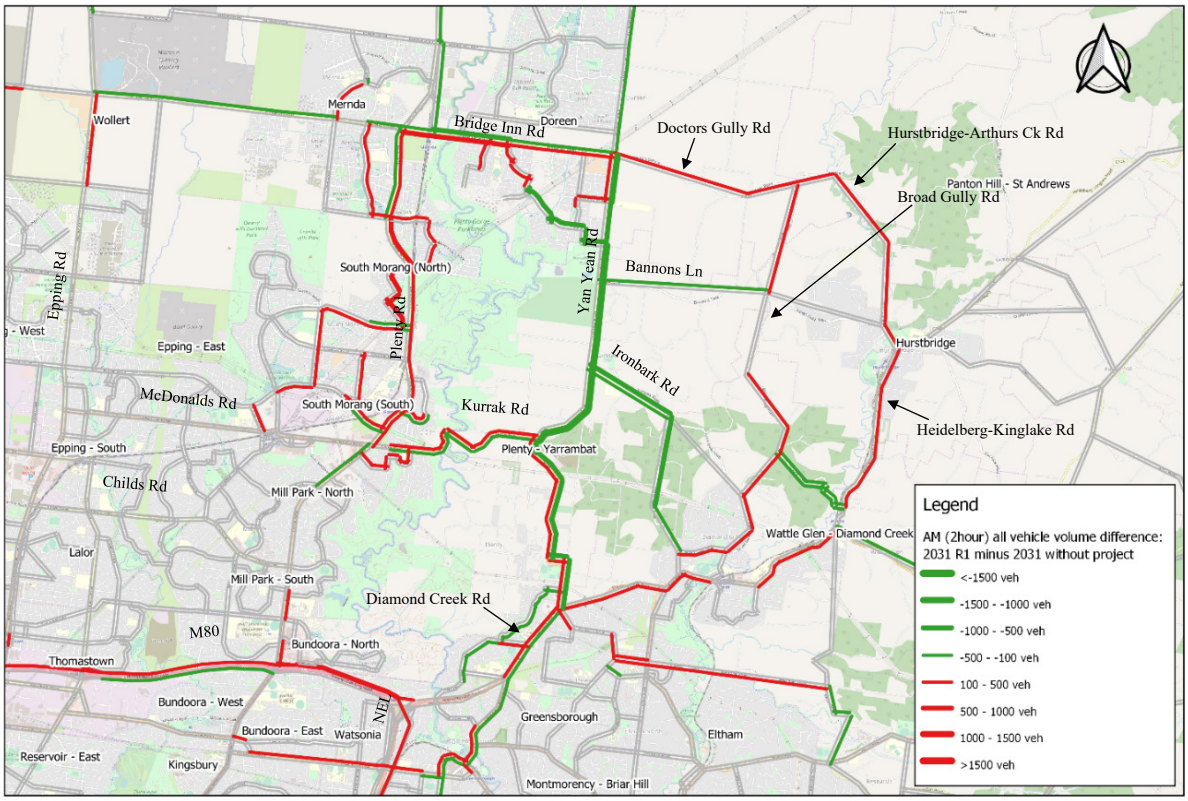

Figure 6.15 2031 Base Case (with Yan Yean Road SB closed) vs 2031 Base Case – AM peak total volume difference (VITM)

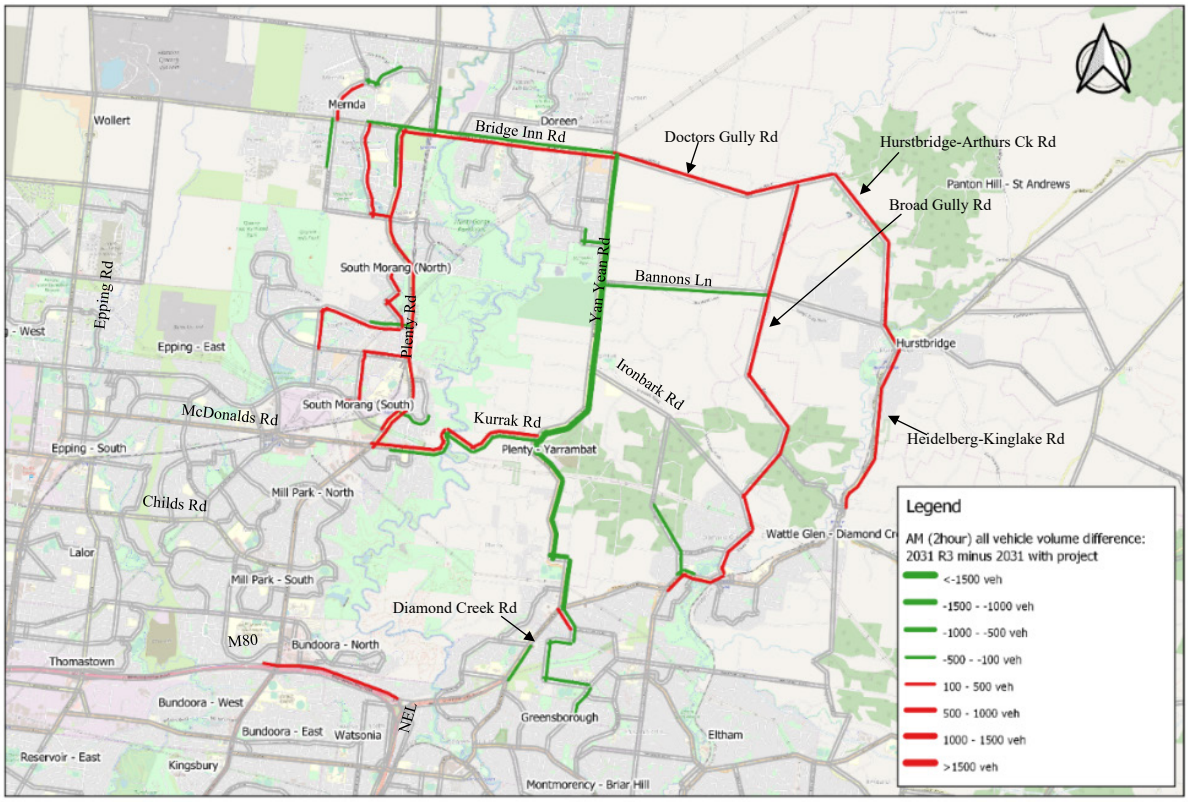

Figure 6.16 2031 Project Case (with one lane on Yan Yean Road SB) vs 2031 Project Case – AM peak total volume difference (VITM)

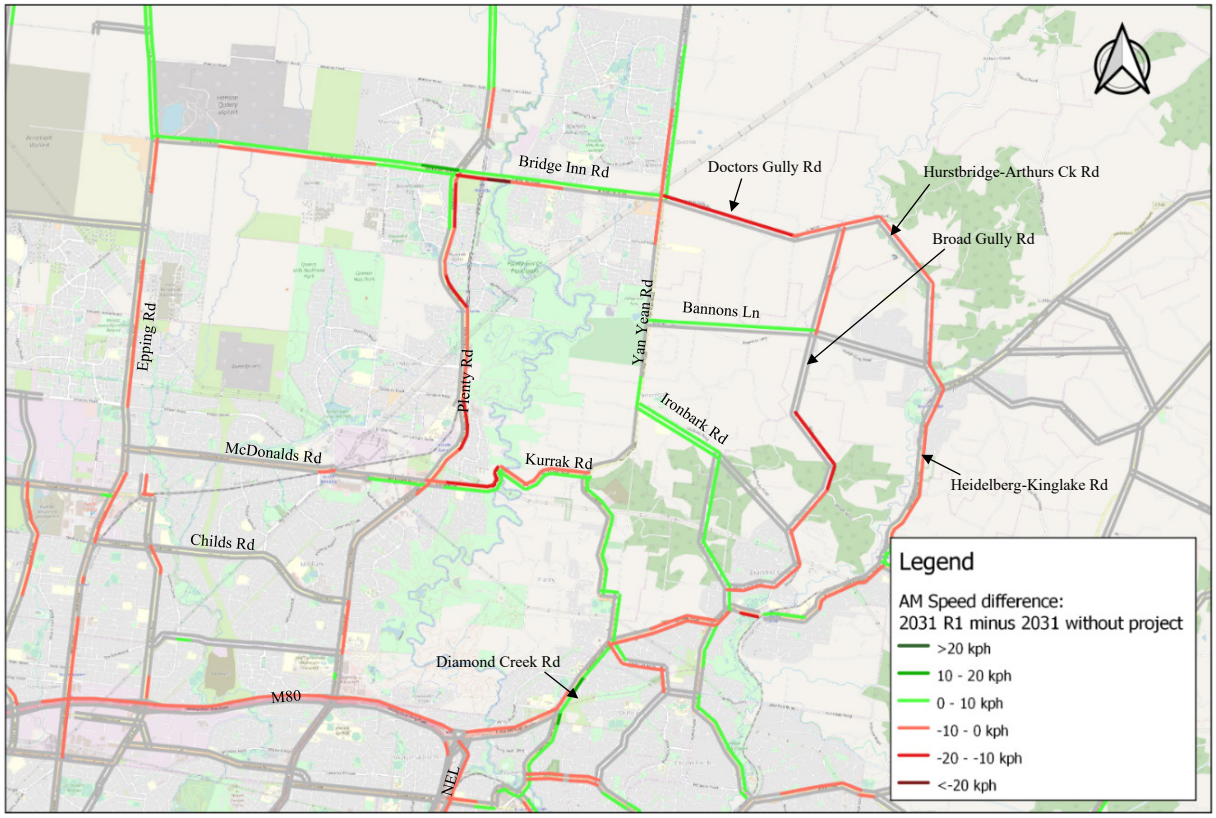

Figure 6.17 2031 Base Case (with Yan Yean Road SB closed) vs 2031 Base Case – AM peak average speed difference

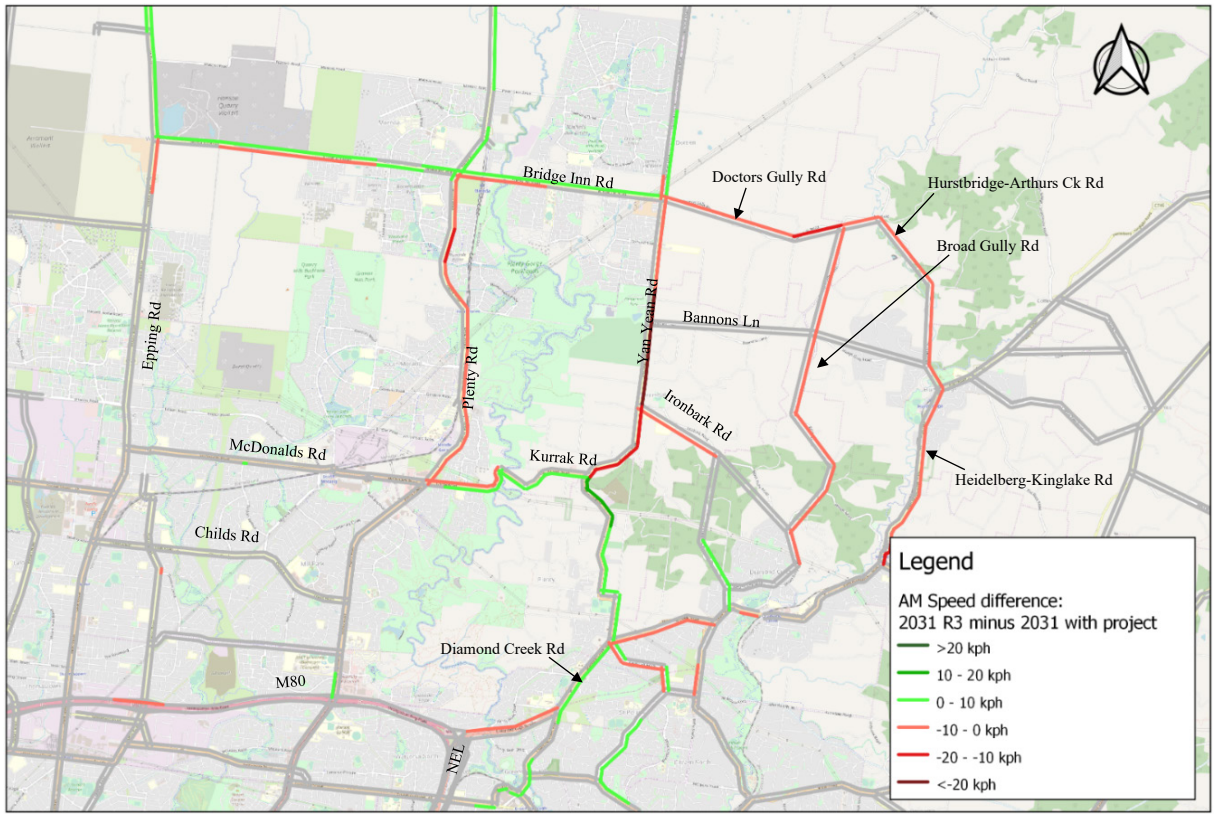

Figure 6.18 2031 Project Case (with one lane on Yan Yean Road SB) vs 2031 Project Case - AM peak average speed difference

