# East West Needs Study

# Transport Supply and Demand

# (Existing and Future)

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# 1 Introduction

## 1.1 Preface

The Victorian Government has appointed Sir Rod Eddington to lead a study into the need for an East-West Transport Link. The East-West Link Study Team supporting Sir Rod has commissioned Sinclair Knight Merz- Maunsell to undertake the Transport Planning Study forming part of the East-West Link Needs Assessment.

The purpose of the Transport Planning Study is to carry out a strategic evaluation of the existing and future mobility constraints for travel between the east and west of Melbourne and identify opportunities for a range of options to address future travel requirements. The findings will assist Sir Rod and the Study Team with providing an assessment of the need for and feasibility of an additional east-west link.

The indicative study area is shown in Figure 1.1.

**Figure 1.1 Indicative Study Area**

The overall project is being delivered as a collaborative approach between a range of specialist teams for the Study Team including:

- Transport planning and costing (Sinclair Knight Merz - Maunsell);
- Environment and heritage analysis (Sinclair Knight Merz - Maunsell);
- Economic analysis (Meyrick and Associates);
- Demographics, social and land use effect analysis (SGS Economics and Planning);
- Commercial and Financial analysis (Ernst & Young);
- Legal (Clayton Utz) and
- Transport modelling (Veitch Lister Consulting).

## 1.2 Structure of this Report

This paper addresses specifically the present and future transport demand and supply issues relevant to the East-West Needs study.

Section 2 discusses the existing demand and capacity for public transport, road and freight users.

Section 3 provides an analysis of the likely demand and base case network capacity for future years using the Reference Case modelling scenario, and summarises the key gaps in the transport network constraining East-West movement for people and freight.

Chapter 4 details the process undertaken to shortlist a potential range of options which could address these gaps, and combines them into a number of packaged options for analysis.

Chapter 5 assesses the impact of each packaged option on the transport network using the Reference Case modelling scenario and compares this to the base case network. Sensitivity tests are also carried out with alternative modelling scenarios.

Chapter 6 provides a summary of the findings.

It is worth noting that the future situation commentary relies on the 'Reference Case' model results. The Reference case modelled scenario makes a number of simplifying assumptions about future drivers of travel demand and mode shares, some of which may change significantly due to changing economic, social and environmental factors and the community's response to them. In order to assess other possible future scenarios, sensitivity testing was completed as part of the options assessment stage using alternative modelling scenarios which investigated the impacts of different population growth rates and high carbon pricing.

# 2 Existing Situation

This section presents a summary of existing demand and capacity on Melbourne's transport network.

## 2.1 People Movement Demand

### 2.1.1 Overview

***Source of transport demand***

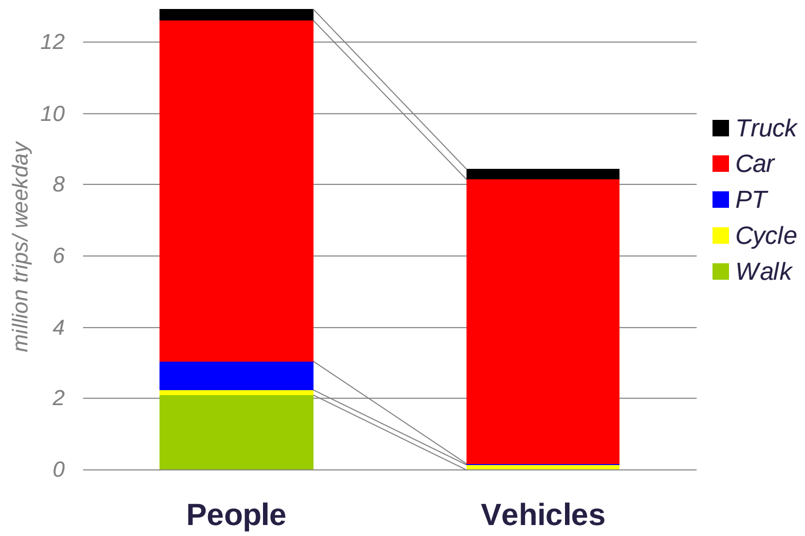
Movement of people and goods is a basic function of the city's levels of economic and social activity (refer to the economic paper by Meyrick for more information).

***Level of demand***

*People movement*

Across Melbourne as a whole in 2001 there were about 13 million person-trips made every typical weekday, broken down by mode as shown in Figure 2.1, from VATS (Victorian Activity and Travel Survey) data[1]. The number of vehicle-trips is also shown, illustrating that the vast majority of travel takes place in cars.

**Figure 2.1: Typical daily travel in Melbourne 2001 (from VATS)**




People movement is driven primarily by land use distribution (eg proximity of jobs and services to residential areas), level of economic activity and living standards. As a rule of thumb, there are about 3.6 trips per typical weekday per head of population.

*Goods movement*

Goods movement is driven by the level of economic activity and balance and strength of trade. It is also influenced by associated land use zoning. Measurements include strength of the economy eg. Gross Domestic Product, and the level of trade through the Port of Melbourne (container throughput).

[1] The Veitch Lister Consulting (VLC) Zenith Melbourne model used for this study has a total of about 14 million person-trips a day (and 0.5 million commercial vehicle trips) within Melbourne in 2006.

*Influence of supply on demand*

The demand for both people and goods movement are also influenced by the supply of transport infrastructure and services (and their prices). Some typical examples of this are:

- The Western Ring Road; its construction has been claimed to have strongly influenced road freight transport industry operations and changed land uses in the corridor;
- Parking supply and prices; these are a key influence on individuals' decisions about car use, particularly for journeys to the CBD. Limited parking supply combined with relatively high cost deters car use and encourages mode shift onto public transport; and
- Suburban train services; express trains are attractive, especially to peak period users who will time their journeys accordingly (data for arrival times from each train line into the CBD shows this clearly).

It is important to consider demand in the context of people and goods rather than vehicles. Mode shift can have a substantial effect on the amount of vehicle movement required to satisfy a given people or goods movement demand. Also the variation in different types of travel through the day can significantly influence traffic congestion and public transport provision, both of which are driven primarily by peak period demands.

One of the main influences of travel demand is considered to be convenience i.e. people are prepared to pay for travel convenience more than anything else. In this context it is clear that car use (for the vast majority of people that have access to it) is more convenient than any of the alternatives for most journeys, primarily because it is available as and when it is needed. By its very nature, public transport will always be less convenient, and will compete best where/when it offers a better journey time or price, or both. The ancillary considerations (reliability, safety, comfort etc) probably make a greater difference to marginal users.

Congestion is both a measure of system performance and an influence on demand and mode share. All cities have congestion; the degree of it varies over the course of a typical day, and can be perceived differently among the general population. It is a function of the activities inherent in the city, especially its centre. Congestion is not necessarily 'bad' of itself, but the economic, social and environmental impacts are the issue, some of which can be influenced by technology changes without changing the level of congestion (eg reducing emissions by improving the technology used in motor vehicles – the effect of hybrid vehicles, engine management systems, etc). Congestion of people is arguably preferable to congestion of vehicles – in fact it is a natural part of a functioning, vibrant city.

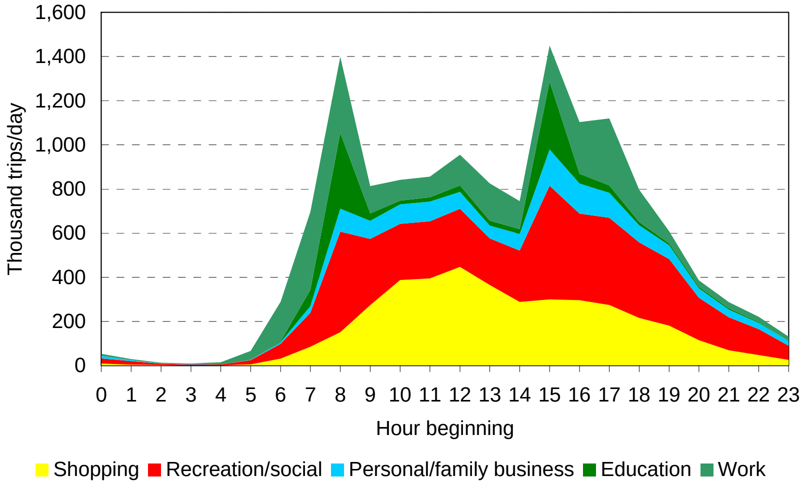
### *2.1.2 People movement*

***Trip purpose and time of travel***

People travel for a variety of reasons. These trips can be divided into the following categories: work, education, shopping, recreation/social and personal/family business.

About 30% of daily person travel occurs in the peak periods. About half of morning peak (and about 30% of afternoon peak) travel is comprised of work and education trips. Figure 2.2 shows the number of trips in each category by time of day, stacked to give the total number of trips for each hour.

**Figure 2.2 - Trip purposes by time of day using VATS data, Melbourne-wide**




By way of explanation:

- Shopping trips are largely influenced by retail business hours, and peak around midday
- Recreational/social trips are highest in the afternoons and evenings, peaking around 3-4pm (after school hours)
- Personal/family business trips have a similar distribution through the day to shopping, but with an afternoon peak (after work/school).
- Education trips show very abrupt peaks in the morning and the evening, coincident with school and university times
- Work trips also have abrupt peaks; in the morning, work trips coincide with education peak, whilst in the evening work trips are later than education trips. There is also significant activity during the day and in the evenings (accounting for business travel during the working day, shift, hospitality and part time workers).

Many trips are linked (eg shopping on the way from work, taking children to school on the way to work). This is an important reason for explaining limitations to public transport market share; the convenience and flexibility of car use is a major attraction.

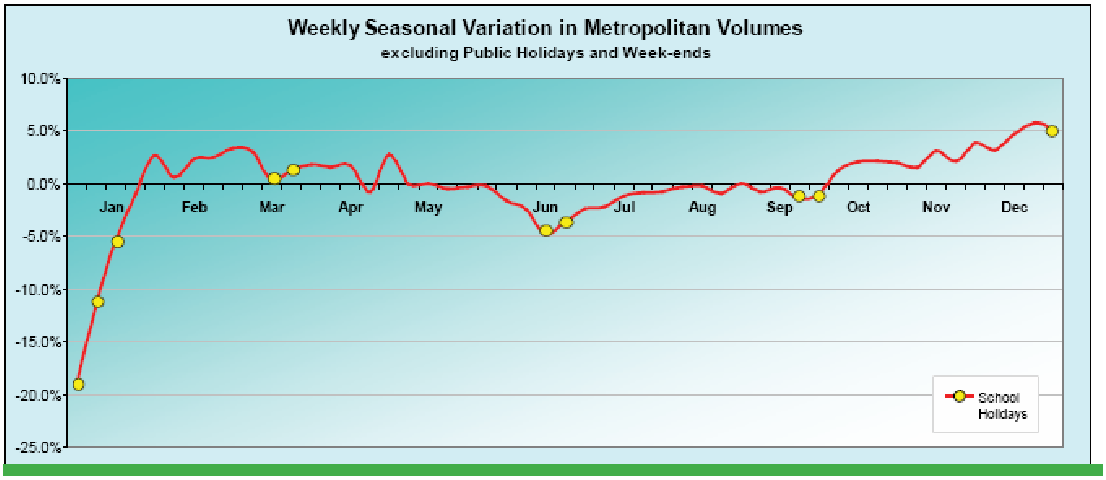
The morning peak period demand is usually the most critical in determining transport level of service requirements, primarily due to the CBD and other business area focus of travel in the morning peak. However the afternoon peak, whilst more dispersive in nature, presents its own issues of congestion and intensity.

Personal travel (personal/family business travel, and recreational/social travel) varies from travel to and from work, as illustrated in Figure 2.2. Although it may be a little less time-critical it is still dominated by daylight (or waking) hours, shopping or business hours and leisure activity times. There may be less scope for public transport use given the different time and origin-destination patterns of this travel.

The business travel category includes most ‘services’ trips, business meetings, trades-people, construction activity etc. Trips of this type are widely spread across the day, but generally limited to business hours.

Education travel is important in its own right, and the effect on work travel during holidays is also significant. It is well known that school holidays result in far less peak congestion, not only because of the students but also their parents, who often choose school holidays to take leave from work. The weekly seasonal variation in traffic volumes is shown in Figure 2.3. It should be noted that the decrease in traffic during these periods is relatively small, however it has a marked effect on the peak period congestion levels on roads and public transport.

**Figure 2.3 – Weekly seasonal variation in traffic volumes**




Source: VicRoads

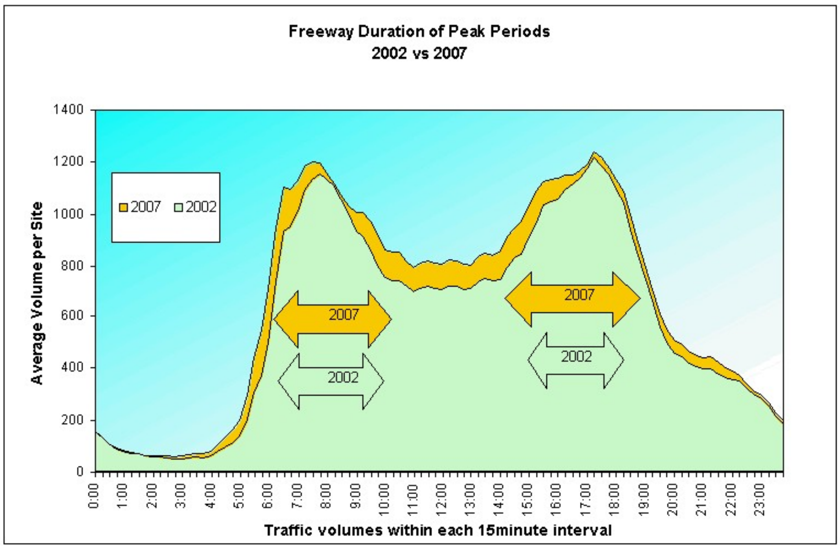
Generally speaking, the relatively high demand for people movement during the peak period reduces the proportion of goods movement during this time.

Influences on the intensity of the peak period and the drivers of peak spreading include:

- Set time constraint: rigid hours / set appointments usually results in intense peaks, while flexible start times / appointments may encourage pre- or post-peak journeys according to needs or desires;
- Level of public transport service provision: service frequencies are higher and express services available during peak periods. This reduces average journey times, increasing the attractiveness of travel during peak periods compared to shoulder and off-peak periods;
- Variable travel costs during the day i.e. off-peak fares, early bird parking rates;
- Level of congestion on all modes (real and perceived): journeys may be brought forward or postponed if possible to avoid peak period congestion. This is also related to the previous points.

The relative influence of these and other factors is not well understood due to a lack of quality data. Figure 2.4 shows the lengthening of the peak period i.e. peak spreading, over the period 2001/2 to 2005/6.

**Figure 2.4 – Peak spreading**



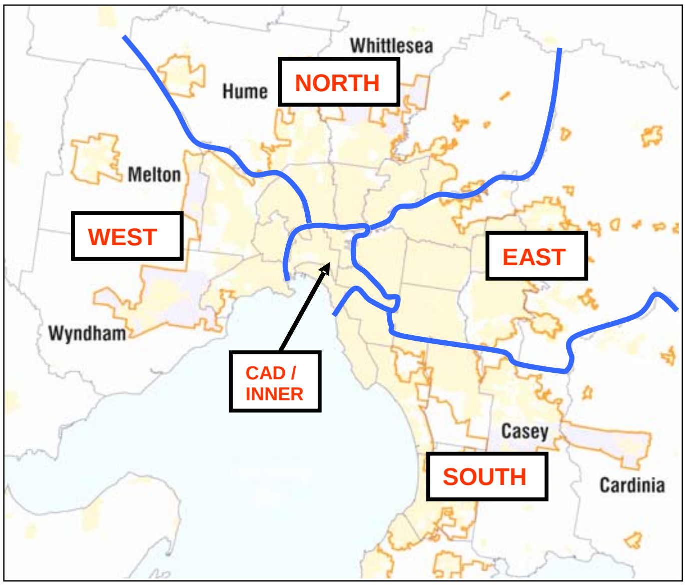

Source: VicRoads

*Movement Patterns*

Melbourne has been divided into five areas (CAD/inner, north, south, east and west) for the purpose of summarising travel patterns (see Figure 2.5). The areas comprise the following municipalities:

- CAD/Inner: Melbourne, Port Phillip, Yarra, Stonnington
- North: Banyule, Darebin, Hume, Moreland, Nillumbik, Whittlesea
- South: Bayside, Cardinia, Casey, Dandenong, Frankston, Glen Eira, Kingston, Mornington
- East: Boroondara, Knox, Manningham, Maroondah, Monash, Whitehorse, Yarra Ranges
- West: Brimbank, Hobsons Bay, Maribyrnong, Melton, Moonee Valley, Wyndham

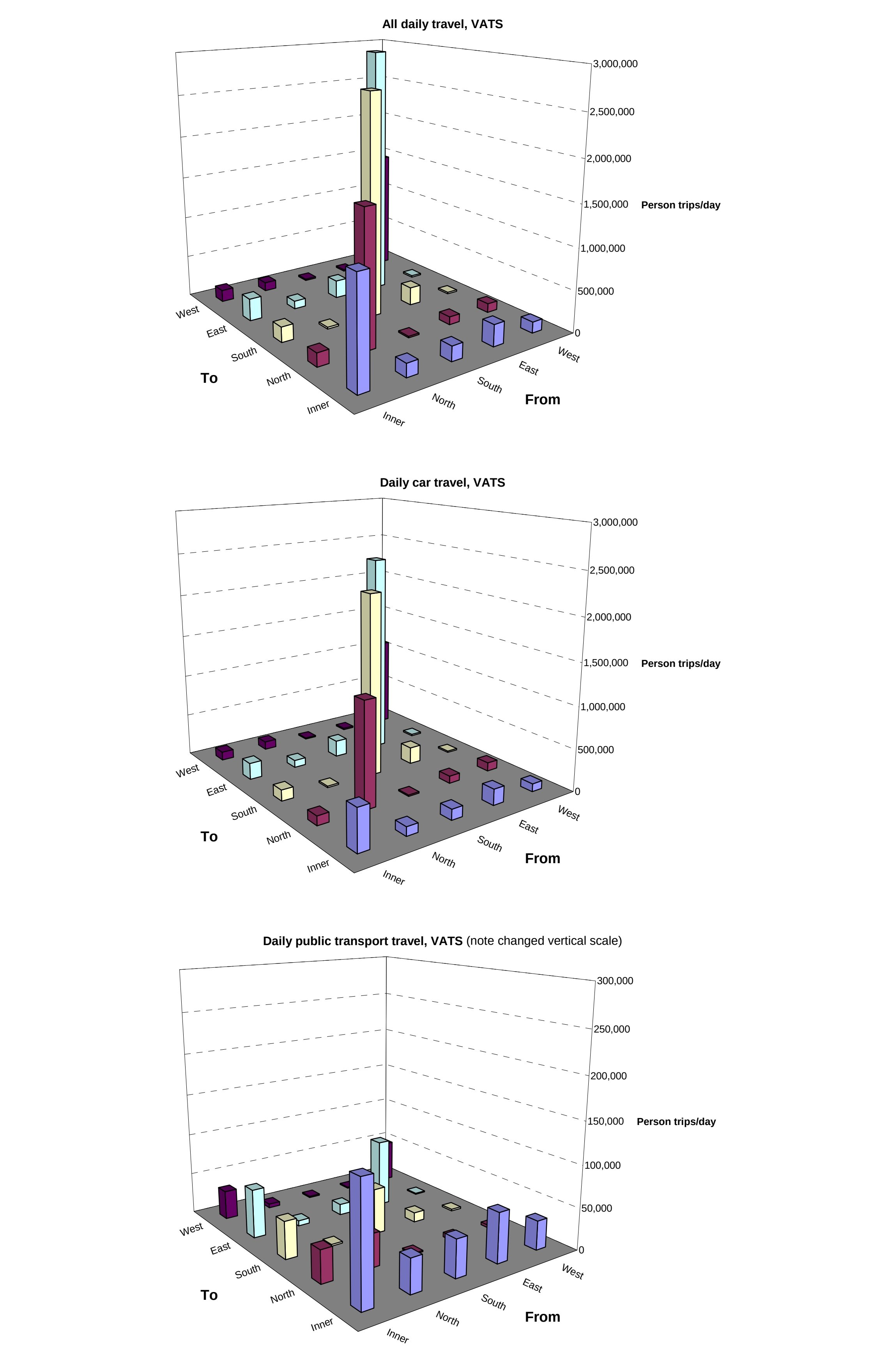
**Figure 2.5: Melbourne Travel Summary Areas**




As shown in Figure 2.6, the vast majority of person-travel takes place wholly within the inner, middle and outer areas (reflecting the relatively short distance of many trips). Radial movements (to/from the inner area) are significant, as are movements between the east and south (explained primarily by the long interface between these two areas due to the shape of the city). Cross-city movements (east-west, south-west and north-south) are very small by comparison.

The overall pattern of movement around the city by public transport is very different to that for car, primarily because of public transport's low share of travel in outer areas, and its substantial role in radial travel (primarily train, but also tram) to/from the inner area.

**Figure 2.6: Origins and destinations of person-travel in Melbourne using VATS data**



*Modes*

People movement takes place using a variety of available transport modes. Many journeys use a combination of these modes:

- Car (driver or passenger)
- Public transport (bus, tram, train)
- Cycling
- Walking

Over Melbourne as a whole, on a daily basis, mode shares are approximately 75% car, 6% public transport and 19% cycling/walking (quoting the principal mode used for a given journey) based on VATS data. These mode shares vary considerably both spatially and with time of day.

Mode shares of people movement in Melbourne are summarised in Table 2-1 for the *primary* mode of travel. Public transport mode share is highest (about 25%) for radial movements to and from the inner area, and very low (2-3%) for movements wholly within the outer areas. Non-motorised travel has the largest mode share for the inner area (49%), due to the high number of walking trips that take place in central Melbourne and the relatively high density of inner area development.

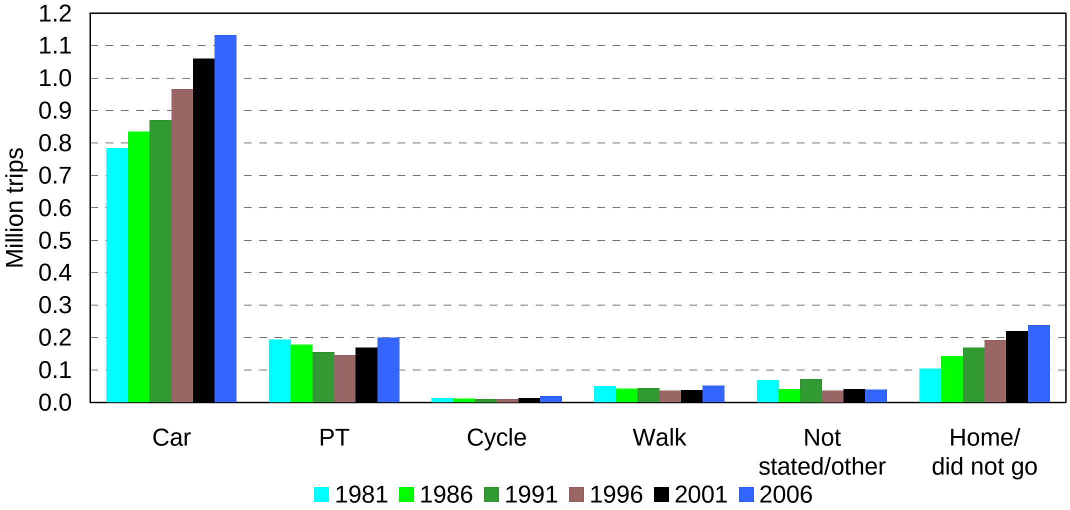
**Table 2-1: Primary mode shares of weekday travel in Melbourne for all trips (VATS)**

| Public | | | | | To | | | |
|---|---|---|---|---|---|---|---|---|
| transport | | Inner | North | South | East | West | Outside | Total |
| | Inner | 11% | 24% | 24% | 22% | 25% | 19% | 16% |
| | North | 25% | 2% | 9% | 7% | 5% | 2% | 5% |
| | South | 25% | 8% | 2% | 6% | 9% | 7% | 4% |
| From | East | 23% | 6% | 5% | 3% | 7% | 3% | 4% |
| | West | 26% | 3% | 11% | 7% | 3% | 3% | 5% |
| | Outside | 2% | 3% | 6% | 6% | 0% | 2% | 2% |
| | Total | 16% | 4% | 4% | 5% | 5% | 3% | 6.2% |
| Car | | Inner | North | South | East | West | Outside | Total |
| | Inner | 39% | 69% | 72% | 74% | 72% | 70% | 51% |
| | North | 67% | 77% | 83% | 90% | 93% | 82% | 78% |
| | South | 70% | 87% | 81% | 91% | 85% | 80% | 82% |
| From | East | 73% | 91% | 91% | 80% | 93% | 93% | 81% |
| | West | 70% | 94% | 89% | 93% | 75% | 97% | 76% |
| | Outside | 94% | 82% | 77% | 89% | 98% | 82% | 84% |
| | Total | 50% | 78% | 82% | 81% | 76% | 83% | 75% |
| Walk/cycle | | Inner | North | South | East | West | Outside | Total |
| | Inner | 49% | 6% | 2% | 2% | 2% | 0% | 32% |
| | North | 7% | 20% | 4% | 2% | 1% | 0% | 17% |
| | South | 3% | 0% | 16% | 1% | 0% | 2% | 14% |
| From | East | 3% | 2% | 0% | 17% | 0% | 0% | 14% |
| | West | 2% | 1% | 0% | 0% | 21% | 0% | 18% |
| | Outside | 0% | 9% | 2% | 0% | 0% | 14% | 11% |
| | Total | 32% | 17% | 14% | 14% | 18% | 10% | 18% |

Source: analysis of VATS data

Trends of mode share with time are best illustrated by Australian Bureau of Statistics (ABS) journey to work data (Figure 2.7). Car use has grown strongly (and more than any other mode), while public transport showed an increase in use in 2001 and 2006 after declines in all previous census years. Cycling and walking are small in comparison, but both showed an increase in 2001and 2006 over the preceding year (similar pattern to public transport use). Another important feature is the increase in people working at home or not going to work on Census day.

**Figure 2.7: Modes used for travel to work in Melbourne 1981-2006**




Source: ABS JTW data analysis

**Table 2-2: Journeys to work in Melbourne LGA and CBD**

| ABS Journey to Work data | | Melbourne metropolitan area | | | | | | | City of Melb LGA | | | CBD | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1976 | 1981 | 1986 | 1991 | 1996 | 2001 | 2006 | 1996 | 2001 | 2006 | 1996 | 2001 | 2006 |
| Trips | Car | 729,472 | 784,347 | 834,897 | 869,709 | 965,571 | 1,060,241 | 1,131,817 | 113,448 | 106,694 | 105,453 | 47,466 | 44,957 | 38,538 |
| | PT | 230,038 | 193,415 | 177,928 | 154,553 | 145,842 | 169,064 | 199,763 | 80,425 | 98,491 | 117,464 | 62,106 | 77,195 | 83,825 |
| | Cycle | 10,058 | 12,628 | 11,809 | 10,863 | 10,620 | 12,856 | 18,920 | 2,389 | 4,014 | 7,169 | 1,082 | 1,981 | 3,133 |
| | Walk | 66,099 | 50,052 | 42,838 | 43,180 | 35,610 | 37,486 | 50,893 | 4,740 | 6,700 | 13,571 | 2,113 | 3,651 | 7,677 |
| | Not stated/other | 77,646 | 67,694 | 40,512 | 72,461 | 36,990 | 40,531 | 38,525 | 5,769 | 10,382 | 10,836 | 2,884 | 5,898 | 5,936 |
| | Total | 1,113,313 | 1,108,136 | 1,107,984 | 1,150,766 | 1,194,633 | 1,320,178 | 1,439,918 | 206,771 | 226,281 | 254,493 | 115,651 | 133,682 | 139,109 |
| Mode shares | Car | 66% | 71% | 75% | 76% | 81% | 80% | 79% | 55% | 47% | 41% | 41% | 34% | 28% |
| | PT | 21% | 17% | 16% | 13% | 12% | 13% | 14% | 39% | 44% | 46% | 54% | 58% | 60% |
| | Cycle | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 2% | 3% | 1% | 1% | 2% |
| | Walk | 6% | 5% | 4% | 4% | 3% | 3% | 4% | 2% | 3% | 5% | 2% | 3% | 6% |
| | Not stated/other | 7% | 6% | 4% | 6% | 3% | 3% | 3% | 3% | 5% | 4% | 2% | 4% | 4% |
| | Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Source: ABS JTW data analysis

Note: "Home/did not go" figures excluded

As shown in Table 2-2, compared with 1996, there were 8,000 fewer trips to work by car in City of Melbourne in the 2006 Census, 37,000 more public transport trips, 4,800 more cycling trips and 8,800 more walking trips. The additional public transport trips were mostly train trips (29,600). These numbers suggest that the growth in journeys to work in the CBD between 1996 and 2006 was primarily accommodated by public transport, walking and cycling. Although car travel is the dominant mode for travel in metropolitan Melbourne as a whole, public transport is the dominant mode for travel to work in the CBD.

The ABS carried out a survey in Victoria[2] to identify the main reasons why people chose to travel by public transport. The most frequently quoted response was "convenience / comfort / less stress" for all age categories. Lower cost was also a significant factor for younger respondents.

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[2] *ABS catalogue 4602.0, 'Environmental Issues: People's Views and Practices'*

In NSW, a recent study carried out by the NSW Ministry of Transport[3] found that the primary influences for using public transport were (not in any order of priority):

- Parking supply
- Car availability
- Cost (mainly the perception of petrol/parking cost compared with public transport fares)

Other factors such as travel time, convenience, accessibility, safety/security and environmental considerations were less significant.

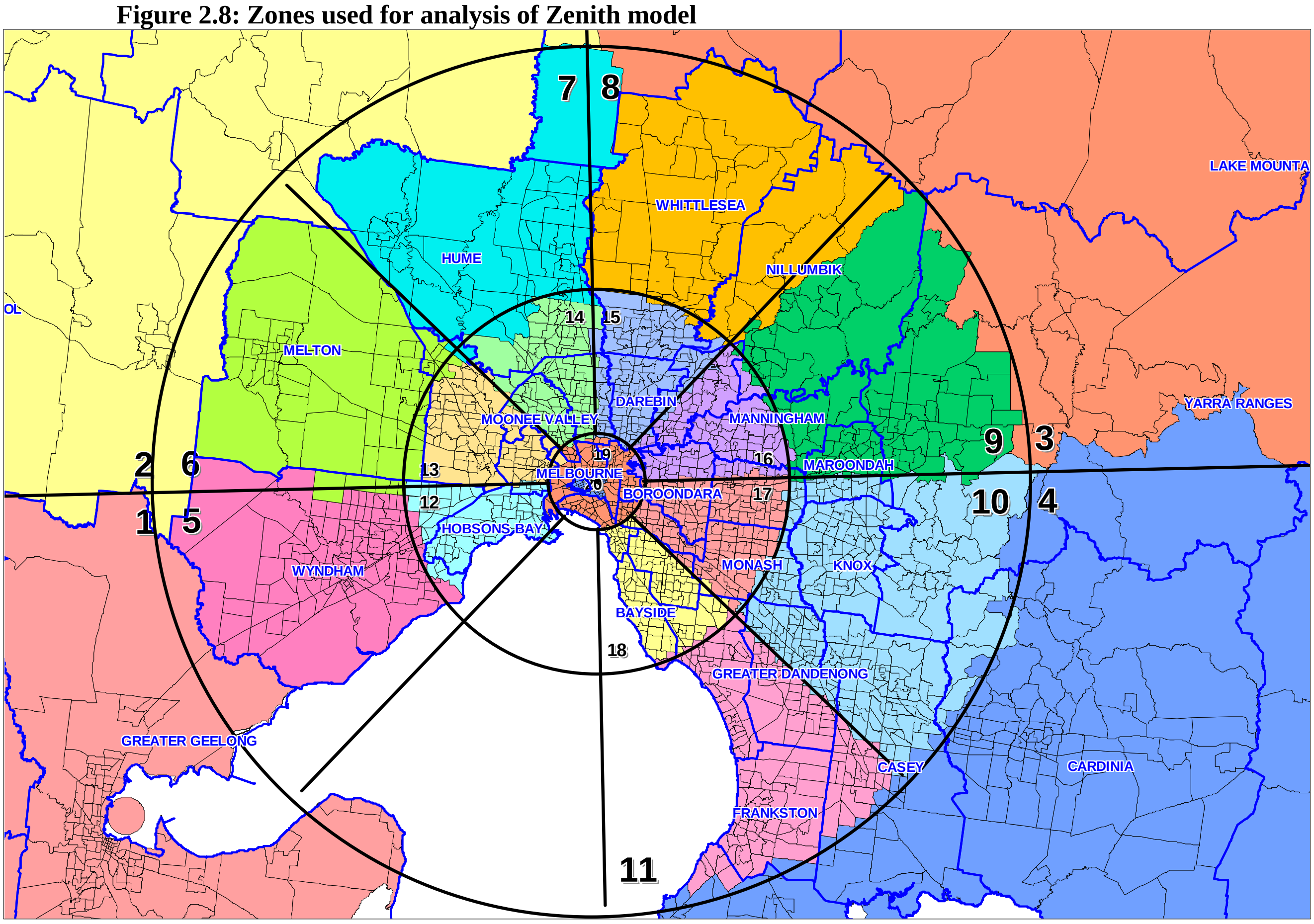
For car drivers, the key influences for choosing to drive were:

- Convenience
- Travel time and reliability thereof
- Flexibility i.e. multiple trips
- Limited availability of public transport (accessibility, frequency, direct services)

***Modelled demand***

Analysis of options for the East-West Needs study was undertaken with the aid of VLC's *Zenith* transport model, which was calibrated (to available information) to reflect conditions in 2006. The 2006 trip data was analysed within and across a total of 20 zones to illustrate the people and freight movement in the Melbourne metropolitan area (see Figure 2.8).

**Figure 2.8: Zones used for analysis of Zenith model**

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[3] "Public Transport or Private Vehicle: Factors that Impact on Mode Choice", Transport Data Centre, NSW Ministry of Transport, 2007

Overall modelled travel demand between the 20 zones is summarised in Table 2-3 and Table 2-4 for a full day and AM peak respectively.  The results are listed in the following order:

- Freight (vehicles)
- People (all modes including walking and cycling)
- People (public transport)
- People (car)

Figure 2.9 and Figure 2.10 show the data geographically.  For clarity, the 20 zones are grouped into 5 zones as shown in Figure 2.5.  In addition, these diagrams do not show the number of trips within each area, which are significantly larger than the number of trips between areas.

## Table 2-3: Modelled 2006 Daily Travel Demand in Melbourne and Regional Centres

Freight

| All | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 20,242 | 669 | 203 | 180 | 198 | 58 | 151 | 14 | 63 | 408 | 202 | 446 | 349 | 340 | 323 | 71 | 323 | 244 | 719 | 345 | 25,548 |
| Regional NW | 669 | 24,248 | 377 | 241 | 88 | 245 | 471 | 42 | 138 | 802 | 390 | 487 | 636 | 842 | 772 | 149 | 605 | 370 | 1,081 | 459 | 33,112 |
| Regional NE | 203 | 377 | 2,938 | 200 | 27 | 31 | 261 | 52 | 354 | 965 | 369 | 316 | 333 | 638 | 704 | 155 | 551 | 288 | 691 | 235 | 9,688 |
| Regional SE | 180 | 241 | 200 | 14,300 | 22 | 21 | 140 | 12 | 260 | 2,558 | 2,348 | 258 | 239 | 326 | 418 | 156 | 1,082 | 635 | 812 | 394 | 24,602 |
| Outer SW | 198 | 88 | 27 | 22 | 1,704 | 83 | 64 | 11 | 14 | 55 | 33 | 634 | 397 | 162 | 106 | 39 | 102 | 73 | 382 | 184 | 4,378 |
| Outer WN | 58 | 245 | 31 | 21 | 83 | 920 | 183 | 9 | 23 | 56 | 15 | 234 | 525 | 331 | 166 | 35 | 58 | 45 | 254 | 128 | 3,420 |
| Outer NW | 151 | 471 | 261 | 140 | 64 | 183 | 2,768 | 114 | 88 | 196 | 75 | 316 | 708 | 2,145 | 1,056 | 191 | 260 | 142 | 907 | 453 | 10,689 |
| Outer NE | 14 | 42 | 52 | 12 | 11 | 9 | 114 | 302 | 85 | 83 | 25 | 27 | 65 | 226 | 537 | 134 | 110 | 34 | 151 | 84 | 2,117 |
| Outer EN | 63 | 138 | 354 | 260 | 14 | 23 | 88 | 85 | 4,370 | 3,177 | 236 | 75 | 87 | 221 | 472 | 690 | 1,271 | 191 | 532 | 279 | 12,626 |
| Outer ES | 408 | 802 | 965 | 2,558 | 55 | 56 | 196 | 83 | 3,177 | 31,286 | 5,928 | 312 | 299 | 429 | 761 | 1,080 | 8,210 | 2,420 | 2,241 | 987 | 62,253 |
| Outer SE | 202 | 390 | 369 | 2,348 | 33 | 15 | 75 | 25 | 236 | 5,928 | 12,030 | 137 | 135 | 180 | 226 | 252 | 2,265 | 2,459 | 1,049 | 449 | 28,803 |
| Inner SW | 446 | 487 | 316 | 258 | 634 | 234 | 316 | 27 | 75 | 312 | 137 | 5,340 | 2,580 | 801 | 454 | 180 | 503 | 348 | 2,603 | 1,104 | 17,155 |
| Inner WN | 349 | 636 | 333 | 239 | 397 | 525 | 708 | 65 | 87 | 299 | 135 | 2,580 | 6,386 | 2,081 | 972 | 241 | 475 | 346 | 3,075 | 1,178 | 21,107 |
| Inner NW | 340 | 842 | 638 | 326 | 162 | 331 | 2,145 | 226 | 221 | 429 | 180 | 801 | 2,081 | 9,346 | 3,887 | 623 | 654 | 385 | 3,075 | 1,370 | 28,062 |
| Inner NE | 323 | 772 | 704 | 418 | 106 | 166 | 1,056 | 537 | 472 | 761 | 226 | 454 | 972 | 3,887 | 11,570 | 2,058 | 1,257 | 536 | 3,617 | 1,553 | 31,445 |
| Inner EN | 71 | 149 | 155 | 156 | 39 | 35 | 191 | 134 | 690 | 1,080 | 252 | 180 | 241 | 623 | 2,058 | 3,342 | 2,444 | 447 | 1,928 | 788 | 15,003 |
| Inner ES | 323 | 605 | 551 | 1,082 | 102 | 58 | 260 | 110 | 1,271 | 8,210 | 2,265 | 503 | 475 | 654 | 1,257 | 2,444 | 17,428 | 3,854 | 4,268 | 1,767 | 47,487 |
| Inner SE | 244 | 370 | 288 | 635 | 73 | 45 | 142 | 34 | 191 | 2,420 | 2,459 | 348 | 346 | 385 | 536 | 447 | 3,854 | 10,650 | 3,317 | 1,275 | 28,059 |
| Inner centre | 719 | 1,081 | 691 | 812 | 382 | 254 | 907 | 151 | 532 | 2,241 | 1,049 | 2,603 | 3,075 | 3,075 | 3,617 | 1,928 | 4,268 | 3,317 | 23,584 | 11,347 | 65,633 |
| CBD | 345 | 459 | 235 | 394 | 184 | 128 | 453 | 84 | 279 | 987 | 449 | 1,104 | 1,178 | 1,370 | 1,553 | 788 | 1,767 | 1,275 | 11,347 | 13,780 | 38,159 |
| TOTAL | 25,548 | 33,112 | 9,688 | 24,602 | 4,378 | 3,420 | 10,689 | 2,117 | 12,626 | 62,253 | 28,803 | 17,155 | 21,107 | 28,062 | 31,445 | 15,003 | 47,487 | 28,059 | 65,633 | 38,159 | 509,346 |

People

| All | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 752,850 | 6,492 | 345 | 538 | 5,396 | 1,083 | 1,194 | 113 | 267 | 1,014 | 456 | 2,478 | 2,972 | 1,646 | 1,481 | 803 | 2,164 | 1,309 | 4,778 | 2,538 | 789,918 |
| Regional NW | 6,402 | 884,578 | 4,240 | 845 | 2,050 | 8,700 | 8,329 | 682 | 1,021 | 2,228 | 938 | 2,496 | 7,615 | 7,254 | 6,255 | 2,530 | 3,955 | 2,442 | 9,379 | 4,731 | 966,671 |
| Regional NE | 336 | 4,299 | 102,668 | 3,010 | 273 | 331 | 1,772 | 1,443 | 9,376 | 6,151 | 826 | 566 | 1,475 | 3,116 | 5,109 | 3,157 | 4,392 | 1,333 | 3,981 | 1,816 | 155,429 |
| Regional SE | 535 | 862 | 3,071 | 677,931 | 339 | 253 | 882 | 187 | 4,534 | 45,192 | 61,659 | 546 | 1,158 | 1,229 | 2,039 | 2,844 | 14,112 | 7,519 | 6,815 | 2,936 | 834,645 |
| Outer SW | 5,517 | 2,044 | 282 | 348 | 207,477 | 4,634 | 1,611 | 209 | 243 | 949 | 354 | 26,376 | 14,024 | 4,547 | 2,629 | 1,208 | 3,354 | 2,104 | 11,455 | 6,671 | 296,035 |
| Outer WN | 1,033 | 8,719 | 326 | 254 | 4,669 | 137,387 | 6,707 | 395 | 314 | 635 | 226 | 6,438 | 44,077 | 12,575 | 5,535 | 1,552 | 2,298 | 1,415 | 9,149 | 4,829 | 248,533 |
| Outer NW | 1,227 | 8,324 | 1,772 | 881 | 1,643 | 6,618 | 135,534 | 2,719 | 1,777 | 2,594 | 1,159 | 2,568 | 10,886 | 36,658 | 19,367 | 4,417 | 4,498 | 2,832 | 12,630 | 7,848 | 265,951 |
| Outer NE | 133 | 663 | 1,388 | 181 | 204 | 389 | 2,708 | 36,072 | 5,745 | 1,073 | 211 | 452 | 1,620 | 5,580 | 30,721 | 7,814 | 2,735 | 804 | 4,217 | 1,972 | 104,680 |
| Outer EN | 268 | 1,023 | 9,370 | 4,612 | 276 | 357 | 1,754 | 5,625 | 370,445 | 92,832 | 3,197 | 615 | 1,853 | 4,410 | 16,851 | 43,925 | 39,882 | 4,071 | 13,295 | 6,240 | 620,899 |
| Outer ES | 1,013 | 2,342 | 6,084 | 45,320 | 934 | 607 | 2,596 | 1,078 | 92,804 | 1,287,312 | 120,396 | 1,663 | 2,951 | 3,843 | 8,050 | 28,540 | 182,105 | 45,951 | 27,823 | 13,010 | 1,874,421 |
| Outer SE | 386 | 947 | 841 | 61,628 | 339 | 243 | 1,155 | 217 | 3,147 | 120,705 | 598,308 | 725 | 1,336 | 1,306 | 2,177 | 4,194 | 36,693 | 60,552 | 12,829 | 6,128 | 913,857 |
| Inner SW | 2,532 | 2,442 | 536 | 567 | 26,217 | 6,481 | 2,644 | 460 | 634 | 1,720 | 712 | 149,242 | 47,795 | 9,524 | 4,195 | 2,449 | 5,734 | 4,626 | 24,372 | 13,977 | 306,861 |
| Inner WN | 2,900 | 7,719 | 1,454 | 1,256 | 14,068 | 44,103 | 10,891 | 1,639 | 1,873 | 3,054 | 1,324 | 47,887 | 376,601 | 66,778 | 18,917 | 6,457 | 8,557 | 6,355 | 47,470 | 21,557 | 690,861 |
| Inner NW | 1,610 | 7,190 | 3,234 | 1,190 | 4,474 | 12,422 | 36,717 | 5,622 | 4,384 | 3,754 | 1,345 | 9,388 | 66,827 | 371,107 | 93,875 | 15,510 | 10,477 | 6,824 | 66,031 | 26,699 | 748,679 |
| Inner NE | 1,414 | 6,227 | 5,171 | 1,954 | 2,641 | 5,549 | 19,446 | 30,734 | 16,718 | 8,194 | 2,239 | 4,317 | 18,746 | 93,912 | 517,662 | 89,863 | 22,113 | 8,718 | 73,869 | 25,859 | 955,344 |
| Inner EN | 833 | 2,576 | 3,085 | 2,945 | 1,167 | 1,574 | 4,345 | 7,779 | 43,977 | 28,472 | 4,356 | 2,393 | 6,493 | 15,644 | 89,346 | 390,304 | 124,044 | 13,974 | 66,616 | 23,615 | 833,538 |
| Inner ES | 2,126 | 3,969 | 4,299 | 14,153 | 3,409 | 2,268 | 4,520 | 2,681 | 40,005 | 181,790 | 36,935 | 5,657 | 8,357 | 10,322 | 22,275 | 123,715 | 808,688 | 130,094 | 97,200 | 35,852 | 1,538,315 |
| Inner SE | 1,241 | 2,475 | 1,317 | 7,362 | 2,142 | 1,390 | 2,826 | 748 | 4,092 | 46,006 | 60,351 | 4,685 | 6,396 | 6,841 | 8,755 | 14,203 | 129,931 | 555,966 | 101,301 | 33,422 | 991,448 |
| Inner centre | 4,851 | 9,416 | 3,979 | 6,678 | 11,447 | 9,157 | 12,605 | 4,203 | 13,259 | 27,995 | 12,788 | 24,360 | 47,701 | 65,945 | 73,669 | 66,583 | 97,282 | 101,237 | 569,596 | 207,400 | 1,370,152 |
| CBD | 2,516 | 4,803 | 1,837 | 2,971 | 6,780 | 4,885 | 7,796 | 1,956 | 6,270 | 12,901 | 6,117 | 13,600 | 21,100 | 26,356 | 25,550 | 23,279 | 35,046 | 32,835 | 204,469 | 324,228 | 765,297 |
| TOTAL | 789,724 | 967,110 | 155,299 | 834,624 | 295,944 | 248,430 | 266,032 | 104,561 | 620,885 | 1,874,571 | 913,897 | 306,452 | 689,985 | 748,593 | 954,457 | 833,346 | 1,538,061 | 990,962 | 1,367,273 | 771,329 | 15,271,535 |

| Public Trans | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 16,398 | 87 | 2 | 3 | 189 | 11 | 4 | 1 | 8 | 30 | 11 | 48 | 118 | 49 | 118 | 33 | 203 | 54 | 826 | 675 | 18,868 |
| Regional NW | 98 | 13,479 | 124 | 0 | 27 | 239 | 225 | 4 | 13 | 26 | 6 | 29 | 206 | 139 | 162 | 51 | 173 | 33 | 1,099 | 914 | 17,047 |
| Regional NE | 4 | 128 | 753 | 117 | 1 | 2 | 26 | 11 | 301 | 106 | 8 | 7 | 33 | 47 | 147 | 63 | 168 | 33 | 513 | 507 | 2,975 |
| Regional SE | 3 | 1 | 114 | 7,795 | 3 | 1 | 4 | 0 | 82 | 1,108 | 2,000 | 11 | 69 | 31 | 162 | 89 | 704 | 248 | 1,387 | 1,057 | 14,869 |
| Outer SW | 194 | 22 | 0 | 1 | 2,598 | 142 | 34 | 5 | 10 | 40 | 15 | 811 | 877 | 336 | 231 | 89 | 324 | 116 | 1,828 | 2,448 | 10,121 |
| Outer WN | 18 | 251 | 3 | 0 | 150 | 2,496 | 211 | 9 | 16 | 25 | 15 | 163 | 1,689 | 553 | 291 | 86 | 255 | 89 | 1,664 | 2,002 | 9,986 |
| Outer NW | 6 | 226 | 25 | 3 | 39 | 210 | 1,992 | 69 | 37 | 20 | 20 | 47 | 372 | 1,034 | 670 | 128 | 189 | 77 | 1,377 | 1,827 | 8,368 |
| Outer NE | 3 | 9 | 7 | 1 | 3 | 13 | 69 | 258 | 166 | 18 | 5 | 12 | 43 | 177 | 1,122 | 240 | 113 | 35 | 649 | 863 | 3,806 |
| Outer EN | 6 | 8 | 297 | 90 | 9 | 12 | 34 | 151 | 7,620 | 3,206 | 90 | 31 | 150 | 194 | 991 | 1,786 | 2,450 | 285 | 2,907 | 3,336 | 23,653 |
| Outer ES | 26 | 19 | 94 | 1,142 | 32 | 28 | 31 | 22 | 3,227 | 30,549 | 4,150 | 89 | 373 | 261 | 756 | 1,456 | 9,904 | 2,444 | 6,251 | 6,486 | 67,340 |
| Outer SE | 12 | 13 | 10 | 1,988 | 14 | 13 | 21 | 3 | 78 | 4,081 | 14,758 | 53 | 226 | 163 | 393 | 283 | 2,624 | 3,477 | 3,584 | 3,709 | 35,503 |
| Inner SW | 51 | 16 | 7 | 13 | 815 | 159 | 52 | 12 | 44 | 102 | 63 | 3,401 | 2,022 | 592 | 343 | 190 | 665 | 405 | 3,804 | 5,046 | 17,802 |
| Inner WN | 118 | 208 | 30 | 85 | 919 | 1,664 | 340 | 54 | 150 | 398 | 191 | 2,000 | 11,189 | 3,478 | 1,375 | 587 | 1,320 | 787 | 8,053 | 8,292 | 41,238 |
| Inner NW | 37 | 128 | 59 | 46 | 335 | 550 | 975 | 170 | 184 | 264 | 144 | 563 | 3,478 | 11,955 | 4,967 | 955 | 1,441 | 755 | 11,350 | 12,014 | 50,370 |
| Inner NE | 95 | 172 | 137 | 146 | 226 | 291 | 693 | 1,093 | 1,019 | 750 | 355 | 374 | 1,401 | 4,982 | 19,903 | 4,690 | 2,576 | 1,234 | 12,607 | 12,847 | 65,591 |
| Inner EN | 47 | 32 | 75 | 69 | 94 | 79 | 122 | 232 | 1,682 | 1,422 | 305 | 167 | 575 | 996 | 4,682 | 10,388 | 6,667 | 1,191 | 9,947 | 11,291 | 50,063 |
| Inner ES | 185 | 183 | 190 | 732 | 329 | 230 | 197 | 113 | 2,396 | 9,719 | 2,516 | 627 | 1,301 | 1,468 | 2,536 | 6,667 | 35,907 | 9,596 | 16,274 | 18,273 | 109,439 |
| Inner SE | 48 | 37 | 35 | 230 | 134 | 98 | 91 | 36 | 299 | 2,406 | 3,441 | 376 | 689 | 794 | 1,218 | 1,236 | 9,634 | 21,248 | 14,718 | 16,299 | 73,067 |
| Inner centre | 848 | 1,046 | 518 | 1,362 | 1,904 | 1,619 | 1,338 | 638 | 2,904 | 6,184 | 3,400 | 3,738 | 7,990 | 11,095 | 12,609 | 9,671 | 16,220 | 14,759 | 45,330 | 32,138 | 175,311 |
| CBD | 636 | 887 | 525 | 1,028 | 2,520 | 1,943 | 1,770 | 856 | 3,410 | 6,531 | 3,583 | 5,022 | 8,171 | 11,990 | 12,611 | 11,039 | 18,229 | 16,191 | 31,779 | 15,826 | 154,547 |
| TOTAL | 18,833 | 16,952 | 3,005 | 14,851 | 10,341 | 9,800 | 8,229 | 3,737 | 23,646 | 66,985 | 35,076 | 17,569 | 40,972 | 50,334 | 65,287 | 49,727 | 109,766 | 73,057 | 175,947 | 155,850 | 949,964 |

| Car | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 622,977 | 6,405 | 343 | 535 | 5,207 | 1,072 | 1,190 | 112 | 259 | 984 | 445 | 2,430 | 2,854 | 1,597 | 1,363 | 770 | 1,961 | 1,255 | 3,952 | 1,863 | 657,575 |
| Regional NW | 6,304 | 770,709 | 4,116 | 845 | 2,023 | 8,461 | 8,104 | 678 | 1,008 | 2,202 | 932 | 2,467 | 7,409 | 7,115 | 6,093 | 2,479 | 3,782 | 2,409 | 8,280 | 3,817 | 849,234 |
| Regional NE | 332 | 4,170 | 94,457 | 2,893 | 272 | 329 | 1,746 | 1,432 | 9,071 | 6,045 | 818 | 559 | 1,442 | 3,069 | 4,962 | 3,094 | 4,224 | 1,300 | 3,468 | 1,309 | 144,991 |
| Regional SE | 532 | 861 | 2,956 | 600,579 | 336 | 252 | 878 | 187 | 4,452 | 44,011 | 59,405 | 535 | 1,089 | 1,198 | 1,877 | 2,755 | 13,408 | 7,271 | 5,428 | 1,879 | 749,891 |
| Outer SW | 5,323 | 2,022 | 282 | 347 | 168,605 | 4,491 | 1,577 | 204 | 233 | 909 | 339 | 25,402 | 13,147 | 4,211 | 2,398 | 1,119 | 3,030 | 1,988 | 9,627 | 4,223 | 249,476 |
| Outer WN | 1,015 | 8,467 | 323 | 254 | 4,519 | 108,268 | 6,492 | 386 | 298 | 610 | 211 | 6,273 | 41,453 | 12,019 | 5,244 | 1,466 | 2,043 | 1,326 | 7,484 | 2,827 | 210,978 |
| Outer NW | 1,221 | 8,098 | 1,747 | 878 | 1,604 | 6,399 | 108,414 | 2,649 | 1,740 | 2,574 | 1,139 | 2,521 | 10,511 | 34,609 | 18,686 | 4,289 | 4,309 | 2,755 | 11,252 | 6,021 | 231,415 |
| Outer NE | 130 | 654 | 1,380 | 180 | 201 | 376 | 2,639 | 29,229 | 5,434 | 1,055 | 206 | 440 | 1,577 | 5,401 | 28,257 | 7,474 | 2,622 | 769 | 3,568 | 1,109 | 92,699 |
| Outer EN | 262 | 1,015 | 9,067 | 4,522 | 267 | 345 | 1,720 | 5,329 | 304,644 | 86,783 | 3,107 | 584 | 1,703 | 4,216 | 15,816 | 41,080 | 36,882 | 3,786 | 10,387 | 2,904 | 534,417 |
| Outer ES | 987 | 2,323 | 5,990 | 44,101 | 902 | 579 | 2,565 | 1,056 | 86,787 | 1,079,597 | 114,227 | 1,574 | 2,578 | 3,582 | 7,294 | 27,044 | 168,539 | 43,428 | 21,572 | 6,524 | 1,621,248 |
| Outer SE | 374 | 934 | 831 | 59,383 | 325 | 230 | 1,134 | 214 | 3,069 | 114,612 | 480,384 | 672 | 1,110 | 1,143 | 1,784 | 3,911 | 33,945 | 55,453 | 9,245 | 2,419 | 771,173 |
| Inner SW | 2,481 | 2,426 | 529 | 554 | 25,227 | 6,321 | 2,592 | 448 | 590 | 1,618 | 649 | 115,670 | 44,291 | 8,923 | 3,851 | 2,259 | 5,068 | 4,220 | 20,461 | 8,806 | 256,986 |
| Inner WN | 2,782 | 7,511 | 1,424 | 1,171 | 13,149 | 41,507 | 10,550 | 1,585 | 1,723 | 2,656 | 1,133 | 44,428 | 293,314 | 61,781 | 17,526 | 5,866 | 7,237 | 5,564 | 37,795 | 12,471 | 571,174 |
| Inner NW | 1,573 | 7,062 | 3,175 | 1,144 | 4,139 | 11,870 | 34,746 | 5,452 | 4,200 | 3,490 | 1,201 | 8,816 | 61,832 | 289,530 | 84,609 | 14,547 | 9,035 | 6,068 | 51,907 | 13,808 | 618,203 |
| Inner NE | 1,319 | 6,055 | 5,034 | 1,808 | 2,415 | 5,258 | 18,740 | 28,309 | 15,662 | 7,444 | 1,884 | 3,943 | 17,328 | 84,591 | 398,950 | 79,990 | 19,526 | 7,481 | 57,089 | 11,993 | 774,817 |
| Inner EN | 786 | 2,544 | 3,010 | 2,876 | 1,073 | 1,495 | 4,223 | 7,449 | 41,198 | 27,008 | 4,051 | 2,226 | 5,917 | 14,639 | 79,481 | 310,056 | 111,877 | 12,772 | 55,315 | 11,867 | 699,863 |
| Inner ES | 1,941 | 3,786 | 4,109 | 13,421 | 3,080 | 2,038 | 4,323 | 2,568 | 37,083 | 168,342 | 34,298 | 5,030 | 7,056 | 8,851 | 19,723 | 111,479 | 616,012 | 114,771 | 78,186 | 16,787 | 1,252,884 |
| Inner SE | 1,193 | 2,438 | 1,282 | 7,132 | 2,008 | 1,292 | 2,735 | 712 | 3,793 | 43,515 | 55,286 | 4,309 | 5,706 | 6,046 | 7,537 | 12,945 | 114,556 | 415,544 | 78,508 | 15,898 | 782,433 |
| Inner centre | 4,003 | 8,370 | 3,461 | 5,316 | 9,543 | 7,538 | 11,267 | 3,565 | 10,355 | 21,810 | 9,388 | 20,517 | 38,078 | 51,996 | 56,933 | 55,517 | 78,424 | 78,465 | 315,160 | 50,564 | 840,271 |
| CBD | 1,880 | 3,916 | 1,312 | 1,943 | 4,260 | 2,942 | 6,026 | 1,100 | 2,860 | 6,370 | 2,534 | 8,455 | 12,122 | 13,462 | 11,918 | 11,792 | 16,003 | 15,423 | 47,553 | 20,945 | 192,818 |
| TOTAL | 657,416 | 849,766 | 144,828 | 749,882 | 249,154 | 211,062 | 231,661 | 92,663 | 534,459 | 1,621,635 | 771,637 | 256,851 | 570,519 | 617,979 | 774,301 | 699,931 | 1,252,484 | 782,049 | 836,235 | 198,035 | 12,102,547 |

*Source: Analysis of VLC Model outputs .Freight movements are in vehicles, all others are in people.*

