Infrastructure Victoria

Urban Development Scenarios

Strategic Transport Modelling

Reference: 293395-00-01

C | 28 July 2023

Job number 293395-00

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Document Verification

Project title	Urban Development Scenarios
Document title	Strategic Transport Modelling
Job number	293395-00
Document ref	293395-00-01
File reference	293395-00-01

Revision	**Date**	**Filename**	Transport_Modelling_Report.docx		
A		**Description**	Draft release for Infrastructure Victoria review.		
			Prepared by	**Checked by**	**Approved by**
		Name	Michael Byrne		
		Signature			
B		**Filename**			
		Description	Final release for Infrastructure Victoria.		
			Prepared by	**Checked by**	**Approved by**
		Name	Michael Byrne	Lucy Pike	Lucy Pike
		Signature			
C		**Filename**			
		Description	Refined release for Infrastructure Victoria.		
			Prepared by	**Checked by**	**Approved by**
		Name	Michael Byrne	Lucy Pike	Lucy Pike
		Signature			

Issue Document Verification with Document ✓

Glossary

Base Infrastructure Pipeline	A standardised set of committed and potential road and public transport interventions scheduled over the next three decades whose primary purpose is to act as a uniform starting point for planning assessments.
Cordon	A passenger volume metric used in strategic transport model validation. This is a ring in space used to define how many passengers are moving into and out of a region.
Educational Enrolment	An enrolment in a primary, secondary, or tertiary education institution.
Passenger Kilometres Travelled	Volume of public transport passengers multiplied by kilometres travelled within a specified area, forming an aggregate measure of total public transport travel.
Public Transport Supply	The total available public transport network available to travellers.
Road Lane Kilometres	Total length of road multiplied by number of lanes within a specified area, forming an aggregate measure of total lane length.
Road Supply	The total available road network available to travellers.
Screenline	A vehicle volume metric used in strategic transport model validation. A screenline represents total volumes crossing a defined boundary, and as such can be used to quantify total traffic travelling in a certain direction.
Upgraded Road	A road that is to undergo characteristic improvements, resulting in an increase to capacity and/or facilitated travel speeds.
Vehicle Kilometres Travelled	Volume of vehicles multiplied by the kilometres travelled within a specified area, forming an aggregate measure of total vehicle travel.
Victorian Integrated Transport Model	The Department of Transport and Planning strategic transport model used for this assessment.

Executive Summary

Context

Infrastructure Victoria is currently undertaking a research project examining the potential long-term urban structures Victoria may evolve towards over the next several decades. The primary questions that stem from this include:

1. What future urban development scenarios could potentially occur in Victoria?
2. What different outcomes, impacts, costs, and benefits do these different scenarios have?

Five separate land use scenarios have been defined as part of this exercise. This report focuses on strategic transport modelling that was undertaken by Arup to assess these land use scenarios with the following overarching goals:

- Act as a basis for determining what transport infrastructure response and transport services would likely be required over the next thirty years for each of these land use scenarios.
- Provide an evidence base regarding the potential travel behaviour, network performance and accessibility outcomes unique to each land use scenario. This was undertaken with the aim of better understanding what pressures would need to be addressed should any of these growth outcomes eventuate.

Approach

Each land use scenario represents a potential pattern of urban growth Victoria may follow over the next thirty years. At a high-level, they can be described as follows:

- **Compact City**: Concentrated urban development within the inner areas of Melbourne and along train corridors across the middle suburbs. Comparatively lower growth in outer Melbourne and regional Victoria compared to the other scenarios.
- **Consolidated City**: Population and jobs growth focused on a select number of suburban centres predominantly within middle Melbourne such as Monash, Heidelberg, and Sunshine.
- **Dispersed City**: Greater growth in outer Melbourne suburbs compared to the other land use scenarios, representing an expanding urban footprint for the city. Growth is also seen in peri-urban towns along major regional transport corridors such as Torquay, Seymour, and Traralgon.
- **Network of Cities**: High growth within Victoria's regional cities as opposed to central Melbourne areas, particularly concentrated in Geelong, Ballarat, and Bendigo.
- **Distributed State**: Dispersed distribution of population growth from existing settlements throughout regional Victoria, resulting in low-density development across the state.

Strategic transport modelling was undertaken across both 2036 and 2056 using land use assumptions derived from these scenarios. These two modelled years served different purposes for the overall assessment:

- **2036**: Each land use scenario was tested against the same set of infrastructure assumptions, reflecting the fact that there is likely less ability for the existing planning pipeline to flexibly react to differing land use growth pressures over the next decade.
- **2056**: Each land use scenario was tested against a different set of infrastructure assumptions, generated using an iterative process that aimed to better fit the unique needs of each scenario. This reflects the greater likelihood of diverging infrastructure pipelines over a longer time horizon in response to changes in demographic distribution.

For both the 2036 and 2056 testing, a *base infrastructure pipeline* was used as the initial basis for the future infrastructure assumptions. This is a standardised set of road and public transport interventions which does not represent future government policy, instead acting as a foundation upon which complex infrastructure plans can be built.

Key Findings

When considering the individual infrastructure needs of each land use scenario, results from scenario testing highlighted that:

- The consistent base infrastructure pipeline performed relatively similarly across the 2036 tests. Nonetheless, there were still localised differences in network performance and accessibility that eventuated because of the differing land use distributions. In particularly, the 2036 *Dispersed City* scenario demonstrated a uniquely high level of congestion and crowding compared to the other scenarios.

- By contrast, if it were not for the specific infrastructure modifications implemented across the five land use scenarios in 2056, all scenarios would have exhibited some form of severe network congestion or crowding in one or more locations. For example, the inner-city tram network could not have serviced the extremely high demand associated with the 2056 *Compact City* scenario without significant capacity uplifts. As an additional example, Geelong's road network would have been incapable of handling the population densities associated with the 2056 *Network of Cities* and *Distributed State* scenarios without key upgrades beyond what the base infrastructure pipeline assumes.

The outcomes clearly highlight that a 'one size fits all' transport infrastructure solution simply does not exist for Victoria. Planning must continuously account for the state's growth direction, with commensurate responses across how the road and public transport networks are augmented over time. Assuming that appropriate transport network supply is provided across each of the land use scenarios, testing indicated:

- The *Compact City* scenario demonstrates the highest aggregate levels of accessibility and the lowest corresponding levels of congested vehicle hours and crowded public transport hours travelled compared to all other land use scenarios tested. This reflects Victoria's existing centralisation around inner and middle Melbourne. By more people living within these areas, they are more closely located to a vast majority of employment centres, schools and other facilities. They are also residing in areas where public transport services are of high quality, increasing the likelihood that they can act as viable forms of day-to-day transport for more people.

- The *Dispersed City* scenario was consistently associated with the slowest private vehicle and public transport journey speeds on average. This is because it assumes a higher density of population within Melbourne's outer and new growth areas. This demands a lot from the transport network in these regions, as they are sparse and less resilient to large influxes of traffic. The more dispersed distribution of the population also means that more people need to make longer journeys, spreading issues of congestion and crowding across larger parts of the network.

- The *Consolidated City* scenario represents a middle ground between the *Compact City* scenario and *Dispersed City* scenario, with greater density of population situated around key suburban activity centres in Melbourne. Accessibility was more favourable under this scenario compared to the *Dispersed City* because more people live closer to where they need to go. However, this distribution of land use is still more spread out than that seen within the *Compact City*. As a result, more pressure is placed on the road and public transport network, resulting in greater levels of congestion and public transport crowding in this scenario compared to the *Compact City*.

- The *Network of Cities* and *Distributed State* scenarios demonstrated the lowest aggregate accessibility levels compared to all other scenarios. This is an expected outcome given the very dispersed nature of the population and employment distributions underlying these scenarios. This is also not necessarily a bad outcome – by definition regional and rural areas will not have close access to a majority of the state's opportunities. The best outcome for these potential scenarios is to ensure that congestion and crowding does not limit people's choices when longer journeys need to be made.

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1. Introduction

1.1 Background

Infrastructure Victoria is currently undertaking a research project examining the potential long-term urban structures Victoria may evolve towards over the next several decades. The primary questions that stem from this include:

1. What future urban development scenarios could potentially occur in Victoria?
2. What different outcomes, impacts, costs, and benefits do these different scenarios have?

It is difficult to precisely predict how the state is likely to grow over time in terms of urban form, yet the spatial distribution of population and jobs act as a primary driver for future infrastructure provision and policy development. This research intends to contribute a better understanding of how Victoria may need to respond under a range of different growth scenarios.

Five separate land use scenarios have been defined as part of this exercise, for which five unique corresponding infrastructure responses have been developed over a thirty-year time horizon. The collective outcomes of cost estimation, transport network performance modelling and economic analysis across these five scenarios have then been used to inform the research.

1.2 This Report

The urban development scenarios research program consists of several components spanning from land use modelling, cost estimation to economic analysis. This report specifically covers the strategic transport modelling component whose purpose was twofold:

- Act as a robust basis for developing individual future transport infrastructure assumptions that match the needs imposed by each of the five unique land use scenarios. These individual infrastructure assumption sets were then used as inputs into separate infrastructure cost estimation work also undertaken as part of this program.
- The network performance and travel behaviour outcomes of each land use scenario combined with its unique infrastructure plan constitute a key set of research outcomes in and of itself, helping describe the potential lived experience of using the transport network across each scenario. These outcomes also feed into subsequent economic analysis work described separately from this report.

This document is structured as follows:

1. *Introduction* provides an overview of the assessment undertaken and how to navigate this report.
2. *Approach* covers how the transport modelling scenarios were constructed and analysed.
3. *2036 Year Testing* summarises the adopted land use assumptions, adopted infrastructure assumptions and testing outcomes corresponding with future scenario testing undertaken for the 2036 modelled year.
4. *2056 Year Testing* summarises the adopted land use assumptions, adopted infrastructure assumptions and testing outcomes corresponding with future scenario testing undertaken for the 2056 modelled year.

Appendices are present to provide further information surrounding the selected transport model (Victorian Integrated Transport Model or VITM) as well as more detailed specifications for the adopted infrastructure assumptions. Select scenario outcomes also discussed estimated carbon emissions from transport – the methodology adopted to perform this estimation is also provided in the appendices.

Select input assumptions and outcomes from the strategic transport modelling assessment were used to inform subsequent transport infrastructure cost estimation (both capital and operating expenses). Appendix D outlines the items exchanged between the disciplines.

1.3 Terminology

In contextualising assessment outcomes, this report uses specific terminology related to scenarios, regions, time periods and performance metrics to illustrate impacts across different parts of Victoria and to elements of the transport system. For clarity, these are outlined in the subsequent sections.

1.3.1 Scenario Naming

Infrastructure Victoria have defined five different land use scenarios that have the following names: *Compact City*, *Consolidated City*, *Dispersed City*, *Network of Cities* and *Distributed State*. Transport model scenario testing has primarily been undertaken for Victoria in 2036 and 2056, representing approximately ten and thirty years into the future respectively. As such, scenario tests in this document will often be referred to as a combination of the modelled year and land use scenario name, for example 2056 *Distributed State*. In certain instances, a 2018 *Base* scenario will also be mentioned. This represents modelled conditions on the road and public transport network in 2018 and was the closest modelled year available at the time of modelling that represented conditions approximating the current day.

1.3.2 Region Systems

When referring to specific parts of the state this report uses two region systems unless otherwise stated – Functional Urban Areas (FUAs) and Local Government Areas (LGAs).

- The FUA system (see Figure 1, Figure 2) splits Victoria into six regions, defined by their level of centrality to Melbourne's Central Business District (CBD). It also accounts for potential growth opportunities that may arise in the future. References to metropolitan Melbourne refer to the combined inner, middle, outer and new growth areas. Regional areas refer to the combined regional cities and regional and rural areas.
- Victoria is split into 79 LGAs, each corresponding with a council municipality (see Figure 3, Figure 4).

1.3.3 Time Periods

The VITM aims to represent travel demand and network performance for the average non-school holiday weekday. This representative day is split into four distinct periods (see Table 1) to account for varying travel behaviours during these times. Assessment outcomes will often correspond to one of these specific time periods or aggregate them all together to form a view of performance throughout an entire typical day.

Table 1 VITM time periods

Time Period	From	To
Morning peak (AM)	7AM	9AM
Inter-peak (IP)	9AM	3PM
Evening peak (PM)	3PM	6PM
Off-peak (OP)	6PM	7AM

1.3.4 Metrics

The outcomes of each scenario are represented through metrics that have precise definitions. Travel will often be characterised in terms of *kilometres travelled* or *hours travelled*. This is the number of people or vehicles travelling multiplied by the distance or time spent travelling for a particular period. Both congested and crowded conditions also have precise definitions within the context of this report:

- **Congestion**: Measures of congestion represent the degradation of road performance that accompanies sources of delay. Within the VITM, road performance is a function of volumes relative to a road's capacity, based on characteristics like number of lanes and purpose. As volumes rise, congestion generally worsens as represented by higher ratios of volume to the road's capacity.
- **Crowding**: Each type of public transport vehicle has a defined load standard capacity as defined by the Department of Transport and Planning (DTP). The level of crowding is characterised as a percentage of this value.

For the purposes of this report, congested or crowded travel is said to occur when volumes or passenger levels exceed 80% of a road's capacity or a vehicle's load standard value. This corresponds approximately with 'Level of Service D' conditions as defined across transport assessments.

Figure 1 Functional Urban Areas

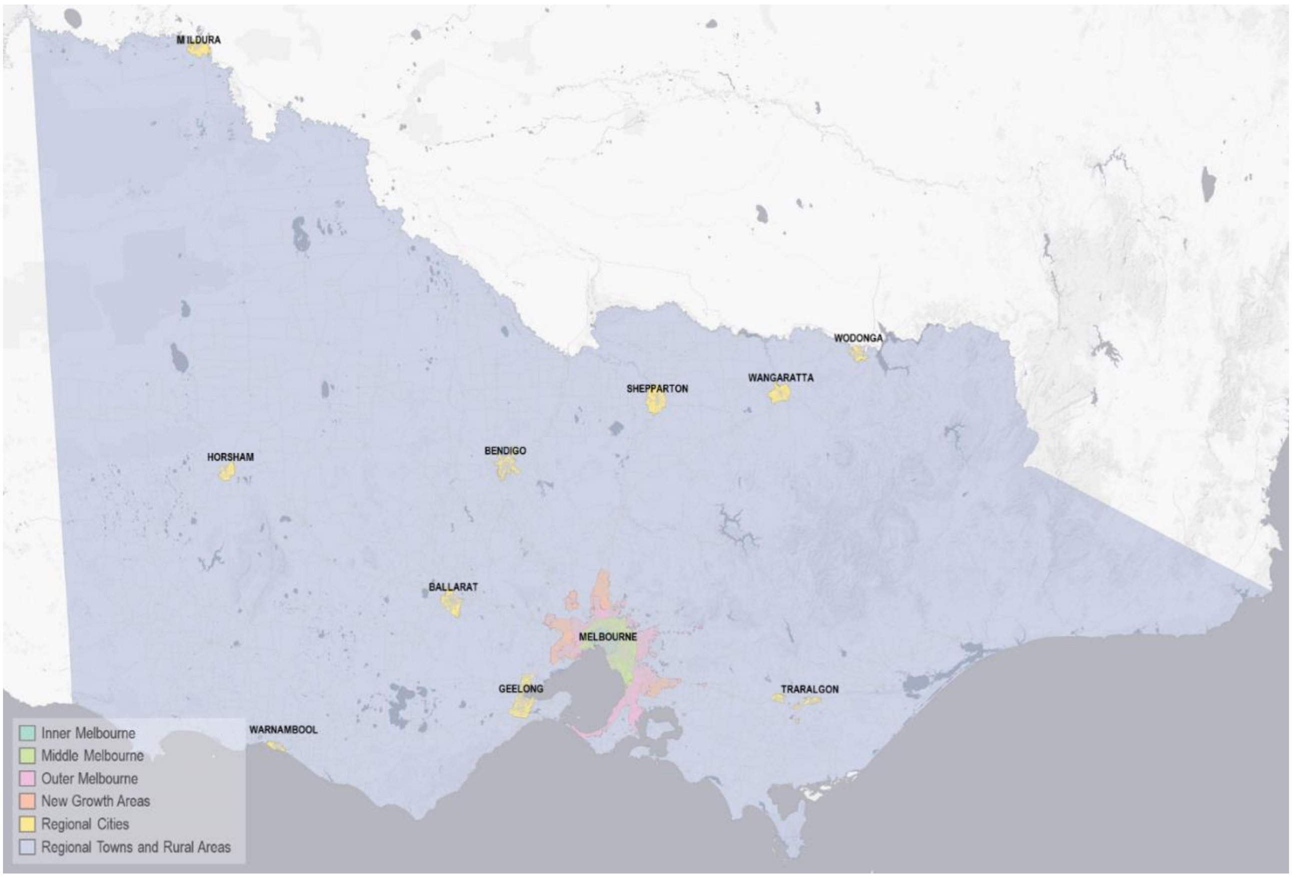


Figure 2 Functional Urban Areas (Melbourne and surrounds)

Figure 3 Local Government Areas (Victoria)

Figure 4 Local Government Areas (Melbourne and surrounds)

2. Approach

2.1 Overview

As mentioned in Section 1, Infrastructure Victoria defined five different land use scenarios representing alternative growth patterns Victoria could potentially follow over the next three decades. The following list provides high-level descriptions of these:

- **Compact City**: Concentrated urban development within the inner areas of Melbourne and along train corridors across the middle suburbs. Comparatively lower growth in outer Melbourne and regional Victoria compared to the other scenarios.
- **Consolidated City**: Population and jobs growth focused on a select number of suburban centres predominantly within middle Melbourne such as Monash, Heidelberg, and Sunshine.
- **Dispersed City**: Greater growth in outer Melbourne suburbs compared to the other land use scenarios, representing an expanding urban footprint for the city. Growth is also seen in peri-urban towns along major regional transport corridors such as Torquay, Seymour, and Traralgon.
- **Network of Cities**: High growth within Victoria's regional cities as opposed to central Melbourne areas, particularly concentrated in Geelong, Ballarat, and Bendigo.
- **Distributed State**: Dispersed distribution of population growth from existing settlements throughout regional Victoria, resulting in unmanaged low-density sprawl across the state.

A broad range of strategic transport modelling scenario testing was undertaken across the 2036 and 2056 modelled years using these land use scenarios, for which each provided a unique distribution of population, employment, and enrolments throughout Victoria. To maintain a degree of comparability between these land use scenarios, total state-wide growth in statistics such as population, households, employment, and educational enrolments was kept constant. In other words, no differences in immigration and birth rates were assumed across the considered land use scenarios. These state-wide growth projections were derived from the latest Victoria in Future (VIF) population projections available at the time of modelling from DTP. This represents the official state government datasets describing forecast population and household growth for Victoria. None of these five scenarios match the spatial distribution of demographic attributes projected in VIF.

Both the 2036 and 2056 modelled years served a different purpose for the overall assessment:

- **2036**: Each land use scenario was tested against the same set of infrastructure assumptions, reflecting the fact that there is likely less ability for the existing planning pipeline to flexibly react to differing land use growth pressures over the next decade.
- **2056**: Each land use scenario was tested against a different set of infrastructure assumptions, generated using an iterative process that aimed to better reflect the unique needs of each scenario. This reflects the greater likelihood of diverging infrastructure pipelines over a longer time horizon in response to changes in demographic distribution.

A *base infrastructure pipeline* was used as the basis for the consistent infrastructure pipeline assumed across the 2036 scenarios. This is a standardised set of committed and potential road and public transport interventions scheduled over the next three decades whose primary purpose is to act as a uniform starting point for planning assessments. It does not represent future government policy, instead acting as a foundation upon which complex infrastructure plans can be built.

An iterative process was adopted in generating the infrastructure assumptions used for the 2056 tests. These were initially tested using a variation of the base infrastructure pipeline. From the outcomes of this initial test, areas of over-supply and under-supply of capacity (such as road lanes or number of train carriages) across the transport network were identified for each scenario. Each land use scenario distributes different levels of residents, jobs, households, and enrolments across the state, resulting in significant spatial differences in travel demand. For example, the *Compact City* scenario is characterised through high densification of Melbourne's inner suburbs. This scenario demonstrated more congestion and crowding within the CBD when compared to the *Distributed State* scenario (characterised by a spreading out of the population throughout Victoria).

Magnitude of over-supply and under-supply were calculated through a combination of congestion and crowding metrics, as well as changes in average journey times and accessibility.

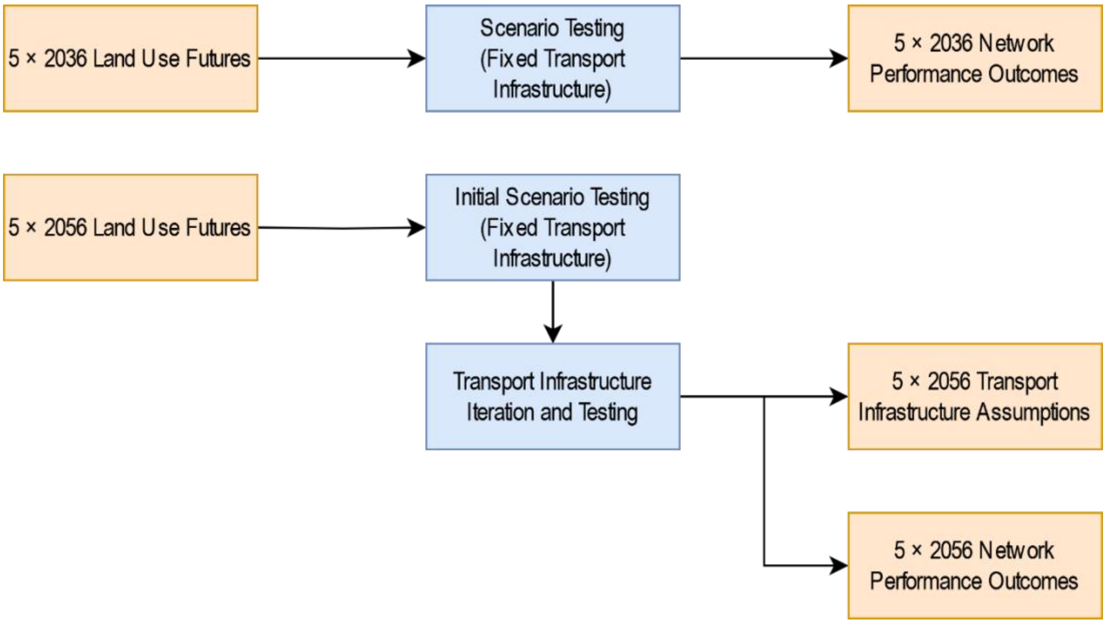
Having quantified over-supply and under-supply, changes were then made to transport services and infrastructure. These changes were scenario-specific, undertaken with a systematic first pass and a qualitative second pass:

- **First pass**: Thresholds were defined to systematically guide the addition and removal of infrastructure from the base infrastructure pipeline. As an example of this, the base infrastructure pipeline might specify that Road A is to be duplicated by 2056. However, because of how people are distributed in the *Compact City* land use scenario, there may be no need for such an upgrade in that scenario as the infrastructure would be under-utilised. Additions and removals of planned infrastructure for road and public transport travel were undertaken in this manner using congestion and crowding thresholds, with the aim of approximately equalising metrics along these dimensions across the land use scenarios. No existing transport infrastructure or under construction transport projects were removed.

- **Second pass**: Additional changes were then made to better align each scenario's infrastructure pipeline with the broader narrative surrounding that land use scenario. This process was led by Infrastructure Victoria, undertaken in a qualitative manner that sought to explore what investments would hypothetically be required under each scenario in addition to the changes incorporated within the first pass.

This process was repeated several times as manual changes to each scenario's infrastructure assumptions had the potential to over- or under-correct. Overall, the adopted process for undertaking both the 2036 and 2056 modelling is shown in Figure 5.

Figure 5 Strategic transport modelling overview



Sections 3.1 and 4.1 provide an overview of the land use assumptions adopted across the 2036 and 2056 testing in line with the provided land use scenarios. Appendix B provides a more detailed inventory of all infrastructure assumptions made throughout this assessment, including:

- Modifications made to the base infrastructure pipeline prior to the initial testing of the 2036 and 2056 scenarios.

- A specification of all changes made in the course of creating infrastructure pipelines unique to each 2056 scenario tested.

2.2 Tested Scenarios

Aligning with the approach outlined in Section 2.1, 22 scenario tests were undertaken in total for this assessment, shown in Table 2. These tests can be broken into three groups:

- **2018 Base**: As of the time of modelling, the 2018 *Base* scenario provided the best representation of 'existing conditions' within Victoria through the VITM. A 2023 base case year is not yet available within the VITM.
- **2036 Tests**: A single group of scenario tests were undertaken for 2036 using the land use scenarios and the base infrastructure assumptions. These tests aimed to reflect network conditions and travel behaviour in 2036 under each land use scenario but with a consistent road and public transport network.
- **2056 Tests**: Several 2056 tests were undertaken for each land use scenario, undergoing the iterative infrastructure definition process described in Section 2.1. Some scenarios required more iteration than others before reaching a satisfactory state.

Within this document, reported outcomes will focus on the 2036 tests and only the final iteration of each 2056 modelled scenario. The remaining scenarios mentioned in Table 2 represent intermediate outputs of the modelling process, some of which incorporated interventions used to test the limits of the VITM and to help guide Infrastructure Victoria and the Arup modelling team towards more optimal combinations of transport infrastructure.

Table 2 Tested scenarios

Scenario	Iteration 1	Iteration 2	Iteration 3	Iteration 4
2018 Base	✓			
2036 Compact City	✓			
2036 Consolidated City	✓			
2036 Dispersed City	✓			
2036 Network of Cities	✓			
2036 Distributed State	✓			
2056 Compact City	✓	✓		
2056 Consolidated City	✓	✓	✓	✓
2056 Dispersed City	✓	✓	✓	✓
2056 Network of Cities	✓	✓	✓	
2056 Distributed State	✓	✓	✓	

As of the time of modelling, the VITM ecosystem does not provide a 2056 modelled year, with 2051 being the latest available by default. The modelling team worked with DTP to create a 2056 modelled year specifically for this assessment, comprising of:

- Updated model parameters reflecting further escalation that would occur across multiple dimensions such as toll prices between 2051 and 2056.
- Hypothetical increases in public transport service provision that may occur during the 2051-to-2056-time window.

Appendix A provides further details surrounding the development of this unique 2056 modelled year within the VITM.

2.3 Limitations of the Approach

It is important to note that model outputs are always an approximation of what can be expected in the real/built environment. They are subject to technical limitations and the general uncertainty associated with projections. As such it is important that results from models like the VITM are treated with caution and interpreted with an understanding of the limitations of these modelling tools.

Further, this assessment engages in the exercise of forming a potential infrastructure pipeline that accompanies a land use scenario in 2056. There are two aspects of this worth noting:

- The final, adopted 2056 infrastructure plans associated with each land use scenario (as will be discussed in Section 4.2) do not represent the definitive way those land use scenarios might be serviced. There are likely to be a myriad of infrastructure plans that would achieve the state's various objectives under those scenarios, of which we are presenting merely one such version for each scenario.
- To represent each infrastructure plan within the VITM, concrete changes must be made to the road and public transport network inputs in a precise fashion. For example, if one land use scenario necessitates an increase in road supply within a given area of the state, specific roads within the model must be upgraded to represent this increase. Despite this level of precision, it would be infeasible for Infrastructure Victoria and the Arup modelling team to confirm that each change is practical to implement (e.g., there may not be enough available land to upgrade certain roads) – especially when hundreds of such changes were being considered across the entire state across both the road and public transport systems. Expert judgement was applied on a best effort basis to avoid specifying non-feasible projects, but ultimately the goal of this exercise was to provide an indication of the infrastructure response that may be required, not an exact specification of such potential investments.

Given these two items, it is worth re-emphasising that whilst very precise changes have been made to represent a thirty-year pipeline of infrastructure projects to accompany each land use scenario, Infrastructure Victoria and the Arup modelling team are not asserting any outcomes at the level of detail of individual projects. Scenario results will be discussed at a regional level, with explorations of broad trends and pressures stemming from different urban structures that may or may not be addressed through specific portfolios of transport infrastructure investment. We ask the reader to engage with the material at this level of abstraction.

3. 2036 Year Testing

3.1 Land Use Assumptions

The number of residents and jobs within Victoria are expected to increase to 8.3 million and 4.3 million by 2036, representing growth of 28% and 34% respectively from 2018. Whilst these state-wide totals have been kept constant across each land use scenario, the spatial distribution of demographic statistics throughout the state differs between scenarios. Table 3 shows the adopted population, employment, and education enrolment totals by FUA while Table 4 summarises the equivalent values relative to the 2018 *Base* scenario. Table 5 and Table 6 show the same statistics but for the entire metropolitan Melbourne and regional areas within Victoria.

- The *Compact City* scenario has the highest population and employment within the inner region compared to other scenarios and shows the most growth relative to 2018 with a 58% increase in population and 40% increase in employment for this area. Correspondingly, this scenario also exhibits some of the smallest levels of growth seen across the outer and new growth suburbs, as well as the regional cities and rural areas.
- The *Consolidated City* scenario has a more distributed growth pattern spread across Melbourne. It exhibits the highest level of employment growth relative to 2018 (and thus the highest employment levels tested) for the middle suburbs of Melbourne and the second-highest total population across inner, middle, and outer areas (with the *Compact City* scenario demonstrating the highest).
- The *Dispersed City* scenario exhibits the largest population and employment levels across the outer and new growth regions of Melbourne across the five scenarios tested, with a 40% and 141% increase in jobs assumed between 2018 and 2036 for those areas respectively. Population within the new growth areas are also expected to increase by 182% in this timeframe.
- The *Network of Cities* scenario focuses on growth within regional cities, which exhibit the greatest increases in population, employment, and enrolments compared to all other scenarios. Population is specifically expected to increase 58% under this scenario within regional cities, Employment demonstrates a similar pattern, with an expected increase of 62%.
- The *Distributed State* scenario exhibits relatively low growth across all regions of Victoria relative to other scenarios except for the regional cities and rural areas, with the latter receiving a majority of the growth. Under this scenario, regional and rural areas are expected to grow by 41% between 2018 and 2036, whilst regional cities are forecast to grow 45%.

Figure 6 provides an alternative view of the differing assumptions, showing the share of population and employment across each FUA.

Figure 6 Relative 2036 population and employment by FUA

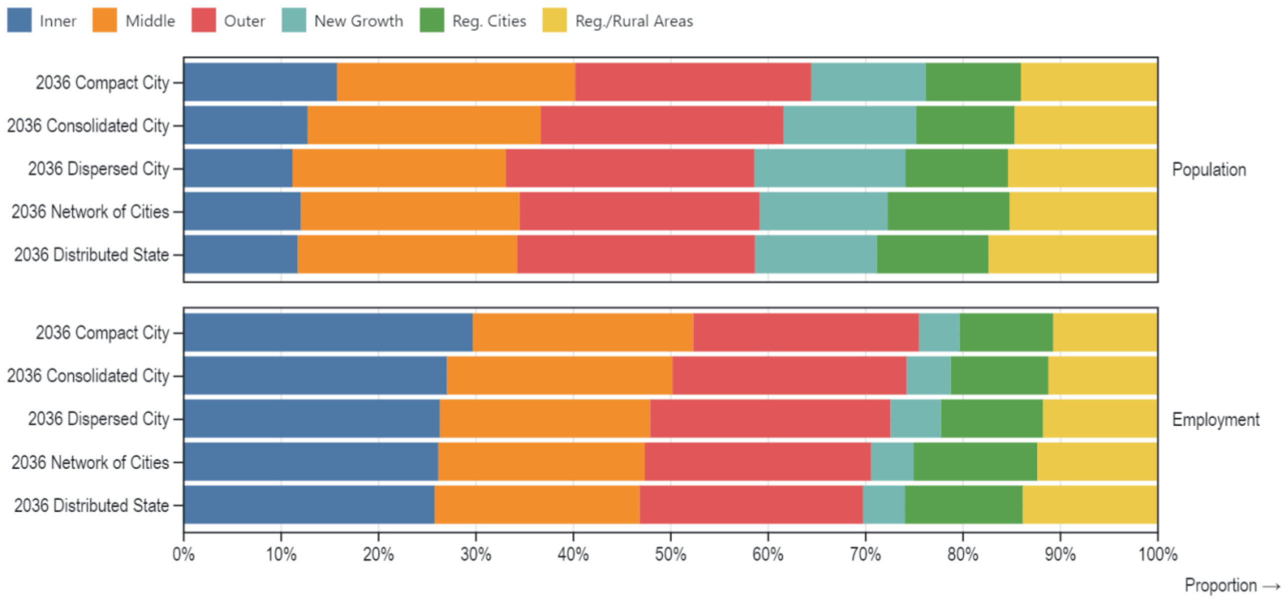


Table 3 2036 land use scenario statistics by FUA

FUA	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
			Population			
Compact City	1,309,000	2,024,000	2,007,000	973,000	809,000	1,157,000
Consolidated City	1,060,000	1,982,000	2,063,000	1,127,000	837,000	1,210,000
Dispersed City	930,000	1,815,000	2,112,000	1,285,000	870,000	1,268,000
Network of Cities	1,003,000	1,858,000	2,042,000	1,086,000	1,035,000	1,255,000
Distributed State	976,000	1,865,000	2,022,000	1,035,000	949,000	1,432,000
			Employment			
Compact City	1,292,000	983,000	1,008,000	180,000	418,000	463,000
Consolidated City	1,178,000	1,005,000	1,045,000	196,000	435,000	485,000
Dispersed City	1,146,000	937,000	1,073,000	225,000	454,000	509,000
Network of Cities	1,139,000	921,000	1,010,000	189,000	551,000	534,000
Distributed State	1,122,000	915,000	997,000	186,000	527,000	598,000
			Education Enrolments			
Compact City	528,000	532,000	361,000	146,000	220,000	153,000
Consolidated City	488,000	509,000	371,000	161,000	227,000	158,000
Dispersed City	462,000	477,000	381,000	177,000	235,000	164,000
Network of Cities	467,000	483,000	362,000	156,000	274,000	164,000
Distributed State	461,000	482,000	357,000	152,000	266,000	186,000

Table 4 2036 land use scenario growth relative to 2018 by FUA

FUA	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
			Population			
Compact City	+58%	+20%	+11%	+113%	+23%	+14%
Consolidated City	+28%	+17%	+14%	+147%	+28%	+19%
Dispersed City	+12%	+7%	+16%	+182%	+33%	+25%
Network of Cities	+21%	+10%	+13%	+138%	+58%	+24%
Distributed State	+18%	+10%	+11%	+127%	+45%	+41%
			Employment			
Compact City	+40%	+33%	+32%	+92%	+23%	+19%
Consolidated City	+28%	+36%	+37%	+110%	+28%	+24%
Dispersed City	+24%	+27%	+40%	+141%	+33%	+30%
Network of Cities	+24%	+25%	+32%	+103%	+62%	+37%
Distributed State	+22%	+24%	+30%	+99%	+55%	+53%
			Education Enrolments			
Compact City	+51%	+27%	+10%	+121%	+18%	+4%
Consolidated City	+40%	+21%	+13%	+143%	+22%	+8%
Dispersed City	+32%	+13%	+16%	+167%	+26%	+11%
Network of Cities	+34%	+15%	+10%	+136%	+46%	+11%
Distributed State	+32%	+15%	+8%	+129%	+42%	+26%

Table 5 2036 land use scenario statistics by area

Area	Metropolitan Melbourne	Regional Victoria	State-wide
		Population	
Compact City	6,313,000	1,966,000	8,279,000
Consolidated City	6,232,000	2,047,000	8,279,000
Dispersed City	6,142,000	2,138,000	8,279,000
Network of Cities	5,989,000	2,290,000	8,279,000
Distributed State	5,898,000	2,381,000	8,279,000
		Employment	
Compact City	3,463,000	881,000	4,344,000
Consolidated City	3,424,000	920,000	4,344,000
Dispersed City	3,381,000	963,000	4,344,000
Network of Cities	3,259,000	1,085,000	4,344,000
Distributed State	3,220,000	1,125,000	4,344,000
		Education Enrolments	
Compact City	1,567,000	373,000	1,940,000
Consolidated City	1,529,000	385,000	1,914,000
Dispersed City	1,497,000	399,000	1,896,000
Network of Cities	1,468,000	438,000	1,906,000
Distributed State	1,452,000	452,000	1,904,000

Table 6 2036 land use scenario growth relative to 2018 by area

Area	Metropolitan Melbourne	Regional Victoria	State-wide
		Population	
Compact City	+32%	+18%	+28%
Consolidated City	+30%	+23%	+28%
Dispersed City	+28%	+28%	+28%
Network of Cities	+25%	+37%	+28%
Distributed State	+23%	+43%	+28%
		Employment	
Compact City	+38%	+21%	+34%
Consolidated City	+36%	+26%	+34%
Dispersed City	+34%	+32%	+34%
Network of Cities	+29%	+48%	+34%
Distributed State	+28%	+54%	+34%
		Education Enrolments	
Compact City	+34%	+12%	+29%
Consolidated City	+31%	+15%	+28%
Dispersed City	+28%	+19%	+26%
Network of Cities	+26%	+31%	+27%
Distributed State	+25%	+35%	+27%

3.2 Infrastructure Assumptions

As outlined in Section 2.1, 2036 scenario testing of the five land use scenarios all used the same set of infrastructure assumptions. This infrastructure pipeline is made up of projects that have already received funding, as well as projects that are in varying stages of preliminary planning. As such, some of the interventions may never be implemented. Overall, the pipeline is not a representation of existing government policy – it provides a realistic but hypothetical foundation to assist in planning how Victoria is going to respond to future growth pressures.

Figure 7 shows the growth in road lane kilometres across each FUA assumed between 2018 and 2036[1]. In both relative and absolute terms, the new growth areas of Melbourne are assumed to receive the largest increases in road infrastructure during this timeframe. This is predominantly driven by the need to service new suburban areas that will be developed at the fringes of the current residential development, requiring significant investment in the upgrading of existing rural roads and the construction of completely new roads.

Figure 7 Change in lane kilometres for 2018 to 2036 by FUA

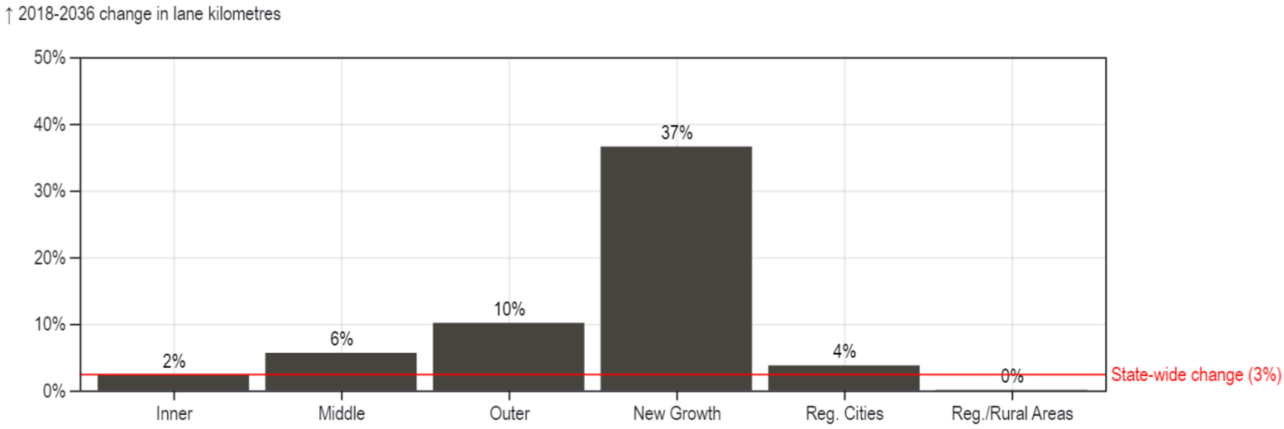
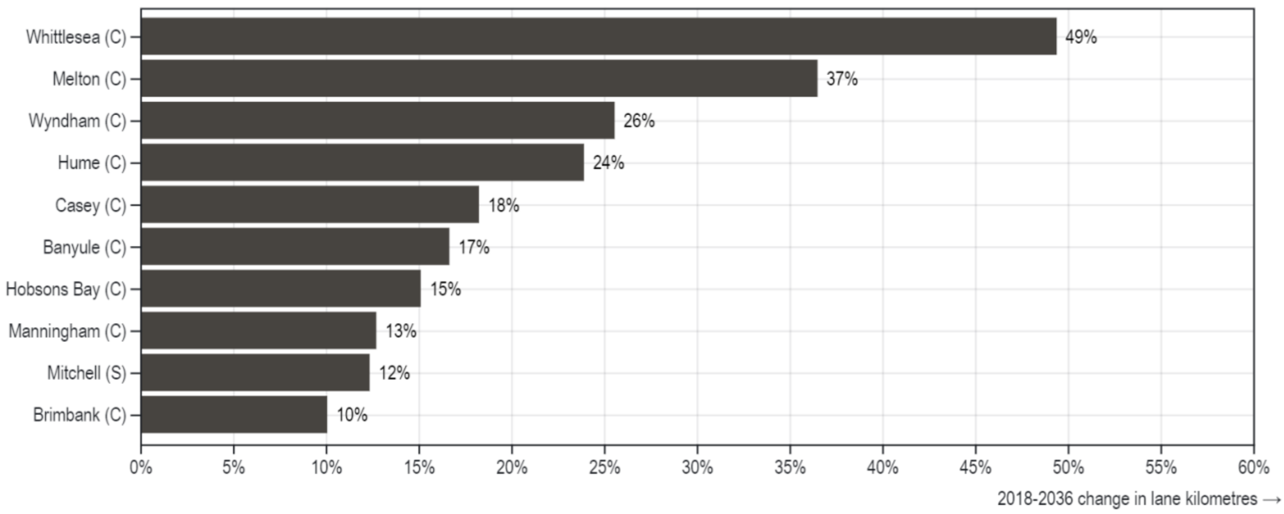


Figure 8 shows this same change in road lane kilometres statistics by LGA, highlighting LGAs with the highest levels of growth across Victoria. Again, it can be seen that much of the infrastructure increase is concentrated in the outer and new growth parts of Melbourne. The City of Whittlesea tops this list, with an assumed 50% increase in lane kilometres between 2018 and 2036 across Melbourne's north. The City of Melton and the City of Wyndham follow closely, representing growth in Melbourne's west.

Figure 8 Change in lane kilometres for 2018 to 2036 by LGA (top ten)



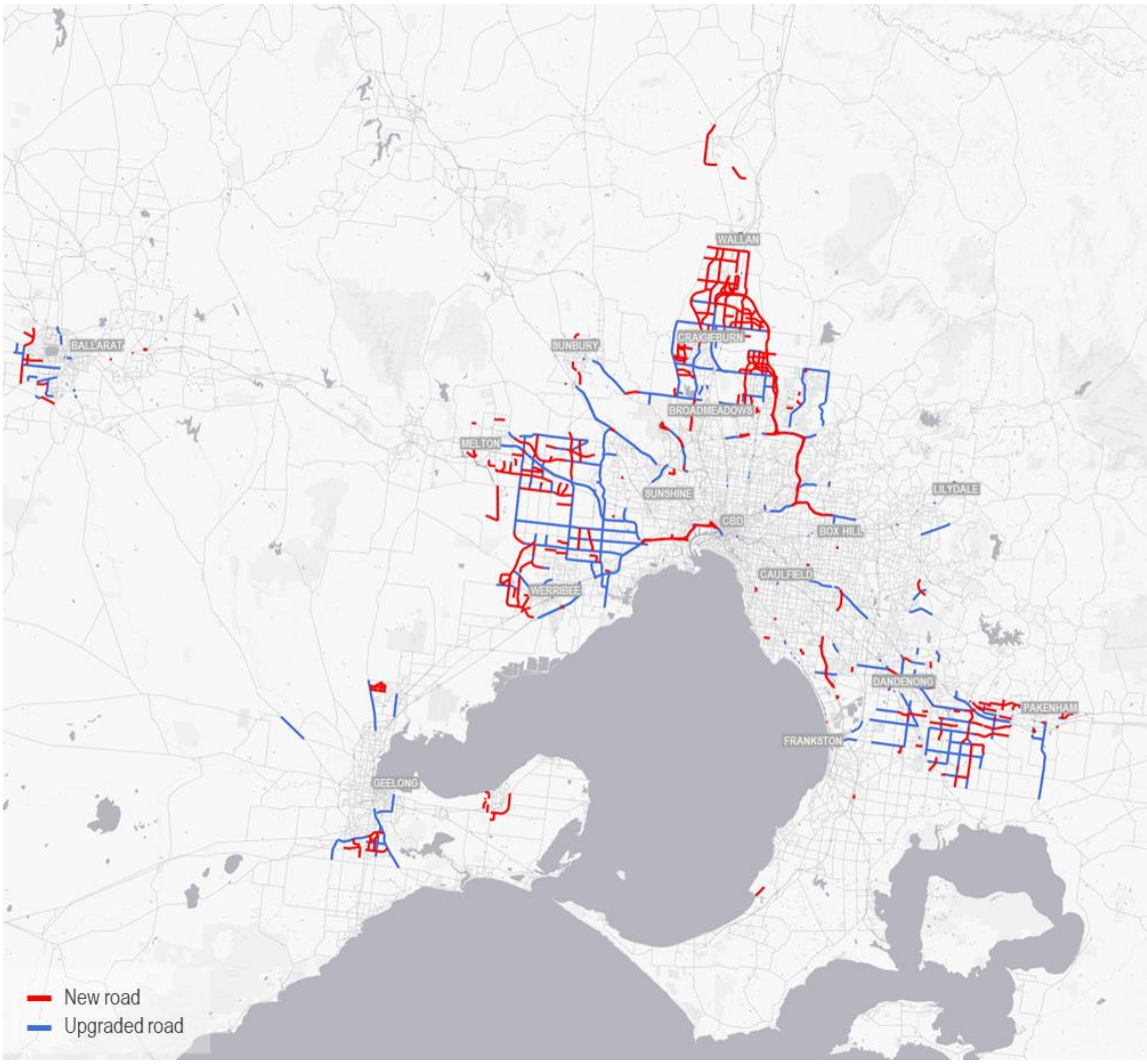
[1] Noting that this growth corresponds to growth accounted for within the modelled road network. The VITM road network does not include a comprehensive representation of local roads which would exist beyond the spatial granularity offered by the model. See Appendix A for further details.