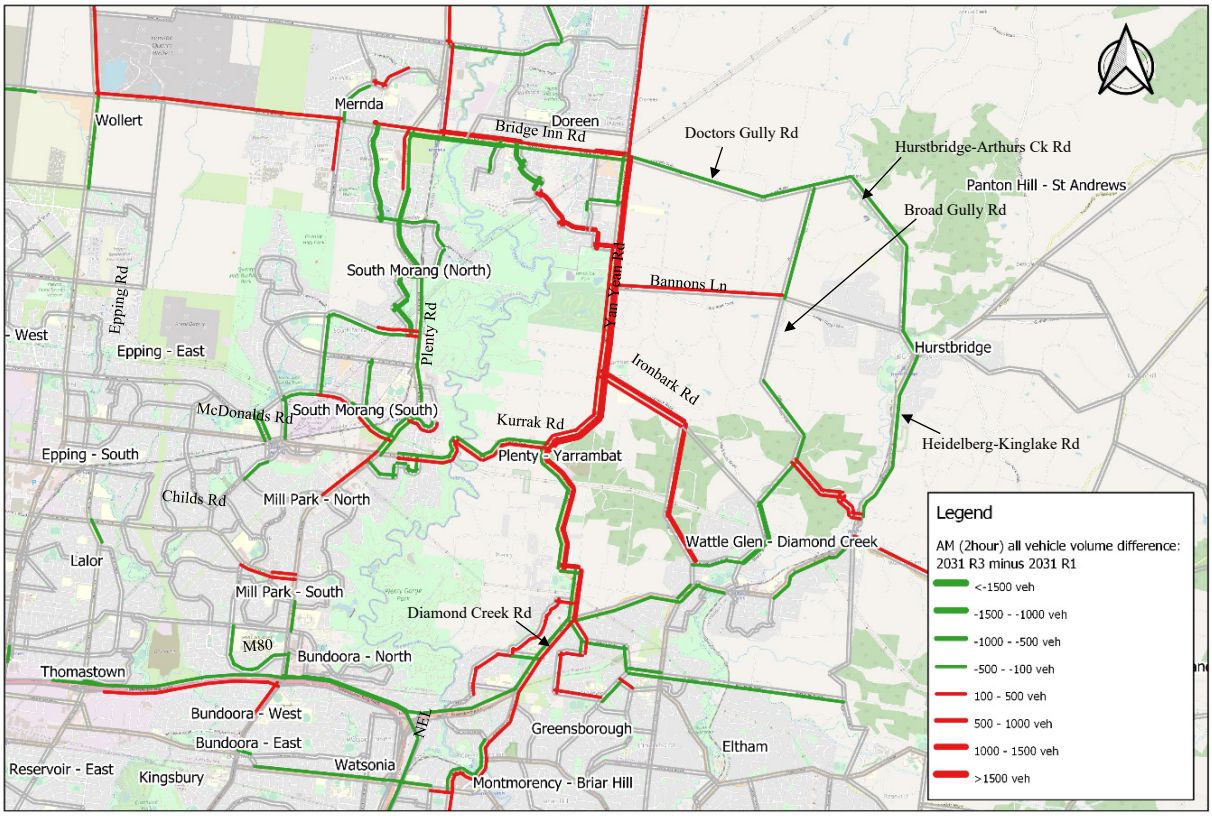

Figure 6.19 2031 Project Case (with one lane on Yan Yean Road SB) vs 2031 Base Case (Yan Yean Road SB closed) - AM peak total volume difference (VITM)

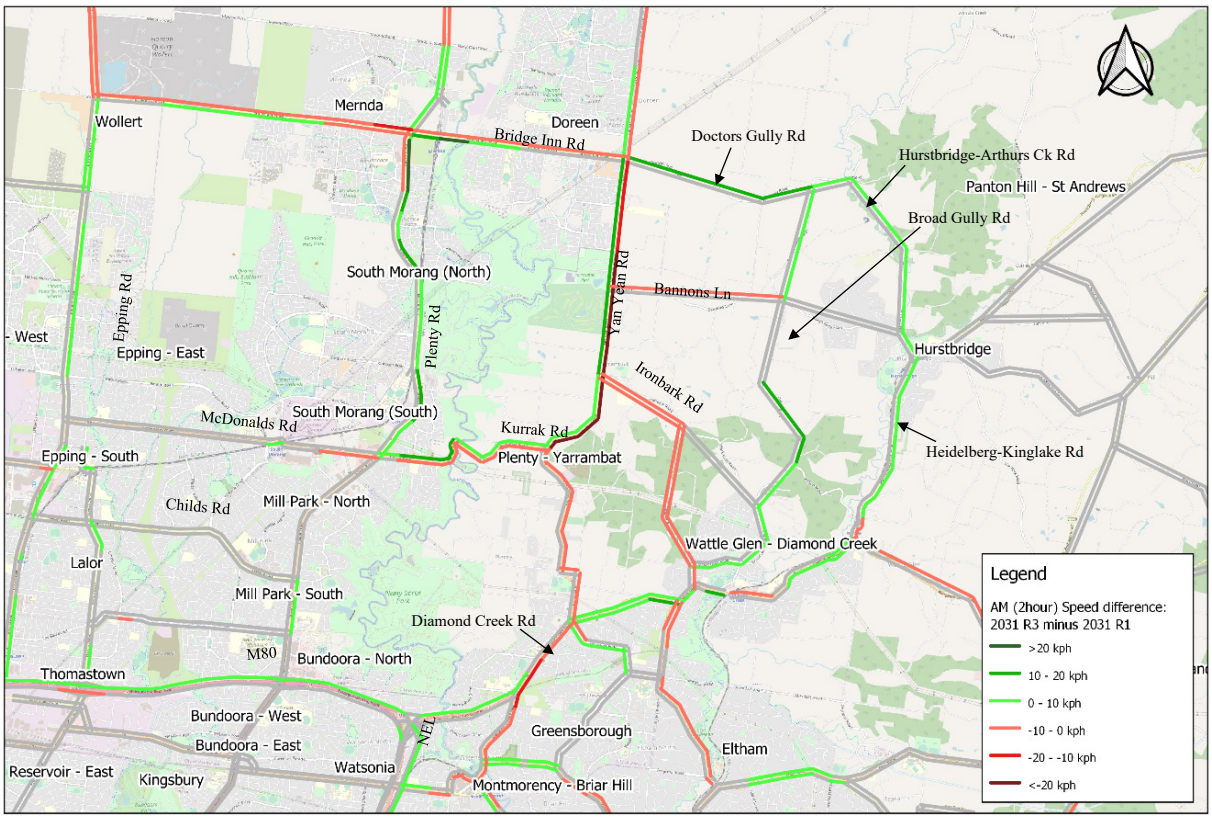

Figure 6.20 2031 Project Case (with one lane on Yan Yean Road SB) vs 2031 Base Case (Yan Yean Road SB closed) – AM peak average speed difference

6.4.2 REDUCTION IN LANES ON PLENTY ROAD

The number of lanes on Plenty Road (between Bridge Inn Road and Gorge Road/Kurrak Road) was reduced from three lanes to two lanes in the peak direction in the 2031 Base Case and 2031 Project Case to gain an understanding of how the network would perform if an incident was to occur on Plenty Road without and with Yan Yean Road (Stage 2) Upgrade.

The change in AM peak total traffic volume between the 2031 Base Case (with one lane reduced on Plenty Road southbound) and the 2031 Base Case is shown in Figure 6.21, while the 2031 Project Case (with one lane reduced on Plenty Road southbound) and the 2031 Project Case is shown in Figure 6.22. In general, modelling suggests that if an incident occurred on Plenty Road, there would be a wider network impact without Yan Yean Road (Stage 2) Upgrade, with volumes on rural roads in the Shire of Nillumbik also increasing in addition to volumes on Yan Yean Road, which would likely to be at capacity. A similar result was found for the PM peak.

The change in the AM peak average speed between the 2031 Base Case (with one lane reduced on Plenty Road southbound) and the 2031 Base Case is also shown in Figure 6.23, while the change between the 2031 Project Case (with one lane reduced on Plenty Road southbound) and the 2031 Project Case is shown in Figure 6.24. Results show that when there is an incident on Plenty Road, speeds on Yan Yean Road are likely to reduce more without Yan Yean Road (Stage 2) Upgrade, with a reduction in speed of up to 20km/hr for most of Yan Yean Road between Bridge Inn Road and Kurrak Road. This is consistent with the increase in volumes being experienced on Yan Yean Road. A similar result was found for the PM peak.

The overall network speed reduction for the study area (as shown Figure 6.11) in the base case is 2.0 km/hr in the AM Peak and 2.0 Km/hr in the PM peak. The speed reduction in the project case is less, 1.4 km/hr in the AM peak and 1.5 km/hr in the PM peak

The AM peak total traffic volume and the AM peak average speed between the 2031 Project Case (with one lane reduced on Plenty Road southbound) and the 2031 Base Case (with one lane reduced on Plenty Road southbound) were also compared and are shown in Figure 6.25 and Figure 6.26, respectively. In the Project Case (with one lane reduced on Plenty Road southbound), traffic on Plenty Road and other north-south corridors such as Broad Gully Road and Arthurs Road reduce and speeds improve compared to the Base Case (with one lane reduced on Plenty Road southbound), since Yan Yean Road has additional capacity to cater for additional demand. This indicates that there is likely to be less impacts to the surrounding road network with Yan Yean Road Stage 2 in place, than without it, when a major disruption occurs on Plenty Road. A similar result was found for the PM peak.