## Table 2-4: Modelled 2006 AM Peak Travel Demand in Melbourne and Regional Centres

Freight

| All | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 2,780 | 80 | 23 | 17 | 26 | 6 | 19 | 1 | 7 | 55 | 22 | 55 | 44 | 45 | 38 | 7 | 34 | 29 | 95 | 50 | 3,433 |
| Regional NW | 80 | 3,356 | 36 | 25 | 10 | 34 | 59 | 4 | 17 | 85 | 47 | 55 | 68 | 101 | 93 | 15 | 75 | 38 | 136 | 61 | 4,395 |
| Regional NE | 23 | 36 | 418 | 19 | 4 | 5 | 33 | 7 | 40 | 113 | 42 | 32 | 32 | 66 | 72 | 15 | 59 | 30 | 78 | 26 | 1,150 |
| Regional SE | 17 | 25 | 19 | 2,004 | 2 | 2 | 17 | 4 | 38 | 317 | 320 | 26 | 27 | 42 | 53 | 25 | 147 | 76 | 90 | 54 | 3,305 |
| Outer SW | 26 | 10 | 4 | 2 | 250 | 11 | 13 | 2 | 1 | 8 | 4 | 79 | 58 | 25 | 14 | 6 | 20 | 8 | 61 | 22 | 624 |
| Outer WN | 6 | 34 | 5 | 2 | 11 | 132 | 29 | 0 | 2 | 12 | 2 | 24 | 86 | 38 | 28 | 5 | 8 | 8 | 35 | 14 | 481 |
| Outer NW | 19 | 59 | 33 | 17 | 13 | 29 | 380 | 17 | 13 | 25 | 11 | 40 | 103 | 295 | 148 | 32 | 35 | 15 | 114 | 64 | 1,462 |
| Outer NE | 1 | 4 | 7 | 4 | 2 | 0 | 17 | 38 | 12 | 15 | 3 | 1 | 10 | 33 | 74 | 16 | 15 | 5 | 17 | 14 | 288 |
| Outer EN | 7 | 17 | 40 | 38 | 1 | 2 | 13 | 12 | 618 | 434 | 33 | 6 | 8 | 31 | 68 | 100 | 179 | 28 | 76 | 42 | 1,753 |
| Outer ES | 55 | 85 | 113 | 317 | 8 | 12 | 25 | 15 | 434 | 4,406 | 819 | 43 | 39 | 61 | 99 | 147 | 1,149 | 344 | 289 | 142 | 8,602 |
| Outer SE | 22 | 47 | 42 | 320 | 4 | 2 | 11 | 3 | 33 | 819 | 1,682 | 21 | 19 | 18 | 34 | 40 | 317 | 351 | 147 | 59 | 3,991 |
| Inner SW | 55 | 55 | 32 | 26 | 79 | 24 | 40 | 1 | 6 | 43 | 21 | 758 | 357 | 115 | 56 | 24 | 65 | 57 | 342 | 165 | 2,321 |
| Inner WN | 44 | 68 | 32 | 27 | 58 | 86 | 103 | 10 | 8 | 39 | 19 | 357 | 924 | 283 | 134 | 35 | 69 | 48 | 422 | 157 | 2,923 |
| Inner NW | 45 | 101 | 66 | 42 | 25 | 38 | 295 | 33 | 31 | 61 | 18 | 115 | 283 | 1,316 | 542 | 89 | 94 | 43 | 412 | 199 | 3,848 |
| Inner NE | 38 | 93 | 72 | 53 | 14 | 28 | 148 | 74 | 68 | 99 | 34 | 56 | 134 | 542 | 1,648 | 299 | 183 | 80 | 498 | 216 | 4,377 |
| Inner EN | 7 | 15 | 15 | 25 | 6 | 5 | 32 | 16 | 100 | 147 | 40 | 24 | 35 | 89 | 299 | 444 | 356 | 61 | 272 | 116 | 2,104 |
| Inner ES | 34 | 75 | 59 | 147 | 20 | 8 | 35 | 15 | 179 | 1,149 | 317 | 65 | 69 | 94 | 183 | 356 | 2,422 | 534 | 568 | 234 | 6,563 |
| Inner SE | 29 | 38 | 30 | 76 | 8 | 8 | 15 | 5 | 28 | 344 | 351 | 57 | 48 | 43 | 80 | 61 | 534 | 1,514 | 457 | 182 | 3,908 |
| Inner centre | 95 | 136 | 78 | 90 | 61 | 35 | 114 | 17 | 76 | 289 | 147 | 342 | 422 | 412 | 498 | 272 | 568 | 457 | 3,158 | 1,587 | 8,854 |
| CBD | 50 | 61 | 26 | 54 | 22 | 14 | 64 | 14 | 42 | 142 | 59 | 165 | 157 | 199 | 216 | 116 | 234 | 182 | 1,587 | 1,922 | 5,326 |
| TOTAL | 3,433 | 4,395 | 1,150 | 3,305 | 624 | 481 | 1,462 | 288 | 1,753 | 8,602 | 3,991 | 2,321 | 2,923 | 3,848 | 4,377 | 2,104 | 6,563 | 3,908 | 8,854 | 5,326 | 69,708 |

People

| All | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 105,774 | 1,091 | 37 | 58 | 896 | 151 | 184 | 17 | 35 | 174 | 73 | 670 | 831 | 419 | 407 | 197 | 644 | 332 | 1,714 | 960 | 114,666 |
| Regional NW | 968 | 125,017 | 516 | 95 | 434 | 1,889 | 1,967 | 154 | 171 | 361 | 121 | 670 | 2,160 | 1,976 | 1,642 | 592 | 960 | 511 | 2,979 | 1,553 | 144,738 |
| Regional NE | 43 | 802 | 13,650 | 496 | 35 | 50 | 402 | 334 | 2,440 | 1,591 | 128 | 121 | 314 | 809 | 1,361 | 757 | 1,145 | 261 | 1,075 | 531 | 26,345 |
| Regional SE | 64 | 99 | 466 | 90,927 | 39 | 29 | 117 | 30 | 1,090 | 11,687 | 13,953 | 103 | 243 | 245 | 468 | 646 | 4,505 | 2,164 | 2,214 | 954 | 130,042 |
| Outer SW | 1,331 | 239 | 27 | 35 | 26,076 | 753 | 405 | 33 | 40 | 248 | 92 | 6,058 | 4,345 | 1,553 | 892 | 429 | 1,231 | 692 | 4,604 | 2,909 | 51,995 |
| Outer WN | 223 | 1,141 | 33 | 34 | 970 | 17,879 | 1,570 | 70 | 76 | 190 | 44 | 1,965 | 9,571 | 3,737 | 1,839 | 512 | 843 | 476 | 3,664 | 2,146 | 46,984 |
| Outer NW | 163 | 814 | 150 | 106 | 232 | 771 | 17,525 | 420 | 261 | 394 | 184 | 573 | 2,288 | 6,827 | 4,195 | 944 | 1,031 | 541 | 3,679 | 2,239 | 43,337 |
| Outer NE | 22 | 85 | 128 | 27 | 35 | 70 | 588 | 4,349 | 1,113 | 291 | 53 | 137 | 441 | 1,628 | 6,561 | 1,857 | 960 | 241 | 1,598 | 843 | 21,028 |
| Outer EN | 32 | 91 | 777 | 358 | 47 | 46 | 351 | 781 | 48,230 | 17,414 | 728 | 182 | 526 | 1,267 | 4,659 | 9,037 | 10,846 | 1,199 | 5,168 | 2,724 | 104,462 |
| Outer ES | 100 | 203 | 397 | 4,217 | 89 | 47 | 338 | 80 | 13,103 | 173,093 | 17,655 | 350 | 697 | 841 | 1,999 | 5,484 | 40,208 | 9,292 | 10,188 | 5,177 | 283,558 |
| Outer SE | 51 | 85 | 56 | 7,721 | 36 | 16 | 154 | 24 | 532 | 22,797 | 78,123 | 146 | 340 | 332 | 628 | 981 | 10,365 | 11,676 | 4,842 | 2,550 | 141,456 |
| Inner SW | 265 | 129 | 43 | 45 | 2,573 | 407 | 341 | 46 | 82 | 257 | 110 | 17,949 | 6,999 | 1,776 | 830 | 491 | 1,421 | 947 | 6,605 | 4,112 | 45,428 |
| Inner WN | 255 | 510 | 105 | 104 | 1,133 | 4,566 | 1,687 | 151 | 192 | 425 | 145 | 7,017 | 46,514 | 11,461 | 3,872 | 1,239 | 2,243 | 1,207 | 12,344 | 6,688 | 101,854 |
| Inner NW | 152 | 385 | 189 | 100 | 353 | 846 | 4,537 | 461 | 410 | 598 | 202 | 1,557 | 8,992 | 45,591 | 13,871 | 2,584 | 2,669 | 1,464 | 16,830 | 9,019 | 110,810 |
| Inner NE | 120 | 365 | 266 | 134 | 194 | 381 | 2,297 | 3,010 | 1,748 | 1,134 | 248 | 778 | 2,857 | 13,858 | 64,687 | 12,351 | 5,238 | 1,631 | 17,821 | 8,717 | 137,835 |
| Inner EN | 95 | 198 | 175 | 219 | 89 | 107 | 601 | 681 | 5,402 | 5,250 | 724 | 492 | 1,273 | 3,119 | 14,537 | 47,581 | 24,614 | 2,882 | 18,329 | 8,938 | 135,307 |
| Inner ES | 109 | 235 | 227 | 655 | 171 | 85 | 446 | 141 | 3,463 | 20,299 | 3,542 | 737 | 1,165 | 1,367 | 3,318 | 13,872 | 98,562 | 16,506 | 23,110 | 11,866 | 199,877 |
| Inner SE | 86 | 160 | 82 | 463 | 150 | 76 | 308 | 50 | 475 | 7,369 | 7,755 | 759 | 1,150 | 1,180 | 1,681 | 2,419 | 24,236 | 66,515 | 24,216 | 11,560 | 150,689 |
| Inner centre | 174 | 376 | 168 | 268 | 368 | 256 | 920 | 133 | 486 | 1,564 | 652 | 1,780 | 3,710 | 5,199 | 6,336 | 5,033 | 9,779 | 8,170 | 63,703 | 28,960 | 138,034 |
| CBD | 87 | 207 | 95 | 132 | 174 | 103 | 559 | 51 | 177 | 535 | 219 | 857 | 1,216 | 1,311 | 1,388 | 987 | 2,235 | 1,573 | 18,223 | 26,781 | 56,908 |
| TOTAL | 110,114 | 132,230 | 17,587 | 106,193 | 34,097 | 28,528 | 35,298 | 11,016 | 79,526 | 265,671 | 124,752 | 42,902 | 95,634 | 104,497 | 135,169 | 107,992 | 243,734 | 128,279 | 242,906 | 139,227 | 2,185,354 |

| Public Trans | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 4,544 | 49 | 0 | 1 | 3 | 1 | 1 | 0 | 4 | 12 | 4 | 16 | 57 | 25 | 55 | 18 | 97 | 23 | 451 | 457 | 5,818 |
| Regional NW | 28 | 4,290 | 37 | 0 | 0 | 126 | 135 | 1 | 7 | 12 | 2 | 19 | 134 | 110 | 94 | 29 | 91 | 18 | 567 | 568 | 6,268 |
| Regional NE | 0 | 66 | 281 | 92 | 0 | 0 | 16 | 5 | 212 | 79 | 2 | 5 | 16 | 35 | 98 | 40 | 100 | 23 | 288 | 293 | 1,651 |
| Regional SE | 0 | 0 | 4 | 2,641 | 2 | 1 | 1 | 0 | 49 | 628 | 947 | 5 | 42 | 18 | 98 | 55 | 425 | 150 | 765 | 652 | 6,483 |
| Outer SW | 157 | 18 | 0 | 0 | 296 | 104 | 28 | 3 | 5 | 23 | 6 | 527 | 687 | 260 | 143 | 57 | 209 | 75 | 1,056 | 1,565 | 5,219 |
| Outer WN | 5 | 70 | 0 | 0 | 2 | 633 | 106 | 6 | 5 | 10 | 7 | 75 | 741 | 345 | 150 | 53 | 135 | 44 | 895 | 1,195 | 4,477 |
| Outer NW | 3 | 48 | 5 | 0 | 2 | 45 | 555 | 20 | 19 | 4 | 8 | 20 | 190 | 425 | 359 | 76 | 97 | 39 | 678 | 1,007 | 3,600 |
| Outer NE | 2 | 4 | 1 | 1 | 0 | 6 | 38 | 45 | 113 | 12 | 3 | 8 | 26 | 97 | 535 | 118 | 62 | 18 | 335 | 494 | 1,918 |
| Outer EN | 1 | 2 | 11 | 13 | 2 | 2 | 11 | 8 | 2,035 | 1,001 | 36 | 13 | 64 | 94 | 456 | 681 | 1,047 | 148 | 1,593 | 1,989 | 9,207 |
| Outer ES | 1 | 0 | 1 | 163 | 5 | 4 | 8 | 2 | 794 | 8,078 | 976 | 34 | 167 | 101 | 350 | 544 | 3,655 | 744 | 3,295 | 3,690 | 22,612 |
| Outer SE | 3 | 1 | 1 | 378 | 1 | 0 | 4 | 0 | 22 | 1,537 | 3,543 | 20 | 89 | 70 | 181 | 120 | 1,170 | 910 | 1,820 | 1,993 | 11,863 |
| Inner SW | 13 | 0 | 0 | 0 | 25 | 33 | 16 | 2 | 11 | 30 | 19 | 704 | 644 | 286 | 139 | 83 | 301 | 158 | 1,718 | 2,480 | 6,662 |
| Inner WN | 15 | 9 | 0 | 3 | 10 | 329 | 59 | 2 | 19 | 56 | 13 | 358 | 2,402 | 1,192 | 430 | 177 | 496 | 208 | 3,220 | 3,806 | 12,804 |
| Inner NW | 7 | 9 | 3 | 4 | 1 | 69 | 196 | 30 | 44 | 55 | 29 | 88 | 742 | 2,531 | 1,219 | 265 | 545 | 226 | 4,295 | 5,609 | 15,967 |
| Inner NE | 5 | 6 | 1 | 1 | 3 | 34 | 105 | 90 | 202 | 92 | 30 | 58 | 321 | 1,204 | 3,938 | 989 | 832 | 264 | 4,532 | 5,751 | 18,458 |
| Inner EN | 11 | 2 | 1 | 1 | 3 | 8 | 13 | 14 | 391 | 407 | 53 | 30 | 166 | 269 | 1,267 | 2,188 | 1,933 | 307 | 3,998 | 5,698 | 16,760 |
| Inner ES | 8 | 0 | 2 | 15 | 2 | 3 | 5 | 2 | 249 | 1,430 | 253 | 82 | 201 | 216 | 517 | 1,163 | 6,458 | 1,479 | 5,696 | 8,077 | 25,858 |
| Inner SE | 5 | 0 | 3 | 6 | 4 | 8 | 10 | 3 | 35 | 682 | 700 | 76 | 169 | 180 | 382 | 334 | 2,521 | 3,702 | 5,302 | 7,412 | 21,534 |
| Inner centre | 8 | 3 | 1 | 7 | 14 | 19 | 39 | 3 | 59 | 164 | 76 | 175 | 463 | 720 | 853 | 607 | 1,604 | 959 | 7,402 | 8,686 | 21,862 |
| CBD | 5 | 8 | 4 | 11 | 17 | 15 | 37 | 7 | 42 | 118 | 59 | 173 | 284 | 358 | 400 | 284 | 762 | 463 | 2,345 | 1,537 | 6,929 |
| TOTAL | 4,821 | 4,585 | 356 | 3,337 | 392 | 1,440 | 1,383 | 243 | 4,317 | 14,430 | 6,766 | 2,486 | 7,605 | 8,536 | 11,664 | 7,881 | 22,540 | 9,958 | 50,251 | 62,959 | 225,950 |

| Car | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional SW | 88,958 | 1,042 | 37 | 57 | 893 | 150 | 183 | 17 | 31 | 162 | 69 | 654 | 774 | 394 | 352 | 179 | 547 | 309 | 1,263 | 503 | 96,576 |
| Regional NW | 940 | 109,296 | 479 | 95 | 434 | 1,763 | 1,832 | 153 | 164 | 349 | 119 | 651 | 2,026 | 1,866 | 1,548 | 563 | 869 | 493 | 2,412 | 985 | 127,039 |
| Regional NE | 43 | 735 | 12,478 | 404 | 35 | 50 | 386 | 329 | 2,228 | 1,512 | 126 | 116 | 298 | 774 | 1,263 | 717 | 1,045 | 238 | 787 | 238 | 23,802 |
| Regional SE | 64 | 99 | 462 | 80,964 | 37 | 28 | 116 | 30 | 1,041 | 11,055 | 12,959 | 98 | 201 | 227 | 370 | 591 | 4,080 | 2,014 | 1,449 | 302 | 116,186 |
| Outer SW | 1,174 | 221 | 27 | 35 | 21,940 | 649 | 377 | 30 | 35 | 225 | 86 | 5,507 | 3,658 | 1,293 | 749 | 372 | 1,022 | 617 | 3,548 | 1,344 | 42,912 |
| Outer WN | 218 | 1,071 | 33 | 34 | 968 | 14,167 | 1,462 | 64 | 71 | 180 | 37 | 1,890 | 8,705 | 3,392 | 1,689 | 459 | 708 | 432 | 2,769 | 951 | 39,301 |
| Outer NW | 160 | 766 | 145 | 106 | 230 | 726 | 13,998 | 400 | 242 | 390 | 176 | 553 | 2,097 | 6,292 | 3,833 | 868 | 934 | 502 | 3,000 | 1,232 | 36,650 |
| Outer NE | 20 | 81 | 126 | 26 | 35 | 64 | 550 | 3,634 | 973 | 279 | 50 | 129 | 415 | 1,531 | 5,801 | 1,721 | 898 | 223 | 1,263 | 349 | 18,169 |
| Outer EN | 31 | 89 | 766 | 345 | 45 | 44 | 340 | 760 | 40,098 | 16,105 | 692 | 169 | 462 | 1,173 | 4,192 | 8,199 | 9,724 | 1,051 | 3,575 | 735 | 88,594 |
| Outer ES | 99 | 203 | 396 | 4,047 | 84 | 43 | 330 | 78 | 11,990 | 146,491 | 16,461 | 316 | 530 | 740 | 1,649 | 4,935 | 35,990 | 8,538 | 6,893 | 1,487 | 241,300 |
| Outer SE | 48 | 84 | 55 | 7,311 | 35 | 16 | 150 | 24 | 510 | 20,953 | 63,778 | 126 | 251 | 262 | 447 | 861 | 9,166 | 10,561 | 3,022 | 557 | 118,218 |
| Inner SW | 252 | 129 | 43 | 45 | 2,523 | 374 | 325 | 44 | 71 | 227 | 91 | 14,177 | 6,163 | 1,487 | 691 | 408 | 1,119 | 788 | 4,842 | 1,584 | 35,383 |
| Inner WN | 240 | 501 | 105 | 101 | 1,123 | 4,094 | 1,628 | 149 | 173 | 369 | 132 | 6,492 | 36,743 | 10,039 | 3,439 | 1,061 | 1,747 | 998 | 8,782 | 2,645 | 80,557 |
| Inner NW | 145 | 376 | 186 | 96 | 352 | 777 | 4,160 | 431 | 366 | 543 | 173 | 1,466 | 8,068 | 35,941 | 12,176 | 2,317 | 2,123 | 1,238 | 11,931 | 3,090 | 85,955 |
| Inner NE | 115 | 359 | 265 | 133 | 191 | 347 | 2,189 | 2,792 | 1,543 | 1,042 | 218 | 720 | 2,533 | 12,227 | 50,402 | 10,802 | 4,403 | 1,366 | 12,497 | 2,625 | 106,769 |
| Inner EN | 84 | 196 | 174 | 218 | 86 | 99 | 588 | 661 | 4,859 | 4,835 | 671 | 462 | 1,106 | 2,849 | 12,626 | 38,514 | 21,796 | 2,574 | 14,001 | 3,078 | 109,478 |
| Inner ES | 101 | 235 | 225 | 640 | 169 | 82 | 441 | 139 | 3,176 | 18,456 | 3,281 | 655 | 964 | 1,149 | 2,796 | 12,163 | 77,103 | 14,455 | 16,871 | 3,524 | 156,626 |
| Inner SE | 81 | 160 | 79 | 457 | 146 | 68 | 298 | 47 | 440 | 6,666 | 6,857 | 683 | 981 | 1,000 | 1,299 | 2,079 | 20,776 | 51,209 | 17,569 | 3,718 | 114,612 |
| Inner centre | 166 | 373 | 167 | 261 | 354 | 237 | 881 | 130 | 427 | 1,400 | 576 | 1,602 | 3,131 | 4,248 | 5,146 | 4,271 | 7,892 | 6,625 | 35,712 | 6,024 | 79,622 |
| CBD | 82 | 199 | 91 | 121 | 157 | 88 | 522 | 44 | 135 | 417 | 160 | 681 | 882 | 913 | 943 | 678 | 1,431 | 1,059 | 5,004 | 1,665 | 15,270 |
| TOTAL | 93,021 | 116,213 | 16,339 | 95,495 | 29,840 | 23,866 | 30,757 | 9,956 | 68,573 | 231,656 | 106,713 | 37,148 | 79,990 | 87,798 | 111,409 | 91,757 | 203,372 | 105,289 | 157,190 | 36,636 | 1,733,020 |

*Source: Analysis of VLC Model outputs .Freight movements are in vehicles, all others are in people.*
*NB AM peak freight movements are estimated by a simple factoring of the daily movements.*

**Figure 2.9: Modelled 2006 Daily Travel Demand in Melbourne**

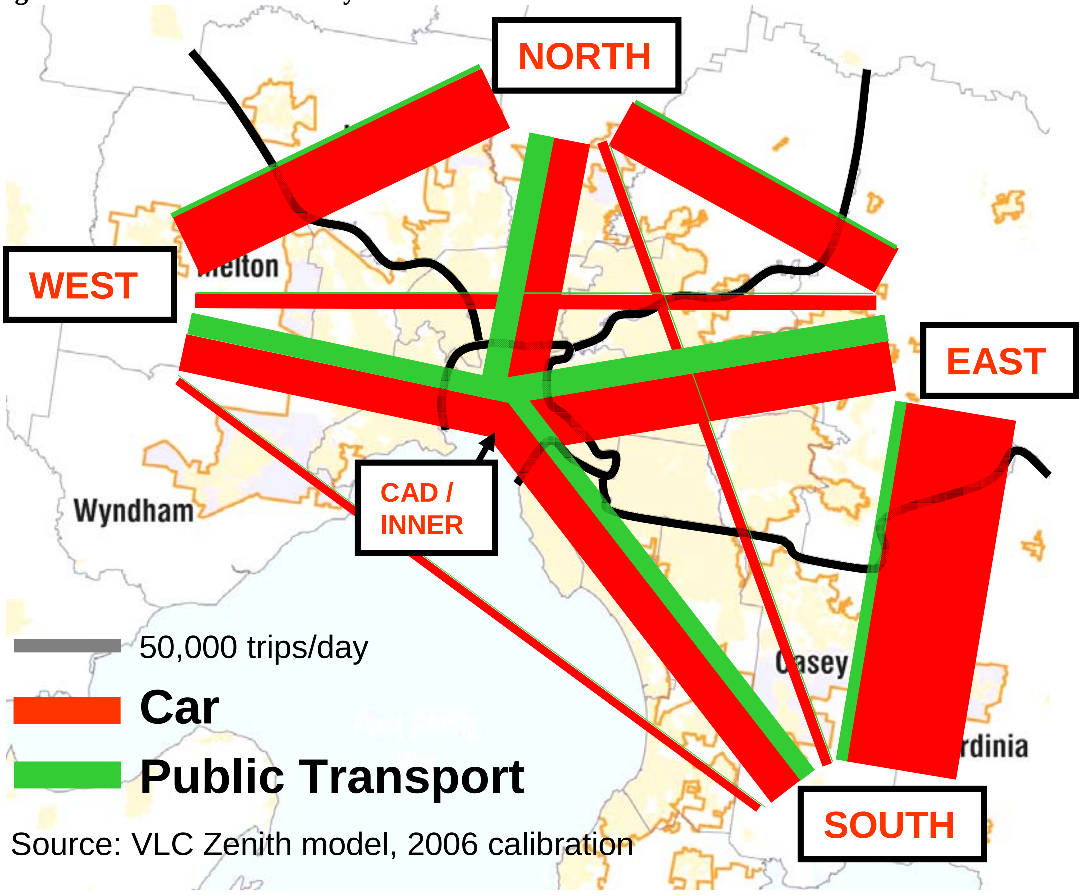
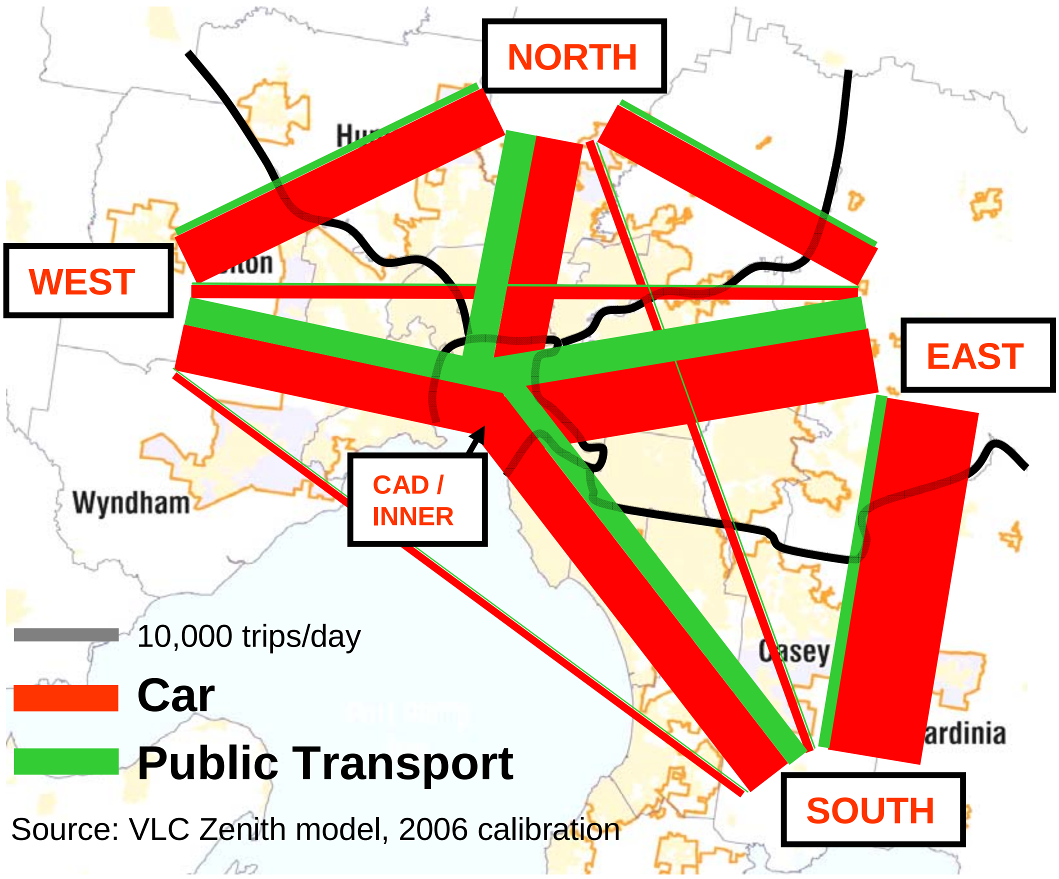



**Figure 2.10: Modelled 2006 AM Peak Travel Demand in Melbourne**



Key features of the modelled 2006 demand patterns are as follows:

- On a daily basis, there are about 1.2 million people movements (including walk trips) modelled to, from and within the CAD, of which about 40% are by public transport. Of these, about 165,000 take place in the morning peak, with a 40% mode share for public transport. Excluding walking trips, the public transport mode share of travel to/from the CAD is about 65% in the AM peak and 50% over the whole day.
- A further 2.2 million movements are modelled in to, out of and within the remainder of the inner area daily, of which 12% are by public transport (24% excluding walk trips).
- About 427,000 trips are modelled between the western region and the CAD, inner, east and south regions. The majority of these trips (70%) are between the western region and the CAD / inner areas. This is typical behaviour and illustrates the relatively high radial movement between the suburbs and the city compared to other origin / destination combinations. The mode share for public transport between the western region and inner / CAD areas is 24% (38% for CAD only). This is lower when compared to the eastern region (26% to inner / CAD areas, 50% to CAD only), reflecting the limited coverage and lower service levels of the public transport network in the west compared to the east.
- Compared with these major movements, about 90,000 movements are modelled making the whole journey between the west and the east per day (45,000 in each direction) including regional trips. About 16,000 of these movements are in the morning peak. Public transport takes a smaller share (15% in peak, 10% daily) of these trips.

Of the three public transport modes, the demand is split approximately 40% train, 40% tram and 20% bus. Trains carry the bulk of radial travel demand in and out of the central area. The tram network is also heavily-oriented towards inner Melbourne, especially in the morning peak, but tram services also play a significant role in local movement (for example, to and from shopping strips and activity centres in the tram network area). The bus network is very extensive and performs a much more local and regional function; it also has much lower levels of service than train and tram, which largely accounts for its lower mode share.

## 2.2 People Movement Supply

### 2.2.1 Overview

Melbourne's transport network grew with the city, from its inception. A detailed narrative of the development of the road network is given by Max Lay in his book 'Melbourne Miles' (which concentrates on the road system, with little mention of the parallel development of rail), and another perspective is given by Graeme Davison in 'Car Wars' (which illustrates the growth in car use and the role of cars in modern Melbourne society).

Alongside the road system, Melbourne's public transport network developed, with initial development corridors being opened up along the railways after the oldest and closest suburbs to the city centre had been established (and supported by cable trams, later to be developed into today's electric tram network). Many books and websites chart the history of Melbourne's public transport. DoI's website has a summary at http://www.doi.vic.gov.au/doi/internet/transport.nsf/allDocs/RWPE06934B7A6094C844A256AFD001C4975?OpenDocument

Transport infrastructure in Melbourne consists of (see Table 2-5):

- 49,500 lane-km of roads, of which 35,000 are (mostly two-lane) local and collector streets and 11,000 (22%) are multi-lane freeways, tollways and arterials.
- 740 kilometres of rail lines
- 490 kilometres of tram lines
- 5,300 route-km of bus routes

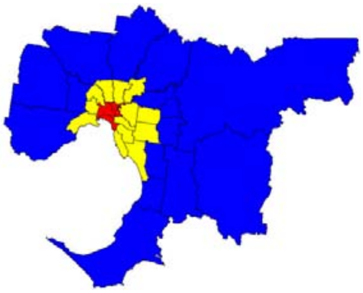


**Table 2-5: Transport Infrastructure in Melbourne**

| | | Inner | Middle | Outer | Total |
|---|---|---|---|---|---|
| Road lane-km | Freeways, tollways | 140 | 450 | 1,130 | 1,720 |
| | Major highways | 30 | 280 | 1,390 | 1,700 |
| | Primary arterials | 200 | 1,180 | 3,140 | 4,520 |
| | Secondary arterials | 150 | 600 | 2,330 | 3,080 |
| | Collectors | 150 | 1,020 | 2,180 | 3,350 |
| | Local streets | 1,260 | 11,450 | 22,400 | 35,110 |
| | Total | 1,930 | 14,980 | 32,570 | 49,480 |
| | Freeways, highways & arterials | 520 | 2,510 | 7,990 | 11,020 |
| Bus | Route km (one direction) | 386 | 1,979 | 2,954 | 5,319 |
| Tram | Track km | 188 | 300 | 2 | 490 |
| Train | Track km (electrified) | 88 | 418 | 236 | 742 |

Source: SKM analysis from various sources. Inner, middle and outer areas as per map above:

Road system performance of all roads with the exception of freeways is influenced mainly by the capacity of road intersections, rather than midblock capacity. This is because a range of measures can be deployed to enhance midblock capacity, such as the use of clearways, transit lanes and tram fairways, to provide more capacity at peak times. Intersection capacity can be altered for selected legs by adjusting traffic signal settings and coordination, however other legs will be adversely affected.

Key transport terminals include the Port of Melbourne and Melbourne Airport. Both facilities are important elements of the city's transport system, being the main termini for international and interstate movement of freight and people in and out of the city.

The Port of Melbourne is the largest container port in Australia with significant room for further expansion of capacity (subject to land-side access constraints and impacts, both by road and rail). Channel deepening will open up more opportunities, whilst in the longer term the growth of the Port of Hastings will provide 'overflow' capacity.

Melbourne Airport similarly has room to grow from an air traffic point of view; provision is made for future runways and noise buffer zones are well-defined, so that the airport operates without curfews (in contrast to Sydney Airport). There is space for terminal expansion and a route is set aside for a rail link in the future, and a new access road is planned from the Western Ring Road which will take some pressure off the busy Tullamarine Freeway accesses.

Non-motorised travel plays an important and increasing part of the overall transport task, especially in and around inner Melbourne and the CBD (as illustrated clearly in Table 2-3 and Table 2-4). Connectivity of cycling routes is best to the north and east of the city but some limitations exist to the west.

### *2.2.2 Public Transport*

For most of the period of Melbourne's post-war development, public transport capital investment has not kept pace with road investment. However as shown in Figure 2.11 this has changed in recent years and will continue through Meeting Our Transport Challenges (MOTC) commitments.

Public transport plays two key roles:

- Mass transit – primarily for central area commuters, students etc and fulfilled mainly by the train and tram systems. Provides for people who may have car as an alternative, but who choose to use public transport for cost or convenience reasons.
- Social transit – primarily at off-peak or weekends and for people who do not have easy access to alternative forms of transport. Largely covered by local area bus services, tram services and off-peak train services. Includes the important issue of providing access for people with disabilities.

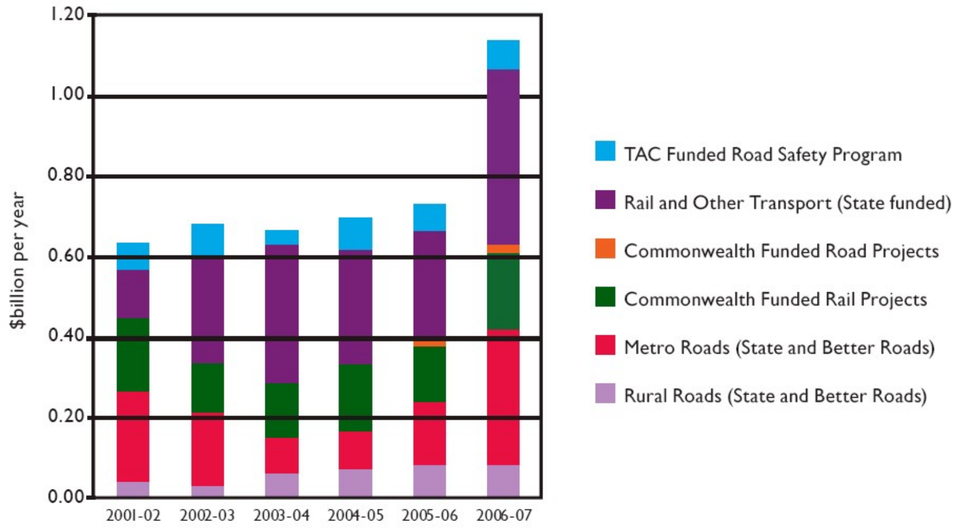
Sometimes there is inherent conflict in trying to provide for both these types of user.

The inner suburbs of Melbourne contain a relatively dense network of public transport infrastructure which includes railways, tram lines and bus routes. Public transport services are generally well patronized and many have reached the point where they are running at capacity in the peak periods with overcrowding occurring on some services. The other parts of the study area have a focus on radial train, feeder and orbital buses.

**Figure 2.11: Annual Victorian transport expenditure 2001-2006**

**Transport investments**

**Figure 9 Annual Victorian road and transport expenditure 2001-2006**




*Source: Budget Information Paper (BIP) No.1 and Accident Black Spots Program.*

The following sections provide details of existing public transport services by mode.

### *2.2.2.1 Rail*

#### *Background*

Melbourne's rail network has been in place for many years. The first line was opened to Port Melbourne in 1854 (now a light rail line) and most of the network was subsequently developed over the next 50 years. Incremental additions to the network since then have been relatively modest. The most recent network extension was the electrification of the Broadmeadows line to Craigieburn, which opened in September 2007. The last piece of major rail infrastructure constructed was the city loop. It was built to relieve excessive crowding at Flinders Street by providing additional access points to the CBD, and was opened in stages during the 1980s.

The network is laid out on a radial basis with the CBD at its hub. A total of 15 lines enter the CBD in four distinct rail groups, as follows:

- Northern – Werribee, Williamstown, Watergardens, Craigieburn, Upfield
- Caulfield – Sandringham, Frankston, Cranbourne, Pakenham
- Clifton Hill – Hurstbridge, Epping
- Burnley – Lilydale, Belgrave, Alamein, Glen Waverley

According to Connex, patronage for the system from September 2006 to September 2007 was 187.4 million.

All lines comprise double track for the majority of their length, enabling typical two-way operations. Two lines, the Frankston and Lilydale/Belgrave lines, have sections of triple track, which provides two tracks in the peak direction (one stopping and one express track) and one for counter-peak trains. Numerous sections of single track are also present on the system, which impose constraints on the two-way capacity of the line. These are located on the Werribee, Epping, Hurstbridge, Lilydale, Belgrave and Cranbourne lines.  Duplication is proposed at several sites on the Hurstbridge and Epping lines to remove these bottlenecks.

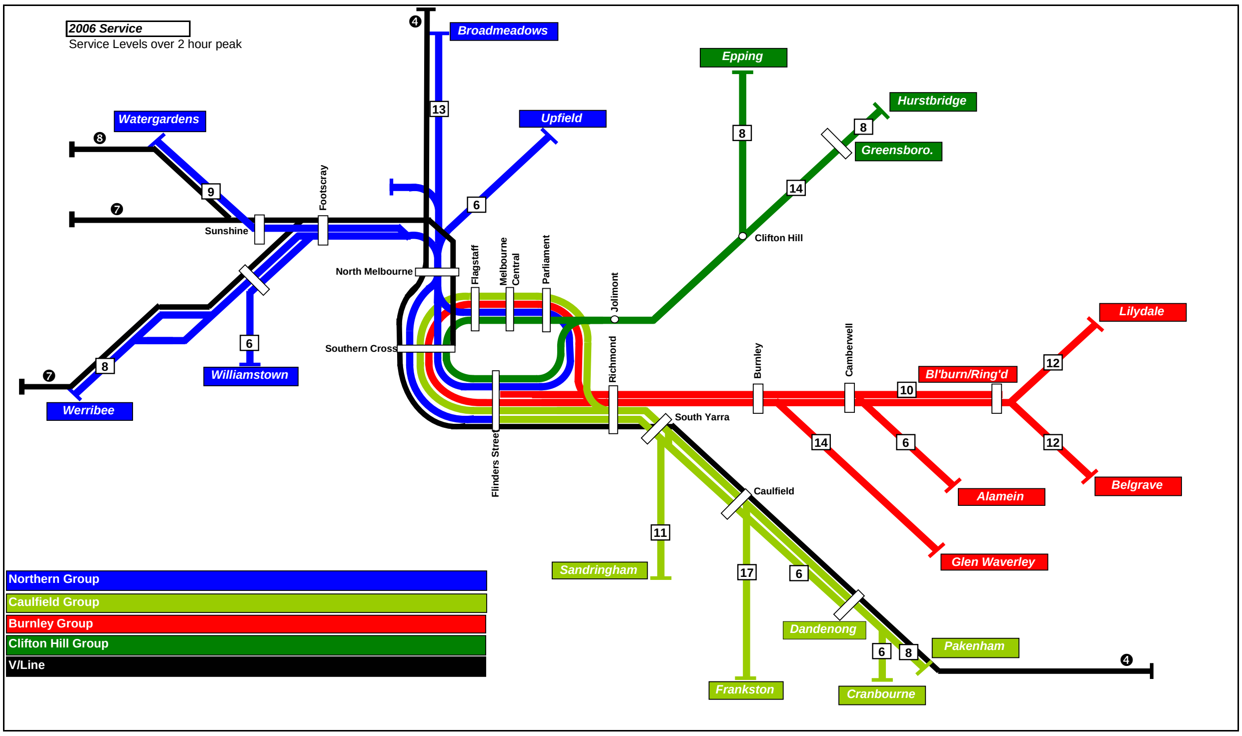
Signalling on the system is comprised almost entirely of an automatic fixed block system. The exception is a small section of the Hurstbridge line which comprises train staff and ticket, which is less efficient than the fixed block system and restrictive to capacity.  The signalling capability in the city and inner suburbs where two or more lines share tracks generally allows for 2 minute headways, extending to 3-5 minutes on each suburban line.  In reality, a frequency of 20 trains per hour (3 minute headway) is seen as the practical achievable capacity which would ensure an acceptable level of reliability is attained.  The reason that a higher practical capacity is not considered possible is because of the long dwell times at the city loop stations, which are up to 50 seconds, and also the irregular arrival of trains from different lines at the loop portals.

The train fleet comprises a variety of rolling stock types:

- Hitachi, c.1970s, 536 seats, 10 6-car sets in service
- Comeng, c.1980s, 536-556 seats, 95 6-car sets in service
- X'trapolis, 2002, 528 seats, 29 6-car sets in service
- Siemens, 2002, 528 seats, 36 6-car sets in service

Figure 2.12 shows the network configuration and number of trains in the 2-hour peak for 2006.

**Figure 2.12: Existing Melbourne Rail Network**




The number of trains entering the city by group over the 2 hour morning peak period in 2006 is shown in Table 2-6 (excludes V/Line).

**Table 2-6: Summary of Melbourne rail services**

| Group | Line | No. trains entering CBD in 2-hour morning peak |
|---|---|---|
| Northern | Williamstown | 6 |
| | Werribee | 8 |
| | Watergardens | 9 |
| | Broadmeadows | 13 |
| | Upfield | 6 |
| | TOTAL | 42 |
| Clifton Hill | Epping | 8 |
| | Hurstbridge | 14 |
| | TOTAL | 22 |
| Burnley | Lilydale/Belgrave | 24 |
| | Blackburn/Alamein | 16 |
| | Glen Waverley | 14 |
| | TOTAL | 54 |
| Caulfield | Pakenham/Cranbourne/Dandenong | 20 |
| | Frankston | 17 |
| | Sandringham | 11 |
| | TOTAL | 48 |

Future committed changes to the rail network are listed in MOTC and include:

- Track duplication – Clifton Hill to Westgarth, Keon Park to Epping
- Track triplication – Caulfield to Dandenong, Sunshine to West Footscray, Altona Junction to Newport
- Signalling upgrade – Hurstbridge line, Werribee line
- Loop reversal – Clifton Hill group
- New stations at Lynbrook, Cardinia Road, Point Cook, Coolaroo
- Additional platforms at Sandringham, Pakenham, Dandenong
- New trains
- Station interchange upgrades across the network, including Park and Ride facilities

***Operations***

The system operates between 5am and midnight Monday to Saturday, extending to 1am on Friday and Saturday nights. Sunday hours are 8am to midnight. Current service frequencies vary widely between lines with average peak frequencies ranging from 3-15 minutes, although some lower frequencies are provided for some outer stations. Off-peak frequencies are 15 minutes on the Burnley and Caulfield groups and 20 minutes for Clifton Hill and Northern groups, and evening frequencies are 30 minutes. Weekend frequencies are 20 minutes for most of the day for all lines. A new timetable was released in September 2007 which increased the number of services on selected lines. This coincided with the electrification extension of the Broadmeadows line to Craigieburn.

The 15 suburban lines converge on the CBD, which is served by five stations located at Flinders Street, Southern Cross, Parliament, Melbourne Central and Flagstaff. The latter three stations are located on the Melbourne Underground Rail Loop (MURL). The area commonly referred to as the 'City Loop and Inner Core' (CLIC) covers all track work within the boundary of the gateway stations (North Melbourne, Richmond and Jolimont), as well as the five CBD stations. The CLIC area comprises of 12 operational platforms at Flinders Street, 14 at Southern Cross and 4 at the MURL stations.

Each rail group operates through MURL, with one track dedicated to each group. Not all lines operate through the loop because of capacity constraints and access conflicts with other lines. These trains travel direct to Flinders Street instead and either travel through the CBD or reverse back out. Direct trains are usually confined to the Sandringham, Alamein and Williamstown lines because of limited loop capacity, although occasionally other lines may operate direct trains. All country trains terminate at Southern Cross station in either one of the dedicated country train platforms 1 to 8 or in platforms 13 and 14 which must be shared with metro services.

Before midday on all groups, most trains currently travel around the loop before terminating at Flinders Street. Northern group trains travel clockwise while the other groups travel anti-clockwise around the loop. After midday, trains on all groups reverse direction through the loop. This means that after midday, all trains approaching the CBD travel direct to Flinders Street and terminate before either continuing on an outbound journey via the loop (in most cases) or reversing as a direct outbound service.

Some of the key issues relating to the rail network capacity and operations are broken down into central area, group specific and suburban corridor and are detailed below.

***Central Area Through-put Issues***

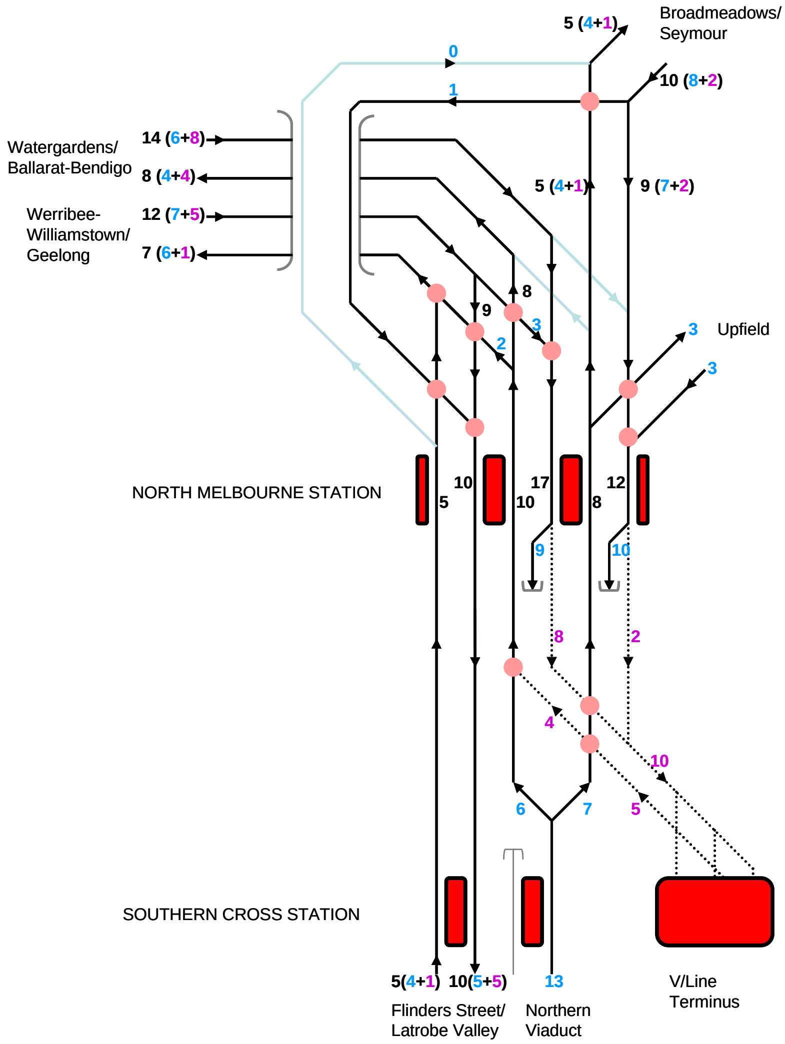
*Limited Sectorisation*

At present services from different lines and groups are scheduled to operate over common junctions and track sections and share platforms in the inner core. For example, although nominated as a Burnley group platform, some trains from the Caulfield group also use platform 6 at Flinders Street.

Reliability is affected by conflicting train movements at junctions. For example, North Melbourne station is a key junction on the CBD fringe. It handles all loop and direct services from the Northern group lines as well as V/Line services. There are many conflict points arising from trains crossing the path of those travelling in the opposing direction, or from trains merging onto the same track. Figure 2.13 demonstrates these conflicts at North Melbourne during the AM peak hour, with the number of metro and V/Line trains shown in blue and purple respectively and the conflict locations represented by pink dots (2006 timetable).

The high number of conflict points means that any late-running train has the potential to adversely affect the reliability of services on other lines in both directions. These conflicts could be resolved by grade separating the junctions i.e. constructing flyovers and underpasses, however this would be very difficult and costly to implement and complex to operate.

**Figure 2.13: Train conflicts around North Melbourne Station, AM peak hour**




Source: SKM analysis from various sources.

*Layovers at Flinders Street*

All trains arriving at Flinders Street lay over at the platform for between 2 and 10 minutes. This allows for crew change and late-running recovery to take place. This process significantly reduces the available capacity of the CLIC area to process additional services. Changing current practices could involve the relocation of crew depots to the suburban termini. The late-running recovery strategy would need to be altered to provide longer layovers at suburban termini and ideally short hold times at a few stations along the line.

Following the introduction of the September 2007 timetable, platform reallocation has been altered at Flinders Street to provide two platform faces for each city loop except Clifton Hill rail group. Platforms are nominally allocated as shown in Table 2-7. The allocation of platforms in this way limits the number of trains that can be operated direct from the Burnley, Caulfield and Northern groups as will be described in the following sections. With the city loops also already close to capacity this limits the potential for extra services to be operated into the CLIC area.

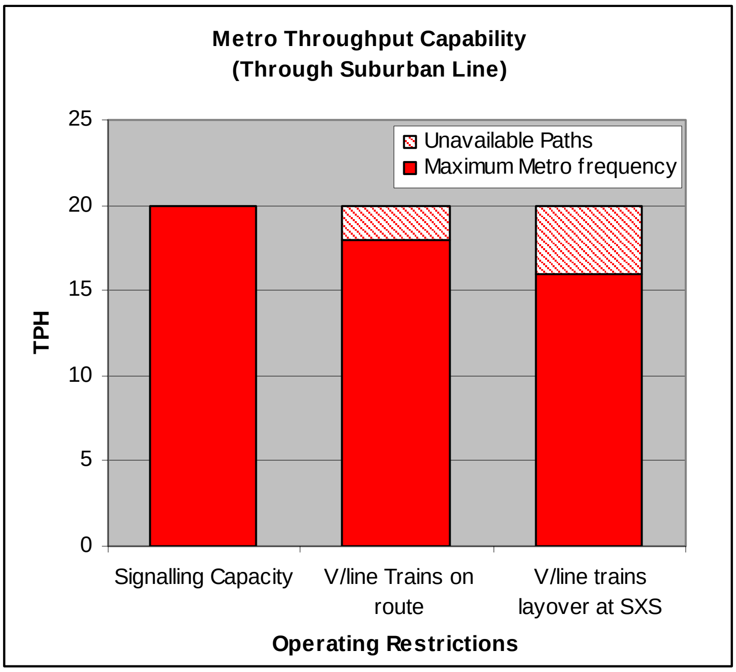
**Table 2-7: Flinders Street Peak period platform utilisation (September 2007 timetable)**

| Platform | Service |
|---|---|
| 1 | Clifton Hill Group |
| 1 West | Disused |
| 2 | Burnley Group (loop) |
| 3 | Burnley Group (loop) |
| 4 | Northern Group (loop) |
| 5 | Northern Group (loop) |
| 6 | Burnley Group (direct) |
| 7 | Caulfield Group (loop) |
| 8 | Caulfield Group (loop & direct) |
| 9 | Northern Group (direct) |
| 10/12 | Sandringham line |
| 13 | Sandringham line |

*V/line trains from La Trobe Valley operating into Southern Cross*

Southern Cross station has always been considered the start and finish point for all V/line services. With the majority of V/line trains running via the Northern Group through North Melbourne, Southern Cross is a logical terminating point. However, V/line trains from La Trobe Valley need to run through Flinders Street to reach Southern Cross station. Those movements must take place on the 'Through Suburban Route' and consequently absorbs two paths per hour in each direction that could be used by additional Northern and Caulfield group trains. On arrival at Southern Cross, La Trobe Valley trains are also scheduled with short layovers on platform 14 before proceeding to South Kensington station out of service where they turn-back to return to platform 13 for further layover time. Even if layovers are reduced to 3 minutes only this absorbs another two paths and further reduces available capacity for Metro trains to 16 tph in each direction as shown in Figure 2.14.

**Figure 2.14: Impact of La Trobe Valley V/line trains operating to Southern Cross station**



*Long Dwell Times in the City Loop*

The performance of dwell times in the city loop has a significant effect on the capacity and reliability of the train service. In early 2007, SKM were engaged by DOI to undertake a detailed study into peak period dwell times in the city loop, this study found that:

- Average dwell times at most city loop platforms range from 35 to 42 seconds
- Dwell times were very variable between trains arriving at the same platform – caused mainly by inconsistent train loadings between stopping and express trains, as well as different rolling stock characteristics i.e. internal layout, number of doors
- The presence of wheelchair passengers affects 2-3% of trains and increases the dwell time up to 55 seconds
- In the PM peak late boarders frequently add up to 20 seconds

A comparison with other international railway operators showed that dwell time performance could be significantly improved in the City loop with the provision of platform staff to assist with train dispatch, improved training for drivers and a marketing campaign.

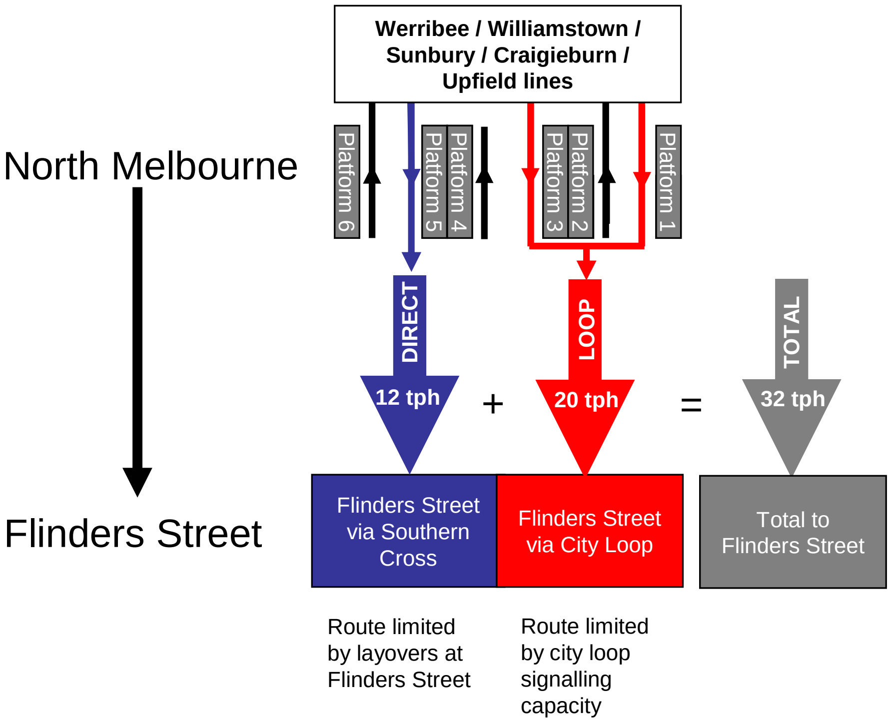
One of the main reasons for long dwell times is the internal layout of trains and number of doors per carriage. For instance, all trains have internal layouts which maximise seating capacity as opposed to standing space. These internal layouts are considered to be suitable for suburban travel due to the distances travelled, especially on the longer lines, for which long periods of standing time would not be acceptable to passengers. However the internal layout of the trains limits passenger capacity and internal movement, thus extending dwell times at stations. Also Siemens trains have 2 doors per carriage per side compared to 3 doors for other train types, further restricting the movement of boarding and alighting passengers.

***Group-specific Issues***

*Northern Group*

All Northern group metro trains merge at North Melbourne from each corridor. To progress into the central area trains can either run via the Northern loop or run direct into Flinders Street via Southern Cross platforms 13 and 14 as shown in Figure 2.15. Based on the long dwell times and signalling capability, it should be assumed that these two routes can achieve a maximum of 20 tph each. However, with only one platform available to the direct route at Flinders Street, the need to provide at least a 2 minute layover on all trains means that platform can only be re-occupied every 5 minutes. This limits the realistic capacity of the direct route to 12 tph. Overall, it can be concluded that the **existing infrastructure and operational plan limits the total number of Northern Group metro trains that can run into CLIC to 32 tph**.

**Figure 2.15: Current maximum achievable hourly CLIC throughput on Northern Group**

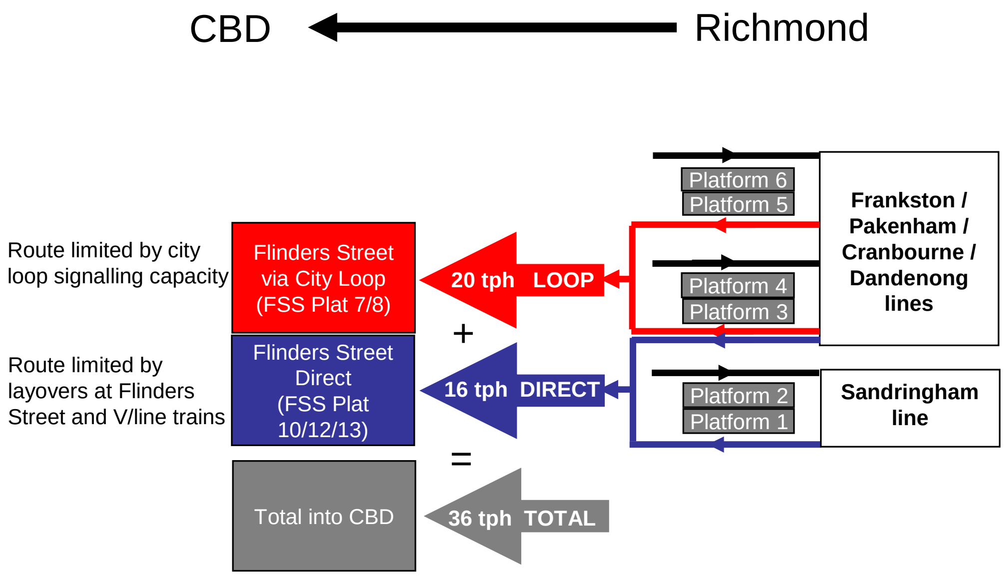



The loop portals can only be accessed from platforms 1 & 3, therefore the service pattern needs to combine all metro trains from platforms 1 & 3 into the city loop. Due to the configuration of North Melbourne platforms and associated track work to the south all up trains running direct should travel from platform 5. Running trains direct is possible from platforms 1 and 3 however these trains would conflict with down trains from Southern Cross.

*Caulfield Group*

Inbound Caulfield group trains merge at South Yarra and run on three separate inbound tracks into Richmond platforms 1, 3 and 5. From there trains from platforms 3 and 5 can enter the city loop and trains from all platforms can run direct into Flinders Street. Due to the requirement to perform crew changes at Flinders Street and the use of platform 6 by the Burnley group there are insufficient platforms and associated pathways to maintain the provision of three separate routes into Flinders Street. As a result direct trains must merge together to access platforms 10/12 and 13, whilst loop trains run into platforms 7 and 8. Some conflicts occur between Caulfield loop and Caulfield direct services in the down direction between Flinders Street and Richmond reducing the available capacity and affecting reliability. In theory, some direct trains may also use platform 8 to increase capacity, however it is not recommended that this be considered as the scheduling of loop and direct trains through the same platform removes the benefit of sectorisation and is likely to worsen reliability. Based on the above, Figure 2.16 shows the realistic maximum achievable frequency in the CLIC area for Caulfield Group trains on the basis that services are appropriately sectorised. **Therefore, the existing infrastructure and operational plan limits the total number of Caulfield Group metro trains that can run into CLIC to 36 tph.**

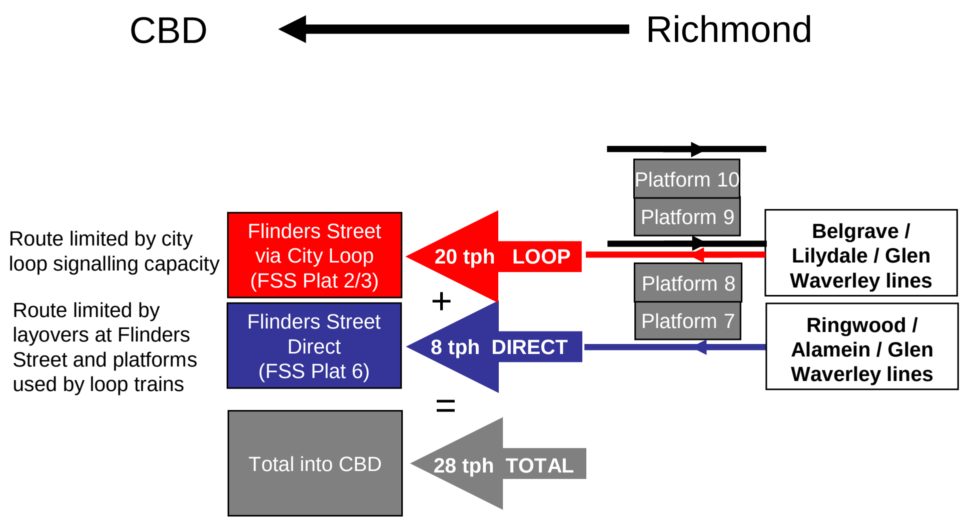
**Figure 2.16: Current Maximum achievable hourly CLIC throughput on Caulfield Group**




*Burnley Group*

Since the introduction of the September 2007 timetable, Northern group loop trains have been scheduled to use platforms 4 and 5 at Flinders Street. As a result, Burnley group direct trains have been moved to platform 6 with the loop trains on platforms 2 and 3. As shown in Figure 2.17 The Burnley loop is limited to 20tph, the use of platform 6 for direct trains allows another 8 tph from the group to run direct. **The existing infrastructure and operational plan limits the total number of Burnley trains that can run into CLIC to 28tph.**

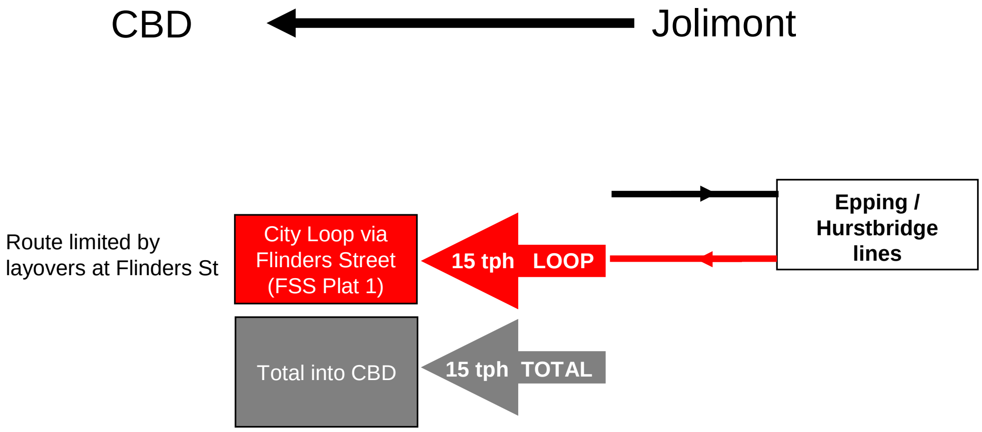
**Figure 2.17: Current Maximum achievable frequency on Burnley Group**




*Clifton Hill Group*

The Clifton Hill group is self contained from the remainder of the network and uses platform 1 for all trains. At present, in the morning peak all trains run via the city loop into Flinders Street where trains layover. The layover on platform 1 limits capacity to 15tph as shown in Figure 2.18. However, it has been proposed that in 2009 the operation of the Clifton Hill loop is reversed in the morning peak so that all trains enter Flinders Street first before progressing via the City loop. Under this scenario it is proposed that layovers are removed from Flinders Street to avoid lengthy delays for passengers on board. The removal of layovers will allow up to 20tph to be operated through the CBD. **However before this happens, the existing infrastructure and operational plan limits the total number of Clifton Hill trains that can run into CLIC to 15tph.**

**Figure 2.18: Current Maximum achievable frequency on Clifton Hill Group**




***Suburban Capacity Issues***

The capacity of the existing network is constrained in many suburban areas by a number of signalling, track and other infrastructure limitations. Consequently, in some cases the capacity of the CLIC area identified above cannot be fully utilised due to restrictions in the number of trains that can run into the gateway stations.