Much of this increased supply in road infrastructure is accounted for through upgrades and new network designed to service greenfield areas as mentioned. However, there are several major road projects assumed to open by 2036 within the base infrastructure pipeline that are highlighted because of their strategic nature:

- Mordialloc Freeway – Extension of the Mornington Peninsula Freeway from Springvale Road to Dingley Bypass in Melbourne's south-east.
- North-East Link – New tolled freeway connecting the Metropolitan Ring Road and the Eastern Freeway in Melbourne's north-east.
- West Gate Tunnel – New tolled freeway connecting the West Gate Freeway to Footscray Road and CityLink in Melbourne's west.
- Upgrades to metropolitan freeways including the Calder Freeway, Western Freeway, Monash Freeway and the Metropolitan Ring Road.

Figure 9 summarises all these changes spatially, showcasing where road upgrades and new roads are assumed to occur between the modelled years of 2018 and 2036.

Figure 9 Change in road supply for 2018 to 2036

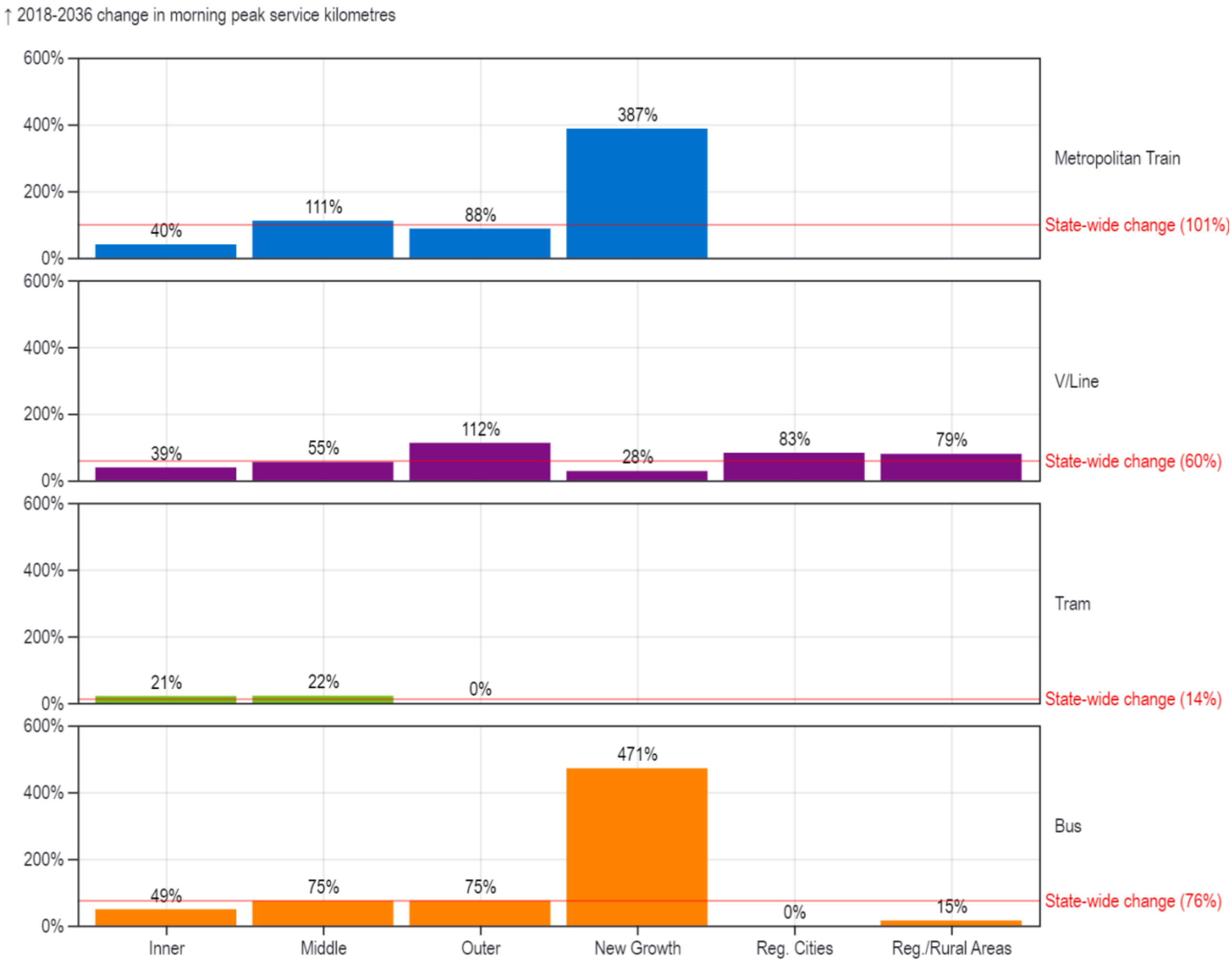


Public transport supply is also expected to change significantly between 2018 and 2036. Figure 10 shows the total change in morning peak service kilometres by public transport mode for each FUA across this timeframe. Proportional increases in supply across all public transport modes for the new growth areas are high due to the lack of infrastructure present in those areas in 2018.

It is worth noting that these changes in service kilometres do not capture simultaneous upgrades in vehicle capacities. For example, upgrades in the tram vehicle fleet will provide further capacity across the tram network, despite the smaller growth in actual service kilometres. Such vehicle upgrades are also present across the metropolitan train and V/Line rolling stock fleet and the consequent capacity upgrades reflected in the modelled outcomes.

- Metropolitan train service kilometres provision is forecast to more than double across middle Melbourne and new growth areas between 2018 and 2036. Increases in supply are proportionally lower for inner Melbourne because this area of Melbourne already acts as the central nexus of the rail system with high capacities.
- V/Line service provision is also forecast to increase in the VITM, rising approximately 80% by 2036 for the regional cities and regional and rural areas as greater train throughput is enabled through various changes within the city loop and other parts of the rail network.
- Tram provision is not forecast to grow significantly into the future given the existing density of the network and logistical difficulties in increasing service frequencies along particular corridors.
- Bus provision is forecast to grow steadily across all areas of Melbourne, with a greater emphasis on the metropolitan regions. There is only minor growth in bus services forecast within the assumed 2036 public transport provision for regional cities and regional and rural areas as specified in the base infrastructure pipeline.

Figure 10 Change in morning peak service kilometres for 2018 to 2036 by FUA

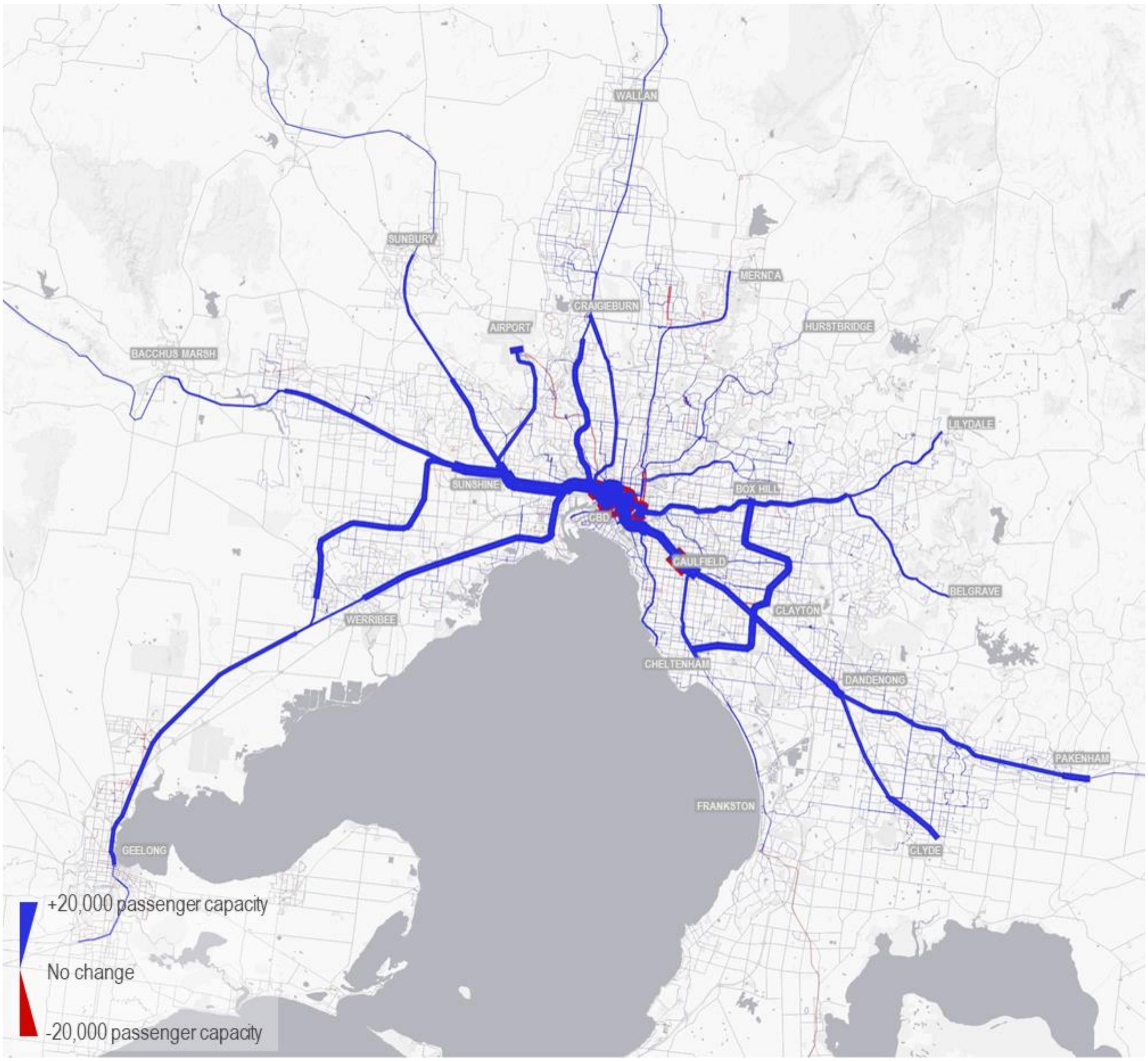


There are several major public transport projects assumed in the modelling to be opened by 2036 that are significant in size and impact on travel times for passengers:

- Melbourne Metro – A new heavy rail tunnel providing a direct connection between the Dandenong corridor and the Sunshine corridor (as opposed to the City Loop) with new five new stations in and around Melbourne's CBD.
- Melbourne Airport Rail Link – a new heavy rail corridor to Melbourne Airport connecting into the existing network at Sunshine Station.
- Suburban Rail Loop East – the first stage of a new rail tunnel connecting Melbourne's middle suburbs between Cheltenham and Box Hill.
- Melton Electrification – Extension of the metropolitan rail network to Melton from Sunshine.
- Clyde Extension – Extension of the metropolitan rail network to Clyde from Cranbourne.
- Various upgrades to regional corridors including Geelong Faster Rail.

Figure 11 shows changes in public transport capacity spatially, capturing both increases in individual vehicle capacities as well as more frequent or new services in the morning peak.

Figure 11 Morning peak change in public transport capacity for 2018 to 2036



3.3 Scenario Outcomes

3.3.1 Travel Patterns

Table 7 shows total modelled private vehicle and public transport trips across the day with details provided for the morning and inter-peak periods, as well as mode share on a trip-basis. Except for the 2036 *Compact City* scenario, there are only minor differences in overall trip statistics and mode share between the tested scenarios. This is an expected outcome, given that all land use scenarios exhibit the same total population and jobs at the state-wide level, as well as having identical infrastructure provision. Nonetheless, as mentioned the 2036 *Compact City* scenario is associated with the greatest use of public transport within this group. The densification of inner Melbourne has placed more people in reach of convenient public transport services, resulting in higher proportional use.

Table 7 State-wide people trips and mode share summary for 2036 using motorised transport

Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
AM Period					
Private Vehicle Trips	3,282,000	3,343,000	3,368,000	3,358,000	3,365,000
Public Transport Trips	489,000	452,000	438,000	436,000	430,000
Public Transport Mode Share of Motorised Trips	13.0%	11.9%	11.5%	11.5%	11.3%
IP Period					
Private Vehicle Trips	8,123,000	8,290,000	8,376,000	8,339,000	8,357,000
Public Transport Trips	648,000	580,000	554,000	559,000	549,000
Public Transport Mode Share of Motorised Trips	7.4%	6.5%	6.2%	6.3%	6.2%
Daily					
Private Vehicle Trips	23,819,000	24,296,000	24,526,000	24,435,000	24,490,000
Public Transport Trips	2,290,000	2,078,000	1,994,000	2,003,000	1,970,000
Public Transport Mode Share of Motorised Trips	8.8%	7.9%	7.5%	7.6%	7.4%

Table 8 shows the equivalent daily trips and mode share but with active transport included. As explained in Appendix B, the VITM does not simulate active transport trips. Instead, a portion of active transport travel is assumed to occur based on the density of multiple land use attributes across regions. These trips are then discarded by the model before modelling of private vehicle and public transport travel begins.

From this table, the *Compact City* scenario is associated with the greatest levels of active transport use compared to all other scenarios, followed by the *Consolidated City* scenario. This reflects the high density of population and jobs within inner and middle Melbourne within these scenarios, where active transport is expected to occur the most. Both the *Network of Cities* and *Distributed State* scenarios exhibit a higher assumed active transport mode share than the *Dispersed City* scenario. Active transport uptake is assumed to be low in the outer and growth areas of Melbourne where much of the growth associated with the *Dispersed City* scenario is assumed to occur.

Table 8 State-wide trip and mode share including active transport for 2036

Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Absolute Values					
Private Vehicle Trips	23,819,000	24,296,000	24,526,000	24,435,000	24,490,000
Public Transport Trips	2,290,000	2,078,000	1,994,000	2,003,000	1,970,000
Active Transport Trips	4,629,000	4,401,000	4,259,000	4,327,000	4,305,000
Proportions					
Private Vehicle Trips	77.5%	78.9%	79.7%	79.4%	79.6%
Public Transport Trips	7.5%	6.8%	6.5%	6.5%	6.4%
Active Transport Trips	15.1%	14.3%	13.8%	14.1%	14.0%

Figure 11 shows the varying proportions of private vehicle (regardless of occupancy) and passenger kilometres travelled during the morning peak across individual functional urban areas. As is evident particularly in inner and middle Melbourne, public transport trips are longer in distance and duration on average compared to the mean private vehicle journey. Several factors can be attributed to this, explored further in Sections 3.3.2 and 3.3.3. A consequence of this is that when considered on a distance-basis rather than a trip-basis, public transport travel represents most of all travel occurring within inner Melbourne.

Figure 12 Morning peak vehicle and passenger kilometres travelled by FUA in 2036

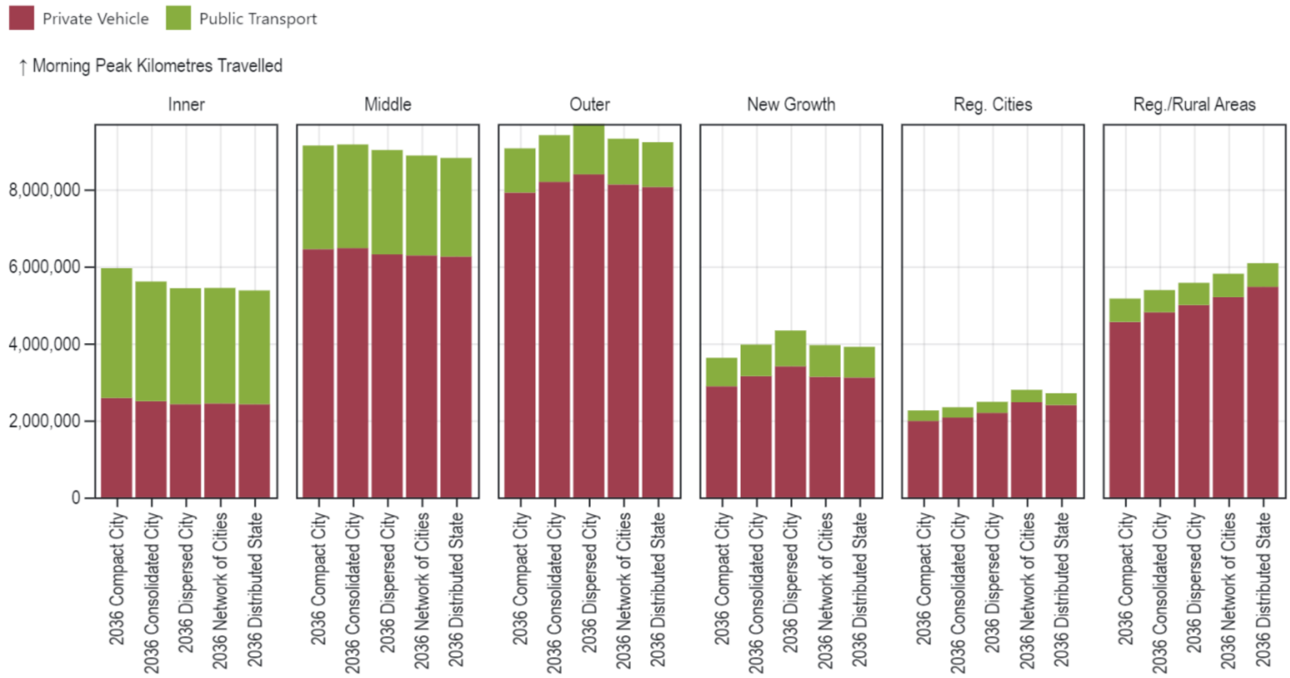
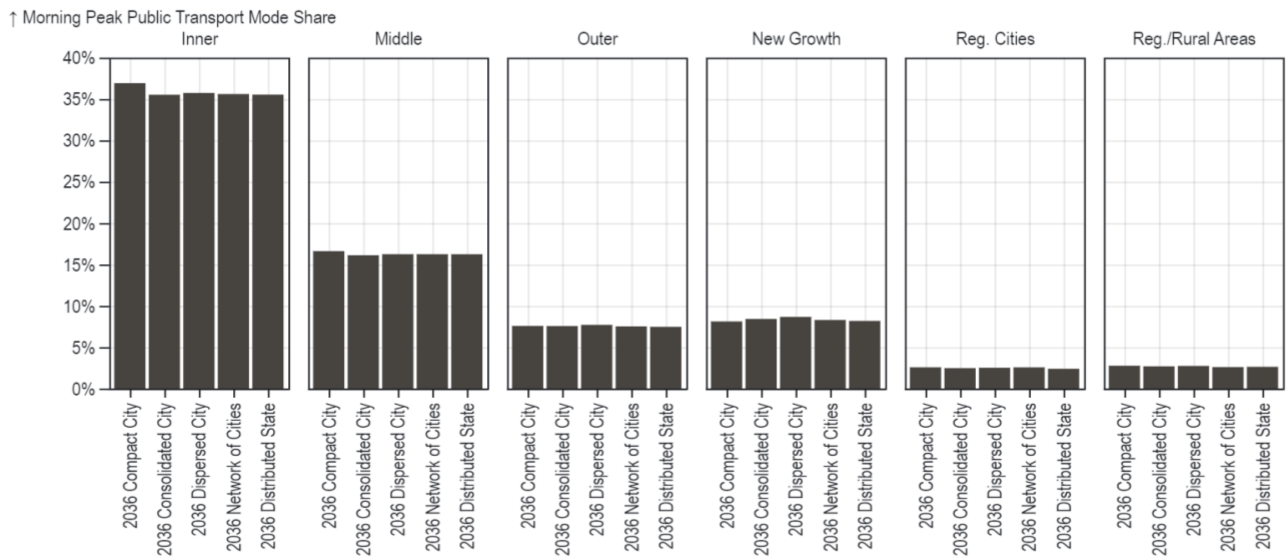


Figure 13 shows public transport mode share by FUA during the morning peak. Again, apart from the 2036 *Compact City* scenario, it can be seen that public transport mode share by FUA is broadly unaffected by the underlying demographic assumptions in place. This indicates that, at least for conditions in 2036, that having proportionally more people live in inner Melbourne is a more sustainable outcome for the state (as shown in Table 7). Outside of where Victorians live, the main driving force behind the uptake of public transport travel would be infrastructure provision or fares and other policy levers. Without any changes in infrastructure provision between the land use scenarios (or fare structure), each functional urban area has demonstrated a similar proportion of public transport use.

Figure 13 Morning peak public transport mode share by FUA in 2036



Public transport boardings follows an expected pattern (Figure 14), with the three Melbourne-focused scenarios (*Compact City*, *Consolidated City* and *Distributed City*) demonstrating the highest levels of metropolitan train use. Tram use is also heaviest in the 2036 *Compact City* scenario, correlating with the highest densities of population in inner Melbourne of the scenarios tested. Interestingly, bus use in terms of boardings is not sensitive to the land use future in place. For example, despite the significantly higher population levels assumed within outer and new growth areas of Melbourne for the *Dispersed City*, this scenario does not see higher absolute levels of bus use compared to the other scenarios. This indicates that the bus network within outer and new growth areas requires change to make it an attractive means of travel compared to alternatives such as private vehicle use.

Figure 14 Morning peak boardings by mode in 2036

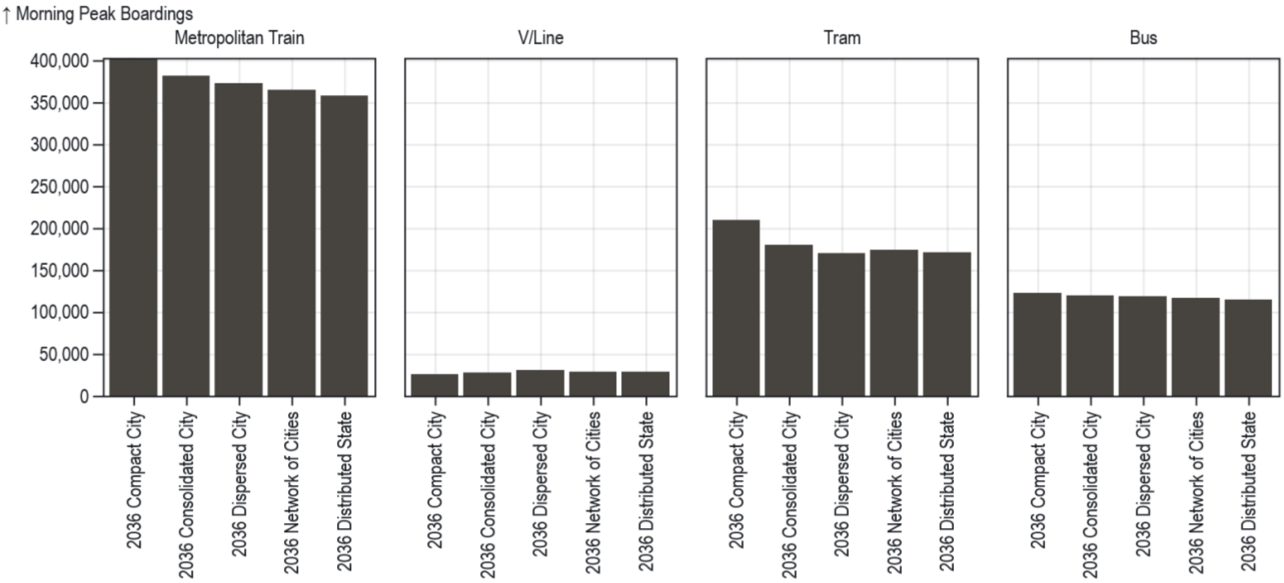
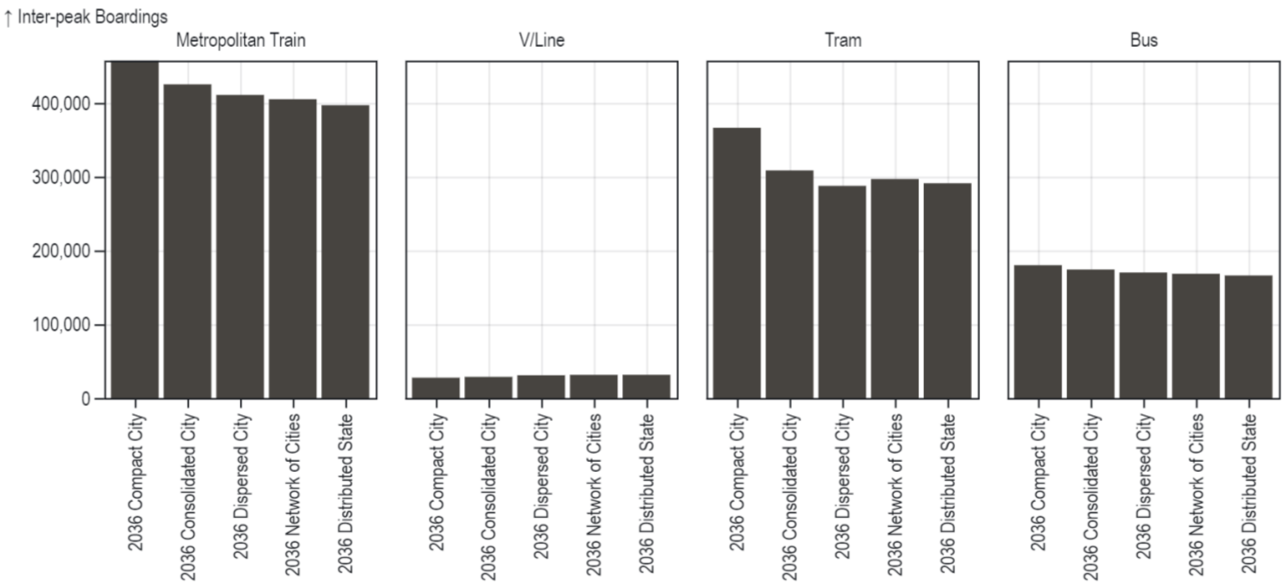


Figure 15 shows the equivalent public transport boardings but for the inter-peak period rather than the morning peak. Usage patterns are broadly the same when comparing behaviour across scenarios, with higher proportional tram use in the 2036 *Compact City* scenario compared to other scenarios. It is worth noting that these figures represent total boardings across a seven-hour inter-peak period, as opposed to the two-hour morning peak period shown in Figure 14. Overall, the inter-peak period exhibits much less travel activity on a per-hour basis compared to the morning and evening peaks.

Figure 15 Inter-peak boardings by mode in 2036



3.3.2 Network Impacts

Given the fixed level of transport infrastructure and services assumed across each of the five 2036 scenarios, the differing distribution of land use attributes throughout the state result in varying levels of congestion and crowding as travellers leverage the transport network.

Figure 16 summarises these congestion and crowding effects by defining the amount of congested/crowded travel that occurs (in terms of hours travelled) as a proportion of all hours travelled for both private vehicles and public transport during the morning peak. As mentioned in Section 1.3.4, congested and crowded travel refers to conditions where a road or public transport vehicle are operating above 80% of their capacity. Outcomes for the 2018 *Base* scenario have also been provided in this comparison for context. From this, it can be seen that:

- Road congestion levels within inner, middle, and outer Melbourne are relatively resilient to varying distributions of population and jobs across the tested scenarios in 2036. There is only a small difference in the amount of experienced congestion between the land use scenarios in the metropolitan area. However, this occurs under circumstances where all scenarios have most private vehicle travel occurring under congested conditions in Melbourne, meaning that this may equally be a consequence of the network itself running close to capacity – this would make it difficult to see large differences between the land use scenarios. Worsening road congestion is seen when considering the new growth areas – the *Dispersed City* scenario exhibits approximately 15% more congested hours travelled than *Compact City* scenario for instance.
- Public transport travel does not experience high levels of crowding in 2036. This can be attributed to the extensive increases in public transport service provision described in Section 3.2. For example, even though total population within Victoria is expected to increase by 28% between 2018 and 2036, metropolitan train service kilometres during the morning peak are assumed to double in this time (see Figure 10). The largest pockets of crowding that do exist in 2036 across each scenario are located within inner Melbourne.

Figure 16 Morning peak congested/crowded travel as proportion of all hours travelled by FUA in 2036

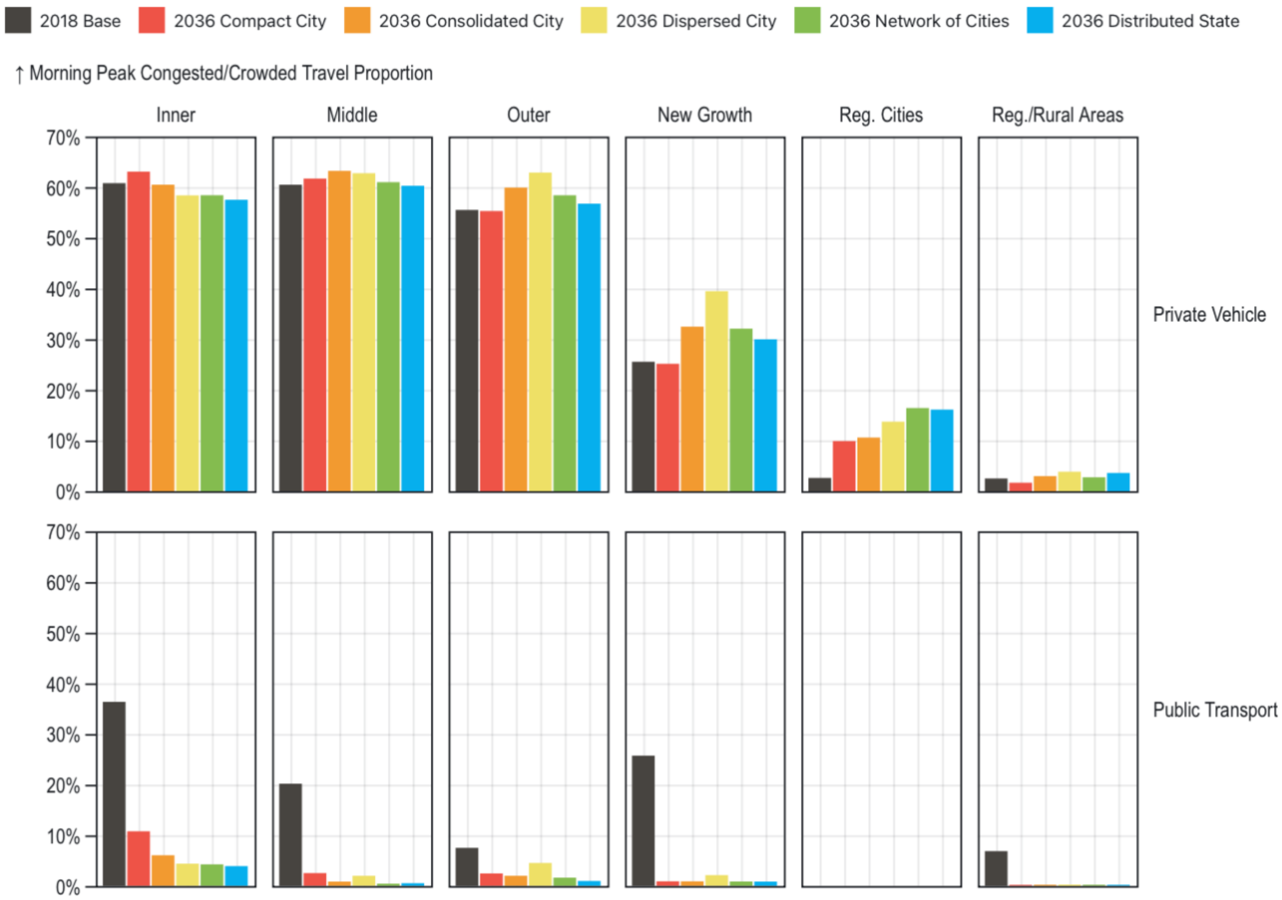


Figure 17 characterises network performance in an alternative way, showing average morning peak vehicle speeds for both private vehicle and public transport travel across the five 2036 scenarios. It is to be noted that this presents an idealised view of public transport journey times, neglecting to include wait times and transfer times (accounted for within analysis provided in Section 3.3.3) which can often make up a non-trivial proportion of a typical journey duration. Nonetheless, despite this limitation several key insights can be gleaned from this output:

- Across both private vehicle and public transport travel, average speeds follow a strict hierarchy of slower journeys as you get closer to Melbourne's CBD. This hierarchy is maintained across all five land use scenarios, with conditions in regional cities roughly equivalent to those experienced in Melbourne's new growth areas.
- Private vehicle journey speeds during the morning peak vary the most within the outer and new growth areas of Melbourne. In particular, the *Dispersed City* scenario (which places the highest concentration of population and jobs within these outer regions) results in noticeably slower travel speeds compared to the other scenarios. This indicates that the road network infrastructure at Melbourne's fringe is more sensitive to demographic pressures and thus susceptible to a breakdown in free-flowing traffic conditions. By contrast, the inner and middle areas demonstrate relatively stable journey speeds – across all scenarios congestion is pervasive within these regions, meaning there is little opportunity for journey speeds to improve or worsen on average.
- Excluding the consideration of dwell times as mentioned previously, public transport journey speeds are universally faster than their private vehicle equivalents. These journey times are also relatively static regardless of land use future. This is not indicative of an overall superior journey experience – it merely reflects that because of waiting times and the inconvenience of transfers, public transport has to offer such speeds to remain competitive. Even so, as demonstrated by mode share figures, public transport services can only offer this in limited circumstances for a fraction of the population.

For context, average state-wide morning peak in-vehicle journey speeds are approximately 41 km/h and 37 km/h for private vehicles and public transport respectively.

Figure 17 Average morning peak in-vehicle journey speeds by FUA in 2036

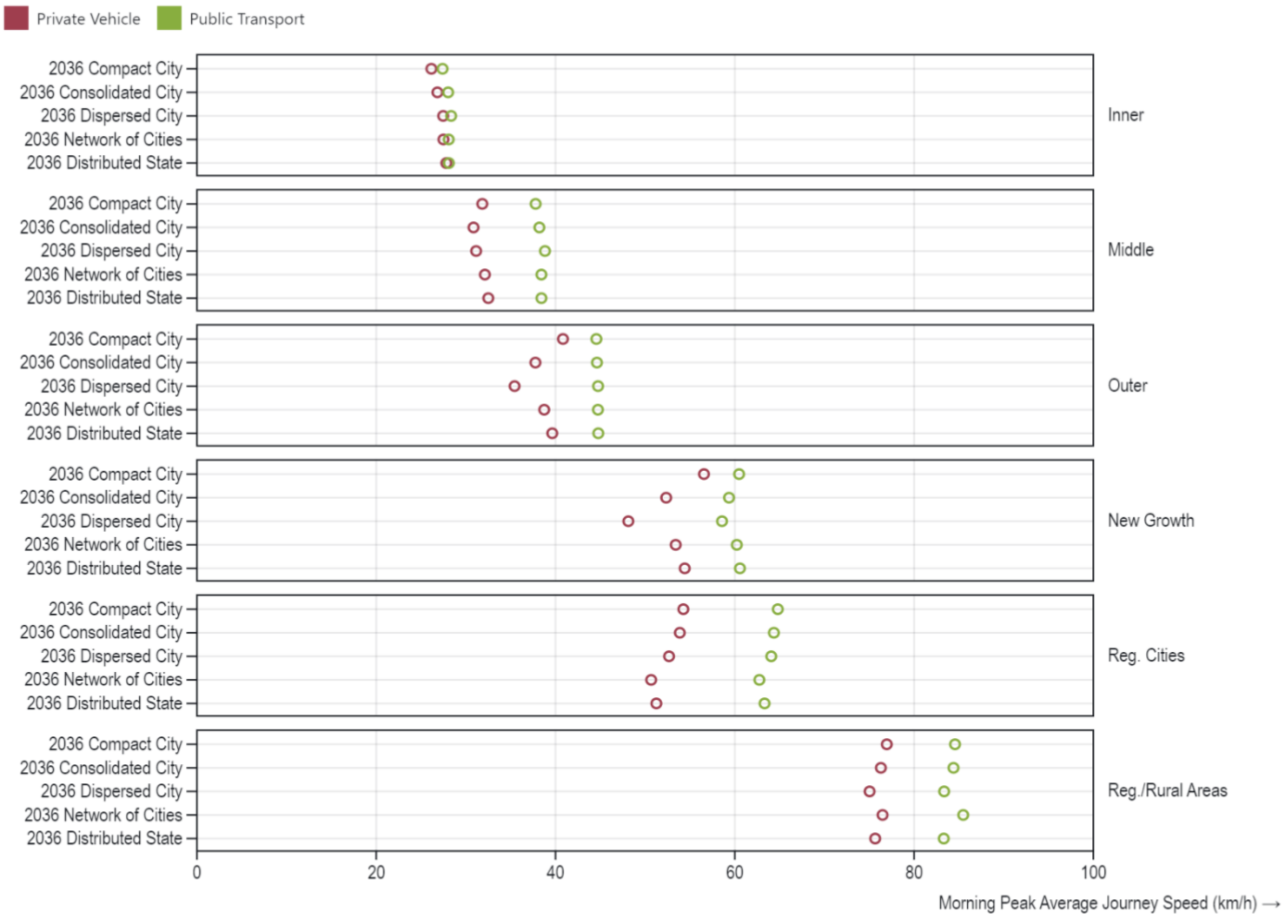
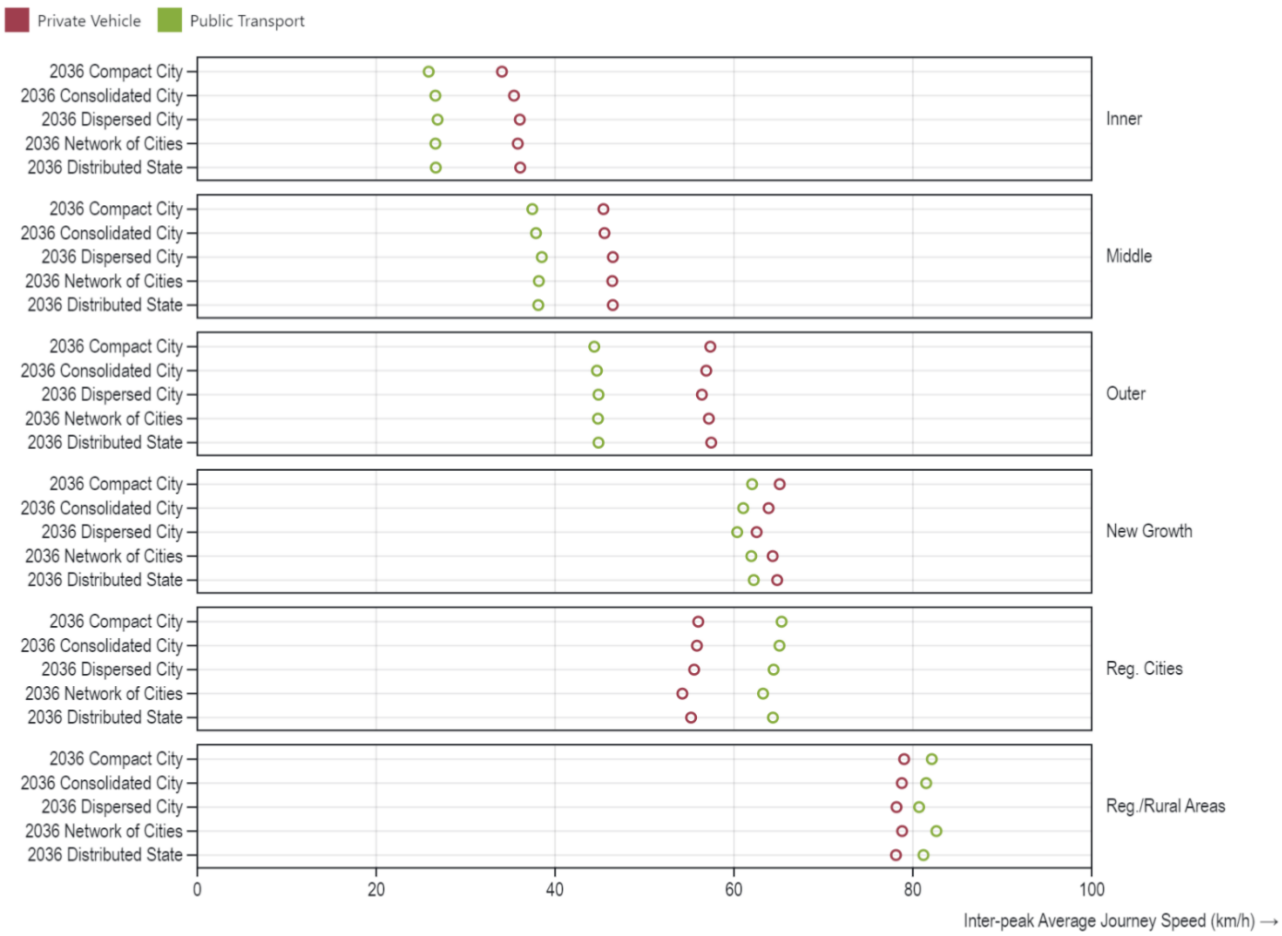


Figure 18 shows equivalent of Figure 17 but for the inter-peak period during the middle of the day. The key difference that arises from this is that road congestion is greatly reduced at this time compared to the morning peak, resulting in the following observations:

- There are minor differences in journey speeds for both private vehicle and public transport travel across the land use scenarios at the functional urban area level. For private vehicle travel, this is likely because the road network is not at capacity during this time of the day, meaning that the differing levels of travel that arise because of changing demographic assumptions have little impact on overall network performance. Similarly for public transport, because the road network is not at capacity on-road services like trams and buses are unlikely to be affected in terms of travel speeds resulting in very little variance in performance across scenarios.
- Compared to the morning peak, inter-peak public transport speeds remain approximately similar but the equivalent private vehicle journeys are much faster. As mentioned previously, this speed calculation excludes journey components such as waiting for a service, meaning that public transport is particularly uncompetitive compared to private vehicles during this time of day. This lack of competitiveness is reflected in the correspondingly low public transport mode share for the inter-peak period, discussed in Section 3.3.1 (see Table 7).
- Public transport journey speeds are still higher than equivalent private vehicle journeys in the regional cities, as well as regional and rural areas of Victoria during the inter-peak period. As was the case when discussing such effects for the morning peak, such results need to be interpreted with caution. Public transport mode share is extremely low for these regions, meaning that these speeds likely reflect the very small number of public transport journeys that are competitive with private vehicles in these regions (such as particular combinations of V/Line express services). Other types of public transport journeys are likely so slow compared to their private vehicle equivalents that travellers do not even attempt them.

For context, average inter-peak state-wide in-vehicle journey speeds are approximately 54 km/h and 37 km/h for private vehicles and public transport respectively.