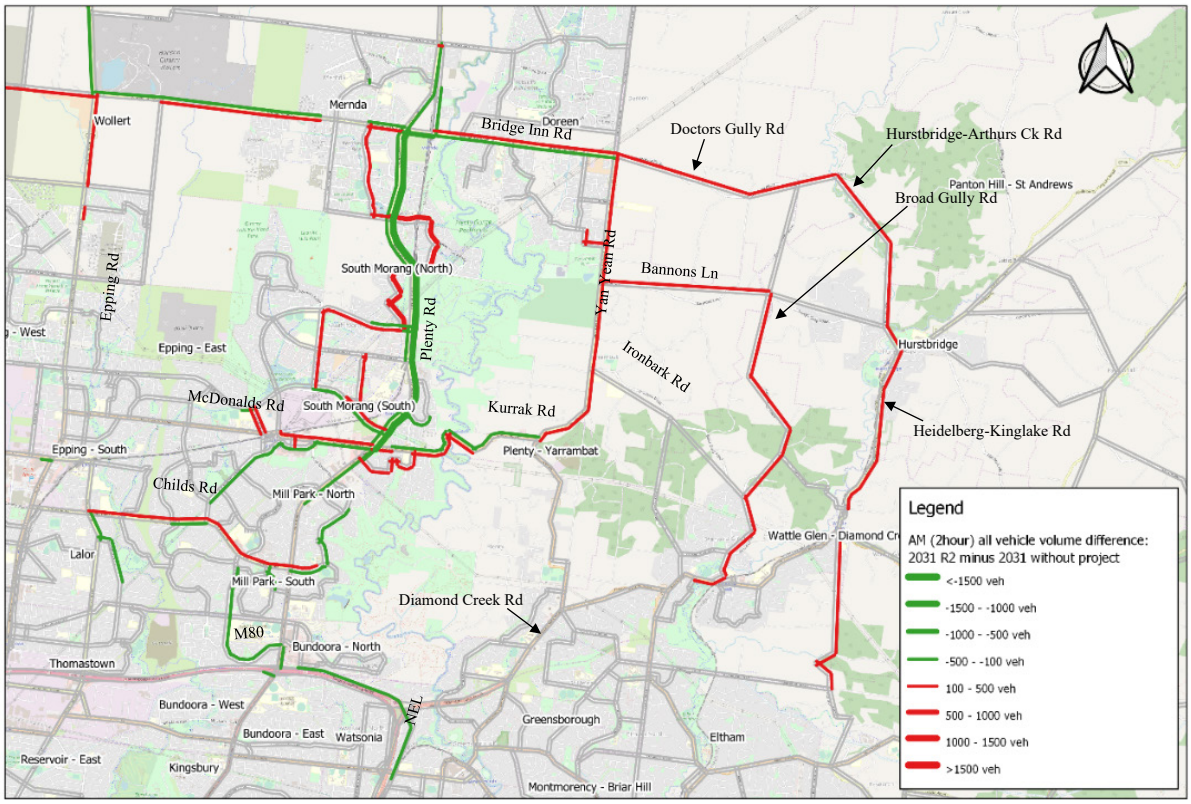

Figure 6.21 2031 Base Case (with one lane reduced on Plenty Road SB) vs 2031 Base Case – AM peak total volumes difference (VITM)

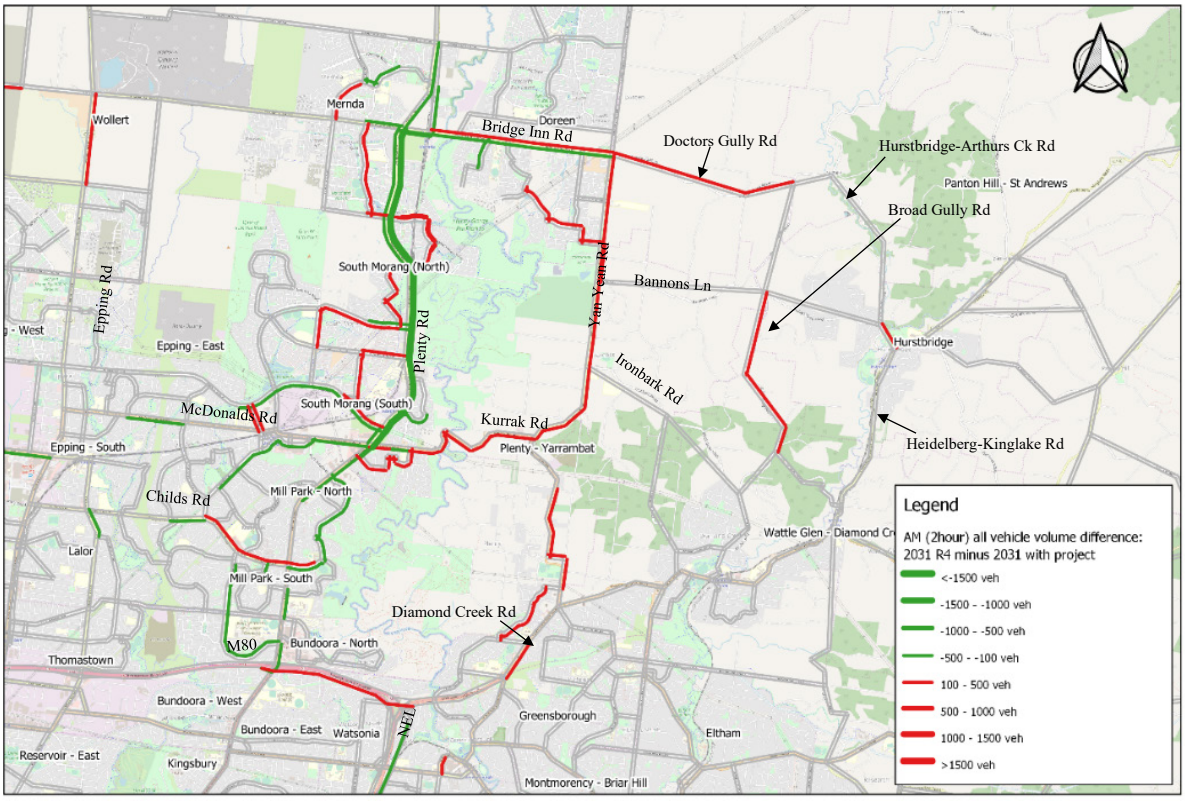

Figure 6.22 2031 Project Case (with one lane reduced on Plenty Road SB) vs 2031 Project Case – AM peak total volumes difference (VITM)

Figure 6.23 2031 Base Case (with one lane reduced on Plenty Road SB) vs 2031 Base Case – AM peak average speed difference

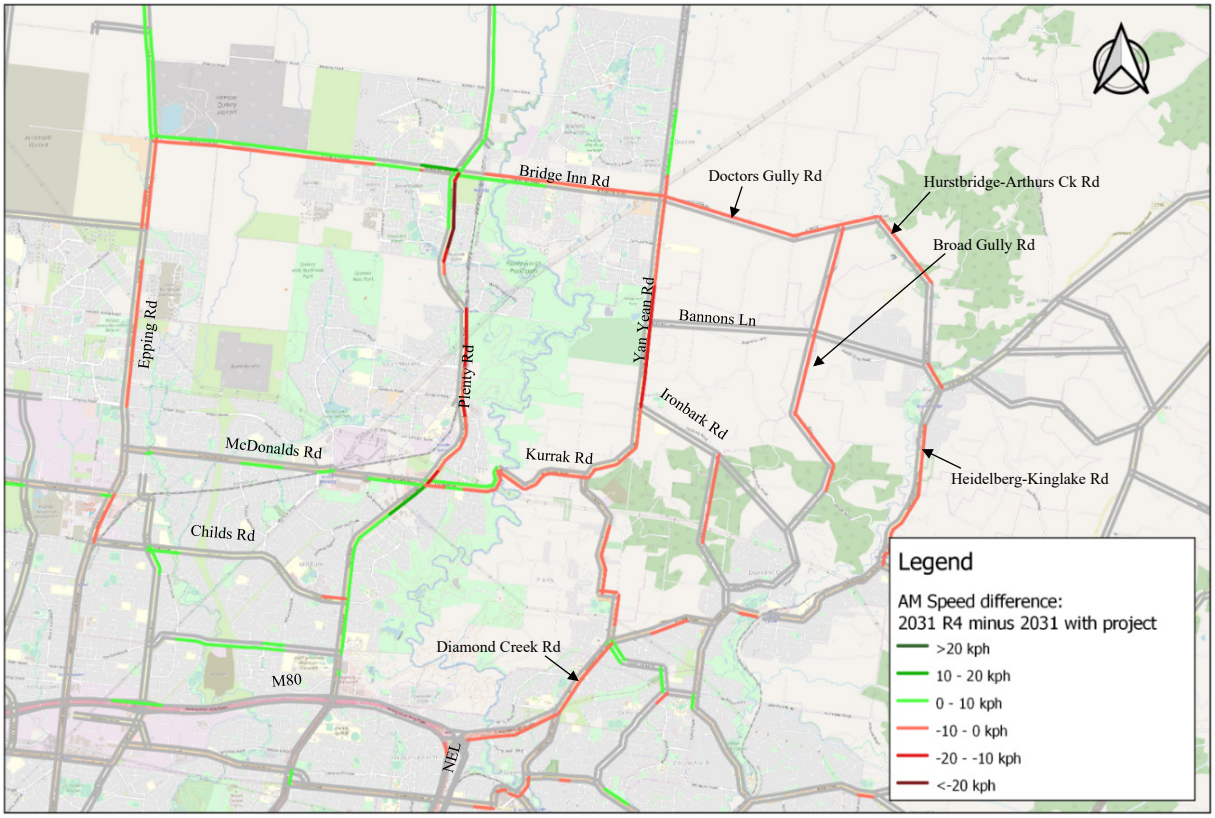

Figure 6.24 2031 Project Case (with one lane on Yan Yean Road SB) vs 2031 Project Case – AM peak average speed difference

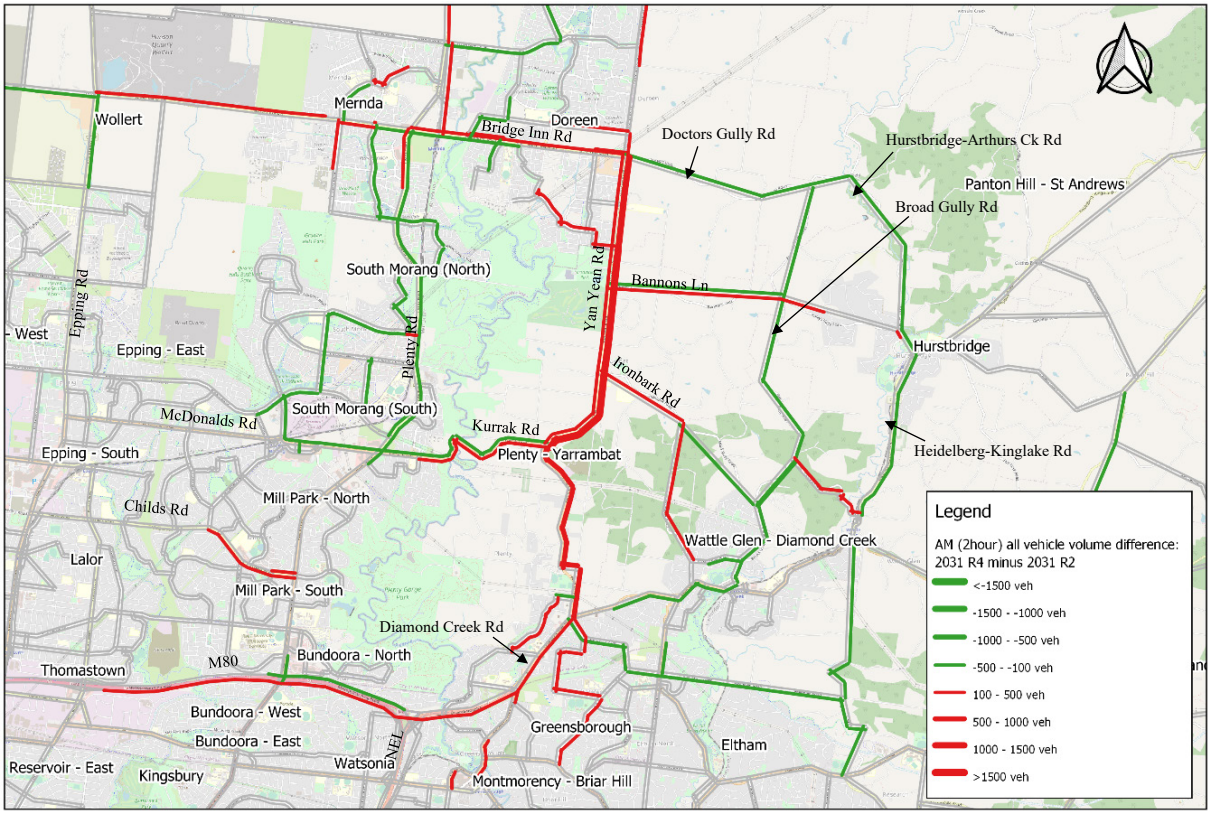

Figure 6.25 2031 Project Case (with one lane on Plenty Road SB) vs 2031 Base Case (with one lane on Plenty Road SB) – AM peak total volumes difference (VITM)