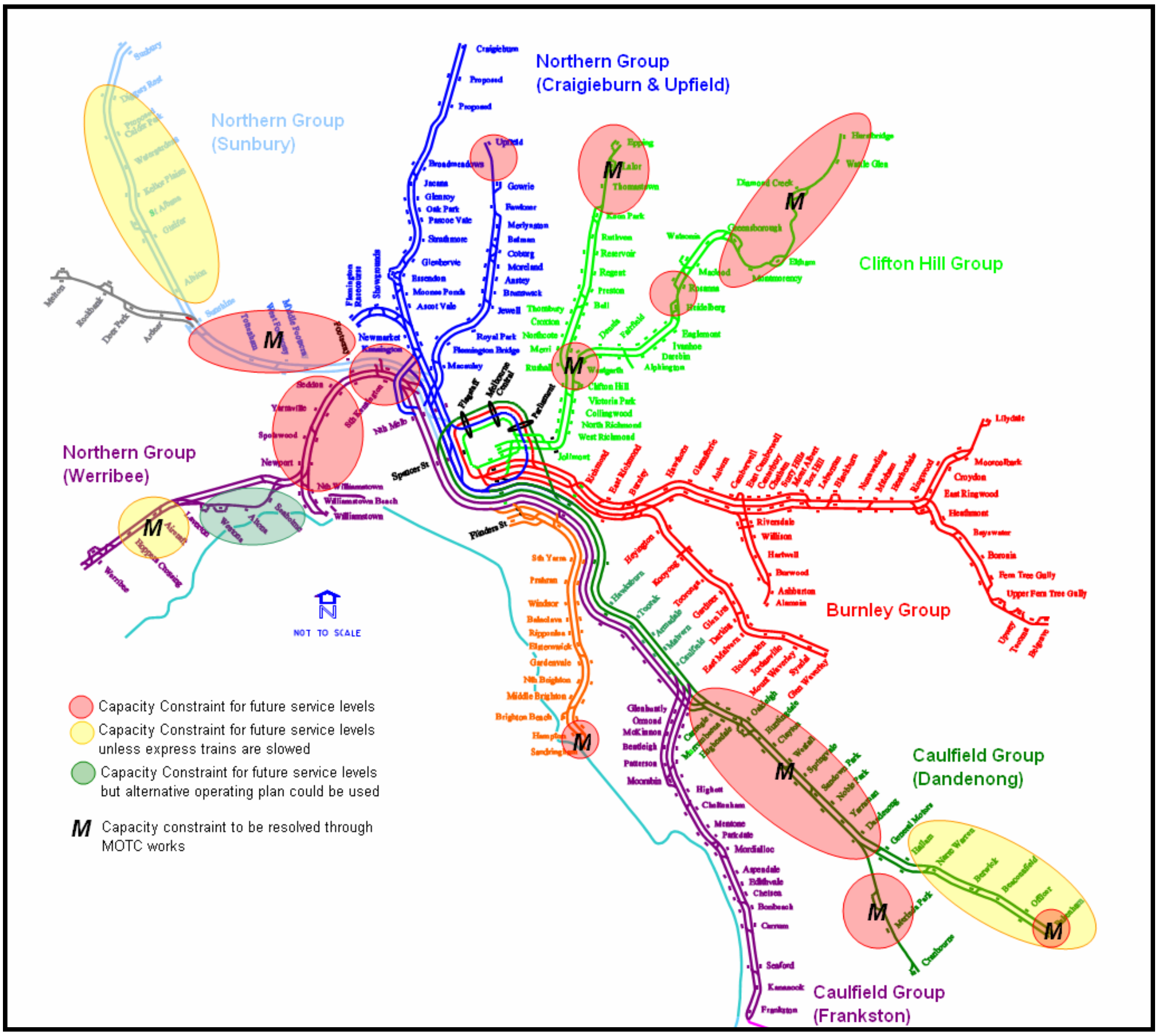
Operations on all groups are complex, especially during peak periods. Trains for each line depart from a variety of platforms at Flinders Street, Southern Cross, Richmond and North Melbourne. Service frequencies are irregular and services follow a number of different stopping patterns i.e. express through some stations. The different stopping patterns reduce train throughput capacity as longer gaps need to be provided between stopping and express services. This is a particular problem for tracks shared by metro and V/Line services, as the latter generally runs express through most suburban stations and can be held up by late-running metro stopping trains. In addition, providing an express train path for V/Line services will result in a big gap in the timetable for metro services, leading to overcrowding and unreliable journey times on the first train following a V/Line service.

In summary, capacity on suburban corridors is affected by a mixture of issues, including:

- single platforms at some suburban termini which reduce the scheduling flexibility and capacity of those branches;
- sub-optimal track configuration at major junctions and flat junctions where trains from parallel lines have to merge together;
- single track sections which reduce capacity on a corridor and affect scheduling flexibility;
- inadequate signalling; and
- the mixture of stopping patterns which absorbs more than one train path per train on average.

Figure 2.19 highlights the key areas where additional capacity will need to be provided to cater for the projected growth in train service numbers over the next 5 years. As shown on the map, solutions to a number of these constraints have been identified and are covered in the MOTC plans for rail upgrades (designated by an 'M'). It is imperative that similar solutions are implemented on the remaining sections.

**Figure 2.19: Melbourne Metropolitan Rail Network – key areas of capacity constraints**




Source: SKM analysis from various sources.

Following the implementation of the MOTC works, additional paths will be available to run more trains from some suburban corridors into the gateway stations. These paths will be exploited as far as possible depending on the available on-ward capacity through CLIC. Table 2-8 shows the theoretical maximum capacity for each line grouping and the consequent number of Metro trains that can be operated after an allowance is made for V/line trains. The values in this table do not necessarily represent the service levels that can be operated across the entire line, they only reflect the capacity available outside the CLIC area.

**Table 2-8: Theoretical maximum capacity from each corridor AFTER MOTC upgrades**

| Line grouping | Theoretical Max capacity from corridor | Theoretical Max Metro trains possible | Reason | Operational Solutions | Infrastructre solutions |
|---|---|---|---|---|---|
| Werribee/Williamstown | 16 tph | 12 tph | Mixture of stopping and express metro and V/Line services limits capacity due to run-time differential | Run all trains at slowest speed - this will allow 20tph | Build third track / Divert Geelong trains via new line from Werribee to Deer Park to use Sunshine corridor 3rd and 4th tracks |
| Sunbury | 14 tph | 8 tph | Platform capacity at North Melbourne and interaction with V/Line services | Run all trains at slowest speed - this will allow 20tph | Build additional tracks/platforms between Sunshine and N.Melbourne |
| Craigieburn/Upfield | 20 tph | 16 tph | Platform capacity at North Melbourne | None available | Build additional tracks/platforms between Footscray and N.Melbourne |
| Pakenham/Cranbourne | 20 tph | 18 tph | Signalling capacity between Caulfield and S.Yarra and platform capacity at Richmond | In the long term, additional direct services could be run on Frankston line between Caulfield and South Yarra but this would create conflicts | Build flyover at Caulfield to allow Dandenong trains onto Frankston tracks without conflicts and allow some Frankston trains to join express track |
| Frankston | 15 tph | 15 tph | Mixture of stopping and express between Malvern and S.Yarra limits capacity due to run-time differential | Stopping all trains between Malvern and South Yarra on Frankston line would allow 20tph | Build flyover at Caulfield to allow Dandenong trains onto Frankston tracks without conflicts and allow some Frankston trains to join express track |
| Sandingham | 15 tph | 15 tph | Platform constraints at Sandringham and Flinders Street | Demand to 2031 doesn't require additional capacity | Demand to 2031 doesn't require additional capacity |
| Lilydale/Belgrave | 16 tph | 16 tph | The need to operate Glen Waverley train into loop restricts available capacity. | Removal of all Glen Waverley trains from loop will allow 20tph service for Lilydale/Belgrave | No cost effective solutions available. |
| Ringwood/Alamein | 10 tph | 10 tph | Section between Burnley and Richmond must be shared with Glen Waverley trains | Demand to 2031 doesn't require additional capacity | Demand to 2031 doesn't require additional capacity |
| Glen Waverley | 10 tph | 10 tph | Section between Burnley and Richmond must be shared with Ringwood/Alamein trains | Demand to 2031 doesn't require additional capacity | Demand to 2031 doesn't require additional capacity |
| Epping | 20 tph | 20 tph | Line signalling limited to 20 tph but demand on Hurstbridge line will require 12 paths long term | None available | Additional trains will need to be accommodated by improving signalling capacity between Clifton Hill and Flinders Street |
| Hurstbridge | 10 tph | 10 tph | Single line section between Heidelberg and Rosanna and mixture of express and stopping services limits capacity to 6 minute service beyond Heidelberg. Also, section between Clifton Hill and Flinders Street limited to 20tph | Terminate all Greensborough trains at Heidelberg instead | Duplicate Heidelberg to Rosanna section and provide passing loops or third track for express trains. Additional trains will need to be accommodated by improving signalling capacity between Clifton Hill and Flinders Street |

### *Overall Rail Capability*

In summary, the current operation of the rail network is considered to be constrained by:

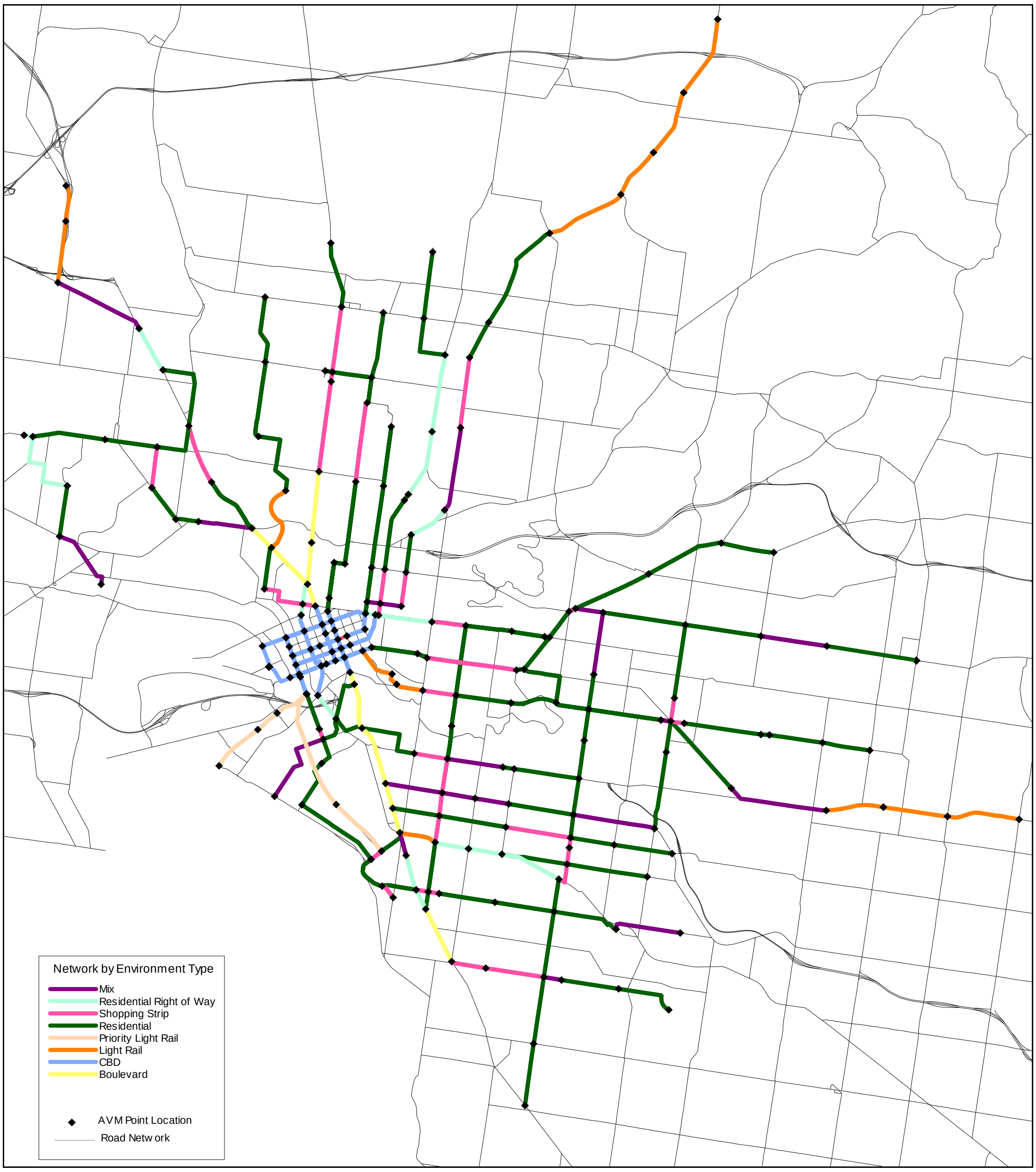
- Infrastructure constraints, including:
  - Restrictions to train capacity i.e. single track sections, single platforms at terminal stations, signalling capability;
  - Restrictions to passenger capacity i.e. internal layout of trains, number of doors per carriage, interchange capability at key stations, one-way services (city loop).
- Operational constraints, including:
  - Practices which restrict capacity in the city and affect reliability and journey time i.e. long layovers, crew changes, reversal of trains, conflicting train movements, long dwell times;
  - Complex service provision which varies during the day, reducing legibility of the system to passengers and resulting in a large imbalance between train loadings during peak periods i.e. bi-directional operation of city loop, irregular frequencies, inconsistent stopping patterns, tracks shared with V/Line services.

The achievable service level on each line is a function of central area capacity available for each line's trains, the group / suburban corridor capacity and the operating plan. The optimisation of available capacity to suit the demand growth will necessitate a rationalisation of the operating plan to be able to fully exploit the benefits of the new infrastructure delivered by MOTC. Solutions to maximize capacity in the short term will be identified in later chapters as well as presenting a proposed optimal base case service following the MOTC works and operational changes.

### *2.2.2.2 Trams*

Melbourne's tram network (Figure 2.20) is the third largest in the world in terms of track length, after St Petersburg in Russia and Budapest in Hungary. The system includes about 240km of double track, 494 trams and 1,813 tram stops. Trams operate on 27 routes, carrying 150 million passengers in 2006/7.

**Figure 2.20: Melbourne Tram Network**




All routes operate on double track with single track sections located at most route termini.

Tram operations are carried out in a variety of environments as shown in Figure 2.20:

- Mix - shared on-street with other vehicles in mixed (residential, retail, commercial etc.) land use environment (eg. Commercial Road, Keilor Road, Droop Street)
- Shopping strip – shared on-street with other vehicles in shopping strip (eg. Chapel Street, Glenhuntly Road, Sydney Road)
- Residential – shared on-street with other vehicles in residential area (eg. Riversdale Road, Hawthorn Road, Melville Road)
- Residential right of way - segregated track in road median in residential area (eg. St. Georges Road, Dandenong Road, Victoria Parade)
- Priority light rail – grade-separated segregated track in former heavy rail reserve (eg. St. Kilda, Port Melbourne lines)
- Light rail – segregated track in road reserve or parkland (eg. Plenty Road, Burwood Highway, Royal Park)
- CBD – right of way in centre of road in CBD
- Boulevard – right of way in centre of road (St. Kilda Road, Royal Parade, Flemington Road)

Tram stops are located at varying spacing along each route. Most stop intervals are between 200 and 500 metres, but in places they are less than 200 metres. Close stop spacing generally increases access to the system but reduces the average speed of the service, reducing the attractiveness of tram travel for passengers.

Most tram stops are not DDA (Disability Discrimination Act) compliant, although there is a program of platform stop implementation underway. DDA compliant stops provide level boarding, enabling easy access for everyone, including wheelchair users and mobility impaired passengers. Furthermore, platform stops are more popular with passengers on account of the improved access, safety and amenity afforded. Monitoring studies have found that stop dwell times have been reduced owing to quicker boarding and alighting times for passengers resulting from the removal of stepped access.

The tram rolling stock which currently serves the network varies widely in performance and capacity, and includes the following classes of tram:

- W, c.1950, 48 seats, 14m, stepped access, 52 in service (heritage routes)
- Z, c.1970s, 48 seats, 16m, stepped access, 145 in service
- A, 1983, 42 seats, 15m, stepped access, 70 in service
- B, 1988, 76 seats, 23m, stepped access, 132 in service
- C, 2000, 40 seats, 23m, level access, 36 in service
- D 3-section, 2000, 36 seats, 20m, level access, 38 in service
- D 5-section, 2000, 58 seats, 30m, level access, 21 in service

The W class trams are operated for heritage reasons and restricted to 2 routes, while the Z class is proposed to be progressively phased out over the next 5 years. It is anticipated that articulated low-floor trams, similar to C and D class, will be introduced to replace these trams, providing more capacity and improving accessibility to the system.

Future committed changes to the tram network as part of the MOTC strategy include:

- Expansion of the Think Tram program i.e. providing more tram priority across the system;
- Replacement of stepped access trams with level access trams;
- Replacement of kerb access and safety zone stops with raised platform stops.

Tram operations are much less complex than rail operations. Trams generally run the full distance between termini all hours of the day and week and generally operate to consistent headways according to the demand. Service frequencies on each route of 4-8 minutes operate during peak periods, 8-12 minutes during the day and 15-20 minutes in the evenings and weekends. Service speeds are slow by world standards mainly because of the large proportion of shared running with other vehicles. Speeds average 16km/hr across the network, slowing to an average speed of 11km/hr in the CBD. The segregated sections of track achieve about 25km/hr, however this represents only a small portion of the network.

As most tram routes converge in the CBD, tracks and stops are shared with other routes on the main approaches. The resulting increased tram frequencies on these approaches produce reduced wait time benefits for passengers. On several approaches, however, different frequencies may be operated on each individual tram route. This can result in irregular service frequencies on the shared section, which in turn gives rise to imbalanced passenger loads between services, extended stop dwell times and a slower service for all passengers. Further exacerbating the situation is the variability in the class of tram, which provides different levels of capacity. An example of this is St Kilda Road, where up to nine tram routes share the tracks. Operations are carried out by both the shorter Z and A class trams as well as the longer B and D class trams, with frequencies ranging from 7-10 minutes on each route.

Reliability is a key issue for tram operations. The high degree of shared running with other road vehicles gives rise to many delays, which can be attributed to traffic signals or obstruction by other vehicles. Traffic congestion accounts for about 40% of tram running time. Modelling undertaken for DOI suggests that unless substantial improvements are made to tram priority and operation in the roads, tram speeds could fall by at least a further 8% by 2020 as a result of increasing road congestion. Tram operating costs will correspondingly increase.

Significant delays can be experienced at major intersections where the crossroad is a key arterial road, including Victoria Street, Alexandra Parade, Hoddle Street and Kingsway. For instance in the inner northern suburbs, trams mainly serve north-south demand and tend to run at capacity during peak periods. As the tram network shares the road with other traffic, considerable delays to tram services are experienced where the demand for road space is high. These delays are exacerbated by the lengthy signal delays encountered at intersections crossing Alexandra Parade and Victoria Street.

Work completed by DOI highlighted that Route 96 (Nicholson Street) has the highest patronage, possibly due to the fact that it offers the best relative journey times to the car in the corridor it serves, has a degree of separation from traffic and has rolling stock with greater passenger capacity (B and D class). Smith Street and Brunswick Street have lower tram speeds, reflecting the interaction and conflicts with traffic due to parking and right turning vehicles. However services using these routes have very high levels of patronage, suggesting that a substantial proportion of the people-moving task on these roads is performed by trams. Any works which assist in reducing the tram travel time on these roads would attract even more passengers.

The ‘Think Tram’ initiative being managed by VicRoads involves the implementation of a series of priority measures across the tram network, with a stated aim of increasing tram service speeds. Measures include the implementation of physical separation devices, part time tram lanes, ‘T’ lights at intersections and traffic signal re-phasing. Recent part time tram lanes and associated signs have been installed in Fitzroy (Smith Street, Brunswick Street) and Balwyn (High Street, Doncaster Road).

The Think Tram program has had some success in giving trams greater priority; at a minimum it has enabled trams to maintain their travel times relative to growth in traffic congestion, as opposed to reducing travel times. The application of ITS technologies and the positive separation of tramway right-of-way from other road users, especially right turning vehicles, appear to offer the best solutions.

In summary, the main constraints facing the tram network are:

- Infrastructure constraints, including:
  - Limited physical segregation of trams from other road vehicles, increasing the number of conflicts and subsequently the delays;
  - Short spacing of stops in some locations which reduces tram service speed;
  - Limited provision of platform stops for increased accessibility through level boarding;
  - Sub-optimal or absent signal priority.
- Operational constraints, including:
  - Excessive delays at intersections with major cross roads. This is particularly evident for north-south tram routes crossing Alexandra Parade and Victoria Street;
  - Inefficient practices mainly observed in inner areas, such as the irregular scheduling of tram timetables and class of tram on shared corridors, resulting in unbalanced passenger loads and a slower service.

#### *2.2.2.3 Buses*

There are approximately 250 bus routes serving metropolitan Melbourne. Most bus services are provided in the middle and outer suburbs. Only a relatively small number of routes serve the CBD and inner suburbs as the bulk of on-street public transport provision in these areas is covered by trams. Annual bus patronage is approximately 85 million boardings, but has grown by 7.4% over the past year, driven in part by significant growth in patronage on SmartBus routes and the first package of service extensions introduced by the MOTC initiative.

In general, buses provide public transport access serving areas not situated close to the rail and tram networks. Analysis of population distribution around Melbourne reveals that only one-third of Melbourne's population is located within walking distance of rail and tram networks. This means that buses are the only form of public transport available within walking distance for most people. Buses perform several functions in Melbourne:

- radial routes linking suburbs with CBD, particularly evident in areas distant from rail and tram routes i.e. western suburbs, Doncaster corridor;
- orbital cross-town routes between regional centres;
- feeder routes to neighbourhood shopping centres / railway stations.

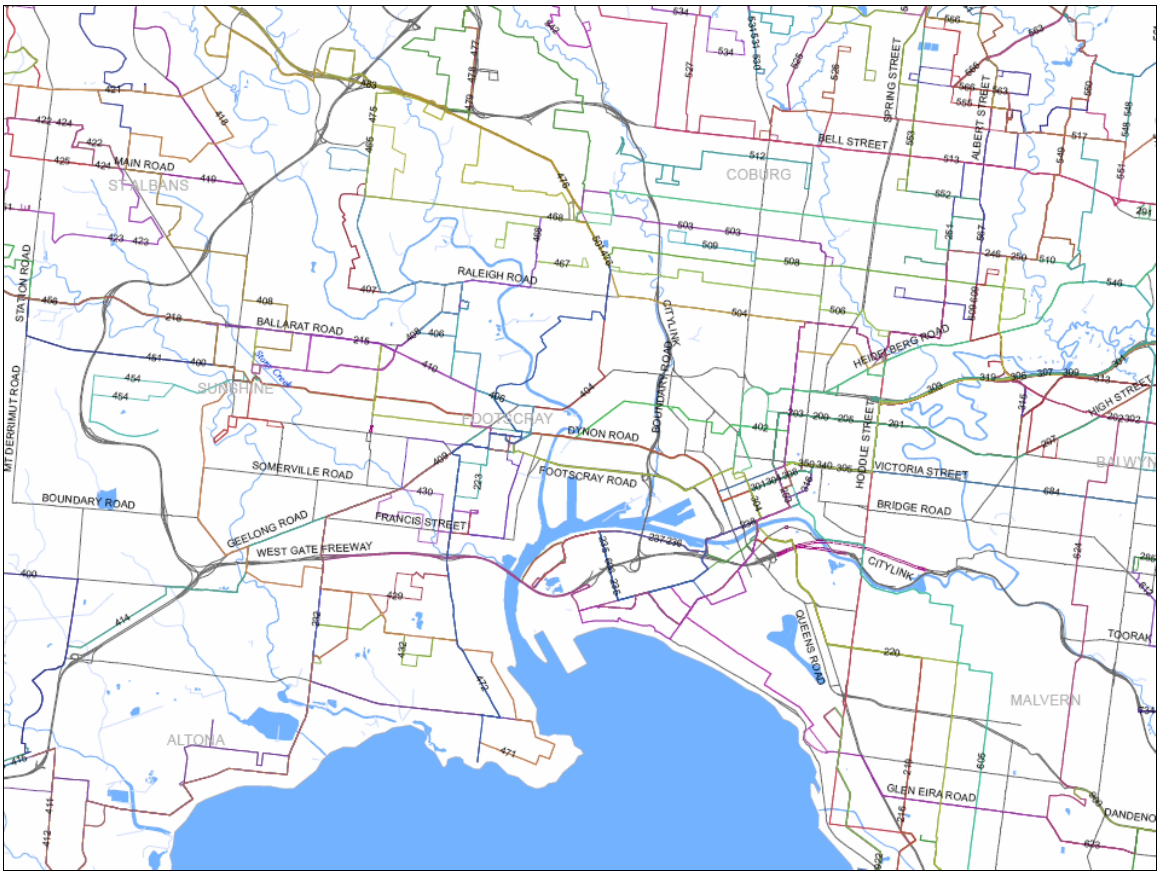
A number of bus services operate in the inner suburbs; their journey time reliability and punctuality are affected by traffic congestion, particularly during the AM and PM peak hour periods. Although bus priority exists at some points on the road network, it is not comprehensive and further development is restricted by limited road widths, demand for on street parking and other traffic management related issues.

In the inner suburbs, bus services from the east (e.g. 20x, 30x, 31x, 340, 350) generally provide a service to or through the CBD, with the main bus related routes being Eastern Freeway - Hoddle Street - Victoria Parade and Johnston Street - Elgin Street - Rathdowne Street. Another key group of services (e.g. 216, 219, 220) link the western suburbs to the south-eastern suburbs, via Footscray and the CBD. Other services provide local access functions in the Footscray area (refer to Figure 2.21).

Bus services on the Eastern Freeway serving the Doncaster area will be upgraded under MOTC to ‘a level of service approaching rail’ as part of the DART (Doncaster Area Rapid Transit) initiative. It is likely that treatments to increase bus priority will be provided along the Eastern Freeway and on roads accessing the CBD (Hoddle Street, Victoria Parade, Lonsdale Street). Separate bus lanes will not be provided in the Eastern Freeway median for the time being as it is considered that current freeway bus speeds are satisfactory where buses are using the emergency lane.

Virtually all bus routes operate on public roads, sharing roadspace with other vehicles. There are no segregated or off-street busways. Dedicated bus infrastructure is limited to bus stops/interchanges and on-street bus lanes (generally part time).

**Figure 2.21: Inner Melbourne Bus Network**




In recent years, selected bus stops have been upgraded to include facilities such as real-time information, service information, shelter and seating, providing DDA compliant access and a more welcoming environment for passengers. Other stops may incorporate some of these features, while the most basic bus stops are designated by a pole and flag only.

Other dedicated bus infrastructure is provided in the form of bus lanes. Bus lanes are usually part time and operate in the peak direction during peak periods. Some lanes have a red surface treatment applied to reinforce their status. The longer bus lanes are provided in Hoddle, Johnston, Victoria and Lonsdale Streets, catering for routes from the Doncaster corridor. Other minor bus only links can be found across Melbourne near bus interchanges and at the approaches to major intersections. The intersection approaches are also referred to as queue-jump lanes and offer priority for buses through the intersection with the aid of a ‘B’ light.

Historically, buses in Melbourne have not provided a convenient transport option for the general public due to low frequencies and limited hours of operation. Most bus routes do not run later than 7pm on weekdays and many routes do not operate on Sundays. Bus frequencies are very low compared to tram, typically in the range of 30-60 minutes during the day, although a minority of routes operate at frequencies better than 30 minutes during the day. Services between key activity centres are often indirect and circuitous.

On-time reliability information is not readily available for each route or the network as a whole, although bus operations are highly dependent on the performance of the road network. Priority measures are being implemented in the form of bus lanes and queue jump lanes, which provide some assistance to on-time running. These measures are usually installed on the major arterial roads where lengthy queues are commonplace.

In summary, the main constraints facing the bus network are the poor service attributes, i.e. restricted hours of operation, low service frequencies, indirect and circuitous routes, limited information provision, and non-DDA compliant access.

### *2.2.3 Road Network and Private Transport*

When considering present traffic demand issues in the context of east/west movements across Melbourne's metropolitan area, there are a number of aspects that need to be taken into consideration. In addition to the analysis of the effectiveness of the road network in dealing with the traffic demand, an examination has also been undertaken of:

- Vehicle ownership rates
- Vehicle operational costs
- Availability and effectiveness of public transport
- Trip origins and destinations
- Intersection and link capacities
- Road safety

Collectively, the findings from this research and analysis provide the basis for a diagnosis of:

- The current state of the road network
- Those sections of the road network that are currently experiencing congestion
- Sections of the road network that are likely to experience future difficulties

The following broad conclusions have been derived with respect to critical areas on the road network in the context of traffic capacity for east/west movements:

- The West Gate Bridge and corridors feeding the bridge are close to, or at, capacity in the peak periods as shown in the screenline analysis
- Considerable congestion is experienced on the Western Ring Road, north of the Western Highway
- Access to the Port of Melbourne from the west is constrained by capacity limitations on Ballarat Road and the absence of direct, convenient links through Footscray into the Port precinct
- Regular congestion is experienced on the route linking Ballarat Road to the Eastern Freeway, via Smithfield Road, Racecourse Road, Elliott Avenue, Macarthur Road, Cemetery Road, Princes Street and Alexandra Parade.

- The Eastern and Monash Freeways experience considerable congestion during both peak periods
- East / west routes in the inner city are regularly congested in peak periods, including Victoria Street / Victoria Parade, Alexandra Avenue / City Road and parts of Dynon and Footscray Roads
- The scarcity of Maribyrnong River crossings acts to concentrate east/west movements on relatively few routes, thus increasing the likelihood of congestion in these areas.

### *Vehicle Ownership and Costs*

The ABS produces a publication of statistics on passenger vehicle, motor cycle, truck and bus use for the state of Victoria. The data is collected in four quarterly surveys from November to October the following year. Table 2-9 shows the annual vehicle registration numbers for different vehicle types for the four years November 2001 to October 2005.

**Table 2-9**: **Victorian vehicle registration rates (November 2001 – October 2005)**

| Year | Passenger vehicles | Motor cycles | Light commercial vehicles | Rigid trucks | Articulated trucks | Non-freight carrying trucks | Buses |
|---|---|---|---|---|---|---|---|
| 01-02 | 2,795,305 | 100,702 | 427,470 | 85,130 | 17,500 | 4,761 | 11,703 |
| 02-03 | 2,832,324 | 103,451 | 444,313 | 85,229 | 18,946 | 5,138 | 13,115 |
| 03-04 | 2,866,027 | 100,117 | 446,538 | 88,206 | 20,207 | 4,720 | 13,007 |
| 04-05 | 2,980,353 | 107,613 | 434,258 | 88,820 | 21,010 | 5,625 | 13,146 |
| Average Annual Increase (p.a.) | 2.2% | 2.2% | 0.5% | 1.4% | 6.3% | 5.7% | 4.0% |

Source: Australian Bureau of Statistics

It can be seen that passenger vehicle registration has increased by 2% per annum over the four year period, while light commercial vehicles have only increased by 0.5%, principally due to a decrease in ownership in the 04-05 year. Rigid trucks have increased by around 1% p.a., while articulated trucks have grown by the greatest margin, namely by 6% p.a. over the 4-year period. Buses have also experienced growth, with a growth of 4% p.a. Articulated vehicles, and to an extent some buses, are heavily reliant on use of the declared road network.

The increasing number of articulated vehicles and buses, as well as the steady growth in smaller vehicles, is a set of statistics that directly reflects the existing pressure and pattern of increasing demand on the declared road network, manifested in peak period congestion in a number of locations.

The ABS also records the population growth within Victoria. In 2001, the population was 4,854,100, while in 2005 the population had grown to 5,022,346. This is a growth of approximately 3% over the four year period, or an average growth of 0.9% p.a. Passenger vehicle ownership has grown by more than twice the population growth rate for the same period, while articulated vehicles have grown by nearly 7 times the population growth rate.

The RACV calculates vehicle operating costs for a number of common new vehicles. The calculations include the cost of financing the vehicle, depreciation, scheduled services, registration, insurance, fuel, tyres, etc. The calculations provide a guide to the cost of owning and operating a vehicle over a five year, 75,000 km (15,000 km per year) period. The costs are summarised in **Table 2-10**.

**Table 2-10: Average cost of owning a car for 5 year period**

| Size of Vehicle | Light car | Small Car | Medium Car | Large car | Sports utility Vehicle (SUV) |
|---|---|---|---|---|---|
| Average Cost | $14,970 | $22,952 | $31,925 | $34,365 | $41,590 |
| Cost (cents/km) | 43.08 | 54.88 | 70.37 | 76.32 | 81.18 |
| Cost ($/week) | 124.27 | 158.30 | 202.99 | 220.14 | 248.60 |

Source: RACV

The costs in **Table 2-10** are typically much higher than equivalent travel by public transport. Private vehicle costs have also risen noticeably in recent times due to petrol price increases. While there is some evidence from public transport operators that shows significant patronage rises in recent years, it is too early to conclude whether increased vehicle operating costs will have a sustained impact on either vehicle ownership rates and/or travel by private vehicle.

***Road network***

Melbourne’s road network is extensive, with more kilometres of roads and freeways per capita than many other Australian and overseas cities. The major freeways and tollways of Melbourne largely radiate from the CBD, with the exception of the Western Ring Road, which provides an orbital route connecting freeways to the west and north of the CBD. A second orbital route – East Link is currently under construction in Melbourne’s outer east and will link the Frankston Freeway to the Eastern Freeway. Cross-town travel requires frequent road changes and the need to pass through or close to the city.

While car usage patterns fluctuate across the metropolitan area, Melbournians overall rely heavily on private motor vehicles. 75% of all personal trips are undertaken by car and car ownership is high by international standards and growing. The road network carries approximately 3.6 million registered vehicles, of which, approximately 81% are passenger vehicles. Reliance on motor vehicles is even higher in the regional cities and outer suburbs given the limited public transport available in some areas. The Victorian freight task is also dominated by road transport, which carries almost 83% of Victorian freight tonnes.[4]

Melbourne has a well-developed grid network of arterial roads that supports more than 10 million personal trips each day[5]. Through the continual development and management of this road network, Melbourne has been able to accommodate substantial increases in commercial and private travel over the years.

The greatest proportion of vehicle kilometres is driven on Victoria's declared road network of freeways and arterial roads, linking centres of activity in rural and metropolitan areas. The declared road network aims to provide a safe, efficient and integrated road transport system for the economic and social benefit of the community.

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[4] VCEC Report September 2006

[5] Meeting our Transport Challenges

VicRoads generally arranges for any upgrading of existing declared roads and construction of new roads that are to be added to the declared road network. Such works may be necessary to accommodate changes in the size and location of our population, and increased road use for freight, business and private travel.

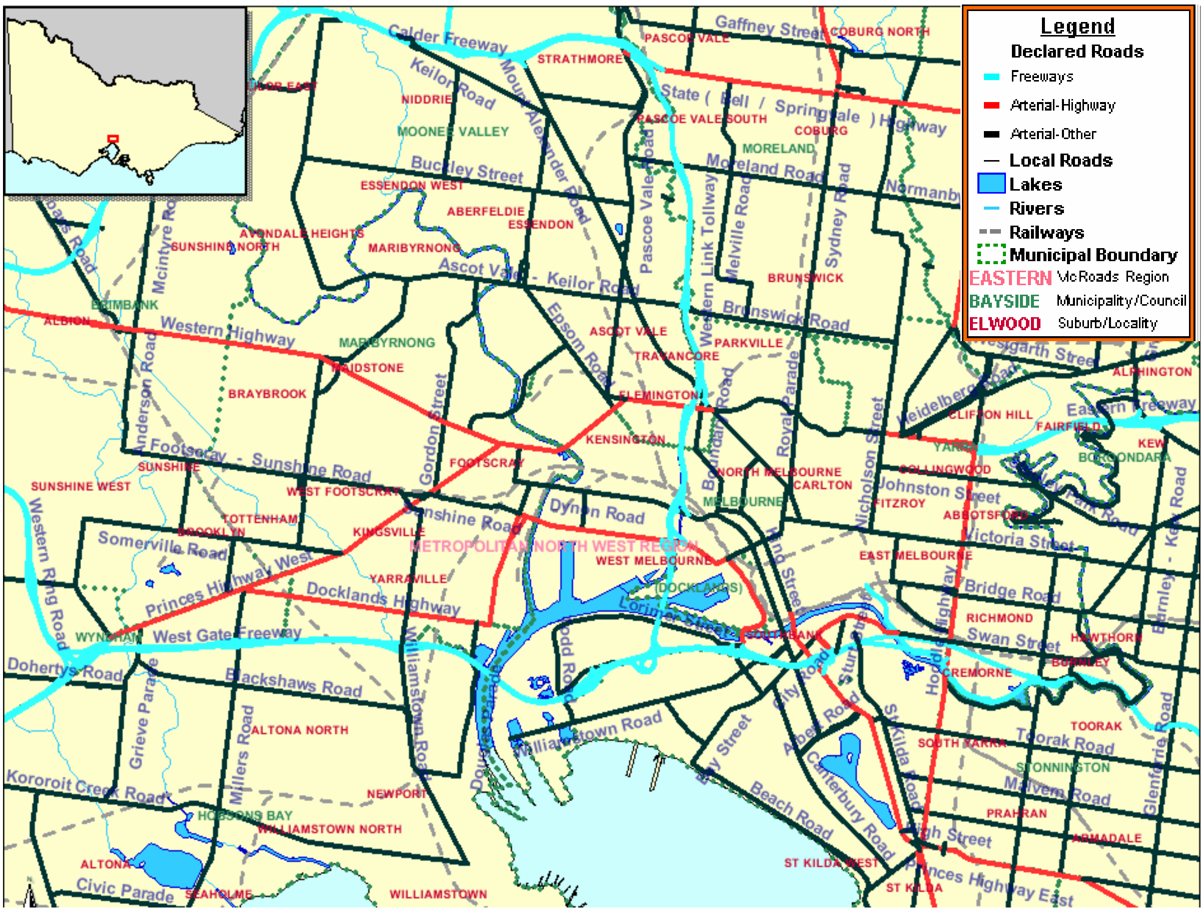
Transurban manages the 22km CityLink section of Melbourne's road network. CityLink is a tollway, which provides a key connection between the Monash, West Gate and Tullamarine Freeways.

Greater Melbourne has a defined road hierarchy, which matches road type to its purpose of use. The road hierarchy can be summarised as follows:

| | |
|---|---|
| Freeway: | Roads having full access control and grade separated intersections, with the primary function of servicing high volume traffic movements. VicRoads is the responsibly authority. A freeway's primary service is to provide for commercial and long distance traffic. |
| Arterial Highway: | Roads whose main function is to form the principal avenue for traffic movements across the metropolitan area not catered for by tollways or freeways. VicRoads is the responsibly authority. An arterial road's primary service is to provide a connection between freeways and activity centres, and to carry large volumes of traffic between urban centres. |
| Arterial -other: | Important municipal roads which distribute traffic between arterial roads and local access roads and to provide access to abutting property. |
| Local roads: | Roads whose function is to provide access to property fronting those streets. |

Figure 2.22 shows the declared network and route hierarchy in inner Melbourne.

**Figure 2.22: VicRoads declared network**




Characteristics of the Victorian road network are described in **Table 2-11**.

**Table 2-11: Victorian Road Network**

| **Road Classification** | **Declared Roads** (22,280km) | | | | **Municipal Roads** (134,200km) |
|---|---|---|---|---|---|
| | **Highways & Freeways** | | | **Other Arterial Roads** | |
| | **National Highways** | **Roads of National Importance** | **Arterial Roads** | | **Local Roads** |
| **Total Length** (km) | 1,030 | 585 | 5,995 | 14,670 | 134,200 |

Source: VicRoads

Of the 22,280km of declared arterial roads, approximately 800km is classified as freeway, not including the CityLink tollway which is approximately 22km in length.

***Summary of key routes***

When considering the patterns of east/west movements across Melbourne, it is useful to identify the key routes that are available in this area (principally these are the freeways and the arterial roads). It is also important to recognise that many of these routes need to cater for a variety of differing requirements including the movement of freight, public transport, peak hour commuter travel and local trips. In many instances the routes are also important pedestrian and bicycle links. If a major incident occurs on any of these routes, the impact can be felt across the whole network[6].

An important outcome of the analysis presented in this chapter is the identification of areas on the road network where there is existing "congestion". Congestion can be defined in various ways and can also be caused by a number of factors. For the purposes of this discussion, congestion will be considered in terms of locations where the available road capacity is unable to cope with the traffic demand that is placed on it. In other words these are locations where demand exceeds supply. Typically the supply deficiency can be defined either:

- geometrically, namely by a lack of road space/capacity, or
- operationally, this arises where insufficient priority is assigned to a link or a to critical node on a route due to the need to satisfy competing demands on a cross-route

The key routes across Melbourne are shown in **Table 2-12** with their classification and typical daily two way traffic volumes. The key routes across Melbourne are also shown in **Figure 2.23**.

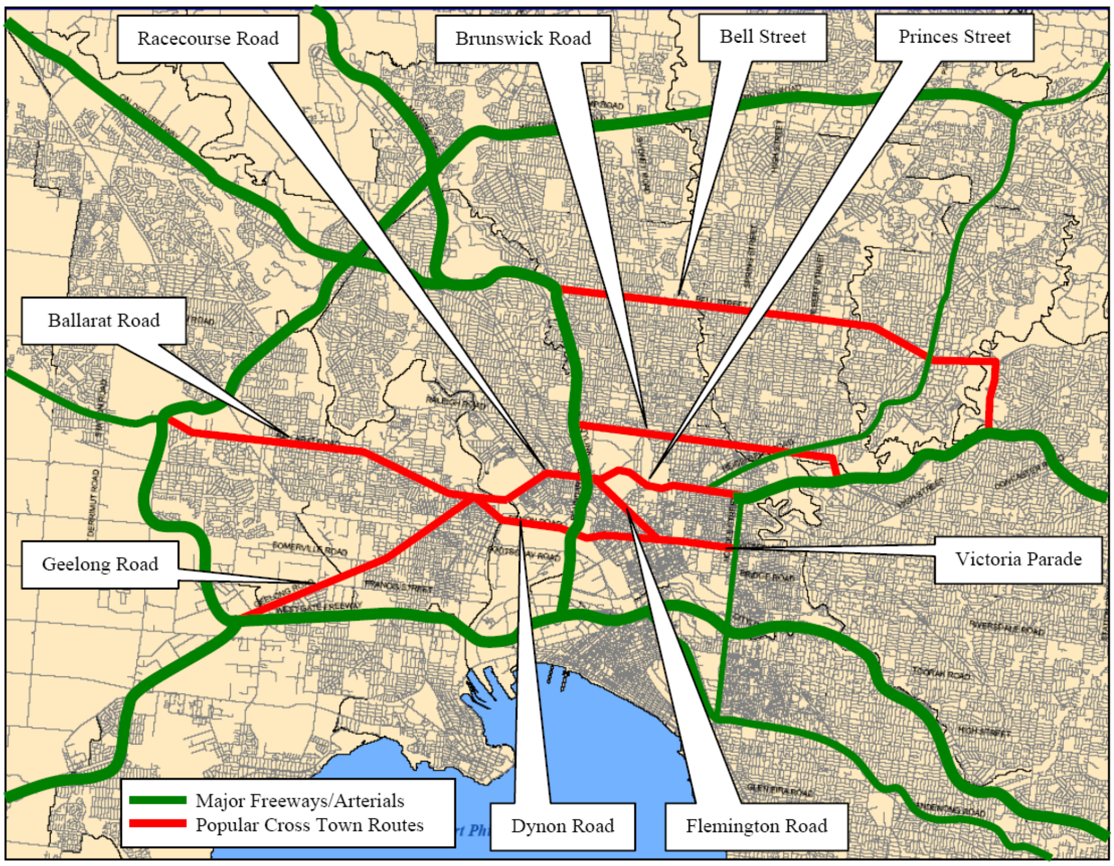
**Table 2-12: Key Routes Across Melbourne**

| Road Name | Location | Classification | Average mid-week Two Way Daily Traffic Volume | % Commercial Vehicles |
|---|---|---|---|---|
| Monash Freeway | East of Toorak Road | Freeway | 150,000 | 10% |
| CityLink | East of MacRobertson Bridge | Freeway | 130,000 | 15% |
| West Gate Freeway | West Gate Bridge | Freeway | 165,000 | 15% |
| Tullamarine Freeway | South of Bell Street | Freeway | 124,000 | 10% |
| Calder Freeway | West of Western Ring Road | Freeway | 87,000 | 5% |
| Eastern Freeway | East of Hoddle Street | Freeway | 128,000 | 3% |
| Alexandra Parade | East of Nicholson Street | Arterial Highway | 85,000 | N/A |
| Racecourse Road | West of CityLink | Arterial Highway | 39,000 | 5% |
| Geelong Road | East of Francis Street | Arterial Highway | 42,000 | 9% |
| Victoria Parade | East of Lygon Street | Arterial Other | 40,000 | N/A |

[6] VCEC Report September 2006

| | | | | |
|---|---|---|---|---|
| Victoria Parade | East of Nicholson Street | Arterial Other | 60,000 | N/A |
| Western Ring Road | North of Deer Park Bypass | Freeway | 113,000 | 14% |
| Dynon Road | At Maribyrnong River | Arterial Other | 35,000 | 6% |
| Footscray Road | At Maribyrnong River | Arterial Highway | 35,000 | 19% |
| Bell Street | At Darebin Creek | Arterial Highway | 51,000 | 6% |
| Brunswick Road | West of Sydney Road | Arterial Other | 20,000 | 6% |
| Flemington Road | South of Elliot Avenue | Arterial Other | 53,000 | 4% |
| Alexandra Avenue/ City Road | East of St Kilda Rd | Arterial Highway | 39,000 | 6% |
| Docklands Highway (Francis Street) | West of Williamstown Road | Arterial Highway | 7,500 | 26% |
| Docklands Highway (Francis Street) | East of Williamstown Road | Arterial Highway | 11,000 | 31% |
| Somerville Road | West of Geelong Road | Arterial Other | 13,000 | 27% |
| Somerville Road | East of Geelong Road | Arterial Other | 13,000 | 17% |
| Sunshine Road / Buckley Street | West of Geelong Road | Arterial Other | 21,000 | 10% |

**Figure 2.23: Key Routes Across Melbourne**




***Monash Freeway, CityLink, West Gate***

The Monash Freeway, CityLink, West Gate Freeway corridor (MCW) is one of Melbourne's busiest and key routes. The MCW corridor has a dual role of providing a major commuter route from the south-eastern and the western suburbs to central Melbourne, while also servicing significant freight movements generated by industrial areas in the south-east and the west as well as around the Port of Melbourne. The West Gate Bridge carries over 165,000 vehicles per day and also carries an estimated 60% of all freight from the west[7].

Increased pressure is expected on this corridor due to ongoing residential development on the urban fringes, in the growth areas to the east and west. Travel times on this route can occasionally reach up to three times longer than those experienced under free flow conditions.[8] Commercial vehicles account for approximately 15% of all vehicle trips over the West Gate Bridge, which is close to or at its carrying capacity[9].

The MCW corridor is congested during commuter peak periods. Traffic congestion is also building up during non-peak weekday periods. There are also periods of congestion during recreational peaks on weekends and holidays. Congestion results in delay and unreliable travel times for businesses and can lead to major disruptions to long distance traffic movements, particularly at times of traffic incidents.

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[7] VTA presentation June 2007

[8] VTA presentation June 2007

[9] VCEC Report September 2006 and VTA presentation June 2007

The MCW suffers its heaviest congestion at freeway on-ramps with vehicles merging onto a freeway that is operating close to capacity.  The recent introduction of ramp metering at key locations along the corridor has helped reduce the impact of these on-ramps on the freeway's operation, however prolonged congestion is still experienced in the peak commuter periods.

The West Gate Bridge also constitutes a capacity constraint, with the number of traffic lanes in each direction being insufficient to cater for the existing traffic demand at adequate service levels.  The lack of physical capacity is manifested in prolonged queuing and delays.  Traffic demands are expected to grow significantly along this part of the corridor, particularly given the imbalance between population growth and employment opportunities in the city's western suburbs, which will maintain a strong pattern of commuter work trips from the broad western region towards central Melbourne.

The central part of the MCW corridor, linking the West Gate and Monash Freeways is the CityLink toll road.  This relatively new addition to the Melbourne road network is heavily utilised throughout the day.  It is important to note that the freight industry appears inclined to use CityLink as a quick alternative to travelling through the CBD.  CityLink operates with approximately 9% commercial vehicles[10] across the whole of the link; in some sections it is considerably higher.  The closure of the Burnley Tunnel in March 2007 showed the importance of this link to the Melbourne network as widespread congestion was experienced on the entire network whilst repairs were performed.

***Western Ring Road***

The Western Ring Road (WRR) is another key route, which feeds into the West Gate Freeway.  This route carries up to 130,000 vehicles per day with a limited number of lanes (in some sections it operates with only two lanes in each direction).  The WRR can carry up to 16% commercial vehicles per day in some sections.

The WRR experiences its most significant delays at freeway on-ramps but also at locations where "lane drops" occur.  These "lane drops" are where a single through lane (the left-most lane) is closed thus forcing vehicles using this lane to merge into the adjacent traffic lane.  Their intent is to allow the following on-ramp to act as an "added lane" and not require the traffic entering from that ramp to merge.  However the impact of removing a full lane of through traffic may outweigh the benefits experienced by the added lane for the on-ramp.

***Tullamarine Freeway and Calder Freeway***

The Tullamarine Freeway and Calder Freeway are also key routes for north-south movements.  The recent upgrade of the merge between these two freeways has removed a major point of congestion for both inbound and outbound traffic.  Previously, travel times on the Tullamarine Freeway could occasionally reach up to three times longer than those experienced under free flow conditions.  However with the new interchange, delays have been reduced.  The Tullamarine Freeway (CityLink section) operates priority "express lanes" in the peak periods which are only available for buses, hire cars and taxis.  These lanes operate from the start of CityLink to Flemington Road.  Their intent is to support public transport.  The express lanes operate in the citybound direction during the morning peak and the outbound direction in the afternoon peak.

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[10] VTA presentation June 2007

In recent years, congestion has also been rising on the Tullamarine Freeway north of Essendon Airport, particularly around the Mickleham Road interchange and at Melbourne Airport interchange. Factors responsible for this increased congestion are:

- Insufficient absorption capacity for exiting traffic at Mickleham Road (Gladstone Park); and
- Heavy traffic flows generated by Melbourne Airport.

Residential growth in the Greenvale / Roxburgh Park region is not as high as in other growth areas but is still expected to maintain demand pressure on the Tullamarine Freeway.

The Calder Freeway experiences both morning and evening congestion in the section through Keilor. Contributing factors to this congestion are:

- The influence of merging and weaving traffic at the Keilor Park and Keilor on/off ramps; and
- Capacity constraint on the Maribyrnong River Bridge – which is two lanes in each direction.

Ongoing residential development in the Taylors Lakes / Sydenham corridor and beyond (coupled with limited job creation in the local area) is expected to lead to increased demand on the Calder Freeway.

***Eastern Freeway***

The Eastern Freeway is another key route, however it is not heavily utilised by freight due to the lack of connection with other freeways and major industrial areas. Extensive congestion is experienced at the western end of the Eastern Freeway as the freeway terminates at Alexandra Parade and Hoddle Street. The Eastern Freeway operates bus lanes (along the shoulder) and transit lanes in the AM peak period. Transit lanes encourage the transition from single occupancy vehicles to higher occupancy vehicles. The Eastern Freeway is underutilised for most of its length, primarily due to its lack of connectivity to the freeway network at each end.

The Eastern Freeway will soon be connected to the Mornington Peninsula Freeway via Eastlink, when it opens in 2008. Eastlink will provide greater access to the Eastern Freeway for a range of vehicles, linking the Mornington Peninsula and the Scoresby industrial areas to the CBD. This may also increase the numbers of commercial vehicles using the Eastern Freeway. Currently it only carries approximately 3% commercial vehicles, which is considerably less than most metropolitan freeways.

***Bell Street***

Bell Street is a major east-west arterial route, connecting Strathmore to Heidelberg. It also provides a connection to the Tullamarine Freeway at the transition point with CityLink tolls. Bus routes operate along Bell Street, with buses interacting with private vehicles as no bus lanes are provided.

Bell Street experiences congestion at a number of locations in the peak commuter periods as it is one of the northern suburbs main east-west routes, with limited alternative choices. It is relevant to note that some traffic may be using Bell Street due to the general scarcity of Merri Creek crossings to service east/west movements. There are only seven road crossings of Merri Creek between the Eastern Freeway and the Western Ring Road. Additional traffic capacity on Bell Street may be released if alternate Merri Creek crossings were available.

The areas on Bell Street that experience most peak period congestion are its intersections with:

- Sydney Road
- Melville Road / Turner Street
- High Street
- St Georges Road
- The rail level crossings (near Sydney Road and High Street)

***Geelong Road***

Geelong Road is a key arterial route with an important role servicing large industrial areas in the inner and outer west (from Footscray to Laverton North). It links areas near the Western Ring Road / West Gate Freeway interchange to Footscray. It is part of a route to the Port of Melbourne, particularly for those inner industrial areas in the Sunshine / Footscray region that are not conveniently located to use the West Gate Freeway. Furthermore, the truck curfews that exist along Francis Street and Somerville Street increase the propensity for Port-related truck traffic, originating in this area, to use Geelong Road.

Geelong Road generally operates with some spare capacity. Trucks comprise 9% of the total traffic volumes along Geelong Road.

The areas on Geelong Road that experience most peak period congestion are its intersections with:

- Ballarat Road
- Barkly Street
- Williamstown Road / Geelong Street
- Somerville Road
- Millers Road / Francis Street

***Brunswick Road/Ormond Road/Maribyrnong Road/Raleigh Road/Hampstead Road***

Brunswick Road is an east/west route starting at Nicholson Street in Fitzroy. Together with Ormond Road, Maribyrnong Road, Raleigh Road and Hampstead Road it provides a continuous inner suburban east/west arterial route linking to the Western Highway (Ballarat Road) in Braybrook. This route utilises one of five crossings of the Maribyrnong River in the western suburbs. It also provides northbound access to CityLink in Ascot Vale.

***Racecourse Road***

Racecourse Road is an inner east/west route that commences at Flemington Road / Royal Park and runs through Kensington and Flemington connecting to Ballarat Road via Smithfield Road. It is part of a broader route that also links to the Eastern Freeway, via Elliott Avenue, Macarthur Road, Cemetery Road, Princes Street and Alexandra Parade. Racecourse Road provides up to two traffic lanes in each direction and has a tram service operating in the centre of the road, which is only segregated in parts. Accordingly, one of the traffic lanes is at times located on a central tram reserve. Racecourse Road provides important linkages to a number of attractions such as Flemington Racecourse, the Royal Melbourne Showgrounds and the

Zoo. However, overall traffic capacity is constrained given that traffic and trams need to share road space in areas such as the shopping strip near Newmarket station.

Other significant areas of congestion are the intersections near Flemington Road and Smithfield Road respectively. Heavy peak period cross movements at these locations limit the priority that can be provided to Racecourse Road. Prolonged congestion also occurs all along Racecourse Road when major events are held at Flemington Racecourse and the Royal Melbourne Showgrounds.

***Alexandra Parade/Princes Street***

Alexandra Parade/Princes Street is a major east-west route connecting the Eastern Freeway to Carlton and connecting to a number of key north-south routes into the CBD. It provides up to four lanes in each direction. Four tram corridors cross Alexandra Parade / Princes Street between the Eastern Freeway and Lygon Street. These tram routes experience notable delays due to high priority being provided to the east-west movements on Alexandra Parade / Princes Street. Despite the priority given to east-west movements, the Alexandra Parade/Princes Street route remains one of inner Melbourne's busiest routes and has prolonged congestion in both peak periods.

The areas on Alexandra Parade / Princes Street that experience most peak period congestion are its intersections with:

- Smith Street
- Queens Parade / Brunswick Street
- Nicholson Street
- Rathdowne Street
- Lygon Street

***Flemington Road***

Flemington Road is a route that radiates diagonally from the central city to the north/west. It connects CityLink (Tullamarine Freeway) to the CBD and is also part, together with Mount Alexander Road, of a much longer arterial route which services a number of inner suburbs in the north-west between Flemington and Niddrie / Strathmore. Its varying cross-section generally provides between three to four lanes in each direction (split between a service road and a central carriageway). It also has a tram service operating down the centre of the road in a segregated tram fairway.

Flemington Road experiences congestion due to a mix of local traffic movements and commuter traffic demands. There are a number of institutional uses serviced by Flemington Road, including various hospitals (which generate large volumes of traffic throughout the day) and Melbourne University. Delays are also experienced at the roundabout with Royal Parade / Elizabeth Street due to heavy conflicting traffic flows from each direction and the priority given to trams through the roundabout.

### *Victoria Parade/Victoria Street*

Victoria Parade is an east-west route connecting Richmond to North Melbourne. It has a segregated tram reserve located in the large central median between Hoddle Street and La Trobe Street. On Victoria Street trams share road space and interact with vehicles (between Hoddle Street and Burnley Street).

Victoria Street experiences heavy congestion in the section between Hoddle Street and Burnley Street as vehicles are required to interact with trams and there is effectively only one traffic lane available at most locations. Clearways are in operation in the peak periods however there can be some problems with parked vehicles disrupting traffic during these times and the regular presence of trams acts to limit the formation of two traffic lanes. Traffic on Victoria Parade/Victoria Street also experiences long delays at the intersection with Hoddle Street due to the high level of north-south priority. This also creates delays for trams and buses.

Victoria Parade between Hoddle Street and Brunswick Street operates with reasonable efficiency in the peak periods, due to its generous geometric capacity (3 to 4 lanes in each direction and separate central tram reservation) when compared with Victoria Street. Greater congestion is experienced in both peak periods in the vicinity of Brunswick Street and Gisborne Street and at Nicholson Street due to more complex intersection traffic signal phasing and tram priority measures as well as the need to cater for higher volumes of north/south traffic.

Further west, Victoria Parade also experiences congestion between Latrobe Street and Elizabeth Street due to the conflicting priorities between north-south and east-west movements, including north-south tram movements.