Figure 18 Average inter-peak in-vehicle journey speeds by FUA in 2036



To further expand upon the outcomes discussed in regards to Figure 17 and Figure 18, Figure 19 and Figure 20 show the average morning peak and inter-peak journey distances in 2036 by private vehicle and public transport. Overall, there are only minor differences in these average journey distances across scenarios, with the *Compact City* scenario exhibiting the shortest public transport journeys on average. This has occurred because this scenario concentrates more residents within inner and middle Melbourne, decreasing average public transport commuting distances. Journey distances are slightly lower in the inter-peak compared to the morning peak.

Public transport journeys cover more than double the distance of the average private vehicle journey. This gap widens as you move further away from Melbourne's CBD, with public transport journeys in regional areas multiple times longer than the average private vehicle journey. It is less likely for people to use public transport for short trips in regional cities and rural areas. This is why the average speeds of public transport journeys are faster on than private vehicle journey speeds in these regions. People are more likely to be spending an extended period of time on a train or on a coach travelling along a regional highway – both representing travel at sustained high speeds. This effect is exaggerated when considering the inter-peak period, where regional public transport travel is more rare.

Figure 19 State-wide morning peak average journey distance in 2036

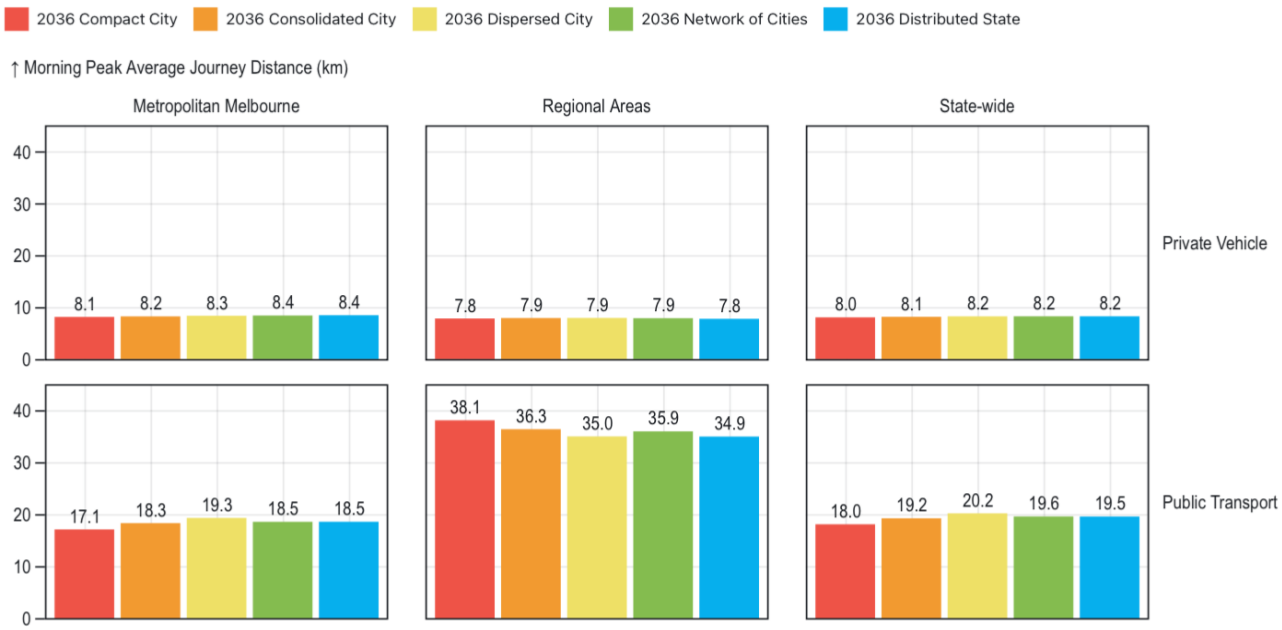
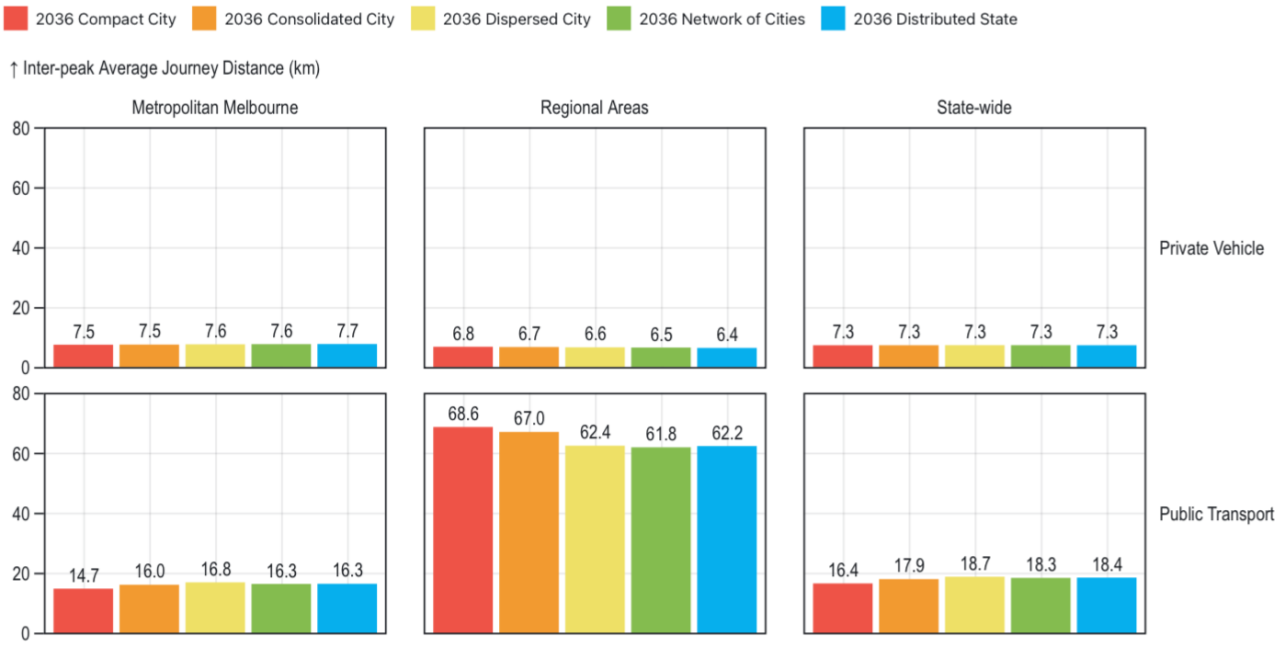


Figure 20 State-wide inter-peak average journey distance in 2036



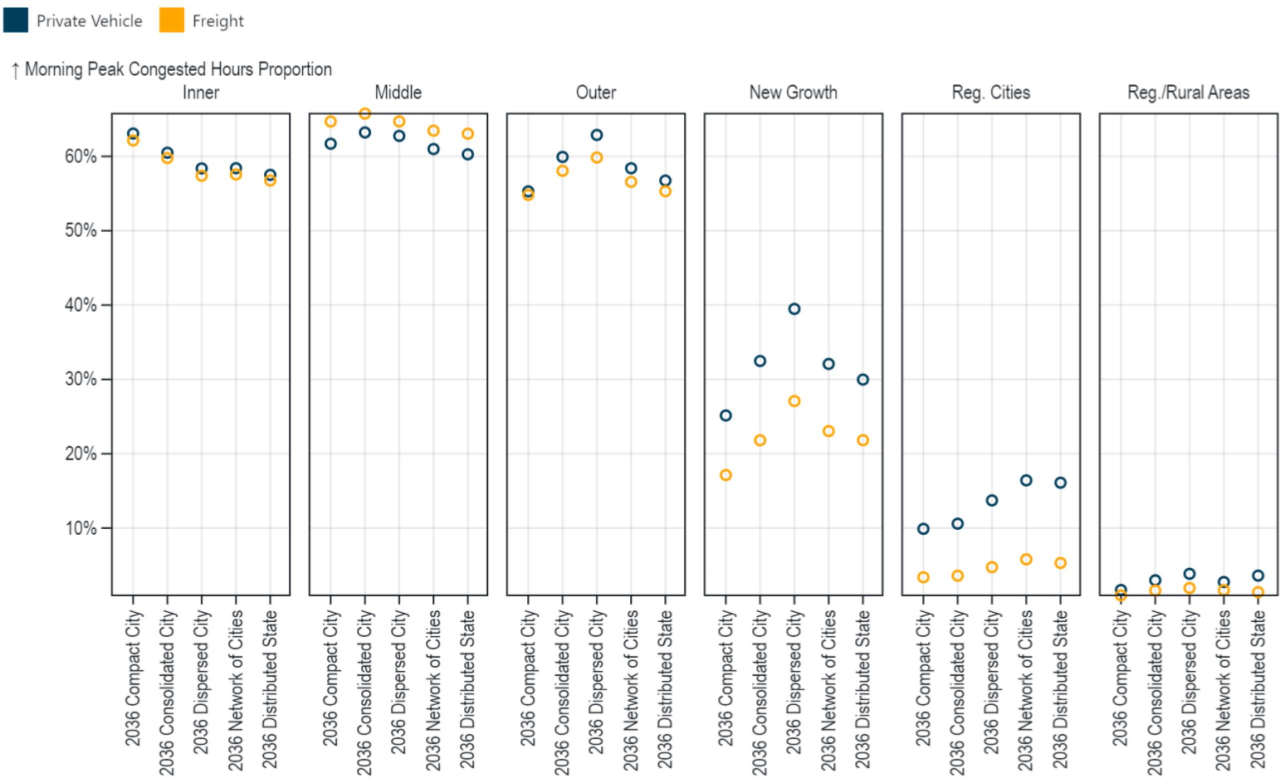
Freight travel (light and heavy commercial vehicles) represents approximately 3-6% of all on-road morning peak travel across all parts of Victoria with the exception of regional and rural areas, where this proportion is significantly higher at approximately 15-17%. Table 9 shows this breakdown across the tested scenarios and FUAs in terms of proportion of all vehicle hours travelled during each modelled time period.

Table 9 Proportion of freight hours travelled by time period and FUA in 2036

Scenario	Time Period	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
2036 Compact City	AM	6%	5%	6%	4%	4%	17%
	IP	10%	9%	10%	8%	7%	31%
	PM	4%	3%	4%	3%	2%	11%
	OP	6%	5%	6%	5%	4%	17%
2036 Consolidated City	AM	6%	5%	5%	4%	4%	17%
	IP	11%	8%	10%	7%	7%	30%
	PM	4%	3%	4%	2%	2%	11%
	OP	6%	5%	5%	4%	4%	16%
2036 Dispersed City	AM	7%	5%	5%	3%	3%	16%
	IP	12%	9%	10%	7%	6%	29%
	PM	5%	3%	3%	2%	2%	10%
	OP	7%	5%	5%	4%	4%	16%
2036 Network of Cities	AM	6%	5%	5%	4%	3%	16%
	IP	11%	9%	10%	8%	6%	30%
	PM	4%	3%	4%	2%	2%	10%
	OP	7%	5%	6%	4%	3%	16%
2036 Distributed State	AM	6%	5%	5%	4%	3%	15%
	IP	11%	8%	9%	8%	6%	28%
	PM	4%	3%	3%	2%	2%	9%
	OP	6%	5%	5%	4%	3%	14%

Depending on scenario changes, freight can be impacted more or less than private vehicles because the travel patterns exhibited by freight differ from that of the average road user. As shown in Figure 21, there is little evidence that this is case for the metropolitan Melbourne area. For new growth areas and regional cities, freight vehicles are subjected to less congestion than private vehicles, likely because the routes experiencing congestion in those areas are not as frequently used by freight.

Figure 21 Morning peak congested travel for private vehicles and freight in 2036

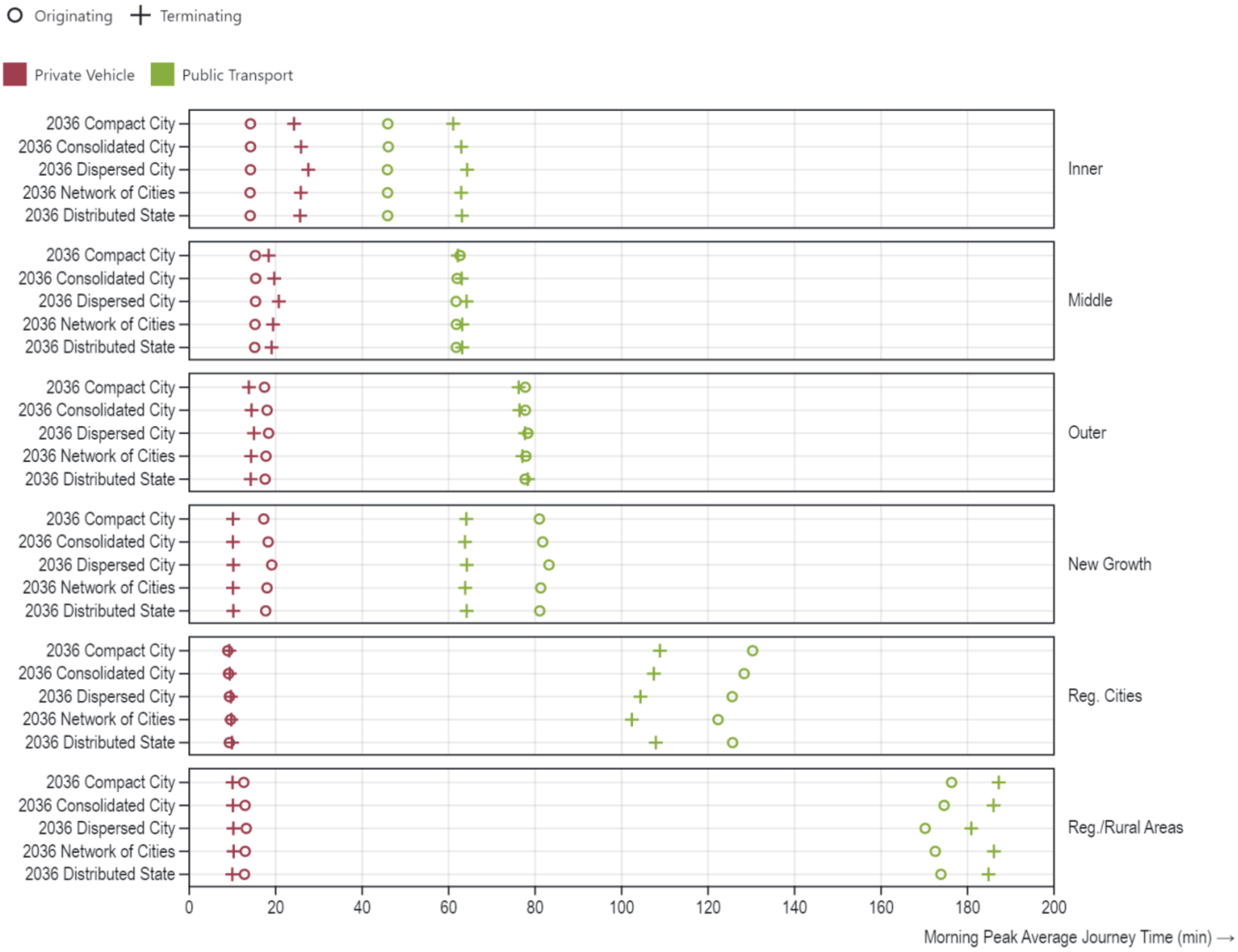


3.3.3 Wider Impacts

Figure 22 shows the average morning peak journey times in minutes by mode of travel and FUA[2]. Average journey times for trips originating in the indicated FUA are marked with circle symbols, whilst journey times for trips terminating within the indicated FUA are marked with cross symbols. To assist in interpreting this, consider private vehicle journeys interacting with the inner FUA. Trips *originating* from the inner FUA take approximately 14 minutes on average. On the other hand, trips *terminating* at the inner FUA during the morning peak take approximately 26 minutes on average. From this chart, it can be seen that:

- Average morning peak journey times interacting with the metropolitan Melbourne areas are very stable regardless of the land use scenario across modes and directions of travel. The greatest variation is seen regarding public transport travel in regional cities, where the *Network of Cities* scenario exhibits the lowest average public transport journey times across all scenarios. This is likely a function of the greater number of jobs placed in regional cities under that scenario, providing a slightly higher number of local employment opportunities for those residing in those areas – some of whom can service these opportunities using public transport, reducing the average journey distance and time for all public transport trips.
- Public transport journey times are significantly longer than their equivalent private vehicle journeys in all circumstances. In contrast to the measures discussed in Section 3.3.2 (Figure 17 and Figure 18), these travel time statistics do incorporate the waiting time components that make up a sizable portion of typical public transport journeys. This, alongside the fact that people typically undertake longer journeys on public transport due to the waiting and transfer times, results in lengthier average journeys compared to private vehicles.

Figure 22 Average morning peak journey times by FUA in 2036



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[2] It is worth noting that average public transport journey times in regional and rural areas exceed two hours in duration despite the VITM's morning peak period only covering two hours. This is possible because the model simulates average conditions during that two-hour block, meaning trips taking place around that time can extend past two hours in durations.

As average journey times remained stable across each tested land use future, it follows that access to opportunity metrics also remained stable. Access to opportunities in this instance is defined as the proportion of opportunities (such as jobs) that can be reached from a given location within a specific time threshold on average. Figure 23 shows these statistics for the morning peak, covering the following metrics:

- **Education:** The percentage of primary, secondary, and tertiary enrolments within Victoria accessible within 45 minutes on average for each FUA via the indicated transport mode.
- **Jobs**: The percentage of jobs within Victoria accessible within 45 minutes on average for each FUA via the indicated transport mode.
- **People**: The percentage of people within Victoria that live within 45 minutes on average for each FUA via the indicated transport mode. Note that this metric considers journeys in the opposite direction compared to the *Jobs* and *Education* metrics.

If a region has an access to opportunity score of 30% for jobs for private vehicle, it means that people living in that region can, on average, reach the locations of 30% of all jobs available in Victoria via private vehicle during the morning peak in 45 minutes or less.

All access to opportunity scores are stable across each land use scenario with the exception of access to people. This metric was lower under the 2036 *Dispersed City* scenario for the inner, middle, and outer areas of Melbourne, meaning that it was harder for people to reach these locations with this land use scenario. This has occurred because the increased congestion seen in new growth areas under this scenario has inflated travel times for residents in those regions. This, in turn, makes it more difficult for them to reach opportunities located in Melbourne's more central areas. In contrast, the 2036 *Compact City* scenario performs the best under this metric simply because it places more people directly in those central areas.

Figure 23 Morning peak access to opportunity by FUA in 2036

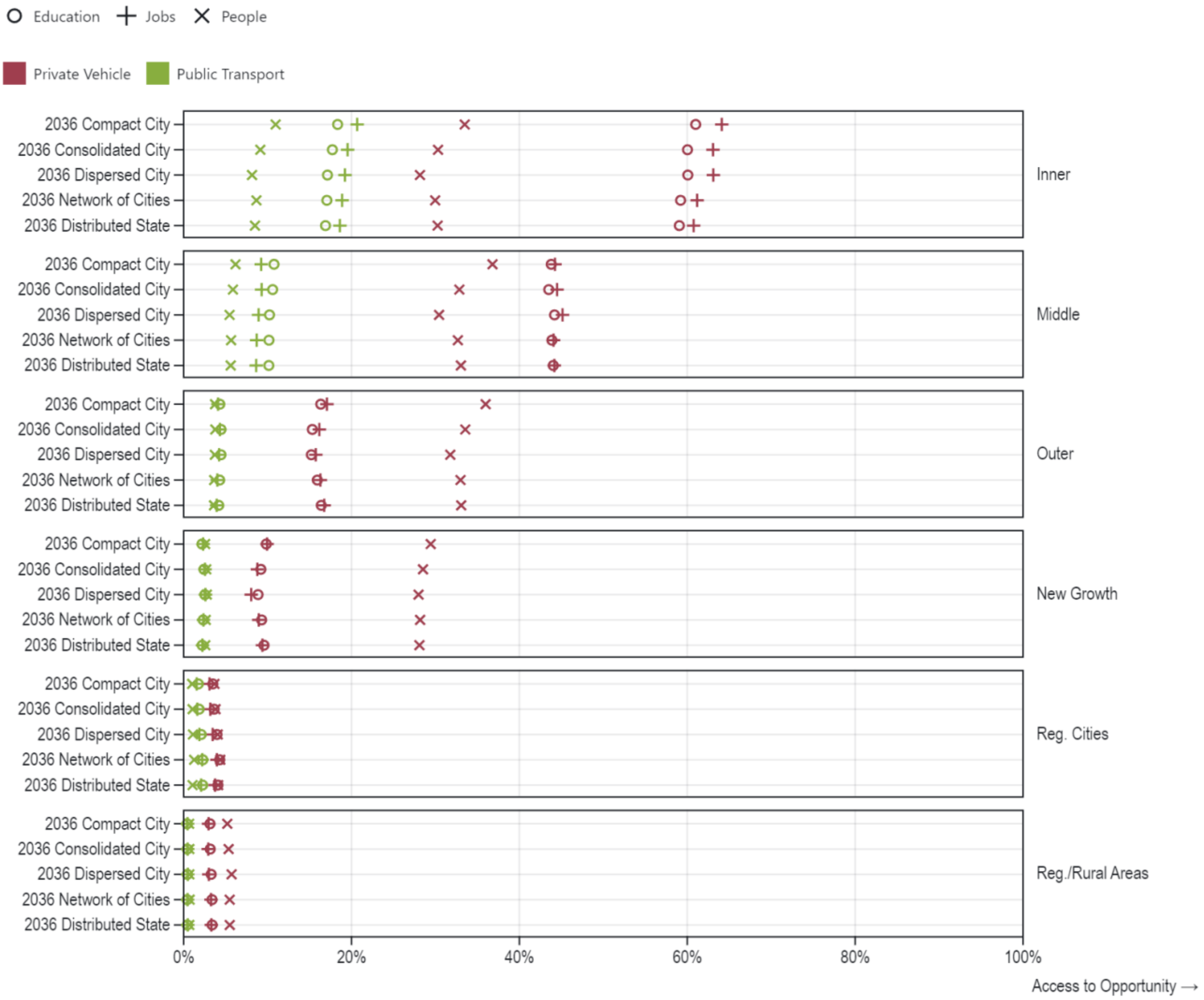


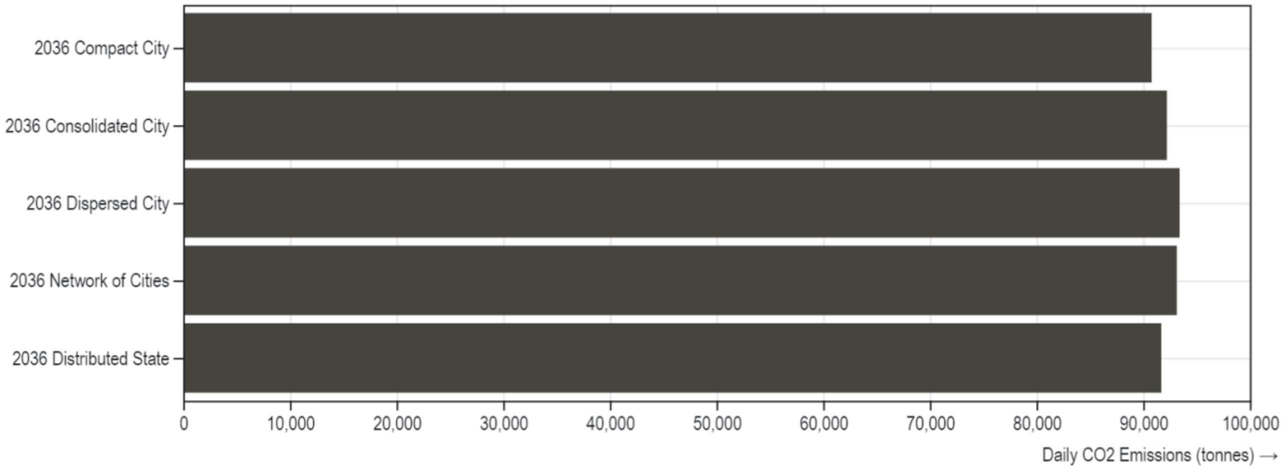
Table 10 shows the equivalent access to opportunity values but as an average for everyone living in the state for the morning peak. At this level of aggregation, differences between the land use scenarios are minimised. However, it is still possible to see that, on average, the *Compact City* scenario displays the best access to opportunity scores followed closely by the *Consolidated City*.

Table 10 State-wide morning peak access to opportunity in 2036

Mode	Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Private Vehicle	Education	24%	22%	21%	21%	21%
	Jobs	24%	23%	21%	22%	22%
	People	27%	25%	23%	24%	24%
Public Transport	Education	15%	14%	13%	13%	13%
	Jobs	16%	15%	14%	14%	14%
	People	9%	8%	7%	7%	7%

Figure 24 summarises the total estimated daily emissions from transport for each scenario in 2036 using the calculation methodology outlined Appendix C, noting that this assumes a 44% uptake of zero emissions vehicles (ZEV) across the private vehicle, freight and bus fleets by this time in line with Australian Energy Market Operator (AEMO) assumptions outlined in their *Draft 2023 Inputs, Assumptions and Scenarios Report* (2022).

Figure 24 Total daily emissions in 2036



3.3.4 2036 Summary

Demographic assumptions associated with the five land use scenarios in 2036 differed in various ways. Despite this, each scenario test exhibited relatively similar outcomes to each other with respect to network performance and accessibility. This is because none of the land use scenarios triggered a fundamental breakdown in the functioning of either the road or public transport system (at least in relation to each other) due to their unique allocation of population or jobs in 2036. Public transport passengers were not impacted by overcrowded services, but persistent low mode shares across all scenarios indicate that fundamental changes to the structure of the public transport system or other policy levers are likely required to increase public transport use beyond simple capacity increases. The other clear means of improving public transport mode share is to place more people in areas that already have good access to public transport.

The 2036 *Dispersed City* scenario represents the one exception to these outcomes. Representing a future with increased urban sprawl within Melbourne's new growth areas, this was the only scenario that triggered consistent and significant changes in network performance. The increased population and employment density associated with this scenario in the outer and new growth areas resulted in higher levels of congestion, likely spurred by the sparse (and thus less resilient) road network present in these regions. This in turn affected average journey times and accessibility for residents in these areas. Greater investment in road and public transport infrastructure would likely be required by 2036 were this scenario to play out. Despite the degraded network performance of this scenario and the increase in population and jobs, new growth area bus services did not see patronage increases compared to other scenarios. This further indicates that the assumed bus system adopted within these regions is incapable of servicing the journeys that people in these areas need to make, prompting them to turn to private vehicles instead.

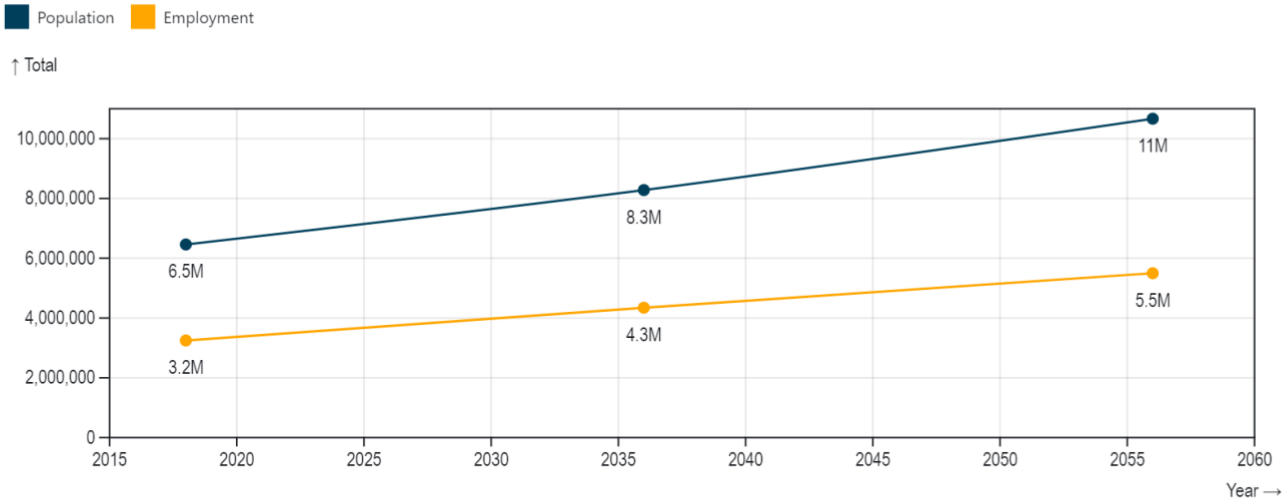
Similar network performance across the scenarios does not imply equivalent outcomes for people experiencing travel on the network. Because each scenario adopted a different spatial distribution of demographic attributes across the state, it follows that groups of the population benefit from each of the land use scenarios in different ways. As a key example of this, the 2036 *Compact City* scenario places the most population and jobs within the inner and middle areas of Melbourne across all the tested scenarios. Despite this resulting in slightly higher levels of congestion and crowding (see Figure 16), this places more people within areas where public transport is a viable form of day-to-day transport. This naturally results in higher public transport mode share at a state-wide level. It also means that more people are within reach of opportunity because much of the state's opportunities are concentrated around central Melbourne. The transport system is only one dimension around which people build their lives, and the style of densification described for the *Compact City* scenario may not fulfil other dimensions under consideration. Nevertheless, density provides significant advantages and efficiencies when it comes to making transport systems effective, as demonstrated by these scenario tests.

4. 2056 Year Testing

4.1 Land Use Assumptions

The 2056 demographic assumptions associated with the five land use scenarios represent a more significant realisation of each unique growth pattern's characteristics compared to 2036. As was the case with the previously discussed group of tests, total state-wide growth in statistics such as population, households, employment, and educational enrolments was kept constant across the five scenarios for 2056. Figure 25 shows these state-wide totals for population and employment as adopted across the 2018, 2036 and 2056 modelled years. Population and employment across Victoria are projected to grow approximately 69% and 72% between 2018 and 2056 respectively, translating into a compounding annual growth rate of 1.4% for both metrics.

Figure 25 State-wide projected population and employment growth, 2018-2056



The spatial distribution of demographic attributes differs significantly across the five land use scenarios in 2056, representing diverging ways in which Victoria's urban structure may develop into the future. This distribution extends beyond differences in broad totals. Each also differs in age distribution, job allocation by industry as well as enrolments across primary, secondary, and tertiary students at a granular spatial level. All ultimately influence the transport behaviour that manifests during scenario testing.

Table 11 shows the adopted population, employment, and enrolment totals by FUA while Table 12 summarises the equivalent values relative to the 2018 *Base* scenario. Table 13 and Table 14 show the equivalent in terms of the metropolitan Melbourne and regional areas. Figure 26 shows the population and employment figures relative to the average across all 2056 scenarios for each FUA.

Figure 26 Relative population and employment by FUA

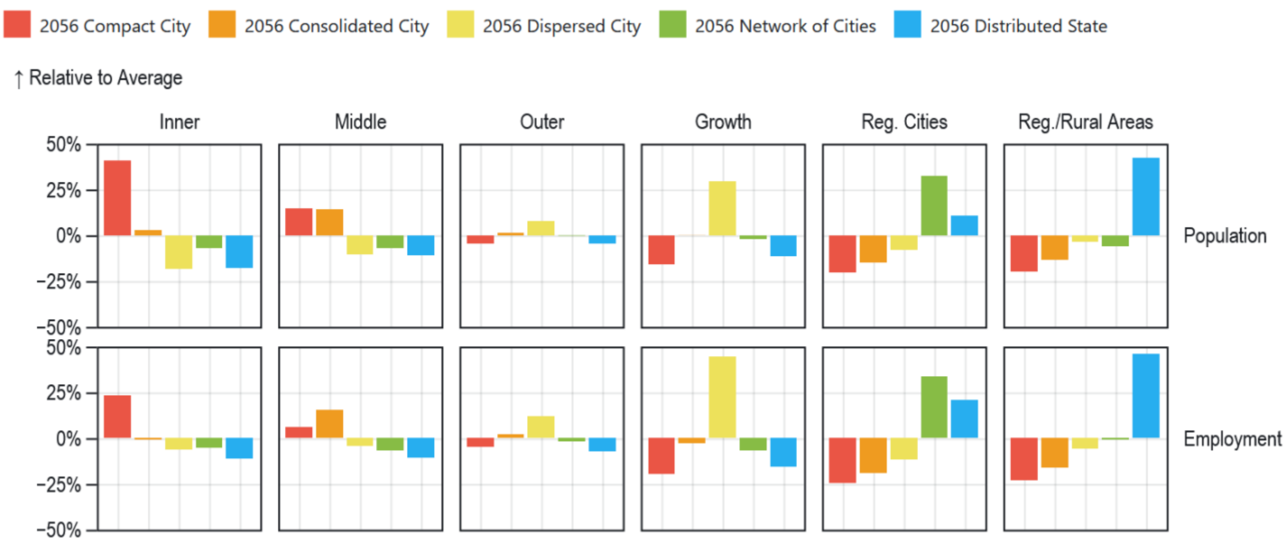


Table 11 2056 land use scenario statistics by FUA

FUA	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
Population						
Compact City	1,970,000	2,751,000	2,339,000	1,322,000	1,003,000	1,281,000
Consolidated City	1,436,000	2,733,000	2,475,000	1,569,000	1,073,000	1,379,000
Dispersed City	1,142,000	2,148,000	2,639,000	2,038,000	1,162,000	1,538,000
Network of Cities	1,297,000	2,228,000	2,438,000	1,535,000	1,668,000	1,500,000
Distributed State	1,145,000	2,130,000	2,335,000	1,390,000	1,398,000	2,268,000
Employment						
Compact City	1,688,000	1,478,000	1,150,000	208,000	473,000	501,000
Consolidated City	1,356,000	1,608,000	1,232,000	251,000	508,000	543,000
Dispersed City	1,280,000	1,329,000	1,351,000	374,000	554,000	610,000
Network of Cities	1,296,000	1,297,000	1,183,000	241,000	838,000	643,000
Distributed State	1,217,000	1,241,000	1,117,000	218,000	758,000	947,000
Education Enrolments						
Compact City	669,000	696,000	418,000	173,000	256,000	175,000
Consolidated City	621,000	675,000	438,000	195,000	273,000	186,000
Dispersed City	584,000	597,000	465,000	242,000	296,000	203,000
Network of Cities	578,000	596,000	422,000	191,000	398,000	201,000
Distributed State	554,000	573,000	403,000	181,000	388,000	289,000

Table 12 2056 land use scenario growth relative to 2018 by FUA

FUA	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
Population						
Compact City	+138%	+63%	+29%	+190%	+53%	+26%
Consolidated City	+74%	+62%	+36%	+244%	+64%	+36%
Dispersed City	+38%	+27%	+45%	+346%	+77%	+52%
Network of Cities	+57%	+32%	+34%	+236%	+154%	+48%
Distributed State	+39%	+26%	+29%	+204%	+113%	+124%
Employment						
Compact City	+83%	+101%	+50%	+122%	+39%	+28%
Consolidated City	+47%	+118%	+61%	+169%	+49%	+39%
Dispersed City	+39%	+80%	+77%	+300%	+63%	+56%
Network of Cities	+41%	+76%	+55%	+158%	+146%	+65%
Distributed State	+32%	+68%	+46%	+133%	+123%	+142%
Education Enrolments						
Compact City	+92%	+66%	+27%	+162%	+37%	+19%
Consolidated City	+78%	+61%	+33%	+195%	+46%	+26%
Dispersed City	+67%	+42%	+41%	+266%	+58%	+38%
Network of Cities	+66%	+42%	+28%	+189%	+113%	+37%
Distributed State	+59%	+36%	+22%	+173%	+107%	+97%

Table 13 2056 land use scenario statistics by area

Area	Metropolitan Melbourne	Regional Victoria	State-wide
	Population		
Compact City	8,382,000	2,284,000	10,666,000
Consolidated City	8,213,000	2,453,000	10,666,000
Dispersed City	7,967,000	2,700,000	10,666,000
Network of Cities	7,499,000	3,168,000	10,666,000
Distributed State	7,000,000	3,666,000	10,666,000
	Employment		
Compact City	4,524,000	974,000	5,498,000
Consolidated City	4,446,000	1,052,000	5,498,000
Dispersed City	4,334,000	1,164,000	5,498,000
Network of Cities	4,017,000	1,481,000	5,498,000
Distributed State	3,793,000	1,705,000	5,498,000
	Education Enrolments		
Compact City	1,956,000	432,000	2,388,000
Consolidated City	1,929,000	458,000	2,388,000
Dispersed City	1,888,000	499,000	2,388,000
Network of Cities	1,788,000	599,000	2,388,000
Distributed State	1,711,000	677,000	2,388,000

Table 14 2056 land use scenario growth relative to 2018 by area

Area	Metropolitan Melbourne	Regional Victoria	State-wide
	Population		
Compact City	+75%	+37%	+65%
Consolidated City	+71%	+47%	+65%
Dispersed City	+66%	+62%	+65%
Network of Cities	+57%	+90%	+65%
Distributed State	+46%	+119%	+65%
	Employment		
Compact City	+80%	+33%	+69%
Consolidated City	+77%	+44%	+69%
Dispersed City	+72%	+59%	+69%
Network of Cities	+60%	+103%	+69%
Distributed State	+51%	+133%	+69%
	Education Enrolments		
Compact City	+68%	+29%	+59%
Consolidated City	+66%	+37%	+59%
Dispersed City	+62%	+50%	+59%
Network of Cities	+53%	+80%	+59%
Distributed State	+47%	+103%	+59%

4.2 Infrastructure Assumptions

4.2.1 Overview

Unlike the approach adopted for the 2036 scenario tests (Section 3), it was assumed that each land use scenario in 2056 would be accompanied by its own transport network infrastructure pipeline. These infrastructure pipelines would reflect the unique pressures imposed by each of the land use distributions, which diverge more heavily from each other than their equivalents in 2036. The more distant timescale of these scenarios also increases the likelihood of differing infrastructure responses beyond what is currently being contemplated in government planning. This base infrastructure pipeline was still used as the initial basis for 2056 scenario testing. As described in Section 2.1, an iterative assessment process was adopted to modify these base infrastructure assumptions to better fit the needs imposed by each land use scenario. This used the following procedure:

1. **Network performance-driven modification**: Key network performance indicators were extracted from the scenario runs, including kilometres and hours travelled, crowding and congestion statistics, travel time statistics by origin-destination pair as well as mode share performance and public transport service patronage. This was used to evaluate and action the following items:

    a. **Infrastructure upgrade utilisation**: All transport network upgrades assumed by the base infrastructure pipeline between 2036 and 2056 were scrutinised against the extracted network performance indicators. This was used to define whether specific upgrades were over-utilised or under-utilised within each tested land use scenario. As an example, the 2056 *Compact City* scenario places the least population in outer and new growth areas of Melbourne compared to all other 2056 scenarios. This means that some assumed road upgrades in these areas are less used under these circumstances, leading to their removal. All assumed road network and public transport changes were evaluated using this lens of utilisation.

    b. **Region-based network performance**: In conjunction with the previous item, road and public transport network performance was also evaluated at a regional level to uncover areas displaying systematic over-supply or under-supply across the transport network. This was then used to define new road and public transport projects that didn't previously exist in the base infrastructure pipeline but would likely be required to facilitate a functioning transport network were the land use scenarios to eventuate in reality. Using the 2056 *Compact City* scenario as an example once again, the significantly higher density of population and jobs within inner Melbourne leads to severe crowding issues across the tram network with the unmodified base infrastructure assumptions. Uplifts in tram frequencies and vehicle capacities were implemented in reaction to this land use scenario.

2. **Qualitative additions**: Infrastructure Victoria worked closely with the modelling team to define further changes to the base infrastructure pipeline to better align each scenario's transport network with the character of each land use scenario. This covered items that would otherwise not arise through the purely quantitative exercise described in task 1. As an example of this, several scenarios involved implementation of entirely new metropolitan rail links, dedicated bus corridors and tram network extensions. These changes were intended to represent the fact that each land use scenario would likely be accompanied by differing transport network upgrades, with some emphasising particular parts of the network much more heavily than others.

The network performance-driven modifications were conducted in a manner that aimed to approximately equalise the experience of crowding and congestion between the five scenarios. This objective was not driven by concrete metrics – it was not actually possible to equalise these as the demographic differences between scenarios are so great in certain areas that network performance is going to differ no matter how much infrastructure is provided in 2056. Instead, this was used as a guiding principle to determine how much infrastructure uplift was required for specific regions of Victoria, taking into consideration practical and physical implementation constraints.

These changes were then balanced with the additional infrastructure modifications led by Infrastructure Victoria to reflect the likely priorities of each land use scenario. Both items 1 and 2 described above were repeated multiple times for each 2056 scenario, reflecting the fact that all of these changes interact with one another in complex and sometimes unintuitive ways. This chapter reflects the final outcomes of this process, with subsequent sections detailing a summary of each scenario's assumptions across each mode of transport.

4.2.2 Road Network

A majority of the road projects assumed by the base infrastructure pipeline were preserved across the five 2056 scenarios. Many of the upgrades and new roads that make up this pipeline are necessary to ensure large parts of the network remain functional no matter which land use scenario is tested. As shown in Section 4.1, the *Distributed State* scenario assumes the lowest level of population growth across the inner, middle, and outer Melbourne areas between 2018 and 2056 compared to all other scenarios. Even in this instance, the level of growth is still approximately 30% (see Table 12), representing a significant uplift in population and thus travel demand for the broader metropolitan area.

Figure 27 shows the individual changes in road supply as implemented across the five 2056 scenarios relative to the road supply in 2018. This is quantified in terms of lane kilometres – i.e., if a road is two kilometres long and has two lanes of traffic, that road would represent 4 lane kilometres of network. Figure 28 shows this change in lane kilometres by LGA, filtering out LGAs that do not exhibit a difference of at least 15 lane kilometres across the scenarios tested. Differences in scenario assumptions are summarised as follows:

- **Compact City**: Less road infrastructure was assigned to this scenario compared to all other scenarios. This was primarily driven by the fact that it exhibits less population and jobs across outer and new growth areas. When conducting utilisation analysis, this demographic distribution meant that certain upgrades slated for those regions were heavily underutilised and in certain circumstances not used at all. Such projects were removed from this scenario as it is unlikely they would proceed in reality given this pattern of growth. Other key changes included:
  - Removal of the proposed E6 transport corridor in Melbourne's north. As discussed, the lower population density within the outer northern Melbourne suburbs obviated the need for this project, with the surrounding network functioning well despite its absence[3].
  - Implementation of unbroken tram and bus priority along key corridors at the expense of a lane of traffic within the inner and middle suburbs, including along Clarendon Street and Johnston Street as examples. This led to increased road congestion along these routes, but the intervention was justified given the higher population density and thus higher demand for public transport services in these areas.
- **Consolidated City**: A key focus of this scenario was enabling better public transport connectivity throughout the inner, middle, and outer suburbs of Melbourne. From a road network perspective, this involved providing instances of unbroken tram and bus priority throughout the metropolitan area. For example, in addition to the bus priority measures present in inner Melbourne for the *Compact City* scenario, the *Consolidated City* scenario also incorporated priority along key corridors such as Springvale Road, Cooper Street and Bell Street. It also incorporated tram priority measures for routes servicing the Sunshine and Latrobe National Employment and Innovation Clusters[4] (NEICs) and Suburban Rail Loop stations, rather than in inner suburbs as seen in the *Compact City* scenario.
- **Dispersed City**: This scenario is characterised by large amounts of urban sprawl surrounding Melbourne, with the outer and new growth areas maintaining a higher population than the other land use scenarios. Because of this, there is a greater need for upgraded and new road infrastructure in these regions (particularly the new growth areas) to ensure that the road network stays functional by 2056. As such, this scenario was assigned the largest supply of road infrastructure in new growth areas to accommodate the assumed population and employment density.
- **Network of Cities**: The increased density of population and jobs across key regional cities such as Ballarat, Bendigo and Geelong necessitated a range of new regional road upgrades that were not previously considered in the base infrastructure pipeline. Without these interventions, the road network surrounding these cities would likely fail to function in their current state as they try to accommodate over 600,000 more residents compared to the other scenarios. Routes intersecting with and parallel to the Princes

[3] It is worth noting that the 2036 testing included early stages of this project given the use of the base infrastructure pipeline. Had the iterative infrastructure testing approach been adopted for 2036, it is likely this project would have been excluded. For the purposes of infrastructure cost estimation, the *Compact City* scenario does not include the E6 as well.