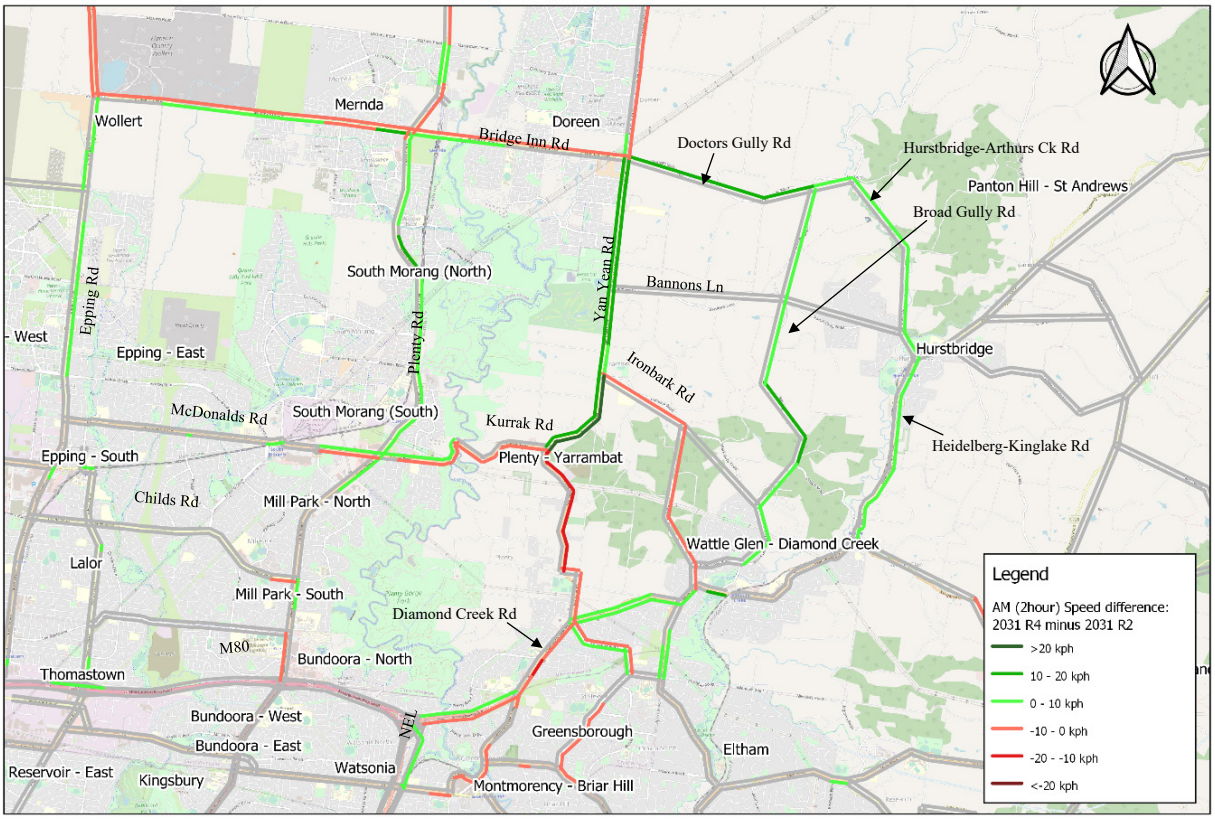

Figure 6.26 2031 Project Case (with one lane on Plenty Road SB) vs 2031 Base Case (with one lane on Plenty Road SB) – AM peak average speed difference

6.5 SENSITIVITY TESTING

6.5.1 2031 PROJECT CASE WITH 2026 LAND USE

The 2031 Project Case was modelled with the 2026 land use projections to gain an understanding of the network impact under a lower land use scenario i.e. if land development rates were slower than currently forecast. The change in total daily traffic volumes between the 2031 Project Case (with 2026 land use) and the 2031 Project Case is shown in Figure 6.27. In general, modelling suggests that under the lower land use scenario, traffic volumes throughout the study area would reduce slightly, with volumes on Yan Yean Road (between Bridge Inn Road and Kurrak Road) reducing by up to 10% per day in the peak direction.

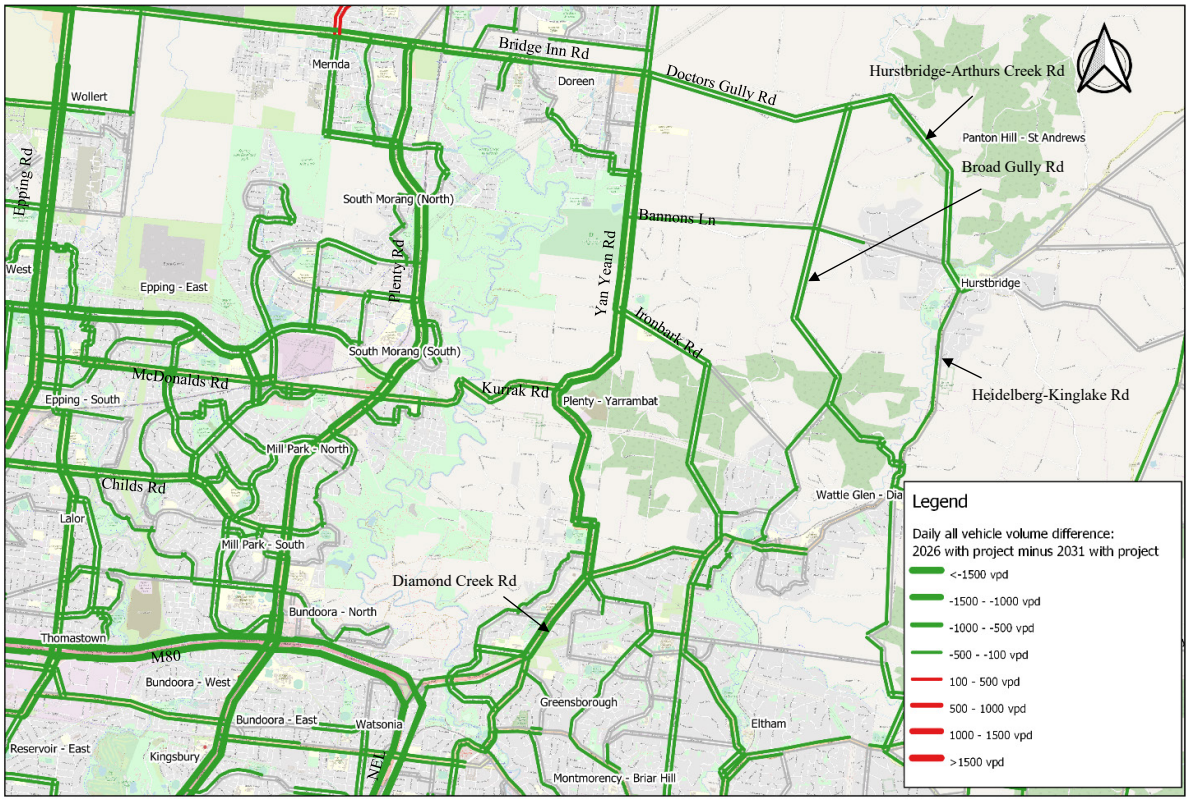

Figure 6.27 2031 Project Case (with 2026 Land Use) vs 2031 Project Case – Daily total volume difference (VITM)

6.5.2 2031 PROJECT CASE WITH 2036 LAND USE

The 2031 Project Case was modelled with 2036 land use projects to gain an understanding of the network impact under a higher land use scenario i.e. if land development rates were faster than currently forecast. The change in total daily traffic volumes between the 2031 Project Case (with 2036 land use) and the 2031 Project Case is shown in Figure 6.28. In general, modelling suggests under a higher land use scenario, traffic volumes throughout the study area would increase slightly, with volumes on Yan Yean Road (between Bridge Inn Road and Kurrak Road) increasing by up to 15% per day in the peak direction.

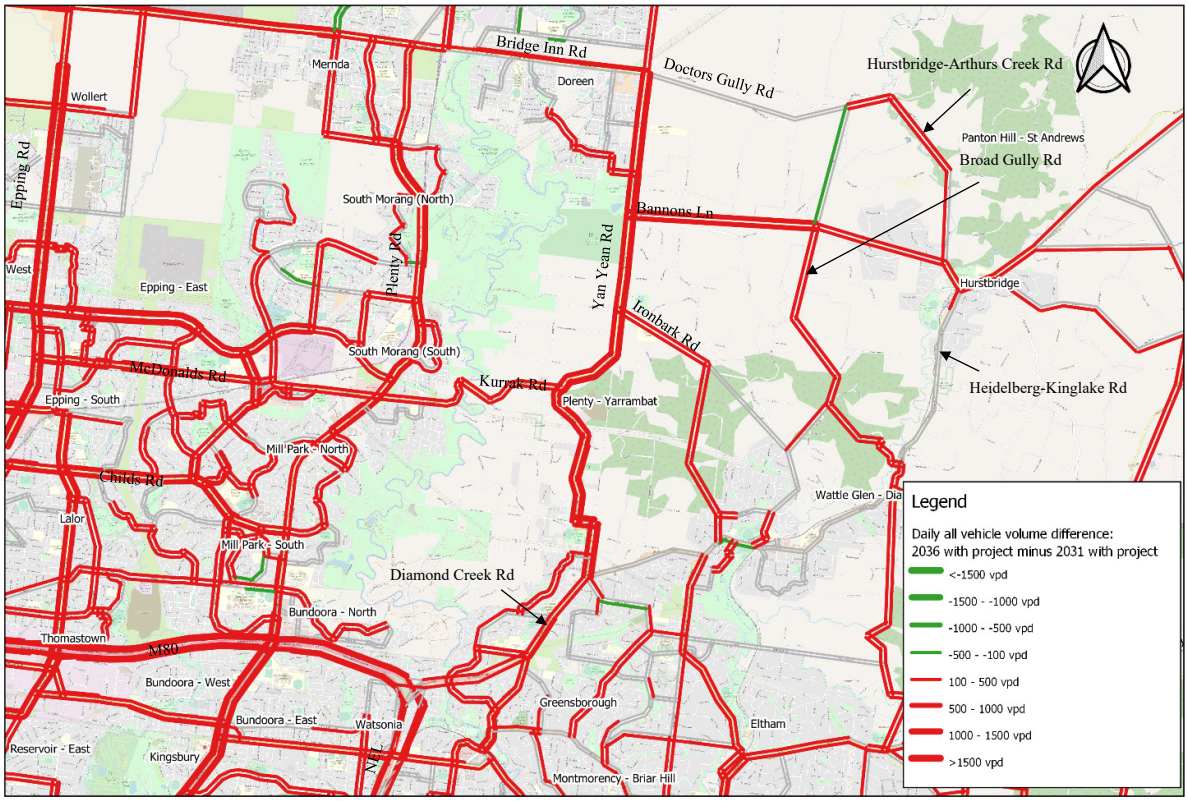

Figure 6.28 2031 Project Case (with 2036 Land Use) vs 2031 Project Case – Daily total volume difference (VITM)

7 CONCLUSION

Strategic traffic forecasting has been undertaken for the proposed Yan Yean Road (Stage 2) Upgrade project to respond to the EES Scoping Requirements. It has been conducted using VITM, which was refined and updated with the latest Reference Case road network and land use assumptions.