### *Dynon Road*

Dynon Road is an east-west route providing access to the Port of Melbourne and connecting Footscray to West Melbourne. It creates one of five crossings of the Maribyrnong River in the western suburbs. As it provides access to the Port of Melbourne, Dynon Road carries high levels of commercial vehicles.

Dynon Road experiences delays throughout the day, especially during the peak commuter and freight periods. In the AM peaks, queues form back from its intersection with Spencer Street past Dock Link Road. Dynon Road also experiences delays in the PM peak period, especially at the intersection with Moore Street. At this intersection, vehicles are directed north to join the arterial network at Ballarat Road. Whilst turning vehicles are provided with two turning lanes, large volumes of turning traffic results in long delays.

Dynon Road is also subject to flooding which can reduce its availability in the network.

### *Footscray Road*

Footscray Road is a major east-west route connecting Footscray to the Docklands and providing access to the Port of Melbourne. It also provides one of five crossings of the Maribyrnong River in the western suburbs. Footscray Road provides up to four lanes in each direction, however it reduces to two lanes at the crossing of the Maribyrnong River. This reduction in capacity generates delays within the peak periods.

The Maribyrnong River creates a barrier for east/west movements within the western suburbs. The crossings at Footscray Road and Dynon Road are heavily utilised by heavy vehicles as they are important access gateways into the Port of Melbourne. The bridge over the

Maribyrnong River limits capacity due to it providing only two lanes, while the approaches from the east have up to four lanes.

***Western Highway / Ballarat Road***

The Western Highway is a major highway connecting the western suburbs to Melbourne via Ballarat Road. Ballarat Road provides a major route from the western suburbs to the CBD, travelling through areas such as Sunshine and Footscray, and provides access to the Port of Melbourne. The Western Highway and Ballarat Road provide up to three lanes in each direction.

***Alexandra Avenue / City Road***

Alexandra Avenue is an arterial east-west route, which is also used as a bypass for the Burnley and Domain Tunnels for over height and placarded loads on heavy vehicles. Alexandra Avenue experiences delays at its intersection with Power Street due to the heavy north-south and east-west volumes. Power Street also provides access onto the freeway network for vehicles required to bypass the tunnels. City Road provides access into industrial areas and as such, carries large numbers of commercial vehicles.

***Dandenong Road/Princes Freeway***

Dandenong Road/Princes Freeway is a major arterial route, connecting the CBD to Dandenong and beyond. It is effectively an alternate parallel route to the CityLink / Monash Freeway route. The route is an identified over-dimensional vehicle route and as such, carries a significant proportion of heavy vehicles. It is a key alternate link between the Port of Melbourne and industrial areas surrounding Dandenong. Dandenong Road has a tram service which operates in a segregated reserve along the central median until Glenferrie Road. Various bus routes also operate along different sections of Dandenong Road, however they are required to interact with other vehicles as no bus lanes are provided. This can create reliability and variability issues with bus schedules.

The areas on Dandenong Road that experiences most peak period congestion are its intersections with major north/south roads:

- Warrigal Road
- Orrong Road
- Williams Road/Hotham Street
- Chapel Street
- Queens Road

***Punt Road/Hoddle Street***

Punt Road/Hoddle Street is a major north-south arterial route, connecting St Kilda to Clifton Hill. It also provides a critical link between the end of the Eastern Freeway and the CBD, carrying over 100,000 vehicles per day. Hoddle Street features designated bus lanes in the peak periods between the Eastern Freeway and Victoria Parade. These bus lanes connect with bus lanes along the Eastern Freeway, enabling buses to avoid delays incurred by traffic congestion. Buses also operate along the remaining length of Hoddle Street/Punt Road (south of Victoria Parade) however there are no bus lanes in this area and buses therefore are required to interact with traffic. This can result in reliability and variability issues with bus schedules.

The areas on Punt Road/Hoddle Street that experience most peak period congestion are its intersections with major east/west roads:

- Johnston Street
- Victoria Parade / Victoria Street
- Albert Street
- Wellington Parade / Bridge Road
- Brunton Avenue
- Swan Street
- Alexandra Avenue
- Toorak Road
- St Kilda junction

***Brighton Road/Nepean Highway***

Brighton Road/ Nepean Highway is a major north-south arterial route connecting Melbourne's southern suburbs (and the Mornington Peninsula to the CBD). It provides up to four lanes in each direction with a tram line running down the central median to Glen Huntly Road. Buses also operate along this route in various sections. No bus lanes are provided.

The Nepean Highway is used as a commuter route to the CBD due to the absence of a direct and continuous freeway-standard connection from Frankston / Mornington Peninsula to the CBD. Some traffic using the Nepean Highway may also be attracted to the route due to congestion on the Monash Freeway. The Mornington Peninsula Freeway currently links Frankston to Aspendale / Keysborough and is therefore only a partial alternative to the Nepean Highway. The Mornington Peninsula Freeway already experiences prolonged peak period congestion at both the Frankston and Aspendale / Keysborough ends.

As the Nepean Highway approaches the CBD it feeds three important routes at St Kilda junction (where there is also a grade-separated interchange with Dandenong Road):

- St Kilda Road
- Punt Road / Hoddle Street
- Queens Road / Kingsway

While some extra traffic capacity is provided on the Nepean Highway (by the addition of traffic lanes as the highway moves to the CBD) congestion remains evident in several areas, including at St Kilda junction, near Carlisle Street, at Glen Huntly Road and sections further south.

***Summary of key routes***

It is evident that the most of the key east-west key routes across Melbourne experience some congestion throughout the day, especially during the peak commuter periods. Where public transport and/or freight interact with commuter traffic, delays are often more significant.

A number of the key east-west routes are also in areas where adjacent land use often conflicts with the large volumes of through traffic and freight, including;

- Docklands Highway (Francis St) through Yarraville;
- Somerville Road through Yarraville;

- Buckley Street through Footscray;
- Racecourse Road through Kensington;

***Traffic volumes on key routes – select link analysis***

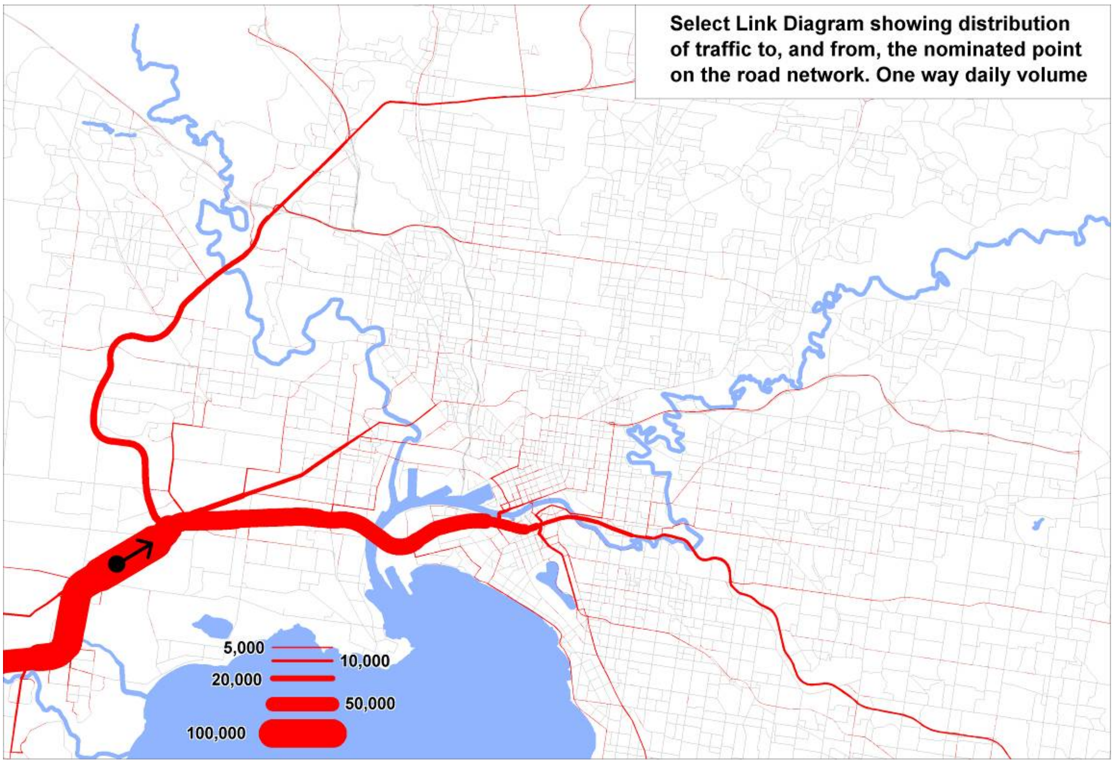
A Select Link is a nominal location on the road network where the traffic passing that point is analysed to determine the roads it uses to reach its final destination. It is a theoretical analysis undertaken using a traffic model. The outcome is a "vein diagram" that shows how much of the traffic that passes the Select Link travels down each of the streets within the study area.

Two Select Links were chosen and applied to the Zenith model to provide traffic flow information, with locations at Princes Freeway (west of Western Ring Road) and Eastern Freeway (east of Hoddle Street). Figure 2.24 and Figure 2.25 show select links at the Princes Freeway and Eastern Freeway.

The Select Links have been analysed separately to determine the route choice of vehicles from each location for the whole of a typical week day. The outputs therefore represent the total movement of vehicles in one direction past that point in the network. The select link analysis provides more detail of traffic desire lines for particular routes. However, as only two links are selected, gaps can be generated in the data provided.

The select link analysis shows that the majority of trips from both freeways are centred towards the CBD and inner areas, and that there are not significant movements for the full east/west trip on any one road, say from the Eastern Freeway to the Western Highway or West Gate Freeway to Monash Freeway. Some routes, such as Bell Street, Brunswick Road and others, are represented in both select links, highlighting its use as a major east/west route.

**Figure 2.24: Select link - Princes Freeway**



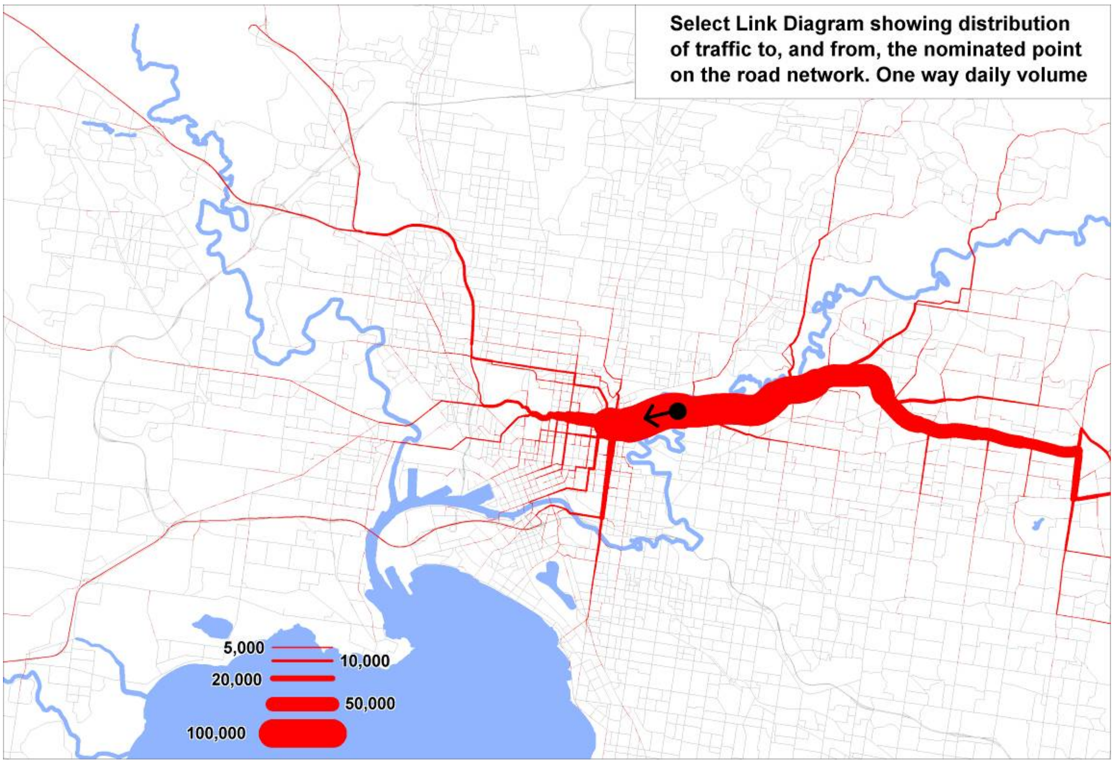

Source: Study Team (VLC)

Cars travelling along the Princes Freeway take three main routes to their destination, the Western Ring Road, Geelong Road or the West Gate Freeway. Almost 20% of all daily traffic takes the Western Ring Road, 20% Geelong Road and 55% take the West Gate Freeway.

Approximately 10% of all traffic from the Princes Freeway is destined for the CBD. There is a very strong connection between the Princes Freeway and CityLink. A small amount of traffic from the Princes Freeway makes its way past the CBD and onto the Eastern Freeway.

The majority of vehicles travelling along the Eastern Freeway, approximately 60%, have a destination in the CBD or inner area. Approximately 5% of vehicles (3,000) travel across the study cordon to at least Racecourse Road while almost 20% of vehicles travel south along Punt Road beyond Bridge Street. There is also a significant connectivity with CityLink to the north with 7% of vehicles completing this journey using either Princes Street or Brunswick Road.

**Figure 2.25: Select link – Eastern Freeway**




Source: Study Team (VLC)

### *Midblock congestion*

Congestion adds to the cost of many activities. The total cost of congestion in Melbourne is estimated to be around $3 billion a year and this could triple over a 20-year period, unless addressed[11]. The majority of congestion currently occurs in the inner to middle suburbs – within 15 km of the Central Business District. Midblock congestion can be shown through a variety of methods. One method is to analyse the average vehicle speed through a section of road and compare this to the posted speed limit. If this ratio is lower than 100%, midblock congestion could be occurring. This congestion can then also affect the speeds on neighbouring roads due to the formation of queues.

Figure 2.26 shows the AM peak speed compared to the free flow speed across Melbourne. It assists in highlighting the pinch points across the Melbourne road network.

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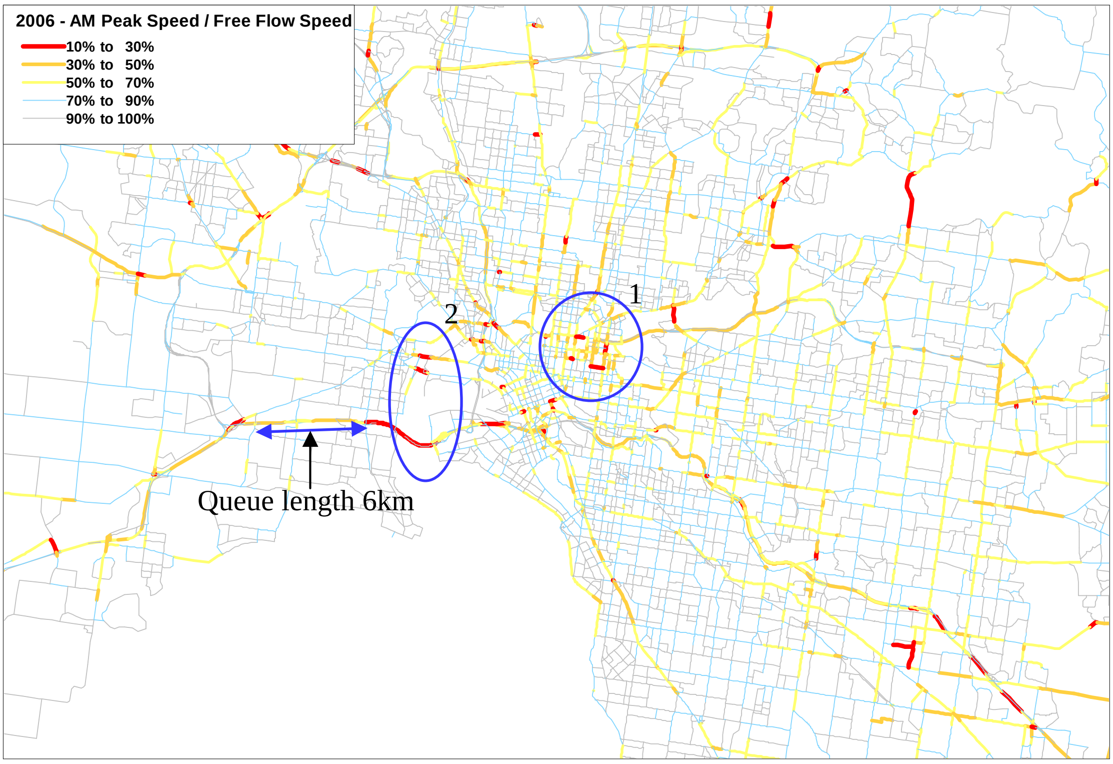
[11] Linking Melbourne

**Figure 2.26: 2006 AM Peak Speed / Free Flow Speed**




Source: Study Team (VLC)

Area 1, in Figure 2.26 highlights the roads around the end of the Eastern Freeway. These roads experience high levels of congestion due to heavy east-west flows interacting with heavy north-south flows. As such, both east-west and north-south vehicle speeds are significantly lower than the posted speed.

Area 2 highlights the Maribyrnong River and Yarra River crossings. The West Gate Bridge is shown to have speeds between 10-30% of the posted speed limit. This could be due to the limited capacity on the bridge combined with the merge from Williamstown Road. This reduction in speed generates a queue that can extend for up to six kilometres. This is confirmed in Figure 2.26 by the reduced speeds along the West Gate Freeway. These delays along the West Gate Freeway can result in longer peak periods

Similarly, the Maribyrnong River crossings at Dynon Road and Footscray Road are shown to be significantly lower than the posted speed limit. Once again, this could be due to the capacity constraints on these bridges as well as the approach and departure to these bridges.

***Eastern City approaches***

The Eastern Freeway is a key route linking Nunawading with Collingwood, and then ultimately the CBD via the local road network. The freeway provides up to 5 lanes in each direction with buses running along the shoulder in sections.

The majority of vehicles on the Eastern Freeway have a destination within the CBD with an almost even split of vehicles using either Alexandra Parade or Hoddle Street.

The Eastern Freeway suffers from heavy congestion, particularly in the morning peak period with queues forming from Hoddle Street to the vicinity of the Chandler Highway. These queues are created due to the freeway terminating at Collingwood and the need for traffic to access either Hoddle Street or Alexandra Parade, which are in turn congested during the morning peak. The opportunity exists to relieve some congestion by enhancing Hoddle Street and Alexander Parade, although there are limited opportunities for this, or by providing an alternative route that bypasses these routes. These issues are discussed in greater detail below:

- Hoddle Street experiences heavy congestion between the Eastern Freeway and Victoria Parade, carrying over 5,500 vehicles in the morning peak. Almost 40% of these vehicles turn into Victoria Parade, while the majority of the remaining southbound vehicles continue over the Yarra River. Delays are experienced due to intersection limitations with large numbers of vehicles travelling along Hoddle Street, while similar volumes of vehicles attempt to cross Hoddle Street to gain access to the CBD.
- Alexandra Parade carries over 5,000 vehicles in the morning peak at its eastern end, with approximately 2,000 turning off before Swanston Street. The key locations of congestion along Alexandra Parade are at the intersections of Brunswick Street and Nicholson Street, both of which are heavily used for CBD access.

In addition to Eastern Freeway and CityLink, there are a number of east-west oriented routes to the east of the city, allowing for multiple travel choices to the central area and across town.

***Western City Approaches***

Approaches from the west of the city are constrained due to the limited number of crossings of the lower Maribyrnong River and Yarra River. Traffic from the west is funnelled to the river crossings of the West Gate Bridge, Footscray Road, Dynon Road and Smithfield Road, all of which experience some form of congestion in both peak periods.

- Racecourse Road is congested on the approach to the section between Newmarket train station and Princes Street. In this section through traffic must share a lane with trams and mix with vehicles attempting to park in the shopping strip. It is also congested on the approach to CityLink which could relate to the number of vehicles attempting to access CityLink and travel south.
- The West Gate Freeway experiences heavy congestion in the morning peak period, with queues extending from Todd Road back past Laverton. This congestion is due to the width constraints of the existing freeway with demand exceeding capacity.
- Francis Street and Somerville Road form some of the key routes into the Port of Melbourne from Geelong Road and as such they carry a large number of freight vehicles. However, the high number of freight vehicles result in delays to all motorists and reduces amenity for local residents.
- Geelong Road operates close to its capacity in the peak periods, particularly near its intersection with Ballarat Road. This is due to the heavy traffic flows on both routes and the capacity constraints at the Maribyrnong River crossing generating some queues.
- Ballarat Road is congested east of the Western Highway due to a limited number of lanes. This congestion is slightly relieved as it passes through Sunshine due to additional capacity, but once again narrows to two lanes at its crossing with the Maribyrnong River.

A number of infrastructure options are being considered as part of the planned M1 upgrade in order to deliver additional effective capacity on the bridge and freeway sections. This is expected to ease the situation for a number of years but will not be a longer term solution. At some point in time it may necessary to provide an additional crossing of the Yarra to satisfy travel demands for through traffic and from the western suburbs.

***Northern City Approaches***

The model outputs for existing congestion do not show any significant congestion problems to the immediate north of the city. However it is noted that whilst some key north-south routes are not highlighted, they experience extensive delays in the peak periods – this can be attributable to intersection congestion, which is not well represented in a strategic model (see intersection congestion discussion below).

North-south routes have a reduced capacity due to crossing major arterial roads such as Princes Street/Alexandra Parade, with traffic signal phasing giving priority to the major route of Alexandra Parade. Nicholson and Brunswick Streets both experience long delays in the peak periods, however they are not highlighted as midblock capacities are adequate due to their relatively low volumes and high capacities, but intersection capacities are constrained.

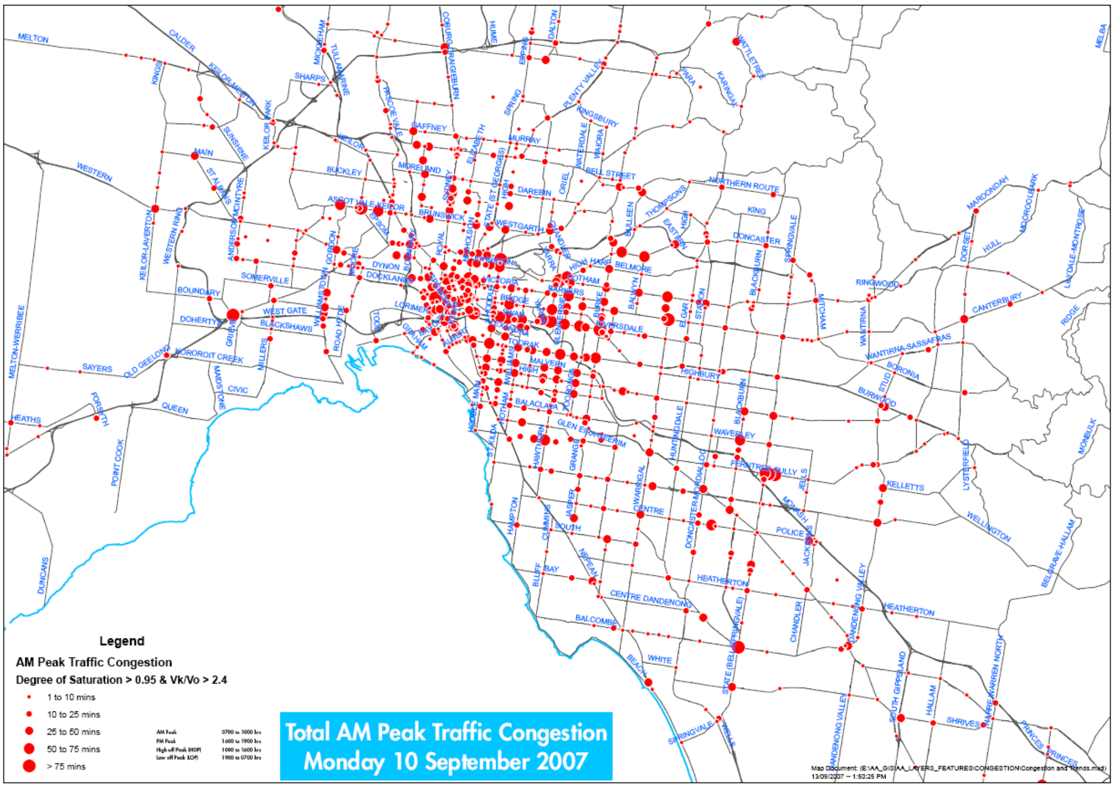
There are a number of routes which provide city access from the north:

- Nicholson Street experiences southbound congestion in the morning peak, particularly at the intersections with Alexandra Parade and Johnston Streets due to their heavy volumes of east-west traffic. In the evening peak, northbound traffic experiences heavy delays at the intersection with Alexandra Parade.
- Rathdowne Street experiences southbound delays in the morning peak due to its intersections with Princes Street due to its heavy east-west traffic flows. In the evening peak, northbound traffic experiences delays at the intersections with Grattan Street and Princes Street.
- Lygon Street experiences delays in the peak periods at Princes Street and Elgin Street, due to their heavy east-west movements.
- Swanston Street experiences significant delays due to its limited length, accessibility, lack of penetration into the CBD and more attractive parallel routes such as Lygon Street and Royal Parade. It has recently been further constrained for vehicles with the trial installation of off-road bicycle lanes which reduce the available space for vehicles.
- Royal Parade experiences heavy southbound congestion in the morning peak, particularly at the intersection with Macarthur Road which carries vehicles between the Tullamarine Freeway and the Eastern Freeway. Of particular concern is the capacity of the Haymarket roundabout, particularly in the evening peak when outbound traffic on Royal Parade blocks inbound traffic from Flemington Road.
- Flemington Road experiences heavy congestion from the exit of the Tullamarine Freeway to Abbotsford Road. The intersection with Elliott Avenue is also heavily congested with vehicles travelling from the Tullamarine Freeway to the Eastern Freeway, or attempting to access the CBD via Alexandra Parade. Flemington Road is also used as a route from the Western Highway to the CBD.
- Victoria Parade currently experiences westbound delays in the morning peak period at a number of intersections between Hoddle Street and Elizabeth Street. This is due to large east-west volumes interacting with large north-south volumes.

### *Intersection congestion*

VicRoads has produced a method of assessing the congestion at intersections across Melbourne. It analyses the length of time an intersection has a degree of saturation over 0.95 (which indicates that the intersection is operating at a congested level) during the peak periods. Figure 2.27 and Figure 2.28 display the degree of congestion at the intersections across Melbourne and inner Melbourne respectively.

**Figure 2.27: AM peak traffic congestion at intersections across Melbourne**




Source: VicRoads

It can be seen that a large number of intersections within inner Melbourne experience a large level of congestion in the AM peak period. Punt Road has high levels of congestion due to the conflicting movements of north-south to east-west, while most intersections within the CBD have high levels of congestion due to commuter travel and pedestrian movements.

It is interesting to note that the eastern suburbs of Richmond and South Yarra experience high levels of congestion at most major intersections, while the western suburbs do not have as many intersections with high levels of congestion. This could be due to the western suburbs having less choice in the number of routes to use in the peak periods, while the eastern suburbs have a number of routes available for commuter travel.

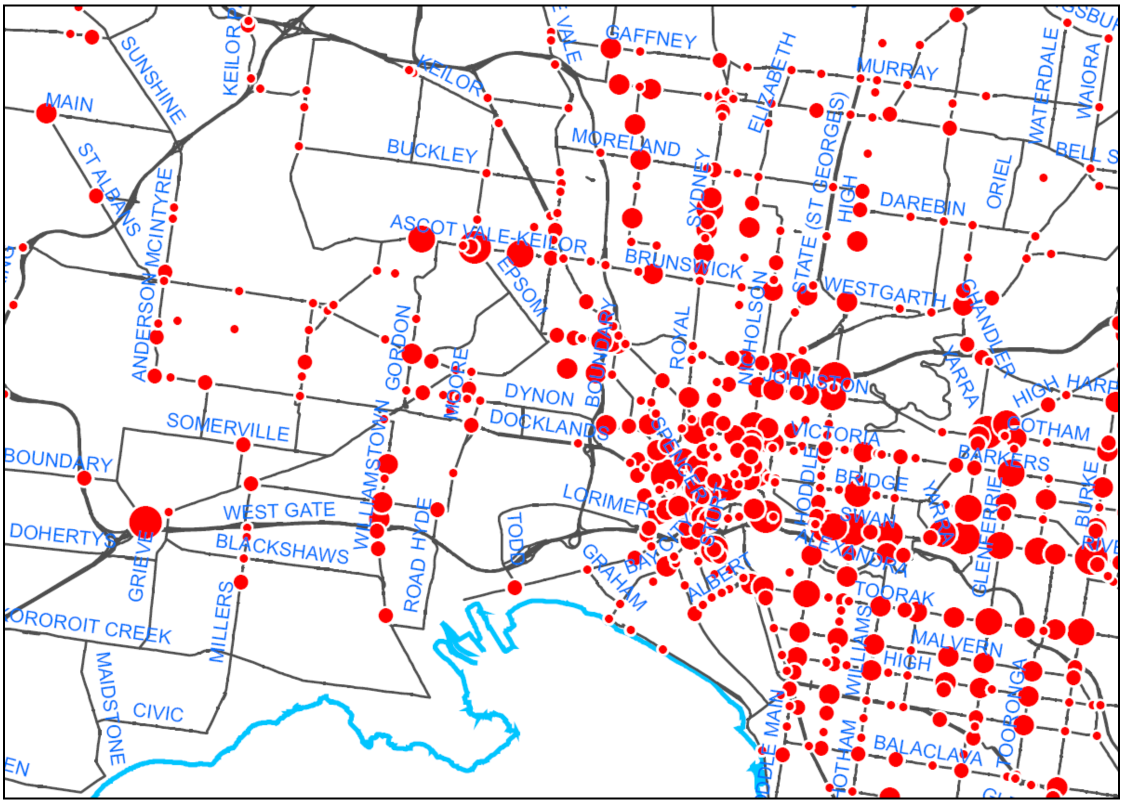
Figure 2.28 shows the congestion at intersections across inner Melbourne. It can be seen that key routes from the east such as Toorak Road and Swan Street have high levels of congestion at most intersections. This could be due to the conflict in priority between the heavy east-west and north-south movements at these intersections and the priority required for the tram routes along Toorak Road and Swan Street. This conflict in east-west and north-south movements is also shown along Alexandra Parade. Alexandra Parade is given priority due to its high traffic volumes, however the north-south routes carry public transport such as trams which also require a level of priority.

It is interesting to note that the western suburbs do not have as many intersections that have high levels of congestion. This could be due to the limited number of river crossings and the funnelling of traffic to these crossings as well as not having a well defined grid network like the eastern suburbs. The intersections of Footscray Road/Whitehall Street and Dynon Road/Whitehall Street are shown to have some level of congestion which would be expected due to these roads providing a river crossing. Another lower Maribyrnong River crossing is at Ballarat Road. The closest signalised intersection near the river crossing (Ballarat Road and

Moore Street) has some congestion, however the higher levels of congestion is located along Racecourse Road which carries traffic from the river crossing.

The CBD has high levels of congestion at most intersections. However, the focus of traffic within the CBD is pedestrian and public transport, and initiatives here would be aimed at improving priority and level of services for these road users. As such, private vehicle congestion within the CBD is generally accepted.

**Figure 2.28: AM peak traffic congestion at intersections across inner Melbourne**




Source: VicRoads

### *Road safety*

VicRoads records all accidents across Victoria in their online system called Crashstats. Crashstats has been used to provide a summary of the number of accidents on the key routes identified previously. This analysis will simply review the number of fatal, serious injury and other injury road accidents over the five-year period of 01/01/2001 and 31/12/2005. The results from the relevant review of Crashstats are shown in **Table 2-13**.

**Table 2-13: Crashstats accident review**

| Name | Between | Fatal | Serious | Other | Total | Length (km) | Average Daily Volume | Accidents per 1000 veh-km |
|---|---|---|---|---|---|---|---|---|
| Victoria Street | Hoddle Street and Burnley Street | 1 | 55 | 128 | 184 | 1.6 | 28,000 | 2.25 |
| Princes Street | Cemetery Road East and Nicholson Street | 0 | 27 | 65 | 92 | 0.6 | 56,000 | 1.50 |
| Flemington Road | CityLink and Royal Parade | 1 | 59 | 122 | 182 | 2.2 | 35,000 | 1.30 |

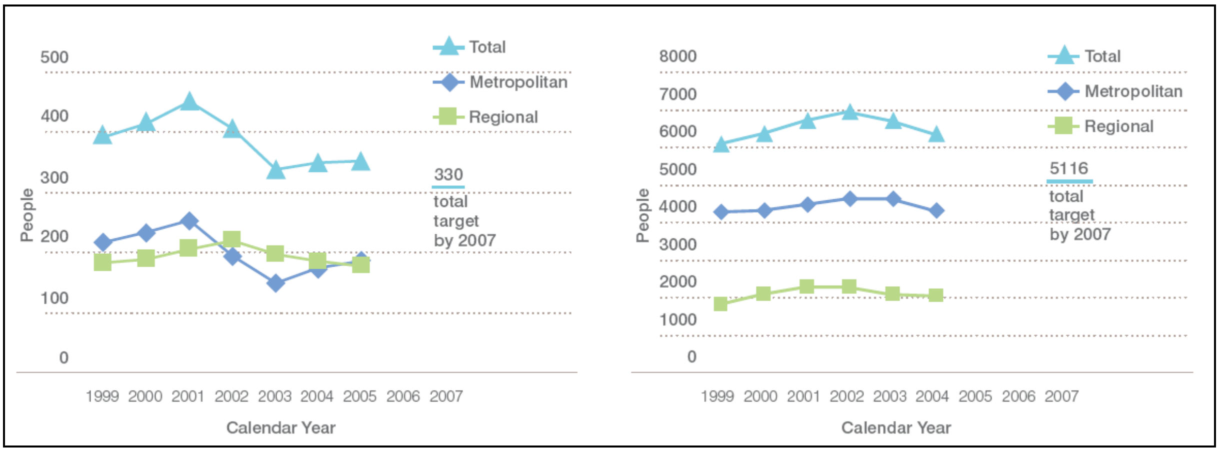
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Racecourse Road | Smithfield Road and Flemington Road | 0 | 41 | 87 | 128 | 1.5 | 37,000 | 1.26 |
| Brunswick Road | CityLink and Nicholson Street | 0 | 24 | 73 | 97 | 3.6 | 20,000 | 0.74 |
| Hoddle Street / Punt Road | Eastern Freeway and Dandenong Road | 9 | 179 | 392 | 580 | 7.8 | 74,000 | 0.55 |
| Alexandra Parade | Nicholson Street and Eastern Freeway | 0 | 21 | 81 | 102 | 1.2 | 87,000 | 0.54 |
| Geelong Road | Ballarat Road and McDonald Road | 1 | 51 | 99 | 151 | 5.4 | 35,000 | 0.44 |
| Princes Highway | Punt Road and Burke Road | 6 | 110 | 149 | 265 | 6.5 | 60,000 | 0.37 |
| Bell Street | Pascoe Vale Road and Upper Heidelberg Road | 6 | 133 | 350 | 489 | 12 | 62,000 | 0.36 |
| Dynon Road | Moore Street and CityLink | 0 | 12 | 35 | 47 | 2.7 | 35,000 | 0.27 |
| Brighton Road - Nepean Hwy | Glen Huntley Road and Centre Road | 0 | 31 | 75 | 106 | 4.1 | 59,000 | 0.24 |
| Western Ring Road | West Gate Freeway and Sydney Road | 4 | 185 | 411 | 600 | 25.8 | 113,000 | 0.11 |
| West Gate Fwy | Power Street to Western Ring Road | 11 | 139 | 364 | 514 | 14 | 203,000 | 0.10 |
| Eastern Fwy | Punt Road and Burke Road | 0 | 36 | 97 | 133 | 6.4 | 140,000 | 0.08 |
| Calder Fwy | Tullamarine Fwy to Sunshine Avenue | 3 | 42 | 85 | 130 | 11.7 | 75,000 | 0.08 |
| Monash Fwy | Toorak Road and Warrigal Road | 3 | 48 | 92 | 143 | 6.8 | 149,000 | 0.08 |
| Tullamarine Fwy | Pascoe Vale Road and Sunbury Road | 1 | 50 | 149 | 200 | 13.5 | 124,000 | 0.07 |
| CityLink | West Gate Freeway and Toorak Road | 0 | 30 | 78 | 108 | 12 | 130,000 | 0.04 |

The highest number of accidents per 1,000,000 vehicle kilometres travelled occurs on Victoria Street. This could be due to a high number of vehicles in a short stretch of road, in combination with a number of cross intersections which experience high levels of congestion in the peak periods. It also has a shopping strip between Hoddle Street and Church Street which could raise the number of accidents due to the interaction between through vehicles, parking vehicles and pedestrians.

The freeways have the lowest number of accidents per 1,000,000 vehicle kilometres which is expected due to the high volumes, safety standards and restricted access. The Western Ring Road has the highest accident rate, which is three times higher than that of CityLink.

The number of fatal and serious accidents across Victoria has dropped over the last five years, with a reduction of almost 30% of fatalities between 2001 and 2005. However, over the past three years (of the analysis period), the number of fatalities within the metropolitan area has increased from approximately 150 to approximately 190. A summary of fatalities and serious injury accidents is provided in Figure 2.29.

**Figure 2.29: Victorian road user fatalities and serious injuries**




Source: Meeting our Transport Challenges

## 2.3 Freight movement

### 2.3.1 Overview

Efficient movement of freight is essential to Victoria's continued economic growth and will reinforce Melbourne's pre-eminent position as a hub for manufacturing and distribution[12]. The Victorian Government has set a target to move 30 per cent of port-related freight by rail by 2010. However, as much of the metropolitan freight is moved on roads, various strategies are needed to help contain the impact of congestion on road freight. These include encouraging people to use public transport, particularly commuters during the peak periods, optimising flow on major arterials, implementing other traffic management measures, and targeted investment around key freight centres and on regional freight links.

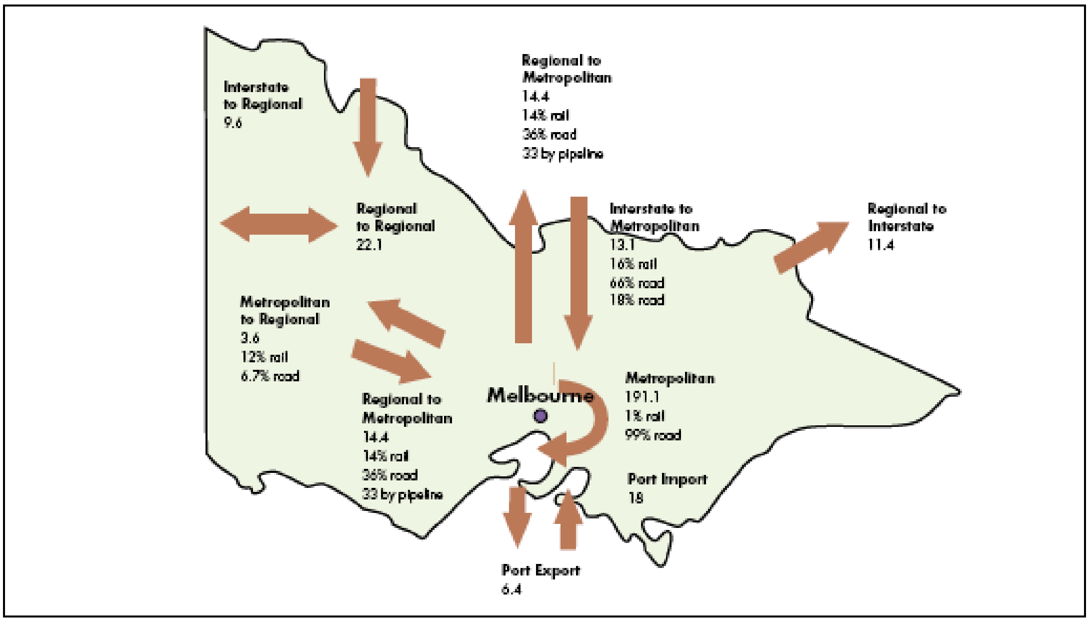
Melbourne is the central hub of Victoria's freight network, and the largest node in freight operations in south east Australia. Melbourne's freight task has a number of main components (refer to Figure 2.30):

- Import export movements, predominantly to and from the ports of Melbourne, Hastings and Geelong;
- Interstate freight movements, predominantly to and from Sydney, Brisbane, Adelaide, Perth and Tasmania;
- Intrastate (country) movements, predominantly bulk and containerised export agricultural and resource commodities, and palletised regional supplies;
- Movements around Melbourne, including
  - Larger deliveries to and from distribution centres, manufacturing sites and larger shopping centres

[12] DOI (2004), Linking Melbourne: Metropolitan Transport Plan

- Medium deliveries to and from manufacturing, processing and assembly sites, offices and retail premises
- Smaller deliveries to and from homes, shops, offices and other premises.

**Figure 2.30**: Victorian Freight Task 2000




Source: VFLC (2005)

### *2.3.2 Melbourne's Freight Task*

To 2020 and beyond the forecast growth in the freight task for Victoria's urban and regional areas will place significant stress on the current available infrastructure.

According to published sources the metropolitan freight task between 2000 and 2020, increase at a rate or 3% per annum[13]. This is virtually the same as the Australia Metropolitan aggregate growth of 3.1%. Over the same period the major regional freight corridors will also experience strong growth in the freight task of approximately 3% per annum[14]. This growth is intensified by a number of changes in dynamics of the logistics industry such as the changing truck fleet which will see more concentrated use of light commercial vehicles and articulated trucks at the expense of rigid vehicles. One of the most significant impediments to a more systematic prioritisation and justification of important freight infrastructure projects is the lack of current and relevant data.

***Goods Movement***

BTRE work on the future freight task in Metropolitan Melbourne indicates a number of interesting features. By 2020, cars will account for almost 80% of the total billion tonne kilometres in metropolitan Melbourne (refer to Figure 2.31). Freight vehicles will make up close to the remainder (not including buses and motorcycles).

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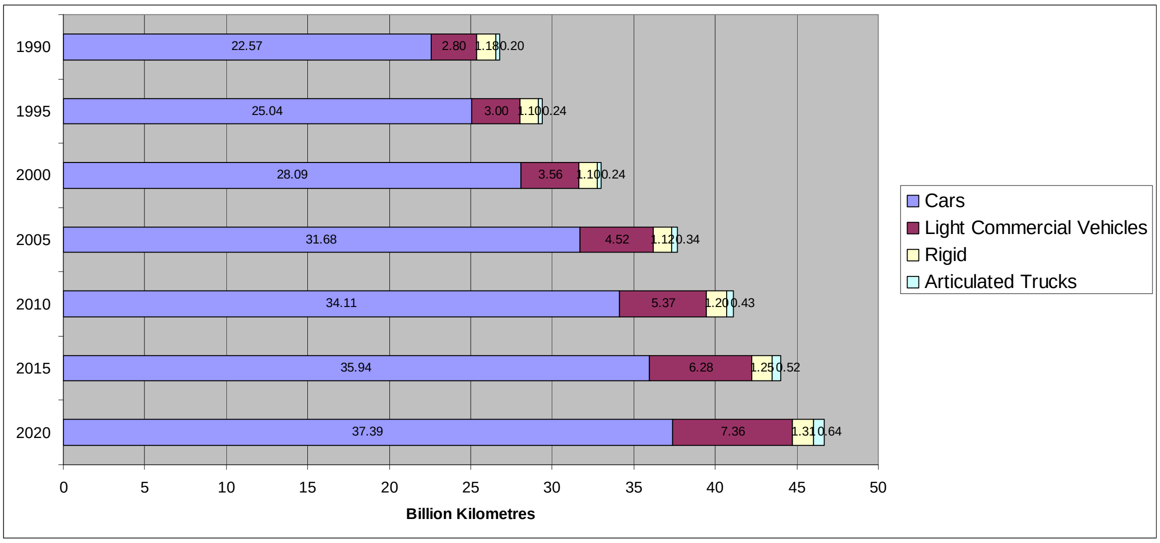
[13] BTRE (2006), Report 112.

[14] VFLC (2005), Freight Forward

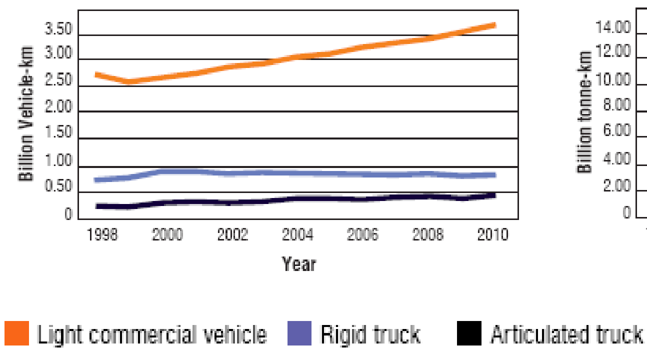
**Figure 2.31 Contribution to Melbourne Traffic 1990-2020**




Source: Recreated from BTRE (2004) Predicting Traffic Growth in Australian Cities

Of these freight movements, most will be undertaken by light commercial vehicles (LCVs), which are forecast to increase from 11% of the total metropolitan kilometres to 16% by 2020. Most freight carried in Victoria is within the metropolitan area and road is often the most practical mode for the majority of this freight. However, there is significant potential to develop intermodal solutions using a combination of road and rail, with freight being shuttled by rail between the port and intermodal terminals. Freight and commercial vehicles comprise only 14% (300,000) of all vehicles in the metropolitan area. Growth in vehicle-km is mostly due to light commercial vehicles (which are increasing both in number and average distance travelled), while growth in tonne-km is mostly due to articulated trucks, where the increased task comes from increases in number and average carrying capacity (see Figure 2.32).

**Figure 2.32 Metropolitan vehicle travel**




Source: DOI (2004), Linking Melbourne

### *Strategic Freight Corridors*

To improve export competitiveness and regional economic development, the Victorian Government continues to foster projects that improve freight access and efficiency along inter-regional and interstate corridors and, where appropriate, to secure funding from the Federal Government through the AusLink program. Rail transport is most suited to bulk freight such as grain and the long-distance movement of containerised freight.

On the following pages a brief discussion is provided about the key observations about freight flows, and freight route choices, associated with two Select Links.

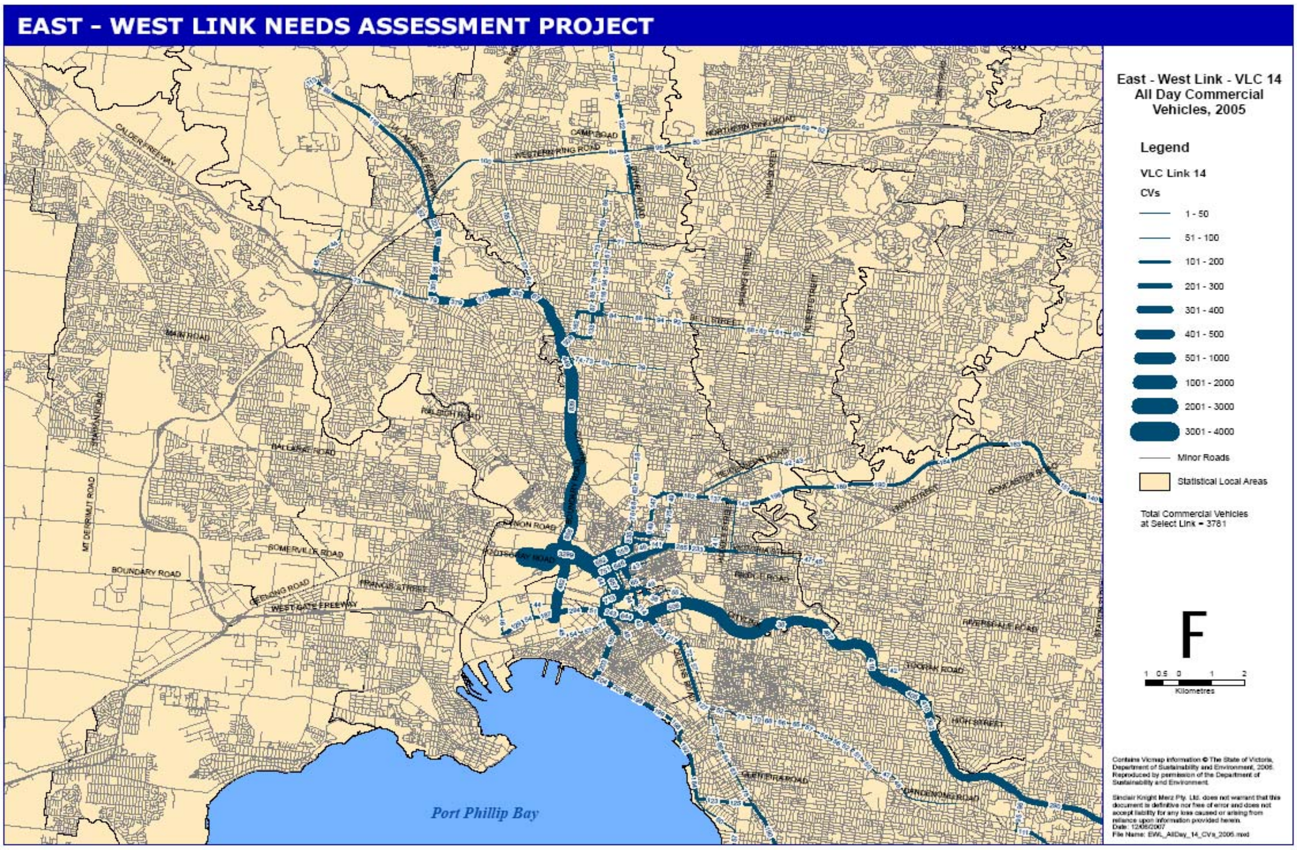
*Appleton Dock Road*

*Location: Northbound south of Footscray Road*

*Freight Volume at Select Link: 3,800 freight vehicles per day*

Approximately 10% of all freight vehicles are using Beach Road to the south east which is an OD route. Freight is predominantly travelling along CityLink with over 500 vehicles travelling east and onto the Monash Freeway towards Dandenong. There are approximately 800 vehicles travelling north along CityLink. There is some distribution along the Eastern Freeway and into the city although this gate is not used by freight vehicles travelling west.

**Figure 2.33 Appleton Dock Road**



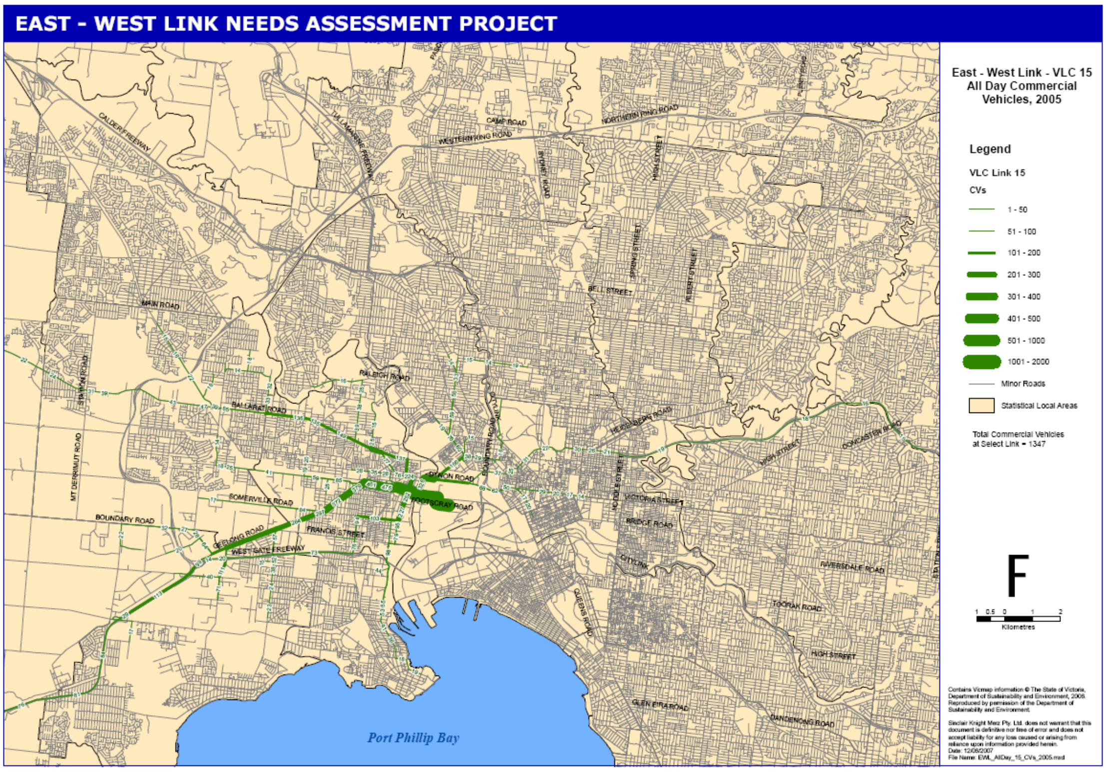

*DockLink Road*

*Location: Southbound north of Footscray*

*Freight Volume at Select Link: 1,300 freight vehicles per day*

Approximately 500 vehicles are travelling westbound along Geelong Road. A further 150 vehicles are taking Ballarat Road and 300 vehicles, Dynon Road. From this gate there are no vehicles using the West Gate.

**Figure 2.34 DockLink Road**




### *Victorian Freight Corridors*

The following is a summary of the strategic freight corridors in Victoria (refer to Figure 2.35).

#### *Eastern Corridor*

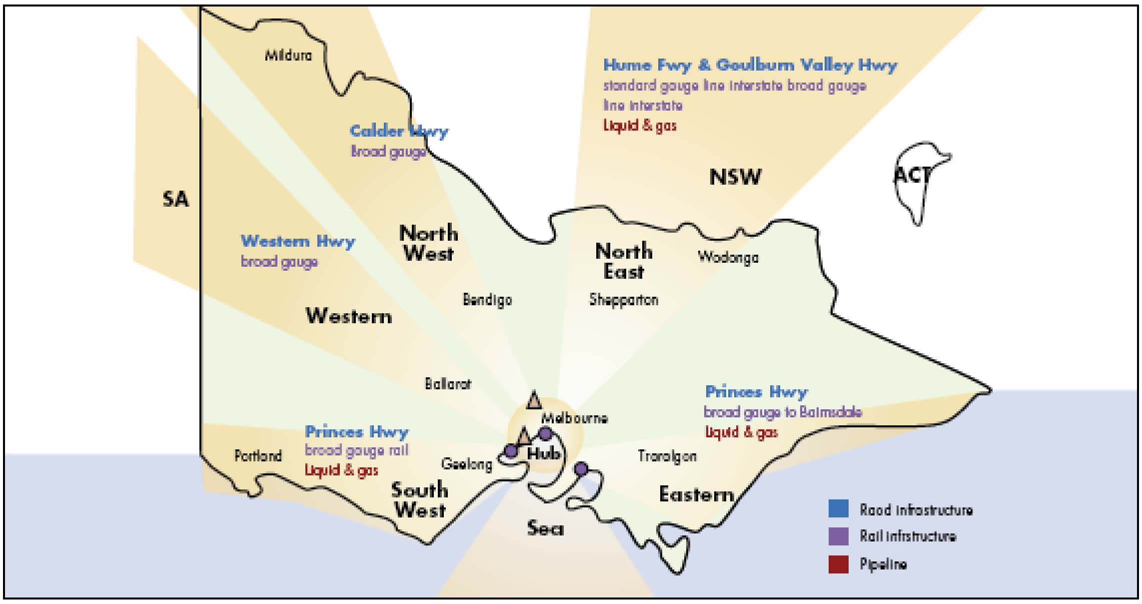
Freight on the Eastern Corridor is dominated by intrastate movements to and from Melbourne, particularly of paper, timber and agricultural products. Some movements go into NSW, but most NSW and Australian Capital Territory (ACT) requirements are serviced via the Hume Corridor. The Eastern Corridor also carries a significant volume of Victoria’s exports including dairy, paper and timber products.

Of the three intercapital corridors investigated in the BTRE information paper, Melbourne-Adelaide will see the most significant modal shift towards road. Over the 20 year period the modal share for road is expected to rise from 80 to 98% of the total task. To some extent this is countered by the significant rail and sea freight task between Melbourne and Perth (with road only carrying about a quarter of the freight task between the eastern state capitals and Perth).

#### *North-east Corridor*

The growth of freight movement in the northern corridor is supported by the most recent work undertaken by the Department of Infrastructure. This analysis encompassed both the intercapital movements undertaken by the BTRE but also forecasts other freight movements which would utilise the corridors. The modelling found that 12.5 million tonnes per annum were carried on the Goulburn-Hume corridor to move from Victoria and 16 million tonnes coming into Victoria. The forecast for the corridor to 2020 sees total freight movements rising from approximately 3 million kilotonnes per annum in 2000 to over 5 million kilotonnes per annum by 2020.

**Figure 2.35 Victoria's Strategic Freight Corridor**




*Source: VFLC Freight Forward: An Industry Perspective on Transport Requirements in Victoria (2005)*

### *Western Corridor*

In the DOI analysis, 12.1 million tonnes of freight is moved on the Western corridor across all modes. The Western corridor is defined as the Western Highway from the SA border through to Melbourne and the interstate standard gauge rail line. The DOI analysis also includes the Henty Highway at Horsham and the Midland Highway at Ballarat. The modal share correlates with the BTRE breakdown and notes the high proportion of rail freight to and from Western Australia.

### *South-west Corridor*

The South-west corridor spans the area from the SA border to Geelong. It includes the Ports of Portland and Geelong and encompasses the South Western, Princes, West, Henty and Hamilton Highways. Rail along the corridor includes the Warrnambool-Geelong broad gauge route as well as the standard gauge rail connection from Portland to Melbourne via Maroon and Gheringhap and the dual gauge connection from Gheringhap to Geelong. The Geelong to Melbourne Pipeline (which also continues to Hastings) is also used to move liquid freight, mostly petroleum.

In 2000, the analysis estimates that 27,694 kilotonnes was moved on this corridor. Of this task shipping accounted for the majority (57.6%) followed by road (26.9%), rail (8.2%) and pipeline (8.2%). Major commodities moving along this route include timber, petroleum products, manufactured goods (from Geelong) and grain.

The analysis forecast a 33% increase in freight on the corridor by 2010 and a further 39% by 2020. The corridor remains second only to the Goulburn-Hume corridor in terms of freight moved now and into the future.

### *Road freight operations by vehicle type*

The three defined freight vehicle classes have substantially different operational patterns, stemming from differences in size and task performed in metropolitan areas. The vehicles used were considered in the following groups:

- Semitrailers and b-doubles ) classified as Heavy Commercial
- Rigid trucks ) Vehicles in VLC model
- Light commercial vehicles

**Semitrailers and b-doubles** are used:

- For the urban ends of interstate movements – between interstate highways and the major freight terminals
- For large deliveries around the city
- For movements of containers between importers, exporters and the port.

These vehicles predominantly use major highways, freeways and arterial roads. They are less manoeuvrable, and less suited to smaller and narrower streets. The general conclusion is that they do not use smaller and local streets unless this produces worthwhile time savings[15]. Operations though relatively narrow and congested arterial roads in the inner west (particularly Yarraville) are a concern in terms of residential amenity and potential for becoming more severe from growth in port traffic.