[4] NEICs are locations throughout Victoria which are aimed to be developed as places with a concentration of linked businesses and institutions providing a major contribution the Victorian economy, with excelled transport links and potential to accommodate significant future growth in jobs and in some instances housing. These locations include East Werribee, Dandenong South, Latrobe, Monash, Parkville, Fishermans Bend and Sunshine.

Highway south of Geelong's CBD were particularly susceptible to this, requiring localised increases in road supply.

- **Distributed State**: Whilst not as significant as the *Network of Cities* scenario, the *Distributed State* scenario was also associated with large population increases within regional cities. As such, the same road interventions were applied to this scenario. No specific road interventions were made in relation to increased density of residents in rural areas as the existing assumed road network absorbed this demand.

Figure 27 Change in lane kilometres between 2018 and 2056 by FUA

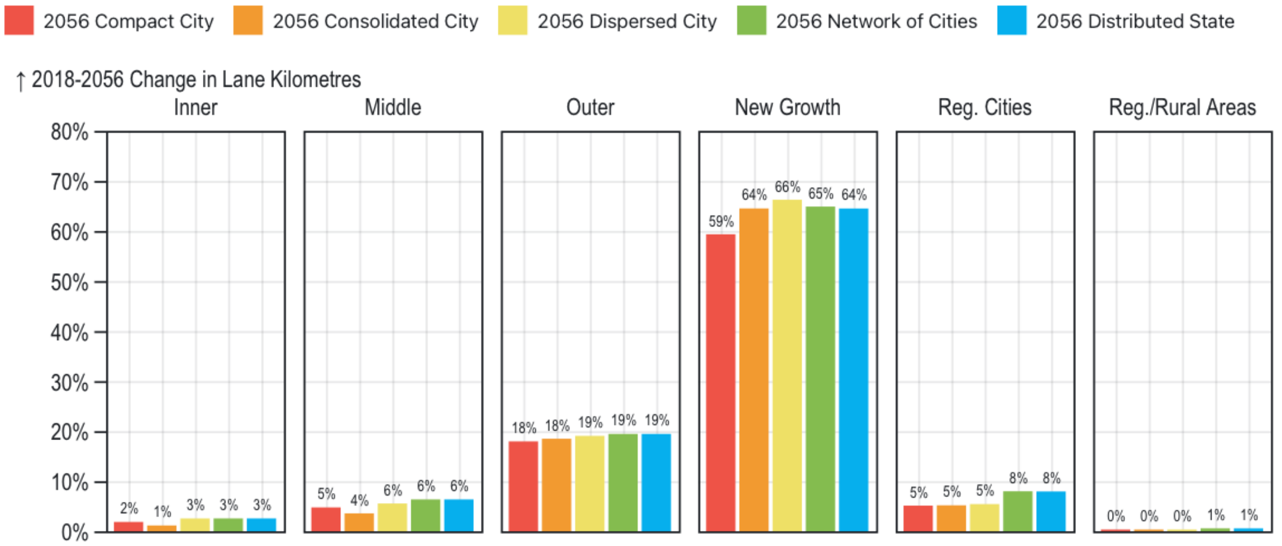
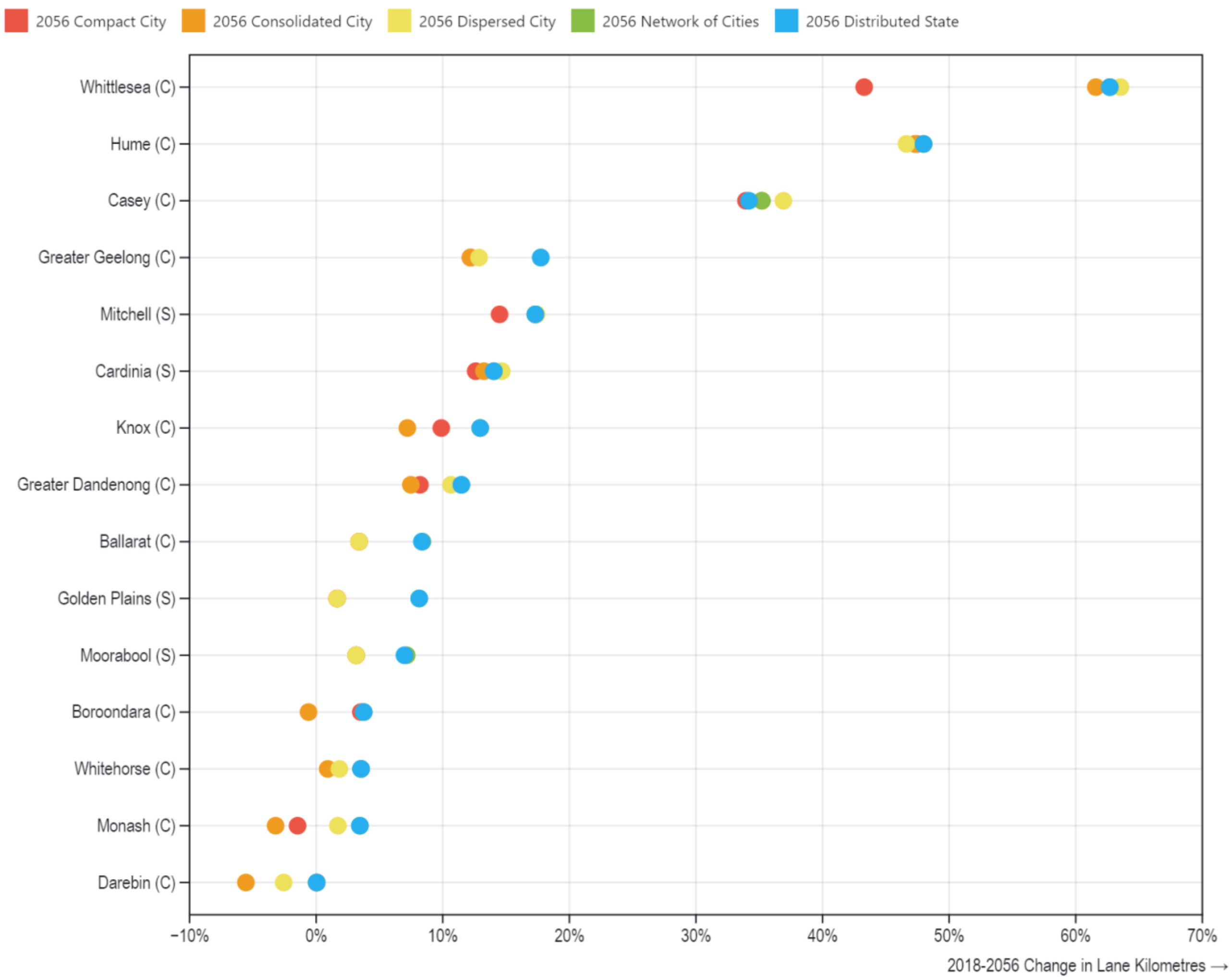


Figure 28 Change in lane kilometres between 2018 and 2056 by LGA



4.2.3 Metropolitan Train

As was the case with the 2036 scenarios, the base infrastructure metropolitan train network offers a proportionally high level of supply compared to the population and employment growth that occurs between 2018 and 2056. Due to this, most changes made to these assumptions were concerned with offering connectivity to parts of Melbourne that trains currently do not reach. Figure 29 shows the implemented morning peak service kilometres for the metropolitan train service across the five 2056 scenarios, including the 2018 *Base* scenario for comparison. Differences in scenario assumptions are summarised as follows:

- **Compact City**: Minimal changes were made to the base infrastructure pipeline metropolitan train assumptions.
- **Consolidated City**: To support greater population and employment growth within the inner and middle areas of Melbourne, the Alamein train line was extended to Oakleigh via Chadstone and East Malvern Station. The aim of this was to offer a direct rail to key activity centre connections that previously did not exist.
- **Dispersed City**: Multiple new rail services were conceptualised to support the land use growth story present in this scenario:
  - The Sunbury metropolitan rail line was extended to Sunbury North with higher frequency services offered along this segment in response.
  - A new rail track was implemented between Watergardens Stations and Melton Central (High St) with multiple intermediate stations. This new line would service large pockets of population growth along its alignment that would otherwise only have access to the road network and a scattering of bus services.
  - A new rail line was implemented extending from Lalor to Wollert, allowing an even distribution of services to either Mernda or Wollert.
- **Network of Cities** and **Distributed State**: Both scenarios demonstrate fairly similar demographic assumptions within the range of the metropolitan rail network and were treated consistently. Changes included:
  - Reducing the scope of the Western Rail Tunnel project as implemented in all other scenarios such that services terminated at Parkville without continuing to Clifton Hill. With lower population densities present in the middle and outer northern suburbs of Melbourne, the drop in metropolitan rail capacity resulting from this change is absorbed by the rest of the train network.
  - Less frequent Suburban Rail Loop services compared to the other scenarios.

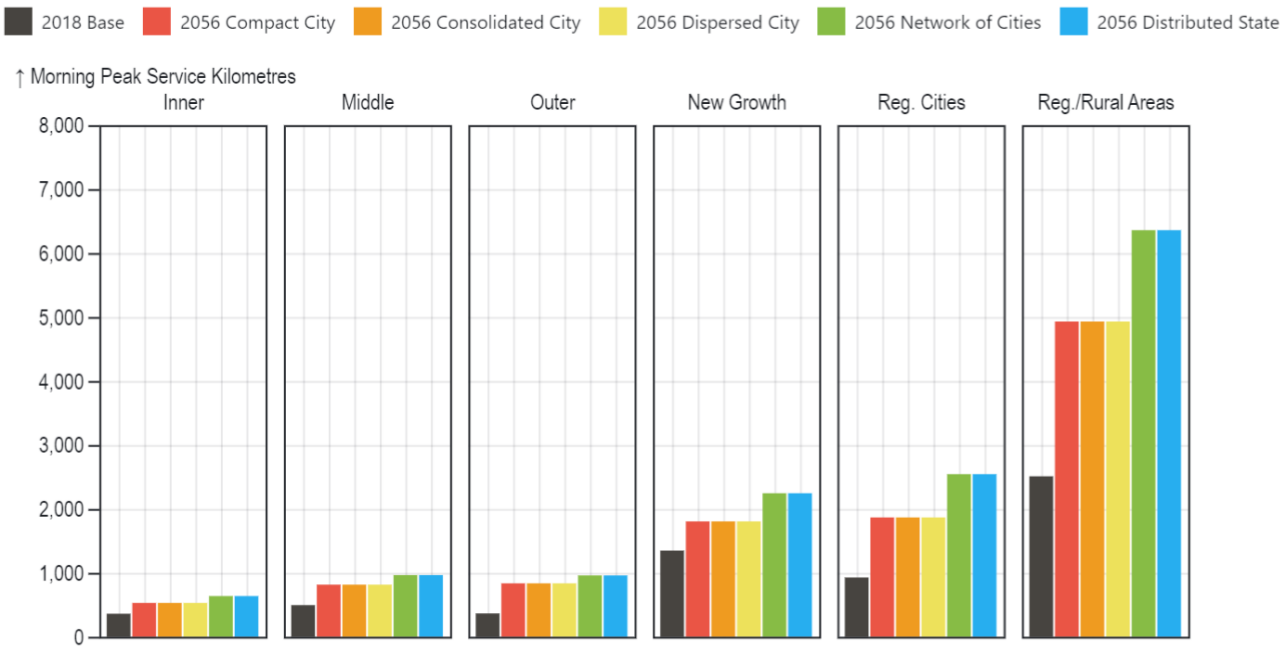
Figure 29 Metropolitan train morning peak service kilometres by FUA in 2056

4.2.4 V/Line

V/Line services predominantly serve as a means for travellers to journey between regional cities as well as the Melbourne CBD. Given their specific purpose, changes made to their base infrastructure pipeline representation were applied consistently when considering the 'Melbourne-based' scenarios (i.e., *Compact City*, *Consolidated City*, and *Dispersed City*) and the 'regional' scenarios (i.e., *Network of Cities*, *Dispersed State*).

- **Melbourne-based scenarios**: Lower concentrations of population, employment, and other opportunities in regional cities as well as regional and rural areas under these scenarios compared to the regional scenarios reduced demand for V/Line services. In response, vehicle capacity upgrades assumed within the base infrastructure pipeline on certain lines were removed in the case that this would not result in any greater degree of crowding than that already experienced.
- **Regional scenarios**: The increased density of residents and jobs within the regional cities and surrounding areas greatly increases demand for V/Line services across the *Network of Cities* and *Dispersed State* scenarios (upwards of 30% greater passenger hours travelled compared to the Melbourne-based scenarios). In contrast to the modifications made for the Melbourne-based scenarios, this involved:
  - More widespread upgrading of V/Line rolling stock to increase passenger-carrying capacity across most lines to alleviate crowding bottlenecks compared to the Melbourne-based scenarios.
  - Additional V/Line services to Colac and Warrnambool.
  - A new rail extension from Geelong Station south to Torquay, with two intermediate stations servicing Armstrong Creek. These areas receive particularly high levels of population growth across both the *Network of Cities* and *Distributed State* scenarios.
  - An approximate 20% increase in the frequency of all Ballarat, Geelong, Bendigo, and Seymour services across all modelled time periods (totalling 100 additional services a day). This was implemented to combat emergent crowding on these services, as well as to improve general public transport accessibility through shorter journey waiting times and associated delays.

Figure 30 V/Line morning peak service kilometres by FUA in 2056

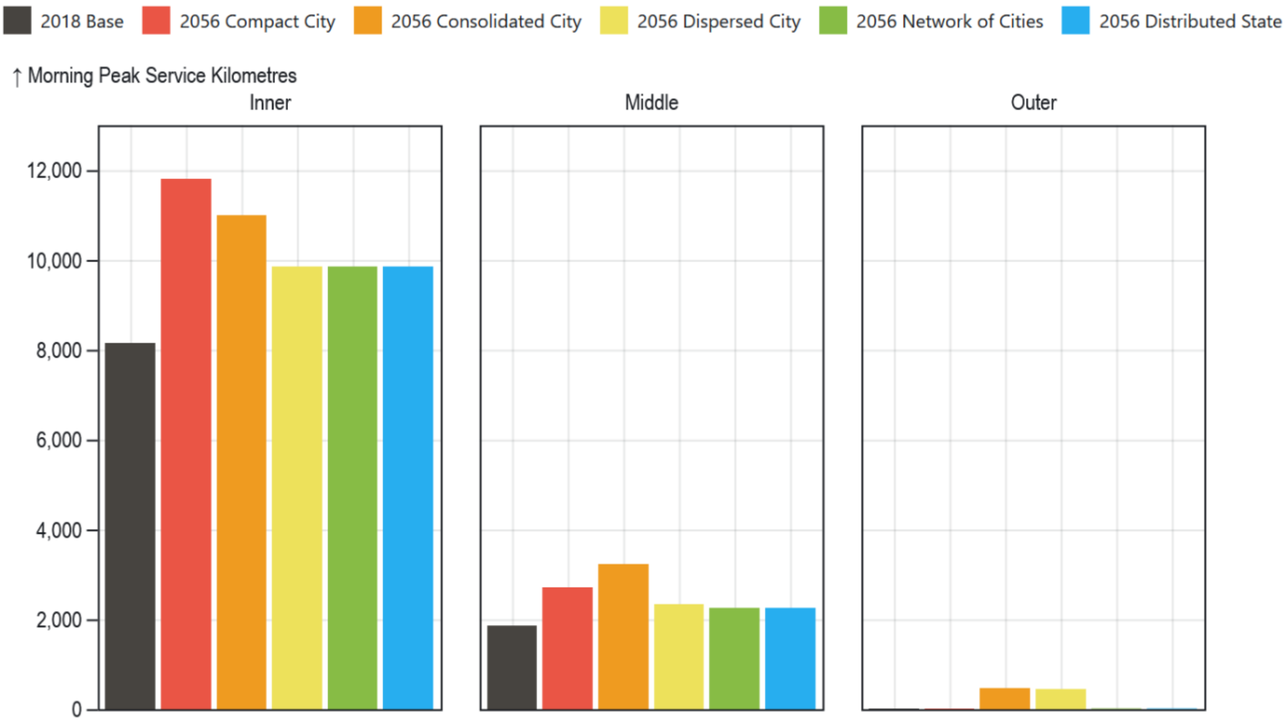


4.2.5 Tram

The implemented representation of the tram network was not modified from the base infrastructure pipeline assumptions for the *Network of Cities* and *Distributed State* scenarios. Despite these scenarios exhibiting the lowest population and employment densities within inner Melbourne across all scenarios tested, there is still a large demand for tram services and the existing implementation serviced this demand well. For the three Melbourne-based scenarios, tram routes that were seen to experience significant crowding had their vehicle capacities upgraded where practical. Other specific changes included:

- **Compact City**: This land use scenario resulted in such high demand across inner city tram services that a vast majority were operating above their capacity before implementing any modifications. This was combatted by increasing the frequency of all tram services that interacted with the CBD by 20% on top of any aforementioned vehicle capacity upgrades. Unbroken tram priority was also implemented across several routes as mentioned in Section 4.2.2, covering almost all lines that extend into the middle south-eastern suburbs of the city.
- **Consolidated City**: Services interacting with Suburban Rail Loop stations as well as the Latrobe and Sunshine NEICs had their frequencies uplifted by 20% in order to combat emergent crowding and to increase public transport accessibility within the middle suburbs of Melbourne. This was combined with vehicle capacity upgrades across the network as required. Several route extensions were also implemented as part of this scenario:
  - Sunshine to Highpoint.
  - Camberwell to Heidelberg.
  - West Preston to Reservoir Station.
  - Airport West to Melbourne Airport.
  - Vermont South to Bayswater.
- **Dispersed City**: A subset of the tram extensions from the Consolidated City scenario, covering Airport West to Melbourne Airport and Vermont South to Bayswater.

Figure 31 Tram morning peak service kilometres by FUA in 2056



4.2.6 Bus

Services levels on buses and coaches are typically planned for future years so that they do not experience passenger crowding. Given this, modifications to the bus network were driven by accessibility to public transport services rather than network performance metrics. Specifically, the number of bus service kilometres per resident was calculated by LGA across the five scenarios. This was used to audit whether specific LGAs were becoming particularly underserved by bus services across some of the land use scenarios, driving frequency changes for specific routes. After this initial pass, further specific modifications were made for the following scenarios:

- **Compact City**: A new elevated busway was implemented to completely separate the Eastern Freeway and Lonsdale Street bus services from Hoddle Street and Victoria Parade traffic, greatly increasing their average travel speeds (and reducing the number of passengers interchanging to trains at Victoria Park station). Additional changes included a 20% increase in frequency for all bus services interacting with Fishermans Bend, as well as several implementations of unbroken on-road bus priority corridors in the following locations (as mentioned in Section 4.2.2):
  - Johnston Street (Yarra River to Swanston Street).
  - Warrigal Road (High Street Road to Oakleigh Station).
  - Lower Dandenong Road (Dandenong to Caulfield).
  - Ferntree Gully Road (Burwood Highway to Dandenong Road).
- **Consolidated City**: This scenario also includes an implementation of the Hoddle Street elevated busway and on-road priority projects described for the *Compact City*. In addition, all bus routes servicing the Monash, La Trobe and Sunshine NEICs received a 20% frequency upgrade to facilitate better public transport accessibility. More on-road priority projects were also included:
  - Derrimut Road (Tarneit to Princes Highway).
  - Springvale Road (Nunawading Station to Nepean Highway).
  - Point Cook Road/Palmers Road (Williams Landing to Aviation Road).
  - Cooper Street (Roxburgh Park Station to Epping Station).
  - Bell Street (Sydney Road to Heidelberg).
- **Dispersed City**: Significant uplifts in the frequency (10 minutes during the peaks) of existing bus routes interacting with new growth areas of Melbourne were implemented, specifically for the Casey, Cardinia, Melton, Mitchell, Wyndham, Hume, and Whittlesea LGAs. In addition, more direct bus routes in these areas specifically servicing key activity centres were created. Also implemented were the bus route priority measures outlined for the *Consolidated City* scenario.
- **Network of Cities** and **Distributed State**: General upgrades to regional bus frequencies across the Geelong, Ballarat, and Bendigo areas as appropriate based on land use scenario outcomes.

Figure 32 Bus morning peak service kilometres by FUA in 2056

This has not exhaustively described all changes that were implemented across the five scenarios, which also included increases in off-peak service provision where appropriate and more frequent coach services connecting regional cities when this aligned with a specific land use scenario's intent. Specific changes were implemented for routes servicing connections between Anglesea and Geelong, Geelong and Ballarat, and Dandenong and Phillip Island/Inverloch. As example, services connecting these locations were reduced from 120 minutes to 40 minutes in the morning peak for the *Consolidated City* and *Dispersed City* scenarios and further to 20 minutes for the *Network of Cities* and *Distributed State* scenarios. Similar increases were applied to these services across the remainder of the day.

4.2.7 Other Parameters

In addition to direct transport infrastructure changes, each of the five land use scenarios incorporates unique changes to their active transport assumptions as well as parking charges. No other parameters were modified as part of this group of scenario tests, including public transport fares which were assumed to maintain their current structure into the future, noting this includes implementation of the regional fare cap introduced in early 2023.

Active Transport

The VITM does not explicitly model active transport behaviour (walking and cycling). However, a specific portion of all travel generated by the model is assumed to be undertaken via active transport means at the start of the simulation process and is removed before private vehicle and public transport journeys are created. This portioning is driven by a set of internal assumptions within the model informed by a combination of population and employment densities. Put simply, the VITM assumes that a greater share of active transport travel occurs when demographic densities within a region are higher.

As such, whilst no explicit active transport infrastructure assumptions have been made across the 2056 scenario tests, implicit differences in active transport uptake will be present in the final outcomes given the differing population densities observed across the land use scenarios. Appendix B shows these aforementioned densities as exhibited by each land use scenario. Such active transport parameters were applied in a similar manner for the 2036 scenarios.

Parking Charges

The VITM incorporates six different levels of parking charges for specific regions, reflecting the perceived and actual cost of parking a car in parts of the state. The default parking charge scheme was modified across the five tested scenarios to better reflect likely parking conditions under each land use scenario. Compared to the default scheme:

- **Compact City**: A broader area of levy 1 (the highest possible) parking charges across inner Melbourne.
- **Consolidated City**: The addition of suburban parking charges for central Sunshine.
- **Dispersed City**: No changes from the default scheme.
- **Network of Cities**: Greater coverage of regional parking charges across Geelong, Ballarat, and Bendigo.
- **Distributed State**: Greater coverage of regional parking charges across Geelong.

Appendix B provides maps showcasing the implementation of parking schemes across the land use scenarios.

4.2.8 Summary

Table 15 summarises the transport network supply assumptions implemented across all modes as a consequence of implementing the methodology outlined in Section 4.2.1. More detailed specifications of all changes made are available in Appendix B, which more exhaustively describes individual modifications implemented across the five 2056 scenario tests.

Table 15 Transport network assumption summary for 2056 scenarios

Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Road Network					
Lane Kilometres	106,850	106,690	106,950	107,310	107,300
Public Transport Morning Peak Service Kilometres					
Metropolitan Train	193,750	194,580	195,700	181,380	181,190
V/Line	70,550	69,710	69,710	86,910	86,910
Tram	93,830	94,730	81,740	78,510	78,510
Bus	776,760	799,090	898,940	808,800	812,350
Coach	5,800	15,300	15,300	25,300	25,300
Other Parameters					
Active Transport	Taken into consideration at the land use level.				
Parking Charges	Scenario-specific assumptions implemented.				

4.3 Scenario Outcomes

4.3.1 Travel Patterns

Public transport mode share is expected to grow over time. Figure 33 shows modelled public transport mode share across 2018, 2036 and 2056 for each VITM time period. Mode share values for 2036 and 2056 in this figure represent averages of all five land use scenarios. This increase can be attributed to two factors:

- The absolute supply of public transport is expected to increase faster than population growth at a state-wide level over time.
- As the population grows, an increasing proportion of people live within inner and middle Melbourne which are particularly amenable to daily public transport travel.

Figure 33 Public transport mode share by year and time period

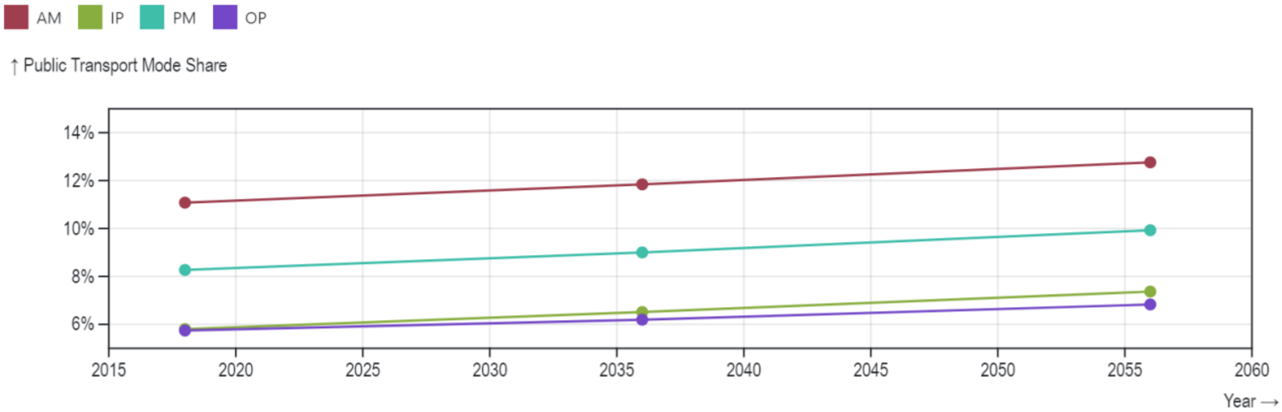


Table 16 summarises state-wide totals of generated trips for private vehicle and public transport, along with mode share. Compared to the equivalent outcomes shown for the 2036 tests (Table 7), the 2056 outcomes display a much greater variance in public transport mode share. There is a difference of over 150,000 public transport trips during the morning peak between the scenario with the most public transport use (*Compact City*) and the least public transport use (*Distributed State*) and around a 250,000 reduction in private vehicle trips between these same two scenarios in the morning peak.

As was the case with the 2036 outcomes, this can be attributed partially to the fact that the *Compact City* scenario places more of the population in locations where public transport accessibility is high, naturally resulting in greater use. An additional contributor to this in 2056 is the additional inner-city public transport supply that has been provided in the *Compact City* scenario such as the tram capacity upgrades. Whilst the other scenarios also received their own unique public transport treatments, the *Compact City's* interventions are heavily used because of their centrality.

Table 16 State-wide trip and mode share summary for 2056

Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
AM Period					
Private Vehicle Trips	4,059,000	4,199,000	4,291,000	4,265,000	4,307,000
Public Transport Trips	715,000	651,000	590,000	583,000	549,000
Public Transport Mode Share	15.0%	13.4%	12.1%	12.0%	11.3%
IP Period					
Private Vehicle Trips	10,171,000	10,579,000	10,845,000	10,763,000	10,887,000
Public Transport Trips	1,023,000	893,000	784,000	791,000	736,000
Public Transport Mode Share	9.1%	7.8%	6.7%	6.8%	6.3%
Daily					
Private Vehicle Trips	29,651,000	30,820,000	31,576,000	31,355,000	31,713,000
Public Transport Trips	3,493,000	3,097,000	2,757,000	2,758,000	2,577,000
Public Transport Mode Share	10.5%	9.1%	8.0%	8.1%	7.5%

Table 17 shows the equivalent daily trips and mode share but with active transport included. As explained in Section 3.3.1 and Appendix B, the VITM does not simulate active transport trips. Instead, a portion of active transport travel is assumed to occur based on the density of multiple land use attributes across regions. These trips are a fixed proportion when VITM then models private vehicle and public transport travel based on time, infrastructure, services and costs.

Similar to 2036, it can be seen that the *Compact City* scenario is associated with the greatest levels of active transport use compared to all other scenarios, followed by the *Consolidated City* scenario. This reflects the high density of population and jobs within inner and middle Melbourne within these scenarios, where active transport is expected to occur the most.

Table 17 State-wide trip and mode share including active transport for 2056

Metric	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Absolute Values					
Private Vehicle Trips	29,651,000	30,820,000	31,576,000	31,355,000	31,713,000
Public Transport Trips	3,493,000	3,097,000	2,757,000	2,758,000	2,577,000
Active Transport Trips	6,491,000	5,830,000	5,450,000	5,622,000	5,452,000
Proportions					
Private Vehicle Trips	74.8%	77.5%	79.4%	78.9%	79.8%
Public Transport Trips	8.8%	7.8%	6.9%	6.9%	6.5%
Active Transport Trips	16.4%	14.7%	13.7%	14.1%	13.7%

Figure 34 and Figure 35 show this effect spatially, comparing morning peak passenger volumes in the *Dispersed City* scenario to the *Compact City* and *Consolidated City* respectively. Despite the fact that both the *Compact City* and *Consolidated City* scenarios assume similar population levels within middle and outer Melbourne, the uptake of public transport use in the *Compact City* scenario is much more pronounced.

Figure 34 Morning peak passenger difference between Dispersed City and Compact City in 2056

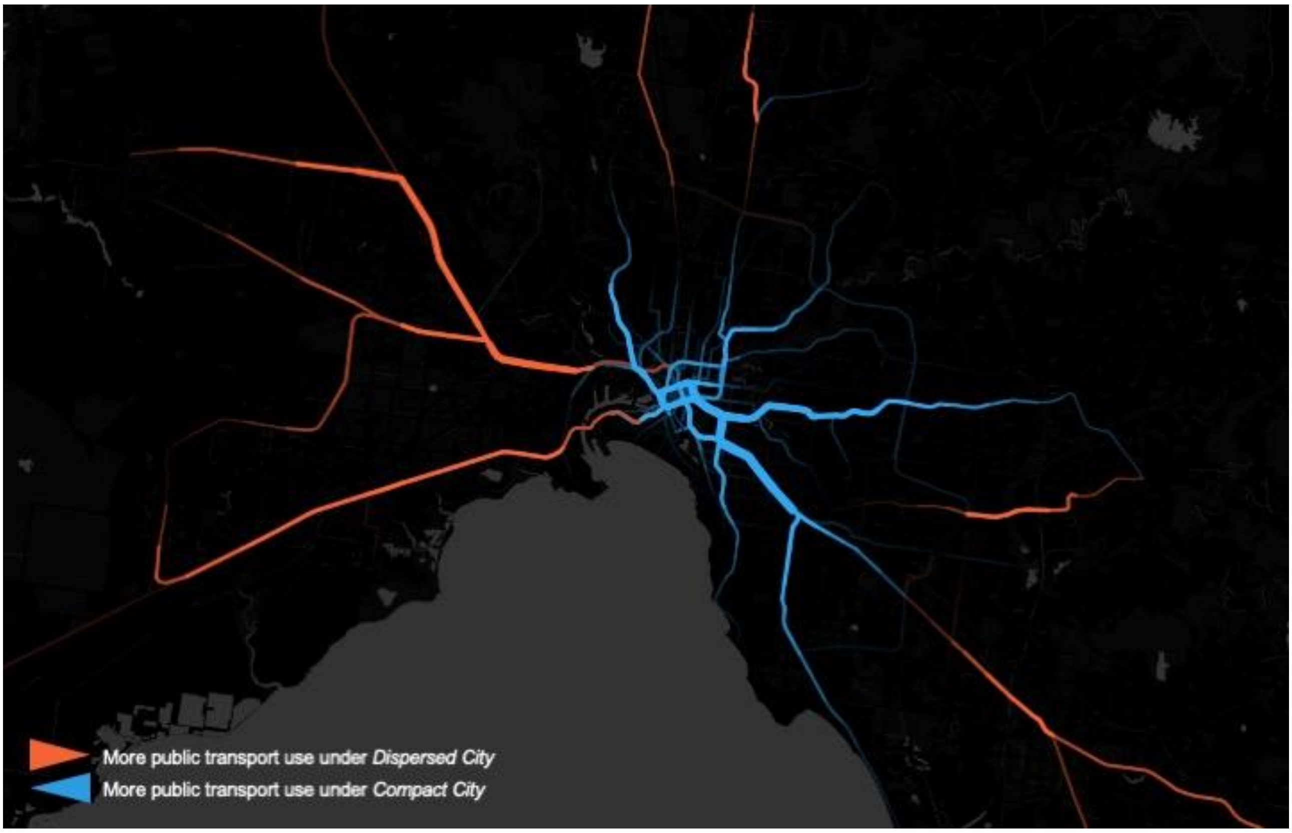


Figure 35 Morning peak passenger difference between Dispersed City and Consolidated City in 2056

Both Figure 36 and Figure 37 characterise private vehicle and public transport travel in terms of kilometres travelled for the morning peak and inter-peak periods respectively. As was the case for the equivalent 2036 analysis (see Figure 12), passenger kilometres travelled represents a significant portion of all travel that occurs within the inner and middle Melbourne areas. These proportions are higher than the corresponding trip-based public transport mode share values discussed previously (Table 16). This is because there is a higher likelihood that any given public transport journey will interact with the inner and middle Melbourne areas regardless of origin. For example, a large portion of public transport trips originating from new growth areas would terminate within the CBD during the morning peak. This increases the share of passenger kilometres travelled for the inner Melbourne areas beyond just those trips originating from inner Melbourne.

The inter-peak period is associated with a higher portion of vehicle kilometres travelled compared to the morning peak, reflecting the fact that the road network becomes more competitive as peak congestion subsides.

Figure 36 Morning peak vehicle and passenger kilometres travelled by FUA in 2056

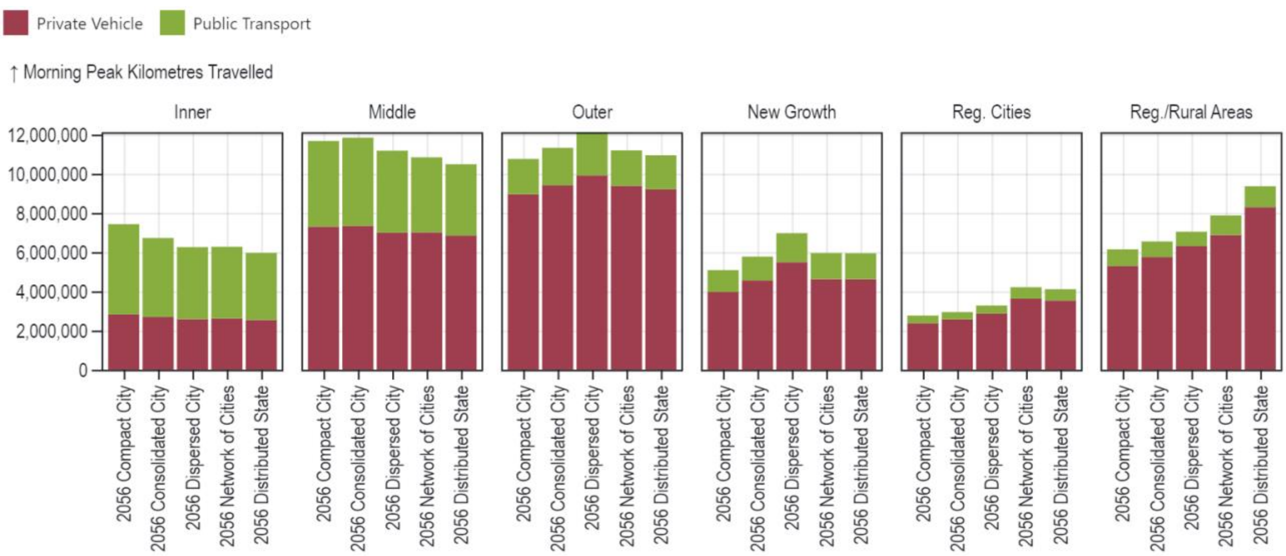
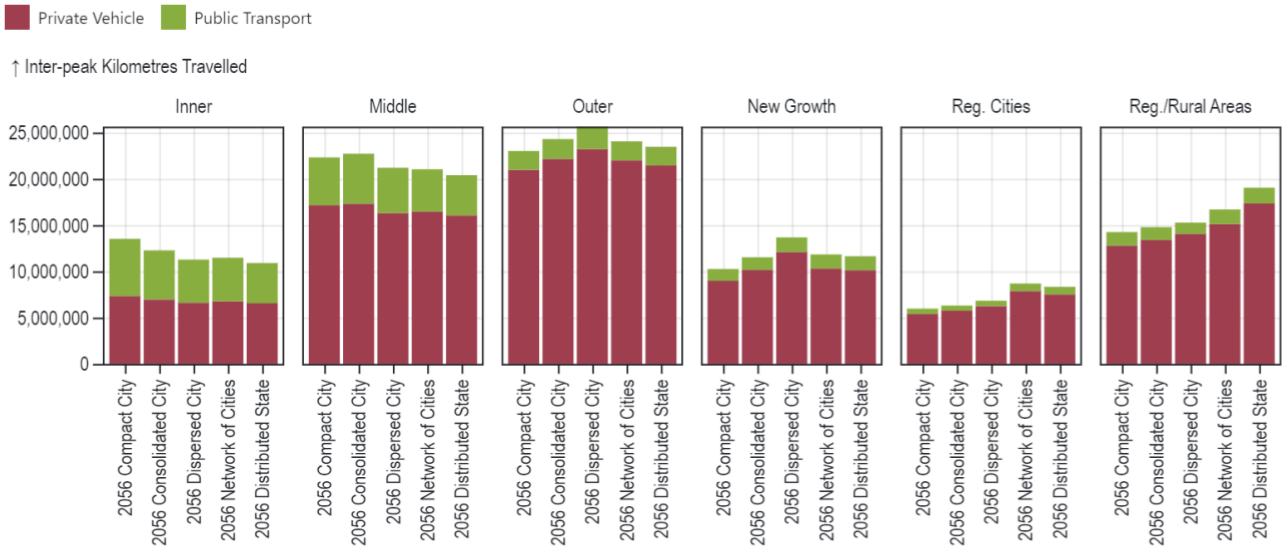


Figure 37 Inter-peak vehicle and passenger kilometres travelled by FUA in 2056



All additional metropolitan train, regional train and tram infrastructure assumptions incorporated into each land use scenario (as described in Section 4.2) were well-utilised. Despite this, we see the same pattern of mode share differences across the scenarios in 2056 as it was in 2036. Figure 38 shows this, summarising public transport mode share by FUA during the morning peak. Public transport mode shares are very stable across each land use scenario at the FUA level, despite significant changes in public transport service provision and underlying demographic assumptions across the tested scenarios. The 2056 *Compact City* scenario exhibits the highest public transport mode share within the inner and middle Melbourne areas.

Figure 38 Morning peak public transport mode share by FUA in 2056

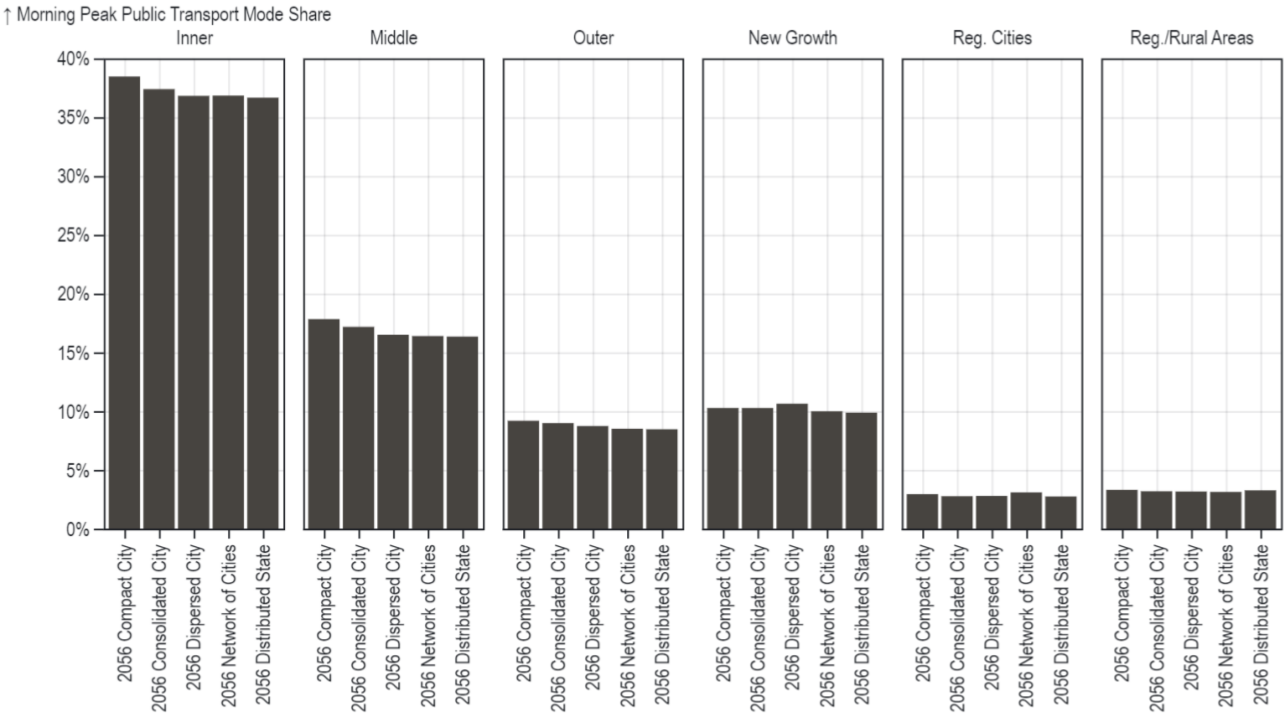


Figure 39 shows the same morning peak mode share statistics as Figure 38 but aggregated to the metropolitan Melbourne and regional areas. This more directly highlights the variance in metropolitan Melbourne public transport mode shares, which range from 15% (*Dispersed City*) to 18% (*Compact City*). In contrast, regional area public transport mode share does not perceptibly change across the tested land use scenarios in 2056.