Traffic forecasting has been undertaken for a Base Case (without Yan Yean Road (Stage 2) Upgrade) and Project Case (with Yan Yean Road (Stage 2) Upgrade) in the future year 2031. Overall, the forecast results indicate that:

- there is likely to be a significant increase in traffic throughout the local region in the future Base Case when compared to 2016, with significant growth in traffic along key north-south routes through the City of Whittlesea
- speeds on most roads in the study area will deteriorate in the future Base Case when compared to 2016, suggesting that the local road network will not have sufficient capacity to support the growth in demand
- speeds in the peak direction (i.e. southbound in the AM and northbound in the PM) on Yan Yean Road, are expected to improve significantly in the future with the project
- Yan Yean Road (Stage 2) Upgrade will be able to cater for more traffic on Yan Yean Road and provide overall capacity improvement for local network. It will significantly improve speeds and travel times on Yan Yean Road, as well as other key north-south routes in the study area (i.e. Plenty Road and Epping Road). The Project will also improve accessibility for local residents to key activity centres including Melbourne CBD, La Trobe NEIC, Greensborough Activity Centre, the Eltham Activity Centre and the Mernda Town Centre.

APPENDIX A

2051 VS 2031 LAND USE

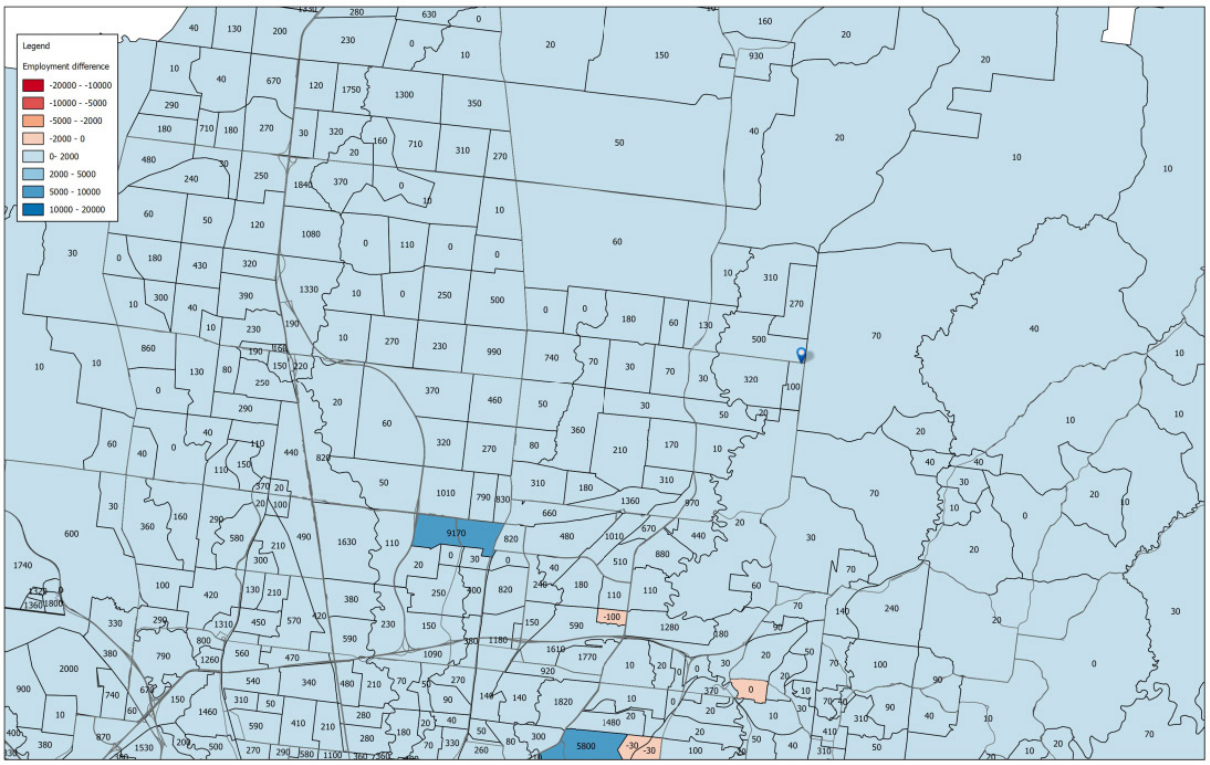

Figure A.1 2051 vs 2031 employment (Yan Yean Road/Bridge Inn Road intersection highlighted)

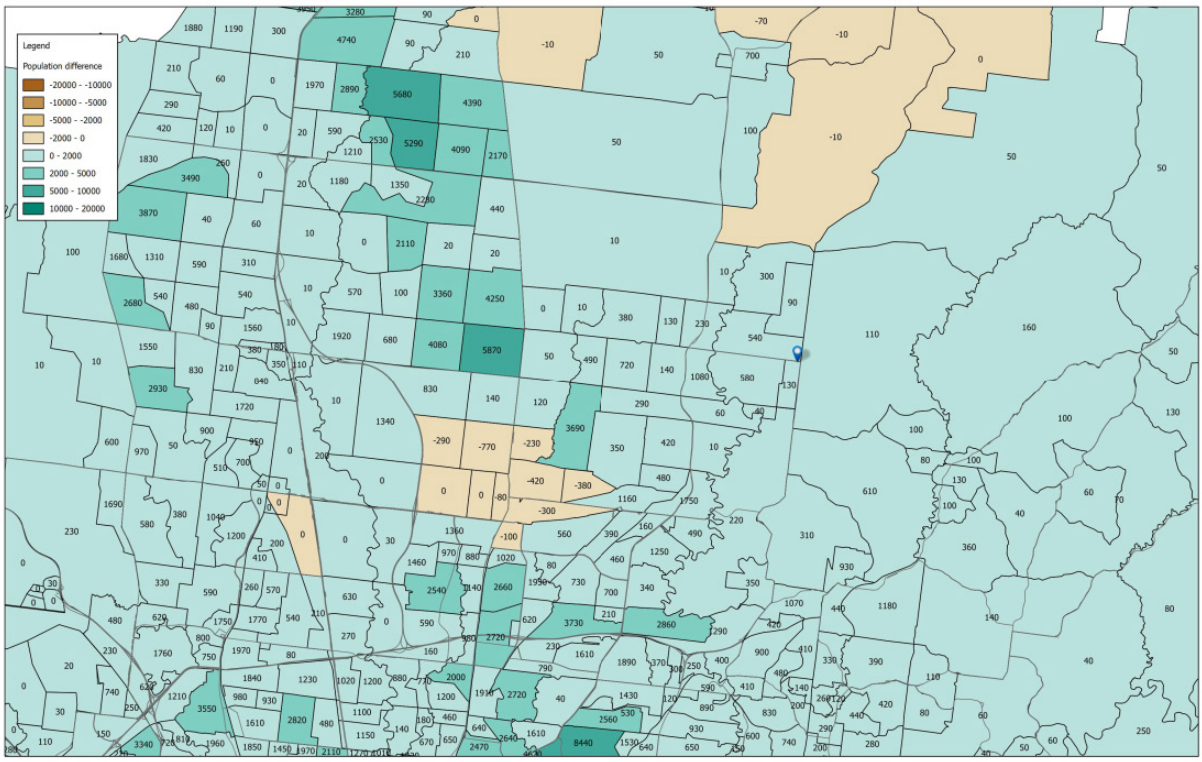

Figure A.2 2051 vs 2031 population (Yan Yean Road/Bridge Inn Road intersection highlighted)

APPENDIX B

AM AND PM SCATTER PLOTS

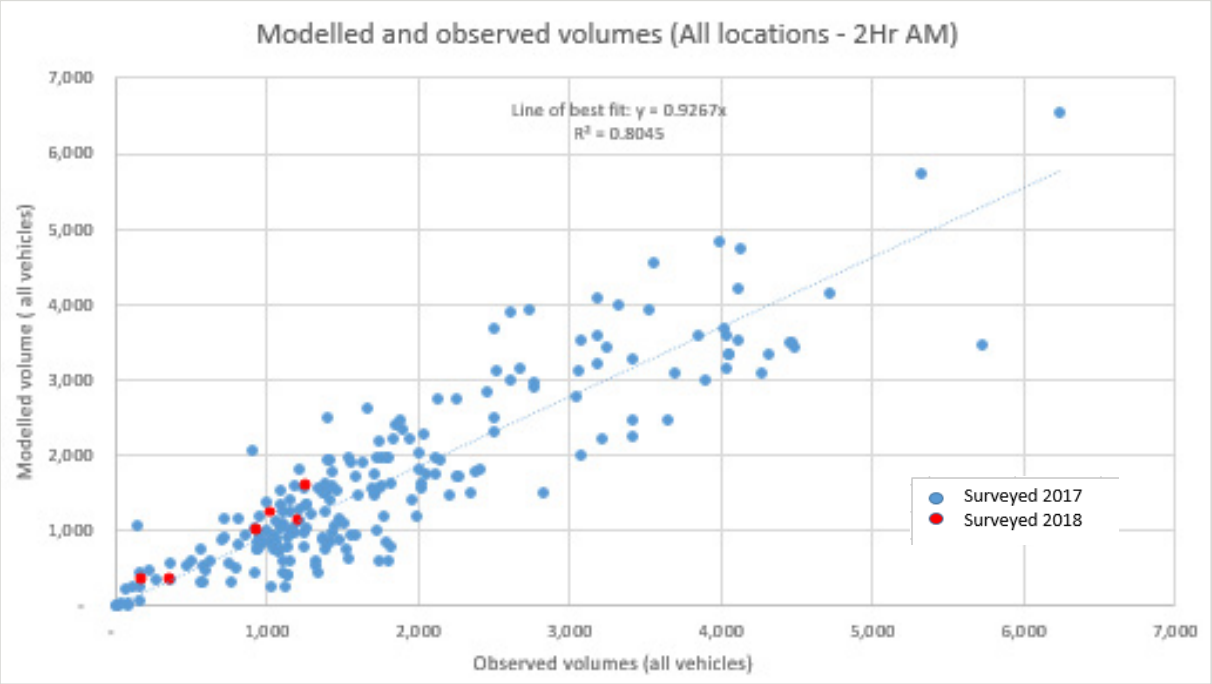

Figure B.1 Comparison of 2016 modelled and observed 2-hour AM link volume (weekday)