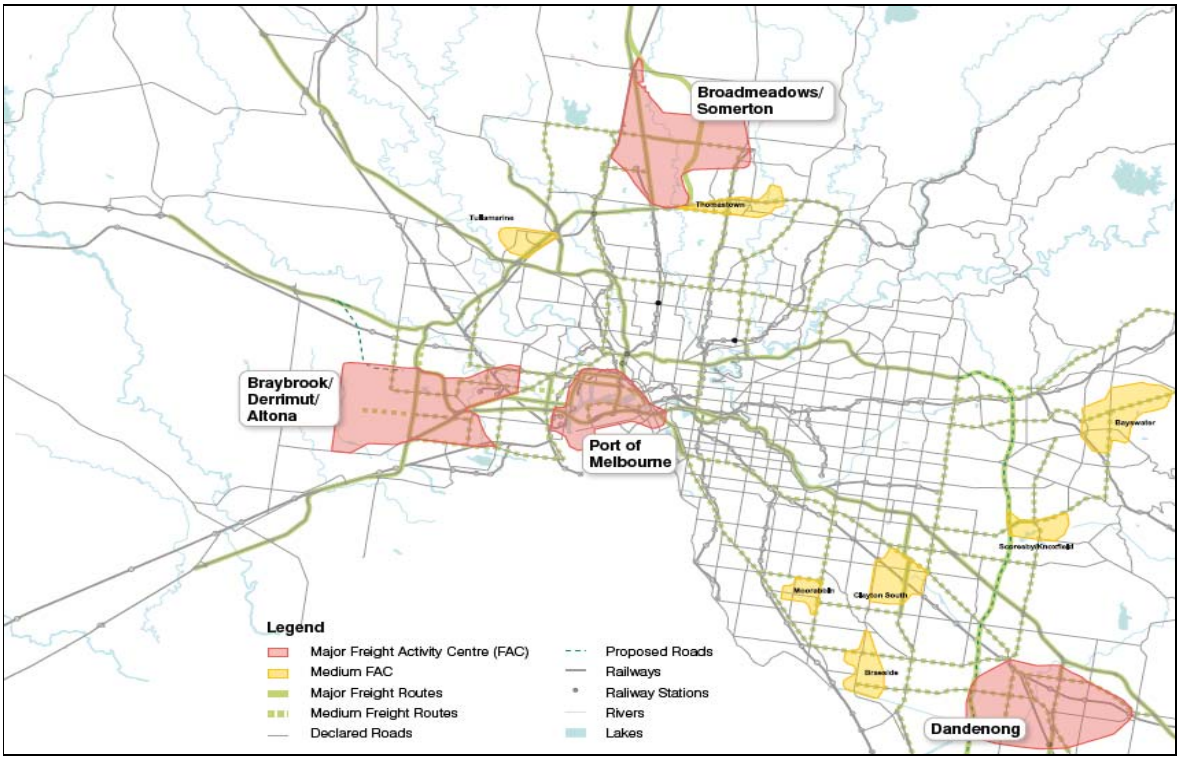
The movements of these vehicles are predominantly between major freight generating nodes and terminals.

- Major warehousing and industrial suburbs:
  - Altona – Laverton North (also two intermodal terminals)
  - Dandenong – South East (intermodal terminals under consideration)
  - Somerton – Coolaroo (also one intermodal terminal)
- Freight nodes and terminals:
  - Port of Melbourne and Dynon
- Smaller industrial areas:
  - Bayswater
  - Clayton South
  - Braeside
  - Scoresby / Knoxfield
  - Moorabbin
  - Thomastown
  - Tullamarine

These vehicles also undertake deliveries to dispersed delivery locations, including major shopping centres and construction sites.

**Figure 2.36: Freight Routes and business / industrial areas**

[15] For example, Melbourne port container origin destination study (DOI, 2003).




Source: East-West Link Needs Assessment Study Overview by Sir Rod Eddington (2007)

**Rigid trucks** are used for a wide range of medium pick up and delivery tasks, ranging from palletised goods for manufacturing, assembly and processing plants through cartons to smaller retailers to collection and disposal of waste. Many are based at depots in the major warehousing and industrial suburbs listed above, typically visiting these depots each morning and evening for freight exchange. They are also highly utilised in building development and construction, a growing industry particularly in times of economic growth.

Rigid trucks undertake deliveries in all suburbs, with density of operation proportional to population density (number of deliveries and pickups); presence of freight origins and destinations (shopping centres, assembly and processing plants), and convenience of the route for connection from present location to next destination.

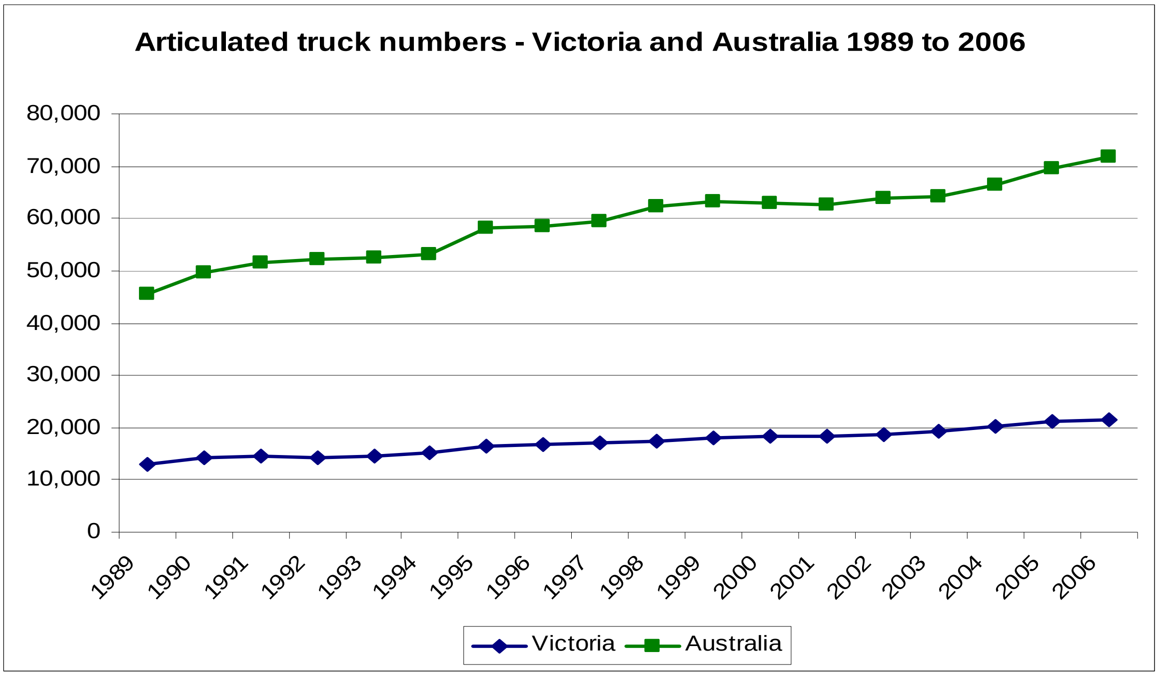
These vehicles predominantly use arterial roads, but will use freeways and highways where these provide quicker journey times or easier driving conditions and local roads where necessary for specific site access. They will use local streets for routine running if worthwhile time savings result.

**Light Commercial vehicles** and similar four tyred vehicles less than 2.5 t have widely dispersed operational patterns, visiting nearly all premises, including residential, retail, offices and industrial. Their operational patterns are very similar to cars and derivatives, being proportional to residential population density, employee density and the convenience of routes from present location to next destination. The density of operations is clearly proportional to residential and employee density. There is often variation with the way light commercial vehicles are counted so it can be difficult to identify all these movements as they are similar to cars.

***Trends in vehicle sizes, numbers and operational patterns***

There has been steady growth in the numbers of articulated vehicles registered in Victoria (and similar trends in the rest of Australia), as shown in Figure 2.37 below.

**Figure 2.37 Articulated truck numbers – Victoria and Australia 1990 – 2006**

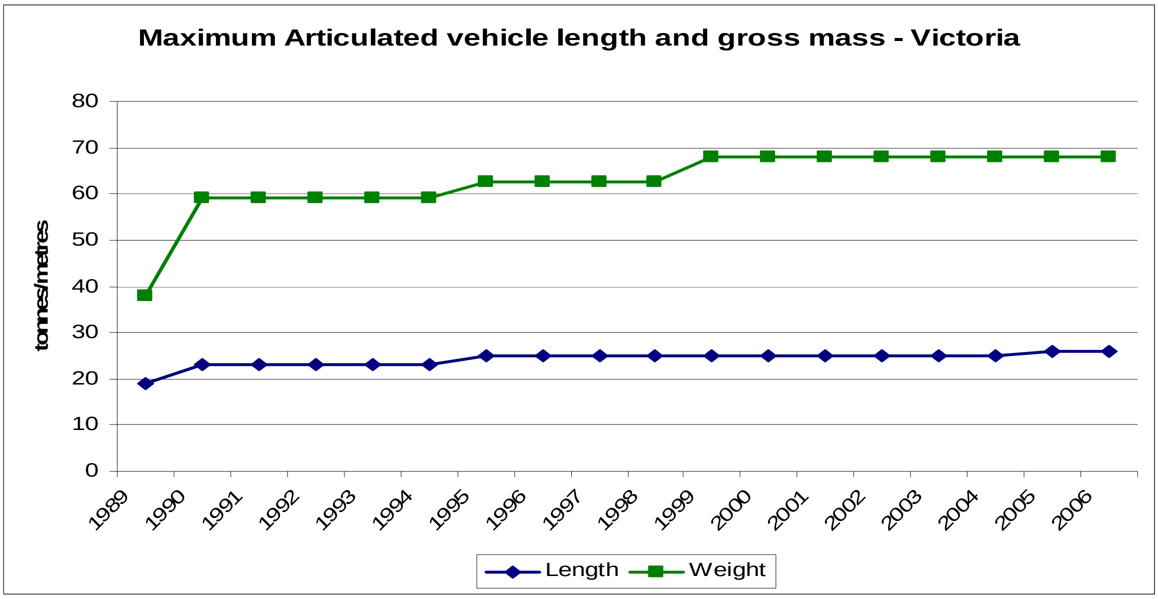



Source: ABS 9309.0 and ABS 9303.0 Note data for 1990, 1992 and 2000 was unavailable. An averaged of the preceding and following years is shown for these years.

This steady growth in vehicle numbers contrasts with the substantial growth in the road freight task generally accepted, with doubling between 2000 and 2020 a commonly accepted forecast[16]. The explanation for this apparent contradiction, lies in the increasing average vehicle size and mass (b-doubles were first allowed in 1990) and greater utilisation throughout the 24 hours of the day (refer to Figure 2.38).

[16] See, for example BTRE (2006) Freight measurement and modelling in Australia, Report 112 and NTC (2006) Twice the task – a review of Australia's freight transport tasks, both of which set out the forecast doubling of task between 2000 and 2020.

**Figure 2.38 Maximum articulated vehicle length and gross mass – Victoria**



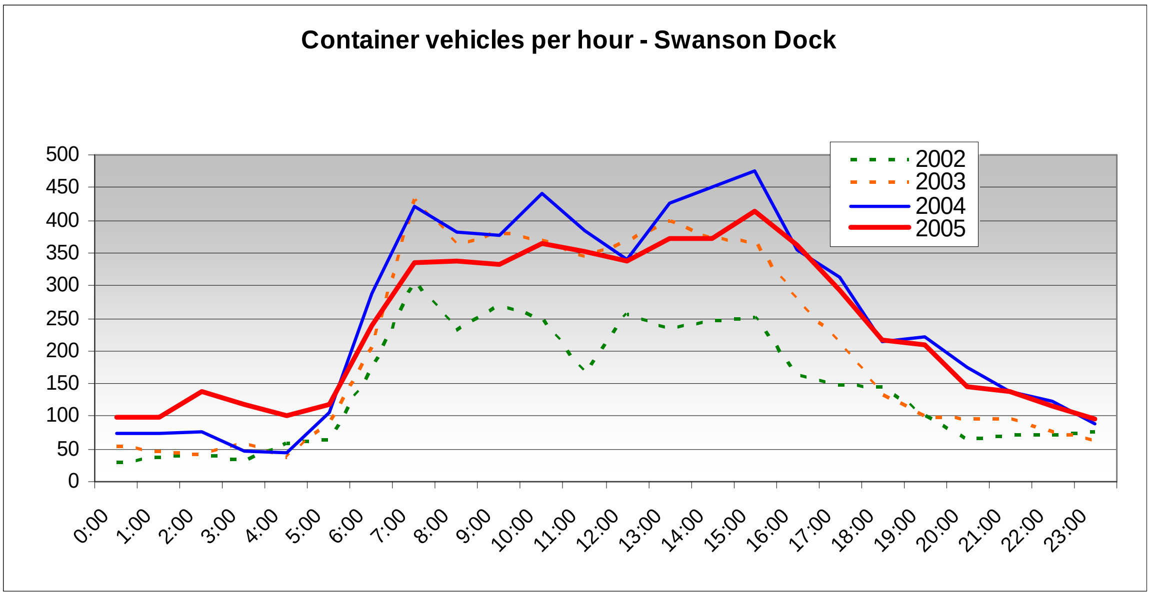

Source: VicRoads discussions, Austroads Review of Mass Concession schemes for heavy vehicles in Australia and New Zealand (2006). B-doubles introduced in 1990, and Higher Mass Limits in 1999.

### *Port Freight Vehicles*

Between the hours of 7am and 6pm there are over 300 container vehicle movements per hour. This peaks at 4pm with just over 400 movements per hour. There has been a continual increase in the number of hours per day the port is busy with a significant increase in the past three years in the time periods 05:00 – 07:00 and 18:00 – 21:00. The numbers of heavy trucks in use throughout the 24 hour day is much more even than light vehicles, as shown in Figure 2.39.

There is scope to significantly reduce the number of truck movements through a better capacity utilisation of trucks, in other words, demand management. The Port of Melbourne container origin destination study, which found that about 36 per cent of trucks observed were not carrying any containers at all, and the average TEU carried was estimated to be 1.07 TEU/vehicle against a vehicle TEU capacity of 2.12. This equates to a container vehicle utilisation rate of just less than 51 per cent. Subsequent studies have shown little change in empty running of container trucks, although the average number of containers per truck has increased, mostly as smaller rigid container truck numbers decline and the numbers of b doubles and super b doubles increase.

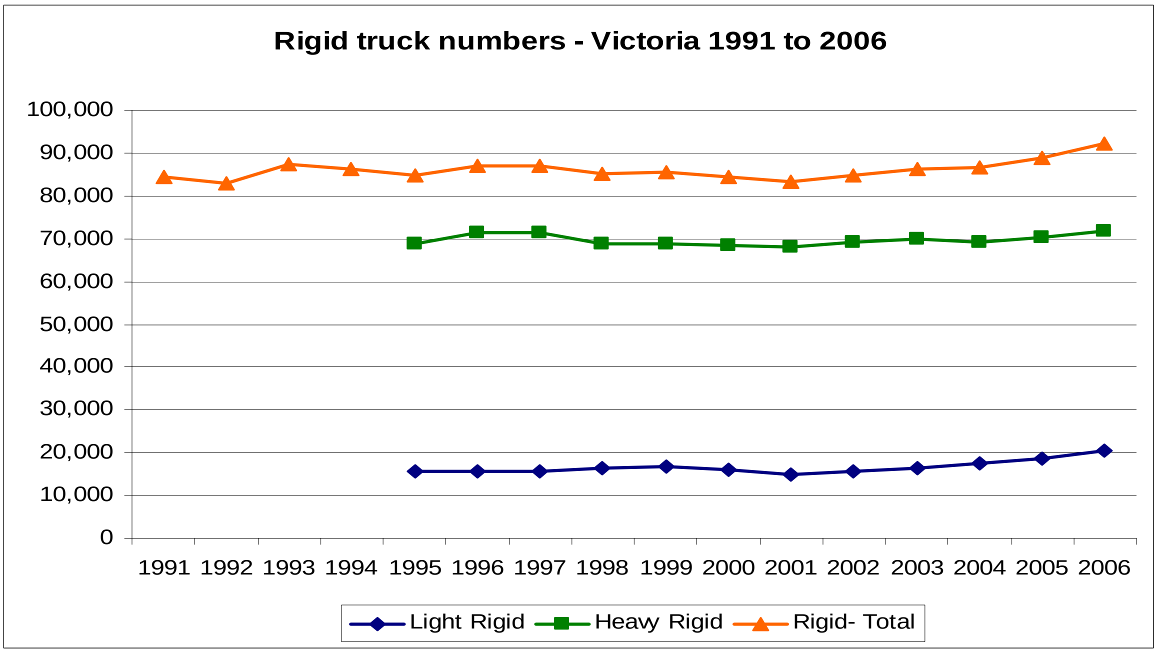
**Figure 2.39 Trends in port truck utilisation 2002 – 2005**




Source: POMC Submission to VCEC Draft Report into Managing Transport Congestion May 2006

Rigid truck numbers overall have been generally steady, with small increases in light rigid truck numbers and little change in heavy rigid truck numbers. Figure 2.40 shows rigid truck numbers from 1991 to 2006. Subdivision into heavy and light rigid trucks was not available before 1995. This chart commences in 1991, as there were major changes in vehicle classification definitions in 1990, which reduced the number of vehicles classified as rigid trucks in Victoria from some 200,000.

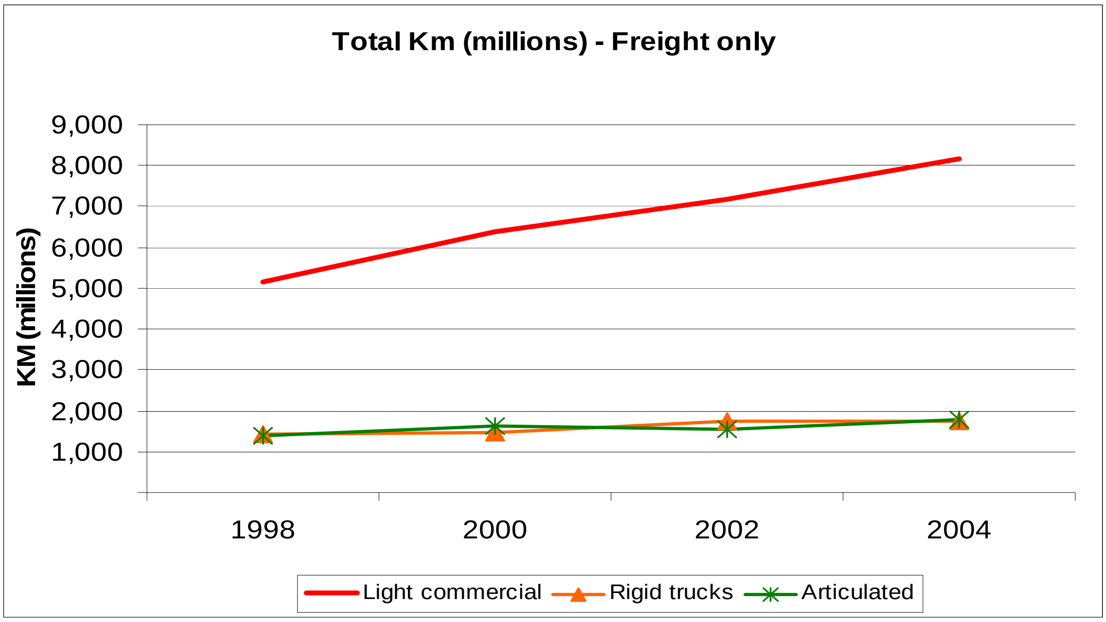
**Figure 2.40 Rigid truck number trends – Victoria 1991 – 2006**




Source: ABS 9309.0 and ABS 9303.0. Separate reporting of light and heavy rigid trucks was not available prior to 1995. Note that data for 2000 was unavailable, and an average of the preceding and following years has been shown.

Light commercial vans have shown the greatest growth of the three categories of freight vehicles considered here, and these trends are expected to continue for at least 10 years with increasing availability of internet purchase with individual order fulfilment and delivery and continuing increase in Just In Time business strategies. This increase comes from two aspects – more courier vans registered, and more kilometres driven on average, shown in Figure 2.41.

**Figure 2.41 Total vehicle kilometres driven – freight vehicles in Victoria**




### *2.3.3 Rail Freight*

The capacity of the rail network is determined by the capabilities of the rail freight terminals[17] as well as the capacity of the tracks/network. Melbourne's rail freight operations are focussed on:

- Receipt and despatch of long intermodal (container) trains to and from interstate capitals from South Dynon, SCT Altona and North Dynon Agents' terminals. These trains traverse the standard gauge interstate access corridor via Footscray, Laverton and Geelong to the west, and Footscray, Sunshine and Broadmeadows to the north. CRT's bulk polymer trains follow similar patterns from its Altona terminal.
- Export container trains, which mostly operate on broad gauge tracks between country Victorian and southern NSW locations and the port and Dynon rail terminals.
- Export and domestic bulk grain trains, which operate between grain growing areas in Victoria, NSW and South Australia to the Appleton Dock dry bulk terminal. Some Geelong-bound grain trains pass through Melbourne.
- Specific commodity trains to and from Victorian and interstate locations. This includes:
  - Steel to and from interstate and Victorian locations, requiring transfer between gauges, carried out at the Steel Terminal, just west of the Melbourne CAD
  - Pulp and paper between Gippsland and the port, which share track with passenger trains and pass through the heart of the rail network between Richmond and North Melbourne stations including Flinders St and Southern Cross (Spencer St) stations and the city viaduct.
  - Logs and woodchip from East Gippsland which pass through Melbourne en route to Geelong

[17] DOTARS, National Intermodal Terminal Study: Final Report, Feb 2006

    - Cement, sand and stone to and from various locations, and some mineral ores and products.
    - These trains generally operate between commodity specific loading and unloading terminals.

- Intrastate container trains containing palletised general freight, regional supplies, parcels and smalls. These mostly operate from Dynon and North Dynon Agents' terminals on broad gauge to relatively unsophisticated intermodal terminals in country locations.
- There have been attempts to establish "port shuttle" trains between the stevedore rail terminals and metropolitan intermodal terminals. The situation and history of these has been mixed:
    - CRT operated smaller port shuttle trains from its Altona terminal, but withdrew this service early 2007 citing unsustainable losses stemming from inadequate volumes and pathing issues preventing the desired number of round trips per day.
    - There are plans to operate a regular port rail shuttle between both Swanson Dock rail terminals and Austrak's Somerton terminal, with some suggestions that operations could commence during 2007.
    - DOI investigated the potential for an intermodal terminal at Greens Rd Dandenong with port shuttle rail services, but development of this potentially feasible project has been influenced by concerns about the size of the Dandenong site as well as rail service levels during the Dandenong corridor triplification project.
    - DOI is currently investigating potential for an intermodal terminal in Geelong, which also may have potential for port shuttles, although domestic commodities were identified.

Historically, there were many rail connected plants in Melbourne's industrial suburbs, particularly the inner ones. Very few of these still have operational rail connections, and even fewer are still in use. Some examples of sites which have disconnected rail connections in recent years (in favour of road transport) include Amcor Fairfield, Pilkington Dandenong, and ACI Spotswood.

It is apparent that Melbourne's rail freight operations nearly all operate between terminals in Melbourne and interstate or country locations. There are virtually no freight rail operations entirely within the urban area. The trends over the past decades have been away from rail and to road for these operations. Rail dominates only on longer corridors – east coast to Perth, Adelaide to Darwin. Even on the nearly 2,000 km Melbourne – Brisbane route, rail's share of land transport was 31.4% in 2001, and has not changed significantly since then.[18]

There is uncertainty as to whether rail freight in urban Melbourne will make gains in mode share – the trends have been in the other direction for many years, despite increasing road congestion, urban sprawl and community desires to "get freight off the road".

The Dynon hub consists of two separate container terminals, each of which serves a distinct market:

- North Dynon – Although the North Dynon terminal has both broad and standard-gauge rail connections, primarily it has historically served Victoria's intrastate rail network. However, with the advent of Pacific National, it has now become an integral part of that company's operations. In the old Agents Area, VicTrack leases out a series of land parcels with the main ones being used as a 'common user' terminal for interstate

[18] BTRE (2006) Freight measurement and modelling in Australia Report 112, Table 6.1.

operators, and a paper logistics operation. The main container terminal has 10 rail tracks of about 500m in length, eight of which are used for freight loading and unloading.

- South Dynon – The South Dynon terminal is the principal hub of Pacific National's interstate rail network. The total paved area of the terminal is estimated at 25,000$m^2$, with total throughput estimated at 680,000 TEU per annum. There is some movement of cargo from the terminal to the port of Melbourne (by road), but the majority of the cargo passing through the terminal has its origin or destination in Melbourne. The terminal has six rail tracks, all of which are used for freight loading and unloading. These tracks are much longer than those in the North Dynon terminal: four tracks of 850m in length and two of 1200m. It is estimated to handle approximately 80 trains per week.

There are also two primary rail terminals within the dock precinct:

- West Swanson – Located on Coode Road West on the western side of Swanson Dock, it is operated by P&O Transport Australia. The fully paved site area is 103,000m2 and contains approximately 9,000m2 of covered storage area. During the 2004 calendar year, the site handled over 44,000 TEU (19% empty) via rail and over 135,000 TEU (39% empty) by road. This task was handled by more than 105,000 trucks and an average of 19 trains per week. The average train capacity was 45 TEU and the maximum length of train which can be accommodated within the terminal gate was 565m. Trains longer than 565m are split at a siding outside the gates of the terminal. Train lengths within the port precinct remain an issue for this terminal operator.

- East Swanson – Located on the eastern side of Swanson Dock, it is operated by Patrick. The fully paved site area is 40,000m2. It is estimated that this facility handles 85,000 TEU per annum via rail and approximately 600,000 TEU by road. The trackwork has recently been expanded to two tracks capable of receiving a maximum train length of approximately 1500m. Total rail containerised cargo throughput is estimated at up to 100,000 TEU.

In addition to the preceding terminals that are all located in the port precinct, there are a small number of satellite facilities as follows:

- Somerton – Operated by P&O Ports, it is located on the corner of Settlement Road and the Hume Highway at Somerton. It began operation in July 2005. The facility includes 60,000$m^2$ of paved area and 160,000$m^2$ unpaved area and provides intermodal services and empty container storage, as well as a number of large warehouses. Between July and September 2005 the facility handled only about 1,000 international shipping containers of which almost 50% were empty. The typical freight task involves imported containers being moved via road to companies locally in Somerton and taken to the Port for export. The site has four dead rail sidings each 750m, and could handle two 1,500m trains simultaneously, each split in two. However, as a result of small start up volumes, no rail companies currently use the site. It is predicted that within 5 years, given the right environment, the site could be handling up to 100,000 TEU. The operator intends to utilise the facility as one end of a rail shuttle service to the port of Melbourne as well as attracting domestic rail services. For this to occur, changes will be required in the relative costs between road and rail transport of containers over the relatively short distances involved. Direct rail connections to interstate (Sydney/Brisbane and Adelaide) corridors are available. The connection to the port requires shunting, as the installed turnouts are to the north only.

- Altona North – Queensland Rail manages the intermodal facility which has road access from Barnes Road. This facility comprises 8,600m2 paved and 647,000m2 unpaved areas. Recent figures indicate that the facility handled around 35,000 TEU via rail (10% empty) and almost 40,000 TEU by road. The road freight task was handled by 39,400 trucks. There was an average of 9 trains per week over the year with a median capacity of 40 TEU. Trains of up to 560m can be handled on site. It is expected that the cargo throughput will more than double in five years.

- Altona – SCT operates an intermodal facility located at Westlink Court in Altona, predominantly handing interstate domestic freight. It consists of 15,000m2 paved, 589,000m2 unpaved, and 55,000m2 of covered storage area. The facility caters for interstate containerised and palletised. In the 2004-05 financial year, the facility moved around 13,000 TEU and almost 408,000 tonnes non-containerised goods by rail as well as almost 9,000 TEU and 728,000 tonnes non-containerised by road. 42,300 trucks managed the road freight task into and out of the facility and an average of 3.2 trains per week managed the rail freight task. Average train capacity was 233 TEU and was limited to 1,500m. Volumes handled at the facility are growing slowly. Non-containerised general cargo is forecast to increase at a faster rate.

Whilst the market is well serviced by railhead terminals, the issues associated with track capacity and capability are much more significant. The major freight lines between the capital cities are managed by the Australian Rail Track Corporation and access to the tracks is controlled by a track access regime with associated charges designed to recoup the cost of maintaining the infrastructure. As part of this network ARTC controls access to all the major rail freight terminals in Melbourne including the Port, and also operates the track owned by POMC within the port boundary. The major capacity of the network can be described as follows:

- Port access tracks – single track link allowing only one train movement at a time into or out of the port precinct
- Sims Street Junction – the point where trains from the Dynon area container terminals merge with trains from the port.
- Bunbury Street Tunnel – two dual gauge tracks used by all interstate and many intrastate trains to the intermodal terminals and the port
- Independent freight tracks – these feed trains to the main lines in the vicinity of Sunshine. There are two standard gauge tracks (interstate trains) and two broad gauge tracks (intrastate trains)
- The interstate rail mainline network – generally consists of single track with crossing loops that delivers a nominal capacity of two trains per hour depending on the closeness of the crossing loops.
- The intrastate rail mainline network – a mixture of single and double tracks with the double track delivering in the order of 3 trains per hour in each direction depending on the closeness of safeworking points
- The metropolitan train network – the system predominantly relies on unidirectional tracks that are typically designed for up to 20 suburban passenger trains per hour. Freight trains must share these tracks with suburban trains and are not generally permitted to operate during the suburban peak periods. This is of particular concern on the Frankston (Long Island and the future Port of Hastings), Dandenong (Gippsland) and Geelong (broad gauge) lines.

### 2.3.4 Goods Demand

Nearly all deliveries in cities worldwide are made by road, underlining the fundamental importance of road infrastructure for efficient freight operations. The only exceptions are large bulk commodity and containerised movements to ports; agricultural and resource commodities to bulk material processing sites, and a few movements between intermodal terminals.

Key influences on demand for freight services are increases in demand for exports such as minerals, logs and other agricultural production. There is an emerging trend for the substitution of domestic production with imports as consumer goods and raw material inputs, (VFLC, 2005). At the same time the domestic construction and housing industry has seen a growth that in turn increases demands for civil and building products.

Our society has become accustomed to shifting time and efficiency expectations to the extent that "7/11 stores should all become 7/24 stores". These visible convenience stores are the obvious parts of a society that is now staying awake longer to compete. The emergence of technology, the drive for profits and a growing expectation by consumers all tend to drive this philosophy.

There is a clear and growing replacement of domestic supply with international sourced supply. This sees a changed impact on the utilisation of infrastructure. The impact of this trend will be a growth of containerized, imported products through the port of Melbourne and a reduction of products moving from local manufacturer to retailer along regional supply routes. It will also result in increased inbound warehousing near the port given the need to clear containers quickly from the port terminals.

At the same time the domestic construction and housing industry has seen a growth that in turn increases demands for civil and building products. The number of housing construction starts in Victoria is expected to rise over the next few years (refer to Table 2-14[19]). There is an enormous task to therefore move all the components required to the building sites and also an associated increase demand on the roads due to the mobility needs of the labour force.

**Table 2-14 Rate of Housing Construction in Victoria**

| Year | New dwelling commencements |
|---|---|
| 2006 (a) | 39320 |
| 2007 | 39350 |
| 2008 (predicted) | 42170 |
| 2009 (predicted) | 43840 |

It is estimated that each new house requires 28 truck movements to the site.[20] With the current growth in housing construction, there are over 5000 trucks movements in Melbourne each day servicing housing construction, not including increased activity in tradesmen servicing this construction activity.

[19] Economic Group http://economics.hia.com.au/factsForcasts.aspx

[20] www.pulse.buildingcommission.com.au, Building work measures.

With the continued growth in housing there will be increased demands on the collection and then moving of household waste to landfill/recycling from one side of town to the other.

The Municipal Waste Management Data Report[21] discussed the household waste movements within Melbourne. The following movements relate to eastern areas utilising western waste management facilities:

- 186 trucks per weekday (2 way) to Organics Processing Plants;
- 421 trucks per weekday (2 way) to Recycling sorting facilities; and
- 1611 trucks per weekday (2 way) to Landfill sites.

The growth of the population will also increase general demand on consumables such as food and clothing. This in turn drives a freight and logistics task geared towards the restocking of supermarkets and shops. The majority of the major freight and logistics warehouses are located in the western suburbs (Altona and Laverton) but the greater bulk of the city's population is orientated towards the eastern suburbs. It is not possible to generalise about the reason for the high concentration of distribution activity in the west as this will be driven by individual company decisions, but we can suppose that the decisions will be driven by issues such as:

- Ready availability of the large land plot sizes required
- The price of land
- A desire to centralise functions in order to obtain benefits from the economies of scale
- Proximity to major freeways and rail links
- Proximity to other warehouse facilities which deliver to each other
- The cost of transport.

Typical transit times for freight vehicles around Melbourne can be calculated at around 40 km/h for most journeys on freeways and major arterial roads, unless the truck is caught in peak hour or other congestion. The largest source of delays and inefficiency for freight vehicles is caused by queues at major facilities, including supermarket and other distribution centres; rail and stevedore terminals and container parks. There are also substantial periods of downtime when vehicles are unable to obtain desired timeslots at major terminals and distribution centres, and are forced to wait for their allocated slot. Many of the queues in Coode Road relate to this.

***Linked Trips***

Most of the road transport companies are seeking to improve the efficiency of their vehicle fleet, and most are tackling this by seeking to allocate the most efficient vehicle type to the nature of the task. This generally results in the creation of separate vehicle fleets for different tasks. Larger vehicles are used where multiple containers are required to make the same journey, such as depot–stevedore transfers. Smaller vehicles such as standard semitrailers are used for one-off container moves, such as to and from exporters and importers. The job allocation systems used by small and medium road transport companies are generally manual,

[21] Northern Regional Waste Management Group, Municipal Waste Management Data Report 99/00-03/04

based on job tickets, driver run-sheets and, generally, telephone and fax communication with clients, stevedores and others in the movement chain. There is growth in use of electronic systems, most commonly email but from a low base.

Even where more sophisticated vehicle scheduling systems are in use, optimum results are limited by issues at individual locations preventing tight scheduling, lack of notice of requirements by users and, in some cases, inability to book desired stevedore slots. Time saving and reductions in linehaul and fleet costs can be substantial if trucks carrying exports to the port can backload and leave the terminal with an import container. However, backloading is difficult to coordinate across the road transport sector involved in port container transport, minimising vehicle utilisation overall.

A new 'Transport Exchange'[22] initiative has been established that allows each member organisation to view contact information of other members' freight and capacity in real time. It is a live database where members log and search for available capacity or freight. The 'Transport Exchange' operates on similar principals to other 'exchanges' such as the Australian Stock Exchange or wotif.com. The process of matching freight with capacity is done via the internet, or by members using the 24/7 call centre.

The need to manage the growing metropolitan freight task has significant implications for infrastructure development and operations in and around the port and its transport linkages to the broader Melbourne metropolitan area, (DOI 2003).

Around 77 per cent of international containers that pass through the Port of Melbourne have origins/destinations within the Melbourne metropolitan area. This figure is expected to increase to 84 per cent by 2035.[23] At present, every single container leaving the port with a city destination is carried by road – confirming the impact on the city's road network of the port's growth. The significance of rail increases dramatically as the distance from the port increases, with a 93 per cent share of container transport when the journey is greater than 250 km.

The predominant journey type for empty containers is between interim locations, by a significant margin, (DOI, 2003). This is due to the greater number of moves required to relocate empty boxes, as directed by shipping line requirements. In terms of vehicle utilisation, the results show that approximately 36 per cent of the container trucks observed were not carrying any containers at all. This figure tends to be higher at around 40 per cent for the smaller vehicles, and lower at around 27 per cent for the larger vehicles. Although the relatively high portion of empty slots can be explained in part by weight limits, the overall low-vehicle utilisation is illustrative of the inefficiencies in the transport chain.

The greater utilisation of super B-doubles and B-doubles may reflect the type of work these vehicles are doing, and the information processing sophistication of their owners, generally larger transport companies, including those associated with stevedores. Also, the high capital value of these vehicles means that they are unlikely to be purchased unless there is a specific need where high utilisation will be achieved. By contrast semitrailers and rigid trucks are more likely to be operated by smaller road transport companies or owner drivers, who have less capability to schedule and link moves, and are more frequently involved in end user pick-up and delivery. Rigid truck combinations are more frequently used for empty container relocation, and evidence suggests that these boxes typically involve large numbers of short moves, with less emphasis on efficient vehicle utilisation and scheduling.

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[22] http://www.fillmytruck.com.au/

[23] DOI (2006), Melbourne Port@l Strategy: Consultation Draft, State of Victoria, Melbourne

*Port related freight movements*

Port freight issues are generally better understood[24] than more diffuse general freight, probably due to larger and more sustained growth rates, high visibility of containers and the lack of specific freight routes between the port and western industrial suburbs. This last issue has sparked ongoing community concerns, with various truck bans on certain roads on evenings and weekends.

Relatively high proportions of heavy vehicles travel in and out of the Yarraville area every day to the surrounding local petrochemical companies, port, shipping container parks and freight depots. The local community is concerned about health, amenity and safety impacts associated with the heavy vehicle traffic.

The State Government established the Yarraville Working Group to develop sustainable solutions to address the concerns of the community while balancing the needs of industry. The Yarraville Working Group has adopted a multi-faceted and co-ordinated approach to dealing with issues.

Actions and programs to provide both short and long term solutions include:

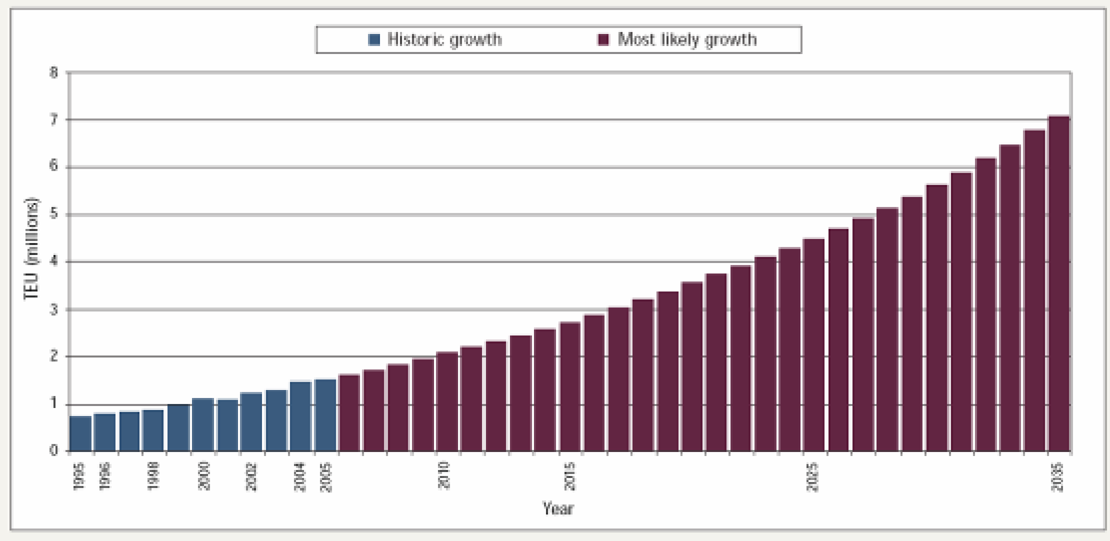
- Investment in road and rail infrastructure;
- Land use and transport planning;
- Monitoring and changing traffic behaviour patterns; and
- Environmental and health surveys.

Night time and weekend truck curfews operate along Francis Street and Somerville Road, prohibiting all non-local heavy vehicles. The curfews are designed to balance the needs of industry with the concerns of the community. All non-local heavy vehicles with a Gross Vehicle Mass Rating of 4.5 tonne or more are prohibited from using Francis Street and Somerville Road between 8pm and 6am Monday to Saturday and between 1pm Saturday and 6am Monday.

Today, international container trade through the port increased from 733,000 TEU’s in 1995 to 1.510million TEU’s in 2005[25]. This is an average annual growth of 7.5%, refer to Figure 2.42. Forecast international trade throughputs for the port are expected to grow in relation the changes in Victorian economic activity.

[24] The Melbourne port container origin destination study (DOI, 2003) provided a substantial depth of understanding on many aspects of landside port transport issues.
[25] Port Development Plan 2006-2035 (Draft Consultation Draft, Aug 2006)

**Figure 2.42 Projected international trade growth at Port of Melbourne**

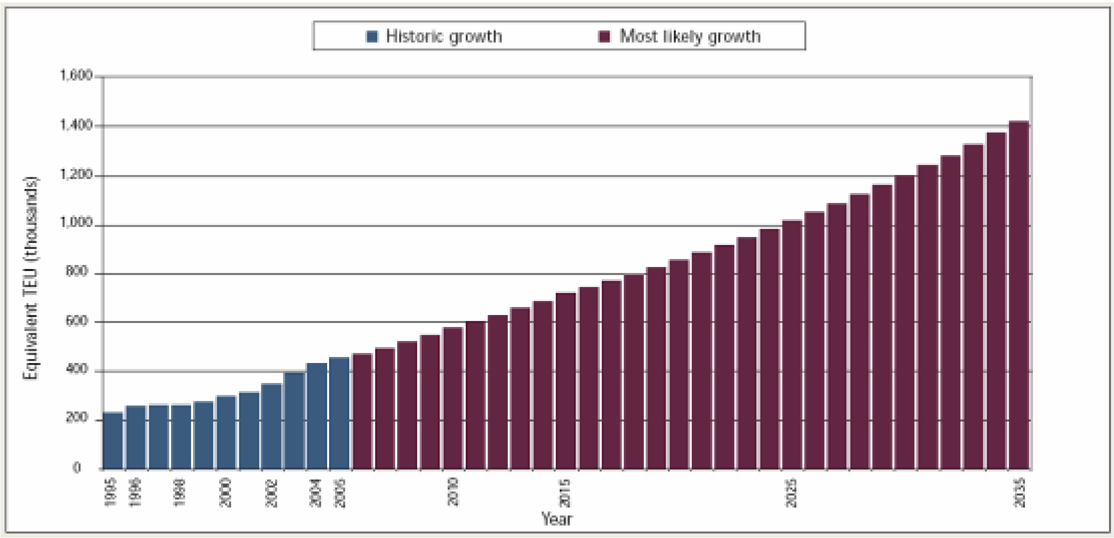



This trade is predominantly handled through the terminal operations at East and West Swanson Dock. The main truck access point to these facilities is via Footscray Road. There are 'on dock' rail intermodal terminals with direct connections to the interstate main lines and transfers to the Dynon rail terminals are via a road movement along Dock Link Road.

In addition to international trade, the Port services Bass Straight trade between Victoria and Tasmania.

Between 1995 and 2005 Tasmania's container trade increased from 153,000TEU to 332,000 TEU - an average annual growth rate of 7.7%, (refer to Figure 2.43). This trade is expected to grow roughly in alignment with the level of economic activity in the Victorian economy.

**Figure 2.43 Bass Strait trade growth at Port of Melbourne**




Bass Straight ships are serviced at Webb Dock located in Port Melbourne. All freight is moved by road transport which must access the arterial routes through the industrial areas of Fishermans Bend. There is currently no rail connection but consideration is being given to re-establishing a previous railway as a basis of servicing future growth at this terminal.

A summary of the commodities handled at the Port of Melbourne, historic growth rates and their predominant landside transport arrangements are shown in Table 2-15.

**Table 2-15 Commodities handled at Port of Melbourne**

| Commodity classification | Volume (2006) | Average Annual Growth Rate (AAGR) | Landside transport arrangements |
|---|---|---|---|
| International containers and interstate containers on international ships | Approx 1.7 million TEU | 7.9% | 79% road<br>21% rail |
| Tasmanian trade | Approx 434,000 TEU equivalents (consisting of containers, motor vehicles, breakbulk and Wheeled Cargo Carrying Units) | 5.5% | Virtually 100% landside movements by road |
| Motor vehicles | 286,000 equivalent units | 10.8%. | Virtually 100% by road from the port.<br>A few move interstate by rail to/from Dynon |
| Break bulk (mostly timber, iron and steel) | 840,000 mass tonnes | 2.9%. | Most landside freight by road |
| Dry bulk (eg cement, grain, fertiliser, sugar, gypsum, stockfeeds) | Around 3.13 million mass tonnes | 3.9%, excluding new grain trade commencing in the analysis period. | Much handled by conveyors and pipelines within the port area, with some distribution to end users by rail but mainly by road. The exception is export grain which is moved predominantly by rail. |
| Liquid bulk (petroleum products, chemicals) | around 4.1 million mass tonnes | -1.7% | Nearly all handled by pipeline between the port and depots and then distributed almost exclusively by road tankers to end consumers (eg petrol stations) across the metropolitan area and country Victoria |

Only about one quarter of containers move direct between exporter and port, or port and importer with the balance moving via various interim locations[26].

Containers are estimated, on average, to have eight separate journeys between departing the port as an import box and arriving back as an export box. (Three from port to importer; one to and one from a container park, and three more from exporter to port).

The findings of the 2002 (report submitted 2003) container origin destination study showed that the most important locations where import containers are unloaded (accounting for nearly two thirds of all import containers) were, in order:

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[26] SKM (2003) Port of Melbourne Container Origin Destination Study

- South East (Dandenong)
- Altona – Laverton North
- Broadmeadows – Somerton.

Development patterns since then suggest that these areas would account for a higher proportion, and that Altona – Laverton North is likely to have overtaken South East Dandenong.

The locations where export containers were loaded were much more dispersed, with more important locations including:

- Western Victoria (about 30%)
- Inner Melbourne and the port (about 20%)
- Altona – Laverton North (10%)
- South East Dandenong (10%)
- NSW (predominantly Riverina) (10%)
- North-East Victoria

Around 11% of container moves were to and from container parks, located in inner and outer western suburbs and near the port. Access to the port for road vehicles is an important consideration. The Port of Melbourne Corporation (POMC) has identified a number of strategic roads in the vicinity of the port that it sees as being critical to the efficient operation of the port, shown in Figure 2.44.

**Figure 2.44 Port of Melbourne Strategic Roads**

Routes and operational patterns of trucks to and from Swanson Dock include:

- CityLink and Tullamarine Freeway to the north
- Footscray Road, Whitehall Street, Somerville Road, Francis Street and Geelong Road to the west (West Gate Freeway is virtually unused)
- CityLink, Monash Freeway, Kingsway, Queens Road, Nepean Hwy and Dandenong Road to the south and south east
- Dudley Street, Peel Street, Victoria Street, LaTrobe Street, Victoria Parade and Victoria Street are used to inner northern locations.

Operational patterns of trucks at Webb Dock are quite different, with Todd Rd, West Gate Fwy, Bolte Bridge and CityLink to the north and west the most important routes.

The next most important are routes to the south and south east, via Williamstown Rd, Graham St, Bay St and Beaconsfield Parade linking to Dandenong Rd and Nepean Hwy. A few Webb dock vehicles use the Eastern Freeway, accessing via Flinders Street, Wellington Parade and Hoddle Street.

# 3 Future Situation

Future demand growth and the implications for transport system performance are discussed in this section of the report, initially using the 'Reference Case' future Zenith model outputs as a basis. The Reference Case incorporates the basic assumption that relative prices and behavioural responses to transport choices will be as they are today; all that is changed in the model is the demographic data (population and employment) and the transport 'supply' side (incorporating MOTC commitments and some 'MOTC+' initiatives)[27]. The Reference Case is based on a 2006 calibration of the Zenith model.

The recently released 2006 Census data suggests that, for journeys to work at least, there has been an appreciable mode shift towards public transport, walking and cycling (19% combined total, up from 16% in 1996), continuing the trends noted between 1996 and 2001.

The implications of this are discussed where relevant in the following text.

## 3.1 Demand

### 3.1.1 Overview

Underlying demand growth in the Zenith Reference Case is summarised in Table 3-1. Figures are presented for the entire model (including external trips) and for the Melbourne MSD. These numbers are summarised from a set of origin-destination matrices for statistical local areas (SLA) provided from the Zenith model for 2006 and 2031.

**Table 3-1: Zenith Model Reference Case demand summary**

| Thousand trips | | | All day | | | AM peak | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2006 | 2031 | % growth | 2006 | 2031 | % growth |
| All of Model | Car | | 12,102 | 15,775 | 30% | 1,728 | 2,171 | 26% |
| | PT | | 950 | 1,454 | 53% | 226 | 343 | 52% |
| | Walk | | 2,219 | 3,201 | 44% | 226 | 317 | 40% |
| | Subtotal | | 15,271 | 20,430 | 34% | 2,180 | 2,831 | 30% |
| | Commercials | | 509 | 761 | 50% | 70 | 104 | 49% |
| | TOTAL | | 15,780 | 21,191 | 34% | 2,250 | 2,935 | 30% |
| | People mode shares | Car | 79.2% | 77.2% | -3% | 79.3% | 76.7% | -3% |
| | | PT | 6.2% | 7.1% | 14% | 10.4% | 12.1% | 17% |
| | | Walk | 14.5% | 15.7% | 8% | 10.4% | 11.2% | 8% |
| Melbourne MSD | Car | | 10,585 | 13,744 | 30% | 1,518 | 1,894 | 25% |
| | PT | | 919 | 1,412 | 54% | 217 | 331 | 53% |
| | Walk | | 1,998 | 2,910 | 46% | 202 | 285 | 41% |
| | Subtotal | | 13,502 | 18,066 | 34% | 1,937 | 2,510 | 30% |
| | Commercials | | 459 | 688 | 50% | 63 | 95 | 51% |
| | TOTAL | | 13,961 | 18,754 | 34% | 2,000 | 2,605 | 30% |
| | People mode shares | Car | 78.4% | 76.1% | -3% | 78.4% | 75.5% | -4% |
| | | PT | 6.8% | 7.8% | 15% | 11.2% | 13.2% | 18% |
| | | Walk | 14.8% | 16.1% | 9% | 10.4% | 11.4% | 9% |

Note: one public transport *trip* may involve multiple *boardings* i.e. more than one mode of public transport. The actual number of public transport *boardings* is approximately 50% higher than the number of *trips* eg. for 'All of Model - 2006 - all day', 950,000 PT *trips* are modelled, while the number of PT *boardings* is 1,391,000.

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[27] Refer to VLC report *'Background Modelling Assumptions for the East-West Link Needs Assessment Study'* for more details on the Reference Case model scenario.

According to the Zenith model, overall travel demand will grow by 34% between 2006 and 2031, to a total of 21.2 million trips a day (18.8 million in the Melbourne MSD). AM peak period travel is predicted to grow somewhat less (30%) to a total of 2.9 million trips (2.6 million in the Melbourne MSD), probably reflecting the fact that the workforce will be a smaller percentage of the overall population due to ageing. Modelled morning peak period travel is about 14% of total daily travel, both in 2006 and 2031.

Further insight into overall demand growth is illustrated in Table 3-2, showing the changes in trip purposes used in the Zenith model. The greatest growth is predicted to occur in commercial trips (47%), non-home-based recreational trips (44%) and work-based work trips (41%), whilst all home-based trips grow more or less in line with population growth (27-28%).

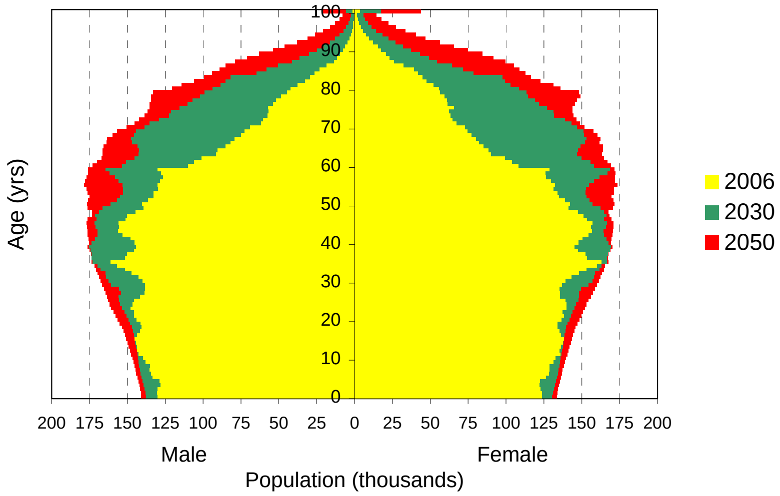
**Table 3-2: Trip purposes modelled in Zenith 2006-2031**

| Thousand trips modelled | All day | | |
|---|---|---|---|
| | 2006 | 2031 | % growth |
| Home-based education | 1,220 | 1,500 | 23% |
| Home-based recreation | 7,340 | 9,420 | 28% |
| Home-based work | 2,685 | 3,410 | 27% |
| Non-home-based recreation | 3,690 | 5,450 | 48% |
| Work-based work | 810 | 1,180 | 46% |
| Commercial trips | 510 | 760 | 49% |

### *3.1.2 People movement*

The overall level of trip-making is influenced by the age profile of the community. ABS forecasts suggest that Melbourne's population age profile will change markedly over the next 20-30 years (see Figure 3.1).

**Figure 3.1: Melbourne age profile projections**




An analysis of activity by age (Ironmonger, 2005) shows that the amount of trip-making varies significantly by age group (people of working age travel more frequently than younger and older people), and when projected into the future using ABS population projections ( Table 3-3), the overall number of trips per head could grow slower than the population. By 2050, Melbourne's population could increase by 36% (according to ABS figures), whilst trip making could increase by only 28%.

**Table 3-3: Modelled people movement demand 2006 & 2031 (thousand trips)**

| Age group (years) | Trips/day /person[1] | Melbourne population (million) | | | Total trips per day (million)[2] | | |
|---|---|---|---|---|---|---|---|
| | | 2006 | 2030 | 2050 | 2006 | 2030 | 2050 |
| 0-14 | 3.0 | 0.69 | 0.70 | 0.73 | 2.07 | 2.10 | 2.19 |
| 25-49 | 4.5 | 1.83 | 1.96 | 2.05 | 8.17 | 8.71 | 9.13 |
| 50-59 | 3.7 | 0.46 | 0.55 | 0.62 | 1.71 | 2.04 | 2.28 |
| 60+ | 2.7 | 0.65 | 1.21 | 1.55 | 1.76 | 3.21 | 4.01 |
| Totals | | 3.64 | 4.43 | 4.96 | 13.7 | 16.06 | 17.62 |
| Increase from 2006 | | | 22% | 36% | | 17% | 28% |
| Overall trips/day/person | | | | | 3.77 | 3.63 | 3.55 |

1. Source: analysis of Ironmonger, 2005.
2. Analysis assumes no future change in the level of trip making by age group.

Trip-making per head has grown faster than population historically; this is in part due to the movement of the 'baby boomer' cohort through the workforce over the last 30 years or so, as well as strong economic growth. However the above analysis suggests that trips per head could be at a peak about now.

Another important implication of the demographic trend is that the trip purpose mix (see Figure 2.2) will also change, and thus the time of day that trips are made. This could lead to slower growth in peak period travel and increased growth in inter-peak travel, consistent with recent observed trends.

People movement represents about 97% of the travel demand in the Zenith model. Table 3-4 shows a summary of the modelled demand geographically, with the CAD (CBD, Southbank and Docklands combined) separated from the rest of Inner Melbourne (Melbourne, Yarra and Port Phillip LGAs) and the rest of the city divided into west, north, east and south. There are several key issues to note:

- Daily travel demand growth is predicted to be greatest (55%) in the inner area including the CAD. Growth in trips in the west (43%) and south (30%) is predicted to be significantly greater than that in the north and east (23-24%). A similar growth pattern is predicted for AM peak.
- Movement into, out of and within Melbourne CAD amounts to about 2.2 million trips a day in the 2031 model, up from 1.2 million in 2006. In the morning peak, about 240,000 trips are predicted to enter the CAD in 2031 (compared with 140,000 in 2006).
- Daily CAD-centred travel is predicted to grow strongest from the west (91%) and the rest of inner Melbourne (79%). Growth from the other areas is also significant i.e. north (66%), south (63%) and east (50%).
- Peak period CAD-centred travel is predicted to grow strongest from the rest of inner Melbourne (89%) and the west (83%). Growth from other areas is also significant i.e. north (65%), south (52%), west (39%).
- The modelled number of trips between the western region and the CAD, inner, east and south regions is about 660,000 trips per day (up from 440,000 in 2006). Trips between the west and the CAD / inner areas are expected to dominate with 70% of the total (68% in 2006).
- Movement between the west and east regions is relatively small (about 45,000 trips each way in 2006) and is predicted to grow at a similar rate to overall demand, reaching about 60,000 trips each way in 2031.
- In the morning peak, the east-west movement growth is greatest from west to east (29%) than in the other direction (7%). This suggests that the main driver of this demand growth is the urban residential growth in the west (the vast majority of morning peak period trips start from the home).

### *Modelled public transport mode share*

Table 3-5 summarises the public transport mode shares of movement contained in the model[28].

Public transport's daily mode share increases by 15% between 2006 and 2031 (from 6.2% to 7.1%), and by 17% for AM peak trips (10.3% to 12.0% between 2006 and 2031). The largest percentage increases are generally in the places where mode share is lowest.

[28] Public transport trip matrices have only been provided in aggregate (i.e. they are not broken down between train, tram and bus).