Figure 39 Morning peak public transport mode share by area in 2056

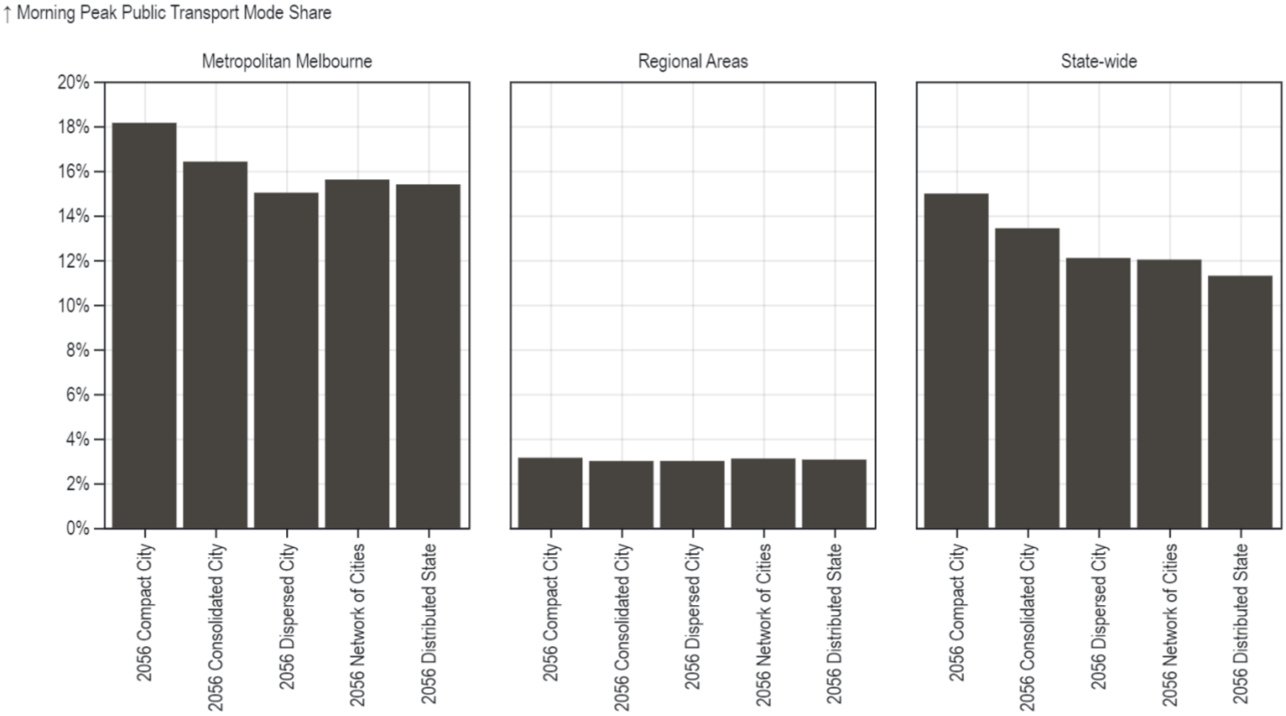
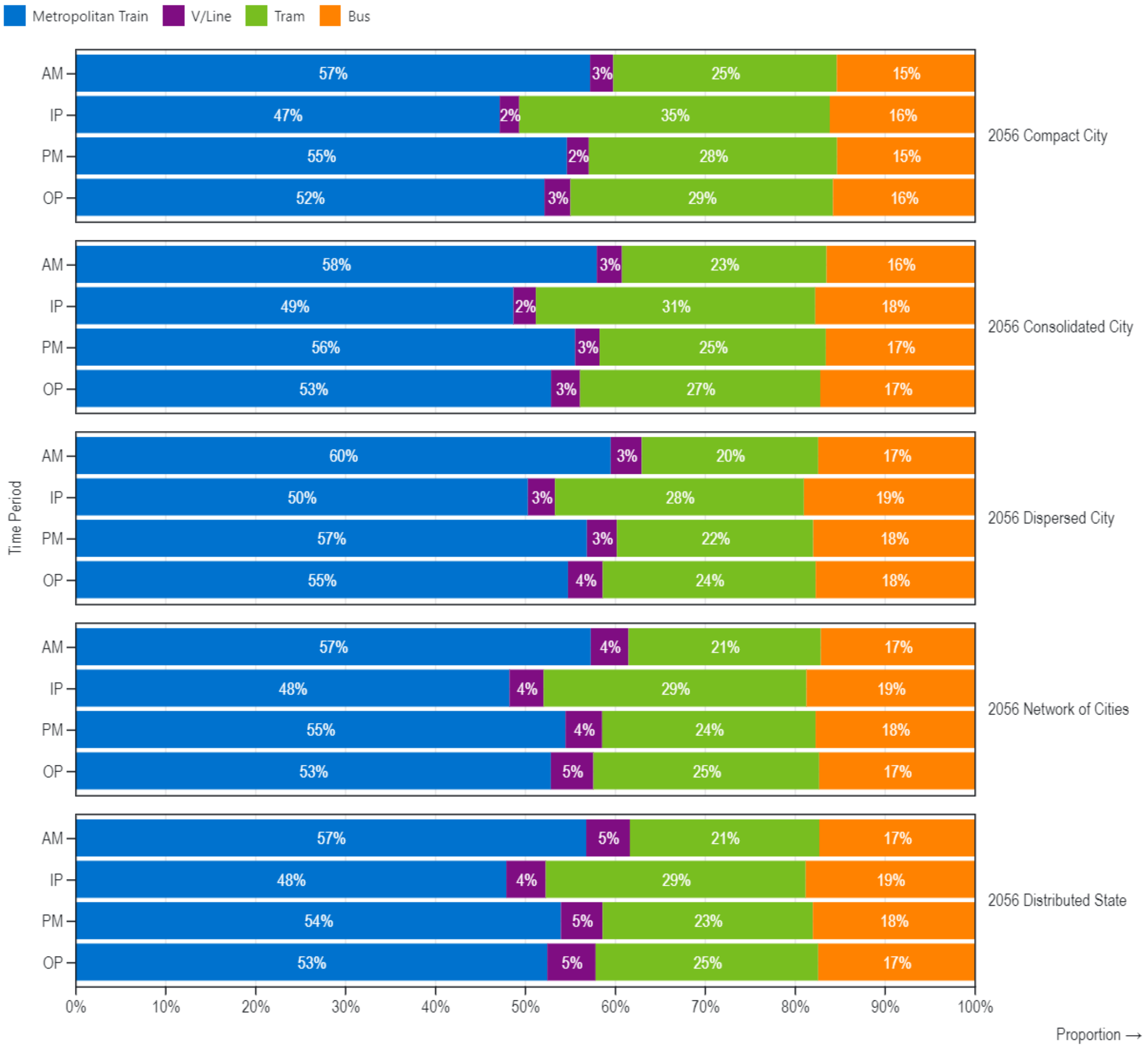


Figure 40 shows total state-wide morning peak boardings by mode in 2056. Usage patterns of each mode reflect the broad trends in public transport mode share already discussed. Metropolitan train use decreases when moving through the land use scenarios from *Compact City* to *Distributed State* in order. Tram and bus use also follow this pattern, albeit with less variation across the scenarios. V/Line boardings increase as more population is distributed within the regional areas, with the *Distributed State* scenario having the highest.

Figure 40 State-wide morning peak boardings by mode in 2056

Figure 41 shows the proportion of these boardings across modes by modelled time period. Proportional bus use is slightly higher with the *Dispersed City*, *Distributed State* and *Network of Cities* scenarios compared to the *Compact City* and *Consolidated City* scenarios. The inter-peak period sees much higher use of trams compared to all other periods across all scenarios, reflecting its importance as a means of traversing Melbourne's CBD during this time. Overall, pattern of use across public transport modes is relatively stable across time periods with the land use scenarios tested.

Figure 41 State-wide proportion of boardings by mode and time period in 2056



4.3.2 Network Impacts

Congestion levels resulting from the five 2056 scenarios were observed to be more varied than their 2036 equivalents. This is to be expected – the population and employment densities associated with the 2056 land use scenarios are significantly higher than their 2036 equivalents (growing approximately 70% since 2018), but the corresponding growth in road supply is relatively small in comparison, especially within the core metropolitan area (see Figure 27).

Figure 42 summarises the amount of morning peak congested hours travelled as a proportion of all hours travelled by FUA in 2056 (including the 2018 Base outcomes as a comparison). The new growth areas and regional cities immediately stand out as areas sensitive to increased density. When faced with the denser land use assumptions associated with the *Dispersed City*, *Network of Cities*, and *Distributed State* scenarios, congestion levels rise heavily – indicating the networks in these areas are reaching their saturation point. It is notable that even the *Dispersed City* scenario induces this effect within regional cities. This occurs because this scenario assumes higher levels of population and employment density in Geelong compared to the *Compact City* and *Consolidated City* scenarios, resulting in greater levels of local congestion.

Figure 42 Morning peak road congested travel as a proportion of all hours travelled by FUA in 2056

Figure 43 shows this same congested hour statistic but in absolute terms rather than proportional terms, highlighting the total experienced duration of congestion in aggregate across the population. It can be immediately seen that the *Dispersed City* scenario is associated with the highest levels of absolute congested hours travelled due to the large allocation of population within the outer and new growth areas compared to other scenarios.

Figure 43 Absolute morning peak road congested hours travelled by FUA in 2056

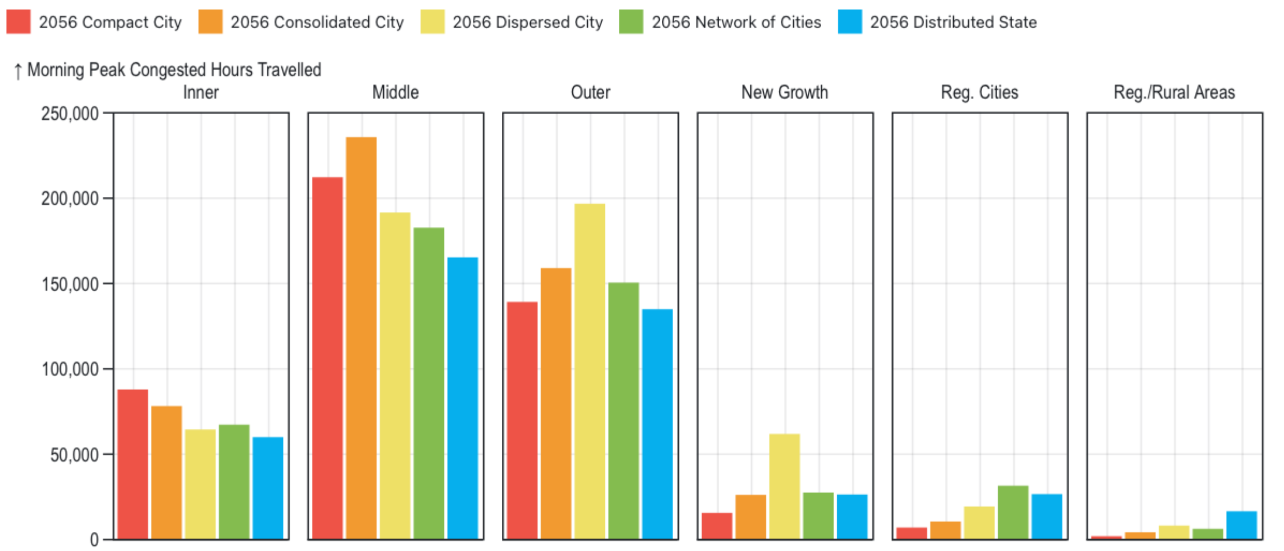
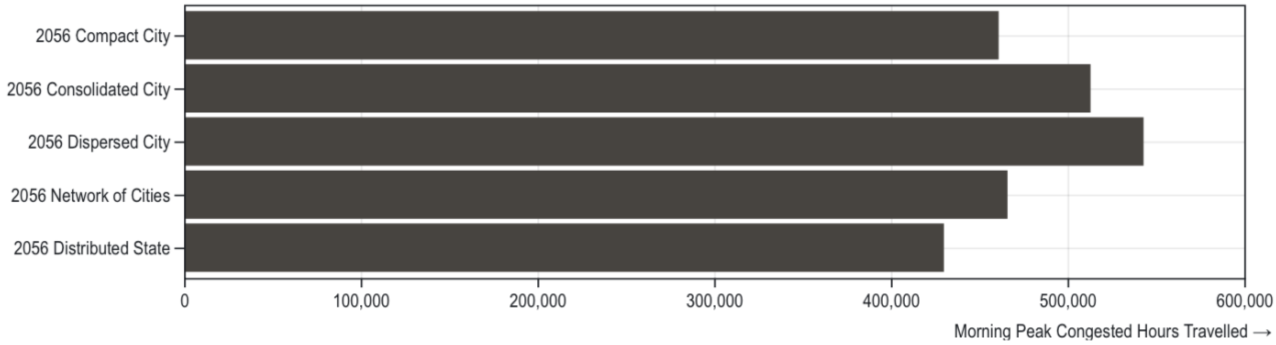


Figure 44 shows this observation more directly, summarising absolute congested hours travelled at the state-wide level. When displayed in this manner, it can be seen that the *Dispersed City* scenario exhibits the highest levels of global congestion across Victoria by a large margin – 30,000 hours more during the morning peak compared to the next highest scenario. The *Network of Cities*, *Consolidated City* and *Distributed State* scenarios perform similarly, followed by the *Compact City* with the lowest global level of congested hours travelled.

Figure 44 State-wide absolute morning peak congested hours travelled on roads in 2056



The difference in congested hours travelled between the *Dispersed City* scenario and the *Compact City* scenario approaches almost 82,000 hours. This is not to say that the latter universally provides a better driving experience. The increased density of population, jobs and other opportunities within inner Melbourne is associated with higher levels of congestion than in all other scenarios tested. As will be shown in proceeding material (Figure 49), this does result in materially lower average journey speeds. However, this effect is concentrated in a dense, but relatively small area. In contrast, the congestion associated with the *Dispersed City* scenario is spatially vast, affecting large parts of Melbourne and its surroundings.

Figure 45 compares the proportion of congested hours travelled spatially by LGA between the *Dispersed City* and *Compact City* scenarios in 2056 during the morning peak. Figure 46 and Figure 47 show further examples of congestion comparison at the individual road level between pairs of scenarios, highlighting the spatial differences in congestion arising primarily from the differing distributions of land use attributes.

Figure 45 Change in proportion of morning peak congested hours on roads, Dispersed City vs. Compact City in 2056 by LGA

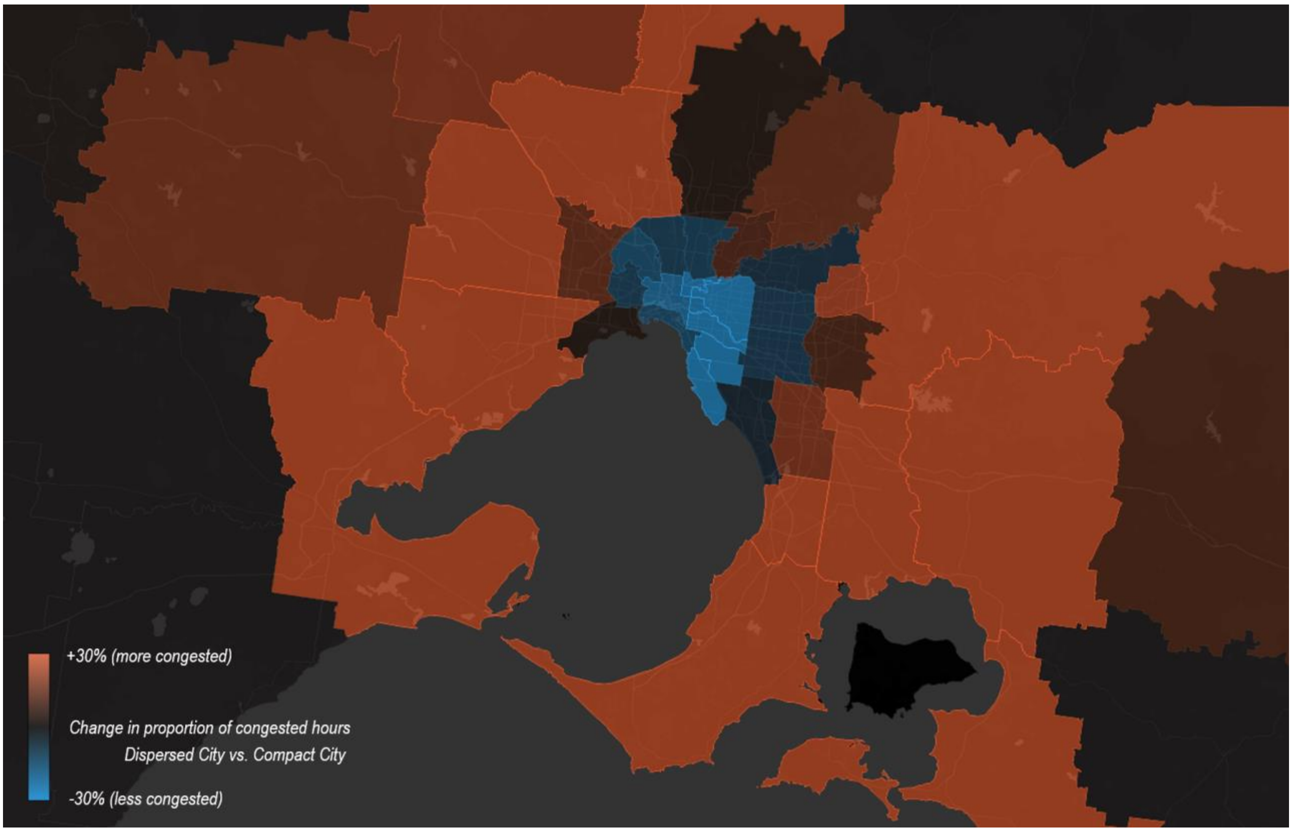


Figure 46 Change in morning peak road volume/capacity ratio, Dispersed City vs. Consolidated City in 2056

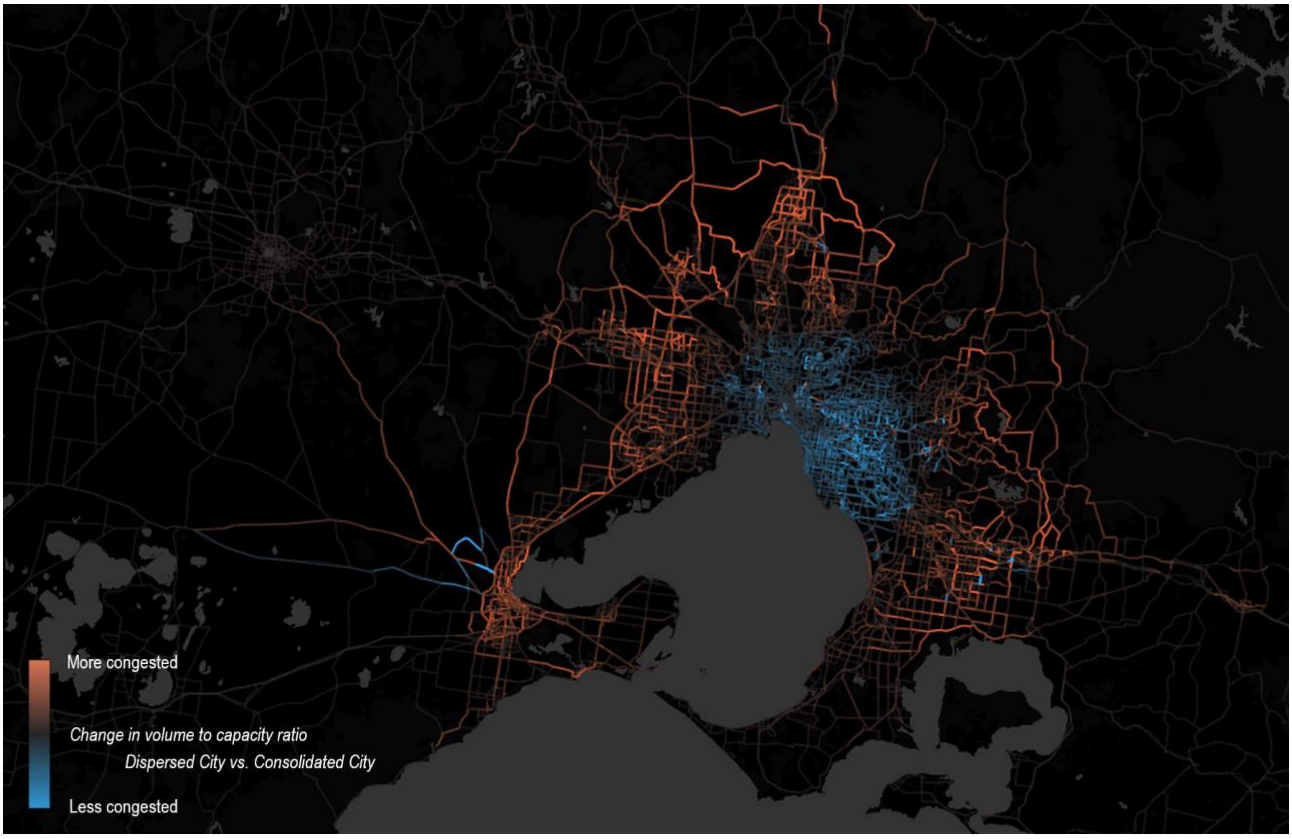
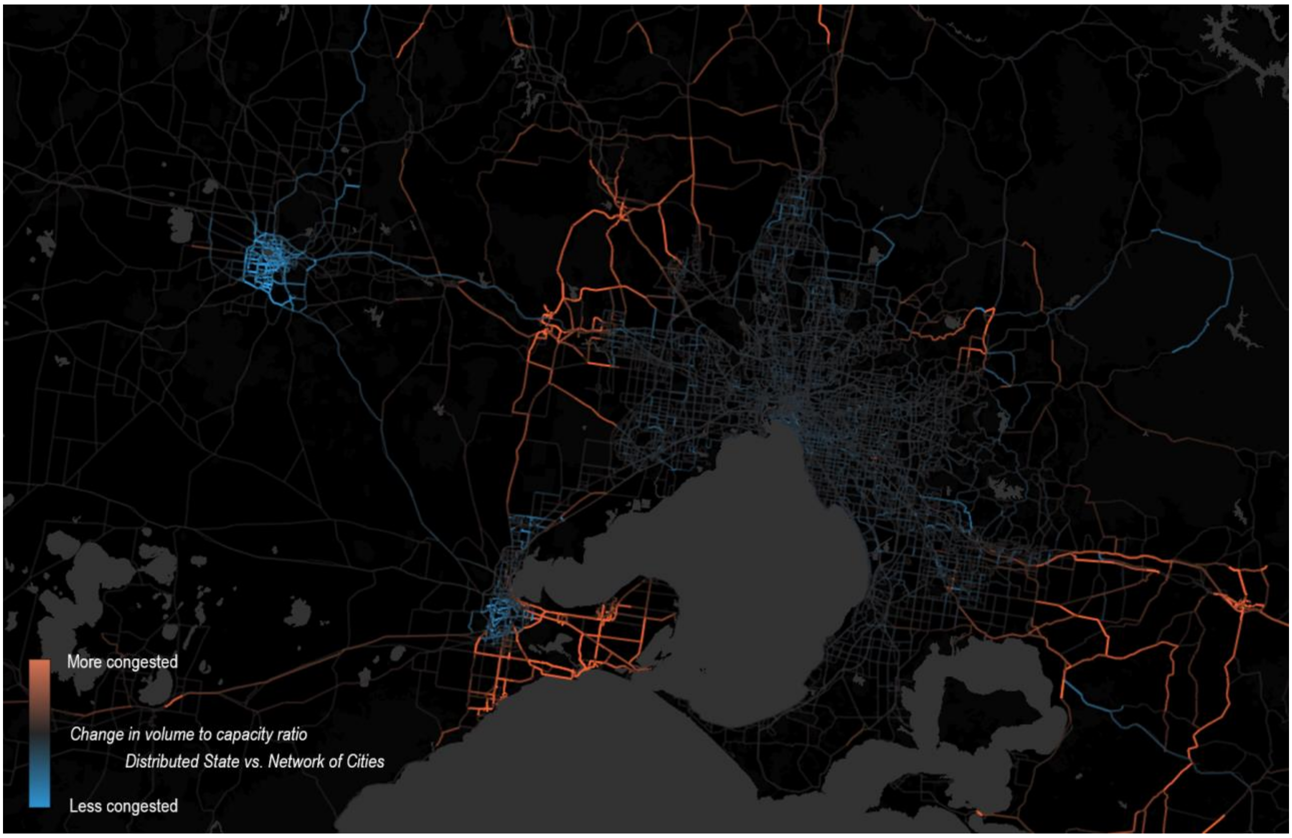


Figure 47 Change in road volume/capacity ratio, Distributed State vs. Network of Cities in 2056



Public transport exhibits limited crowding when considered at the FUA level in 2056. This is because, like in 2036, the public transport network has been planned to limit overcrowding. It is worth noting that unlike in 2036 however, these outcomes are being observed after the infrastructure modifications outlined in Section 3.2 have been implemented. With this in mind, the following can be seen:

- **Metropolitan train**: Crowding levels are observed to be relatively consistent across scenarios, with the *Compact City* scenario performing worse within inner and middle areas due to segments of the Belgrave and Lilydale lines reaching capacity within the Boroondara LGA. Trains travelling via Werribee through Hobsons Bay experience crowding within the *Dispersed City* scenario due to population growth.
- **V/Line**: Regional train services experience the most crowding under the *Network of Cities* scenario as expected, with greater demand servicing Ballarat, Bendigo, and Geelong. Crowding levels would have eclipsed those seen in 2018 without additional service frequency uplifts and vehicle capacity upgrades.
- **Tram**: As mentioned in Section 4.2.5, tram frequencies and vehicle capacities were significantly increased to handle the inner-city population density present within the *Compact City* scenario. With these changes, an approximately uniform level of crowding was achieved across all five tested scenarios for the inner areas of Melbourne. Some level of crowding is observed on tram services within middle areas of Melbourne under the *Consolidated City* scenario. It is worth noting that this is both a consequence of the demographic distribution present in this scenario, as well as the implementation of tram extensions within Darebin and Whitehorse – inducing higher passenger patronage than would otherwise be seen.
- **Bus**: Bus crowding levels remained stable across the scenarios, noting that some services were approaching capacity in regional and rural areas under the *Compact City* and *Consolidated City* scenarios, specifically within the Greater Geelong area. Bus uplifts were not included for these regions under these scenarios.

Figure 48 Morning peak crowded travel as a proportion of all hours travelled by FUA in 2056

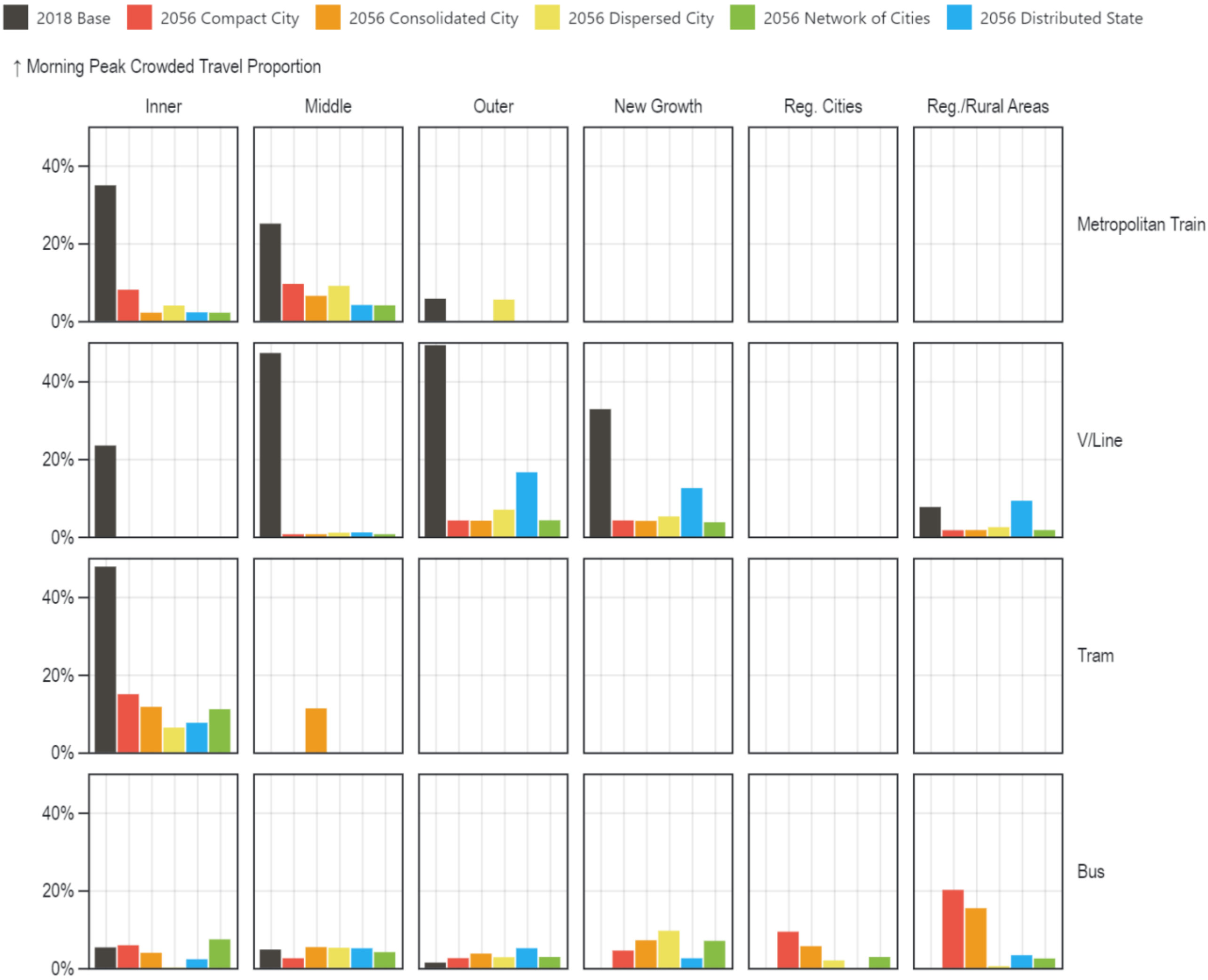


Figure 49 summarises average morning peak in-vehicle journey speeds for both private vehicle and public transport travel across the five 2056 scenarios. As explained in Section 3.3.2 for the equivalent 2036 output (Figure 17), this presents an idealised view of public transport journey times that does not include dwell times. It can be seen that:

- In contrast to the 2036 outcomes, by 2056 general levels of road congestion have reached a point where the average journey speeds observed in middle Melbourne are roughly equivalent to those within inner Melbourne. The general radius of severe road congestion has spatially expanded over this time period, stopping short of the outer Melbourne suburbs where average private journey speeds are similar to those seen in 2036.
- Average private vehicle journey speeds in new growth areas in 2056 exceed those seen in 2036 across most scenarios, highlighting the impact of the large group of road upgrades and new roads that are assumed to be implemented between these two years. Road infrastructure investment catches up to the corresponding population growth in these areas, resulting in material improvements to network conditions. The *Dispersed City* scenario stands as an exception to this, where the increased population density in new growth areas outstrips the local infrastructure's capacity.
- As was the case in 2036, in-vehicle public transport journey times are still universally faster than the equivalent private vehicle journeys on average. As discussed in Section 3.3.2, this does not suggest a superior journey experience. Instead, this reflects that such journeys need to be faster than private vehicles on average when considering in-vehicle time because passengers also need to wait for stops and transfer. This is what makes the train attractive (in that it does not interact with congestion) and is likely a large contributor to these faster journey times.

Figure 49 Average morning peak in-vehicle journey speeds by FUA in 2056

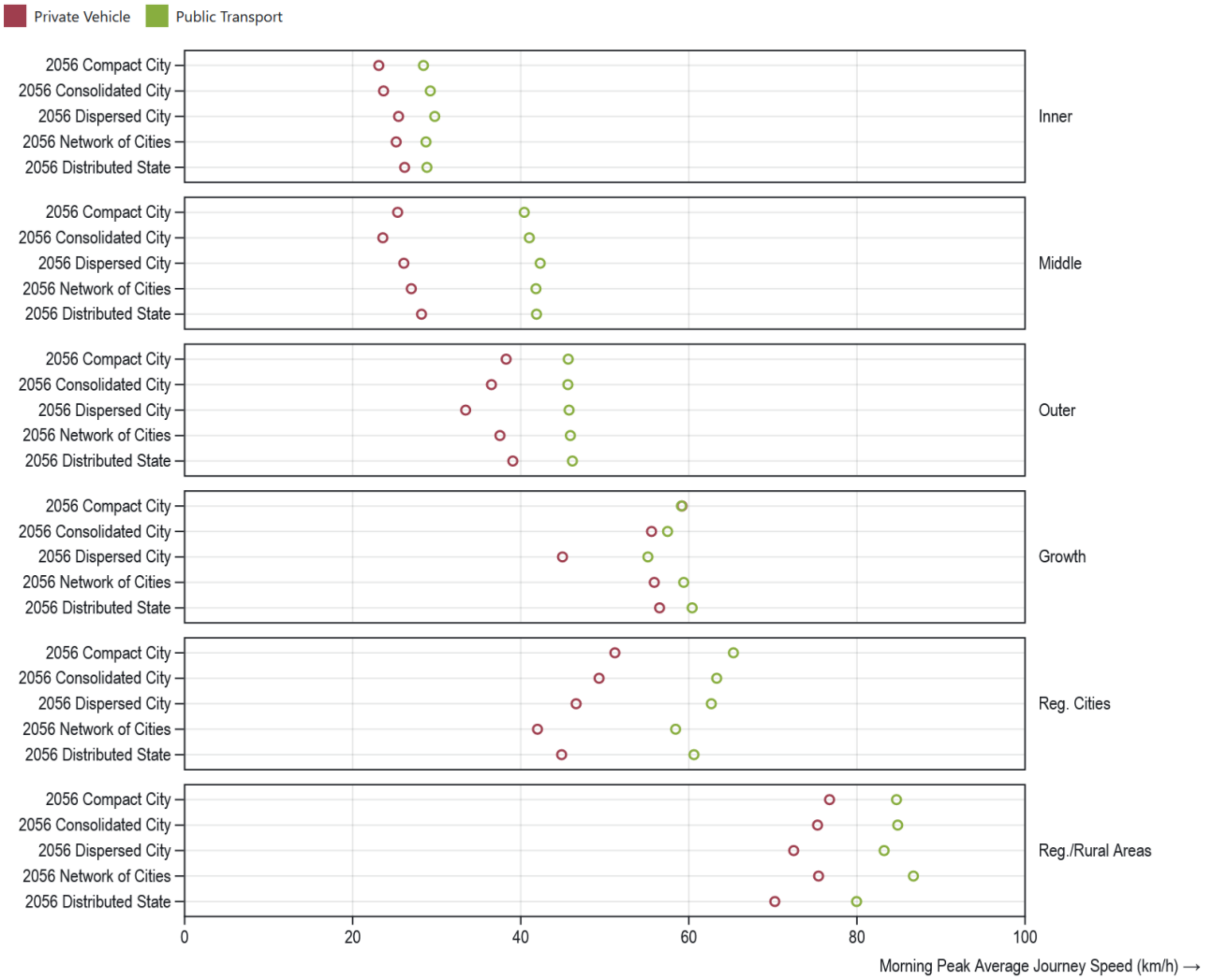
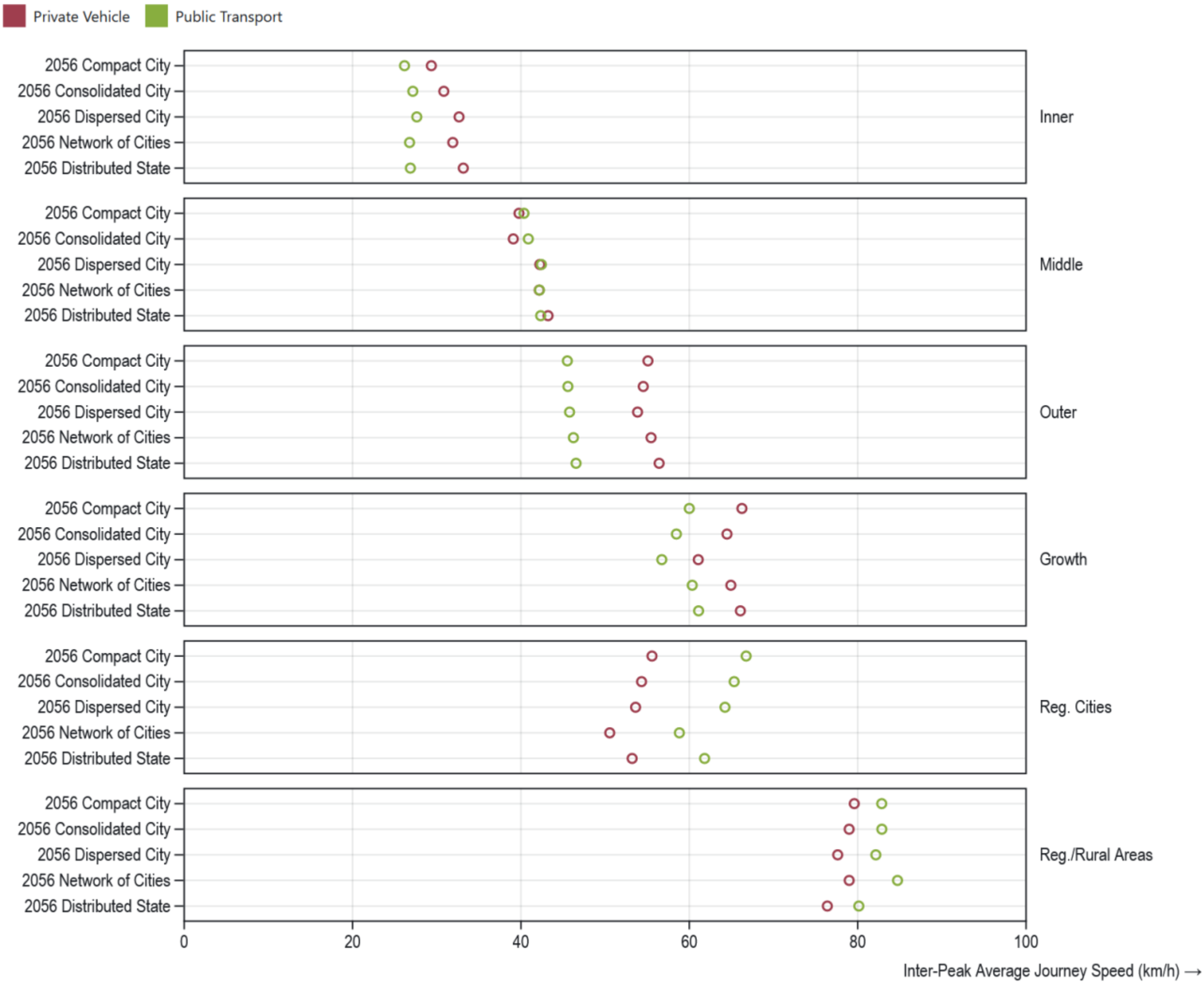


Figure 50 shows the equivalent average in-vehicle journey speeds for the inter-peak period in 2056. Outcomes are similar to those described for 2036 (see Section 3.3.2 and Figure 18) albeit with a higher degree of variance in speeds between scenarios.

Figure 50 Average inter-peak in-vehicle journey speeds by FUA in 2056



As was the case in 2036, public transport journeys are on average much longer than private vehicle journeys. This is especially the case as you move further away from the CBD, where public transport is rarely used for shorter journeys across regional and rural areas. Someone taking public transport in these regions are more likely to be spending a majority of their travel time on a train or on a coach service, increasing the average speed of these journeys above the average private vehicle journey. Figure 51 shows these average journey distances for the morning peak in 2056, whilst Figure 52 shows the equivalent for the inter-peak period.

Figure 51 State-wide morning peak average journey distance in 2056

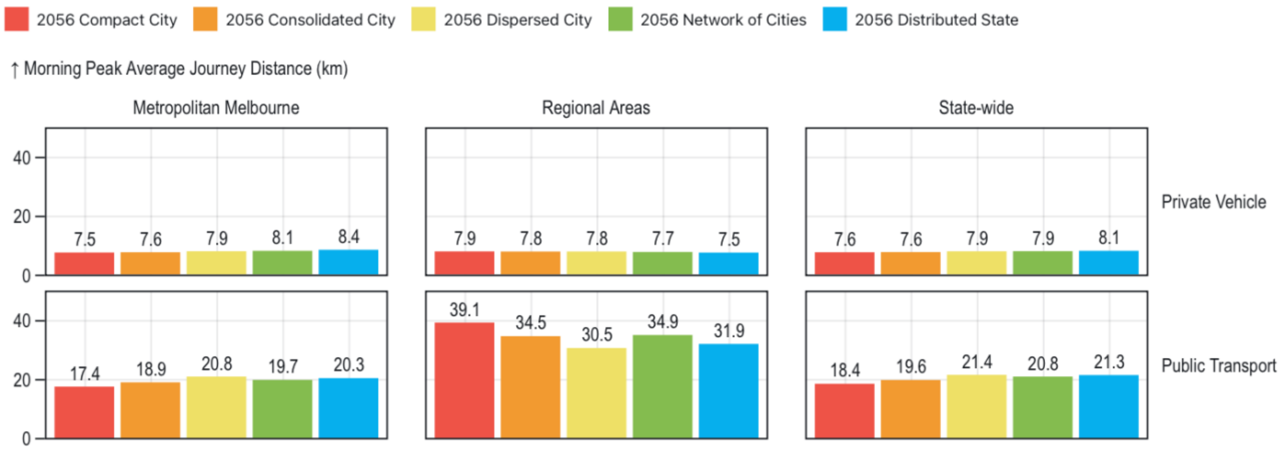


Figure 52 State-wide inter-peak average journey distance in 2056

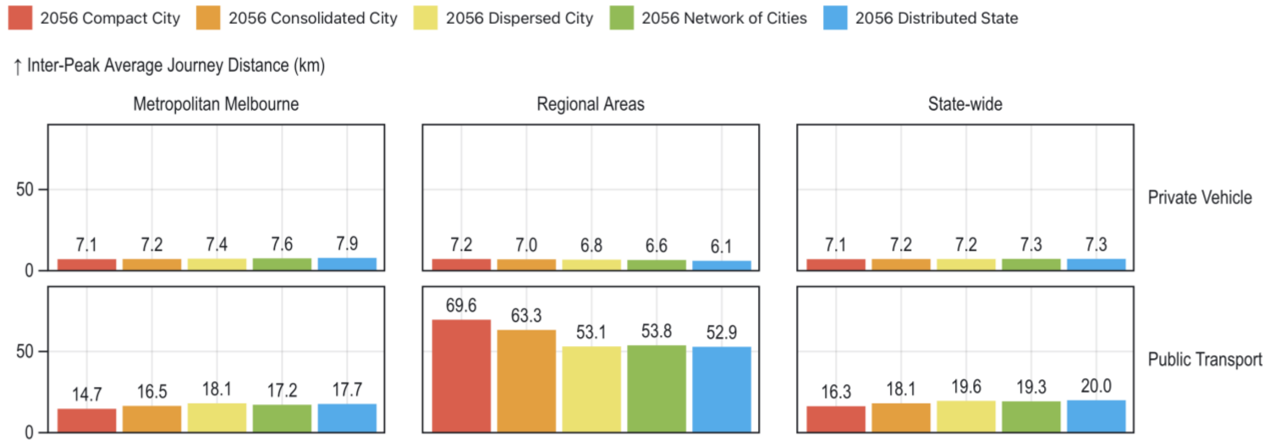


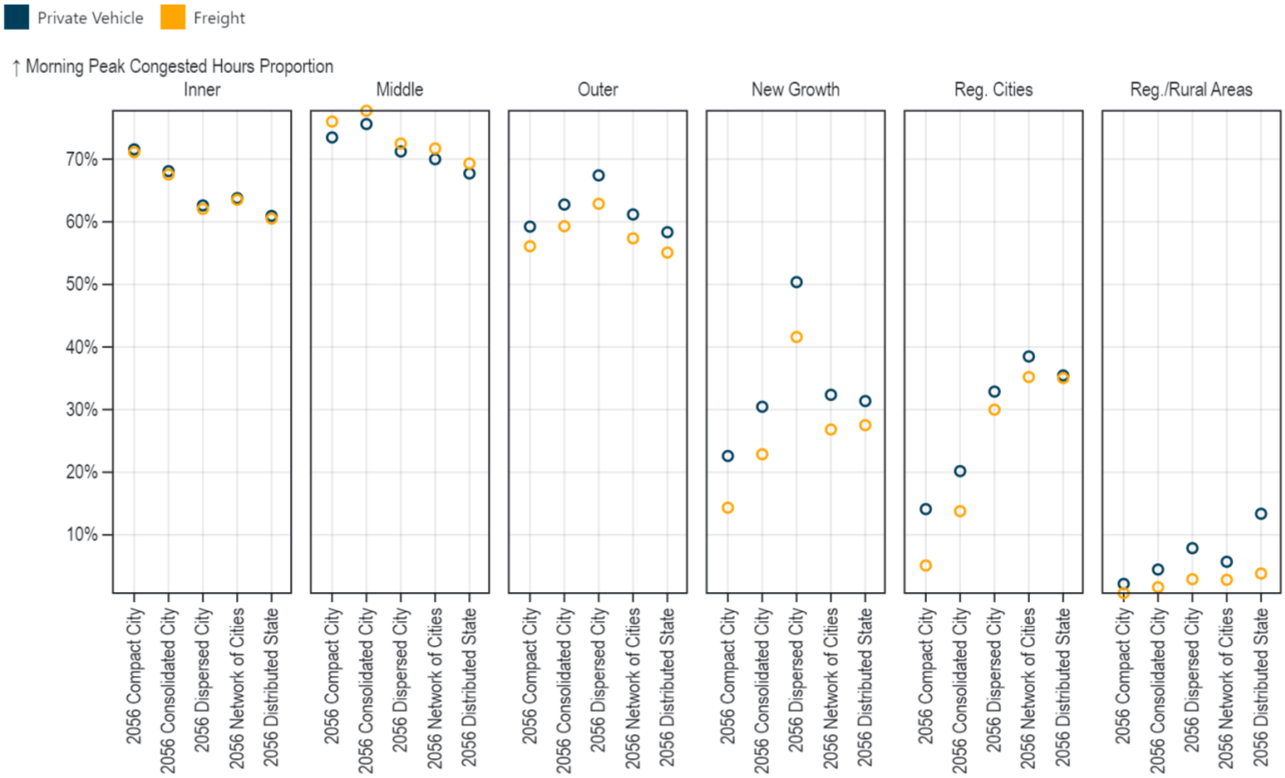
Table 18 shows the proportion of freight hours travelled by FUA and modelled time period in 2056. Similar to 2036, freight travel (comprising of light of heavy commercial vehicles) represents approximately 2-6% of all on-road morning peak travel across all parts of Victoria with the exception of the regional and rural areas, where this proportion is significantly higher at approximately 11-18%.