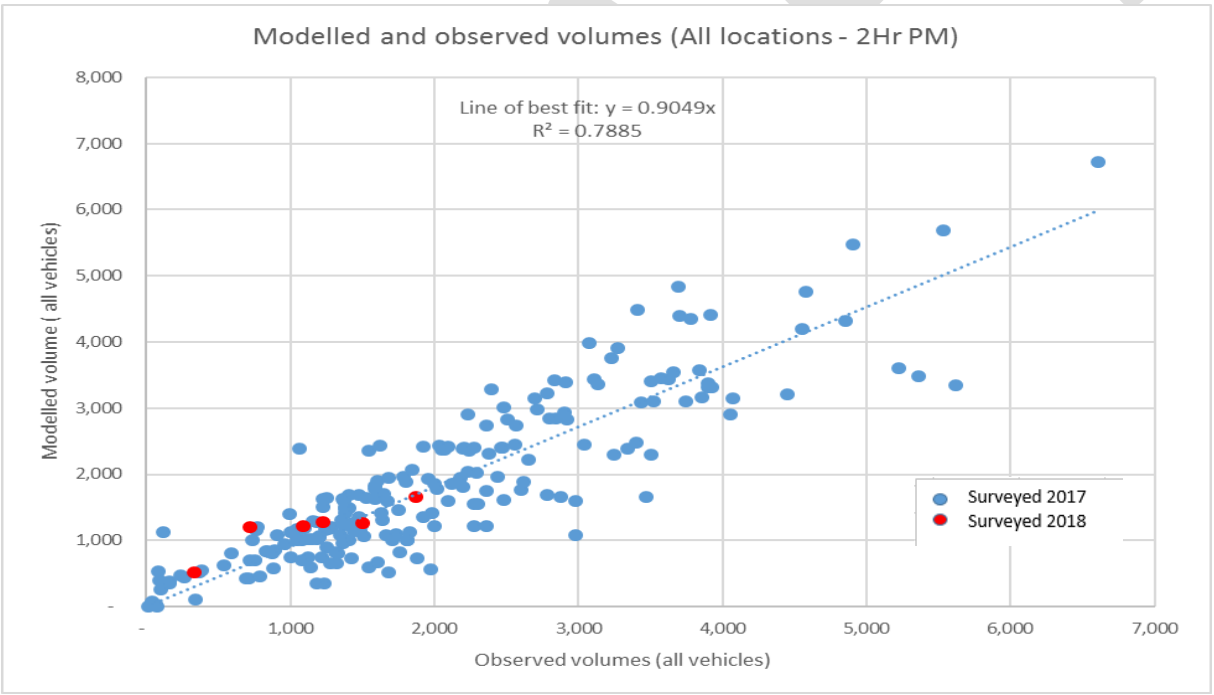

Figure B.2 Comparison of 2016 modelled and observed 2-hour PM link volume (weekday)

APPENDIX C

ADDITIONAL VOLUME PLOTS

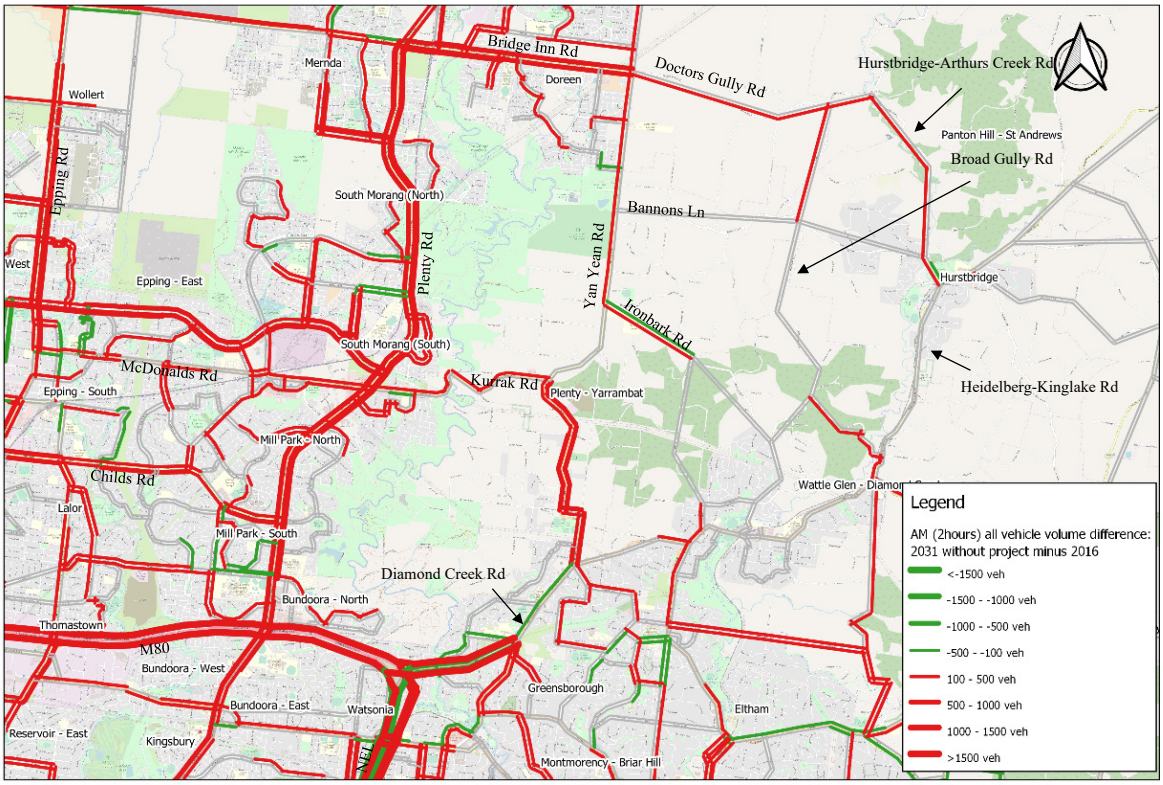

Figure C.1 2031 Base Case vs 2016 – Two-hour AM total traffic difference (from VITM)

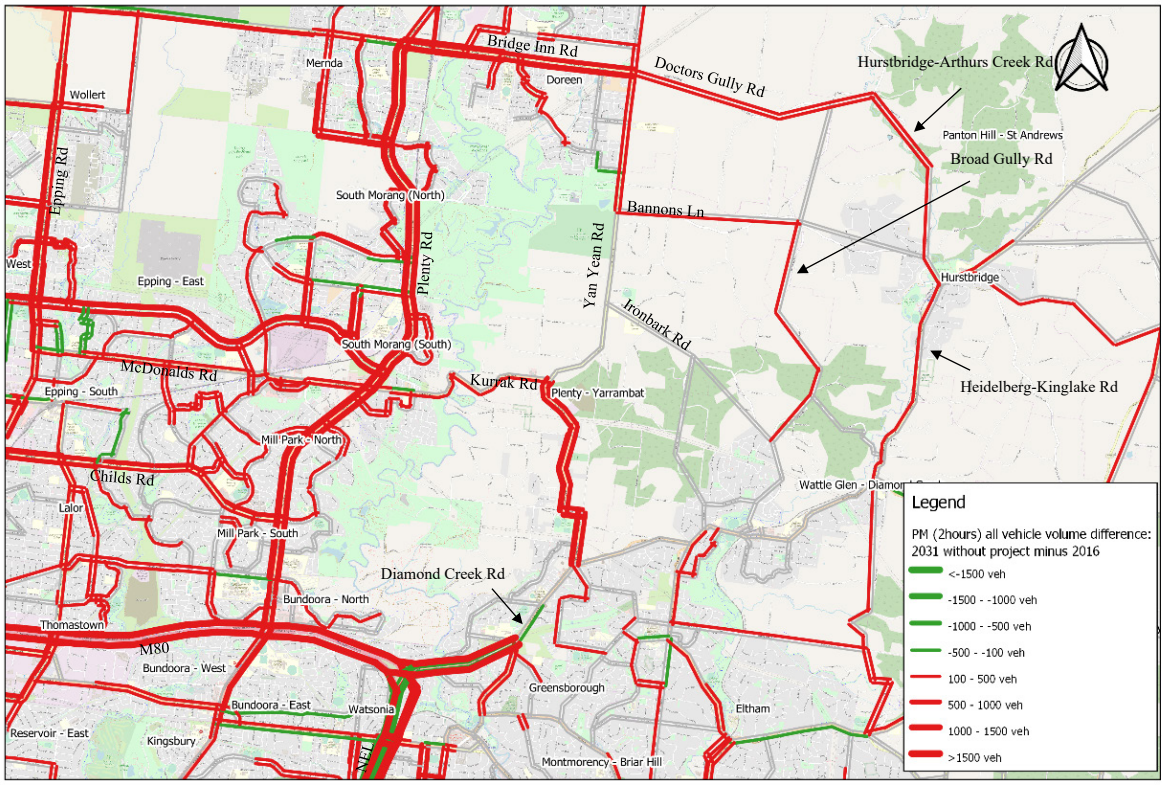

Figure C.2 2031 Base Case vs 2016 – Two-hour PM total traffic difference (from VITM)

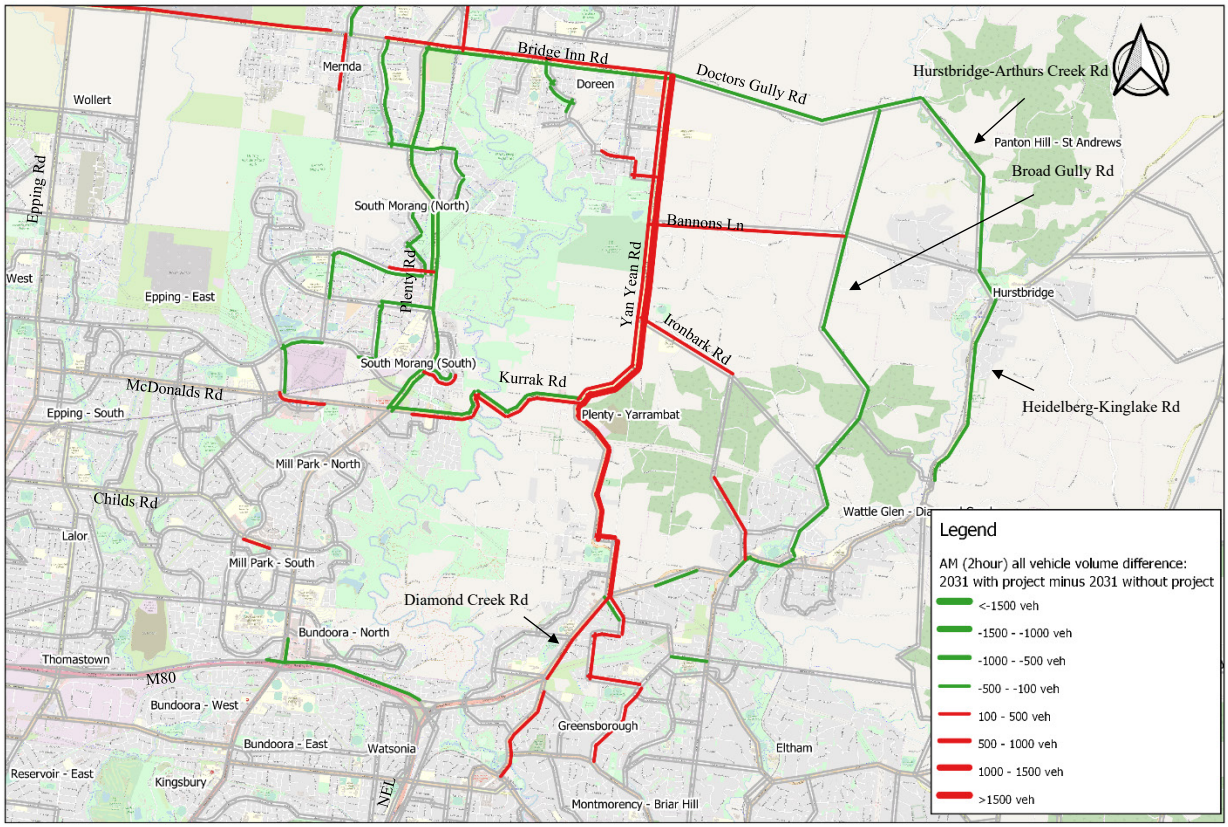

Figure C.3 2031 Project Case vs 2031 Base Case – Two-hour AM total traffic difference (from VITM)