**Table 3-4: Modelled people movement demand 2006 & 2031 (no. trips by all modes including walking/cycling)**

| | 2006 Daily | Reg SW | Reg NW | Reg NE | Reg SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES (To) | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Regional SW | 752,850 | 6,492 | 345 | 538 | 5,396 | 1,083 | 1,194 | 113 | 267 | 1,014 | 456 | 2,478 | 2,972 | 1,646 | 1,481 | 803 | 2,164 | 1,309 | 4,778 | 2,538 | 789,918 |
| | Regional NW | 6,402 | 884,578 | 4,240 | 845 | 2,050 | 8,700 | 8,329 | 682 | 1,021 | 2,228 | 938 | 2,496 | 7,615 | 7,254 | 6,255 | 2,530 | 3,955 | 2,442 | 9,379 | 4,731 | 966,671 |
| | Regional NE | 336 | 4,299 | 102,668 | 3,010 | 273 | 331 | 1,772 | 1,443 | 9,376 | 6,151 | 826 | 566 | 1,475 | 3,116 | 5,109 | 3,157 | 4,392 | 1,333 | 3,981 | 1,816 | 155,429 |
| | Regional SE | 535 | 862 | 3,071 | 677,931 | 339 | 253 | 882 | 187 | 4,534 | 45,192 | 61,659 | 546 | 1,158 | 1,229 | 2,039 | 2,844 | 14,112 | 7,519 | 6,815 | 2,936 | 834,645 |
| | Outer SW | 5,517 | 2,044 | 282 | 348 | 207,477 | 4,634 | 1,611 | 209 | 243 | 949 | 354 | 26,376 | 14,024 | 4,547 | 2,629 | 1,208 | 3,354 | 2,104 | 11,455 | 6,671 | 296,035 |
| | Outer WN | 1,033 | 8,719 | 326 | 254 | 4,669 | 137,387 | 6,707 | 395 | 314 | 635 | 226 | 6,438 | 44,077 | 12,575 | 5,535 | 1,552 | 2,298 | 1,415 | 9,149 | 4,829 | 248,533 |
| | Outer NW | 1,227 | 8,324 | 1,772 | 881 | 1,643 | 6,618 | 135,534 | 2,719 | 1,777 | 2,594 | 1,159 | 2,568 | 10,886 | 36,658 | 19,367 | 4,417 | 4,498 | 2,832 | 12,630 | 7,848 | 265,951 |
| | Outer NE | 133 | 663 | 1,388 | 181 | 204 | 389 | 2,708 | 36,072 | 5,745 | 1,073 | 211 | 452 | 1,620 | 5,580 | 30,721 | 7,814 | 2,735 | 804 | 4,217 | 1,972 | 104,680 |
| | Outer EN | 268 | 1,023 | 9,370 | 4,612 | 276 | 357 | 1,754 | 5,625 | 370,445 | 92,832 | 3,197 | 615 | 1,853 | 4,410 | 16,851 | 43,925 | 39,882 | 4,071 | 13,295 | 6,240 | 620,899 |
| From | Outer ES | 1,013 | 2,342 | 6,084 | 45,320 | 934 | 607 | 2,596 | 1,078 | 92,804 | 1,287,312 | 120,396 | 1,663 | 2,951 | 3,843 | 8,050 | 28,540 | 182,105 | 45,951 | 27,823 | 13,010 | 1,874,421 |
| | Outer SE | 386 | 947 | 841 | 61,628 | 339 | 243 | 1,155 | 217 | 3,147 | 120,705 | 598,308 | 725 | 1,336 | 1,306 | 2,177 | 4,194 | 36,693 | 60,552 | 12,829 | 6,128 | 913,857 |
| | Inner SW | 2,532 | 2,442 | 536 | 567 | 26,217 | 6,481 | 2,644 | 460 | 634 | 1,720 | 712 | 149,242 | 47,795 | 9,524 | 4,195 | 2,449 | 5,734 | 4,626 | 24,372 | 13,977 | 306,861 |
| | Inner WN | 2,900 | 7,719 | 1,454 | 1,256 | 14,068 | 44,103 | 10,891 | 1,639 | 1,873 | 3,054 | 1,324 | 47,887 | 376,601 | 66,778 | 18,917 | 6,457 | 8,557 | 6,355 | 47,470 | 21,557 | 690,861 |
| | Inner NW | 1,610 | 7,190 | 3,234 | 1,190 | 4,474 | 12,422 | 36,717 | 5,622 | 4,384 | 3,754 | 1,345 | 9,388 | 66,827 | 371,107 | 93,875 | 15,510 | 10,477 | 6,824 | 66,031 | 26,699 | 748,679 |
| | Inner NE | 1,414 | 6,227 | 5,171 | 1,954 | 2,641 | 5,549 | 19,446 | 30,734 | 16,718 | 8,194 | 2,239 | 4,317 | 18,746 | 93,912 | 517,662 | 89,863 | 22,113 | 8,718 | 73,869 | 25,859 | 955,344 |
| | Inner EN | 833 | 2,576 | 3,085 | 2,945 | 1,167 | 1,574 | 4,345 | 7,779 | 43,977 | 28,472 | 4,356 | 2,393 | 6,493 | 15,644 | 89,346 | 390,304 | 124,044 | 13,974 | 66,616 | 23,615 | 833,538 |
| | Inner ES | 2,126 | 3,969 | 4,299 | 14,153 | 3,409 | 2,268 | 4,520 | 2,681 | 40,005 | 181,790 | 36,935 | 5,657 | 8,357 | 10,322 | 22,275 | 123,715 | 808,688 | 130,094 | 97,200 | 35,852 | 1,538,315 |
| | Inner SE | 1,241 | 2,475 | 1,317 | 7,362 | 2,142 | 1,390 | 2,826 | 748 | 4,092 | 46,006 | 60,351 | 4,685 | 6,396 | 6,841 | 8,755 | 14,203 | 129,931 | 555,966 | 101,301 | 33,422 | 991,448 |
| | Inner centre | 4,851 | 9,416 | 3,979 | 6,678 | 11,447 | 9,157 | 12,605 | 4,203 | 13,259 | 27,995 | 12,788 | 24,360 | 47,701 | 65,945 | 73,669 | 66,583 | 97,282 | 101,237 | 569,596 | 207,400 | 1,370,152 |
| | CBD | 2,516 | 4,803 | 1,837 | 2,971 | 6,780 | 4,885 | 7,796 | 1,956 | 6,270 | 12,901 | 6,117 | 13,600 | 21,100 | 26,356 | 25,550 | 23,279 | 35,046 | 32,835 | 204,469 | 324,228 | 765,297 |
| | TOTAL | 789,724 | 967,110 | 155,299 | 834,624 | 295,944 | 248,430 | 266,032 | 104,561 | 620,885 | 1,874,571 | 913,897 | 306,452 | 689,985 | 748,593 | 954,457 | 833,346 | 1,538,061 | 990,962 | 1,367,273 | 771,329 | 15,271,535 |

Source: VLC model results

*Totals may not add due to rounding*

| 2031 Daily | | To | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reg SW | Reg NW | Reg NE | Reg SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| From | Regional SW | 1,040,628 | 8,065 | 518 | 936 | 9,817 | 2,320 | 1,892 | 269 | 491 | 1,584 | 730 | 3,885 | 3,190 | 1,840 | 1,557 | 1,139 | 3,503 | 2,045 | 7,175 | 5,812 | 1,097,395 |
| | Regional NW | 8,053 | 1,118,942 | 6,477 | 1,537 | 4,492 | 16,752 | 11,645 | 1,655 | 1,405 | 3,527 | 1,620 | 4,410 | 8,585 | 8,694 | 6,881 | 3,563 | 5,943 | 3,533 | 13,774 | 10,088 | 1,241,575 |
| | Regional NE | 519 | 6,436 | 124,402 | 5,041 | 610 | 767 | 3,353 | 2,984 | 11,139 | 7,583 | 1,569 | 823 | 1,631 | 3,685 | 5,671 | 3,964 | 5,254 | 1,726 | 5,381 | 3,573 | 196,111 |
| | Regional SE | 975 | 1,539 | 5,080 | 1,109,933 | 844 | 624 | 1,826 | 466 | 8,163 | 105,513 | 110,012 | 1,107 | 1,546 | 1,621 | 2,673 | 5,178 | 24,926 | 11,630 | 11,984 | 8,288 | 1,413,928 |
| | Outer SW | 9,844 | 4,433 | 604 | 866 | 374,834 | 13,712 | 3,527 | 858 | 604 | 2,068 | 888 | 58,030 | 21,467 | 6,893 | 3,892 | 2,125 | 6,618 | 4,205 | 20,300 | 15,980 | 551,747 |
| | Outer WN | 2,281 | 16,801 | 731 | 653 | 13,920 | 312,234 | 12,367 | 1,488 | 757 | 1,635 | 623 | 16,324 | 67,605 | 20,196 | 7,997 | 2,798 | 4,962 | 2,948 | 17,343 | 13,008 | 516,669 |
| | Outer NW | 1,899 | 11,578 | 3,320 | 1,818 | 3,532 | 12,316 | 222,989 | 14,332 | 2,934 | 4,655 | 2,191 | 4,832 | 14,028 | 54,028 | 28,954 | 7,060 | 7,969 | 4,470 | 21,554 | 16,690 | 441,149 |
| | Outer NE | 283 | 1,638 | 3,031 | 497 | 853 | 1,484 | 14,204 | 148,626 | 9,568 | 2,861 | 672 | 1,487 | 3,759 | 14,897 | 61,639 | 15,493 | 6,688 | 1,867 | 11,481 | 7,474 | 308,501 |
| | Outer EN | 462 | 1,417 | 11,117 | 8,128 | 596 | 728 | 2,935 | 9,533 | 464,010 | 123,104 | 7,882 | 825 | 1,758 | 4,427 | 16,952 | 54,022 | 49,232 | 5,419 | 14,998 | 9,970 | 787,515 |
| | Outer ES | 1,481 | 3,507 | 7,667 | 105,723 | 2,187 | 1,642 | 4,612 | 2,926 | 123,287 | 1,433,425 | 183,665 | 2,411 | 3,222 | 4,297 | 8,806 | 39,987 | 214,127 | 51,535 | 32,658 | 21,583 | 2,248,748 |
| | Outer SE | 759 | 1,668 | 1,567 | 110,091 | 837 | 615 | 2,259 | 676 | 7,742 | 183,516 | 839,641 | 1,046 | 1,438 | 1,593 | 2,502 | 6,679 | 46,825 | 71,293 | 15,908 | 10,966 | 1,307,620 |
| | Inner SW | 3,910 | 4,406 | 763 | 1,065 | 57,938 | 16,376 | 4,761 | 1,482 | 813 | 2,433 | 1,088 | 176,366 | 53,722 | 10,104 | 4,406 | 2,719 | 7,191 | 5,850 | 33,014 | 24,287 | 412,695 |
| | Inner WN | 3,061 | 8,514 | 1,716 | 1,533 | 21,461 | 67,657 | 14,081 | 3,721 | 1,798 | 3,322 | 1,395 | 54,029 | 363,462 | 68,004 | 16,678 | 6,403 | 9,662 | 6,846 | 58,457 | 35,462 | 747,261 |
| | Inner NW | 1,872 | 8,791 | 3,694 | 1,611 | 6,828 | 20,235 | 54,099 | 14,807 | 4,371 | 4,205 | 1,667 | 9,931 | 67,947 | 363,129 | 85,185 | 15,131 | 11,289 | 6,937 | 70,669 | 39,079 | 791,478 |
| | Inner NE | 1,597 | 6,922 | 5,637 | 2,766 | 3,843 | 7,958 | 29,054 | 61,701 | 16,937 | 8,789 | 2,486 | 4,406 | 16,845 | 85,195 | 485,944 | 98,253 | 24,204 | 8,949 | 80,184 | 37,999 | 989,668 |
| | Inner EN | 1,101 | 3,618 | 3,941 | 5,197 | 2,103 | 2,794 | 6,990 | 15,422 | 54,187 | 39,992 | 6,645 | 2,731 | 6,472 | 15,134 | 98,518 | 454,180 | 145,917 | 15,581 | 74,511 | 34,061 | 989,093 |
| | Inner ES | 3,543 | 6,049 | 5,220 | 25,071 | 6,727 | 4,982 | 8,010 | 6,610 | 49,374 | 213,791 | 47,205 | 7,318 | 9,741 | 11,146 | 24,181 | 145,714 | 967,455 | 151,449 | 122,495 | 56,593 | 1,872,674 |
| | Inner SE | 2,057 | 3,489 | 1,718 | 11,610 | 4,245 | 2,973 | 4,436 | 1,877 | 5,406 | 51,531 | 71,500 | 5,901 | 6,989 | 6,980 | 8,983 | 15,504 | 151,294 | 645,299 | 124,092 | 51,425 | 1,177,310 |
| | Inner centre | 7,173 | 13,848 | 5,383 | 12,032 | 20,362 | 17,431 | 21,500 | 11,535 | 14,921 | 32,763 | 16,013 | 33,002 | 58,134 | 70,417 | 80,122 | 74,288 | 122,498 | 124,159 | 803,394 | 370,018 | 1,908,994 |
| | CBD | 5,993 | 10,104 | 3,529 | 8,308 | 16,021 | 13,145 | 16,716 | 7,598 | 9,941 | 21,371 | 10,789 | 23,498 | 34,876 | 38,693 | 37,531 | 33,703 | 55,104 | 50,726 | 366,079 | 629,506 | 1,393,230 |
| | TOTAL | 1,097,489 | 1,241,764 | 196,116 | 1,414,417 | 552,049 | 516,744 | 441,257 | 308,564 | 787,848 | 2,247,670 | 1,308,281 | 412,361 | 746,417 | 790,973 | 989,071 | 987,903 | 1,870,659 | 1,176,466 | 1,905,450 | 1,401,863 | 20,393,361 |

Source: VLC model results

*Totals may not add due to rounding*

| % change (Daily) | | To | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| From | Regional SW | 38% | 24% | 50% | 74% | 82% | 114% | 59% | 138% | 83% | 56% | 60% | 57% | 7% | 12% | 5% | 42% | 62% | 56% | 50% | 129% | 39% |
| | Regional NW | 26% | 26% | 53% | 82% | 119% | 93% | 40% | 143% | 38% | 58% | 73% | 77% | 13% | 20% | 10% | 41% | 50% | 45% | 47% | 113% | 28% |
| | Regional NE | 55% | 50% | 21% | 67% | 123% | 132% | 89% | 107% | 19% | 23% | 90% | 45% | 11% | 18% | 11% | 26% | 20% | 29% | 35% | 97% | 26% |
| | Regional SE | 82% | 79% | 65% | 64% | 149% | 146% | 107% | 149% | 80% | 133% | 78% | 103% | 34% | 32% | 31% | 82% | 77% | 55% | 76% | 182% | 69% |
| | Outer SW | 78% | 117% | 114% | 148% | 81% | 196% | 119% | 310% | 149% | 118% | 151% | 120% | 53% | 52% | 48% | 76% | 97% | 100% | 77% | 140% | 86% |
| | Outer WN | 121% | 93% | 124% | 157% | 198% | 127% | 84% | 277% | 141% | 158% | 175% | 154% | 53% | 61% | 44% | 80% | 116% | 108% | 90% | 169% | 108% |
| | Outer NW | 55% | 39% | 87% | 106% | 115% | 86% | 65% | 427% | 65% | 79% | 89% | 88% | 29% | 47% | 49% | 60% | 77% | 58% | 71% | 113% | 66% |
| | Outer NE | 112% | 147% | 118% | 175% | 317% | 282% | 425% | 312% | 67% | 167% | 219% | 229% | 132% | 167% | 101% | 98% | 145% | 132% | 172% | 279% | 195% |
| | Outer EN | 72% | 38% | 19% | 76% | 116% | 104% | 67% | 69% | 25% | 33% | 147% | 34% | -5% | 0% | 1% | 23% | 23% | 33% | 13% | 60% | 27% |
| | Outer ES | 46% | 50% | 26% | 133% | 134% | 171% | 78% | 171% | 33% | 11% | 53% | 45% | 9% | 12% | 9% | 40% | 18% | 12% | 17% | 66% | 20% |
| | Outer SE | 96% | 76% | 86% | 79% | 147% | 153% | 95% | 211% | 146% | 52% | 40% | 44% | 8% | 22% | 15% | 59% | 28% | 18% | 24% | 79% | 43% |
| | Inner SW | 54% | 80% | 42% | 88% | 121% | 153% | 80% | 222% | 28% | 41% | 53% | 18% | 12% | 6% | 5% | 11% | 25% | 26% | 35% | 74% | 34% |
| | Inner WN | 6% | 10% | 18% | 22% | 53% | 53% | 29% | 127% | -4% | 9% | 5% | 13% | -3% | 2% | -12% | -1% | 13% | 8% | 23% | 65% | 8% |
| | Inner NW | 16% | 22% | 14% | 35% | 53% | 63% | 47% | 163% | 0% | 12% | 24% | 6% | 2% | -2% | -9% | -2% | 8% | 2% | 7% | 46% | 6% |
| | Inner NE | 13% | 11% | 9% | 42% | 46% | 43% | 49% | 101% | 1% | 7% | 11% | 2% | -10% | -9% | -6% | 9% | 9% | 3% | 9% | 47% | 4% |
| | Inner EN | 32% | 40% | 28% | 76% | 80% | 78% | 61% | 98% | 23% | 40% | 53% | 14% | 0% | -3% | 10% | 16% | 18% | 12% | 12% | 44% | 19% |
| | Inner ES | 67% | 52% | 21% | 77% | 97% | 120% | 77% | 147% | 23% | 18% | 28% | 29% | 17% | 8% | 9% | 18% | 20% | 16% | 26% | 58% | 22% |
| | Inner SE | 66% | 41% | 30% | 58% | 98% | 114% | 57% | 151% | 32% | 12% | 18% | 26% | 9% | 2% | 3% | 9% | 16% | 16% | 22% | 54% | 19% |
| | Inner centre | 48% | 47% | 35% | 80% | 78% | 90% | 71% | 174% | 13% | 17% | 25% | 35% | 22% | 7% | 9% | 12% | 26% | 23% | 41% | 78% | 39% |
| | CBD | 138% | 110% | 92% | 180% | 136% | 169% | 114% | 288% | 59% | 66% | 76% | 73% | 65% | 47% | 47% | 45% | 57% | 54% | 79% | 94% | 82% |
| | TOTAL | 39% | 28% | 26% | 69% | 87% | 108% | 66% | 195% | 27% | 20% | 43% | 35% | 8% | 6% | 4% | 19% | 22% | 19% | 39% | 82% | 34% |

Source: VLC model results

*Totals may not add due to rounding*

| | 2006 (AM Peak) | | | | | | | | | To | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | 105,774 | 1,091 | 37 | 58 | 896 | 151 | 184 | 17 | 35 | 174 | 73 | 670 | 831 | 419 | 407 | 197 | 644 | 332 | 1,714 | 960 | 114,666 |
| | Regional NW | 968 | 125,017 | 516 | 95 | 434 | 1,889 | 1,967 | 154 | 171 | 361 | 121 | 670 | 2,160 | 1,976 | 1,642 | 592 | 960 | 511 | 2,979 | 1,553 | 144,738 |
| | Regional NE | 43 | 802 | 13,650 | 496 | 35 | 50 | 402 | 334 | 2,440 | 1,591 | 128 | 121 | 314 | 809 | 1,361 | 757 | 1,145 | 261 | 1,075 | 531 | 26,345 |
| | Regional SE | 64 | 99 | 466 | 90,927 | 39 | 29 | 117 | 30 | 1,090 | 11,687 | 13,953 | 103 | 243 | 245 | 468 | 646 | 4,505 | 2,164 | 2,214 | 954 | 130,042 |
| | Outer SW | 1,331 | 239 | 27 | 35 | 26,076 | 753 | 405 | 33 | 40 | 248 | 92 | 6,058 | 4,345 | 1,553 | 892 | 429 | 1,231 | 692 | 4,604 | 2,909 | 51,995 |
| | Outer WN | 223 | 1,141 | 33 | 34 | 970 | 17,879 | 1,570 | 70 | 76 | 190 | 44 | 1,965 | 9,571 | 3,737 | 1,839 | 512 | 843 | 476 | 3,664 | 2,146 | 46,984 |
| | Outer NW | 163 | 814 | 150 | 106 | 232 | 771 | 17,525 | 420 | 261 | 394 | 184 | 573 | 2,288 | 6,827 | 4,195 | 944 | 1,031 | 541 | 3,679 | 2,239 | 43,337 |
| | Outer NE | 22 | 85 | 128 | 27 | 35 | 70 | 588 | 4,349 | 1,113 | 291 | 53 | 137 | 441 | 1,628 | 6,561 | 1,857 | 960 | 241 | 1,598 | 843 | 21,028 |
| | Outer EN | 32 | 91 | 777 | 358 | 47 | 46 | 351 | 781 | 48,230 | 17,414 | 728 | 182 | 526 | 1,267 | 4,659 | 9,037 | 10,846 | 1,199 | 5,168 | 2,724 | 104,462 |
| From | Outer ES | 100 | 203 | 397 | 4,217 | 89 | 47 | 338 | 80 | 13,103 | 173,093 | 17,655 | 350 | 697 | 841 | 1,999 | 5,484 | 40,208 | 9,292 | 10,188 | 5,177 | 283,558 |
| | Outer SE | 51 | 85 | 56 | 7,721 | 36 | 16 | 154 | 24 | 532 | 22,797 | 78,123 | 146 | 340 | 332 | 628 | 981 | 10,365 | 11,676 | 4,842 | 2,550 | 141,456 |
| | Inner SW | 265 | 129 | 43 | 45 | 2,573 | 407 | 341 | 46 | 82 | 257 | 110 | 17,949 | 6,999 | 1,776 | 830 | 491 | 1,421 | 947 | 6,605 | 4,112 | 45,428 |
| | Inner WN | 255 | 510 | 105 | 104 | 1,133 | 4,566 | 1,687 | 151 | 192 | 425 | 145 | 7,017 | 46,514 | 11,461 | 3,872 | 1,239 | 2,243 | 1,207 | 12,344 | 6,688 | 101,854 |
| | Inner NW | 152 | 385 | 189 | 100 | 353 | 846 | 4,537 | 461 | 410 | 598 | 202 | 1,557 | 8,992 | 45,591 | 13,871 | 2,584 | 2,669 | 1,464 | 16,830 | 9,019 | 110,810 |
| | Inner NE | 120 | 365 | 266 | 134 | 194 | 381 | 2,297 | 3,010 | 1,748 | 1,134 | 248 | 778 | 2,857 | 13,858 | 64,687 | 12,351 | 5,238 | 1,631 | 17,821 | 8,717 | 137,835 |
| | Inner EN | 95 | 198 | 175 | 219 | 89 | 107 | 601 | 681 | 5,402 | 5,250 | 724 | 492 | 1,273 | 3,119 | 14,537 | 47,581 | 24,614 | 2,882 | 18,329 | 8,938 | 135,307 |
| | Inner ES | 109 | 235 | 227 | 655 | 171 | 85 | 446 | 141 | 3,463 | 20,299 | 3,542 | 737 | 1,165 | 1,367 | 3,318 | 13,872 | 98,562 | 16,506 | 23,110 | 11,866 | 199,877 |
| | Inner SE | 86 | 160 | 82 | 463 | 150 | 76 | 308 | 50 | 475 | 7,369 | 7,755 | 759 | 1,150 | 1,180 | 1,681 | 2,419 | 24,236 | 66,515 | 24,216 | 11,560 | 150,689 |
| | Inner centre | 174 | 376 | 168 | 268 | 368 | 256 | 920 | 133 | 486 | 1,564 | 652 | 1,780 | 3,710 | 5,199 | 6,336 | 5,033 | 9,779 | 8,170 | 63,703 | 28,960 | 138,034 |
| | CBD | 87 | 207 | 95 | 132 | 174 | 103 | 559 | 51 | 177 | 535 | 219 | 857 | 1,216 | 1,311 | 1,388 | 987 | 2,235 | 1,573 | 18,223 | 26,781 | 56,908 |
| | TOTAL | 110,114 | 132,230 | 17,587 | 106,193 | 34,097 | 28,528 | 35,298 | 11,016 | 79,526 | 265,671 | 124,752 | 42,902 | 95,634 | 104,497 | 135,169 | 107,992 | 243,734 | 128,279 | 242,906 | 139,227 | 2,185,354 |

Source: VLC model results

*Totals may not add due to rounding*

| 2031 (AM Peak) | | To | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | 145,180 | 1,438 | 58 | 121 | 2,042 | 321 | 264 | 26 | 87 | 325 | 132 | 1,187 | 872 | 508 | 454 | 270 | 1,153 | 542 | 2,488 | 2,165 | 159,632 |
| | Regional NW | 1,318 | 159,111 | 740 | 186 | 1,032 | 3,635 | 2,486 | 309 | 246 | 601 | 251 | 1,310 | 2,337 | 2,422 | 1,810 | 806 | 1,493 | 772 | 4,149 | 3,308 | 188,322 |
| | Regional NE | 58 | 1,196 | 16,216 | 898 | 105 | 130 | 820 | 652 | 2,743 | 1,829 | 290 | 177 | 335 | 948 | 1,459 | 947 | 1,376 | 346 | 1,343 | 1,022 | 32,890 |
| | Regional SE | 125 | 165 | 636 | 147,378 | 105 | 66 | 241 | 46 | 1,966 | 25,405 | 26,184 | 229 | 325 | 297 | 613 | 1,272 | 8,061 | 3,306 | 3,726 | 2,887 | 223,033 |
| | Outer SW | 1,845 | 426 | 47 | 95 | 48,307 | 1,984 | 589 | 102 | 118 | 509 | 225 | 11,634 | 4,827 | 1,936 | 1,106 | 618 | 2,253 | 1,231 | 7,218 | 6,260 | 91,331 |
| | Outer WN | 484 | 2,034 | 68 | 80 | 2,951 | 40,032 | 2,211 | 194 | 157 | 450 | 156 | 4,927 | 12,558 | 5,435 | 2,365 | 855 | 1,678 | 959 | 6,463 | 5,360 | 89,417 |
| | Outer NW | 273 | 1,367 | 254 | 230 | 701 | 2,078 | 29,569 | 1,496 | 512 | 868 | 369 | 1,373 | 3,184 | 10,914 | 6,065 | 1,567 | 1,973 | 977 | 6,518 | 5,433 | 75,720 |
| | Outer NE | 47 | 213 | 293 | 77 | 218 | 327 | 3,277 | 19,474 | 2,063 | 912 | 187 | 519 | 1,140 | 4,600 | 13,843 | 4,202 | 2,427 | 613 | 4,418 | 3,263 | 62,114 |
| | Outer EN | 52 | 111 | 870 | 848 | 88 | 108 | 485 | 1,148 | 57,014 | 21,820 | 1,767 | 211 | 442 | 1,194 | 4,051 | 10,459 | 12,270 | 1,424 | 5,362 | 4,084 | 123,807 |
| From | Outer ES | 129 | 296 | 526 | 11,439 | 187 | 112 | 492 | 158 | 16,381 | 180,606 | 29,032 | 431 | 563 | 776 | 1,765 | 6,826 | 40,788 | 8,998 | 10,260 | 7,856 | 317,620 |
| | Outer SE | 62 | 142 | 114 | 11,208 | 100 | 42 | 269 | 40 | 1,281 | 29,900 | 103,899 | 207 | 278 | 308 | 562 | 1,445 | 11,901 | 12,252 | 5,330 | 4,199 | 183,540 |
| | Inner SW | 322 | 220 | 56 | 84 | 5,418 | 900 | 396 | 61 | 94 | 398 | 165 | 20,015 | 6,421 | 1,575 | 731 | 479 | 1,726 | 1,076 | 7,475 | 6,354 | 53,963 |
| | Inner WN | 281 | 601 | 130 | 132 | 2,393 | 8,237 | 1,757 | 255 | 270 | 622 | 268 | 8,605 | 43,269 | 11,266 | 3,306 | 1,265 | 2,624 | 1,469 | 14,060 | 10,631 | 111,442 |
| | Inner NW | 186 | 454 | 205 | 146 | 637 | 1,569 | 5,308 | 769 | 505 | 788 | 294 | 1,868 | 8,297 | 42,971 | 11,541 | 2,500 | 3,035 | 1,489 | 17,003 | 12,529 | 112,093 |
| | Inner NE | 120 | 410 | 325 | 222 | 358 | 596 | 3,305 | 4,799 | 1,994 | 1,582 | 390 | 929 | 2,514 | 12,721 | 58,319 | 13,726 | 6,013 | 1,760 | 18,787 | 12,369 | 141,238 |
| | Inner EN | 88 | 252 | 236 | 440 | 165 | 209 | 815 | 1,110 | 6,822 | 7,492 | 1,174 | 524 | 1,003 | 2,795 | 13,827 | 52,607 | 27,360 | 3,119 | 18,455 | 11,805 | 150,297 |
| | Inner ES | 139 | 299 | 287 | 1,335 | 338 | 186 | 688 | 241 | 5,015 | 26,352 | 5,420 | 906 | 1,091 | 1,297 | 2,903 | 16,285 | 113,698 | 18,281 | 24,985 | 16,749 | 236,494 |
| | Inner SE | 138 | 227 | 115 | 827 | 340 | 167 | 413 | 71 | 676 | 8,935 | 9,894 | 962 | 1,021 | 1,067 | 1,432 | 2,697 | 28,282 | 75,251 | 27,232 | 16,987 | 176,734 |
| | Inner centre | 253 | 552 | 256 | 534 | 852 | 568 | 1,386 | 313 | 858 | 2,564 | 1,099 | 2,710 | 4,377 | 5,655 | 6,520 | 6,332 | 14,078 | 10,839 | 89,089 | 52,791 | 201,625 |
| | CBD | 179 | 359 | 163 | 325 | 492 | 315 | 967 | 134 | 329 | 1,049 | 424 | 1,583 | 1,935 | 2,045 | 1,839 | 1,689 | 3,937 | 2,794 | 30,952 | 52,541 | 104,050 |
| | TOTAL | 151,279 | 169,872 | 21,594 | 176,605 | 66,826 | 61,580 | 55,739 | 31,396 | 99,131 | 313,008 | 181,620 | 60,307 | 96,789 | 110,731 | 134,510 | 126,846 | 286,126 | 147,499 | 305,313 | 238,592 | 2,835,363 |

Source: VLC model results

*Totals may not add due to rounding*

| % change (AM Peak) | | To | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| From | Regional SW | 37% | 32% | 57% | 110% | 128% | 112% | 43% | 51% | 146% | 87% | 80% | 77% | 5% | 21% | 12% | 37% | 79% | 63% | 45% | 125% | 39% |
| | Regional NW | 36% | 27% | 43% | 96% | 138% | 92% | 26% | 100% | 44% | 66% | 108% | 96% | 8% | 23% | 10% | 36% | 56% | 51% | 39% | 113% | 30% |
| | Regional NE | 36% | 49% | 19% | 81% | 197% | 163% | 104% | 95% | 12% | 15% | 126% | 46% | 7% | 17% | 7% | 25% | 20% | 32% | 25% | 92% | 25% |
| | Regional SE | 96% | 67% | 36% | 62% | 171% | 125% | 105% | 55% | 80% | 117% | 88% | 122% | 34% | 21% | 31% | 97% | 79% | 53% | 68% | 203% | 72% |
| | Outer SW | 39% | 78% | 73% | 167% | 85% | 163% | 45% | 212% | 192% | 105% | 143% | 92% | 11% | 25% | 24% | 44% | 83% | 78% | 57% | 115% | 76% |
| | Outer WN | 117% | 78% | 110% | 135% | 204% | 124% | 41% | 178% | 107% | 137% | 255% | 151% | 31% | 45% | 29% | 67% | 99% | 101% | 76% | 150% | 90% |
| | Outer NW | 68% | 68% | 70% | 117% | 202% | 170% | 69% | 256% | 96% | 120% | 101% | 140% | 39% | 60% | 45% | 66% | 91% | 81% | 77% | 143% | 75% |
| | Outer NE | 115% | 151% | 129% | 189% | 515% | 368% | 457% | 348% | 85% | 213% | 256% | 279% | 158% | 182% | 111% | 126% | 153% | 155% | 176% | 287% | 195% |
| | Outer EN | 60% | 22% | 12% | 137% | 85% | 135% | 38% | 47% | 18% | 25% | 143% | 16% | -16% | -6% | -13% | 16% | 13% | 19% | 4% | 50% | 19% |
| | Outer ES | 29% | 46% | 33% | 171% | 111% | 140% | 45% | 97% | 25% | 4% | 64% | 23% | -19% | -8% | -12% | 24% | 1% | -3% | 1% | 52% | 12% |
| | Outer SE | 22% | 68% | 102% | 45% | 174% | 167% | 74% | 66% | 141% | 31% | 33% | 42% | -18% | -7% | -10% | 47% | 15% | 5% | 10% | 65% | 30% |
| | Inner SW | 21% | 70% | 31% | 86% | 111% | 121% | 16% | 34% | 14% | 55% | 50% | 12% | -8% | -11% | -12% | -3% | 21% | 14% | 13% | 55% | 19% |
| | Inner WN | 10% | 18% | 24% | 27% | 111% | 80% | 4% | 69% | 41% | 46% | 85% | 23% | -7% | -2% | -15% | 2% | 17% | 22% | 14% | 59% | 9% |
| | Inner NW | 22% | 18% | 9% | 45% | 81% | 85% | 17% | 67% | 23% | 32% | 45% | 20% | -8% | -6% | -17% | -3% | 14% | 2% | 1% | 39% | 1% |
| | Inner NE | 0% | 12% | 22% | 65% | 84% | 56% | 44% | 59% | 14% | 39% | 57% | 19% | -12% | -8% | -10% | 11% | 15% | 8% | 5% | 42% | 2% |
| | Inner EN | -7% | 27% | 35% | 101% | 84% | 95% | 36% | 63% | 26% | 43% | 62% | 6% | -21% | -10% | -5% | 11% | 11% | 8% | 1% | 32% | 11% |
| | Inner ES | 28% | 27% | 26% | 104% | 98% | 118% | 54% | 71% | 45% | 30% | 53% | 23% | -6% | -5% | -13% | 17% | 15% | 11% | 8% | 41% | 18% |
| | Inner SE | 60% | 42% | 40% | 79% | 127% | 119% | 34% | 42% | 42% | 21% | 28% | 27% | -11% | -10% | -15% | 12% | 17% | 13% | 12% | 47% | 17% |
| | Inner centre | 45% | 47% | 52% | 99% | 131% | 122% | 51% | 135% | 77% | 64% | 69% | 52% | 18% | 9% | 3% | 26% | 44% | 33% | 40% | 82% | 46% |
| | CBD | 105% | 74% | 72% | 147% | 182% | 206% | 73% | 162% | 86% | 96% | 93% | 85% | 59% | 56% | 33% | 71% | 76% | 78% | 70% | 96% | 83% |
| | TOTAL | 37% | 28% | 23% | 66% | 96% | 116% | 58% | 185% | 25% | 18% | 46% | 41% | 1% | 6% | 0% | 17% | 17% | 15% | 26% | 71% | 30% |

Source: VLC model results

*Totals may not add due to rounding*

**Table 3-5: Modelled public transport mode shares (%)**

| 2006 (Daily) | | To | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| From | Regional SW | 2.2% | 1.3% | 0.6% | 0.6% | 3.5% | 1.0% | 0.3% | 0.9% | 3.0% | 3.0% | 2.4% | 1.9% | 4.0% | 3.0% | 8.0% | 4.1% | 9.4% | 4.1% | 17.3% | 26.6% | 2.4% |
| | Regional NW | 1.5% | 1.5% | 2.9% | 0.0% | 1.3% | 2.7% | 2.7% | 0.6% | 1.3% | 1.2% | 0.6% | 1.2% | 2.7% | 1.9% | 2.6% | 2.0% | 4.4% | 1.4% | 11.7% | 19.3% | 1.8% |
| | Regional NE | 1.2% | 3.0% | 0.7% | 3.9% | 0.4% | 0.6% | 1.5% | 0.8% | 3.2% | 1.7% | 1.0% | 1.2% | 2.2% | 1.5% | 2.9% | 2.0% | 3.8% | 2.5% | 12.9% | 27.9% | 1.9% |
| | Regional SE | 0.6% | 0.1% | 3.7% | 1.1% | 0.9% | 0.4% | 0.5% | 0.0% | 1.8% | 2.5% | 3.2% | 2.0% | 6.0% | 2.5% | 7.9% | 3.1% | 5.0% | 3.3% | 20.4% | 36.0% | 1.8% |
| | Outer SW | 3.5% | 1.1% | 0.0% | 0.3% | 1.3% | 3.1% | 2.1% | 2.4% | 4.1% | 4.2% | 4.2% | 3.1% | 6.3% | 7.4% | 8.8% | 7.4% | 9.7% | 5.5% | 16.0% | 36.7% | 3.4% |
| | Outer WN | 1.7% | 2.9% | 0.9% | 0.0% | 3.2% | 1.8% | 3.1% | 2.3% | 5.1% | 3.9% | 6.6% | 2.5% | 3.8% | 4.4% | 5.3% | 5.5% | 11.1% | 6.3% | 18.2% | 41.5% | 4.0% |
| | Outer NW | 0.5% | 2.7% | 1.4% | 0.3% | 2.4% | 3.2% | 1.5% | 2.5% | 2.1% | 0.8% | 1.7% | 1.8% | 3.4% | 2.8% | 3.5% | 2.9% | 4.2% | 2.7% | 10.9% | 23.3% | 3.1% |
| | Outer NE | 2.2% | 1.4% | 0.5% | 0.6% | 1.5% | 3.3% | 2.5% | 0.7% | 2.9% | 1.7% | 2.4% | 2.7% | 2.7% | 3.2% | 3.7% | 3.1% | 4.1% | 4.4% | 15.4% | 43.8% | 3.6% |
| | Outer EN | 2.2% | 0.8% | 3.2% | 2.0% | 3.3% | 3.4% | 1.9% | 2.7% | 2.1% | 3.5% | 2.8% | 5.0% | 8.1% | 4.4% | 5.9% | 4.1% | 6.1% | 7.0% | 21.9% | 53.5% | 3.8% |
| | Outer ES | 2.6% | 0.8% | 1.5% | 2.5% | 3.4% | 4.6% | 1.2% | 2.0% | 3.5% | 2.4% | 3.4% | 5.4% | 12.6% | 6.8% | 9.4% | 5.1% | 5.4% | 5.3% | 22.5% | 49.9% | 3.6% |
| | Outer SE | 3.1% | 1.4% | 1.2% | 3.2% | 4.1% | 5.4% | 1.8% | 1.4% | 2.5% | 3.4% | 2.5% | 7.3% | 16.9% | 12.5% | 18.1% | 6.7% | 7.2% | 5.7% | 27.9% | 60.5% | 3.9% |
| | Inner SW | 2.0% | 0.7% | 1.3% | 2.3% | 3.1% | 2.5% | 2.0% | 2.6% | 6.9% | 5.9% | 8.8% | 2.3% | 4.2% | 6.2% | 8.2% | 7.8% | 11.6% | 8.8% | 15.6% | 36.1% | 5.8% |
| | Inner WN | 4.1% | 2.7% | 2.1% | 6.8% | 6.5% | 3.8% | 3.1% | 3.3% | 8.0% | 13.0% | 14.4% | 4.2% | 3.0% | 5.2% | 7.3% | 9.1% | 15.4% | 12.4% | 17.0% | 38.5% | 6.0% |
| | Inner NW | 2.3% | 1.8% | 1.8% | 3.9% | 7.5% | 4.4% | 2.7% | 3.0% | 4.2% | 7.0% | 10.7% | 6.0% | 5.2% | 3.2% | 5.3% | 6.2% | 13.8% | 11.1% | 17.2% | 45.0% | 6.7% |
| | Inner NE | 6.7% | 2.8% | 2.6% | 7.5% | 8.6% | 5.2% | 3.6% | 3.6% | 6.1% | 9.2% | 15.9% | 8.7% | 7.5% | 5.3% | 3.8% | 5.2% | 11.6% | 14.2% | 17.1% | 49.7% | 6.9% |
| | Inner EN | 5.6% | 1.2% | 2.4% | 2.3% | 8.1% | 5.0% | 2.8% | 3.0% | 3.8% | 5.0% | 7.0% | 7.0% | 8.9% | 6.4% | 5.2% | 2.7% | 5.4% | 8.5% | 14.9% | 47.8% | 6.0% |
| | Inner ES | 8.7% | 4.6% | 4.4% | 5.2% | 9.7% | 10.1% | 4.4% | 4.2% | 6.0% | 5.3% | 6.8% | 11.1% | 15.6% | 14.2% | 11.4% | 5.4% | 4.4% | 7.4% | 16.7% | 51.0% | 7.1% |
| | Inner SE | 3.9% | 1.5% | 2.7% | 3.1% | 6.3% | 7.1% | 3.2% | 4.8% | 7.3% | 5.2% | 5.7% | 8.0% | 10.8% | 11.6% | 13.9% | 8.7% | 7.4% | 3.8% | 14.5% | 48.8% | 7.4% |
| | Inner centre | 17.5% | 11.1% | 13.0% | 20.4% | 16.6% | 17.7% | 10.6% | 15.2% | 21.9% | 22.1% | 26.6% | 15.3% | 16.8% | 16.8% | 17.1% | 14.5% | 16.7% | 14.6% | 8.0% | 15.5% | 12.8% |
| | CBD | 25.3% | 18.5% | 28.6% | 34.6% | 37.2% | 39.8% | 22.7% | 43.8% | 54.4% | 50.6% | 58.6% | 36.9% | 38.7% | 45.5% | 49.4% | 47.4% | 52.0% | 49.3% | 15.5% | 4.9% | 20.2% |
| | TOTAL | 2.4% | 1.8% | 1.9% | 1.8% | 3.5% | 3.9% | 3.1% | 3.6% | 3.8% | 3.6% | 3.8% | 5.7% | 5.9% | 6.7% | 6.8% | 6.0% | 7.1% | 7.4% | 12.9% | 20.2% | 6.2% |

Source: VLC model results

*Totals may not add due to rounding*

| 2031 (Daily) | | To | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| From | Regional SW | 2.2% | 1.5% | 0.6% | 1.9% | 2.5% | 0.9% | 0.6% | 0.7% | 5.3% | 4.9% | 6.3% | 2.1% | 4.0% | 2.8% | 11.0% | 7.5% | 14.3% | 10.1% | 23.2% | 42.4% | 2.6% |
| | Regional NW | 1.3% | 1.6% | 2.8% | 0.6% | 1.7% | 3.1% | 2.9% | 1.0% | 1.7% | 2.0% | 2.6% | 1.2% | 2.8% | 1.9% | 3.8% | 2.6% | 9.2% | 6.9% | 16.2% | 35.9% | 2.1% |
| | Regional NE | 0.6% | 3.1% | 0.8% | 2.7% | 1.0% | 0.8% | 1.4% | 2.5% | 3.2% | 2.3% | 1.7% | 0.7% | 2.3% | 2.0% | 2.8% | 2.1% | 6.6% | 4.6% | 14.9% | 37.9% | 2.5% |
| | Regional SE | 2.1% | 0.4% | 2.8% | 1.4% | 2.4% | 1.6% | 1.7% | 0.6% | 2.1% | 3.6% | 3.5% | 4.8% | 7.7% | 5.4% | 10.6% | 5.0% | 9.1% | 8.1% | 26.0% | 52.0% | 2.5% |
| | Outer SW | 2.8% | 1.6% | 0.3% | 1.8% | 2.4% | 3.8% | 1.9% | 2.1% | 8.6% | 8.3% | 9.3% | 2.8% | 4.3% | 4.6% | 9.2% | 10.3% | 18.3% | 13.0% | 24.3% | 51.3% | 5.2% |
| | Outer WN | 1.4% | 3.0% | 0.4% | 2.4% | 3.9% | 1.9% | 3.3% | 2.8% | 5.3% | 6.0% | 8.7% | 2.0% | 3.7% | 3.9% | 5.3% | 5.4% | 16.0% | 12.3% | 21.6% | 53.0% | 4.6% |
| | Outer NW | 0.8% | 2.6% | 1.5% | 1.5% | 2.2% | 3.2% | 1.6% | 2.7% | 2.8% | 2.0% | 3.1% | 1.8% | 3.4% | 3.5% | 4.0% | 3.2% | 7.4% | 6.7% | 15.4% | 37.7% | 4.4% |
| | Outer NE | 0.4% | 1.7% | 2.5% | 0.2% | 2.3% | 2.9% | 2.9% | 1.0% | 3.4% | 2.8% | 3.4% | 1.9% | 3.9% | 3.1% | 3.7% | 3.8% | 6.3% | 8.2% | 17.8% | 54.3% | 4.1% |
| | Outer EN | 5.2% | 1.7% | 3.5% | 2.1% | 7.2% | 5.8% | 2.6% | 3.3% | 2.2% | 4.0% | 3.4% | 8.6% | 7.3% | 5.5% | 6.2% | 4.7% | 7.9% | 9.7% | 25.2% | 61.2% | 4.4% |
| | Outer ES | 4.2% | 1.9% | 1.8% | 3.4% | 8.1% | 6.0% | 2.2% | 2.4% | 4.0% | 2.9% | 3.9% | 8.0% | 11.1% | 8.3% | 9.6% | 5.6% | 6.4% | 6.9% | 23.8% | 56.1% | 4.4% |
| | Outer SE | 5.5% | 3.0% | 1.4% | 3.6% | 8.7% | 6.5% | 2.6% | 3.0% | 3.8% | 4.0% | 2.7% | 11.4% | 14.0% | 13.7% | 18.5% | 7.5% | 7.9% | 7.0% | 28.7% | 63.3% | 4.3% |
| | Inner SW | 1.6% | 0.8% | 0.7% | 4.6% | 2.8% | 2.0% | 1.6% | 1.5% | 9.3% | 9.0% | 10.8% | 2.4% | 4.1% | 6.3% | 7.6% | 10.1% | 15.6% | 12.2% | 18.1% | 41.4% | 6.8% |
| | Inner WN | 3.9% | 2.7% | 2.3% | 6.7% | 4.4% | 3.6% | 3.5% | 3.5% | 8.7% | 10.7% | 13.8% | 4.0% | 3.0% | 5.1% | 7.5% | 8.4% | 18.4% | 15.6% | 17.7% | 44.3% | 7.0% |
| | Inner NW | 2.7% | 1.7% | 1.9% | 6.4% | 4.6% | 3.8% | 3.4% | 3.3% | 5.5% | 8.9% | 12.7% | 5.9% | 5.1% | 3.4% | 5.8% | 7.3% | 15.9% | 14.5% | 18.9% | 49.7% | 7.9% |
| | Inner NE | 10.0% | 3.2% | 3.3% | 10.8% | 9.4% | 5.6% | 4.0% | 3.7% | 6.3% | 10.4% | 14.9% | 8.9% | 7.8% | 5.8% | 3.9% | 5.6% | 12.7% | 16.9% | 19.2% | 54.6% | 8.0% |
| | Inner EN | 9.1% | 2.6% | 2.4% | 5.0% | 9.7% | 5.2% | 3.1% | 3.7% | 4.7% | 5.4% | 7.3% | 8.8% | 8.5% | 6.9% | 5.7% | 3.0% | 5.8% | 10.2% | 15.9% | 52.5% | 6.8% |
| | Inner ES | 13.7% | 7.7% | 6.2% | 8.5% | 15.7% | 13.5% | 7.3% | 5.9% | 7.6% | 6.3% | 7.8% | 14.8% | 17.0% | 15.9% | 12.2% | 5.8% | 4.6% | 7.9% | 16.8% | 52.7% | 8.0% |
| | Inner SE | 10.1% | 5.2% | 4.4% | 7.6% | 12.1% | 11.0% | 6.2% | 7.6% | 9.8% | 6.8% | 6.8% | 10.9% | 15.2% | 15.1% | 16.0% | 10.2% | 7.8% | 4.1% | 15.0% | 51.9% | 8.6% |
| | Inner centre | 22.1% | 14.5% | 15.8% | 25.5% | 23.3% | 20.6% | 14.6% | 17.9% | 23.8% | 23.5% | 27.9% | 17.1% | 17.2% | 18.7% | 18.7% | 15.6% | 16.7% | 14.9% | 8.1% | 15.7% | 13.3% |
| | CBD | 39.8% | 32.4% | 39.3% | 51.1% | 50.4% | 50.4% | 37.2% | 52.1% | 60.9% | 56.7% | 64.0% | 41.5% | 44.2% | 49.8% | 54.3% | 51.8% | 53.7% | 52.5% | 15.7% | 5.2% | 20.8% |
| | TOTAL | 2.6% | 2.1% | 2.6% | 2.4% | 5.1% | 4.4% | 4.3% | 4.1% | 4.4% | 4.4% | 4.2% | 6.6% | 6.9% | 7.9% | 7.9% | 6.8% | 8.1% | 8.6% | 13.5% | 20.9% | 7.1% |

Source: VLC model results

*Totals may not add due to rounding*

| % change (Daily) | | | | | | | | | | | To | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | 2% | 10% | 0% | 245% | -28% | -7% | 89% | -16% | 77% | 64% | 161% | 6% | 2% | -7% | 38% | 82% | 53% | 145% | 34% | 60% | 11% |
| | Regional NW | -15% | 3% | -3% | 0% | 27% | 12% | 6% | 75% | 34% | 73% | 305% | 3% | 4% | 1% | 46% | 29% | 110% | 411% | 39% | 86% | 20% |
| | Regional NE | -51% | 5% | 7% | -32% | 169% | 29% | -4% | 225% | 1% | 31% | 71% | -41% | 1% | 30% | -1% | 7% | 72% | 85% | 16% | 36% | 32% |
| | Regional SE | 266% | 236% | -25% | 21% | 168% | 306% | 274% | 0% | 17% | 46% | 9% | 138% | 29% | 115% | 34% | 60% | 83% | 146% | 28% | 44% | 39% |
| | Outer SW | -19% | 45% | 0% | 544% | 94% | 24% | -11% | -12% | 109% | 97% | 120% | -9% | -31% | -37% | 5% | 40% | 90% | 136% | 52% | 40% | 52% |
| | Outer WN | -22% | 3% | -55% | 0% | 21% | 4% | 3% | 24% | 4% | 52% | 31% | -21% | -3% | -12% | 0% | -2% | 45% | 96% | 19% | 28% | 14% |
| | Outer NW | 72% | -4% | 9% | 336% | -7% | 2% | 8% | 6% | 36% | 159% | 77% | -2% | -2% | 22% | 17% | 10% | 77% | 146% | 42% | 62% | 39% |
| | Outer NE | -84% | 26% | 404% | -64% | 60% | -13% | 16% | 41% | 16% | 67% | 44% | -27% | 46% | -3% | 0% | 24% | 53% | 88% | 16% | 24% | 13% |
| | Outer EN | 132% | 117% | 10% | 8% | 121% | 71% | 32% | 23% | 7% | 16% | 20% | 71% | -9% | 25% | 6% | 16% | 28% | 39% | 15% | 14% | 16% |
| From | Outer ES | 63% | 135% | 18% | 36% | 136% | 31% | 87% | 17% | 15% | 20% | 14% | 50% | -12% | 23% | 2% | 10% | 18% | 29% | 6% | 12% | 22% |
| | Outer SE | 78% | 118% | 18% | 12% | 111% | 22% | 44% | 114% | 55% | 17% | 9% | 56% | -17% | 10% | 2% | 11% | 11% | 22% | 3% | 5% | 11% |
| | Inner SW | -19% | 21% | -50% | 101% | -11% | -17% | -17% | -43% | 35% | 51% | 22% | 5% | -2% | 1% | -7% | 30% | 35% | 40% | 16% | 15% | 18% |
| | Inner WN | -4% | -1% | 10% | -2% | -32% | -5% | 13% | 7% | 9% | -18% | -4% | -4% | 1% | -2% | 4% | -8% | 19% | 26% | 4% | 15% | 18% |
| | Inner NW | 19% | -6% | 2% | 65% | -39% | -14% | 30% | 9% | 31% | 27% | 18% | -2% | -2% | 7% | 9% | 18% | 16% | 31% | 10% | 11% | 18% |
| | Inner NE | 48% | 17% | 24% | 44% | 9% | 7% | 12% | 4% | 3% | 14% | -6% | 2% | 4% | 9% | 1% | 8% | 9% | 19% | 12% | 10% | 16% |
| | Inner EN | 61% | 111% | -1% | 114% | 20% | 3% | 11% | 25% | 22% | 9% | 4% | 26% | -4% | 8% | 8% | 11% | 7% | 20% | 6% | 10% | 14% |
| | Inner ES | 58% | 68% | 40% | 65% | 63% | 33% | 67% | 40% | 27% | 18% | 14% | 34% | 9% | 12% | 7% | 8% | 5% | 7% | 0% | 3% | 13% |
| | Inner SE | 161% | 245% | 66% | 144% | 94% | 56% | 93% | 57% | 35% | 30% | 19% | 36% | 41% | 30% | 15% | 17% | 5% | 7% | 3% | 6% | 16% |
| | Inner centre | 27% | 31% | 21% | 25% | 40% | 17% | 38% | 18% | 9% | 6% | 5% | 12% | 3% | 11% | 9% | 7% | 0% | 2% | 2% | 1% | 4% |
| | CBD | 58% | 76% | 37% | 48% | 35% | 27% | 64% | 19% | 12% | 12% | 9% | 12% | 14% | 9% | 10% | 9% | 3% | 6% | 1% | 7% | 3% |
| | TOTAL | 10% | 17% | 32% | 37% | 46% | 13% | 40% | 13% | 15% | 23% | 11% | 16% | 17% | 17% | 15% | 14% | 13% | 17% | 5% | 4% | 15% |

Source: VLC model results

*Totals may not add due to rounding*

| | 2006 (AM peak) | To | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | 4.30% | 4.49% | 0.00% | 1.73% | 0.33% | 0.66% | 0.54% | 0.00% | 11.37% | 6.91% | 5.44% | 2.39% | 6.86% | 5.96% | 13.52% | 9.15% | 15.05% | 6.93% | 26.31% | 47.59% | 5.07% |
| | Regional NW | 2.89% | 3.43% | 7.17% | 0.00% | 0.00% | 6.67% | 6.86% | 0.65% | 4.08% | 3.33% | 1.65% | 2.84% | 6.20% | 5.57% | 5.72% | 4.90% | 9.48% | 3.52% | 19.03% | 36.56% | 4.33% |
| | Regional NE | 0.00% | 8.23% | 2.06% | 18.54% | 0.00% | 0.00% | 3.98% | 1.50% | 8.69% | 4.97% | 1.56% | 4.12% | 5.10% | 4.33% | 7.20% | 5.28% | 8.73% | 8.80% | 26.79% | 55.16% | 6.27% |
| | Regional SE | 0.00% | 0.00% | 0.86% | 2.90% | 5.15% | 3.41% | 0.85% | 0.00% | 4.50% | 5.37% | 6.79% | 4.86% | 17.26% | 7.35% | 20.94% | 8.51% | 9.43% | 6.93% | 34.55% | 68.34% | 4.99% |
| | Outer SW | 11.79% | 7.52% | 0.00% | 0.00% | 1.14% | 13.80% | 6.91% | 9.15% | 12.36% | 9.26% | 6.49% | 8.70% | 15.81% | 16.74% | 16.04% | 13.30% | 16.97% | 10.84% | 22.94% | 53.79% | 10.04% |
| | Outer WN | 2.24% | 6.14% | 0.00% | 0.00% | 0.21% | 3.54% | 6.75% | 8.59% | 6.59% | 5.26% | 15.96% | 3.82% | 7.74% | 9.23% | 8.16% | 10.34% | 16.02% | 9.23% | 24.42% | 55.67% | 9.53% |
| | Outer NW | 1.84% | 5.90% | 3.34% | 0.00% | 0.86% | 5.84% | 3.17% | 4.76% | 7.27% | 1.02% | 4.35% | 3.49% | 8.30% | 6.23% | 8.56% | 8.05% | 9.40% | 7.21% | 18.43% | 44.97% | 8.31% |
| | Outer NE | 9.15% | 4.72% | 0.78% | 3.77% | 0.00% | 8.59% | 6.46% | 1.03% | 10.16% | 4.12% | 5.70% | 5.84% | 5.89% | 5.96% | 8.15% | 6.35% | 6.46% | 7.48% | 20.96% | 58.61% | 9.12% |
| | Outer EN | 3.11% | 2.19% | 1.42% | 3.64% | 4.22% | 4.35% | 3.13% | 1.02% | 4.22% | 5.75% | 4.95% | 7.15% | 12.16% | 7.42% | 9.79% | 7.54% | 9.65% | 12.35% | 30.83% | 73.03% | 8.81% |
| From | Outer ES | 1.00% | 0.00% | 0.25% | 3.87% | 5.64% | 8.59% | 2.36% | 2.50% | 6.06% | 4.67% | 5.53% | 9.71% | 23.95% | 12.01% | 17.51% | 9.92% | 9.09% | 8.01% | 32.34% | 71.27% | 7.97% |
| | Outer SE | 5.86% | 1.18% | 1.78% | 4.90% | 2.74% | 0.00% | 2.59% | 0.00% | 4.13% | 6.74% | 4.54% | 13.68% | 26.18% | 21.06% | 28.84% | 12.24% | 11.29% | 7.79% | 37.59% | 78.15% | 8.39% |
| | Inner SW | 4.90% | 0.00% | 0.00% | 0.00% | 0.97% | 8.10% | 4.70% | 4.35% | 13.43% | 11.68% | 17.31% | 3.92% | 9.20% | 16.10% | 16.76% | 16.89% | 21.19% | 16.68% | 26.01% | 60.31% | 14.67% |
| | Inner WN | 5.89% | 1.77% | 0.00% | 2.89% | 0.88% | 7.21% | 3.50% | 1.33% | 9.90% | 13.19% | 8.97% | 5.10% | 5.16% | 10.40% | 11.11% | 14.29% | 22.11% | 17.23% | 26.09% | 56.91% | 12.57% |
| | Inner NW | 4.62% | 2.34% | 1.59% | 3.98% | 0.28% | 8.16% | 4.32% | 6.51% | 10.74% | 9.20% | 14.36% | 5.65% | 8.25% | 5.55% | 8.79% | 10.26% | 20.42% | 15.44% | 25.52% | 62.19% | 14.41% |
| | Inner NE | 4.17% | 1.64% | 0.38% | 0.74% | 1.54% | 8.91% | 4.57% | 2.99% | 11.56% | 8.11% | 12.08% | 7.45% | 11.24% | 8.69% | 6.09% | 8.01% | 15.88% | 16.19% | 25.43% | 65.98% | 13.39% |
| | Inner EN | 11.62% | 1.01% | 0.57% | 0.46% | 3.35% | 7.46% | 2.16% | 2.06% | 7.24% | 7.75% | 7.32% | 6.09% | 13.04% | 8.63% | 8.72% | 4.60% | 7.85% | 10.65% | 21.81% | 63.75% | 12.39% |
| | Inner ES | 7.36% | 0.00% | 0.88% | 2.29% | 1.17% | 3.52% | 1.12% | 1.42% | 7.19% | 7.04% | 7.14% | 11.12% | 17.25% | 15.81% | 15.58% | 8.38% | 6.55% | 8.96% | 24.65% | 68.07% | 12.94% |
| | Inner SE | 5.83% | 0.00% | 3.64% | 1.30% | 2.67% | 10.52% | 3.25% | 6.02% | 7.38% | 9.26% | 9.03% | 10.01% | 14.69% | 15.26% | 22.73% | 13.81% | 10.40% | 5.57% | 21.89% | 64.12% | 14.29% |
| | Inner centre | 4.60% | 0.80% | 0.59% | 2.61% | 3.80% | 7.43% | 4.24% | 2.25% | 12.14% | 10.49% | 11.66% | 9.83% | 12.48% | 13.85% | 13.46% | 12.06% | 16.40% | 11.74% | 11.62% | 29.99% | 15.84% |
| | CBD | 5.73% | 3.87% | 4.22% | 8.36% | 9.75% | 14.58% | 6.62% | 13.74% | 23.77% | 22.06% | 26.91% | 20.20% | 23.36% | 27.30% | 28.82% | 28.78% | 34.10% | 29.43% | 12.87% | 5.74% | 12.18% |
| | TOTAL | 4.38% | 3.47% | 2.02% | 3.14% | 1.15% | 5.05% | 3.92% | 2.21% | 5.43% | 5.43% | 5.42% | 5.79% | 7.95% | 8.17% | 8.63% | 7.30% | 9.25% | 7.76% | 20.69% | 45.22% | 10.34% |

Source: VLC model results

*Totals may not add due to rounding*

| 2031 (AM peak) | | | | | | | | | | | To | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | 4.23% | 4.31% | 1.72% | 5.78% | 4.55% | 2.80% | 1.14% | 0.00% | 16.15% | 14.46% | 18.13% | 3.71% | 8.94% | 6.89% | 22.70% | 21.85% | 29.75% | 24.74% | 42.36% | 74.32% | 6.18% |
| | Regional NW | 1.97% | 3.52% | 6.35% | 2.14% | 4.55% | 9.33% | 7.56% | 2.59% | 5.68% | 8.16% | 11.54% | 2.82% | 7.83% | 5.29% | 8.79% | 7.45% | 24.11% | 21.89% | 34.23% | 71.52% | 5.97% |
| | Regional NE | 1.72% | 8.45% | 1.98% | 11.91% | 3.80% | 3.83% | 4.15% | 8.43% | 8.42% | 5.63% | 4.14% | 2.27% | 8.37% | 5.70% | 6.71% | 5.91% | 15.04% | 14.74% | 34.70% | 71.95% | 8.13% |
| | Regional SE | 6.41% | 0.00% | 1.10% | 3.15% | 3.80% | 3.02% | 8.30% | 4.33% | 4.93% | 7.62% | 7.17% | 13.99% | 23.69% | 17.50% | 25.60% | 13.45% | 18.43% | 16.25% | 48.88% | 81.29% | 6.85% |
| | Outer SW | 5.74% | 2.58% | 2.14% | 2.11% | 4.75% | 10.79% | 5.43% | 3.91% | 28.79% | 20.81% | 25.80% | 3.98% | 9.57% | 10.84% | 17.73% | 25.73% | 36.92% | 29.72% | 42.94% | 78.89% | 14.88% |
| | Outer WN | 2.89% | 3.54% | 0.00% | 3.75% | 7.15% | 4.14% | 6.15% | 3.61% | 10.18% | 13.55% | 25.02% | 2.42% | 6.66% | 7.03% | 9.26% | 11.11% | 31.17% | 25.04% | 36.44% | 78.11% | 12.50% |
| | Outer NW | 1.46% | 5.34% | 2.76% | 2.17% | 4.99% | 7.51% | 3.17% | 6.82% | 7.81% | 4.72% | 6.50% | 3.21% | 7.85% | 6.29% | 8.47% | 7.66% | 19.72% | 18.12% | 30.28% | 67.51% | 12.21% |
| | Outer NE | 0.00% | 3.75% | 1.71% | 1.31% | 4.58% | 10.10% | 5.46% | 2.27% | 8.24% | 5.38% | 6.41% | 3.08% | 7.55% | 5.57% | 7.58% | 6.95% | 11.17% | 16.31% | 28.43% | 74.22% | 10.72% |
| | Outer EN | 11.62% | 0.00% | 2.99% | 2.83% | 5.70% | 7.42% | 4.13% | 4.62% | 4.07% | 6.54% | 4.87% | 14.72% | 12.90% | 8.29% | 10.59% | 7.95% | 13.09% | 16.22% | 39.33% | 80.90% | 10.24% |
| | Outer ES | 8.51% | 0.68% | 1.14% | 4.35% | 9.11% | 8.06% | 3.25% | 5.07% | 6.12% | 5.02% | 5.79% | 11.37% | 22.02% | 14.18% | 18.98% | 9.55% | 11.33% | 12.34% | 38.42% | 77.12% | 9.23% |
| From | Outer SE | 6.41% | 0.70% | 0.88% | 4.83% | 10.02% | 14.41% | 4.47% | 0.00% | 7.10% | 7.19% | 4.71% | 20.25% | 26.23% | 24.65% | 33.28% | 15.08% | 13.68% | 11.14% | 43.40% | 80.14% | 9.25% |
| | Inner SW | 5.60% | 1.37% | 0.00% | 3.56% | 6.35% | 11.56% | 4.55% | 4.88% | 33.07% | 21.12% | 21.25% | 3.81% | 8.44% | 16.25% | 17.92% | 26.12% | 34.42% | 31.14% | 37.28% | 73.69% | 20.12% |
| | Inner WN | 6.75% | 2.33% | 0.00% | 8.32% | 7.77% | 8.22% | 6.15% | 8.24% | 15.55% | 17.04% | 16.43% | 4.33% | 4.96% | 9.75% | 11.74% | 13.91% | 32.39% | 28.86% | 31.77% | 68.35% | 16.52% |
| | Inner NW | 3.23% | 1.32% | 0.49% | 6.17% | 6.44% | 8.86% | 5.60% | 8.20% | 11.09% | 14.22% | 17.02% | 5.30% | 7.59% | 5.75% | 8.74% | 12.48% | 27.54% | 25.78% | 30.98% | 70.53% | 18.40% |
| | Inner NE | 5.00% | 1.22% | 0.31% | 6.77% | 6.71% | 11.57% | 5.33% | 5.02% | 10.08% | 9.80% | 14.10% | 7.96% | 12.01% | 8.89% | 6.15% | 8.38% | 19.24% | 26.13% | 31.03% | 73.80% | 16.82% |
| | Inner EN | 11.31% | 0.40% | 0.42% | 2.50% | 6.67% | 8.61% | 3.31% | 4.59% | 6.85% | 7.63% | 8.09% | 7.45% | 12.27% | 9.55% | 8.81% | 4.76% | 8.56% | 14.43% | 25.64% | 70.47% | 14.14% |
| | Inner ES | 6.49% | 0.67% | 1.74% | 2.32% | 3.85% | 4.84% | 3.05% | 4.57% | 7.06% | 7.55% | 7.23% | 9.82% | 14.57% | 16.89% | 14.71% | 7.80% | 6.71% | 10.17% | 26.32% | 70.79% | 13.92% |
| | Inner SE | 5.81% | 0.88% | 0.87% | 3.51% | 7.35% | 10.20% | 5.81% | 1.41% | 8.44% | 8.90% | 9.36% | 9.04% | 16.36% | 18.27% | 20.33% | 14.64% | 10.64% | 6.00% | 23.34% | 67.48% | 16.05% |
| | Inner centre | 2.37% | 0.91% | 3.52% | 5.43% | 7.75% | 8.63% | 4.76% | 5.75% | 11.42% | 11.93% | 15.38% | 10.00% | 11.49% | 15.70% | 14.98% | 12.76% | 16.27% | 13.51% | 11.89% | 29.90% | 17.06% |
| | CBD | 6.71% | 5.02% | 11.01% | 12.63% | 18.51% | 12.69% | 12.41% | 28.46% | 28.89% | 28.90% | 36.79% | 18.76% | 25.06% | 29.53% | 33.76% | 29.48% | 36.96% | 34.26% | 12.96% | 6.58% | 12.80% |
| | TOTAL | 4.24% | 3.52% | 2.12% | 3.40% | 5.28% | 5.78% | 4.37% | 3.59% | 5.48% | 6.22% | 5.87% | 4.93% | 7.55% | 8.32% | 8.99% | 7.85% | 11.33% | 10.39% | 23.72% | 48.53% | 12.08% |

Source: VLC model results

*Totals may not add due to rounding*

| % change (AM peak) | | | | | | | | | | | To | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Regional SW | Regional NW | Regional NE | Regional SE | Outer SW | Outer WN | Outer NW | Outer NE | Outer EN | Outer ES | Outer SE | Inner SW | Inner WN | Inner NW | Inner NE | Inner EN | Inner ES | Inner SE | Inner centre | CBD | TOTAL |
| | Regional SW | -2% | -4% | 0% | 234% | 1261% | 324% | 109% | 0% | 42% | 109% | 233% | 55% | 30% | 15% | 68% | 139% | 98% | 257% | 61% | 56% | 22% |
| | Regional NW | -32% | 3% | -11% | 0% | 0% | 40% | 10% | 299% | 39% | 145% | 599% | 0% | 26% | -5% | 53% | 52% | 154% | 522% | 80% | 96% | 38% |
| | Regional NE | 0% | 3% | -4% | -36% | 0% | 0% | 4% | 463% | -3% | 13% | 165% | -45% | 64% | 32% | -7% | 12% | 72% | 67% | 30% | 30% | 30% |
| | Regional SE | 0% | 0% | 28% | 8% | -26% | -11% | 873% | 0% | 10% | 42% | 6% | 188% | 37% | 138% | 22% | 58% | 95% | 134% | 41% | 19% | 37% |
| | Outer SW | -51% | -66% | 0% | 0% | 318% | -22% | -21% | -57% | 133% | 125% | 298% | -54% | -39% | -35% | 11% | 93% | 118% | 174% | 87% | 47% | 48% |
| | Outer WN | 29% | -42% | 0% | 0% | 3370% | 17% | -9% | -58% | 55% | 158% | 57% | -37% | -14% | -24% | 14% | 7% | 95% | 171% | 49% | 40% | 31% |
| | Outer NW | -20% | -9% | -17% | 0% | 479% | 29% | 0% | 43% | 8% | 365% | 49% | -8% | -5% | 1% | -1% | -5% | 110% | 151% | 64% | 50% | 47% |
| | Outer NE | -100% | -20% | 119% | -65% | 0% | 18% | -15% | 119% | -19% | 31% | 12% | -47% | 28% | -7% | -7% | 9% | 73% | 118% | 36% | 27% | 18% |
| | Outer EN | 274% | -100% | 111% | -22% | 35% | 71% | 32% | 351% | -4% | 14% | -2% | 106% | 6% | 12% | 8% | 5% | 36% | 31% | 28% | 11% | 16% |
| From | Outer ES | 753% | 0% | 352% | 13% | 62% | -6% | 38% | 103% | 1% | 8% | 5% | 17% | -8% | 18% | 8% | -4% | 25% | 54% | 19% | 8% | 16% |
| | Outer SE | 9% | -40% | -50% | -1% | 265% | 0% | 72% | 0% | 72% | 7% | 4% | 48% | 0% | 17% | 15% | 23% | 21% | 43% | 15% | 3% | 10% |
| | Inner SW | 14% | 0% | 0% | 0% | 553% | 43% | -3% | 12% | 146% | 81% | 23% | -3% | -8% | 1% | 7% | 55% | 62% | 87% | 43% | 22% | 37% |
| | Inner WN | 15% | 32% | 0% | 188% | 781% | 14% | 76% | 522% | 57% | 29% | 83% | -15% | -4% | -6% | 6% | -3% | 46% | 68% | 22% | 20% | 31% |
| | Inner NW | -30% | -43% | -69% | 55% | 2170% | 9% | 30% | 26% | 3% | 55% | 19% | -6% | -8% | 4% | -1% | 22% | 35% | 67% | 21% | 13% | 28% |
| | Inner NE | 20% | -26% | -18% | 809% | 335% | 30% | 17% | 68% | -13% | 21% | 17% | 7% | 7% | 2% | 1% | 5% | 21% | 61% | 22% | 12% | 26% |
| | Inner EN | -3% | -61% | -26% | 448% | 99% | 15% | 53% | 123% | -5% | -2% | 10% | 22% | -6% | 11% | 1% | 4% | 9% | 35% | 18% | 11% | 14% |
| | Inner ES | -12% | 0% | 98% | 1% | 228% | 38% | 172% | 222% | -2% | 7% | 1% | -12% | -16% | 7% | -6% | -7% | 2% | 14% | 7% | 4% | 8% |
| | Inner SE | 0% | 0% | -76% | 170% | 176% | -3% | 79% | -77% | 14% | -4% | 4% | -10% | 11% | 20% | -11% | 6% | 2% | 8% | 7% | 5% | 12% |
| | Inner centre | -48% | 13% | 493% | 108% | 104% | 16% | 12% | 156% | -6% | 14% | 32% | 2% | -8% | 13% | 11% | 6% | -1% | 15% | 2% | 0% | 8% |
| | CBD | 17% | 30% | 161% | 51% | 90% | -13% | 87% | 107% | 22% | 31% | 37% | -7% | 7% | 8% | 17% | 2% | 8% | 16% | 1% | 15% | 5% |
| | TOTAL | -3% | 2% | 5% | 8% | 359% | 15% | 11% | 63% | 1% | 14% | 8% | -15% | -5% | 2% | 4% | 8% | 23% | 34% | 15% | 7% | 17% |

Source: VLC model results

*Totals may not add due to rounding*

***Modelled future traffic volumes***

The predicted traffic volume change along some key routes from the western suburbs has been determined using the Veitch Lister model. The predicted volumes are for the year 2031 and are shown in Table 3-6. Table 3-7 shows the growth in commercial vehicles between 2006 and 2031.