Table 18 Proportion of freight hours travelled by time period and FUA in 2056

Scenario	Time Period	Inner	Middle	Outer	New Growth	Reg. Cities	Reg./Rural Areas
2056 Compact City	AM	6%	5%	6%	4%	4%	18%
	IP	10%	9%	13%	10%	8%	37%
	PM	4%	3%	4%	3%	2%	12%
	OP	7%	5%	7%	6%	5%	21%
2056 Consolidated City	AM	6%	5%	5%	4%	3%	17%
	IP	11%	9%	12%	8%	7%	35%
	PM	4%	3%	4%	2%	2%	11%
	OP	7%	5%	7%	5%	4%	20%
2056 Dispersed City	AM	7%	5%	5%	3%	3%	15%
	IP	13%	10%	11%	7%	7%	33%
	PM	4%	3%	3%	2%	2%	10%
	OP	8%	6%	6%	4%	4%	18%
2056 Network of Cities	AM	6%	5%	5%	4%	2%	15%
	IP	12%	10%	12%	9%	6%	34%
	PM	4%	3%	4%	2%	1%	10%
	OP	8%	6%	7%	5%	3%	18%
2056 Distributed State	AM	6%	5%	5%	4%	2%	11%
	IP	12%	9%	11%	8%	6%	27%
	PM	4%	3%	3%	2%	2%	7%
	OP	8%	6%	6%	5%	3%	14%

Individual impacts to freight travel were also similar between 2036 and 2056, with Figure 53 highlighting differences in morning peak congested hours travelled as a proportion of all hours travelled for both private vehicle and freight travel. Freight travel generally experiences less congestion than the private vehicle travel with the exception of middle Melbourne where the proportions are slightly higher for freight. In the new growth, regional cities as well as the regional and rural areas, the gap between congestion experienced by freight and private vehicles is much smaller than it was in 2036.

Figure 53 Morning peak congested travel for private vehicles and freight in 2056



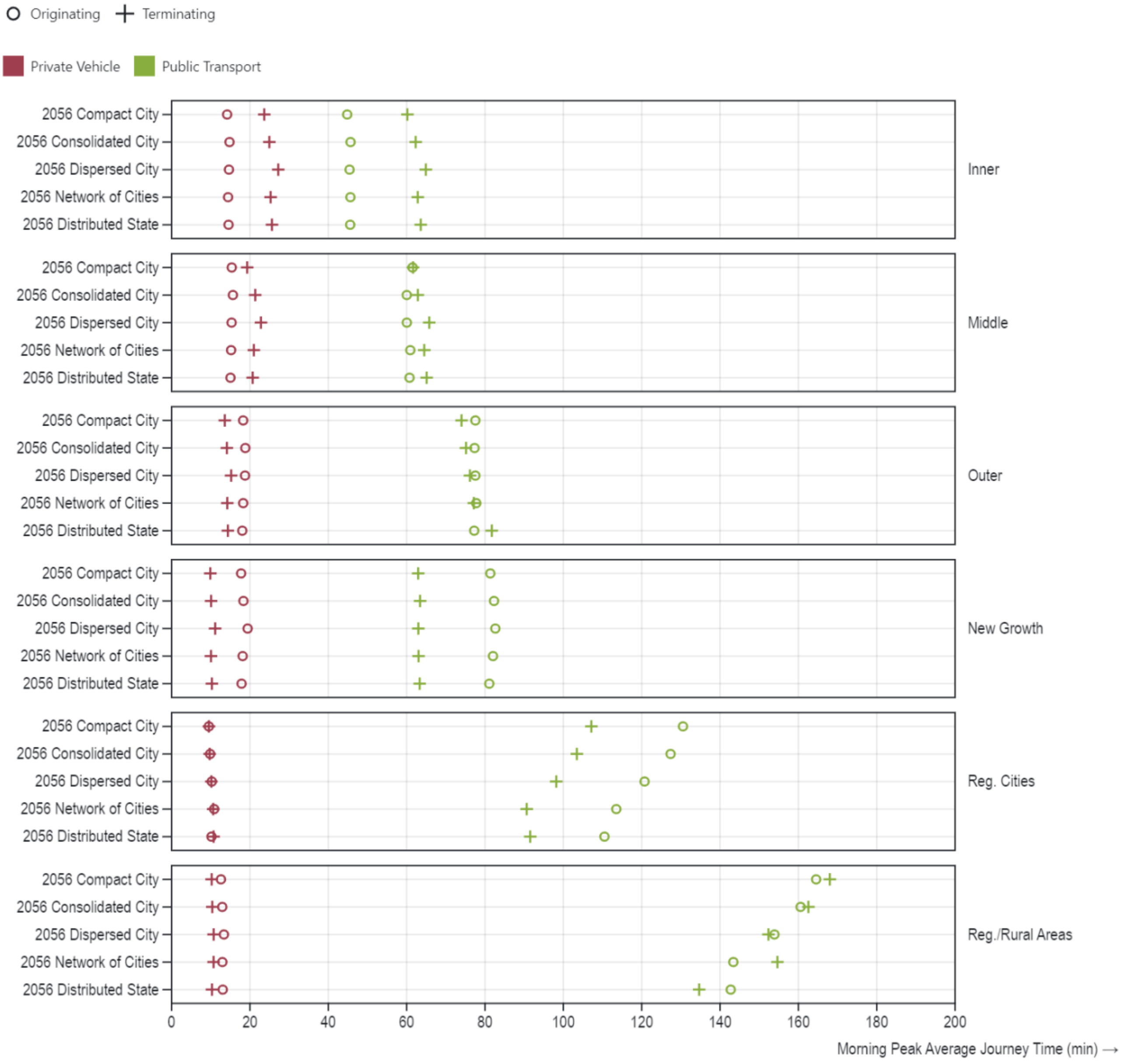
4.3.3 Wider Impacts

Figure 54 shows the average morning peak journey times in minutes by mode of travel and FUA. This is the 2056 equivalent of Figure 22, with separate values presented for trips originating in the indicated FUA as opposed to terminating within it, distinguished with circle and cross symbols respectively. In all circumstances, public transport journeys were slower than their equivalent average private vehicle journey times, even within inner Melbourne.

As will be explored in this section, metrics such as average journey times for a FUA were not significantly impacted by the particular land use scenario in place. The exception to this is the behaviour seen in regional cities and rural areas, where a greater density of population, employment and general opportunity is associated with decreases in average journey time. This is not a function of network performance, but rather the fact that increased density in these areas simply means that there is a higher likelihood that the activities a person needs to complete are more likely to be located around them. This pattern is not seen for the inner, middle, outer or even new growth areas of Melbourne because:

1. The high magnitude of trips occurring in these areas makes it difficult for even relatively large shifts in demographic attributes to affect average journey times.
2. The density of opportunities (such as jobs and enrolments) in metropolitan Melbourne areas is already high, providing significant choice to residents. The addition of more opportunities does not result in large, aggregate changes in travel behaviour in response.

Figure 54 Average morning peak journey times by FUA in 2056

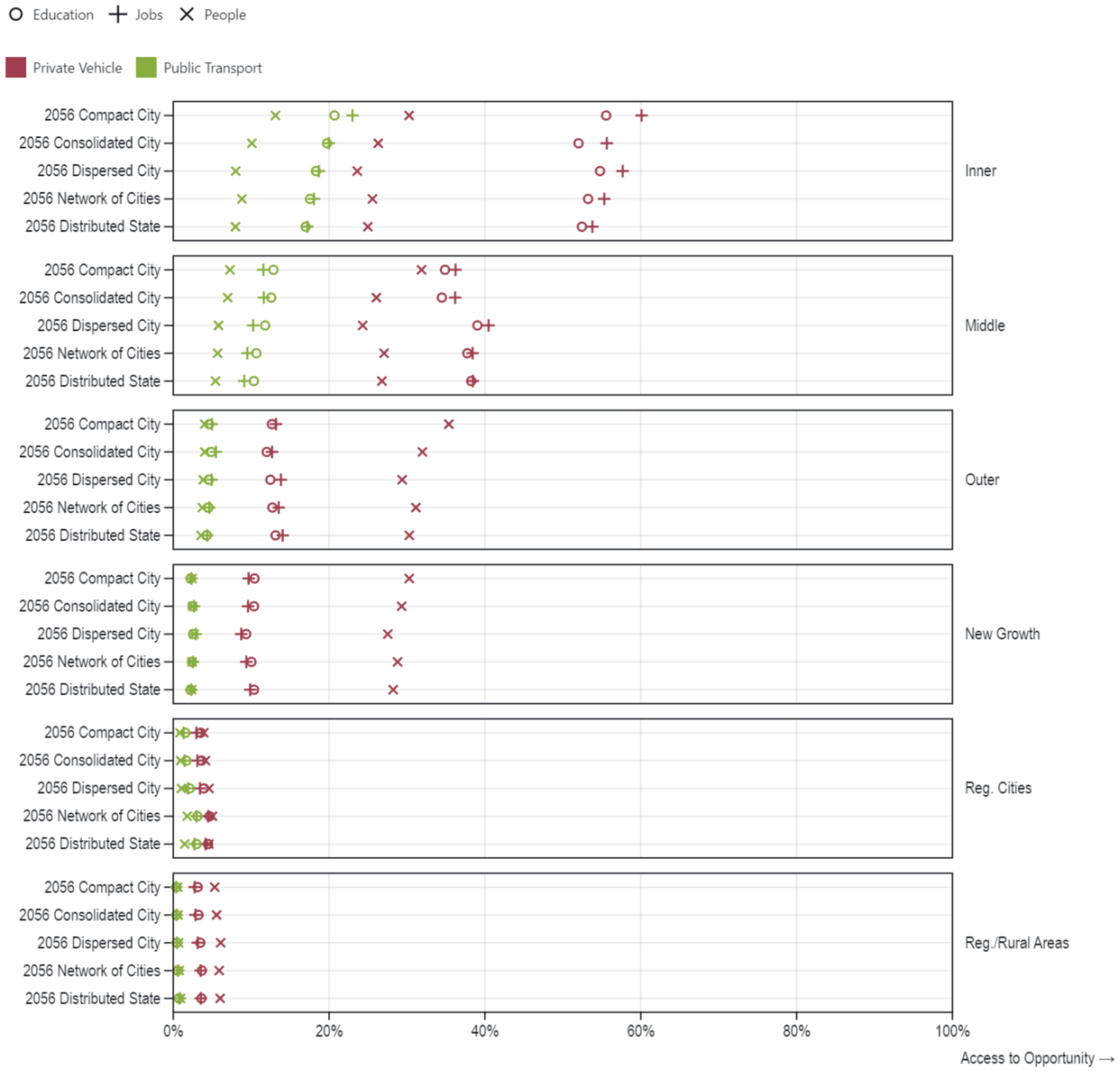


Access to opportunity was also not overly affected by the various land use scenarios. As first described in Section 3.3.3, access to opportunity is defined as the proportion of opportunities (such as jobs) that can be reached from a given location within a specific time threshold on average. Figure 55 shows these statistics for the morning peak with a trip journey threshold of 45 minutes, covering the same education, jobs and people metrics as shown in Figure 23. From this, it can be seen that:

- The *Compact City* scenario often demonstrates the highest accessibility performance within the inner and middle areas, particularly regarding the access to people metric. As has been explored extensively throughout this assessment, the greater density of people and associated opportunities within central Melbourne simply puts more things closer together. In turn, it is easier to travel to a broader range of opportunities in a shorter amount of time.

- Public transport access to opportunity values are universally lower than the equivalent private vehicle journeys. The fixed nature of the public transport system means that it, by definition, can only cater for journeys within the constraints of each individual route, whereas private vehicle journeys offer spatial flexibility. Even in instances where private vehicles travel slower than individual public transport services because of congestion, the flexibility can often mean private vehicle journeys are the only real choice for large parts of the state.

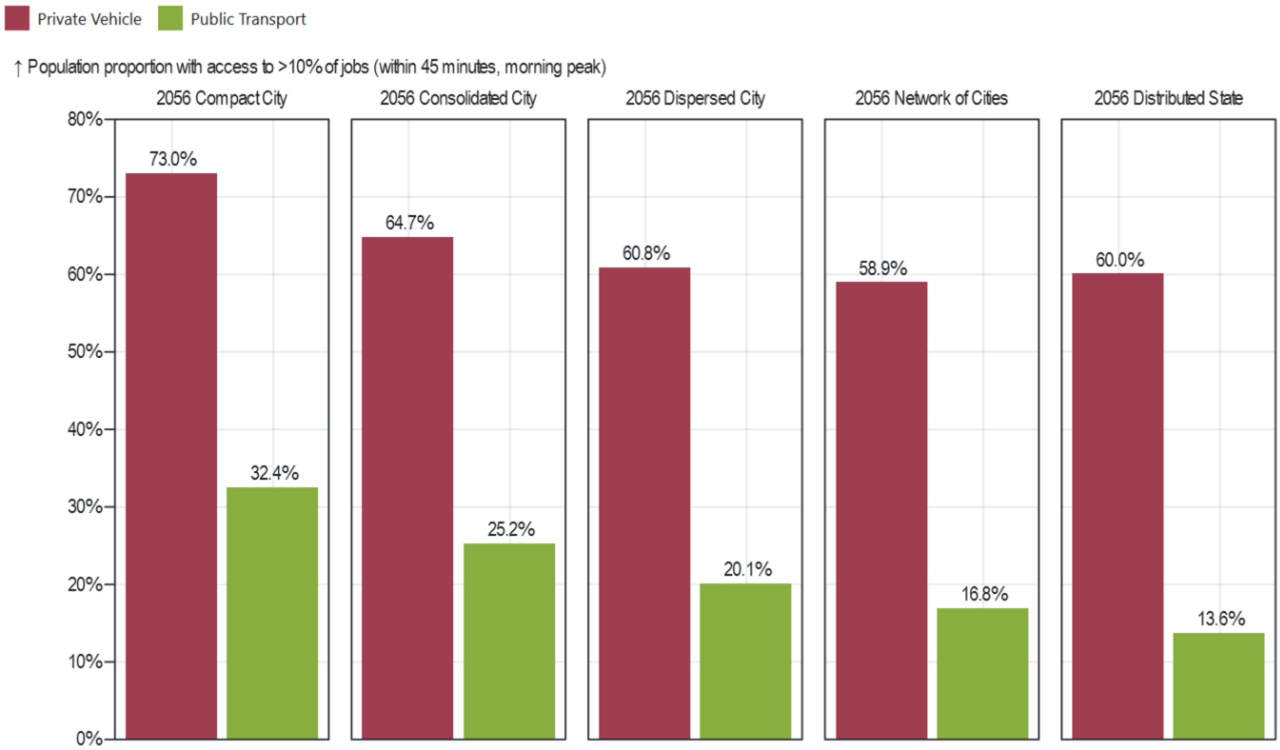
Figure 55 Morning peak access to opportunity by FUA in 2056



Despite the stability of these accessibility metrics across each land use future in 2056, the differing distribution of people and jobs mean that each scenario provides different aggregate accessibility outcomes across the population. To highlight this, Figure 56 shows the proportion of the population for each of the five 2056 scenarios that can reach more than 10% of jobs available in Victoria within 45 minutes during the morning peak. The figure of 10% of jobs reachable within 45 minutes represents access to a variety of job types that means people are likely to more easily find a job suitable to their skills.

In alignment with the outcomes presented previously, both private vehicle and public transport accessibility are lower when the underlying population is less densely distributed. In particular, there is a significant disparity in public transport accessibility when comparing the highest performing scenario (*Compact City*) and the lowest performing scenario (*Distributed State*), exhibiting a difference of almost 20% when accessibility is characterised in this manner. Notably, the *Dispersed City* scenario performs similarly to both the *Network of Cities* and *Distributed State* scenarios in terms of private vehicle accessibility, despite the fact that these latter two scenarios are associated with a greater reallocation of population into Victoria's regional areas.

Figure 56 Relative access to jobs in 2056



Emissions were not calculated for the 2056 scenarios. As per the emissions calculation methodology outlined in Appendix C, by 2056 all private vehicles were assumed to be electric in alignment with AEMO-specified assumptions. As such, the only carbon dioxide emissions present in these scenarios relates to the remaining diesel-powered regional trains. Despite this, it is worth noting that other types of air pollution such as small particulates from tyres will continue to grow in proportion with growth in private vehicle kilometres travelled.

4.3.4 2056 Summary

As outlined in Section 4.2, a methodology was employed to generate a unique infrastructure pipeline for each of the land use scenarios in 2056. This was done for two reasons:

- Localised travel demand generated by some of the land use scenarios far exceeded the capacity of the unmodified base infrastructure assumptions.
- Beyond simply addressing capacity, each land use future would likely be accompanied by diverging infrastructure needs and priorities that reflect their underlying demographic distribution.

This resulted in a group of scenarios that performed relatively similarly in terms of network performance impacts. However, it is to be noted that this came at the expense of significant transport investment in some scenarios compared to others. For example, the *Compact City* required approximately 25% more service kilometres of tram capacity within inner Melbourne to reach a level of crowding comparable to the other scenarios.

After having 'normalised' the infrastructure supply across scenarios in this fashion, it is clear that the primary driver of accessibility is density. A denser Melbourne results in lower average travel times (on both public transport and via private vehicle), greater average access to opportunity and less congestion and crowding when considered at a state-wide level. As this density of population and jobs decreases, the transport network becomes less efficient across these metrics to compensate for the greater coverage required. This effect is seen consistently across the five tested scenarios, particularly the Melbourne-based scenarios:

- The *Compact City* scenario contains the highest density of residents concentrated within inner and middle Melbourne compared to all the scenarios tested. As a result, it exhibited increased localised crowding and congestion around Melbourne's CBD but nonetheless still demonstrated the best overall accessibility outcomes on average. It was also associated with the least congested and crowded hours travelled overall compared to the other land use scenarios.
- The *Consolidated City* scenario focuses on density within Melbourne's suburban centres rather than the CBD. It places the second-largest concentration of people within the inner, middle, and outer Melbourne areas across the land use scenarios. The resulting distribution of population and jobs is more dispersed than that seen in the *Compact City*. This means that it is more difficult for the public transport network to cater for the range of destinations required, even with specific improvements in access to key activity centres. As a result, public transport mode share is slightly lower in this scenario, and overall crowding and congestion levels are higher.
- The *Dispersed City* scenario represents the least dense metropolitan Melbourne land use scenario with greater growth concentrated in the outer and new growth areas of the city. Following the trends established with the *Compact City* and *Consolidated City* scenarios, this sparser distribution of people and jobs places even greater pressures on both the road and public transport networks. In the case of private vehicle travel, residents need to travel longer distances on average creating greater congestion in areas of the city where an abundance of alternate routes do not exist. For public transport travel, many potential destinations remain out of reach due to the sparse nature of the bus and metropolitan train network even with increased frequencies and direct routes to activity centres.

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Appendix A
Victorian Integrated Transport Model

Model Features

The Victorian Integrated Transport Model (VITM) is a state-wide strategic transport model owned and maintained by the Department of Transport and Planning (DTP). It is used to test and assess transport policies and strategies, estimate future demands on the transport network and analyse the potential impacts of road, public transport, and land-use planning projects. The model is accompanied by the *base infrastructure pipeline*, a standard set of infrastructure, land use and parameter assumptions that can act as a foundation for complex scenario testing.

The VITM version used within this assessment was *VITM22_v2_04*. The following list summarises its features:

- Four time periods, encompassing the AM peak (7am – 9am), inter-peak (9am – 3pm), PM peak (3pm – 6pm) and off-peak (6pm – 7am).
- Representation of both road and public transport modes.
  - Multiple road vehicle types including cars, rigid trucks, and articulated trucks.
  - Multiple public transport vehicle types including train (metropolitan and V/Line), trams and buses.
  - Optional public transport capacity constraint.
  - Integration of the Freight Movement Model (FMM) to forecast freight truck movements and volumes.
- Integrated consideration of potential future working from home behaviour across regions and occupation types. The base assumptions include an increase in working from home post the 2018 base scenario reflecting a change in travel behaviour observed post the COVID-19 pandemic.

All model runs described for this assessment used *constrained capacities*, i.e., crowding effects on public transport were represented.

It is to be noted that the VITM's road network representation is not a one-to-one representation of the road network in reality. The model contains a *strategic* representation of the road network which contains enough connections to accurately represent broad travel patterns between regions. As such, many local roads are not included within the simulation.

Model and Approach Limitations

It is crucial to acknowledge that model outputs are only an approximation of what can be expected in the real/built environment. The VITM as a strategic planning tool is more effective at representing strategic-level demands and patterns (i.e., across screenlines and cordons) than individual links within a network. Thus, certain outputs from the VITM must be treated with caution and interpreted with an understanding of both the model's strengths and weaknesses, as well as the input assumption inherent to the forecasting process.

Some limitations and key assumptions associated with the VITM worth considering in the context of this report are:

- **Land use forecasts**: Land use forecasts (as were modified in this assessment) directly affect the trips generated and where they originate/terminate in the model. If the timing or intensity of demographic growth at a travel zone level differs from forecasts, travel behaviour will likely differ from modelling results.
- **Future road and public transport**: Assumptions around the timing of road and public transport projects will affect modelled mode share and route choice. These shift over time as government expectations surrounding future investments evolve.
- **Intersections not explicitly modelled**: During the traffic assignment phase of the model, link-based speed-flow relationship curves are used to calculate the travel time for a link based on the assigned volume and capacity of that link. This is a simplification of reality, where each section of the road will have unique operational behaviour and queuing back may impact adjacent intersections. This means that the model will not fully represent the impacts that significant capacity bottlenecks may cause over wider extents of the network. It also presents limitations in assessing projects that involve intersection improvements.

- **Commercial vehicles**: Future commercial vehicle movements are estimated within the FMM components of the VITM. Forecast movements are thus directly linked to the assumptions present within the FMM, such as the Port of Melbourne remaining the sole container port for Melbourne in the timeframes modelled. More broadly, growth in commercial vehicle movements will be directly related to the rate of growth in industry – itself influenced by broader economic conditions at a city, state, and national level. This includes considerations such as future land use patterns for commercial and industrial areas, changes to vehicle sizes/mass limits as well as government policy in relation to these items.
- **Active transport**: Active transport (i.e., walking and cycling) is not explicitly modelled within the VITM. The proportion of travel that is undertaken through walking and cycling is estimated using a high-level process within the model, but these trips are never assigned nor are these proportions used across any subsequent analysis of outcomes.

2056 Modelled Year

As of the time of testing, the VITM only provides up to a 2051 modelled year. As this assessment required a 2056 modelled year, the modelling team worked with DTP to devise one. This involved undertaking the following steps:

- **Road network**: Despite 2051 being the latest available year by default, DTP maintains an untested specification of future road projects up to 2056 as part of the base infrastructure pipeline. These assumptions were verified with the DTP team prior to their implementation within the scenarios presented across this assessment. Appendix B provides a full list of all projects incorporated into each scenario, including those from the base infrastructure pipeline in 2056.
- **Public transport network**: The base infrastructure pipeline provides no guidance for future public transport infrastructure projects beyond 2051. For certain modes like trams, there is no such guidance beyond 2036. The modelling team collaborated with DTP to devise several interventions that could potentially occur between 2051 and 2056, resulting in implemented changes focusing on the metropolitan rail network:
  - One additional train per hour during the AM and PM peak for the Sandringham line.
  - One additional train per hour during the AM and PM peak for the Werribee line via Sayers Road.
  - Three additional trains per hour during the AM and PM peak for the Melton line.
  - Two additional trains per hour during the AM and PM peak each for services travelling through Roxburgh Park and Frankston Station.
  - One additional train per hour during the AM and PM peak for services travelling from Wallan to Glen Waverley.
  - One additional train per hour during the AM and PM peak for services travelling through Hurstbridge.
- **Parameters**: Alongside network assumptions, the VITM also requires numerous tables of inputs governing year-specific model parameters. The modelling team reviewed these parameters, ensuring that correct escalation was applied to items such as toll prices, public transport fares, parking charges and other monetary-based values subject to indexation.

The new 2056 modelled year was tested using default VITM assumptions other than those described above to verify sensible outcomes and model response.

Appendix B

Detailed Infrastructure Specification

Detailed Specification Overview

The 2036 scenario tests presented in this report use a modified version of the *base infrastructure pipeline*, incorporating changes made to better align the scenario tests with the intent of the assessment. 2056 testing also used a modified version of the *base infrastructure pipeline* as the initial basis of infrastructure supply before undertaking the procedure outlined in Section 4.2 used to generate unique infrastructure pipelines for each scenario.

This appendix documents the consistent *base infrastructure pipeline* modifications made to all scenarios across the 2036 and 2056 testing. It then describes the unique infrastructure pipeline implemented for each 2056 scenario test, accompanied by corresponding changes in active transport and parking charge assumptions.

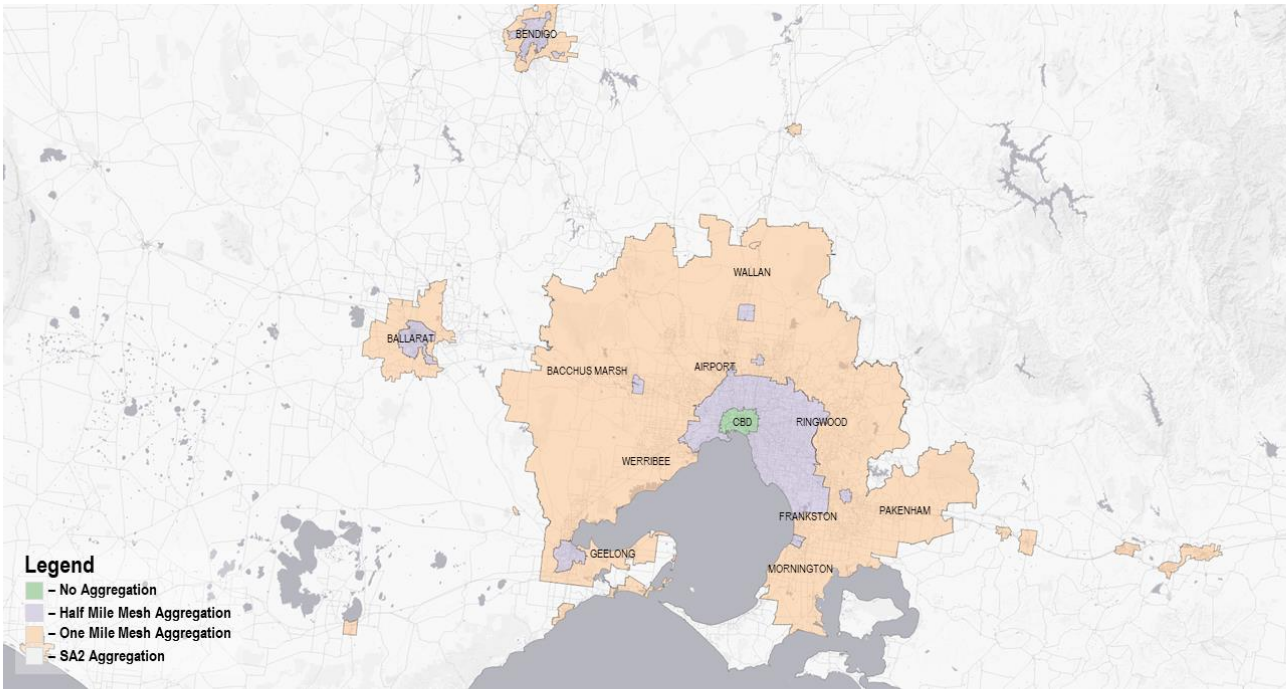
Model Modifications

Zonal Aggregation Scheme

The VITM uses a zonal aggregation scheme to collapse a 7,000-travel zone system into approximately 3,500 travel zones. This procedure is used to reduce spatial detail in certain areas of Victoria, providing transport modellers a means of trading between fast model run times and greater outcome granularity. The default zonal aggregation scheme provided by DTP reduces detail in the regional and rural areas, focusing instead on the inner and middle Melbourne suburbs.

Across all scenarios tested, a modified zonal aggregation scheme was adopted which restored spatial granularity across regional cities and select rural areas to ensure that region-specific behaviours were captured as best as possible.

Figure 57 Adopted zonal aggregation scheme



V/Line Fares

As of the time of modelling, the officially released version of the VITM from DTP had yet to incorporate the newly announced regional public transport fare cap. Representing a daily capped fare of $9.20 across the entire regional network, this change was incorporated into the public transport fare matrix of every scenario tested in this assessment (other than the 2018 *Base* scenario). Rolling stock on select V/Line services were simultaneously upgraded in capacity in anticipation of the larger travel demand induced from this fare change.

Additional Regional Bus Services

A greater level of off-peak bus services were added throughout Victoria in an effort to better represent provision of services at these times. The VITM has historically under-represented off-peak public transport travel.

Scenario-Specific Modifications

Road Infrastructure

Table 19 outlines the road infrastructure projects as implemented across the 2036 and 2056 scenarios by land use future. Project implemented in the year 2036 were also implemented in 2056. An active project is denoted with a '1' in the far-right columns, with '0' defined as inactive.

Table 19 Road infrastructure assumptions

Project	Scope	Category	LGA	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Koo Wee Rup Road - Ballarto Rd to Hall Rd	Duplication (4 lanes divided)	Arterial	Cardinia	2036	1	1	1	1	1
Koo Wee Rup Road - Hall Rd to Pakenham Bypass	Duplication (4 lanes divided)	Arterial	Cardinia	2036	1	1	1	1	1
Koo Wee Rup Road - Manks Rd to Ballarto Rd	Duplication (4 lanes divided)	Arterial	Cardinia	2036	1	1	1	1	1
McGregor Road - Pakenham Bypass to Henry Rd	Duplication (4 lanes divided)	Arterial	Cardinia	2036	1	1	1	1	1
Hall Road - Western Port Hwy to Sladen St	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Hallam North Road - Heatherton Rd to James Cook Dve	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Narre Warren North Road - Fox Rd to Belgrave-Hallam Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Narre Warren-Cranbourne Road - South Gippsland Hwy to Thompsons Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Pound Road/Greaves Road/O'Shea Road route - Berwick-Cranbourne Rd to Princes Freeway	Widening (6 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Racecourse Road - Princes Fwy to Henry St	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Hall Road - McCormicks Rd to Western Port Hwy	Duplication (4 lanes divided)	Arterial	Frankston	2036	1	1	1	1	1
Lathams Road - Oliphant Wy to Dandenong Frankston Road	Duplication (4 lanes divided)	Arterial	Frankston	2036	1	1	1	1	1
Pound Road - West to Remington Drive Extension	New route (4 lanes divided) and grade separation	Arterial	Greater Dandenong	2036	1	1	1	1	1
Barwon Heads Road - Settlement Rd to Reserve Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Craigieburn Road - Aitken Bvd to Dorchester St	Widening (6 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Craigieburn Road - Dorchester St to Hanson Rd	Widening (6 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Craigieburn Road - Hanson Rd to Hardy Av	Widening (6 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Craigieburn Road - Hardy Av to Hume Hwy	Widening (3 lanes, south bound only)	Arterial	Hume	2036	1	1	1	1	1
Craigieburn Road - Mickleham Rd to Aitken Bvd	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Sunbury Road - Bulla-Diggers Rest Rd to Melbourne-Lancefield Rd	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Sunbury Road - Melbourne-Lancefield Road to Powlett Street	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Fitzsimons Lane- Foote St to Porter St	Removal of bus lanes (6 lanes divided)	Arterial	Manningham	2036	1	1	1	1	1
Grattan Street, Carlton	Narrowing (4 lanes to 2 lanes divided)	Arterial	Melbourne	2036	1	1	1	1	1
Hopkins Road Extension - Neale Rd to Melton Hwy	New route (2 lanes)	Arterial	Melton	2036	1	1	1	1	1
Taylors Road - City Vista Ct to Westwood Dr	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Yan Yean Road - Kurrak Road to Bridge Inn Road	Duplication (4 lanes divided)	Arterial	Nillumbik	2036	1	1	1	1	1
Bridge Inn Road - Plenty Rd to Yan Yean Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Childs Road - Beaumont Cr to west of Prince of Wales Av	Duplication (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Epping Road - Findon Rd to Craigieburn Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Epping Road - Memorial Av to Findon Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Findon Road - Williamsons Rd to Plenty Rd	New route (2 lanes)	Arterial	Whittlesea	2036	1	1	1	1	1
Union Road, Surrey Hills	Grade separation	LX Removal	Boroondara	2036	1	1	1	1	1
Calder Park Drive, Calder Park	Grade separation	LX Removal	Brimbank	2036	1	1	1	1	1
Fitzgerald Road, Deer Park	Grade separation	LX Removal	Brimbank	2036	1	1	1	1	1
Mount Derrimut Road, Deer Park	Grade separation	LX Removal	Brimbank	2036	1	1	1	1	1
Robinsons Road, Deer Park	Grade separation	LX Removal	Brimbank	2036	1	1	1	1	1
Brunt Road, Beaconsfield	Grade separation	LX Removal	Cardinia	2036	1	1	1	1	1
Main Street, Pakenham	Grade separation	LX Removal	Cardinia	2036	1	1	1	1	1
McGregor Road, Pakenham	Grade separation	LX Removal	Cardinia	2036	1	1	1	1	1

Project	Scope	Category	LGA	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Station Street, Beaconsfield	Grade separation	LX Removal	Cardinia	2036	1	1	1	1	1
Station Street, Officer	Road closure	LX Removal	Cardinia	2036	1	1	1	1	1
Camms Road, Cranbourne	Grade separation	LX Removal	Casey	2036	1	1	1	1	1
Clyde Road, Berwick	Grade separation	LX Removal	Casey	2036	1	1	1	1	1
Hallam South Road, Hallam	Grade separation	LX Removal	Casey	2036	1	1	1	1	1
Webb Street, Narre Warren	Grade separation	LX Removal	Casey	2036	1	1	1	1	1
Bell Street, Preston	Grade separation	LX Removal	Darebin	2036	1	1	1	1	1
Cramer Street, Preston	Grade separation	LX Removal	Darebin	2036	1	1	1	1	1
Keon Parade, Keon Park	Grade separation	LX Removal	Darebin	2036	1	1	1	1	1
Murray Road, Preston	Grade separation	LX Removal	Darebin	2036	1	1	1	1	1
Oakover Road, Preston	Grade separation	LX Removal	Darebin	2036	1	1	1	1	1
Glenhuntly Road, Glen Huntly	Grade separation	LX Removal	Glen Eira	2036	1	1	1	1	1
Neerim Road, Glen Huntly	Grade separation	LX Removal	Glen Eira	2036	1	1	1	1	1
Greens Road, Dandenong South	Grade separation	LX Removal	Greater Dandenong	2036	1	1	1	1	1
Progress Street, Dandenong South	Road closure	LX Removal	Greater Dandenong	2036	1	1	1	1	1
Webster Street, Dandenong	Grade separation	LX Removal	Greater Dandenong	2036	1	1	1	1	1
Ferguson Street, Williamstown	Grade separation	LX Removal	Hobsons Bay	2036	1	1	1	1	1
Gap Road, Sunbury	Grade separation	LX Removal	Hume	2036	1	1	1	1	1
Argyle Avenue, Chelsea	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Bondi Road, Bonbeach	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Chelsea Road, Chelsea	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Edithvale Road, Edithvale	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Parkers Road, Parkdale	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Swanpool Avenue, Chelsea	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Warrigal Road, Mentone	Grade separation	LX Removal	Kingston	2036	1	1	1	1	1
Bedford Road, Ringwood	Grade separation	LX Removal	Maroondah	2036	1	1	1	1	1
Coolstore Road, Croydon	Grade separation	LX Removal	Maroondah	2036	1	1	1	1	1
Dublin Road, Ringwood East	Grade separation	LX Removal	Maroondah	2036	1	1	1	1	1
Holden Road, Calder Park	Road closure	LX Removal	Melton	2036	1	1	1	1	1
Glenroy Road, Glenroy	Grade separation	LX Removal	Merri-bek	2036	1	1	1	1	1
Mont Albert Road, Mont Albert	Grade separation	LX Removal	Whitehorse	2036	1	1	1	1	1
Old Geelong Road, Hoppers Crossing	Grade separation	LX Removal	Wyndham	2036	1	1	1	1	1
Cave Hill Road, Lilydale	Road closure	LX Removal	Yarra Ranges	2036	1	1	1	1	1
Manchester Road, Mooroolbark	Grade separation	LX Removal	Yarra Ranges	2036	1	1	1	1	1
Maroondah Highway, Lilydale	Grade separation	LX Removal	Yarra Ranges	2036	1	1	1	1	1
Bells Road - Grices Rd to Hardys Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Bells Road - O'Shea Rd to Grices Rd	New route (2 lanes divided)	Local/Collector	Casey	2036	1	1	1	1	1
Hardys Road - Berwick-Cranbourne Rd to Bells Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Tuckers Road - Pound Rd to Ballarto Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Aitken Boulevard (E14) - Mt Ridley Rd to Donnybrook Rd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Blossom Drive - Somerton Rd to Greenvale Gardens Bvd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Cloverton Boulevard - Donnybrook Rd to Cameron St	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Craigieburn West PSP connector road - Marathon Bvd to Mt Ridley Rd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Elevation Boulevard - Mickleham Rd to Vantage Blv	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Fairways Boulevard - Waterview Bvd to Aitken Bvd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Gunns Gully Road - Mandalay Rd to Hume Fwy	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Highlander Drive - Craigieburn Rd to Mt Ridley Rd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Jacksons Hill Link - Vineyard Rd to Watsons Rd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Lysterfield Drive - Candlebark Dr to Fairways Bvd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Marathon Boulevard - Craigieburn West PSP connector road to Whites La	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Marathon Boulevard - Mickleham Rd to Craigieburn West PSP connector road	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1

Project	Scope	Category	LGA	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Melbourne Airport - New elevated ring road connecting to Tullamarine Fwy	New link (1-way, 1-3 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Polaris Drive - Donnybrook Rd to English St	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Waterview Boulevard - Fairways Bvd to Elevation Dr	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Cameron Street - Cloverton Bvd to Sydney Melb rail line	New route (2 lanes)	Local/Collector	Hume/Whittlesea	2036	1	1	1	1	1
Faulkners Road - Harrison Rd to Greigs Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Ferris Road - Bridge Road to Iramoo Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Mt Atkinson Road - Kirkpatrick Bvd to Greigs Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Mt Cottrell Road - Greigs Rd to Western Fwy	Sealing (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Paynes Road - Greigs Rd to Western Fwy	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Taylors Road Extension - Leakes Rd to Plumpton Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Vearings Road- Cooper Street to O'Herns	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
East-West Connector - Patterson Dr to Koukoura Dr	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Grange Drive Extension - Gordons Rd to The Lakes Bvd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Koukoura Drive - Cooper St to Craigieburn Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Koukoura Drive- Donnybrook Road to Gunns Gully Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
North-South Connector - Donnybrook Rd to Cameron St	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
North-South Connector - Donnybrook Rd to Gunns Gully Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Boundary Road - Mt Cottrell Rd to Davis Rd	Sealing 2 lanes	Local/Collector	Wyndham	2036	1	1	1	1	1
Ison Road - 1km north of Ballan Road to Dohertys Rd	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
Ison Road - Greens Rd to 1km north of Ballan Road	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
Ison Road - Princes Fwy to Browns Rd	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
M80 - Plenty Rd to Greensborough Hwy (associated with NEL)	Widening (8/10 lane freeway)	Major	Banyule	2036	1	1	1	1	1
North-East Link -connection between Metropolitan Ring Road and Eastern Freeway at Bulleen	New route (6-8 lane freeway)	Major	Banyule/Manningham	2036	1	1	1	1	1
Greensborough Bypass - Metropolitan Ring Rd to Diamond Creek Rd	Conversion to freeway (4 lanes)	Major	Banyule/Nillumbik	2036	1	1	1	1	1
Eastern Freeway - Chandler Hwy to Bulleen Rd	Widening (10 lane freeway)	Major	Boroondara	2036	1	1	1	1	1
Eastern Freeway - Bulleen Rd to Springvale Rd (NEL associated)	Widening (2-4 additional lanes each way)	Major	Boroondara/Manningham/Whitehorse	2036	1	1	1	1	1
Monash Freeway - Officer South Rd Interchange	Interchange (west-facing ramps)	Major	Cardinia	2036	1	1	1	1	1
O'Shea Road - Soldiers Rd to Princes Fwy including South-East facing ramps and bridge widening	New route (4 lanes) and south-facing ramps	Major	Cardinia	2036	1	1	1	1	1
Princes Freeway East, Interchange - McGregor Rd	Interchange (easterly oriented ramps)	Major	Cardinia	2036	1	1	1	1	1
Princes Freeway / Clyde Road Interchange	Interchange Upgrade - improve capacity	Major	Casey	2036	1	1	1	1	1
Monash Freeway - Clyde Rd to Cardinia Road	Widening (6 lanes freeway)	Major	Casey/Cardinia	2036	1	1	1	1	1
Princes Freeway - Kororoit Creek Rd to Dohertys Rd (associated with WGT)	Widening (5 lanes freeway, outbound only)	Major	Hobsons Bay	2036	1	1	1	1	1
Gunns Gully Road Northern Half Connection to Hume Freeway	Interchange (1/2 diamond, notherly oriented)	Major	Hume	2036	1	1	1	1	1
Gunns Gully Road Southern Half Connection to Hume Freeway	Interchange (1/2 diamond, southerly oriented)	Major	Hume	2036	1	1	1	1	1
West Gate Distributor, Shepherds Bridge and Merri-bek St Widening	Widening (4 lanes outbound)	Major	Maribyrnong/Melbourne	2036	1	1	1	1	1
West Gate Tunnel - West Gate Fwy to Citylink / North Melbourne	New freeway (4 lanes)	Major	Maribyrnong/Melbourne	2036	1	1	1	1	1
Watson Street (Wallan-Whittlesea Road) - Hume Fwy Interchange	Southerly ramps and duplication of overpass	Major	Mitchell	2036	1	1	1	1	1
Monash Freeway - Springvale Rd to Eastlink	Widening (10 lane freeway)	Major	Monash	2036	1	1	1	1	1
Monash Freeway - Warrigal Rd to Springvale Rd (outbound)	Widening (5 lanes outbound, no change to inbound)	Major	Monash	2036	1	1	1	1	1

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Ballarat-Carngham Road - Dyson Rd to Midland Hwy	Widening (4 lanes)	Arterial	Ballarat	2036	0	0	0	1	1
Cobden Street - Miles St to Ross Creek Rd	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Cuthberts Road - West of N-S Connector to Dyson Dr	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Glenelg Highway - Cherry Flat Road to Midland Hwy	Widening (4 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Greenhalghs Road - New North-South Connector to Wiltshire Lane	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Mair Street - Dawson to Humffray St	Widening (4 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Midland Highway - Howitt Street to Western Fwy	Duplication (4 lanes divided)	Arterial	Ballarat	2036	1	1	1	1	1
North-South Connector - Glenelg Hwy to Greenhalghs Rd	New link (2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Ross Creek Road - Cobden St to Tait St	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Sturt Street - Dawson St to Peel St	Downgrade (2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Western Link Road - Ross Creek Rd to Midland Hwy	New link (2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Western Link Road (Bells Road) - Cherry Flat Rd to Ross Creek Rd	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Western Link Road (Dyson Drive) - Ballarat-Carngham Rd to Glenelg Hwy	New link (2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Western Link Road (Dyson Drive) -Cuthberts Rd to Ballarat-Carngham Rd	New link (2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Western Link Road (Ross Creek Road) - Bells Rd to East-West Connector (south of Cobblers La)	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2036	1	1	1	1	1
Calder Park Drive - Melton Hwy to Calder Fwy	Duplication (4 lanes divided)	Arterial	Brimbank	2036	1	1	1	1	1
Taylors Road - West of Shire boundary to Kurung Dr	Duplication (4 lanes divided)	Arterial	Brimbank	2036	1	1	1	1	1
Cardinia Road - Western Arterial to South of Princes Freeway	Duplication (4 lanes)	Arterial	Cardinia	2036	0	0	1	0	0
Hallam South Road - Pound Rd to Princes Hwy (except at railway crossing)	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Hallam South Road - At railway crossing	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Arnold Street - Fenton St/ Prouses Rd to Grattan St	Widening (4 lanes)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Arthur Street - Queen St to Garsed St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Calder Highway - Monsants Rd/Hermitage Rd to Inglis St/ Specimen Hill Rd	Widening (4 lanes)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Galvin Street - Mitchell St to Mundy St	Speed optimisation (20kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Mackenzie Street - Midland Hwy to View St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Marong Road - Inglis St/ Specimen Hill Rd to Eaglehawk Rd	Widening (4 lanes)	Arterial	Greater Bendigo	2036	0	1	1	1	1
Midland Highway - Howard St to Taylor St	Widening (4 lanes)	Arterial	Greater Bendigo	2036	0	0	0	0	0
Midland Highway - McIvor Hwy/ Chapel St to Myrtle St/ Don St	Downgrade to 2 lanes + 2 Bus Lanes and Speed to 40kmph	Arterial	Greater Bendigo	2036	1	1	1	1	1
Mitchell Street - Myerst St to Galvin St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Park Road - Barnard St to Midland Hwy	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Queen Street - Mitchell St to Williamson St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Queen Street - Myrtle Rd to Mitchell St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Short Street - Midland Hwy to Queen St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Viewpoint - View St to Forest st	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
View Street / Mitchell Street - Barnard St to Myers St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Watte Street - Bernard St to Midland Hwy	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Williamson Street - Midland Hwy to Myers St	Speed optimisation (40kmph from 50kmph)	Arterial	Greater Bendigo	2036	1	1	1	1	1
Anglesea Road - Geelong Ring Road to Mount Duneed Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Bacchus Marsh Road - Elcho Rd to Geelong Ring Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Bacchus Marsh Road - Elcho Rd to Windermere Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Bacchus Marsh Road - Geelong Ring Rd to Teleta Cr	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Barwon Heads Road - Reserve Rd to Lower Duneed Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1