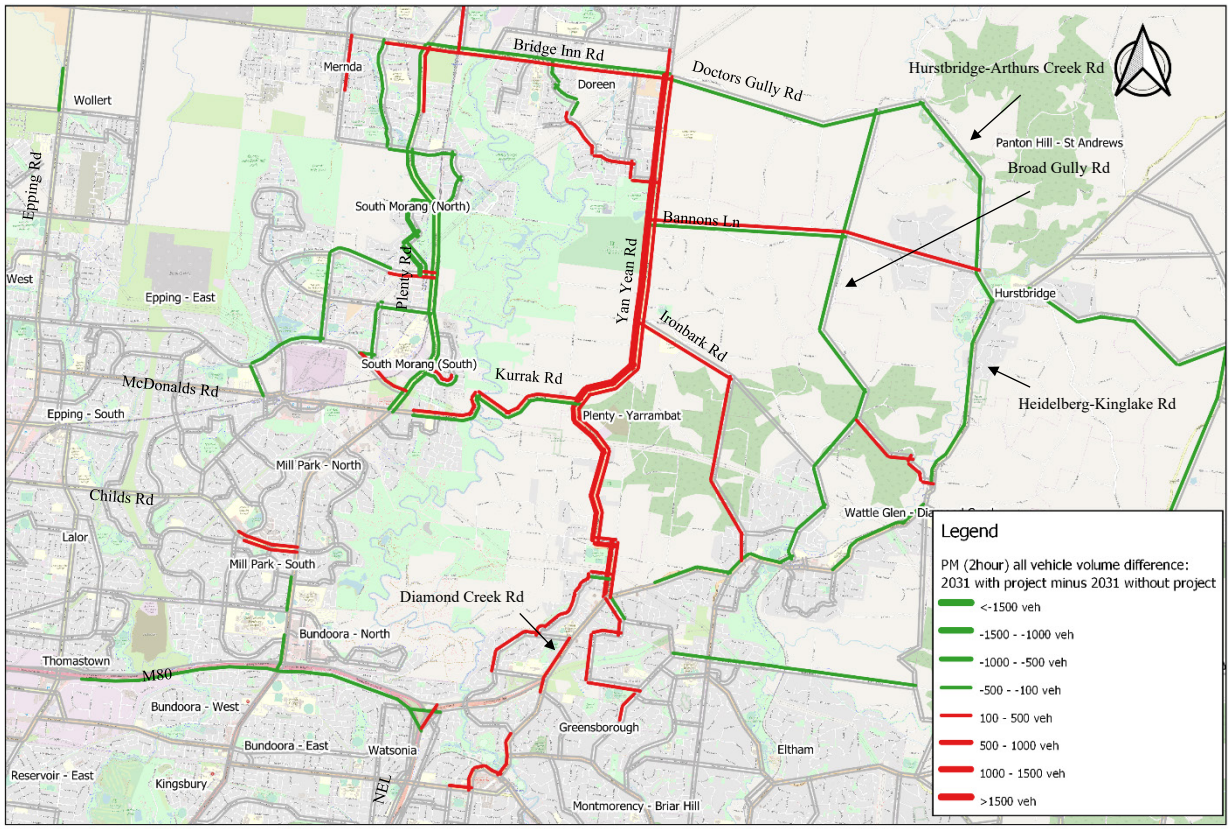

Figure C.4 2031 Project Case vs 2031 Base Case – Two-hour PM total traffic difference (from VITM)

ABOUT US

WSP is one of the world's leading engineering professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors, environmental specialists, as well as other design, program and construction management professionals. We design lasting Property & Buildings, Transportation & Infrastructure, Resources (including Mining and Industry), Water, Power and Environmental solutions, as well as provide project delivery and strategic consulting services. With 43,600 talented people in more than 550 offices across 40 countries, we engineer projects that will help societies grow for lifetimes to come.

wsp

APPENDIX C – PEER REVIEW SUMMARY

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Frank De Santis
Project Director
Major Road Projects Victoria
GPO Box 4509
Melbourne VIC 3001

3 August 2020

Dear Frank,

Yan Yean Road Upgrade (Stage 2) – Transport Impact Assessment Modelling Peer Review

This letter provides peer reviewer endorsement of the transport modelling undertaken for the Yan Yean Road Stage 2 Upgrade Environment Effects Statement (EES).

I undertook the peer review at the request of Major Road Projects Victoria (MRPV) during 2019. The objectives of the review were to investigate the assumptions and methodologies used in the transport modelling for the EES and to assess the reasonableness of the final forecasts.

The scope of my work included:

- a review of the original transport modelling undertaken to assess intersection designs and capacity along Yan Yean Road between Kurrak Road and Bridge Inn Road;
- a review of further transport modelling completed for the Transport Impact Assessment (TIA) which forms a part of the EES.

The review was based on information provided in the following reports and correspondence:

- Arcadis (2018), *Yan Yean Road Upgrade, Stage Two - Reference Design Traffic Analysis*, Report no. A01-AA009647-VC-R-1 (15May2018). The review focused on Chapter 2 (Traffic Forecasting) and Appendix A (Yan Yean Road Traffic Forecasting Pivot Method).
- WSP (2019), 190307_*Yan Yean Road peer review_responses.docx* with accompanying maps and databases, Responses to peer review questions, received 7 March 2019.
- Arcadis (2019), *Yan Yean Road Design Volumes -summary of adjustments.docx*, Responses to peer review questions, received 7 March 2019.
- WSP (2019), OSAR_North_TMVol_Ver0-rl.xlsx, Pivoting spreadsheet.
- WSP (2019), *Yan Yean Road (Stage 2) Upgrade Traffic Forecasting Report*, Revision E, 15 November 2019. This formed Appendix A of Arcadis(2019), *Yan Yean Road (Stage 2) Upgrade Environment Effects Statement Technical Appendix A – Transport Impact Assessment*, Revision D, 20 November 2019.

The scope of my review did not include model computer files and software; therefore my findings have assumed that these reports accurately represent the modelling that was undertaken.

The two phases of my peer review are documented in the following reports:

- Transport Analytics (2019a), *Yan Yean Road Stage 2 Upgrade – Transport Modelling Peer Review*, Revision C, March 2019.
- Transport Analytics (2019b), *Yan Yean Road Stage 2 Upgrade – Transport Impact Assessment Modelling Peer Review*, Revision A, December 2019.

The remainder of this letter summarises the findings of the two phases of the review and confirms that all issues have been satisfactorily addressed.

Phase 1: Intersection Analysis

The first phase of the peer review examined the traffic forecasting undertaken by MRPV's technical advisor, WSP, to assess the performance of proposed intersection designs along the Yan Yean Road corridor. The traffic forecasts were a critical consideration in the determination of the "footprint" of each intersection and the consequent impact on significant trees and native habitat along the road corridor.

The peer review found that the overall modelling methodology was sound and that sensible assumptions were adopted. Noted strengths of the modelling were:

- the comprehensive program of traffic counts provided a good foundation for the analysis and helped to increase confidence in the accuracy of the outcomes;
- the methodology for adjusting the forecasts (using a pivoting process) was appropriate for individual intersections, and appeared to produce logical results;
- the model outputs were carefully considered and adjusted to take account of road capacities and adjacent land use, such as nearby schools;
- sensitivity tests were used to investigate the influence of school traffic, giving greater assurance that the intersection designs would accommodate school peaks; and
- the application of the SIDRA intersection capacity model was clearly documented and consistently applied, with reasonable performance metrics chosen.

The strategic model used for the Yan Yean Road forecasting was taken from the Mordialloc Bypass Transport Impact Assessment. While the Mordialloc model was originally validated in the south-east suburban area, similar validation checks had not yet been completed for the northern suburban area at the time of the peer review. The recommendations for improvement therefore focused on establishing the fitness of the transport model in the Yan Yean Road area.

The main recommendations from the first phase of the peer review were as follows:

- the modelling documentation needed to better demonstrate that the strategic model (as configured for the Mordialloc Bypass study) was fit for the purpose of the Yan Yean Road analysis;

- the land use assumptions for the northern suburban area needed to be checked and updated; and
- given the critical nature of the intersection sizing, sensitivity tests were recommended to determine the traffic volumes that would trigger an increase or reduction in the number of turning lanes at each intersection.

Following the review, WSP carried out further modelling work to address these recommendations. The further work is documented in the memorandum "*Yan Yean Road Stage 2 EES – WSP's response to transport modelling peer review*" (document code 2135645A-N-32-TPLMEM-002 RevB), dated 27 May 2019.

The further modelling resulted in the following outcomes:

1) The model was found to underestimate Yan Yean Road traffic volumes by 21% (southbound) in the AM peak and 28% (northbound) in the PM peak. In my view, the pivoting process adopted by WSP was appropriate and sufficient to compensate for these forecasting discrepancies at the intersections on the Yan Yean Road Stage 2 alignment.
2) Additional models were run using 2018 land use projections, showing some redistribution of population and employment in comparison to the original projections. The 2018 land use projections were also carried forward to the Phase 2 Transport Impact Assessment modelling. In my opinion, the 2018 projections should provide results that more accurately reflect government land use expectations in the Yan Yean Road area.
3) Sensitivity testing was agreed and undertaken later as part of the EES transport impact assessment.

These responses satisfied the recommendations of the first stage of the peer review.

Phase 2: Transport Impact Assessment Modelling

The second phase of the review investigated the transport modelling undertaken for the TIA[1]. The TIA used the same strategic model as was used in the first phase, so the basic functionality of the model in the Yan Yean Road corridor had already been established. My review therefore focused on the model's application for forecasting transport impacts in the wider northern suburban area.

The review identified the following strengths of the modelling approach:

- the use of the Victorian Integrated Transport Model was an appropriate choice for the TIA;
- the model was prepared using a systematic process with up-to-date land use and network assumptions;
- checks of the model were backed with comprehensive traffic count data;
- forecasts for the "No Project" and "With Project" scenarios seemed logical and the conclusions from the modelling analysis appeared to be sound.

[1] The peer review did not cover the application of traffic forecasts to other aspects of the EES, such as noise and air quality assessments.

However, as noted in the first phase of the review, it was evident that the model was tending to underestimate traffic volumes in the Yan Yean Road area when applied to a 2016 base scenario.

Ideally, the model would be adjusted so that its outputs meet published validation criteria. Given that the wider traffic impacts of the Yan Yean Road Stage 2 upgrade were expected to be relatively small, the transport modelling team opted for a simpler approach which dealt with the model's forecasting limitations by:

- presenting difference ranges (for example, "between 500 and 1000 vehicles") when comparing scenarios, rather than quoting absolute point forecasts; and
- carrying out sensitivity tests (including a high-growth scenario) to explore the impacts of higher traffic volumes.

This approach has resulted in logical and defensible outputs that provide a reasonable foundation for the transport impact assessment.

The review recommended several other minor clarifications and corrections to the transport modelling report, all of which have been addressed satisfactorily.

Conclusion

The Yan Yean Road Stage 2 modelling has been carried out using an appropriate methodology, is supported by observed data, uses suitable network and land use assumptions, and has produced logical results.

While acknowledging that the model underestimates traffic volumes in the Yan Yean Road area, the Transport Impact Assessment has included sensitivity tests to assess the impacts of higher and lower traffic volumes. These tests provide evidence that a reasonable range of potential future impacts has been accounted for in the analysis.