**Table 3-6: Volume change daily vehicles in 2031**

| Road Name | Direction | Current Volume | % Change in 2031 |
|---|---|---|---|
| Western Ring Road | South of Deer Park Bypass | 113,000 | 33% |
| Princes Highway West | West of Western Ring Road | 141,000 | 38% |
| Geelong Road | East of Francis Street | 42,000 | 91% |
| Calder Freeway | West of Western Ring Road | 87,000 | 47% |
| West Gate Freeway | West Gate Bridge | 165,000 | 43% |
| Monash Freeway | East of Toorak Road | 150,000 | 42% |

Source: VLC model results

It can be seen that traffic volumes from the west are expected to grow strongly over the 25 year period, with a minimum growth of 33% experienced on the Western Ring Road. The West Gate Bridge is expected to carry about 236,000 vehicles per day in both directions which will place considerable pressure on this freight and commuter corridor. The M1 corridor upgrade will assist in relieving some of this pressure in the short term.

The Calder Freeway is expected to experience the highest level of growth of over 47% by 2031. This could be due to the predicted residential growth within the northern suburbs. As the Calder Freeway typically provides two lanes in each direction, it may require upgrading by 2031 to accommodate the predicted increases.

**Table 3-7: Commercial vehicle growth 2006 to 2031**

| Location | Commercial vehicle growth |
|---|---|
| West Gate Bridge | 55% |
| Princes Freeway (west of the Western Ring Road) | 98% |
| Princes Highway (Geelong Road) in the west | 200% |
| Princes Highway (Smithfield Road) | 61% |
| Dynon Road over the Maribyrnong River | 37% |
| Footscray Road over the Maribyrnong River | 68% |
| CityLink / Monash Freeway | 53% |
| Alexandra Parade | 23% |

Source: VLC model results

Table 3-7 shows that the key freight routes across Melbourne will experience moderate to high levels of commercial vehicle growth, with Geelong Road experiencing the highest level of growth. This is due to its role of providing access to the Port of Melbourne from the west.

***Traffic origin/destinations and desire lines***

The VLC model has been used to generate origin/destination and select links models for the base case (2006) and future years based on statistical local areas (SLA). This SLA data was then summarised into six sectors to generate an origin/destination matrix for Greater Melbourne.

It is clear that the CBD and inner areas are major attractors of vehicle movements. These areas are the origin or destinations for a total of approximately 1.5 million car movements per day. Over 300,000 of these trips were generated in the east, while approximately 220,000 of these trips were generated in the west. It is interesting to note that over 450,000 trips were generated within the CBD and inner areas, suggesting that about one third of trips starting or ending in these areas are short local trips.

There is some demand for east/west movements with almost 95,000 trips travelling across Greater Melbourne everyday. It should be noted that these trips are from the outer eastern and outer western municipalities. The inner areas also include municipalities to the east and west of the CBD and should also be considered in the cross city movements. The inner municipalities make over 420,000 movements to the eastern and western areas, however not all of these movements would be cross city movements.

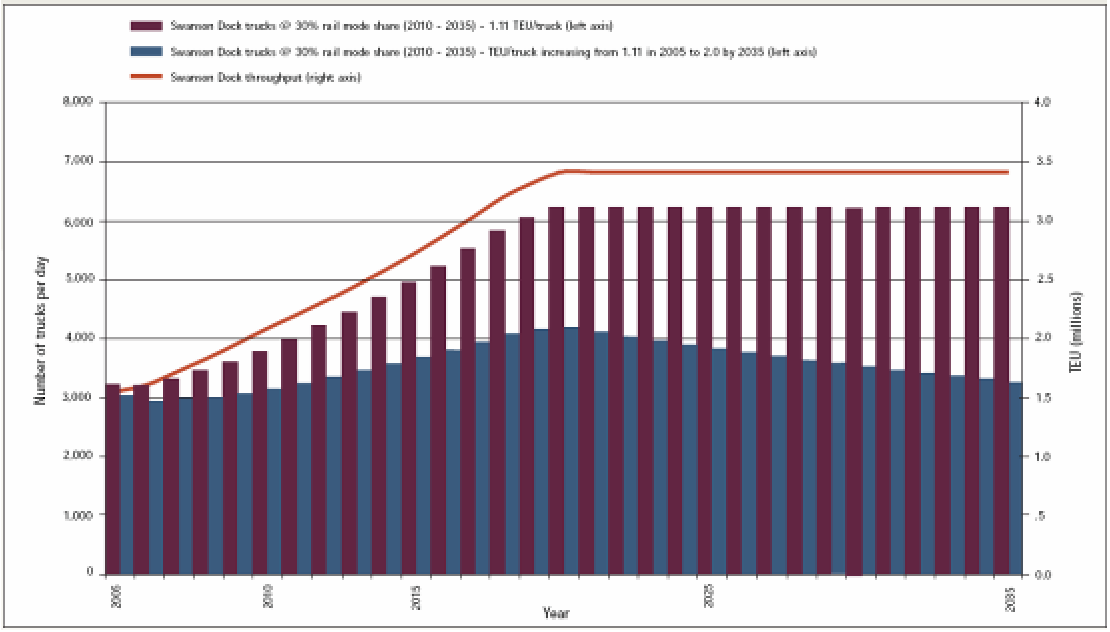
### *3.1.3 Goods movement*

In order to manage future truck numbers, substantial improvements in trucking efficiency will be essential. POMC surveys indicate that 51% of total vehicle capacity was used with an average of 1.11 containers per truck. To minimise the number of port trucks on roads POMC and government departments such as DOI are encouraging, when possible, the trucking and transport industry to deliver a significant increase in truck utilisation by[29];

- Encouraging change in the truck fleet by increasing B-doubles and Super B-doubles at the expense of semi-trailers and smaller rigid trucks;
- Encouraging stevedore systems and practices that drive efficiency;
- Integrating supply chain logistics such as the proportion of loaded inbound trucks with an outbound load (and vice versa).

The potential for impact on the demand for road space as a result of improving truck productivity from 1.11 TEU per truck in 2005 to 2 TEU per truck in 2020 is shown in the following graph.

[29] POMC (2006) Port Development Plan (Consultation Draft)



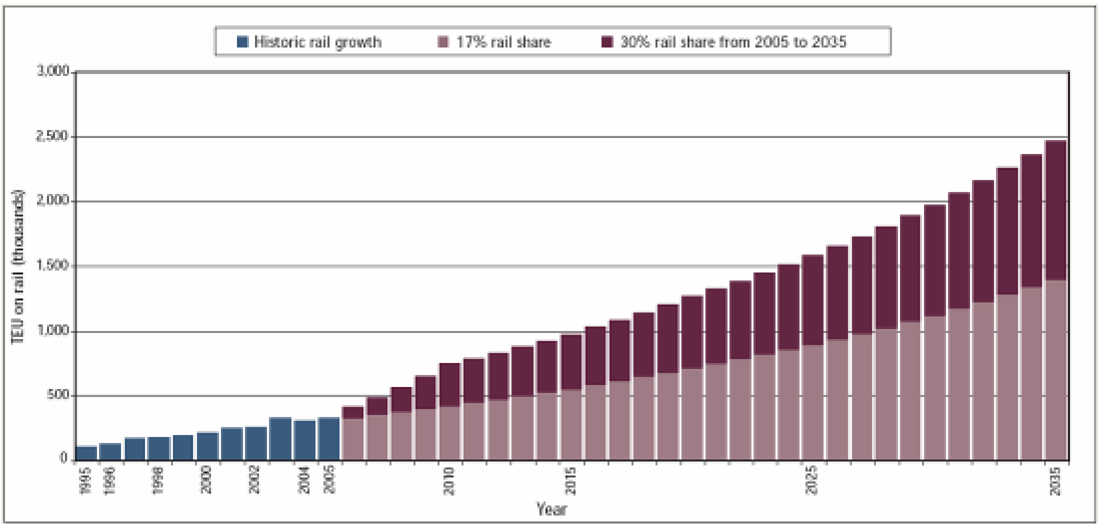

Trends demonstrated in the five annual port truck utilisation surveys (2002 – 2006) show very little change in truck utilisation and numbers of empty trucks and empty containers slots. It seems evident that changes in the regulatory environment will be required if the increases in the graph above are to occur.

The role of rail in delivering efficient operation to the port has been the focus of much discussion in recent years. In its Development Plan, POMC adopts the following assumptions in relation to future rail usage:

- 30% rail share is obtained by 2010 and maintained through to 2035
- Average load on interstate trains increases from 150 TEU in 2010 to 200 TEU in 2035
- Average load on intrastate trains increases from 60 TEU in 2010 to 90 TEU in 2035
- Average load on shuttle trains increases from 40 TEU in 2010 to 75 TEU in 2035
- Inward and outward freight flows are balanced giving optimum train efficiency

On this basis, the rail freight growth is forecast to increase as shown in Figure 3.2.

**Figure 3.2 Forecast rail growth at Port of Melbourne**



This creates a number of significant issues in relation to the availability and future supply of rail infrastructure/capacity which are discussed later.

Key influences on demand for freight services are increases in demand for exports such as minerals, logs and other agricultural production. There is an emerging trend for the substitution of domestic production with imports as consumer goods and raw material inputs (VFLC, 2005), as discussed in the preceding chapter.

***Movement across screenlines***

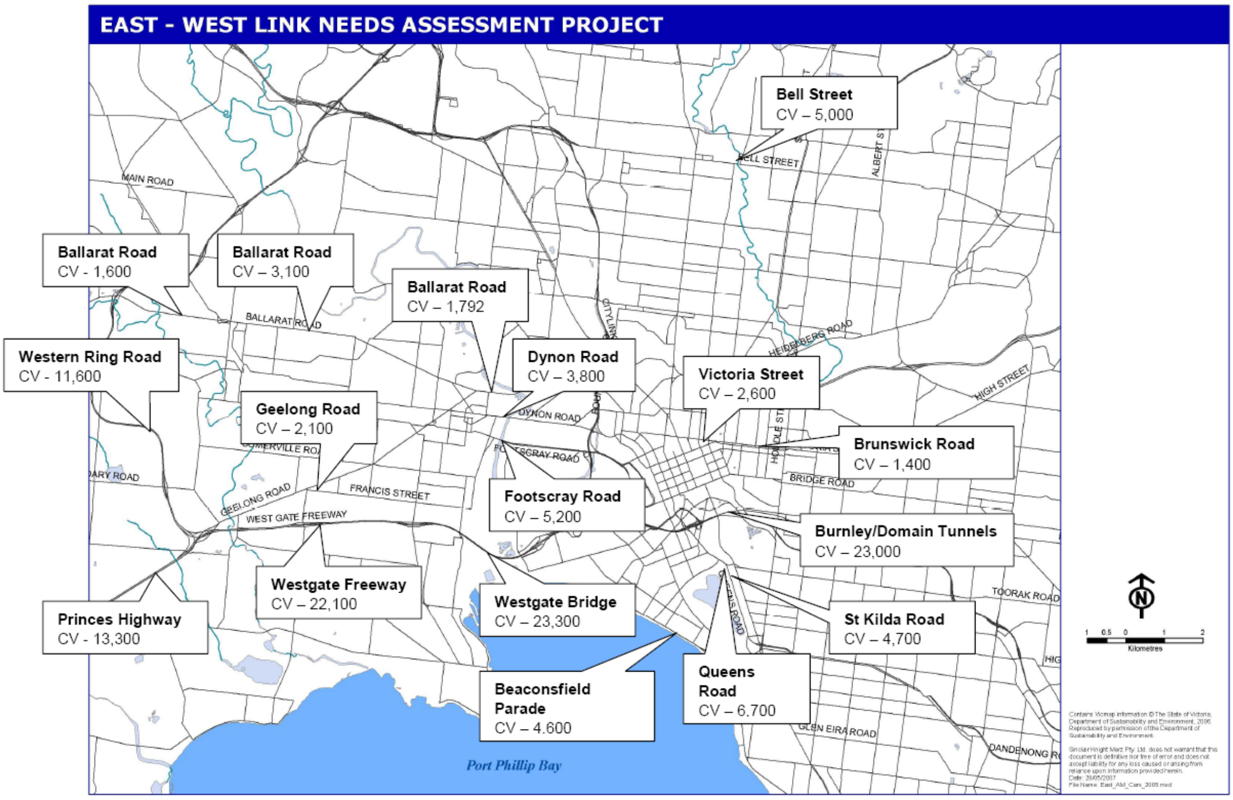
The demand for commercial vehicle movements was analysed from the Zenith model[30] across a set of screenlines for 2006 and 2031. The screenlines are shown in section 3.3. Analyses were not carried out for all screenlines shown in the figure; the focus was on the west, centre and inner south (nos. 2, 3, 4, 5, 6).

Figure 3.3 illustrates a selection of the model's commercial vehicle movements (the model does not provide breakdowns of this movement between truck types or sizes). Some observations from this data are:

- The Western Ring Road currently has 11,600 daily commercial vehicle trips (2006), this will increase by 51% by 2031;
- The Princes Freeway will see an additional 100% daily commercial vehicle trips in 2031, up from 13,300 in 2006;
- Citylink will see a high growth in daily commercial vehicles by 2031; an increase of 47% from 23,000 vehicles in 2006;
- The West Gate Bridge will see a modelled increase in daily commercial vehicle movements of around 57% between 2006 and 2031.

[30] The VLC model does not include rail freight movements.

**Figure 3.3: 2006 Daily commercial vehicles volumes**




Source: VLC model results

### *3.1.4 Overall transport task*

The Zenith model standard outputs provide some insight into the modelled impact on the transport system overall. Some key summary statistics are given in Table 3-8.

The model results indicate that:

- Between 2006 and 2031, overall trips increase by 25%, trip-km by 30% and trip-hours by 32%, suggesting that average trip lengths and times will grow faster than the number of trips themselves.
- Average distance per trip is greater for vehicle trips (12.6km) than public transport trips (9.9km). Between 2006 and 2031, trip lengths increase for all modes except tram, which decreases slightly (from 3.7km to 3.4km).
- Average travel speeds go down for all road vehicle trips except buses, but go up for trains (presumably because of assumptions regarding the future mix of train service patterns – proportionately more express trains are introduced).

**Table 3-8: VLC reference case model results**

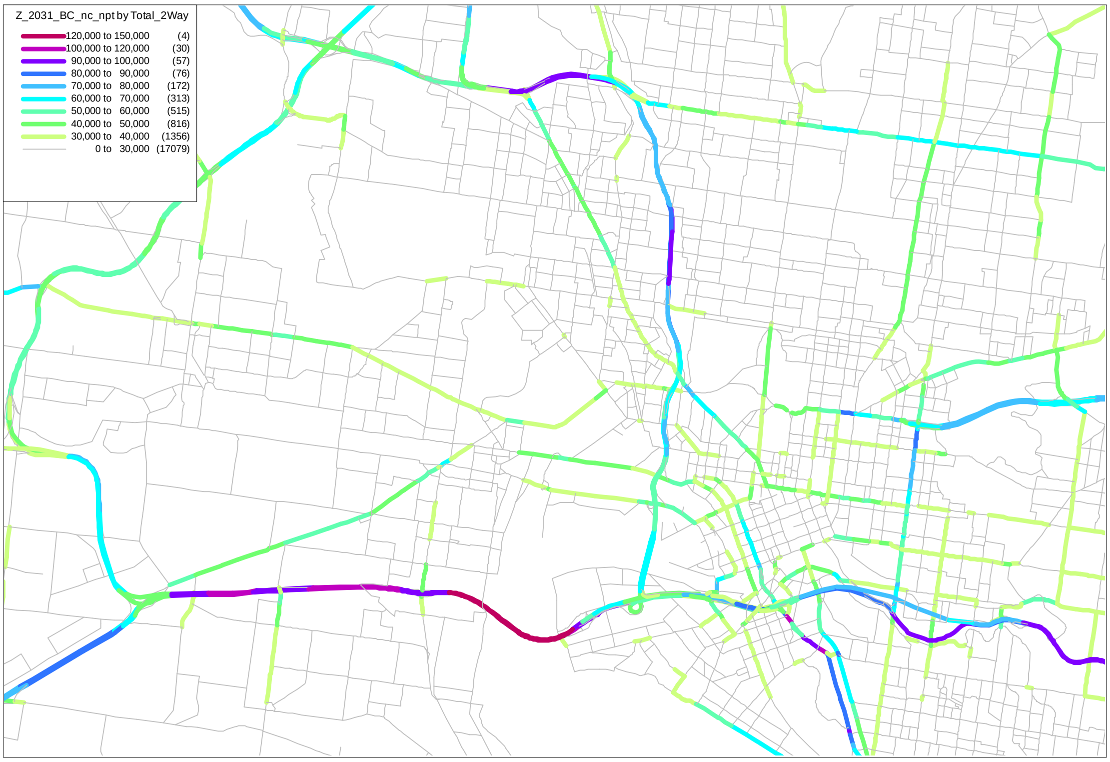
| | | | 2006 | 2031 | Change |
|---|---|---|---|---|---|
| Trips | Private Vehicle | | 12,102,547 | 15,774,913 | 23% |
| | Commercial Vehicle | | 509,346 | 760,974 | 33% |
| | Public Trar | Bus | 283,657 | 491,706 | 42% |
| | | Rail - Suburban | 603,563 | 885,763 | 32% |
| | | Rail - V/Line | 23,274 | 49,546 | 53% |
| | | Tram | 480,199 | 699,167 | 31% |
| | | Total boardings | 1,390,693 | 2,126,182 | 35% |
| | | PT total trips | 949,964 | 1,418,271 | 33% |
| | Walk/cycle | | 2,219,024 | 3,200,770 | 31% |
| | **Total** | | **15,780,881** | **21,154,928** | **25%** |
| Trip-km | Private Vehicle | | 142,423,300 | 198,063,100 | 28% |
| | Commercial Vehicle | | 11,489,100 | 17,974,600 | 36% |
| | Public Trar | Bus | 1,753,306 | 3,463,320 | 49% |
| | | Rail - Suburban | 7,713,849 | 12,444,051 | 38% |
| | | Rail - V/Line | 1,138,663 | 2,739,191 | 58% |
| | | Tram | 1,766,712 | 2,346,194 | 25% |
| | | PT total trips | 12,372,530 | 20,992,757 | 41% |
| | Walk/cycle | | - | - | |
| | **Total** | | **166,284,929.7** | **237,030,457** | **30%** |
| Trip-hrs | Private Vehicle | | 2,886,752 | 4,134,062 | 30% |
| | Commercial Vehicle | | 193,616 | 317,915 | 39% |
| | Public Trar | Bus | 58,379 | 115,116 | 49% |
| | | Rail - Suburban | 218,147 | 348,124 | 37% |
| | | Rail - V/Line | 17,167 | 41,525 | 59% |
| | | Tram | 86,137 | 114,823 | 25% |
| | | PT total trips | 379,830 | 619,589 | 39% |
| | Walk/cycle | | - | - | |
| | **Total** | | **3,460,197.9** | **5,071,565.8** | **32%** |
| Veh-km | Private Vehicle | | 100,491,100 | 139,028,300.0 | 28% |
| | Commercial Vehicle | | 11,489,100 | 17,974,600 | 36% |
| Veh-hrs | Private Vehicle | | 2,039,595 | 2,905,632 | 30% |
| | Commercial Vehicle | | 193,616 | 317,915 | 39% |
| km/trip | Private Vehicle | | 11.8 | 12.6 | 6% |
| | Commercial Vehicle | | 22.6 | 23.6 | 5% |
| | Public Trar | Bus | 6.2 | 7.0 | 12% |
| | | Rail - Suburban | 12.8 | 14.0 | 9% |
| | | Rail - V/Line | 48.9 | 55.3 | 12% |
| | | Tram | 3.7 | 3.4 | -10% |
| | | PT total trips | 8.9 | 9.9 | 10% |
| min/trip | Private Vehicle | | 14.3 | 15.7 | 9% |
| | Commercial Vehicle | | 22.8 | 25.1 | 9% |
| | Public Trar | Bus | 12.3 | 14.0 | 12% |
| | | Rail - Suburban | 21.7 | 23.6 | 8% |
| | | Rail - V/Line | 44.3 | 50.3 | 12% |
| | | Tram | 10.8 | 9.9 | -9% |
| | | PT total trips | 16.4 | 17.5 | 6% |
| tripkm/h | Private Vehicle | | 49.3 | 47.9 | -3% |
| | Commercial Vehicle | | 59.3 | 56.5 | -5% |
| | Public Trar | Bus | 30.0 | 30.1 | 0% |
| | | Rail - Suburban | 35.4 | 35.7 | 1% |
| | | Rail - V/Line | 66.3 | 66.0 | -1% |
| | | Tram | 20.5 | 20.4 | 0% |
| | | PT total trips | 32.6 | 33.9 | 4% |
| vehkm/h | Private Vehicle | | 49.3 | 47.8 | -3% |
| | Commercial Vehicle | | 59.3 | 56.5 | -5% |

### *3.1.5 Resulting loads on the transport network*

***Road traffic***

Figure 3.4 shows the modelled daily traffic volumes in 2031.

**Figure 3.4: 2031 Modelled daily traffic flows**




Source: VLC model results

The greatest increases in traffic occur on the primary road routes, particularly (in the context of this study):

- West Gate, CityLink and Monash Freeways (reflecting their forthcoming capacity improvements to some degree)
- Calder and Tullamarine Freeways and CityLink (Bolte Bridge section)
- Geelong Road, Smithfield Road and Racecourse Road
- Footscray Road, Dynon Road

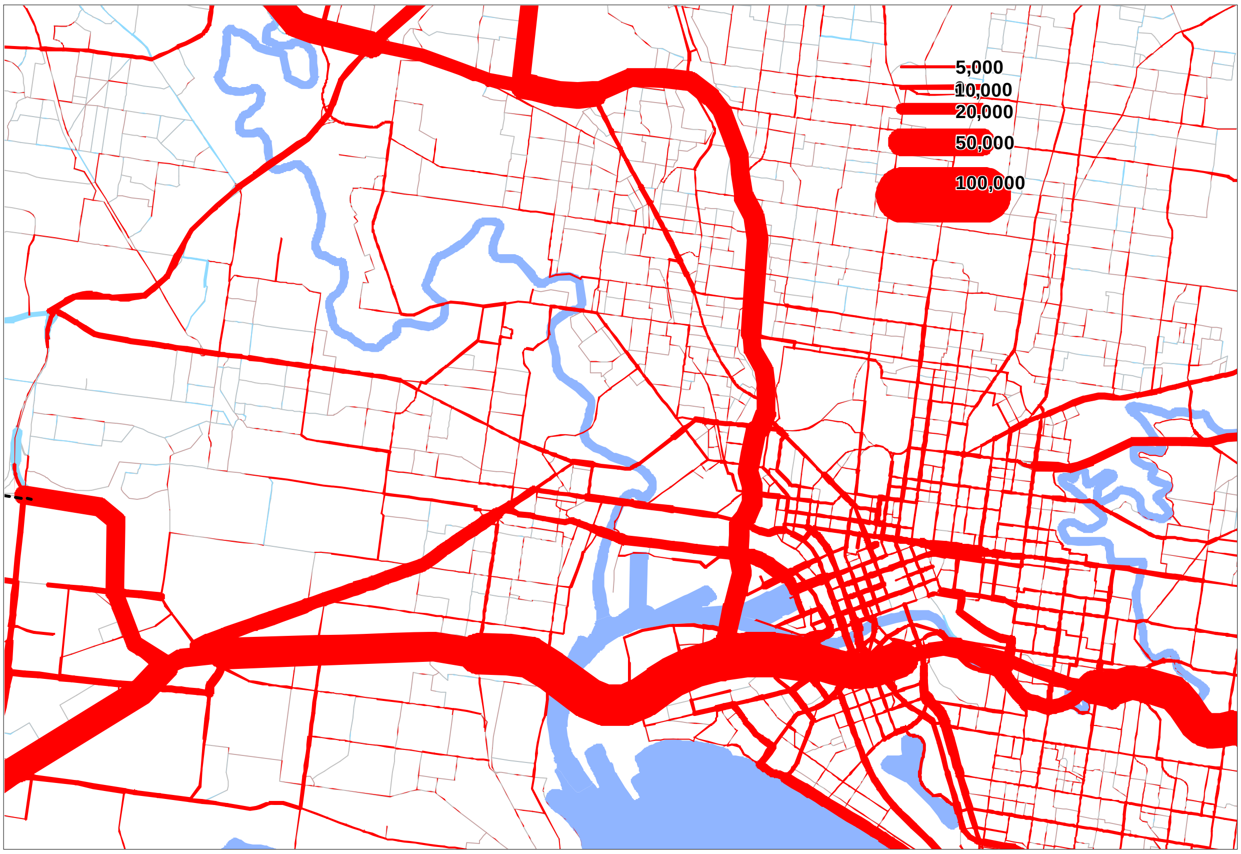
Figure 3.5 shows the all day modelled growth between 2006-2031.

It is notable that the predictions show relatively modest increases in traffic on some key routes, such as Eastern Freeway, Ballarat Road and Western Ring Road. It is also worth noting the large number of roads in the 'grid' pattern of the inner eastern suburbs that are showing increases (albeit small ones individually), probably reflecting capacity limits on the Eastern and Monash Freeways that will 'force' traffic increases on other arterials.

It is also significant to note the projected increases in traffic on roads in and around the CBD grid. Given the model (in common with most urban network models) does not explicitly model intersection capacity as a constraining influence on the network, it is possible that the increases noted on inner city roads will be in excess of practical capacity, especially if in future there are changes to the network and its management to give greater priority to public transport, walkers and cyclists (as outlined in the City of Melbourne's Transport Plan, amongst others).

This increase on the CBD grid also differs from what would be expected with the journey to work data presented in Table 2-2 and Table 2-4. This data showed a reduction in journeys to work via private cars, however traffic volumes on CBD roads are still expected to grow. This could be due to motorists travelling through the CBD to reach their final destination.

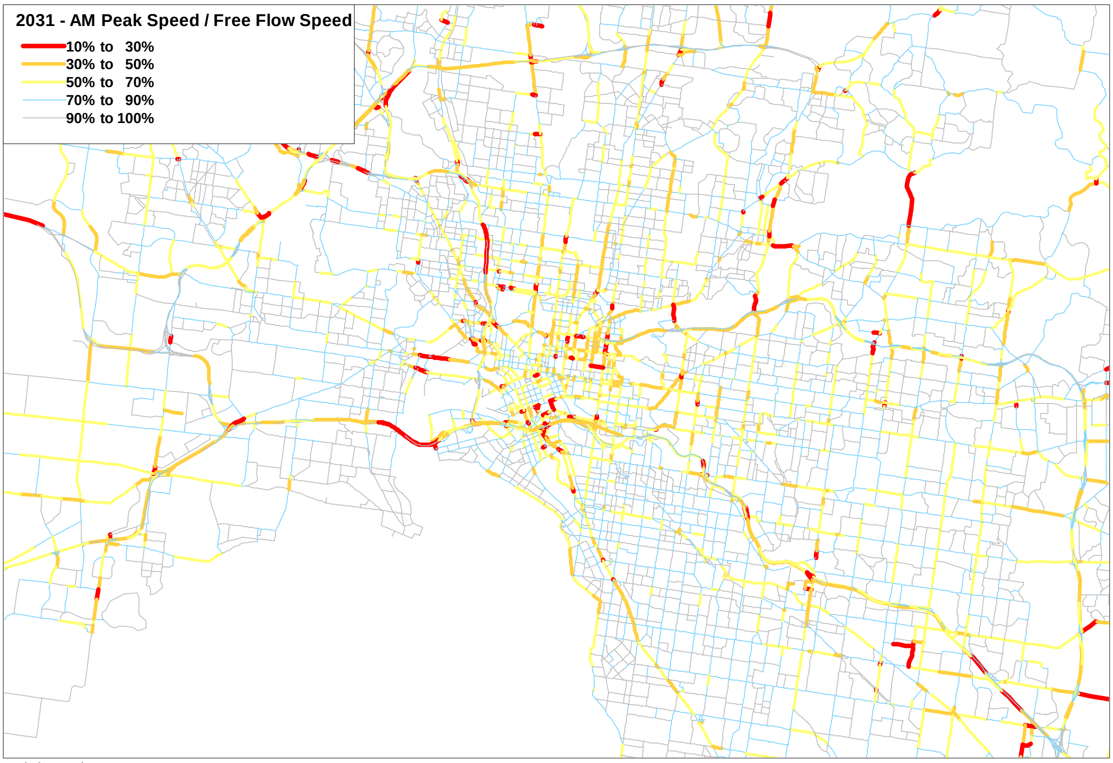
Figure 3.5: Modelled growth, all day 2006-2031




Source: VLC model results

Figure 3.6 shows the predicted AM peak speeds versus the free flow speed in 2031 for the AM peak period. It shows that roads such as the Tullamarine and West Gate Freeways will have a decrease in the traffic speed (as a result of increasing levels of congestion) as traffic volumes increase in the future. Travel speeds along roads neighbouring the end of the Eastern Freeway are predicted to be slower than those shown in Figure 2.26 due to increasing traffic volumes and the greater demand on intersections that are operating close to capacity. The West Gate Bridge remains a pinch point on the M1 corridor, which is expected to affect travel speeds along the whole route. These lower travel speeds will result in longer delays to all vehicles and peak spreading.

**Figure 3.6: 2031 AM peak speed / free flow speed**

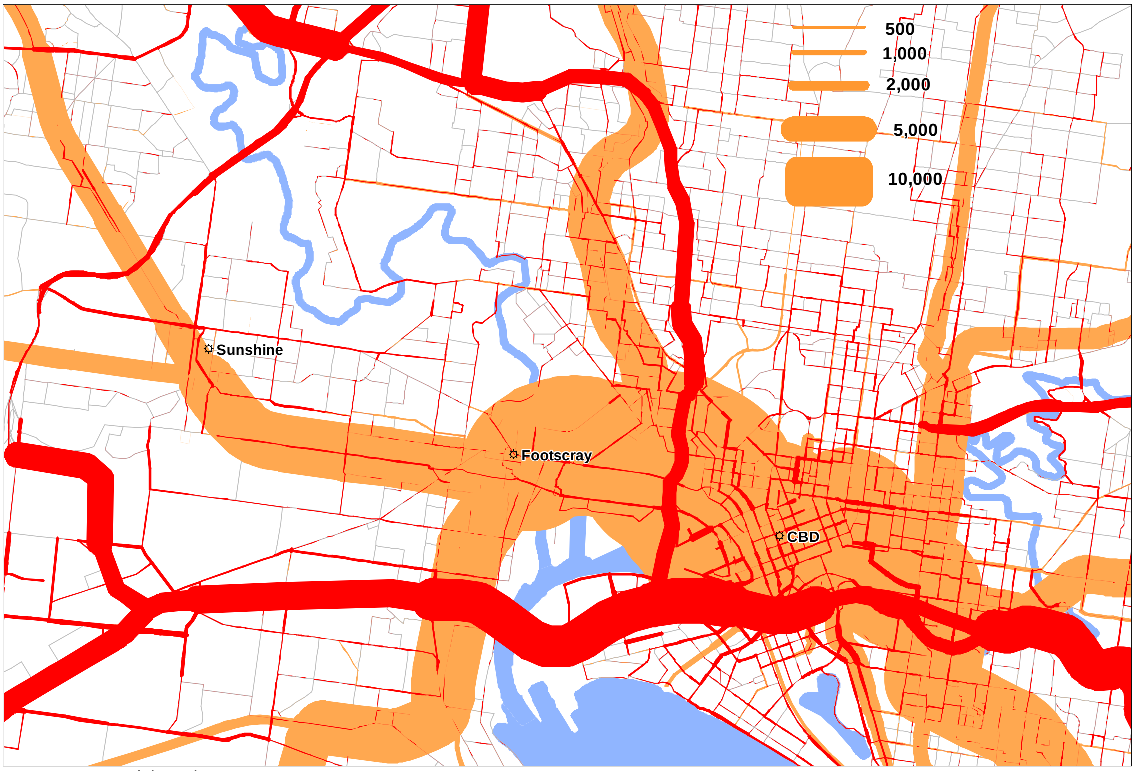



Source: VLC model results

### *Public transport*

Figure 3.7 shows that during the AM peak, the majority of the growth in trips on the base case network from the west will be accommodated by public transport, with the remainder using road.

**Figure 3.7: Modelled change in road (red) & public transport (orange) trips, AM peak 2006-2031**




Source: VLC model results

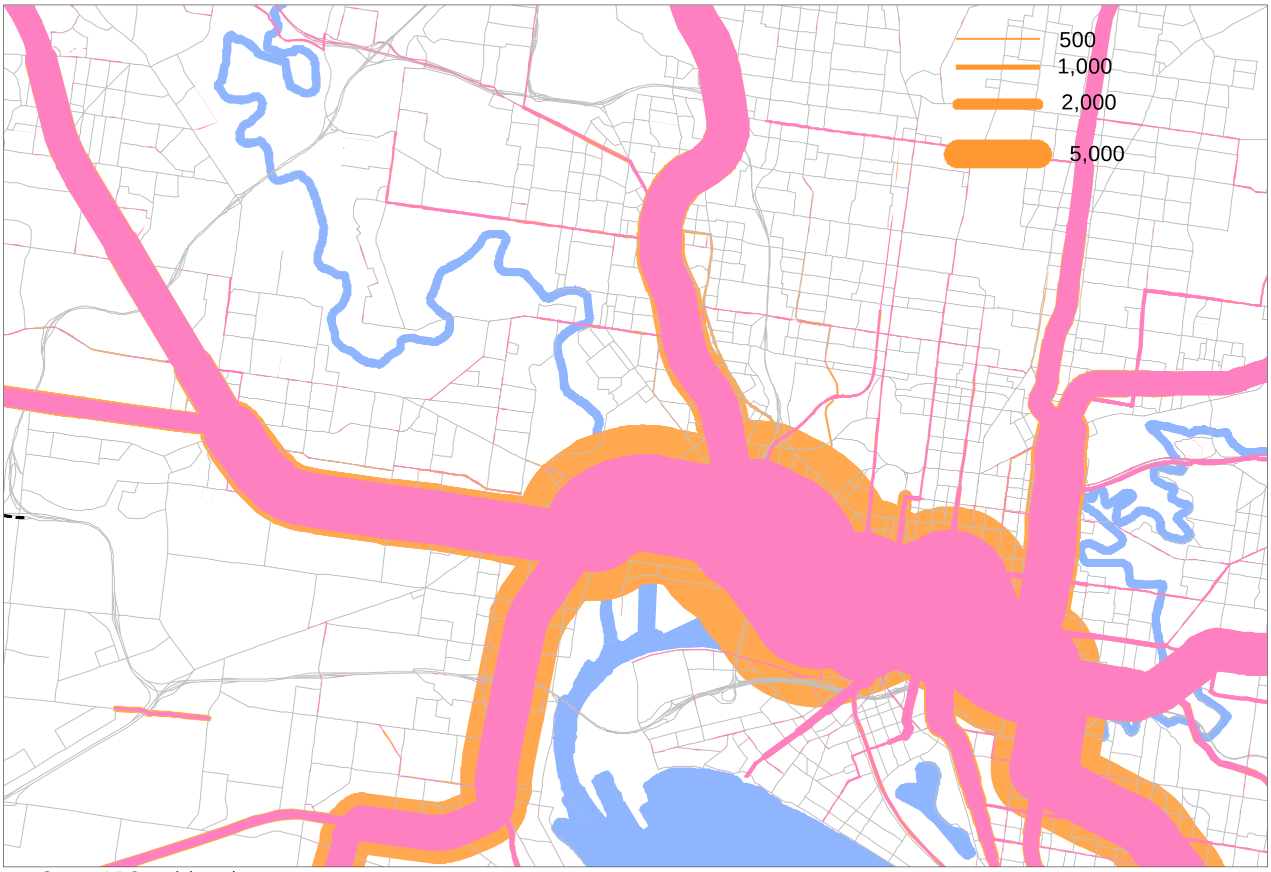
The growth in public transport trips will be facilitated by the additional services operated during the AM peak, while the additional road trips would be enabled by the extra lane on the West Gate Bridge.

The diagram shows the importance of the rail network for the people movement task during peak periods, as well as the more important tram corridors (St Kilda Road in particular). The increases in public transport patronage are concentrated on the rail and major tram routes, with the greatest growth in patronage located on the Werribee and Sydenham lines in the west, and on lines in the Caulfield and Burnley rail groups in the east.  Significant growth is also noted on the Craigieburn line and Clifton Hill rail group.

It must be noted however that the Strategic Transport Model is not constrained for public transport usage, i.e. it is possible in the model to have more people on a public transport service than can physically fit.  This situation occurs in the 2031 model.  Figure 3.8 shows the total growth in patronage demand in the AM peak between 2006 and 2031 (pink and orange lines combined).  A constrained public transport base case model was run for 2031 to determine more realistic patronage demands, shown in pink, which would be accommodated by the base case network.  The orange line designates the additional demand which would not be met due to capacity constraints.

The figure shows how growth between 2006 and 2031 would be limited if the public transport constraints on the Northern and Caulfield Lines were not addressed in the intervening period. The unmet public transport trips (orange) would likely be made by alternative modes, predominantly car, despite the congested nature of the road network.  Alternatively these trips may be made at another time, or not be made at all.

**Figure 3.8: Modelled change in public transport patronage during AM Peak showing constrained (pink) and unconstrained (orange) demand, 2006-2031**




Source: VLC model results

## 3.2 Supply

Committed changes to the transport network to 2016 are outlined in MOTC. Studies are continuing into plans beyond this timeframe.

As discussed previously, the vast majority of daily trips made both now and in the future from the west will be to the CAD/inner area (about 75%). The modelled results indicate that between 2006 and 2031, the majority of the growth in trips between the west and CAD/inner will be accommodated by public transport. Of the public transport modes, rail will have the biggest potential to increase people-moving capacity into and across the city. As such, the details in this section focus predominantly on that mode.

### 3.2.1 Public Transport

***Rail***

Rail commitments in MOTC include:

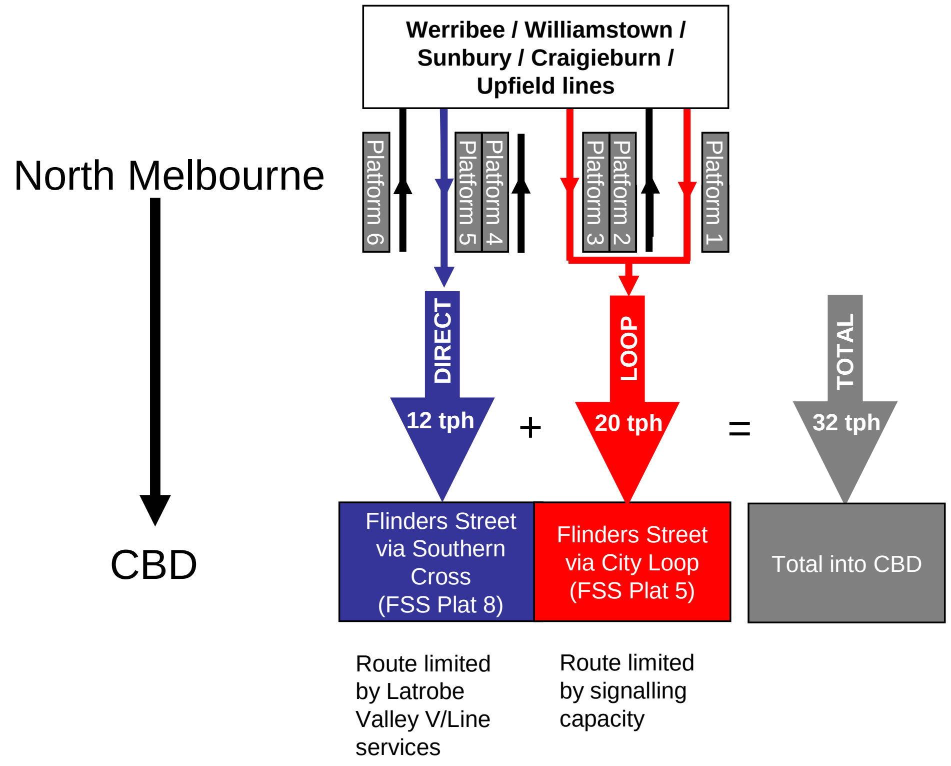
- Track duplication – Clifton Hill to Westgarth, Keon Park to Epping
- Track triplication – Caulfield to Dandenong, Sunshine to West Footscray, Altona Junction to Newport
- Signalling upgrade – Hurstbridge line, Werribee line
- Loop reversal – Clifton Hill group
- New stations at Lynbrook, Cardinia Road, Point Cook, Coolaroo
- Additional platforms at Sandringham, Pakenham, Dandenong
- New trains to increase fleet size
- Station interchange upgrades across the network, including Park and Ride facilities

Work is being carried out by DOI in relation to the proposed north-south rail tunnel through the CBD. As part of that project, base case assumptions have been agreed and operating strategies for each line have been developed. Base case assumptions include the following features which were detailed in the previous chapter:

- Committed MOTC infrastructure upgrades
- Sectorised routes eg. Werribee/Williamstown to Frankston
- Consistent timetables i.e. regular headways and stopping patterns
- Operational efficiencies
  - removal of layover at Flinders Street for through trains
  - one way operation of the Altona Loop

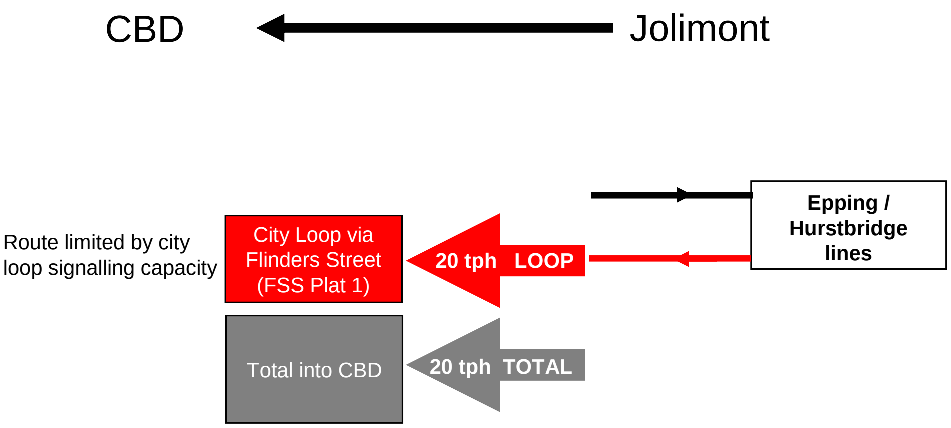
Figure 3.9, Figure 3.10, Figure 3.11 and Figure 3.12 show the revised theoretical maximum throughput achievable in the CLIC area with the implementation of all these operational changes. It should be noted that the maximum achievable service overall may be lower due to constraints in suburban locations and these capacities may not need to be fully utilised on some groups. Note that increases in throughput are achieved for Burnley, Caulfield and Clifton Hill rail groups, while no increase is possible for the Northern rail group due to the interaction with V/Line services.

**Figure 3.9: Revised maximum achievable hourly CLIC throughput on Northern Group**



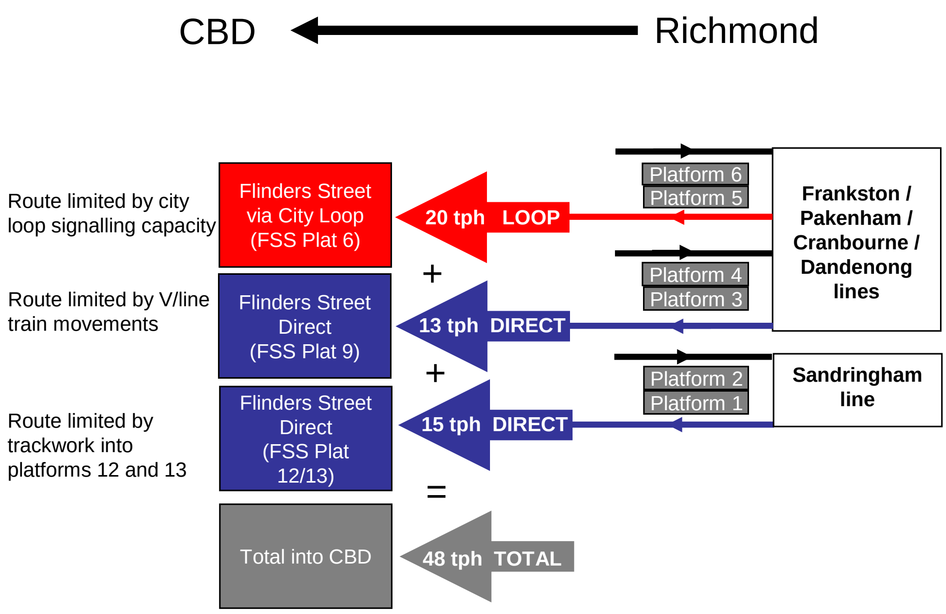

Source: DOI

**Figure 3.10: Revised maximum achievable hourly CLIC throughput on Clifton Hill Group**



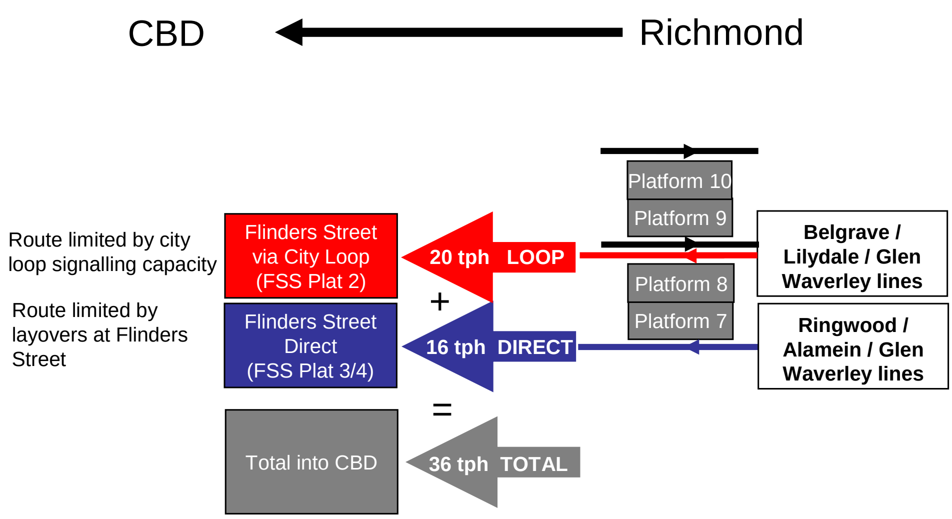

Source: DOI

**Figure 3.11: Revised maximum achievable hourly CLIC throughput on Caulfield Group**




Source: DOI

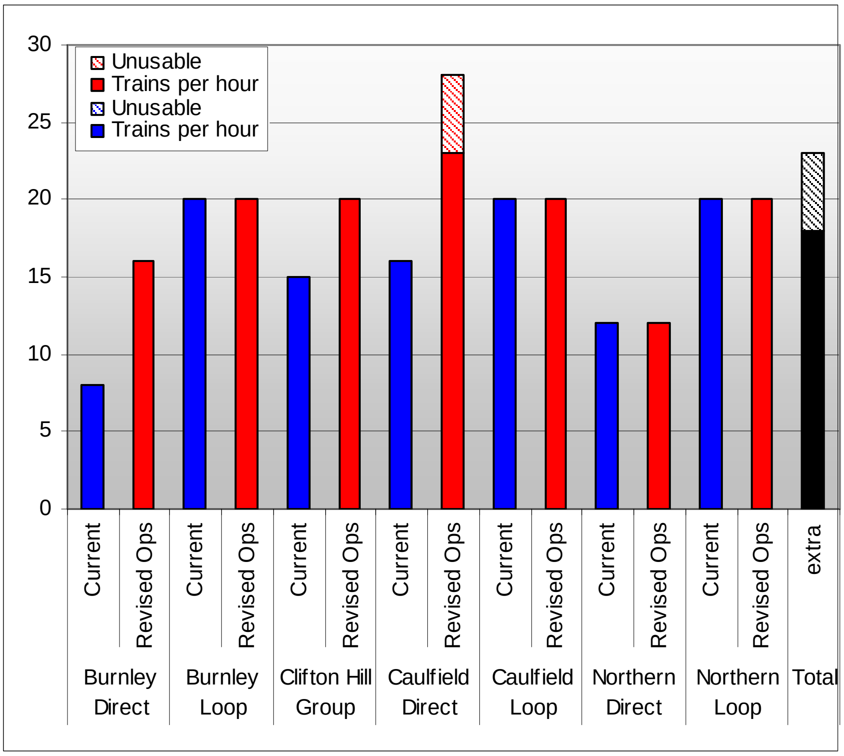
**Figure 3.12: Revised maximum achievable hourly CLIC throughput on Burnley Group**




Source: DOI

Figure 3.13 summarises the overall change in theoretical capacity provided by implementing the package of operational changes outlined above. It should be noted that the graph shows an area as 'unusable' – this is because the theoretical capacity available on the Caulfield group with the revised operations is unlikely to be fully used as 15 tph is only available to the Sandringham line clearway, higher than the demand for trains from the Sandringham line which is unlikely to exceed 10 tph.

**Figure 3.13: CLIC area theoretical capacity, current and revised operations**




Source: DOI

The operating strategies prepared for each line on the network for the base case take into account V/Line operations, track configurations, signalling capability and other network conflicts and constraints.

Table 3-9 shows the number of trains arriving in the CBD between 8am and 9am for 2007 and the practical capacity as outlined in the Base Case assumptions. Note that the peak number of trains for some lines in 2007 does not necessarily coincide with this timeframe i.e. Pakenham / Cranbourne / Dandenong line peak is 7.30 – 8.30am.

**Table 3-9: Practical capacity of each rail group**

| Group | Line | No. trains entering CBD (8-9am) 2007 | Base Case Capacity (2016+) |
|---|---|---|---|
| Northern | Williamstown | 3 | 4 |
| | Werribee | 5 | 8 |
| | Watergardens (Sunbury in base case) | 5 | 8 |
| | Craigieburn | 8 | 9 |
| | Upfield | 3 | 3 |
| | TOTAL | 24 | 32 |
| Clifton Hill | Epping | 5 | 8 |
| | Hurstbridge | 8 | 12 |
| | TOTAL | 13 | 20 |
| Burnley | Lilydale / Belgrave | 14 | 20 |
| | Blackburn / Alamein | 7 | 8 |
| | Glen Waverley | 8 | 8 |
| | TOTAL | 29 | 36 |
| Caulfield | Pakenham / Cranbourne / Dandenong | 11 | 18 |
| | Frankston | 11 | 15 |
| | Sandringham | 7 | 15 |
| | TOTAL | 29 | 48 |

***Tram***

Tram commitments in MOTC include:

- Expansion of the Think Tram program i.e. providing more tram priority across the system;
- Replacement of stepped access trams with level access trams;
- Replacement of kerb access and safety zone stops with raised platform stops.

Progress on tram-related initiatives is well under way. Tram priority measures in traffic are not having the anticipated effect on travel times, partly because of the resistance from parts of the community to some of the plans (and hence their postponement or modification) and partly because of the lack of enforcement or education of drivers to tram-related road infringements. At any rate the average travel speed of trams in Melbourne is still slowly deteriorating.