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Bellarine Link - Baanip Bvd to Barwon Heads Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Bellarine Link (Baanip Boulevard) - Anglesea Rd to Torquay Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Boundary Road - Surfcoast Hwy to Barwon Heads Rd	Widening (4 Lanes)	Arterial	Greater Geelong	2036	1	1	1	1	1
Breakwater Road - Barwon River to St Albans Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Breakwater Road - St Albans Rd to Portarlington Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Forest Road South - Station Lake Rd to Geelong Ring Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Horseshoe Bend Road - Boundary Rd to Burvilles Rd	Duplication (4 lanes divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Horseshoe Bend Road - Burvilles Rd to Stewarts Rd	Duplication (4 lanes divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Horseshoe Bend Road - Reserve Rd to Barwon Heads Rd	Duplication (4 lanes divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Horseshoe Bend Road - Reserve Rd to Boundary Rd	Duplication (4 lanes divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Midland Highway - Bannockburn-Shelford Rd to Fyansford-Gheringhap Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2036	1	1	1	1	1
Point Cook Road - Dunnings Road to Triholm Ave	Duplication (4 lanes divided)	Arterial	Hobsons Bay	2036	1	1	1	1	1
Bulla Bypass (Somerton Rd Extension) - Sunbury Rd to Wildwood Rd	New route (4 lanes)	Arterial	Hume	2036	1	1	1	1	1
Bulla Bypass (Somerton Rd) - Wildwood Rd to Melbourne Airport Link	Widening (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Bulla Bypass (Somerton Road) - Melbourne Airport Link to Oaklands Rd	Widening (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Craigieburn Road - East of Hume Hwy to Hume Freeway	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Donnybrook Road - Mickleham Rd to Errol Bvd	Widening (4 lanes)	Arterial	Hume	2036	1	1	1	1	1
Mickleham Road - Craigieburn Road to Donnybrook Road	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Mickleham Road - Somerton Road to Craigieburn Road	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Oaklands Road - Somerton Rd to Sunbury Rd	Duplication (4 lanes divided)	Arterial	Hume	2036	0	0	0	0	0
Roxburgh Park Drive - Donald Cameron Dr to James Mirams Dr	Upgrade (4 lanes) divided	Arterial	Hume	2036	1	1	1	1	1
Somerton Road - Mickleham Rd to Roxburgh Park Dr	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Somerton Road - Oaklands Rd to Mickleham Rd	Duplication (4 lanes divided)	Arterial	Hume	2036	1	1	1	1	1
Governor Road - Boundary Rd to Springvale Rd	Duplication (4 lanes divided)	Arterial	Kingston	2036	1	1	1	1	1
Dorset Road - Burwood Hwy to Lysterfield Rd	New route (2 lanes)	Arterial	Knox	2036	1	1	1	1	1
Napoleon Road - Kelletts Rd to Lysterfield Rd	Duplication (4 lanes divided)	Arterial	Knox	2036	1	1	1	1	1
Wellington Road - Napoleon Rd to Kelletts Rd	Duplication (4 lanes divided)	Arterial	Knox	2036	1	1	1	1	1
Wellington Road- Kellets Road to Lysterfield Road	Duplication (4 lanes divided)	Arterial	Knox	2036	0	0	0	0	0
Christies Road - Western Freeway to Western Highway	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Hopkins Road - Boundary Rd to Greigs Rd	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Melton Highway - Federation Dr to Leakes Rd	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Melton Highway - Leakes Rd to The Regency	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Robinsons Road - through Deer Park Bypass interchange	Widening (6 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Robinsons Road/Westwood Drive - Deer Park Bypass to Western Hwy	Duplication (4 lanes divided) and grade separation	Arterial	Melton	2036	1	1	1	1	1
Rockbank Middle Road - Lanaghan Av to Westwood Dr	Duplication (4 lanes)	Arterial	Melton	2036	0	1	1	0	0
Taylors Road - Plumpton Rd to Calder Park Dve	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Westwood Drive - Western Hwy to Rockbank Middle Rd	Widening (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Kilmore Wallan Bypass - Northern Hwy at Boundary Road to Hume Fwy at Wandong	New route (2 lanes)	Arterial	Mitchell	2036	1	1	1	1	1
Middleborough Road - Eastern Fwy to Springfield Rd	Widening (4 lanes undivided)	Arterial	Whitehorse	2036	1	1	1	1	1

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Craigieburn Road East - Hume Freeway to Epping Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Ballan Road - Bolton Rd to Ison Road	Widening (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Boundary Road - Fitzgerald Rd to Western Ring Rd	Widening (6 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Derrimut Road - Dohertys Road to Boundary Road	Duplication (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Heaths Road - Shaws Rd to Tarneit Rd	Duplication (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Heaths Road/Bolton Road - Ballan Rd to Shaws Rd	Duplication (4 lanes divided) and bridge widening	Arterial	Wyndham	2036	1	1	1	1	1
Point Cook Road - Pt Cook Homestead Road to Dunnings Road	Duplication (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Summerhill Road, Craigieburn	Grade separation	LX Removal	Hume	2036	1	1	1	1	1
Beveridge Road, Beveridge	Grade separation	LX Removal	Mitchell	2036	1	1	1	1	1
Wallan-Whittlesea Road, Wallan	Grade separation	LX Removal	Mitchell	2036	1	1	1	1	1
Donnybrook Road, Donnybrook	Grade separation	LX Removal	Whittlesea	2036	1	1	1	1	1
Cuzens Road - Ballarat-Carngham Rd to Cuthberts Rd	New link (2 lanes)	Local/Collector	Ballarat	2036	1	1	1	1	1
East-West Connector - Western Link Rd to Gillies St	New link (2 lanes)	Local/Collector	Ballarat	2036	1	1	1	1	1
Miles Street - Cobden St to Edwards St	Upgrade (Urban 2 lanes)	Local/Collector	Ballarat	2036	1	1	1	1	1
East-West Connector - Gum Scrub Creek to Cardinia Rd	New route (2 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
East-West Connector - O'Neil Road to Timbertop Bvd	New route (2 lane bvd)	Local/Collector	Cardinia	2036	1	1	1	1	1
East-West Connector - Timbertop Bvd to Gum Scrub Creek	New route (2 lane bvd)	Local/Collector	Cardinia	2036	1	1	1	1	1
North-South Collector - Princes Hwy to Canty La	New route (2 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
Southern Collector Road - Ryan Rd to Princes Hwy	New route (4 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
Western Arterial Road - Gum Scrub Creek to east of Cardinia Creek	New route (2 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
Bells Road - Hardys Rd to Ballarto Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Bells Road/Yallambie Road - Manks Rd to Ballarto Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Casey Fields Boulevard - Lineham Dr to South Gippsland Hwy	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Casey Fields Boulevard - Thompsons Rd to Linsell Bvd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Glasscocks Road - Narre Warren-Cranbourne Rd to Berwick-Cranbourne Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Grices Road - Soldiers Rd to west of Cardinia Creek	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Hardys Road - Bells Rd to Muddy Gates La	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Moores Road - South Gippsland Hwy to Bells Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Muddy Gates Lane/McCormacks Rd/Alexander Bvd - Ballarto Rd to Hardys Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Pattersons Road - Berwick-Cranbourne Rd to Tuckers Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Pattersons Road - Tuckers Rd to Pound Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Pound Road - Thompsons Rd to Ballarto Rd (3 sections)	Road closure	Local/Collector	Casey	2036	1	1	1	1	1
Soldiers Road - Bells Rd to Thompsons Rd	Closure	Local/Collector	Casey	2036	1	1	1	1	1
Soldiers Road - O'Shea Rd to Grices Rd	Closure	Local/Collector	Casey	2036	1	1	1	1	1
Tuckers Road/Derricks Road - Ballarto Rd to Manks Rd	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Belchers Road - Gubb Rd to Peninsula Dr (extension)	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
Burvilles Road - Horseshoe Bend Rd to Barwon Heads Rd	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
Burvilles Road - Torquary Rd to Horseshoe Bend Rd	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
Drews Road - Reserve Rd to Tannery Rd	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
East-West Connector - Bacchus Marsh Rd to Ohallorans Rd	New Road (2 Lanes divided)	Local/Collector	Greater Geelong	2036	1	1	1	1	1

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East-West Connector - between P22224 to P22225	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
East-West Connector - Ghazeepore Rd to Unity Dr	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
East-West Connector -P21036 to Ohallorans Rd	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Burvilles Rd to Baanip Boulevard	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Burvilles Rd to Boundary Rd	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Burvilles Rd to Boundary Rd	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Burvilles Rd to Horseshoe Bend Rd	New Road (4 Lanes connector)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Centennial Blvd to South	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Oceania Dr to Centennial Blvd	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Oceania Dr to North	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - P21030 to Patullos Rd	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - P21034 to Patullos Rd	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - P21034 to P1=21030	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Patullos Rd to P21030	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Portarlington Rd to Coriyule Rd	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Sovereign Dr to Baanip Boulevard	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Sovereign Rd to Freehans Rd	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
North-South Connector - Windermere Rd to Patullos Rd	New Road (2 Lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
Peninsula Drive Extension - Peninsula Dr to Belchers Rd	New Road (2 lanes)	Local/Collector	Greater Geelong	2036	1	1	1	1	1
Aitken Boulevard (E14) - Broadmeadows Rd Deviation to Somerton Rd	New route (2 lanes divided)	Local/Collector	Hume	2036	1	1	1	1	1
Cameron Street - Aitken Bvd to Hume Fwy	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Cloverton Boulevard - Cameron St to Beveridge	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Patterson Street - Beveridge to north of Beveridge	New route (2 lanes)	Local/Collector	Hume/Mitchell	2036	1	1	1	1	1
Gunns Gully Road - Hume Fwy to Syd/Melb Rail	New route (2 lanes)	Local/Collector	Hume/Whittlesea	2036	1	1	1	1	1
Harrison Road/Kirkpatrick Boulevard - Downing St to Hopkins Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Harrison Road/Kirkpatrick Boulevard - Mount Cottrell Rd to Downing St	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Hume Drive - Plumpton Road to Gourlay Road	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Iramoo Road - Exford Rd to Ferris Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Iramoo Road - Ferris Rd to Greigs Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Mt Cottrell Road - Western Fwy to Melton Hwy	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Paynes Road - Western Fwy to Melton Hwy	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Saric Road - Melton Highway to Taylors Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Tarletons Road - Leakes Rd to Plumpton Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Taylors Road Extension - Paynes Rd to Leakes Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Taylors Road Extension (Federation Drive) - Melton Hwy to Paynes Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Beveridge-Darraweit Road Extension - Old Sydney Rd to Patterson Dr	New route (2 lanes)	Local/Collector	Mitchell	2036	1	1	1	1	1
New east-west arterial north of Camerons Lane - Old Sydney Rd to Stewart St	New route (2 lanes)	Local/Collector	Mitchell/Whittlesea	2036	1	1	1	1	1
New east-west arterial south of Camerons Lane (Rankin St?) - Old Sydney Rd to Stewart St	New route (2 lanes)	Local/Collector	Mitchell/Whittlesea	2036	1	1	1	1	1
Edgars Road- Craigieburn Road to Summerhill Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Andrew Road - Craigieburn Road to Summerhill Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Bodycoats Road - Boundary Rd to Summerhill Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1

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Boundary Road - Koukoura Dr to Epping Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Cameron Street - at Sydney Melb railway	New railway overpass	Local/Collector	Whittlesea	2036	1	1	1	1	1
Cameron Street- Sydney Melb railway overpass to Merriang Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
East-West Connector - Edgars Rd to Salt Lake Bvd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
East-West Connector - Koukoura Dr to Epping Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
East-west connector - Spring St extension to N-S connector	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
East-West Connector - Vearings Rd to Edgars Bvd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Gunns Gully Road- Sydney Melb railway overpass to E6	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Harvest Home Road - Bindts Rd to North-South Connector	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Koukoura Drive - Craigieburn Rd to Summerhill Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Lithgow Street extension - Stewart St to N-S connector	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
North- South Connector- Findon Road to Lehmans Road	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
North-South Connector - Salt Lake Bvd to Boundary Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Patterson Drive - Beveridge Rd to Wallan	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Patterson Drive - Koukoura Dr to Donnybrook Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Rankin Street extension - Stewart St to N-S connector	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Spring Street extension - Rankin St to Cloverton Bvd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Vearings Road - Craigieburn Rd to Edgars Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Armstrong Road - Ballan Rd to Sayers Rd	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
Davis Road - Leakes Rd to Dohertys Rd	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
Forsyth Road/Christies Road - Leakes Rd to Boundary Rd	New route (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
Ison Road - Browns Rd to Armstrong Rd	New route (2 lanes) incl grade separation over Melb/Geelong rail line	Local/Collector	Wyndham	2036	1	1	1	1	1
Western Highway - Ballarat-Burrumbeet Rd to Bungaree-Wallace Rd	Conversion to freeway (4 lane freeway)	Major	Ballarat	2036	0	0	0	1	0
Calder Freeway - M80 Ring Road to Melton Hwy	Widening (8 lanes divided)	Major	Brimbank	2036	1	1	1	1	1
Calder Freeway, Interchange - Calder Park Dve	Interchange (full diamond)	Major	Brimbank	2036	1	1	1	1	1
Eastlink - Thompson Rd to Peninsula Link, south bound only	Widening (6 lane freeway)	Major	Frankston	2036	1	1	1	1	1
Princes Freeway - Kororoit Creek Rd to Dohertys Rd	Widening (5 lanes freeway, inbound only)	Major	Hobsons Bay	2036	1	1	1	1	1
Mt Atkinson Road - Middle Rd to Riding Boundary Rd	Closure	Major	Melton	2036	1	1	1	1	1
Riding Boundary Road - West of Mt Atkinson Rd to Hopkins Rd	New route (2 lanes)	Major	Melton	2036	1	1	1	1	1
Western Freeway - Ballarat Rd to Hopkins Rd	Widening (6 lanes)	Major	Melton	2036	1	1	1	1	1
Western Freeway - Hopkins Rd to Leakes Rd	Widening (6 lanes)	Major	Melton	2036	1	1	1	1	1
Western Freeway - Troupes Rd North	Remove direct freeway access	Major	Melton	2036	1	1	1	1	1
Western Freeway, Interchange - Mt Cottrell Rd	New interchange (half diamond, easterly ramps)	Major	Melton	2036	1	1	1	1	1
M80 - WestGate Fwy to Western Hwy	Widening (8 lane freeway)	Major	Wyndham/Brimbank	2036	1	1	1	1	1
Calder Park Drive - Taylors Rd to Melton Hwy	Duplication (4 lanes divided)	Arterial	Brimbank/Melton	2036	1	1	1	1	1
Brunt Road - Rix Rd to Princes Hwy	Duplication (4 lanes)	Arterial	Cardinia	2036	0	0	1	0	0
Rix Road - Officer South Rd to Brunt Rd	Duplication (4 lanes)	Arterial	Cardinia	2036	0	0	0	0	0
Ballarto Road - Casey Fields Bvd to Clyde-Five Ways Rd	Widening (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Ballarto Road - South Gippsland Hwy to Casey Fields Bvd	Duplication (4 lanes divided)	Arterial	Casey	2036	0	1	1	1	0
Berwick-Cranbourne Road - Cameron St to Clyde-Five Ways Rd	Duplication (4 lanes, not divided)	Arterial	Casey	2036	1	1	1	1	1
Berwick-Cranbourne Road - Pattersons Rd to Thompsons Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1

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Clyde-Five Ways Road - Pattersons Rd to Ballarto Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Evans Road - Hall Rd to South Gippsland Hwy	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Glasscocks Road - Evans Rd to South Gippsland Hwy	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Glasscocks Road - Western Port Hwy to Evans Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Grices Road - Berwick-Cranbourne Rd to Soldiers Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Pound Road/Greaves Road/O'Shea Road route - Hallam South Rd to Narre Warren-Cranbourne Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Pound Road/Greaves Road/O'Shea Road route - Narre Warren-Cranbourne Rd to Berwick-Cranbourne Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
Shrives/Centre/Fullard Roads - Pound Rd to Narre Warren-Cranbourne Rd	Widening (4 lanes not divided)	Arterial	Casey	2036	1	1	1	1	1
South Gippsland Highway - South Gippsland Fwy to Thompsons Rd	Widening (6 lanes divided)	Arterial	Casey	2036	1	1	1	1	1
William Thwaites Boulevard - Glasscocks Rd to Thompsons Rd	Duplication (4 lanes divided)	Arterial	Casey	2036	0	0	0	0	0
Glasscocks Road - Dandenong Valley Hwy to Western Port Hwy	Duplication (4 lanes divided)	Arterial	Greater Dandenong/Casey	2036	1	1	1	1	1
Cooper Street - Hume Hwy to Hume Freeway	Widening (6 lanes divided)	Arterial	Hume	2036	1	0	0	1	1
Donnybrook Road - Hume Fwy to E6	Widening (4 lanes)	Arterial	Hume/Whittlesea	2036	1	1	1	1	1
Westall Road - Dingley Arterial to Springvale Rd	Widening (6 lanes divided)	Arterial	Kingston	2036	1	1	1	1	1
Templestowe Road - Bridge St to Thompsons Rd	Duplication (4 lanes divided)	Arterial	Manningham	2036	1	1	1	1	1
Canterbury Road - Dorset Rd to Liverpool Rd	Widening (6 lanes divided)	Arterial	Maroondah	2036	1	1	1	1	1
Federation Drive - Centenary Av to Melton Hwy	Widening (4 lanes)	Arterial	Melton	2036	1	1	1	1	1
Hopkins Road - Greigs Rd to Plumpton Rd	Widening (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Leakes Road (Melton) - Iramoo Rd to Taylors Rd	Widening (4 lanes)	Arterial	Melton	2036	1	1	1	1	1
Mt Cottrell Road - Leakes Rd to Melton Hwy	Widening (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Westwood Drive - Rockbank Middle Rd to Taylors Rd	Duplication (4 lanes divided)	Arterial	Melton	2036	1	1	1	1	1
Westall Road (Northern Extension) - Princes Hwy East to Monash Fwy	New route (4 laned divided)	Arterial	Monash	2036	1	1	1	1	1
Epping Road - Craigieburn Rd to Bridge Inn Rd	Widening (4 lanes divided)	Arterial	Whittlesea	2036	1	1	1	1	1
Boundary Road - Davis Rd to Derrimut Rd	Duplication (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Boundary Road - Derrimut Rd to Palmers Rd	Widening (6 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Boundary Road- Palmers Rd to Fitzgerald Rd	Widening (6 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Dohertys Road - Derrimut Rd to Palmers Rd	Widening (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Ison Road - Armstrong Rd to Ballan Rd	Duplication (4 lanes divided)	Arterial	Wyndham	2036	1	1	1	1	1
Ison Road - Ballan Rd to Leakes Rd	Duplication (4 lanes)	Arterial	Wyndham	2036	1	1	1	1	1
Leakes Road (Wyndham) - Davis Rd to Derrimut Rd	Duplication (4 lanes)	Arterial	Wyndham	2036	1	1	1	1	1
Leakes Road (Wyndham) - Shanahans Rd to Davis Rd	Widening (4 lanes divided)	Arterial	Wyndham	2036	0	1	1	1	0
Sayers Road - Derrimut Rd to Palmers Rd	Widening (4 lanes)	Arterial	Wyndham	2036	1	1	1	1	1
Officer South Road - Patterson Rd to Pakenham Bypass	Sealing (2 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
Thompsons Road Extension - Officer South Rd to Cardinia Rd	New route (2 lanes)	Local/Collector	Cardinia	2036	1	1	1	1	1
Craig Road - new connection to South Gippsland Hwy	New route (2 lanes)	Local/Collector	Casey	2036	1	1	1	1	1
Thompsons Road Extension - Soldiers Rd to Officer South Rd	New route (2 lanes)	Local/Collector	Casey/Cardinia	2036	1	1	1	1	1
Aitken Boulevard (E14) - Donnybrook Rd to Gunns Gully Rd	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Aitken Boulevard (E14) - Somerton Rd to Mt Ridley Rd	Widening (4 lanes divided)	Local/Collector	Hume	2036	1	1	1	1	1
Canterbury Avenue - Bundanoon Avenue to Albert Road	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
Merrifield Road - Cameron St to Beveridge	New route (2 lanes)	Local/Collector	Hume	2036	1	1	1	1	1
English Street - Polaris Dr to Donnybrook Rd	New route (2 lanes)	Local/Collector	Hume / Whittlesea	2036	1	1	1	1	1
Downing Street - Greigs Rd to Harrison Rd	Sealing (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1

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Troups Road South - Greigs Rd to Harrison Rd	New route (2 lanes)	Local/Collector	Melton	2036	1	1	1	1	1
Mandalay Road (E14) - Camerons Lane to north of boundary	New route (2 lanes)	Local/Collector	Mitchell	2036	1	1	1	1	1
Mandalay Road (E14) - Gunns Gully Rd to Camerons Lane	New route (2 lanes)	Local/Collector	Mitchell	2036	1	1	1	1	1
New east-west route north of OMR - Mandalay Rd to Patterson St	New route (2 lanes)	Local/Collector	Mitchell	2036	1	1	1	1	1
Stewart Street - Beveridge to Northern Highway at Hume Interchange	New route (2 lanes)	Local/Collector	Mitchell	2036	1	1	1	1	1
North-South connector - Lithgow St extension to E-W connector	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Patterson Drive - Merri Creek to Beveridge Rd	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Summerhill Road/Masons Road - Koukoura Dr to E6	New route (2 lanes)	Local/Collector	Whittlesea	2036	1	1	1	1	1
Greens Road - Ison Rd to OMR	Sealing (2 lanes)	Local/Collector	Wyndham	2036	1	1	1	1	1
M80 - West of Plenty Rd to Greensborough Hwy (associated with E6)	Widening (10 lane freeway)	Major	Banyule	2036	1	1	1	1	1
Western Freeway - M80 to Ballarat Rd	Widening (6 lane freeway)	Major	Brimbank/Melton	2036	1	1	1	1	1
Officer South Road - Pakenham Bypass to Rix Rd	Interchange (full diamond), duplication (4 lanes divided)	Major	Cardinia	2036	1	1	1	1	1
Monash Freeway - South Gippsland Fwy Interchange	New ramp (south to east) and additional lane on Monash Fwy E bd to Tinks Rd	Major	Casey	2036	1	1	1	1	1
South Gippsland Freeway - Monash Fwy to Dandenong Bypass	Widening (6 lanes)	Major	Casey	2036	1	1	1	1	1
Dandenong Bypass - Perry Rd to South Gippsland Hwy	Widening (6 lanes divided)	Major	Greater Dandenong	2036	1	1	1	1	1
Dandenong Bypass - South Gippsland Hwy to South Gippsland Fwy	New route (6 lanes divided)	Major	Greater Dandenong	2036	1	1	1	1	1
Princes Freeway West - Kororoit Creek Rd to Forsyth Rd	Widening (10 lane freeway)	Major	Hobsons Bay/Wyndham	2036	1	1	1	1	1
Hume Freeway - Craigieburn Rd to Hume Hwy	Widening (6 lane freeway)	Major	Hume	2036	1	1	1	1	1
Hume Freeway - Hume Hwy to south of Donnybrook Rd	Widening (8 lane freeway)	Major	Hume	2036	1	1	1	1	1
Hume Freeway - south of Donnybrook Rd to Gunns Gully Rd	Widening (6 lane freeway)	Major	Hume/Mitchell	2036	1	1	1	1	1
Western Freeway - Leakes Rd to Coburns Rd	Widening (6 lanes)	Major	Melton	2036	1	1	1	1	1
Calder Freeway - Melton Hwy to Vineyard Rd	Widening (6 lanes)	Major	Melton/Hume/Brimbank	2036	1	1	1	1	1
E6 - Patterson Dr to Hume Fwy	New route (4 lane freeway)	Major	Mitchell	2036	0	1	1	1	1
E6 - Lehmans Rd to Patterson Dr	New route (4 lane freeway)	Major	Mitchell/Whittlesea	2036	0	1	1	1	1
E6 - Findon Rd to Lehmans Rd (includes sealing of Lehmans Rd from E6 to Epping Rd)	New route (4 lane freeway)	Major	Whittlesea	2036	0	1	1	1	1
E6 - Lehmans Rd to Masons Rd	Widening (6 lane freeway)	Major	Whittlesea	2036	0	1	1	1	1
E6 - Metropolitan Ring Rd to Findon Rd	New route (4 lane freeway)	Major	Whittlesea	2036	0	1	1	1	1
E6 - Metropolitan Ring Road to Lehmans Rd	Widening (6 lane freeway)	Major	Whittlesea	2036	0	1	1	1	1
Lehmans Road - Epping Rd to E6 (associated with E6)	Duplication (4 lanes divided)	Major	Whittlesea	2036	0	1	1	1	1
Princes Freeway West - Geelong Rd (Werribee Western Interchange) to Heaths Rd (Werribee Eastern Interchange)	Widening (8 lane freeway)	Major	Wyndham	2036	1	1	1	1	1
E6 - Masons Rd to Donnybrook Rd	Widening (6 lane freeway)	Major		2036	0	1	1	1	1
Ararat Bypass	New road (4 lanes divided)	Arterial	Ballarat	2056	1	1	1	1	1
Beaufort Bypass	New road (4 lanes divided)	Arterial	Ballarat	2056	1	1	1	1	1
Cherry Flat Road- Schreenans Rd to Webb Rd	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Cobden Street Extension - Western Link Rd to Miles St	New link (2 Lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Greenhalghs Road - Western Link Rd to North-South Connector	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Mt Buninyoung Road - Midland Hwy to Yankee Flat Rd	Upgrade (Arterial 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
North-South Connector - Greenhaighs Rd to Ballarat-Carngham Rd	New link (2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Ross Creek Road - Western Link Rd to Cobden St	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Schreenans Road - Cherry Flat Rd to Ross Creek Rd	New link (2 Lanes)	Arterial	Ballarat	2056	1	1	1	1	1

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Warrenheip Road - Navigators Rd to Old Melbourne Rd	Upgrade (Arterial 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Western Link Road (Bells Road) - Lewis Ct to Cherry Flat Rd	Upgrade (Urban 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Western Link Road- Glenelg Hwy to Bells Rd	New link (2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Yankee Flat Road - Yendon Number One Rd to Butlers Rd	Upgrade (Arterial 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Yankee Flat Road/Navigators Road - Butlers Rd to Warrenheip Rd to	Upgrade (Arterial 2 lanes)	Arterial	Ballarat	2056	1	1	1	1	1
Little Boundary Road - Fairbairn Rd to Princes Hwy	Widening (6 lanes divided)	Arterial	Brimbank	2056	1	1	1	1	1
Taylors Road - Kurung Dr to Kings Rd	Duplication (4 lanes divided)	Arterial	Brimbank	2056	1	1	1	1	1
Cardinia Road - Thompsons Rd to South of Western Arterial	Duplication (4 lanes)	Arterial	Cardinia	2056	0	0	0	0	0
Cardinia Road - Western Arterial to South of Princes Freeway	Widening (6 lanes)	Arterial	Cardinia	2056	0	0	1	0	0
McGregor Road - Thompsons Rd Extension to Pakenham Bypass	Duplication (4 lanes divided)	Arterial	Cardinia	2056	0	0	1	0	0
Officer South Road - Rix Rd to Princes Hwy	New route (4 lanes divided)	Arterial	Cardinia	2056	1	1	1	1	1
Princes Highway - Old Princes Hwy to Officer South Rd	Widening (6 lanes divided)	Arterial	Cardinia	2056	1	1	1	1	1
Bells Road - O'Shea Rd to Hardys Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Berwick-Cranbourne Road - Thompsons Rd to Grices Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Casey Fields Boulevard/Craig Road - Browns Rd to Ballarto Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	0	0	1	0	0
Clyde Road - Grices Rd to Moondarra Dr	Widening (6 lanes divided)	Arterial	Casey	2056	0	0	0	0	0
Clyde-Five Ways Road - Ballarto Rd to South Gippsland Hwy	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Glasscocks Road - South Gippsland Hwy to Berwick-Cranbourne Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Hardys Road - Berwick-Cranbourne Rd to Bells Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Linsell Boulevard - Narre Warren-Cranbourne Rd to Berwick-Cranbourne Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Linsell Boulevard Extension - Sth Gippsland Hwy to Narre Warren-Cranbourne Rd	New route (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Racecourse Road - Henry St to Princes Hwy	Duplication (4 lanes divided)	Arterial	Casey	2056	0	0	1	0	0
Thompsons Road - Berwick-Cranbourne Rd to Officer South Rd	Widening (4 lanes divided)	Arterial	Casey/Cardinia	2056	1	1	1	1	1
Grange Road - Heidelberg Rd to Darebin Rd	Duplication (4 lanes divided)	Arterial	Darebin	2056	1	1	1	1	1
McIvor Highway - Lyttleton Terrace/Chapel St to Kennedy St/ Stemberg St	Widening (8 lanes)	Arterial	Greater Bendigo	2056	0	0	0	1	0
McIvor Highway - Pratts Park Rd to St Vincents Rd	Widening (4 lanes)	Arterial	Greater Bendigo	2056	1	1	1	1	1
Strathfieldsaye Road - Reservoir Rd to Emu Creek Rd	Widening (4 lanes)	Arterial	Greater Bendigo	2056	1	1	1	1	1
Taylors Road/Colemans Road - Remington Drive to Bangholme Rd	New route (4 lanes divided)	Arterial	Greater Dandenong	2056	1	1	1	1	1
Thompsons Road - McCormicks Rd to Clyde Rd	Widening (6 lanes divided)	Arterial	Greater Dandenong/Casey	2056	1	1	1	1	1
Aitken Boulevard (E14) - Broadmeadows Rd Deviation to Somerton Rd	Widening (4 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Broadmeadows Road - Mickleham Rd to Ripplebrook Dr	Duplication (4 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Melbourne-Lancefield Road - Sunbury Rd to north of Raes Rd	Widening (4 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Somerton Road - Roxburgh Park Drive to Hume Hwy	Widening (6 lanes divided)	Arterial	Hume	2056	1	0	0	1	1
Sunbury Road - OMR to Melbourne-Lancefield Rd	Widening (6 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Burwood Highway - Scoresby Rd to Ferntree Gully Rd	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Lysterfield Road - Napoleon Rd to Wellington Rd	Duplication (4 lanes divided)	Arterial	Knox	2056	0	0	0	0	0
Stud Road Extension (Bayswater Bypass) - Mountain Highway to Dorset Road	New route (4 lanes)	Arterial	Knox/Maroondah	2056	1	1	1	1	1

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Wantirna Road - Canterbury Road to Maroondah Hwy	Duplication (4 lanes divided)	Arterial	Maroondah	2056	1	1	1	1	1
Greigs Road - Troups Rd Sth to Hopkins Rd	Widening (4 lanes)	Arterial	Melton	2056	1	1	1	1	1
Hopkins Road - Boundary Rd to Greigs Rd	Widening (6 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Iramoo Road - Mt Cottrell Rd to Greigs Rd	Widening (4 lanes)	Arterial	Melton	2056	1	1	1	1	1
Paynes Road - Western Freeway overpass	New road (4 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Plumpton Road - Hopkins Road Extension to Calder Freeway	Widening (4 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Bacchus Marsh Bypass	New road (4 lanes divided)	Arterial	Moorabool	2056	1	1	1	1	1
Mornington-Tyabb Road - Nepean Hwy to Moorooduc Hwy	Duplication (4 lanes divided)	Arterial	Mornington Peninsula	2056	1	1	1	1	1
Diamond Creek Road - Greensborough Bypass to Yan Yean Rd	Widening (6 lanes divided)	Arterial	Nillumbik	2056	1	1	1	1	1
Surrey Road - Eastern Fwy to Springfield Rd	Widening (4 lanes divided)	Arterial	Whitehorse	2056	1	1	1	1	1
Bridge Inn Road - Cravens Rd to Plenty Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Bridge Inn Road - E6 to Cravens Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Bridge Inn Road - Epping Rd to E6	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Childs Road - High St to Dalton Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Deveny Road - Edgars to High St	New route (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Findon Road - Epping Rd to Glendale Av	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Findon Road - Glendale Av to west of Civic Dr	Widening (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Findon Road - West of Civic Drive to Plenty Road	Widening (4 lanes divided) and new link	Arterial	Whittlesea	2056	1	1	1	1	1
Ballan Road - Bulban Rd to Bolton Rd	Widening (4 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Ballan Road - Ison Rd to OMR	Widening (4 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Boundary Road - WRR to Fairbairn Rd	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Derrimut Road - Hogans Rd to Sayers Rd	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	0	0	1	1
Fitzgerald Road - Kororoit Creek Rd to Western Fwy ramp	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Leakes Road (Wyndham) - Palmers Rd to Fitzgerald Rd	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Sayers Road/ Old Geelong Road - Palmers Road to Kororoit Creek Road	Duplication (4 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Forsyths Road/Christies Road - Sayers Rd to Caroline Springs Station	Duplication (4 lanes divided)	Arterial	Wyndham/Melton	2056	1	1	1	1	1
Canterbury Road - Liverpool Rd to Mount Dandenong Tourist Rd	Widening (6 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Moorolbark Road - Healesville Arterial to Maroondah Hwy	Duplication (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Mount Dandenong Road - Liverpool Rd to Canterbury Rd	Duplication (4 lanes divided)	Arterial	Yarra Ranges	2056	0	0	0	0	0
Swansea Road - York Rd to Mt Dandenong Rd	Widening (6 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Wellington Road - Lysterfield Rd to Belgrave-Hallam Rd	Duplication (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Cobblers Lane - Ross Creek Rd to Cobden St	Upgrade (Urban 2 lanes)	Local/Collector	Ballarat	2056	1	1	1	1	1
Cameron Street - at Hume Fwy	New freeway overpass	Local/Collector	Hume	2056	1	1	1	1	1
Mt Atkinson Road - Boundary Rd to Kirkpatrick Bvd	New route (2 lanes)	Local/Collector	Melton	2056	1	1	1	1	1
Tarletons Road - Mt Cottrell Rd to Leakes Rd	New route (2 lanes)	Local/Collector	Melton	2056	1	1	1	1	1
Calder Freeway, Interchange - Sunshine Ave	Interchange (1/2 diamond, westerly oriented)	Major	Brimbank	2056	1	1	1	1	1
Monash Freeway - Cardinia Road to Koo Wee Rup Rd	Widening (6 lanes freeway)	Major	Cardinia	2056	1	1	1	1	1
South Gippsland Freeway - Dandenong Bypass to South Gippsland Hwy	Widening (6 lanes)	Major	Casey	2056	1	1	1	1	1
Thompsons Road/Western Port Highway Interchange	Interchange (full diamond) and grade separation	Major	Casey	2056	1	1	1	1	1
Western Port Highway - North Rd to Baxter Tooradin Rd	Duplication (4 lanes divided)	Major	Casey	2056	1	1	1	1	1
Peninsula Link (Frankston Bypass) - EastLink to Frankston-Flinders Rd, south-bound only	Widening (6 lane freeway)	Major	Frankston	2056	1	1	1	1	1
Melbourne Airport Link - Melbourne Airport to Somerton Rd	New route (4 lane freeway)	Major	Hume	2056	1	1	1	1	1
Melbourne Airport Link - Somerton Rd to OMR	New route (4 lane freeway)	Major	Hume	2056	1	1	1	1	1
OMR - Calder Fwy to Sunbury Rd	New route (4 lane freeway)	Major	Hume	2056	1	1	1	1	1

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OMR - Sunbury Rd to Hume Fwy	New route (4 lane freeway)	Major	Hume/Mitchell	2056	1	1	1	1	1
West Gate Distributor, Whitehall St Widening	Widening (4 lanes not divided)	Major	Maribyrnong	2056	1	1	1	1	1
Punt Road - Swan Street to St Kilda junction	Widening (6 lanes)	Major	Melbourne	2056	1	1	1	1	1
OMR - Western Fwy to Calder Fwy	New route (4 lane freeway)	Major	Melton/Hume	2056	1	1	1	1	1
OMR/E6 - Connection at Hume Fwy I/C including west-facing ramps at Patterson Dr	New route (4 lane freeway)	Major	Mitchell	2056	0	1	1	1	1
Eastlink - Maroondah Hwy to Dingley Arterial	Widening (8 lane freeway)	Major	Whitehorse/Knox/Greater Dandenong	2056	1	1	1	1	1
Hume Freeway - Metropolitan Ring Rd to O'Herns Rd	Widening (8 lanes)	Major	Whittlesea	2056	1	1	1	1	1
Somerton Road - Mickleham Rd to Roxburgh Park Dr	Widening (6 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Melton Highway - Ryans La to The Regency	Widening (6 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Melton Highway - The Regency to Banchory Av	Widening (6 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Duncans Road - Princes Highway to Princes Freeway	Duplication (4 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Leakes Road (Wyndham) - Mt Cottrell Rd to Palmers Rd	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Palmers Road/Robinsons Road - Leakes Rd to Boundary Rd	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Calder Park Drive - Melton Hwy to Calder Fwy	Widening (6 lanes divided)	Arterial	Brimbank	2056	1	1	1	1	1
Calder Park Drive - Taylors Rd to Melton Hwy	Widening (6 lanes divided)	Arterial	Brimbank/Melton	2056	1	1	1	1	1
Cardinia Road - Lecky Rd to Henry Rd	Widening (6 lanes divided)	Arterial	Cardinia	2056	0	0	1	0	0
Greenhills Road - McGregor Rd to Koo Wee Rup Rd	Widening (4 lanes divided)	Arterial	Cardinia	2056	1	1	1	1	1
Officer South Road - Lecky Rd to Pakenham Bypass	Widening (4 lanes not divided)	Arterial	Cardinia	2056	1	1	1	1	1
Officer South Road - Thompsons Rd to Lecky Rd	Widening (4 lanes not divided)	Arterial	Cardinia	2056	1	1	1	1	1
Thompsons Road Extension - Officer South Rd to McGregors Rd	Widening (4 lanes divided)	Arterial	Cardinia	2056	0	0	1	1	1
Bells Road - Hardys Rd to Ballarto Rd	Widening (6 lanes divided)	Arterial	Casey	2056	0	0	1	0	0
Berwick-Cranbourne Road - Cameron St to Clyde-Five Ways Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Berwick-Cranbourne Road - Pattersons Rd to Thompsons Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Browns Road - Western Port Hwy to Craig Rd	Widening (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Casey Fields Boulevard - Ballarto Rd to Thompsons Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	0	1	1	1	0
Clyde-Five Ways Road - Ballarto Rd to South Gippsland Hwy	Widening (6 lanes divided)	Arterial	Casey	2056	0	0	0	0	0
Clyde-Five Ways Road - Pattersons Rd to Ballarto Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Cranbourne-Frankston Road - Western Port Hwy to Hall Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Heatherton Road - Hallam North Rd to Belgrave-Hallam Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Muddy Gates Lane/McCormacks Rd/Alexander Bvd - Ballarto Rd to Hardys Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Narre Warren-Cranbourne Road - Pound Rd to Centre Rd	Widening (6 lanes divided)	Arterial	Casey	2056	0	0	1	0	0
Narre Warren-Cranbourne Road - Thompsons Rd to Pound Rd	Widening (6 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Pattersons Road - Bells Rd to Pound Rd	Duplication (4 lanes divided)	Arterial	Casey	2056	1	1	1	1	1
Grices Road / Western Arterial Road - Soldiers Rd to Cardinia Road	Duplication (4 lanes)	Arterial	Casey/Cardinia	2056	0	1	1	1	1
Hall Road - Dandenong-Frankston Rd to Western Port Hwy	Widening (6 lanes divided)	Arterial	Frankston	2056	1	1	1	1	1
Dandenong Valley Hwy (Stud Road) - Heatherton Rd to Monash Fwy	Widening (3 lanes south bound)	Arterial	Greater Dandenong	2056	0	1	0	0	0
Dandenong-Frankston Road - Greens Rd to Dandenong Bypass	Widening (6 lanes divided)	Arterial	Greater Dandenong	2056	1	1	1	1	1
Dandenong-Frankston Road - Thompsons Rd to Greens Rd	Widening (6 lanes divided)	Arterial	Greater Dandenong	2056	1	1	1	1	1
Glasscocks Road - Dandenong Valley Hwy to Evans Rd	Widening (6 lanes divided)	Arterial	Greater Dandenong/Casey	2056	1	1	1	1	1

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Dandenong Valley Hwy (Stud Road) - Monash Fwy to Wellington Road	Widening (6 lanes divided)	Arterial	Greater Dandenong/Knox	2056	1	1	1	1	1
Anglesea Road - Mount Duneed Rd to Great Ocean Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Bellarine Highway - La Trobe Tce to Moolap Station Rd	Widening (6 lanes divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Bellarine Link - Barwon Heads Rd to Portarlington Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Fyans Street - La Trobe Tce to Boundary Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Midland Highway - Dog Rocks Rd to Princes Fwy	Widening (6 lanes divided)	Arterial	Greater Geelong	2056	0	0	1	1	1
Midland Highway - Fyansford-Gheringhap Rd to Dog Rocks Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Mount Duneed Road - Anglesea Rd to Barwon Heads Rd	Duplication (4 lane divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Surf Coast Highway - James Harrison Bridge to Princes Hwy	Widening (6 lanes divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Surf Coast Highway - Princes Hwy to Mount Duneed Rd	Widening (6 lanes divided)	Arterial	Greater Geelong	2056	1	1	1	1	1
Brookville Drive - Summerhill Rd to Donnybrook Rd	Widening (4 lanes divided)	Arterial	Hume	2056	0	1	1	1	1
English Street - Aitken Bvd to Brookville Dr	Duplication (4 lanes divided) + 1/2 diamond interchange, south facing ramps	Arterial	Hume	2056	1	1	1	1	1
Hume Highway - Craigieburn Rd to Hume Freeway	Widening (6 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Mickleham Road - Somerton Road to Craigieburn Road	Widening (6 lanes divided)	Arterial	Hume	2056	1	1	1	1	1
Donnybrook Road - Mickleham Rd to E6	Widening (6 lanes divided)	Arterial	Hume/Whittlesea	2056	1	1	1	1	1
Boronia Road - Mountain Hwy to Stud Rd	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Burwood Highway - Cathies Lane to Stud Road	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Dandenong Valley Hwy (Stud Road) - High Street to Burwood Highway	Widening (3 lanes north bound)	Arterial	Knox	2056	1	1	1	1	1
Dandenong Valley Hwy (Stud Road) - Burwood Hwy to Boronia Rd	Widening (3 lanes north bound)	Arterial	Knox	2056	1	1	1	1	1
Dandenong Valley Hwy (Stud Road) - Ferntree Gully Road to High St Road	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Dandenong Valley Hwy (Stud Road) - Wellington Road to Kellets Road	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Dorset Road - Burwood Hwy to Boronia Rd	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Dorset Road - Rosella Av to Olive Grove	Duplication (4 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Ferntree Gully Road - Scoresby Rd to Burwood Hwy	Widening (6 lanes divided)	Arterial	Knox	2056	0	0	0	0	0
Ferntree Gully Road - Stud Rd to Scoresby Rd	Widening (6 lanes divided)	Arterial	Knox	2056	1	1	1	1	1
Main Road - Fitzsimons La to Bridge St	Widening (4 lanes not divided)	Arterial	Manningham	2056	1	1	1	1	1
Springvale Road - Mitcham Rd to Old Warrandyte Rd	Duplication (4 lanes divided)	Arterial	Manningham	2056	1	1	1	1	1
Springvale Road - Old Warrandyte Rd to Reynolds Rd	Duplication (4 lanes divided)	Arterial	Manningham	2056	1	1	1	1	1
Victoria Street - Doncaster Road to King St	Widening (4 lanes not divided)	Arterial	Manningham	2056	1	1	1	1	1
Williamsons Road - Eucalypt Av to Foote St	Widening (6 lanes divided)	Arterial	Manningham	2056	1	1	1	1	1
Bayswater Road - Canterbury Rd to Mt Dandenong Rd	Widening (4 lanes)	Arterial	Maroondah	2056	1	1	1	1	1
Dorset Road - Hull Rd to Maroondah Highway	Duplication (4 lanes divided)	Arterial	Maroondah	2056	1	1	1	1	1
Mt Dandenong Road - Whitehorse Rd to Dublin Rd	Widening (6 lanes divided)	Arterial	Maroondah	2056	1	1	1	1	1
Croydon Road/Wonga Road/Warranwood Road/Plymouth Road - Yarra Road to Ringwood-Warrandyte	Duplication (4 lanes divided)	Arterial	Maroondah/Manningham	2056	1	1	1	1	1
Stud Road Extension (Healesville Arterial) - Dorset Rd to Moorolbark Rd	New route (4 lanes divided)	Arterial	Maroondah/Yarra Ranges	2056	1	1	1	1	1
Robinsons Road/Westwood Dive - Deer Park Bypass to Western Hwy	Widening (6 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Westwood Drive - Western Hwy to Taylors Rd	Widening (6 lanes divided)	Arterial	Melton	2056	1	1	1	1	1
Baxter-Tooradin Road - Western Port Hwy to South Gippsland Hwy	Widening (4 lanes divided)	Arterial	Mornington Peninsula	2056	1	1	1	1	1
Golf Links Road - Peninsula Link to Baxter-Tooradin Rd	Duplication (4 lanes divided)	Arterial	Mornington Peninsula	2056	1	1	1	1	1