Yours sincerely

Dr Craig McPherson
Director, Transport Analytics Pty Ltd
craig.mcpherson@transportanalytics.com.au

APPENDIX D – TRANSPORT RISK ASSESSMENT

Major Road Projects Victoria

Project name: Yan Yean Road Stage 2 EES Environmental Risk Register - Draft Post Environmental Risk Workshop & Specialist Input

Version: 5

Date: 26/06/2020

Author: Sabrina Chapman

Contributors: Matt Knight, Tori Harvey, Paige Krygger, Louie D'Amore, Will Parker, Clinton Kenna, Arvind Deivasigamani, Louise McGinley, Sarah Sawyer, Sam Vertucci, Cameron Ryder, Rachael Mino, Samantha Fidge, Ellen Buswell, George Baeley, Marianne Stoettrup

Review: Mat Peel

				Initial Risk					Residual Risk				
No.	Aspect	Impact Pathway	Activity	Likelihood	Consequence	Inherent Risk Rating	Mitigation measures to inform Environmental Performance Requirement	EPR	Likelihood	Consequence	Residual Risk Rating	Rationale	Relevant impact assessment
CONSTRUCTION - SITE ESTABLISHMENT													
17	Transport - Active users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders.	Site establishment	Possible	Moderate	Medium	To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impact s on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Consider the needs of horse riders, in consultation with the Pony Club • Provide detour routes for affected active transport users • Maintain community engagement with advance warning of changed traffic conditions	EPR TP2	Unlikely	Moderate	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. • Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: • Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. • Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential	Technical Report A - *Transport Impact assessment*
18	Transport - Road users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses)	Site establishment	Likely	Minor	Medium	To mitigate impacts associated with construction activities on road users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impact s on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Provide detour routes where required • Are coordinated with other works occurring in the area where construction timeframes overlap • Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Likely	Insignificant	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. • Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: • Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. • Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential • Given that the Project is within a growth area, coordination of detour routes, closure times, signage and communication across the Project and other nearby projects under construction.	Technical Report A - *Transport Impact assessment*
19	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections	Site establishment	Likely	Minor	Medium	A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions • Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Maintain community engagement with advance warning of changed access conditions.	EPR TP2	Likely	Insignificant	Medium	It is expected that access to some properties along Yan Yean Road will need to be altered for construction (and some will also be permanently altered as part of the design). The details of which locations and how this will be managed are not currently known and will be determined by the contractor.	Technical Report A - *Transport Impact assessment*
CONSTRUCTION - EARTHWORKS													
37	Transport - Active users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders	Earthworks	Possible	Moderate	Medium	To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impact s on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Consider the needs of horse riders, in consultation with the Pony Club • Provide detour routes for affected active transport users • Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Unlikely	Moderate	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. * Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: * Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. * Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential.	Technical Report A - *Transport Impact assessment*
38	Transport - Road users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses)	Earthworks	Likely	Moderate	Significant	To mitigate impacts associated with construction activities on road users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impact s on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Provide detour routes where required • Are coordinated with other works occurring in the area where construction timeframes overlap • Maintain community engagement with advance warning of changed traffic conditions.	EPR TP2	Possible	Moderate	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. * Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: * Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. * Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential • Given that the project is within a growth area, coordination of detour routes, closure times, signage and communication across the project and other nearby projects under construction.	Technical Report A - *Transport Impact assessment*
39	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections	Earthworks	Likely	Minor	Medium	A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions • Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Maintain community engagement with advance warning of changed access conditions.	EPR TP2	Likely	Insignificant	Medium	It is expected that access to some properties along Yan Yean Road will need to be altered for construction (and some will also be permanently altered as part of the design). The details of which locations and how this will be managed are not currently known and will be determined by the contractor.	Technical Report A - *Transport Impact assessment*

No	Aspect	Impact Pathway	Activity	Initial Risk			Mitigation measures to inform Environmental Performance Requirement	EPR	Residual Risk			Rationale	Relevant impact assessment
				Likelihood	Consequence	Inherent Risk Rating			Likelihood	Consequence	Residual Risk Rating		
CONSTRUCTION - CIVILS AND STRUCTURES													
57	Transport - Active users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders	Civils and structures	Possible	Moderate	Medium	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on active transport users where possible. To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impacts on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Consider the needs of horse riders, in consultation with the Pony Club •Provide detour routes for affected active transport users • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Moderate	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. * Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: * Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. * Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential	Technical Report A - *Transport Impact assessment*
58	Transport - Road users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses)	Civils and structures	Likely	Moderate	Significant	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on road users where possible. To mitigate impacts associated with construction activities on road users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users including pedestrians, cyclists and horse riders • Consider impacts on both formal and informal pedestrian access, paths and trails • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Provide detour routes where required • Are coordinated with other works occurring in the area where construction timeframes overlap • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Possible	Moderate	Medium	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. * Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: * Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. * Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential • Given that the project is within a growth area, coordination of detour routes, closure times, signage and communication across the project and other nearby projects under construction.	Technical Report A - *Transport Impact assessment*
59	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections	Civils and structures	Likely	Minor	Medium	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on access where possible. A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions • Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. • At a minimum adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Maintain community engagement with advance warning of changed access conditions.	EPRTP2	Likely	Insignificant	Medium	It is expected that access to some properties along Yan Yean Road will need to be altered for construction (and some will also be permanently altered as part of the design). The details of which locations and how this will be managed are not currently known and will be determined by the contractor.	Technical Report A - *Transport Impact assessment*
CONSTRUCTION - REINSTATEMENT													
77	Transport - Active users	Construction activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders	Reinstatement	Possible	Minor	Medium	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on active transport users where possible. To mitigate impacts associated with construction activities on active transport users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise access restrictions and disruption to all active transport users, including pedestrians, cyclists and horse riders • Consider impacts on both formal and informal pedestrian access, paths and trails • At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route. • Consider the needs of horse riders, in consultation with the Pony Club • Provide detour routes for affected active transport users • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Minor	Low	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. • Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: • Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. • Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential.	Technical Report A - *Transport Impact assessment*
78	Transport - Road users	Construction activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses)	Reinstatement	Possible	Minor	Medium	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on road users where possible. To mitigate impacts associated with construction activities on road traffic users, a Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The Project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: • Minimise disruption to road traffic • At a minimum, adhere to safe construction practices in accordance with WorkSafe and road authority requirements • Consider crossing routes for kangaroos to avoid entrapment on the roadway and collision with vehicles • Include planned haulage routes for construction equipment and materials and where possible schedules these movements to occur at times that minimise impacts on other road users • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route • Provide detour routes where required • Are coordinated with other works occurring in the area where construction timeframes overlap • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Minor	Low	Construction staging and appropriate traffic management is key to maintaining safe traffic flow. • Staging details and traffic management approach will ultimately be determined by the contractor in consultation with relevant authorities. Construction staging may include: • Constructing the majority of the second carriageway offline while maintaining traffic flow on the existing carriageway. • Switching the traffic flow to the second carriageway to allow upgrade of the old carriageway. • Temporary closures (off peak times) to traffic may be required for constructing complicated intersections Community engagement • Staging is expected to have impacts on local direct access at times - communication with residents is essential.	Technical Report A - *Transport Impact assessment*
79	Transport - Road users	Construction activities result in access changes for adjacent residents and businesses that increase trip lengths and travel times. Examples include converting 'all movements' access to left in/left out and turn bans at intersections	Reinstatement	Likely	Minor	Medium	Optimise the design in consultation with the appropriate road management authorities to allow construction to be completed in stages and reduce impacts on access where possible. A Traffic Management Plan should be completed in consultation with the appropriate road management authorities, Nillumbik Shire Council and Whittlesea Council in accordance with AS1742.3-2009. The project should be completed in stages to minimise impact. The Traffic Management Plan should clearly outline traffic control measures that: * Minimise access restrictions *Consider the viability of alternative routes available and impacts of additional turning traffic along these routes. • Consider crossing routes for kangaroos to avoid entrapment on the roadway and collision with vehicles • Include planned haulage routes for construction equipment and materials and where possible schedules these movements to occur at times that minimise impacts on other road users • Consider the needs of vulnerable road users and in particular pedestrian and cyclist paths and crossings at the schools along the route • Provide detour routes where required • Are coordinated with other works occurring in the area where construction timeframes overlap • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Likely	Insignificant	Medium	It is expected that access to some properties along Yan Yean Road will need to be altered for construction (and some will also be permanently altered as part of the design). The details of which locations and how this will be managed are not currently known and will be determined by the contractor.	Technical Report A - *Transport Impact assessment*

				Initial Risk					Residual Risk				
No	Aspect	Impact Pathway	Activity	Likelihood	Consequence	Inherent Risk Rating	Mitigation measures to inform Environmental Performance Requirement	EPR	Likelihood	Consequence	Residual Risk Rating	Rationale	Relevant impact assessment
OPERATIONS													
97	Transport - Active users	Design layout and inefficient operation of the road impedes the movement of active users, including pedestrians, cyclists and horse riders	Operations	Unlikely	Minor	Low	Optimise the design in consultation with appropriate road management authorities, Nillumbik Shire Council and Whittlesea City Council to: • Design the road, walking and cycling elements and other recreation activities to meet relevant road and transport authority requirements • Maintain, and where practicable, enhance pedestrian movements, bicycle connectivity, and walking and cycling paths, including access to public open space and reserves.	EPRTP1	Unlikely	Minor	Low	While traffic analysis can be carried out through design development (and to assess any design changes), forecasting traffic demands and operational performance is always subject to uncertainty. For this reason the consequence and impact ratings have been held constant.	Technical Report A - *Transport impact assessment*
98	Transport - Road users	Inefficient operation of the road impedes the movement of road users, including emergency services, public transport (e.g. buses), active users and private vehicles	Operations	Unlikely	Minor	Low	Traffic analysis to be carried out during detailed design development to demonstrate design performance under forecast demands.	EPRTP1	Unlikely	Minor	Low	While traffic analysis can be carried out through design development (and to assess any design changes), forecasting traffic demands and operational performance is always subject to uncertainty. For this reason the consequence and impact ratings have been held constant.	Technical Report A - *Transport impact assessment*
99	Transport - Road users	Local access movements are adversely impacted by the Project due to the design layout such as changes in permanent access to adjacent businesses, residential properties and local roads	Operations	Almost Certain	Insignificant	Medium	To minimise the impact on road users, optimise the design in consultation with appropriate road management authorities, Nillumbik Shire Council and Whittlesea City Council to: • Design the road elements to meet relevant road and transport authority requirements • Where existing traffic movements are altered by the Project, ensure that alternative movements are incorporated in to the design to the satisfaction of relevant road authorities.	EPRTP1	Almost Certain	Insignificant	Medium	• Access changes included in design are consistent with road functionality • Permanent access changes will occur but adequate alternative provisions should assist in managing impacts.	Technical Report A - *Transport impact assessment*
MAINTENANCE													
117	Transport - Active users	Maintenance activities impede the efficient movement of active users, including pedestrians, cyclists and horse riders	Maintenance	Unlikely	Minor	Low	During maintenance activities: • Provide detour routes for active users • Where formal vehicle or pedestrian access is altered by the Project, such access must be replaced • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Minor	Low	Maintenance activities could range from very minor works with little traffic impact (e.g. replacement of a sign) through to full closures e.g. for resurfacing works.	Technical Report A - *Transport impact assessment*
118	Transport - Road users	Maintenance activities impede the efficient movement of road traffic including general traffic, emergency services, public transport (i.e. buses)	Maintenance	Unlikely	Minor	Low	During maintenance activities: • Provide detour routes for active users • Where formal vehicle or pedestrian access is altered by the Project, such access must be replaced • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Minor	Low	Maintenance activities could range from very minor works with little traffic impact (e.g. replacement of a sign) through to full closures e.g. for resurfacing works.	Technical Report A - *Transport impact assessment*
119	Transport - Road users	Maintenance activities results in access changes for adjacent residents and businesses that increase trip lengths and travel times	Maintenance	Unlikely	Minor	Low	During maintenance activities: • Provide detour routes for active users • Where formal vehicle or pedestrian access is altered by the Project, such access must be replaced • Maintain community engagement with advance warning of changed traffic conditions.	EPRTP2	Unlikely	Minor	Low	Maintenance activities could range from very minor works with little traffic impact (e.g. replacement of a sign) through to full closures e.g. for resurfacing works.	Technical Report A - *Transport impact assessment*

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