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Diamond Creek Road- Aqueduct Road to Ryans Road	Duplication (4 lanes divided)	Arterial	Nillumbik	2056	1	1	1	1	1
Edgars Road - Cooper St to O'Herns Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Gorge Road/ Kurrak Road - Plenty Rd to Yan Yean Rd	Duplication (4 lanes divided)	Arterial	Whittlesea	2056	1	1	1	1	1
Scanlon Drive - O'Herns Rd to Craigieburn Rd	Duplication	Arterial	Whittlesea	2056	1	1	1	1	1
Derrimut Road - Dohertys Road to Boundary Road	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Derrimut Road - Leakes Road to Dohertys Road	Widening (6 lanes divided)	Arterial	Wyndham	2056	1	1	1	1	1
Hobbs Road/Sewells Road - Ballan Rd to Sayers Rd	Duplication (4 lanes divided)	Arterial	Wyndham	2056	0	1	1	1	1
Palmers Road/Robinsons Road - Sayers Rd to Leakes Rd	Widening (6 lanes divided)	Arterial	Wyndham/Melton	2056	1	1	1	1	1
Maroondah Highway - Warburton Highway to Melba Highway	Duplication (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Maroondah Highway Deviation at Lilydale - Maroondah Hwy to Anderson Rd	New route (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Melba Highway - Coldstream to north of Yarra Glen	Duplication and deviation (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Victoria Road - Maroondah Hwy to Paynes Rd Extension	Duplication (4 lanes divided)	Arterial	Yarra Ranges	2056	1	1	1	1	1
Belgrave Hallam Road - Heatherton Rd to Wellington Rd	Duplication (4 lanes divided)	Arterial	Yarra Ranges/Casey	2056	1	1	1	1	1
Clarendon Street, Frankston	Grade separation	LX Removal	Frankston	2056	1	1	1	1	1
Hillcrest Road, Frankston	Grade separation	LX Removal	Frankston	2056	1	1	1	1	1
Moorooduc Highway, Frankston	Grade separation	LX Removal	Frankston	2056	1	1	1	1	1
Robinsons Road, Langwarrin South	Grade separation	LX Removal	Frankston	2056	1	1	1	1	1
Barry Road - Malmsbury Dr to Aitken Bvd	New route (2 lanes)	Local/Collector	Hume	2056	1	1	1	1	1
Koukoura Drive - Summerhill Rd to Donnybrook Rd	New route (2 lanes)	Local/Collector	Whittlesea	2056	1	1	1	1	1
Koo Wee Rup Road, new freeway - Princes Freeway at Pakenham to South Gippsland Highway at Koo Wee Rup	Conversion to freeway (4 lanes)	Major	Cardinia	2056	1	1	1	1	1
Western Port Highway - South Gippsland Hwy to Cranbourne-Frankston Rd (excludes Wedge Rd interchange)	Conversion to freeway (4 lanes)	Major	Casey	2056	1	1	1	1	1
Western Port Highway - Baxter Tooradin Rd to Frankston Flinders Rd	Duplication (4 lanes divided)	Major	Casey/Mornington Peninsula	2056	1	1	1	1	1
Eastlink - Thompson Rd to Peninsula Link, north bound only	Widening (6 lane freeway)	Major	Frankston	2056	1	1	1	1	1
Peninsula Link (Frankston Bypass) - EastLink to Frankston-Flinders Rd, north bound only	Widening (6 lane freeway)	Major	Frankston	2056	1	1	1	1	1
Dingley Freeway - Cheltenham Rd to Perry Rd	Conversion to freeway (6 lanes)	Major	Greater Dandenong	2056	1	1	1	1	1
Dingley Freeway - Perry Rd to South Gippsland Fwy	Conversion to freeway (6 lanes)	Major	Greater Dandenong	2056	1	1	1	1	1
OMR - Calder Fwy to Sunbury Rd	New route (6 lane freeway)	Major	Hume	2056	1	1	1	1	1
OMR - Sunbury Rd to Melbourne Airport Link	Widening (6 lanes)	Major	Hume	2056	1	1	1	1	1
Mornington Peninsula Freeway - Dingley Bypass to Lower Dandenong Rd	Widening (6 lane freeway)	Major	Kingston	2056	1	1	1	1	1
Mornington Peninsula Freeway - Lower Dandenong Rd to Springvale Rd	Widening (6 lane freeway)	Major	Kingston	2056	1	1	1	1	1
Mornington Peninsula Freeway - Thames Prm to Thompson Rd	Widening (6 lane freeway)	Major	Kingston/Frankston	2056	1	1	1	1	1
Dingley Freeway - South Road to Cheltenham Rd	Conversion to freeway (6 lanes)	Major	Kingston/Greater Dandenong	2056	1	1	1	1	1
Hume Freeway - Northern Hwy to Watson St	Widening (6 lane freeway)	Major	Mitchell	2056	1	1	1	1	1
Hume Freeway - OMR to Northern Hwy	Widening (6 lane freeway)	Major	Mitchell	2056	1	1	1	1	1
Princes Freeway West - Heaths Rd	New interchange	Major	Wyndham	2056	1	1	1	1	1
Barwon Heads-Ocean Grove Road Upgrade	Duplication	Arterial	Barwon Heads	2056	0	0	0	1	1
Midland Highway Upgrade	Duplication/Widening	Arterial	Between Geelong and Ballarat	2056	0	0	0	1	1
Geelong Road Upgrade	Duplication/Widening	Arterial	South of Ballarat	2056	0	0	0	1	1
Moss Avenue Upgrade	Duplication	Arterial	South of Ballarat	2056	0	0	0	1	1
Mount Clear-Sebastopol Road Upgrade	Duplication	Arterial	South of Ballarat	2056	0	0	0	1	1
Withshire Lane Upgrade	Duplication	Arterial	South of Ballarat	2056	0	0	0	1	1
Yankee Flat Road Upgrade	Duplication	Arterial	South of Ballarat	2056	0	0	0	1	1

Project	Scope	Category	LGA	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Surf Coast Highway Upgrade	Widening	Arterial	South of Geelong	2056	0	0	0	1	1
Bellarine Highway Upgrade	Widening	Arterial	South-east of Geelong	2056	0	0	0	1	1
Portarlington Road Upgrade	Widening	Arterial	South-east of Geelong	2056	0	0	0	1	1
Melbourne Airport Link - Melbourne Airport to Somerton Rd	Widening (6 lane freeway)	Major	Hume	2056	1	1	1	1	1
Deer Park Bypass Extension - Deer Park Bypass to OMR (connections to OMR south only)	New route (4 lane freeway)	Major	Melton	2056	1	1	1	1	1
OMR - Boundary Rd to Western Fwy	New route (4 lane freeway)	Major	Melton	2056	1	1	1	1	1
OMR - Boundary Rd to Western Fwy	Widening (6 lane freeway)	Major	Melton	2056	0	1	1	1	1
OMR/Deer Park Bypass Extension interchange	New freeway ramps, north facing (2 lanes)	Major	Melton	2056	1	1	1	1	1
Hume Freeway - O'Herns Rd to Craigieburn Rd	Widening (8 lanes)	Major	Whittlesea	2056	1	1	1	1	1
OMR - Princes Fwy to Ballan Rd	New route (4 lane freeway)	Major	Wyndham	2056	1	1	1	1	1
OMR - Ballan Rd to Boundary Rd	New route (6 lane freeway)	Major	Wyndham/Melton	2056	1	1	1	1	1
E6 - Donnybrook Rd to Hume Fwy (includes Gunns Gully Rd I/C)	Widening (6 lane freeway)	Major	Mitchell	2056	0	0	1	0	0

Public Transport Infrastructure

Table 20 outlines the public transport infrastructure projects as implemented across the 2036 and 2056 scenarios by land use scenario. Project implemented in the year 2036 were also implemented in 2056. An active project is denoted with a '1' in the far-right columns, with '0' defined as inactive.

Table 20 Public transport infrastructure assumptions

Project	Category	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Bendigo Line Upgrade	Heavy Rail	2036	1	1	1	1	1
Black Forest Road Station and Track Extension from Wyndham Vale	Heavy Rail	2036	1	1	1	1	1
Cranbourne Duplication	Heavy Rail	2036	1	1	1	1	1
Geelong Line Upgrade	Heavy Rail	2036	1	1	1	1	1
Gippsland Line Upgrade	Heavy Rail	2036	1	1	1	1	1
Hurstbridge Line Upgrade Stage 2	Heavy Rail	2036	1	1	1	1	1
Shepparton Line Upgrade Stage 3	Heavy Rail	2036	1	1	1	1	1
Waurn Ponds Stage 2 (duplication beyond Geelong Tunnel)	Heavy Rail	2036	1	1	1	1	1
Wyndham Vale 9 Car Services	Heavy Rail	2036	1	1	1	1	1
Park Street Link	Light Rail	2036	1	1	1	1	1
Clyde Extension	Heavy Rail	2036	1	1	1	1	1
Geelong Fast Rail Stage 1: Werribee Line 3rd and 4th Tracks	Heavy Rail	2036	1	1	1	1	1
Geelong Fast Rail Stage 2: 5tph via Werribee 3 via RRL	Heavy Rail	2036	1	1	1	1	1
Geelong Fast Rail Stage 3: Geelong / Waurn Ponds, Barwon River Bridge Duplication	Heavy Rail	2036	1	1	1	1	1
Melbourne Airport Rail to MTP	Heavy Rail	2036	1	1	1	1	1
Melton Electrification	Heavy Rail	2036	1	1	1	1	1
Somerton Link (Roxburgh Park – Upfield)	Heavy Rail	2036	1	1	1	1	1
Caulfield-Monash Route	Light Rail	2036	1	1	1	1	1
Fishermans Bend North Route	Light Rail	2036	1	1	1	1	1
Fishermans Bend South Route	Light Rail	2036	1	1	1	1	1
Spencer St-Arden Route	Light Rail	2036	1	1	1	1	1
Burnley-Camberwell Quadruplication	Heavy Rail	2036	1	1	1	1	1
Davis Road Station	Heavy Rail	2036	1	1	1	1	1
Hopkins Road Station (Mt. Atkinson)	Heavy Rail	2036	1	1	1	1	1
Intermediate Airport Line Stations	Heavy Rail	2036	1	1	1	1	1
Loop Split (City Loop Reconfiguration)	Heavy Rail	2036	1	1	1	1	1
Sayers Road Station	Heavy Rail	2036	1	1	1	1	1
SRL Stage 1 - Southland to Box Hill	Heavy Rail	2036	1	1	1	1	1
Toolern East Station (Paynes Road)	Heavy Rail	2036	1	1	1	1	1
Truganina Station	Heavy Rail	2036	1	1	1	1	1
Waurn Ponds Stage 3 (Geelong Tunnel Duplication)	Heavy Rail	2036	1	1	1	1	1
Elizabeth Street Curves	Light Rail	2036	1	1	1	1	1
Black Forest Road to Werribee Connection	Heavy Rail	2056	1	1	1	1	1
Melton Quadruplication	Heavy Rail	2056	1	1	1	1	1
Shepparton Line Standard Gauge Conversion	Heavy Rail	2056	1	1	1	1	1
Sunshine to Southern Cross RRL Line	Heavy Rail	2056	1	1	1	1	1
Sunshine-Dandenong Corridor Upgrade	Heavy Rail	2056	1	1	1	1	1
WRT: Parkville to Clifton Hill / Victoria Park Tunnel	Heavy Rail	2056	1	1	1	0	0
WRT: Spotswood / Newport to Parkville Tunnel	Heavy Rail	2056	1	1	1	1	1
SRL Stage 2/3 - To Airport	Heavy Rail	2056	1	1	1	1	1
Wallan Electrification	Heavy Rail	2056	1	1	1	1	1

Project	Category	Year	Compact City	Consolidated City	Dispersed City	Network of Cities	Distributed State
Bell Street Bus Priority	Bus	2056	0	1	1	0	0
Caroline Springs Boulevard Bus Priority	Bus	2056	0	0	1	0	0
Dandenong Road Bus Priority	Bus	2056	1	1	0	0	0
Derrimut Road Bus Priority	Bus	2056	0	1	1	0	0
Dohertys Road Bus Priority	Bus	2056	0	0	1	0	0
Ferntree Gully Road Bus Priority	Bus	2056	1	1	0	0	0
Glen Waverley BRT	Bus	2056	0	0	1	0	0
Hoddle Street Elevated BRT	Bus	2056	1	1	0	0	0
Hoddle Street/Victoria Parade BRT	Bus	2056	1	1	0	0	0
Johnston Street Bus Priority	Bus	2056	1	1	0	0	0
Leakes Road Bus Priority	Bus	2056	0	0	1	0	0
Lower Dandenong Road/Cheltenham Road Bus Priority	Bus	2056	1	1	0	0	0
Palmers Road/Pt Cook Road Bus Priority	Bus	2056	0	1	1	0	0
Plenty Road Bus Priority	Bus	2056	0	0	1	0	0
Somerton Road Bus Priority	Bus	2056	0	0	1	0	0
Somerton Road/Cooper Street Bus Priority	Bus	2056	0	1	1	0	0
Springvale Road/Edithvale Road Bus Priority	Bus	2056	0	1	1	0	0
Warrigal Road Bus Priority	Bus	2056	1	1	0	0	0
Alamein to Oakleigh Extension	Heavy Rail	2056	0	1	0	0	0
Electric Regional Trains to Baxter	Heavy Rail	2056	1	1	1	1	0
Sunbury North Electrification	Heavy Rail	2056	0	0	1	0	0
Torquay Extension	Heavy Rail	2056	0	0	0	1	1
Watergardens Extension	Heavy Rail	2056	0	0	1	0	0
Wollert Extension	Heavy Rail	2056	0	0	1	0	0
Airport West - Melbourne Airport Route Extension	Light Rail	2056	0	1	1	0	0
Bundoora RMIT - South Morang Route Extension	Light Rail	2056	0	0	0	0	0
Camberwell - Heidelberg Route Extension	Light Rail	2056	0	1	0	0	0
Sunshine - Highpoint Route Extension	Light Rail	2056	0	1	0	0	0
Vermont South - Bayswater Route Extension	Light Rail	2056	0	1	1	0	0
West Preston - Reservoir Route Extension	Light Rail	2056	0	1	0	0	0

Active Transport

The VITM uses population density as a proxy to determine the share of active transport trips generated from travel zones prior to assignment of motorised transport. As each land use scenario is associated with a different set of demographic assumptions (and thus population densities), different active transport activity levels were implicitly generated for all of the scenarios tested across this assessment. The subsequent figures show these density assumptions as generated from the demographic statistics for the five land use scenarios 2056.

Figure 58 Active transport density groups for the 2056 Compact City scenario

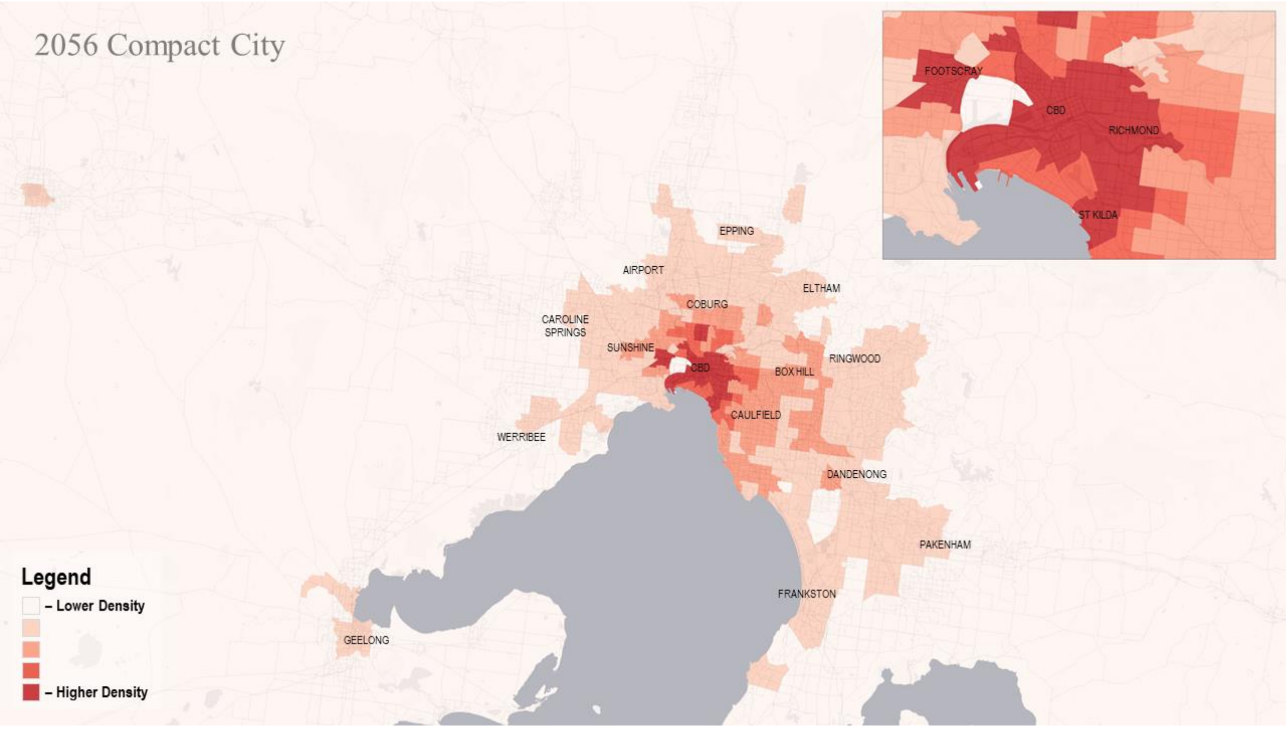


Figure 59 Active transport density groups for the 2056 Consolidated City scenario

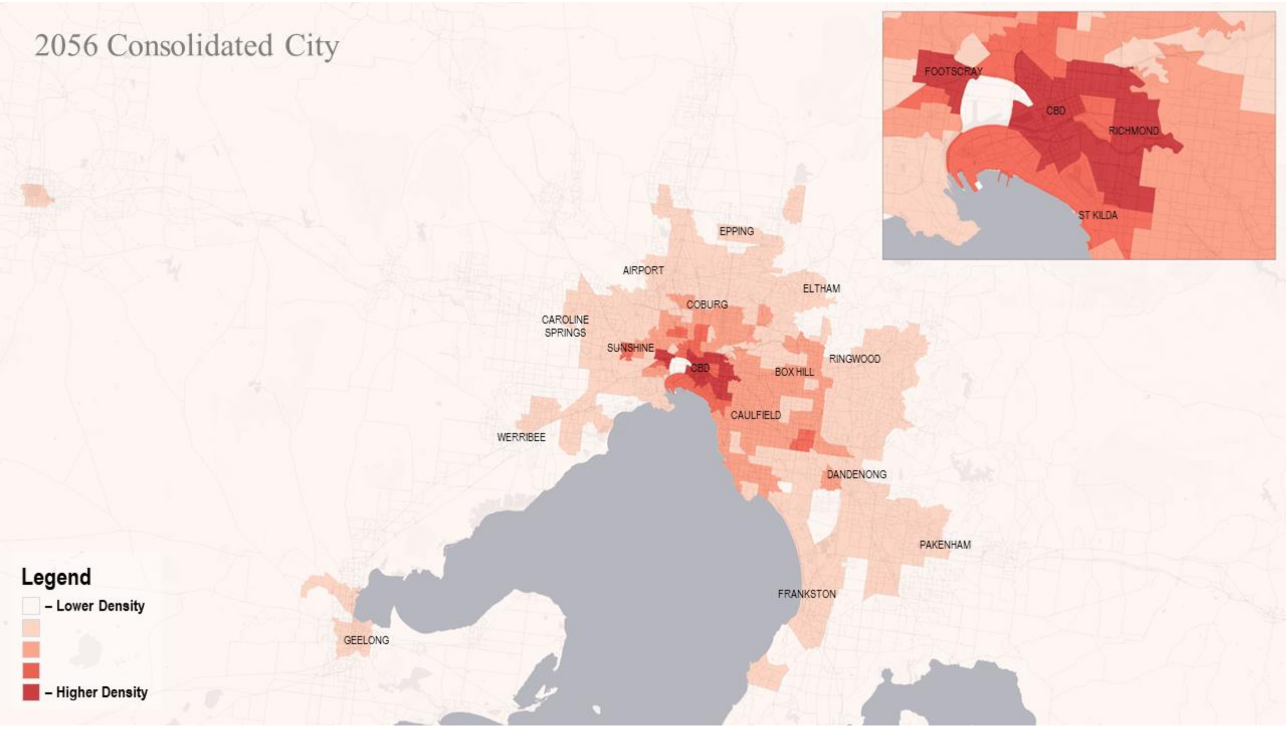


Figure 60 Active transport density groups for the 2056 Dispersed City scenario

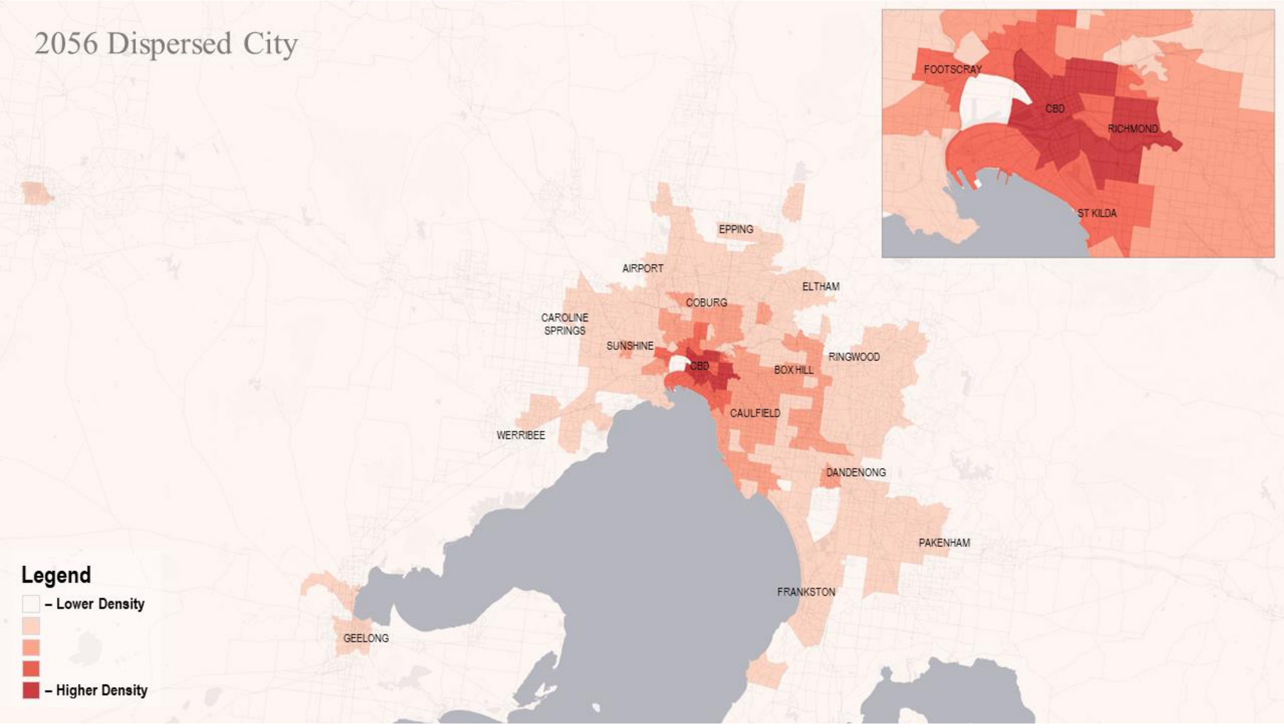


Figure 61 Active transport density groups for the 2056 Network of Cities scenario

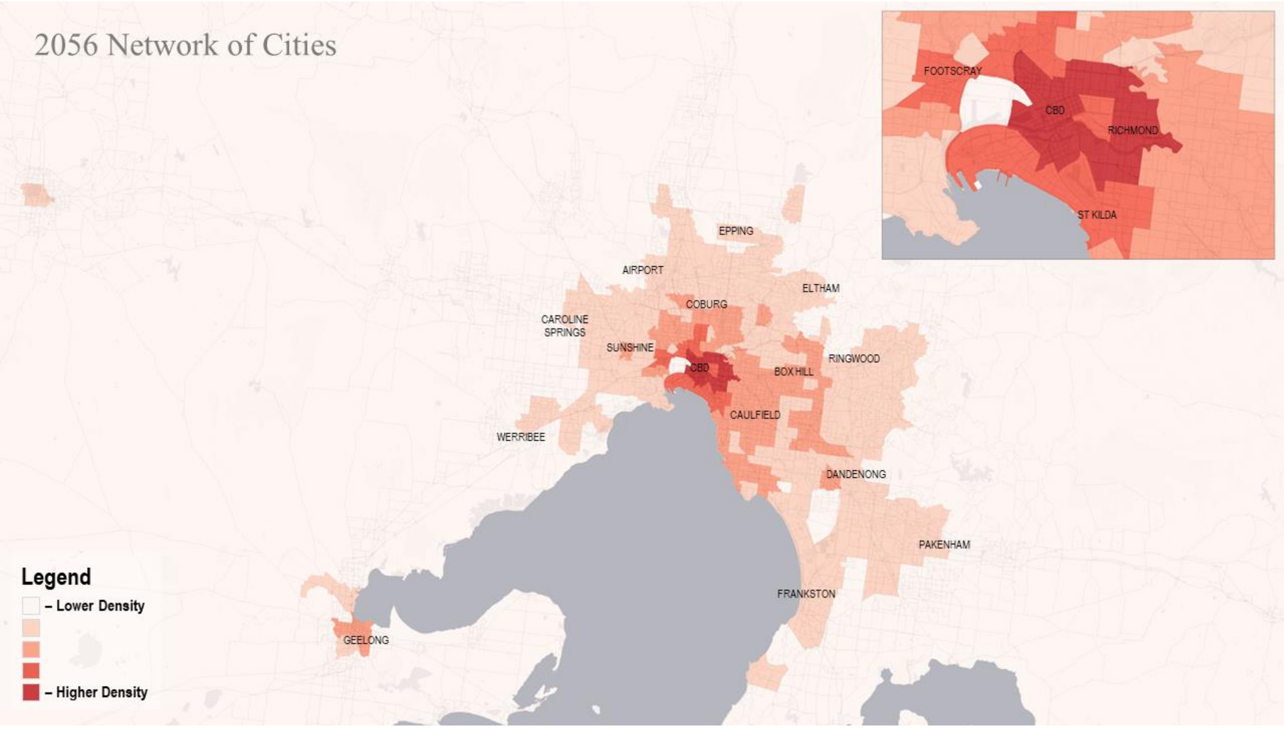
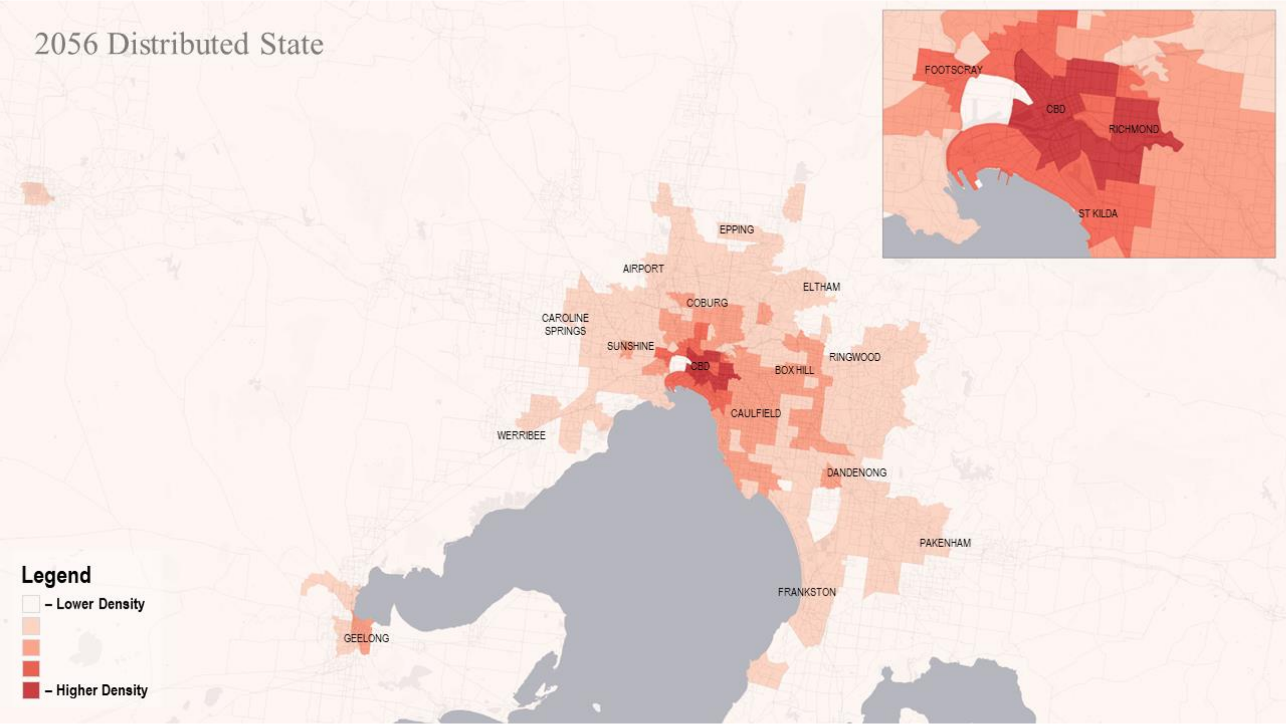


Figure 62 Active transport density groups for the 2056 Distributed State scenario



Parking Charges

The VITM uses six different 'parking cost area' types, with each travel zone assigned to a particular area (or no type for no parking charge). These costs are dependent on trip type, with some charges following an escalation pattern into the future. Table 21 summarises these parking charge by trip values as specified by default within the VITM.

Table 21 Assumed parking charges by trip type and year

Source: Victorian Integrated Transport Parameters

#	2018		2036		2056	
	Work	Other	Work	Other	Work	Other
1	$9.22	$3.85	$9.22	$5.04	$9.22	$6.78
2	$3.66	$1.20	$3.66	$1.56	$3.66	$2.10
3	$2.06	$0.71	$2.06	$0.93	$2.06	$1.25
4	$2.08	$1.11	$2.08	$1.45	$2.08	$1.96
5	$1.61	$1.02	$1.61	$1.33	$1.61	$1.80
6	$12.25	$12.25	$13.52	$13.52	$13.80	$13.80

These parking charge amounts were not varied across the scenarios tested in this assessment. However, the travel zones associated with the parking charges were. These modifications were made to reflect the fact that greater densification of key areas as assumed within each land use scenario would likely be accompanied by both real and perceived increases in parking charge cost. The subsequent figures show these parking area type assumptions as implemented for the five land use scenarios.

Figure 63 Parking charge areas for the Compact City scenario

Figure 64 Parking charge areas for the Consolidated City scenario

Figure 65 Parking charge areas for the Dispersed City scenario

Figure 66 Parking charge areas for the Network of Cities scenario

Figure 67 Parking charge areas for the Distributed State scenario

Car Ownership

The VITM does not directly represent car ownership within its assignment mechanisms. Nonetheless, the model does simulate the concept of car availability to households. Specific areas of the state are associated with higher levels of car availability compared to others based on several factors. This means that differing distributions of population density throughout the state are associated with different levels of total aggregate car ownership.

As mentioned, the VITM does not directly model car ownership, but it is possible to infer the minimum number of private vehicles associated with each of the tested scenarios as shown in Table 22. The Compact City and Consolidated City scenarios are associated with the lowest levels of minimum private vehicle ownership due to their concentration of residents towards central Melbourne. This area is associated with lower levels of car ownership compared to outer suburban and regional areas.

Table 22 Minimum private vehicle ownership by scenario

Scenario	Minimum Private Vehicles
2018 Base	4,275,300
2036 Compact City	5,660,700
2036 Consolidated City	5,710,300
2036 Dispersed City	5,733,900
2036 Network of Cities	5,726,900
2036 Distributed State	5,733,800
2056 Compact City	7,499,700
2056 Consolidated City	7,579,900
2056 Dispersed City	7,653,700
2056 Network of Cities	7,622,300
2056 Distributed State	7,666,200

Appendix C
Emissions Calculation Methodology

Introduction

Carbon dioxide-equivalent (CO2-e) emissions were estimated using a combination of VITM scenario outputs, vehicle fleet composition assumptions and vehicle emissions rate assumptions. The methodology applied to achieve this is described in this appendix. It is worth noting that the emissions estimates presented in this report represent *tailpipe* emissions, meaning that vehicles powered purely through electricity are associated with zero emissions.

Calculation Methodology

Modelled Kilometres Travelled

The primary basis of emissions estimates as conducted for this assessment was the conversion of vehicle kilometres travelled (VKT) to tonnes of CO2. The VITM is able to provide VKT statistics directly for the following groups of vehicle types:

- **Private vehicles**: Encompassing non-freight road network travel via passenger cars.
- **Freight**: Encompassing light and heavy commercial vehicle travel on the road network.
- **Public transport**: Encompassing service kilometres travelled by metropolitan train, V/Line, tram, and bus.

Emissions Per Kilometre

Different emissions rates were assumed for each vehicle type using a variety of sources. This is outlined subsequently for road and public transport vehicles.

Road Travel

The Australian Transport Assessment and Planning (ATAP) guidelines provide fuel consumption coefficients and emissions conversion factors in *PV2 Road Parameter Values* (2016). This facilitates the calculation of both fuel efficiency (litres of fuel per 100 km) and CO2-e per litre of fuel for a range of vehicle types. Taken together, this in turn enables the calculation of tonnes of CO2-e per kilometre of travel.

The ATAP guidelines provide fuel consumption coefficients across twenty different vehicle types. Emissions conversion factors are provided for a several vehicle manufacturing dates and fuel types. In the absence of detailed vehicle fleet composition forecasts, Table 23 summarises the combination of vehicle and fuel type assumptions that were adopted for emissions estimates within this assessment, best representing the median vehicle of each class. As emissions estimates were conducted for the 2036 and 2056 modelled years, the latest available manufacture date was adopted across all road vehicle rates.

Table 23 Road vehicle type assumptions for emissions estimates

Vehicle Group	Vehicle Type	Manufacture Date	Fuel Type
Private Vehicle	Medium Car	Post-08	Petrol
Freight	Artic 4-Axle	Post-08	Diesel
Bus	Heavy Bus	Post-08	Diesel

Table 24 shows the associated fuel consumption parameters provided by ATAP for the nominated vehicle types. This corresponds with the use of the interrupted flow model with both stop-start and free-flow components, the latter of which is used when the speed of the vehicle exceeds 60 km/h. Fuel consumption is calculated with these parameters using the following equations:

- **Stop-start model**: $f = A + {}^{B}/_{V}$
- **Free-flow model**: $f = C_0 + C_1 V + C_2 V^2$

where:

- f: Fuel consumption in litres per 100 km.
- V: Average vehicle speed in km/h.

Table 24 Vehicle type fuel consumption parameters

Vehicle Type	A	B	C0	C1	C2
Medium Car	8.80170	179.68900	9.80140	-0.07850	0.00080
Heavy Bus	38.32970	661.06880	30.20180	-0.25070	0.00290
Artic 4 Axle	63.96080	458.94120	40.13530	-0.35410	0.00530

With fuel efficiency calculated, CO_2-e emissions are then estimated using the emissions factors also provided by ATAP in *PV2 Road Parameter Values* (2016). Table 25 shows the adopted emissions factors, used to convert litres of fuel consumed into grams of CO_2-e emitted.

Table 25 Vehicle type emissions conversion factors

Vehicle Type	Fuel type	L to g/L
Passenger Car	Petrol	2282.0
Heavy Truck	Diesel	2671.2
Heavy Bus	Diesel	2671.2

Public Transport Travel

Metropolitan train and tram rolling stock are entirely electric, meaning that they were assumed to emit zero tonnes of CO_2-e as mentioned previously. Emissions from buses are captured under the methodology employed for road travel, with modelled service kilometres used to estimate VKT for this mode.

The remaining mode is regional trains, for which a majority are diesel powered. Emissions for this mode were estimated using data contained within ATAP's *PV5 Environmental Parameter Values* (2021). This document values the average parameter values of CO_2-e emissions for such vehicle types at $117.59 per 1,000 VKT. With an assumed unit rate of $60 per tonne of CO_2-e as also specified within the guidelines, this translates into approximately 1.96 kg of CO_2-e emitted per VKT of travel.

Electric Vehicle Uptake

Electric vehicle uptake was applied as an additional assumption layer over the estimated emissions rates. In alignment with the *'Step Change'* scenario outlined in the Australian Energy Market Operator's (AEMO) *Draft 2023 Inputs, Assumptions and Scenarios Report* (2022), it was assumed that uptake of private zero emissions vehicles (ZEVs) would reach 44% by 2036, subsequently reaching 100% by 2056. In the absence of detailed forecasts for electric vehicle uptake within the Victorian public transport bus fleet and freight fleet, these assumptions were also applied to these vehicle types.

From an estimation perspective, this means that emissions were calculated using the relationships outlined in the previous sections for road travel. Once this was complete, the final 2036 values were factored to 44% of their original value. 2056 outcomes for road travel were disregarded due to the assumption that 100% of vehicles would be electric by this time, leaving only emissions from diesel regional trains in this year.

Limitations of emissions methodology

The estimation of statistics such as CO_2-e emissions is complex and is associated with a significant degree of uncertainty. Many assumptions have been made throughout the presented methodology regarding the composition of the future vehicle fleet, average fuel consumption rates and emissions rates for vehicles within that fleet and overall uptake of electric vehicle technology. These assumptions themselves are applied to demand generated by the strategic transport simulation, itself a large source of uncertainty. As such, relative comparisons between emissions calculated through this methodology are likely more robust than the absolute values themselves.

Of particular note is the use of tailpipe emissions as the basis for the outlined calculations. ATAP presents a means of calculating 'well-to-wheel' (WTW) emissions, which represent a combination of the upstream emissions used in generating the fuel used by the vehicle (i.e., fuel refining or electricity generation and delivery in the case of battery-powered vehicles) alongside the actual exhaust emissions of a vehicle. This metric was not used in this assessment as ATAP themselves advise of significant limitations surrounding the estimation of WTW emissions factors.

Appendix D
Cost Estimation Inputs

Introduction

Strategic modelling outputs were used directly to inform the derivation of both capital and operational expenditure cost estimates. This appendix provides details surrounding modelling outputs that were derived to support the cost estimation exercise undertaken by WT Partnership.

Road Project Details

Each individual road project upgrade assumed within the base infrastructure pipeline and subsequent land use scenario-specific modifications was distilled into its:

- Road type (e.g., urban highway, freeway etc.)
- Intervention type and details (e.g., duplication, interchange upgrade etc.)
- Extent distance (if applicable)
- Location within Victoria (LGA)

This was then used by WT Partnership to form estimates of associated capital and operating expense for each project.

Public Transport Project Details

The Arup modelling team worked with DTP to disaggregate assumptions surrounding future public transport service provision into individual interventions. Once complete, relevant details regarding each individual intervention were provided to WT Partnership including (where relevant):

- The extent and nature of any new alignments (e.g., new rail track, new tram priority measures etc.)
- Additional or modified service kilometre requirements associated with the new intervention.
- Rolling stock type to be adopted by any new services.

Specific calculations surrounding fleet requirements are outlined in the subsequent section.

Public Transport Fleet Requirements

The VITM defines public transport services at an individual line level. These lines are defined with attributes associated with a public transport service including its alignment, vehicle type and headways (at what interval the service operates) for each of the periods that the VITM models (AM, IP, PM, OP).

When each of the highway and public transport assignments are completed, each link for which a public transport service operates along is assigned a time to traverse this link for each public transport mode. This time incorporates components such as the speed a vehicle would operate, reductions in speed associated with congestion (for on-road public transport without priority) and dwell time. By aggregating this metric across all links that the line traverses, the time taken for the service to travel from its start point to end point can be calculated.

The estimated number of vehicles required to service a particular route in a particular period was derived by calculating the total time for a service to traverse the route divided by the headway of the service. For example,

In the morning peak for the Compact City scenario, the 109 tram from Box Hill to Docklands operates with a headway of 6.7 minutes. It also takes 70.4 minutes to traverse its entire length. It is assumed that this would require approximately 70.4/6.7 $\approx$ *11 vehicles to facilitate this.*

This was then aggregated for all routes in the network to derive the number of each vehicle type required to operate the entire network. The fleet required for a particular scenario was then derived by taking the maximum number of each vehicle type required across any of the modelled periods. It is noted that this represents a very approximate means of estimating vehicle fleet requirements that does not account for idiosyncratic operational patterns that may be necessary to service specific routes. Nonetheless, given the level of detail available from future VITM assumptions this methodology was deemed appropriate in informing order-of-magnitude cost estimates.

Active Transport Requirements

The VITM does not model active transport travel, and thus does not contain any infrastructure-specific assumptions regarding active transport infrastructure provision. However, it is unrealistic to assume that each land use scenario would be associated with the same level of active transport infrastructure provision. To address this, IV and the Arup modelling team devised an approximate measure of how much additional activate transport infrastructure would be associated with each land use scenario by 2056. Active transport infrastructure types were split into the following categories:

- On-road shared user paths (i.e., wide footpaths).
- Off-road shared user paths (i.e., along waterways and within reserves).
- On-street bike lanes.
- Segregated on-street bike lanes (including curbing).

A total length of each active transport infrastructure type was estimated for each land use scenario based on several sources including:

- The Victorian Planning Authority's draft framework plans for the La Trobe, Monash and Sunshine NEICs (2023).
- City of Ballarat's *Ballarat Integrated Transport Action Plan* (2020).
- City of Greater Bendigo's *Walking and Cycling Strategy 2019* (2019).
- City of Melbourne's *Transport Strategy 2030* (2021).
- City of Port Phillip's *Integrated Transport Strategy 2018-28* (2017).
- City of Yarra's *Transport Strategy 2022-32* (2020).

Interventions described in each of these strategies were assigned to each of the land use scenarios based on the character of the population and employment distribution implemented for each scenario. The total length of active transport infrastructure assumed for each land use scenario is shown in Table 26.

Table 26 Length of new active transport infrastructure assumed for each land use scenario in kilometres

Infrastructure Type	Compact City	Consolidated City	Network of Cities
On-road shared user paths	20	27	206
Off-road shared user paths	24	56	0
On-street bike lanes	31	40	0
Segregated on-street bike lanes	178	23	120
Total	**253**	**146**	**326**