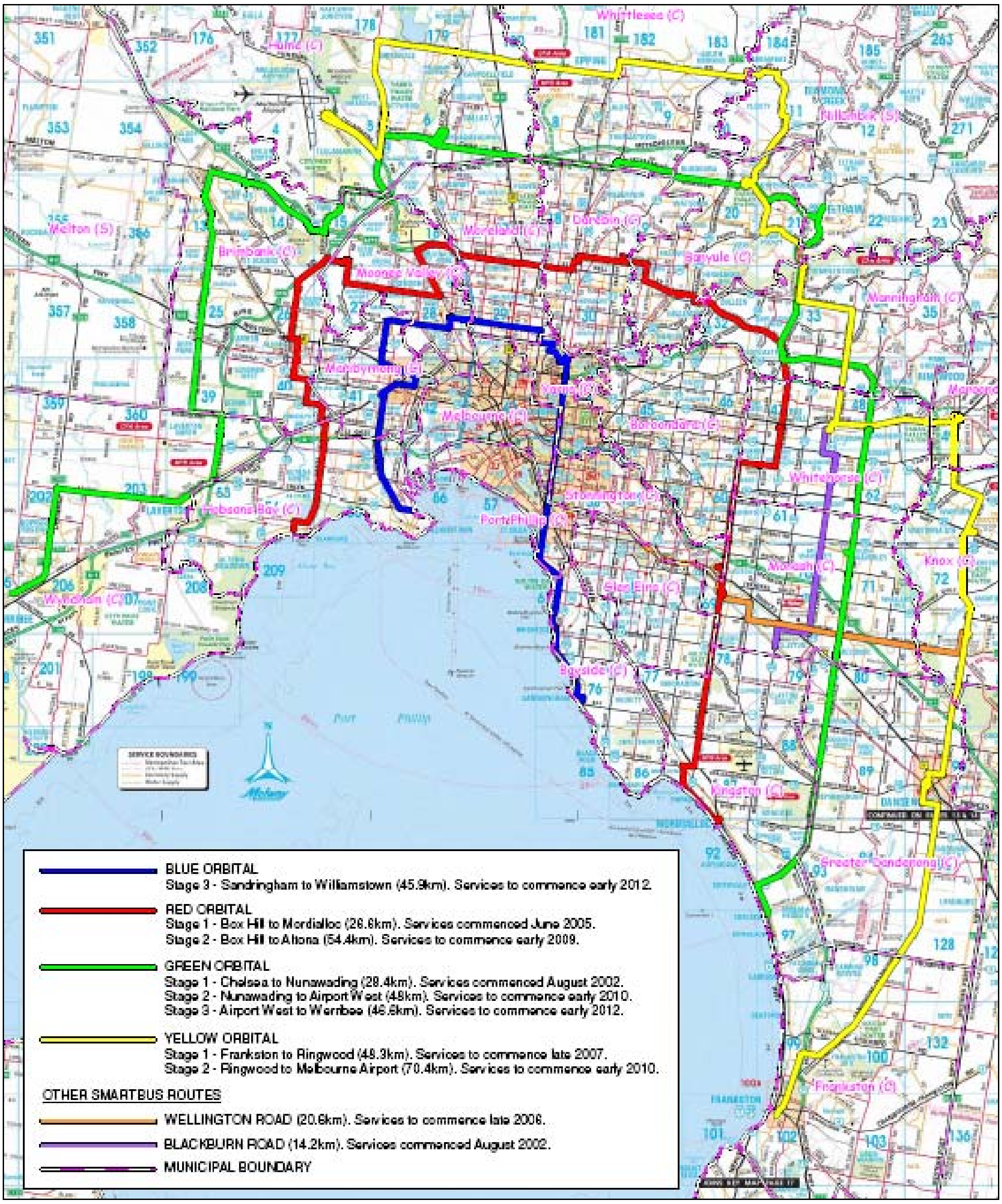
***Bus***

Future committed changes to the bus network listed in MOTC include:

- expanding the SmartBus network through the creation of a network of cross-town routes. operating on arterial roads between key activity centres. SmartBus routes operate similar hours and frequencies to the rail and tram networks, and include features such as DDA compliant accessible bus stops and real-time information. The first major orbital SmartBus routes are shown in Figure 3.14, but MOTC provides for an ultimate 900km of SmartBus services;
- upgrading selected Doncaster area bus routes operating on the Eastern Freeway to SmartBus standards (Figure 3.15);
- providing additional bus priority measures across Melbourne, focussing on signal priority measures at intersections;
- carrying out bus service reviews across the whole network. These reviews will assess each route and recommend if any changes are required to route coverage and other service parameters. It is anticipated that the existing route structure will be simplified with reduced route variations, standardised timetables, more direct routes, and improved co-ordination;
- introducing minimum service standards to every route in Melbourne. This involves a minimum service frequency of 60 minutes and hours of operation extended to at least 9pm seven days a week.

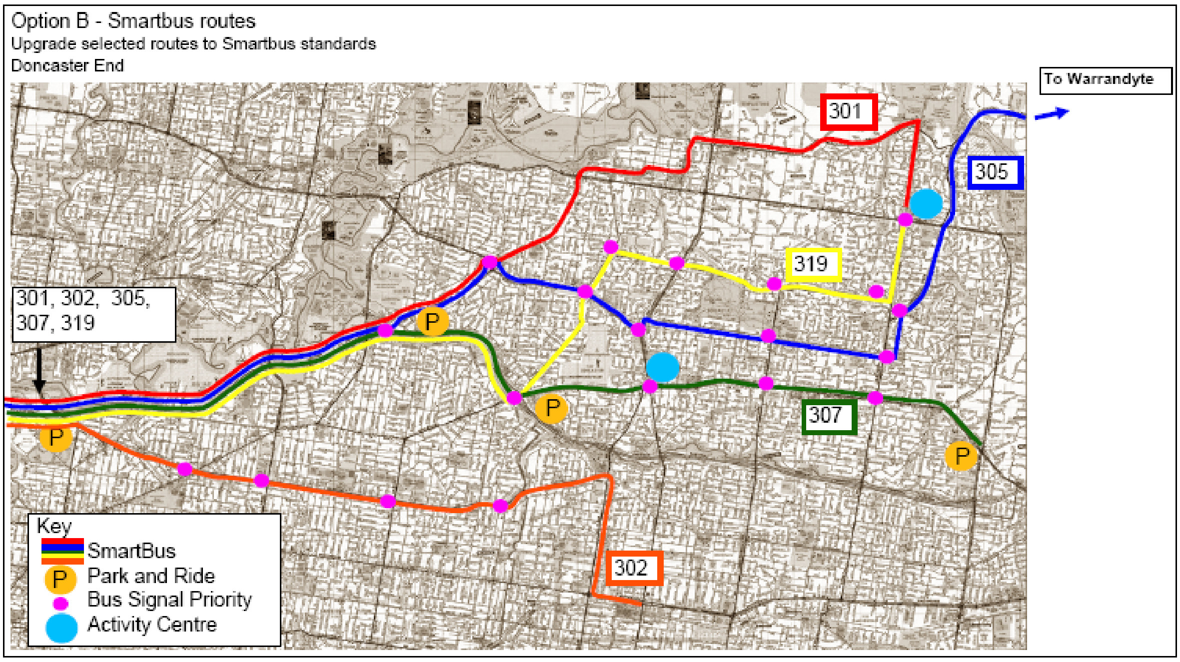
Some of these changes have been implemented. In particular there has been a partial rollout of SmartBus services, while about one third of bus routes have had services extended to operate at minimum service standards. Marketing strategies are informing communities of the upgrades to local services as they are rolled out. Evidence so far suggests that both initiatives have been extremely well received by the public, with patronage growth of up to 50% recorded on some Smartbus routes, and overall growth in bus patronage of 7% in 2007. This trend is likely to continue as service provision is expanded.

**Figure 3.14: Proposed Smartbus Network**




Source: DOI

**Figure 3.15: Proposed Upgrade to Doncaster Bus Services**




Source: DOI

### *3.2.2 Road*

A number of current and proposed road projects is described below.

**Eastlink** is a 40km tollway from Ringwood to Frankston. The tollway is proposed to open in 2008. It will connect some of Melbourne's key industrial areas, such as Scoresby, to the freeway network. Eastlink will bypass at least 45 signalised intersections between the Mornington Peninsula and Eastern Freeways, running parallel to Springvale and Stud Roads.

The **Monash-CityLink-West Gate (MCW) upgrade** is a $1billion project that aims to improve traffic flow and safety on one of the state's busiest routes. Works will include widening sections of the road between Williamstown and Dandenong, improving entry/exit points and introducing a new intelligent freeway management system

The **Deer Park Bypass** currently under construction will be a 9.3km four lane freeway between the Western Highway at Caroline Springs and the Western Ring Road at Sunshine West. The bypass is jointly funded by the State and Federal Governments as part of the AusLink Agreement. The Leakes Road intersection with the Western Freeway at Rockbank will also be upgraded to a grade separated full diamond interchange as part of the project. The Western Highway is the principal road link between Melbourne and Adelaide and at Deer Park it carries over 70,000 vehicles per day with 10 per cent of these heavy vehicles. The Deer Park Bypass is a key element to provide a continuous freeway standard facility from the Western Freeway to the Western Ring Road and Melbourne's urban freeway network. The bypass is expected to reduce travel times and improve the safety of local residents as the high traffic volumes including heavy vehicles will be reduced.

The **Pakenham Bypass** provides an important link between Gippsland and Melbourne. Its alignment runs to the south of the townships of Pakenham and Officer. This $242 million, 20km bypass will consist of a four-lane freeway between the Princes Freeway at Beaconsfield and at Nar Nar Goon Road. The Pakenham Bypass has been declared a Road of National Importance and will be jointly funded by the State and Australian Governments.

The Pakenham Bypass will aim to reduce traffic congestion and alleviate delays on the Princes Freeway, particularly during peak periods. It will also improve safety for road users, improve access to local facilities and provide agricultural, tourism and industrial businesses in southeast Victoria with improved access to Melbourne and export markets.

These, and other possible future capacity enhancements, have been incorporated within the Zenith model in the appropriate future years.

### *3.2.3 Freight*

The Port of Melbourne is a multi-trade port, catering for international and coastal containers (including Bass Strait), new motor vehicles, break bulk (non bulk cargo that is not containerised), dry bulk (such as grain and cement) and liquid bulk (such as crude oil). Increasingly, the port's operations are dominated by container trade.

In response to this, two significant strategic documents have been developed by the Government to guide the future development of the port.

- Victorian Ports Strategic Framework – States that the Government will support future port development that builds on the existing capabilities and competitive strengths of Victoria's commercial trading ports by:
  - a. maintaining the Port of Melbourne as Australia's premier container port through support for developments to maximise the use of the Swanson Dock container facilities until these facilities are substantially utilised and demand for container services warrants the development of the West Gate-Webb Dock precinct for this purpose
  - b. protecting the future potential of the Port of Hastings to allow container trade to be accommodated in the longer term when the Port of Melbourne is fully utilised (noting that Hastings would supplement rather than replace the role of Melbourne)
  - c. maintaining the regional commercial trading ports as the focus of the bulk trades through planning and investment in connecting road and rail infrastructure
  - d. allowing market forces to determine the location of the break bulk and coastal trades in the longer term, noting the capability of the regional commercial trading ports to pursue opportunities in these trades in the short to medium term
  - e. maintaining the Port of Melbourne as the focus for Bass Strait passenger ferry and cruise ship services.

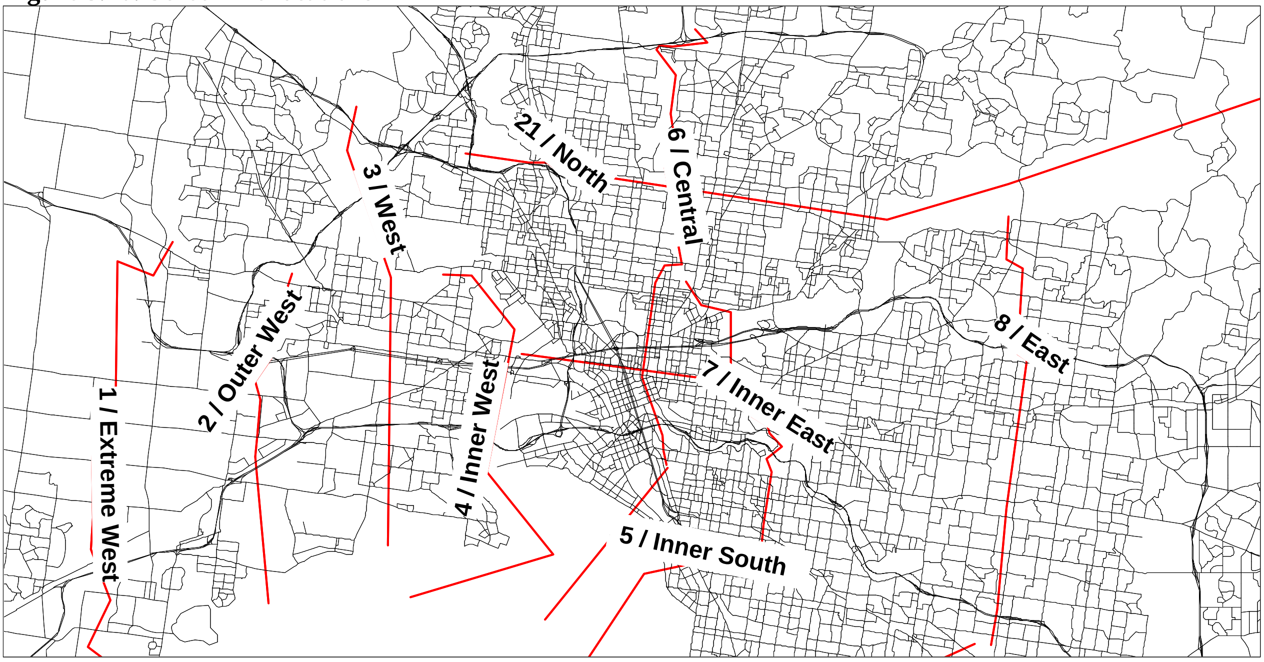
- Melbourne Port@L Strategy – The Melbourne Port@L is a long-term strategic planning initiative to improve the efficiency of the Port of Melbourne, primarily by integrating the port and the adjacent Dynon rail precinct into a single world-class intermodal hub. The Government has established the Melbourne Port@L Board, which includes road, port and rail track authorities, to progress the concept. Government initiatives will seek to:
  - a. enhance rail and road access to and between rail and shipping terminals
  - b. use information technology to improve logistics-chain performance
  - c. reduce road congestion around the port
  - d. free up strategic land around the port for freight-related activities
  - e. encourage growth of outer metropolitan intermodal terminals servicing the port
  - f. increase the Port of Melbourne's capacity, including its container terminal capacity at Swanson Dock.

## 3.3 Supply vs. Demand

***Screenline analysis***

The demand for public transport was analysed from the Zenith model across a set of screenlines for 2006 and 2031. The screenlines are shown in Figure 3.16. Analyses were not carried out for all screenlines shown in the figure; the focus was on the west, centre and inner south and east (nos. 2, 3, 4, 5, 6).

**Figure 3.16: Screenline locations**




The demands were compared against the actual capacity for 2006 and nominal transport supply in 2031 to determine where if any shortfall in capacity was located. The corridor capacity was assumed to be the same for bus, tram and V/Line for both years (although MOTC improvements were modelled), while metro rail capacity was assumed to be increased to the 'base case' i.e. rail network with MOTC changes and agreed operational changes detailed in Section 3.2. Vehicle capacities for each mode were assumed.

The modelled demand was calculated over a 2 hour peak period. However it is important to note that the actual demand will not be constant across the 2 hour peak period, instead it will be variable. An example of this is illustrated by the current patronage demand profile for the Sandringham line, which currently has a regular 9 minute service frequency (7 trains per hour) across the peak 2 hours. An analysis of the passenger counts during this time shows that demand is not constant, with the peak 1 hour demand equating to about 60% of total demand across the 2 hour peak period. This means that demand during the other hour (usually the half-hour periods immediately before and after the peak 1 hour) is about 40% of the total peak period demand. Hence the variable load profile will result in some trains carrying more passengers than others over 2 hour peak period. For this screenline analysis, comparisons will therefore be made between the peak 1 hour demand (calculated as 60% of the modelled peak 2 hour demand) and the peak 1 hour capacity to identify capacity shortfalls. This ratio of peak 1 hour vs. peak 2 hour patronage on the Sandringham line is also observed on transport systems worldwide, notably the London Underground, where similar analysis revealed that the peak 1 hour demand averaged 60% of the peak 2 hour demand across lines with consistent frequencies.

It should be noted that in the event that forecast demand exceeds capacity, it still may be possible to carry more passengers on these trains, however overcrowded conditions approaching crush loading would be experienced which would be very unattractive to passengers and dissuade some people from travelling by train.

Screenline locations are detailed as follows:

Screenline 2 runs in a north-south alignment between Laverton and Sunshine, broadly in line with the Western Ring Road. Across screenline 2, there are 2 heavy rail line corridors and 4 bus corridors serving an east-west connectivity function. Key roads crossing the screenline include Ballarat Road, Western Ring Road and Princes Freeway.

Screenline 3 runs in a north-south alignment between Altona and Maidstone, broadly in line with Millers Road. Across screenline 3, there are 3 heavy rail line corridors and 4 bus corridors serving an east-west connectivity function. Key roads crossing the screenline include Ballarat Road, Geelong Road and West Gate Freeway.

Screenline 4 runs in a north-south alignment between Williamstown and Footscray, in line with the Maribyrnong River. Across screenline 4, there are 3 heavy rail line corridors, 1 tram corridor and 3 bus corridors serving an east-west connectivity function. Key roads crossing the screenline include Ballarat Road, Dynon Road, Footscray Road and West Gate Bridge.

Screenline 5 runs in an southwest-northeast alignment between Middle Park beach and St Kilda Road, across Albert Park lake. Across screenline 5, there are 3 tram corridors and 1 bus corridor serving an east-west connectivity function. Key roads crossing the screenline include Beaconsfield Parade, Queens Road and St Kilda Road.

Screenline 6 runs in a north-south alignment between St Kilda and Clifton Hill, in line with Hoddle Street / Punt Road. Across screenline 6, there are 2 heavy rail corridors, 5 tram corridors and 5 bus corridors serving an east-west connectivity function. Key roads crossing the screenline include Bell Street, Brunswick Road, Victoria Street and Burnley/Domain Tunnels.

***Public Transport***

The analysis of public transport demand and capacity for the major public transport corridors across selected screenlines is shown in Table 3-10. Note that the modelled peak 1 hour passenger demand columns for 2006 and 2031 have been highlighted; the various colours represent the level of demand for these years as a ratio of the capacity provided (base case used for 2031). The colours indicate the following demand / capacity ratios:

- Green: Demand / Capacity 0 - 74%
- Yellow: Demand / Capacity 75 - 90%
- Red: Demand / Capacity > 90%

**Table 3-10 Public Transport Screenline Analysis – 2006 and 2031 AM Peak**

| Location | 2006 peak 1 hour capacity (pass.) | 2006 modelled peak 1 hour demand (pass.) | 2006 modelled daily demand (pass.) | Base case peak 1 hour capacity (pass.) | 2031 modelled peak 1 hour demand (pass.) | 2031 modelled daily demand (pass.) |
|---|---|---|---|---|---|---|
| *SCREENLINE 2* | | | | | | |
| Melton, Ballarat rail | 2000 | 850 | 4700 | 2000 | 3200 | 14000 |
| Werribee, Geelong rail | 4725 | 4000 | 21000 | 8800 | 8400 | 44000 |
| Queen Street bus 411, 412, 415 | 225 | 300 | 1700 | 225 | 850 | 5000 |
| Cherry Lane bus 414 | 75 | 50 | 350 | 75 | 50 | 450 |
| Forrest Road bus 400, 451 | 300 | 100 | 900 | 300 | 100 | 700 |
| Western Hwy bus 215, 216, 456 | 500 | 350 | 2100 | 500 | 350 | 3100 |
| *SCREENLINE 3* | | | | | | |
| Watergardens, Sunbury, Bendigo rail | 5575 | 4750 | 29300 | 7800 | 9200 | 48000 |
| Melton, Ballarat rail | 2000 | 850 | 4700 | 2000 | 3200 | 14000 |
| Werribee, Geelong rail | 4725 | 4400 | 26000 | 8800 | 10600 | 58000 |
| Ballarat Road bus 215, 220, 410 | 750 | 250 | 2200 | 750 | 200 | 2500 |
| South Road bus 216, 219 | 400 | 150 | 900 | 400 | 250 | 2200 |
| Geelong Road bus 411, 412, 414 | 225 | 250 | 1800 | 225 | 200 | 2400 |
| West Gate Fwy bus 232 | 400 | 50 | 400 | 400 | 50 | 450 |
| *SCREENLINE 4* | | | | | | |
| Watergardens, Sunbury, Bendigo rail | 5575 | 6000 | 40300 | 7800 | 12200 | 84000 |
| Melton, Ballarat rail | 2000 | 850 | 4700 | 2000 | 3200 | 14000 |
| Werribee, Geelong, Williamstown rail | 7275 | 6150 | 37000 | 12200 | 13800 | 67000 |
| Wests Road tram 82 | 400 | 150 | 2000 | 400 | 150 | 1800 |
| Dynon Road bus 216, 219, 402 | 700 | 100 | 1200 | 700 | 100 | 2100 |
| Footscray Road bus 220 | 400 | 50 | 950 | 400 | 50 | 800 |
| West Gate Fwy bus 232 | 400 | 50 | 400 | 400 | 50 | 450 |
| *SCREENLINE 5* | | | | | | |
| Park Street tram 112 | 1000 | 100 | 950 | 1000 | 100 | 800 |
| St Kilda tram 96 | 1000 | 650 | 6500 | 1000 | 950 | 9500 |
| St Kilda Road tram 3, 5, 6, 16, 64, 67, 72 | 4300 | 2600 | 28000 | 4300 | 3500 | 43000 |
| St Kilda Road bus 216, 219, 220 | 400 | 50 | 200 | 400 | 50 | 200 |
| *SCREENLINE 6* | | | | | | |
| Belgrave, Lilydale, Alamein, Glen Waverley, Pakenham, Frankston, Cranbourne, Sandringham rail | 43950 | 41000* | 195000 | 73700 | 57000* | 300000 |
| Epping, Hurstbridge rail | 9350 | 9000 | 57000 | 17000 | 14200 | 89000 |
| Domain Road tram 8 | 800 | 400 | 2600 | 800 | 550 | 4100 |
| Swan Street tram 70 | 700 | 300 | 4900 | 700 | 350 | 6100 |
| Wellington Parade tram 48, 75 | 1800 | 1300 | 16000 | 1800 | 1400 | 22000 |
| Victoria Parade tram 24, 109 | 1800 | 1300 | 14000 | 1800 | 1800 | 19000 |
| Queens Parade tram 86 | 1100 | 1200 | 17000 | 1100 | 1300 | 20000 |
| Swan Street bus 605 | 200 | 50 | 50 | 200 | 50 | 100 |
| Victoria Parade bus 30x, 31x, 340, 350 | 2700 | 800 | 4300 | 2700 | 1000 | 8100 |
| Johnston Street bus 20x | 600 | 200 | 1300 | 600 | 250 | 1400 |
| Queens Parade bus 546 | 100 | 50 | 100 | 100 | 50 | 300 |
| Rushall Street bus 250, 251 | 300 | 100 | 300 | 300 | 50 | 200 |

Notes:
Shading:

- Red: Demand > 90% Capacity
- Yellow: 75% < Demand < 90%
- Green: Demand < 75% Capacity

Assumed vehicle capacity:

- Metro train: 850 passengers
- V/Line train: 500 passengers
- Tram: 100 passengers
- Bus: 50 passengers

Tram, bus and V/Line rail base case capacity assumed to be unchanged.
* In 2006, this figure is obtained from patronage counts. In 2031, this figure is obtained by factoring up the 2006 figure using reference case growth rates.

*Melton/Ballarat rail corridor*

The Melton/Ballarat line crosses screenlines 2, 3 and 4.

The model results for 2006 for the Melton/Ballarat line indicate that the line has spare capacity across screenline 2 during the peak 1 hour, with demand about 40% of capacity. At screenline 3, the modelled demands indicate that demand is about 75% capacity on all trains (Sydenham, Melton/Ballarat, Bendigo) in the corridor. This figure rises to about 90% across screenline 4. Observations of actual passenger demand across each screenline correlate well with these results, with some trains exceeding capacity during the peak 1 hour period, with downstream passengers unable to board.

In 2031, despite the significant increase in rail capacity provided on this line in the base case, the large increases in population and subsequent travel demand arising from the increased development of the growth areas will place severe stress on Melton/Ballarat services. Unconstrained demand is predicted to be 60% higher than the available capacity across screenline 2 during the peak 1 hour. This would obviously not be sustainable and would result in overloading of services and the consequent inability of passengers to board trains at stations immediately upstream of this screenline (Melton, Rockbank, Deer Park, Ardeer). Across screenlines 3 and 4, conditions are unchanged on Melton/Ballarat trains because these trains will not stop to pick up passengers at any stations downstream of screenline 2.

This screenline analysis of the Melton/Ballarat line reveals that the unconstrained modelled demand will not be met, therefore likely patronage levels are estimated to be 60-70% lower. Implications of passengers being unable to board would likely be to travel by car instead, exacerbating congested conditions on the roads. There may be opportunities to lengthen V/Line trains to provide additional passenger capacity although this is not considered to be sufficient to meet demand. It would also not be possible to increase service frequency due to infrastructure constraints and interaction with metropolitan services closer in to Melbourne.

*Watergardens/Sunbury/Bendigo rail corridor*

The Watergardens/Bendigo line crosses screenlines 3 and 4.

In 2006, the modelled results reveal that demand for Watergardens/Bendigo trains is about 75% of capacity at screenline 3, rising to about 90% at screenline 4. This correlates well with recorded passenger loadings.

By 2031, electrification to Sunbury will have taken place, so Watergardens metro trains will be extended to Sunbury. Modelled demand for Sunbury metro trains across screenline 3 will be about 20% over capacity during the peak 1 hour, suggesting that there will be no capacity available to pick up passengers at stations downstream of this screenline i.e. Tottenham, West

Footscray, Middle Footscray, Footscray, as well as stations immediately upstream (Sunshine, Albion). At screenline 4, the unconstrained modelling results indicate that peak 1 hour demand on Sunbury metro trains will be 65% over capacity.

On Bendigo trains, analysis of demand at screenline 3 suggests that these trains will be at capacity. Conditions on Bendigo trains at screenline 4 will be the same as there will be no intermediate stops to pick up passengers. As mentioned in the Melton/Ballarat line analysis, there is some opportunity to extend V/Line trains to provide more capacity if necessary.

The screenline analysis of the model results for the Watergardens/ Sunbury/ Bendigo line suggests that the demand will exceed capacity on the metro services prior to arriving at Sunshine. Very few passengers will be able to board metro services inbound from Albion. It is therefore considered that the unconstrained modelled demand will not be met by the available capacity on this line with likely patronage levels estimated to be in the order of 60-70% lower, with many passengers forced to drive, further exacerbating road congestion.

*Werribee/Geelong/Williamstown rail corridor*

The Werribee/Geelong line crosses screenlines 2, 3 and 4, while the Williamstown line crosses screenline 4 only.

In 2006 on the Werribee/Geelong rail corridor, modelled demand is about 85% of capacity over the peak 1 hour at screenline 2, rising to about 95% at screenline 3. Across screenline 4 the modelled demand is about 80% of capacity. The reason that this figure is less than the corresponding figure across screenline 3 is because of the inclusion of the Williamstown line which has some spare capacity relative to the Werribee/Geelong lines. The modelled demands across all screenlines on all lines (Werribee, Geelong, Williamstown) correlates well with observed passenger demands, with many trains exceeding passenger capacity during the peak 1 hour, particularly on Werribee and Geelong trains.

In 2031, the modelled demand for Werribee metro trains implies that trains will be about 80% of capacity during the peak 1 hour across screenline 2, suggesting that MOTC improvements carried out during the intervening years will maintain the 2006 conditions at this screenline. This means there will be limited space for passengers boarding at stations downstream of Laverton i.e. Westona, Altona, Seaholme. Analysis of the demand across screenline 3 confirms this, where the unconstrained peak 1 hour modelled demand exceeds capacity by over 10%, suggesting that many passengers at these above-mentioned stations will not be able to board. There will be no capacity on Werribee trains for boarding passengers further on down the line at stations including Newport, Spotswood, Yarraville, Seddon, Footscray, although some capacity may be available on Williamstown trains which also stop at these stations. However, despite the addition of the Williamstown trains across screenline 4, demand for Werribee/Williamstown metro services exceeds capacity by over 5%, which suggests that passengers wishing to board at the stations immediately upstream (Footscray) are not likely to be able to.

For Geelong services, demand will exceed capacity by 50% at screenline 2. Geelong trains will not be stopping to pick up passengers between screenlines 2, 3 and 4, so conditions will be the same across all these screenlines. Extra capacity could be provided by lengthening trains to carry more passengers although this measure alone would be unlikely to satisfy the demand.

It is therefore considered that the unconstrained modelled demand is not achievable. The likely patronage during the peak 1 hour is therefore likely to be significantly less, estimated to be in the order of 20-30% lower for the Werribee/Geelong/Williamstown lines, resulting in lower mode share for rail and increased traffic on the road network.

An important point arising from this screenline analysis is the lack of capacity available for passengers on trains arriving at Footscray station. Currently Footscray station is one of the busiest on the metropolitan rail network in terms of passenger volumes, however as the analysis at screenline 4 shows, all trains arriving at Footscray in 2031 on the three metro lines (Sunbury, Werribee, Williamstown) will be over capacity during the 1 hour peak. This means that many Footscray passengers will be unable to board any train during the peak 1 hour, potentially forcing passengers to seek alternative means of transport. This would likely exacerbate the high levels of congestion experienced on the road network and also have severe repercussions on the development of Footscray into a Transit City.

*Caulfield and Burnley rail groups*

The patronage figure shown for the Caulfield and Burnley groups at screenline 6 was obtained using the passenger load counts carried out for DOI in 2006. This equates to a figure of about 41,000 passengers in the peak 1 hour, which is about 95% of capacity.

For 2031, forecast demand using the reference case growth rate suggest that the passenger demand is likely to approach 57,000 passengers during the peak 1 hour, implying that demand is 80% of capacity. This demonstrates that the MOTC capacity enhancements made in the intervening period will provide a significant increase in capacity.

However further analysis of each group revealed that there will be more spare capacity on the Burnley group compared to the Caulfield group. Demand for Burnley group trains will be about 70% of capacity, whereas for Caulfield group trains the demand will be over capacity. This suggests that passengers will have difficulty boarding trains inbound from Caulfield. There will be no opportunity to increase capacity in this corridor for any metro or V/Line services in future. In addition, freight trains will be restricted from travelling on this corridor, which would have significant impacts on the potential for fully developing Hastings port into a major container terminal in future.

*Clifton Hill rail group*

On the Clifton Hill group (Epping and Hurstbridge lines), the modelled passenger demand for 2006 implies that demand is about 95% of capacity over the 1 hour peak. Taking into consideration the varying population catchment sizes for the Epping and Hurstbridge lines as well as different stopping patterns, some trains would exceed capacity which correlates well with observations.

For 2031, the modelled demand is about 85% of capacity during the peak 1 hour, which implies that the MOTC capacity enhancements made in the intervening period will relieve the current overcrowding during the peak 1 hour as well as meet future growth in demand.

*Bus corridors*

The modelled demand for buses in 2006 across all screenlines suggests that all main radial bus corridors would generally have sufficient capacity. It is considered that these demand figures are underestimated as radial routes travelling to the city would be expected to attract more demand. A review of the number of boardings on these routes confirms this view, with some routes attracting up to 2-3 times more passengers compared to the modelled results. The underestimated demand for bus travel may be due to the fact that the model assumes that the parallel train routes are considered to be more attractive.

In 2031, modelled bus demand figures suggest that sufficient capacity exists across all screenlines for most bus services. The exceptions to this are the Queen Street routes in Altona (411, 412, 415), for which demand is 3 times higher than capacity. Additional capacity could be provided with extra services and larger vehicles. Other noteworthy bus corridors where modelled demand is greater than 50% of capacity include the Western Highway (screenline 2), South Road and Geelong Road (both screenline 3). Also of note is the growth in demand for Doncaster bus services of 25% modelled between 2006 and 2031. Despite this, modelled demand is about 40% of capacity in 2031, which is considered to be underestimated because of reasons discussed above.

*Tram corridors*

For trams, the 2006 model suggests that there is spare capacity on all corridors except the Queens Parade tram (route 86), where modelled demand exceeds capacity by about 10%. This is considered to be underestimated for most trams corridors, especially the St Kilda Road routes and St Kilda light rail, as these routes currently carry very high passenger volumes. The modelled demand for trams is therefore considered to be underestimated for reasons detailed above for buses.

In 2031, the modelling results imply that demand for route 86 on Queens Parade will still be above capacity, while Victoria Parade routes will be at capacity. The demand for St Kilda light rail will be about 95% of capacity, meaning that downstream passengers may have difficulty boarding due to overcrowding. The model results for the St Kilda Road trams suggest that these routes will be about 70% of capacity during the peak 1 hour. There should be sufficient capacity on these routes to handle downstream boarders, especially when considering that many passengers will be alighting along St Kilda Road. Modelled demand for Wellington Parade trams will also be about 70% of capacity.

It is worth noting that by 2031, it is likely that the tram fleet will consist of longer trams with corresponding increases in passenger capacity, so the base case capacity could in fact be higher than shown. Increased service frequencies could also be added by 2031 to meet forecast demands.

***Road***

The discussion about current and future traffic volumes on Melbourne's road network is based on outputs derived from the Zenith model. These modelled traffic volumes differ from measured volumes in some instances. Rather than focusing on the variations apparent on individual road segments or routes, a more global assessment has been undertaken that takes into consideration the total capacities of the network.

The analysis of road network demand and capacity for the major traffic corridors across selected screenlines is shown in Table 3-11. Note that the modelled peak 1 hour AM peak demand columns for 2006 and 2031 have been highlighted; the various colours represent the level of demand for these years as a ratio of the capacity provided (base case used for 2031). The colours indicate the following demand / capacity ratios:

- Green: Demand / Capacity 0 - 74%
- Yellow: Demand / Capacity 75 - 90%
- Red: Demand / Capacity > 90%

**Table 3-11: Road screenline capacity analysis - 2006-2031 AM Peak**

| Road Name | 2006 Daily Vehicles | Vehicle Growth 06-31 | Typical Peak 1 Hour Capacity | Peak 1 Hour Volume - Capacity Ratio 2006 | Peak 1 Hour Volume - Capacity Ratio 2031 | | 2006 Daily Commercial Vehicles | CV Growth 06-31 |
|---|---|---|---|---|---|---|---|---|
| *SCREENLINE 2* | | | | | | | | |
| Ballarat Road | 38,000 | 40% | 2,800 | 106% | 126% | | 1,580 | 36% |
| Western Ring Road | 104,000 | 34% | 5,400 | 85% | 124% | | 11,640 | 51% |
| Princes Highway | 134,000 | 37% | 9,000 | 87% | 90% | | 13,270 | 100% |
| Other roads across screenline | 55,600 | 42% | 6,900 | 76% | 124% | | 3,470 | 121% |
| Total across screenline | 331,600 | 39% | 24,100 | 86% | 111% | | 31,620 | 83% |
| *SCREENLINE 3* | | | | | | | | |
| Ballarat Road | 51,000 | 19% | 4,200 | 77% | 83% | | 3,120 | 6% |
| Geelong Road | 42,000 | 88% | 4,200 | 94% | 97% | | 2,110 | 193% |
| Westgate Freeway | 148,000 | 32% | 7,200 | 102% | 117% | | 22,100 | 57% |
| Other roads across screenline | 123,800 | 30% | 10,800 | 71% | 117% | | 6,080 | 21% |
| Total across screenline | 364,800 | 35% | 26,400 | 84% | 108% | | 33,400 | 54% |
| *SCREENLINE 4* | | | | | | | | |
| Ballarat Road | 39,000 | 23% | 2,000 | 115% | 117% | | 1,800 | 60% |
| Dynon Road | 35,000 | 32% | 2,400 | 101% | 110% | | 3,840 | 37% |
| Footscray Road | 35,000 | 66% | 3,200 | 115% | 124% | | 5,190 | 58% |
| Westgate Bridge | 165,000 | 41% | 10,000 | 82% | 105% | | 23,280 | 57% |
| Other roads across screenline | 55,400 | 28% | 9,100 | 27% | 38% | | 2,770 | 15% |
| Total across screenline | 329,400 | 38% | 22,700 | 84% | 101% | | 36,860 | 52% |
| *SCREENLINE 5* | | | | | | | | |
| Beaconsfield Parade | 42,000 | 41% | 2,700 | 89% | 94% | | 4,580 | 54% |
| Queens Road | 81,000 | 14% | 3,600 | 106% | 116% | | 6,750 | 9% |
| St Kilda Road | 52,000 | 31% | 3,000 | 100% | 109% | | 4,700 | 31% |
| Other roads across screenline | 34,700 | 70% | 2,600 | 86% | 112% | | 2,000 | 90% |
| Total across screenline | 209,700 | 32% | 11,900 | 96% | 108% | | 36,855 | 35% |
| *SCREENLINE 6* | | | | | | | | |
| Bell Street | 49,000 | 1% | 2,700 | 76% | 76% | | 5,010 | 0% |
| Brunswick Road | 20,000 | 16% | 1,600 | 57% | 65% | | 1,380 | 41% |
| Victoria Street | 40,000 | 43% | 2,700 | 83% | 96% | | 2,600 | 51% |
| Burnley/Domain Tunnels | 105,000 | 47% | 5,400 | 81% | 113% | | 22,950 | 59% |
| Princes Street | 56,000 | 14% | 2,700 | 97% | 106% | | 3,970 | 34% |
| Other roads across screenline | 302,600 | 20% | 21,200 | 69% | 72% | | 22,700 | 32% |
| Total across screenline | 572,600 | 23% | 36,300 | 74% | 82% | | 59,798 | 39% |

The commercial vehicle growth is taken into consideration in the capacity analysis for all key routes, as these volumes are part of the daily vehicles for each route.

*Ballarat Road Corridor*

Existing traffic volumes on Ballarat Road show that it operates beyond its capacity in the AM one-hour peak period at screenline 2, with Ballarat Road being limited by its two lanes in each direction. For Ballarat Road crossing screenline 3, it provides three lanes in each direction, and operates at approximately 80% volume to capacity ratio. Ballarat Road operates beyond its theoretical capacity at screenline 4 as it reduces down to two lanes for the crossing of the Maribyrnong River.

In 2031, Ballarat Road is expected to operate beyond its capacity at screenline 2 and 4. This is due to its configuration of two lanes at both of these locations. At screenline 3, where Ballarat Road provides three lanes, it is still expected to operate within its capacity.

Commercial vehicle growth along Ballarat Road varies depending on location. At screenline 2, growth is expected to be approximately 36%. Screenline 3 has a growth of 6%, while screenline 4 experiences a growth of 60%.

This screenline analysis shows that where Ballarat Road has a three lane configuration, it is expected to operate with no capacity constraints. In the locations where it has a two lane configuration, capacity issues are experienced in 2006 and expected to increase by 2031. This may result in peak spreading and longer periods of delays along this route.

*Princes Freeway/West Gate Freeway Corridor*

Existing traffic volumes on the Princes Freeway show that it operates at 87% of its capacity in the AM one-hour peak period at screenline 2. At screenline 3, where the Princes Freeway has become the West Gate Freeway, it has increased to 2% above capacity. At screenline 4, it operates at 82% of capacity on the West Gate Bridge.

In 2031, increases in traffic volumes result in the Princes Freeway operating close to its capacity in the AM one-hour peak period. The West Gate Freeway and the West Gate Bridge at screenline 3 and 4 are expected to operate beyond their theoretical capacities.

Commercial vehicle growth along this route varies between the Princes Freeway and the West Gate Freeway. The Princes Freeway experiences a growth of 100%, while the West Gate Freeway experiences a growth of 57% where it crosses both screenlines. The commercial vehicle growth is taken into consideration in the previous capacity analysis.

This analysis shows that peak spreading can be expected at screenline 3 and 4 by 2031.

*Other routes*

The Western Ring Road operates at 85% capacity at screenline 2 in the 2006 one-hour peak period. However by 2031, traffic volumes are expected to increase by 34%, which results in it operating beyond its capacity which will create peak spreading and longer delays to vehicles. Commercial vehicle growth on the Western Ring Road is expected to be 51%.

Geelong Road operates at 94% capacity at screenline 3 in the 2006 one-hour peak period. By 2031, traffic volumes are expected to increase by 88%. Commercial vehicle growth on Geelong Road is expected to be 193%. However, these increases in traffic result in Geelong Road operating at 97% of its capacity.

Dynon Road operates beyond its capacity at screenline 3 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 32%. Commercial vehicle growth is expected to be 37%. This growth results in Dynon Road operating further beyond its theoretical capacity which would further encourage peak spreading which would result in longer delays.

Footscray Road operates beyond its capacity at screenline 4 in the 2006 peak hour. At this location Footscray Road is restricted to two lanes. In 2031, traffic volumes increase by 66%, and commercial vehicles increase by 58%. which results in Footscray Road operating further beyond its capacity. This would result in peak spreading and longer delays.

Beaconsfield Parade operates at 89% of its capacity at screenline 5 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 41%, and commercial vehicle growth is expected to be 54%. This results in Beaconsfield Parade operating at 94%. This could result in longer delays occurring along Beaconsfield Parade.

St Kilda Road operates at its capacity at screenline 5 in the 2006 peak period. By 2031, traffic volumes are expected to increase by 31%. This will result in St Kilda Road operating beyond its capacity, which will create peak spreading and increase delays. Commercial vehicle growth is expected to be 31%.

Bell Street operates at 69% of its capacity at screenline 6 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 1%. As such, it should operate without major delays within the peak periods. Commercial vehicles volumes are not expected to change on Bell Street at screenline 6. This level of growth is not considered accurate for Bell Street, when growth across the rest of Melbourne’s key routes is typically 40%. If a 40% growth rate was applied to Bell Street, it will be operating beyond its capacity in 2031, which will result in longer delays and peak spreading.

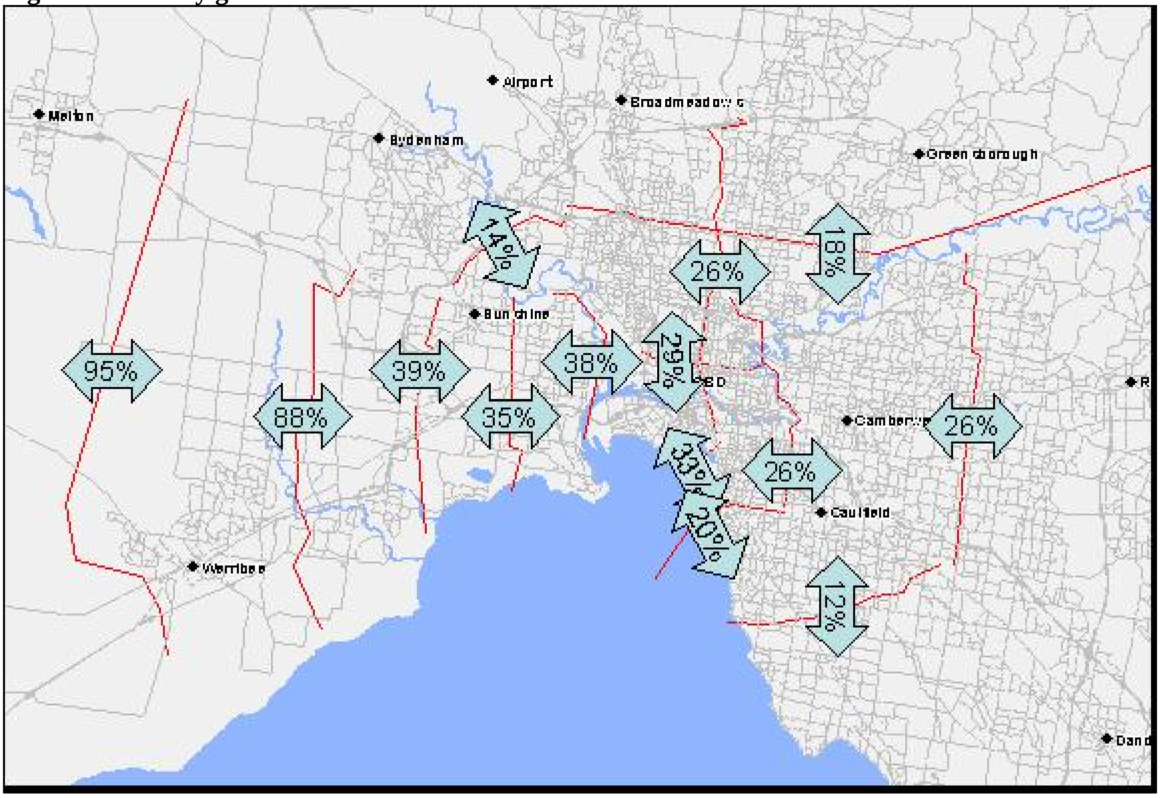
Brunswick Road operates at 56% of its capacity at screenline 6 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 16%. This results in Brunswick Road operating at 65%. As such, it should operate without major delays within the peak periods. Commercial vehicles growth is expected to be 41%.

Victoria Street operates at 83% of its capacity at screenline 6 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 43%. This results in Victoria Street operating at 96%. As such, it would be expected that delays along Victoria Street will increase. Commercial vehicles growth is expected to be 51%.

Princes Street operates at 97% of its capacity at screenline 6 in the 2006 peak hour. By 2031, traffic volumes are expected to increase by 14%. This would result in Princes Street operating beyond its capacity, creating additional delays. Commercial vehicle growth is expected to be 34%.

Figure 3.17 shows the daily growth across each screenline. While Table 3-11 shows that the AM peak period growth is typically between 23-39%, the daily growth can be much higher. This would suggest that a number of key routes are operating at capacity during the peak period, while during the off-peak periods there is some spare capacity. The highest daily growth occurs across screenlines 1 and 2, with growth of 95% and 88% respectively. This could be due to the high amounts of residential development to the west of Melbourne.

**Figure 3.17: Daily growth across screenlines 2006-2031**




Source: East West Study Team

## 3.4 Transport Network Gaps

### 3.4.1 Public Transport

As mentioned previously, the screenline analysis identified rail as the key public transport mode in terms of its large people-moving capacity. Furthermore, the modelled demands suggest that it is the public transport mode which will be most constrained in the future. Bus and tram capacity will generally be able to meet the demand, with any future excess demand for a particular bus or tram service being met with additional services which can be added relatively easily as and when necessary. The exception to this is in the Doncaster corridor where a recent study revealed capacity shortfalls for bus routes, particularly during peak periods (discussed further below). The key issue facing trams and buses will be their on-street performance.

***Rail***

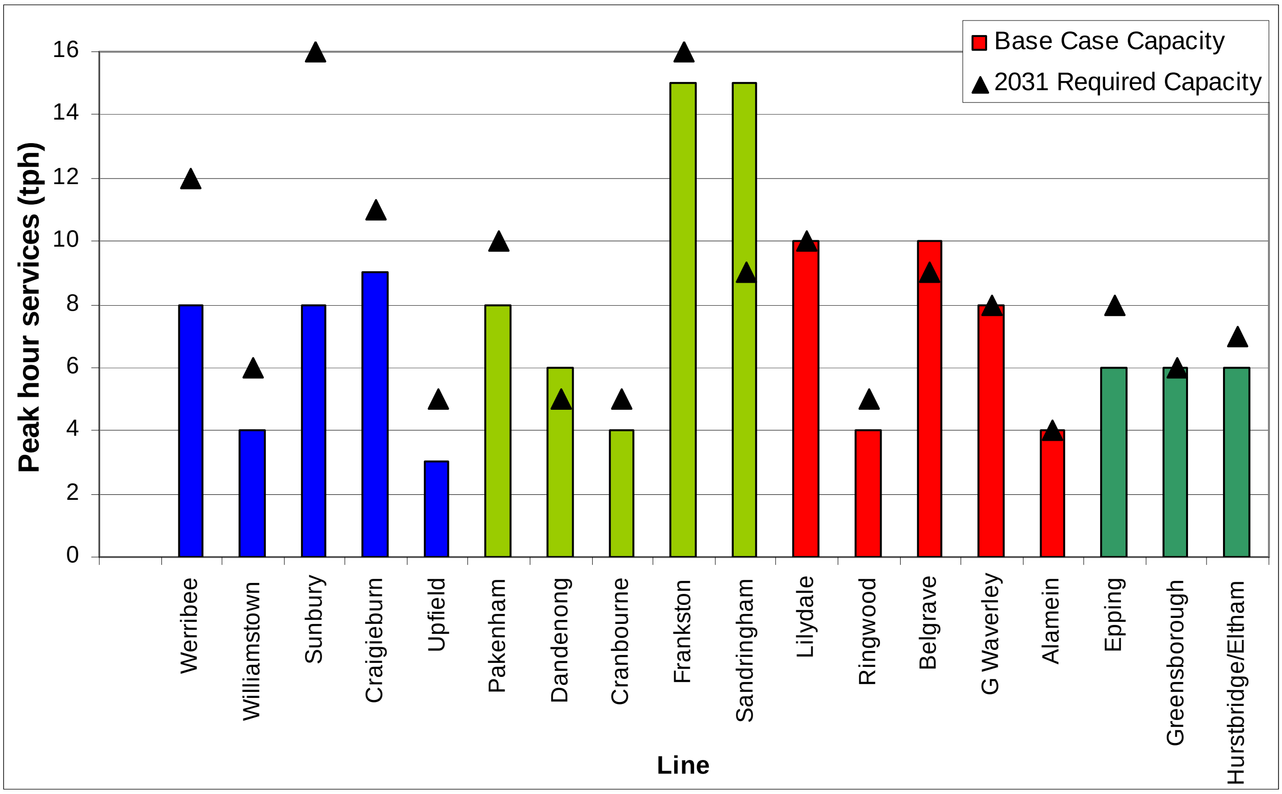
The service frequencies outlined in Table 3-9 have been compared against the projected future demand for services. Figure 3.18 shows the capacity provided in the base case and the capacity required in the peak hour in 2031. Peak hour service requirements are based on the DOI projections for services in the 'maximum hour' during the peak 2 hour period from each line.

Figure 3.18 shows that the optimal number of services that can be provided on the Northern and Caulfield groups in the base case will not sufficiently cater for the projected growth in demand on those lines in the longer term.

On the Burnley and Clifton Hill groups, the demand is satisfied by the service provision for most lines; for the remaining lines on these rail groups where demand exceeds capacity, small changes could be made to service patterns to increase capacity, thereby accommodating the demand.

From a network perspective, the base case would provide no additional capacity for any possible extension of the rail network, including links to Melbourne Airport, Rowville, electrification to Melton/Caroline Springs or other growth areas, because of the constraints on the Northern and Caulfield groups.

**Figure 3.18 Base case services and projected 2031 service requirement**




Note that the surplus capacity on the Sandringham line will not be available for other lines on the Caulfield group (light green columns).

The development of the base case has aimed to address future growth in train services by designing a service around the delivery of MOTC works and a new set of operating principles and compromises. However, despite providing significant additional capacity it has been shown that the demand for services on the Northern and Caulfield groups will still not be met. Using the DOI calculations for trains required in the peak hour on each corridor, Table 3-12 demonstrates when the demand for services outstrips the service level offered in the base case. Service frequencies for individual lines have been added together where the same corridor is used.

Table 3-12 shows the number of trains required for each line in the peak hour in 2031. Red shading indicates where and when the demand will exceed base case capacity. The table shows that demand for Sunbury/Watergardens trains will exceed capacity in 2010, with 11 trains required in the peak hour (this confirms current trends on this corridor, where all peak hour trains exceed the load standard). By 2015, demand will exceed supply on the Craigieburn line, while the Pakenham/ Cranbourne line demand will exceed capacity by 2016. The Werribee/Williamstown corridor will become constrained in 2017 with demand for 15 trains exceeding the base case capacity of 12 trains. It is anticipated that additional infrastructure works and operational changes would be required after this time to handle further patronage growth. This demonstrates the need to identify, in the immediate term, a longer term capacity solution which can address constraints on both the Northern and Caulfield groups.

Note that the years mentioned above are indicative and based on previous DOI growth forecasts. New forecasts have been recently released which take into consideration the substantial growth (~10%p.a.) experienced on the network since 2005 (more details in section 5). The effect of these higher growth rates would result in the above-mentioned rail lines becoming constrained earlier than shown in Table 3-12.

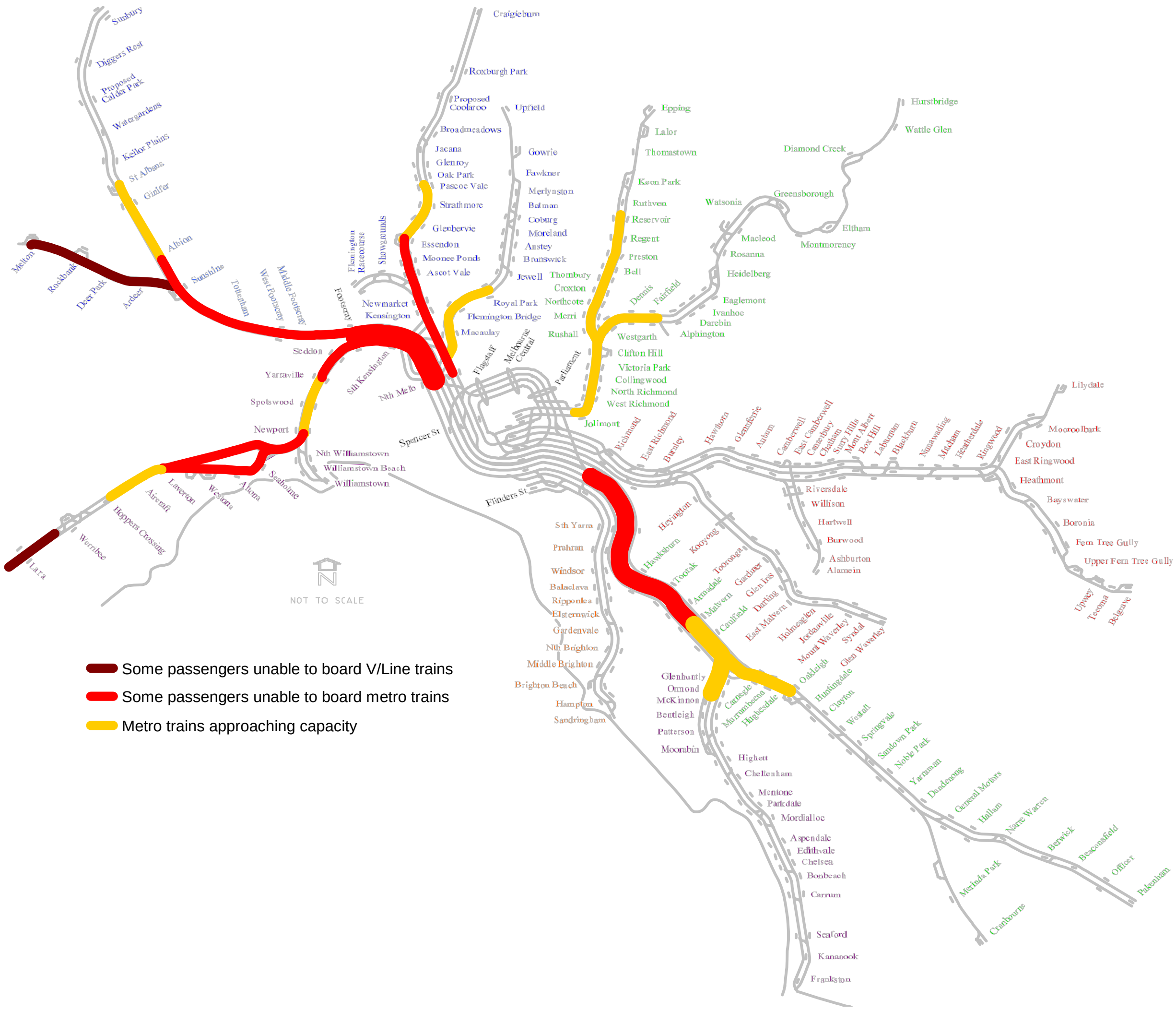
**Table 3-12: DOI Service projections and achievable frequency in base case**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Northern Group*** | | | | | | | | | | | | | | | | | | | | | | |
| Werribee, Laverton & Williamstown | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 15 | 15 | 15 | 15 | 15 | 15 | 16 | 17 | 17 | 17 | 17 | 17 | 18 | 18 | 18 |
| Watergardens & Sunbury | 11 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 16 | 16 |
| Craigieburn | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Upfield | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | *23* | *24* | *24* | *24* | *24* | *26* | *26* | *29* | *30* | *30* | *31* | *31* | *31* | *32* | *33* | *33* | *33* | *33* | *33* | *34* | *34* | *34* |
| ***Clifton Hill Group*** | | | | | | | | | | | | | | | | | | | | | | |
| Epping | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 |
| Hurstbridge & Greensborough | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| | *16* | *16* | *16* | *17* | *18* | *18* | *18* | *18* | *18* | *18* | *18* | *18* | *18* | *18* | *19* | *19* | *19* | *19* | *19* | *20* | *20* | *20* |
| ***Burnley Group*** | | | | | | | | | | | | | | | | | | | | | | |
| Lilydale & Belgrave | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 19 | 19 | 19 |
| Glen Waverley | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| Alamein & Ringwood | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| | *30* | *30* | *30* | *30* | *30* | *30* | *30* | *30* | *30* | *31* | *32* | *33* | *33* | *33* | *33* | *33* | *34* | *34* | *35* | *35* | *35* | *35* |
| ***Caulfield Group*** | | | | | | | | | | | | | | | | | | | | | | |
| Pakenham, Cranbourne & Dandenong | 16 | 16 | 16 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 20 | 20 | 20 | 20 |
| Frankston | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 |
| Sandringham | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | *36* | *37* | *37* | *37* | *38* | *38* | *39* | *40* | *41* | *41* | *41* | *41* | *41* | *41* | *41* | *41* | *41* | *42* | *44* | *44* | *45* | *45* |

In summary, the key gaps on the rail network are listed below and shown pictorially in Figure 3.19:

- Insufficient capacity on Sunbury line to cater for passenger demand;
- Insufficient capacity on Craigieburn line to cater for passenger demand;
- Insufficient capacity on Werribee / Williamstown lines to cater for passenger demand;
- Insufficient capacity on Caulfield rail group to cater for passenger demand;
- Insufficient capacity on V/Line lines, particularly Ballarat and Geelong lines, to cater for passenger demand;
- Adverse impacts on reliability for lines where metro and V/Line trains share tracks;
- No opportunity to implement network expansion to new destinations such as Melbourne Airport, Rowville.

**Figure 3.19 Melbourne rail network showing capacity constraints**




### *Bus and Tram*

The main deficiency in bus service provision is to the Doncaster corridor. Analysis carried out as part of the DART study[31] found that services are at capacity during the peak hour, with many passengers left behind at bus stops. In addition, frequency of services during off-peak hours including weekends are very low compared to adjacent corridors comprising rail and tram services. In order to provide a level of service equivalent to these corridors, significant enhancements would be required across the whole corridor to be attractive to prospective passengers, particularly those currently travelling by car.

For other bus and tram routes, the screenline analysis found that in general, demand would be met by the capacity provided. Any increases in capacity for these modes could be relatively easy to provide in the form of increased service frequency and/or larger vehicles.

However, it will be important in future years to ensure that tram and bus services are attractive to passengers, especially during the peak periods, to maximise the people-moving ability of the transport network as a whole. This would require substantial implementation of priority measures for these modes in the form of roadspace reallocation (eg. bus lanes) and

[31] SKM (2007) DART Bus Project – Options Development and Assessment Study

signal priority.  This would ensure that road congestion from other vehicles would have minimal impact on trams and buses resulting in competitive journey times for these modes, as well as greater operational efficiencies which could result in smaller fleet requirements.

In summary, the key gaps on the bus and tram networks are:

- Insufficient segregation from other traffic, which during congested periods adversely affects journey times and operational efficiency;
- Insufficient signal priority for trams and buses at intersections;
- Insufficient levels of service in the Doncaster corridor to meet demand and provide suitable travel alternatives to private transport.

### *3.4.2 Road*

The screenline analysis showed that a number of key routes across Melbourne are operating at or near capacity, while the select link analysis shows that the CBD is a major destination for private vehicle trips throughout the day. The locations where congestion is expected are:

- The M1 corridor

The current upgrade of the M1 corridor will provide additional capacity for vehicle trips from the southeast and southwest, however there are limited connections between the eastern and western suburbs which have spare capacity during peak periods. The West Gate Bridge is expected to operate beyond it capacity by 2031 along with its key feeders of the West Gate Freeway and Western Ring Road.

- The Maribyrnong River

The Maribyrnong River creates a major barrier for vehicle travel from the west with a limited number of crossings, however there are limited opportunities to create additional river crossings at locations that will provide sufficient road capacity.  Dynon Road, Footscray Road and Ballarat Road provide some of the key river crossings. However all of these river crossing only provide two lanes in each direction, while the approaches to the river crossing along Ballarat Road and Footscray Road provide up to 4 lanes. This results in the crossings being a major congestion point for vehicles travelling from the west.

- The Western Ring Road, north of the Western Highway

The Western Ring Road north of the Western Highway carries approximately 115,000 vehicles per day (two way), yet it provides only two traffic lanes in each direction. By comparison, the Western Ring Road south of the Western Highway carries approximately 104,000 vehicles per day (two way), but it provides three traffic lanes in each direction. As such, the northern section of the Western Ring Road experiences heavy congestion in the peak periods due to lack of capacity.

- Access into the Port of Melbourne

Access into the Port of Melbourne from the west is constrained due to capacity limitations on key routes such as Ballarat Road. Ballarat Road in the vicinity of the Port is expected to operate beyond its capacity by 2031, which is the same for Ballarat Road near the Western Ring Road.

- Congestion on route between Eastern Freeway and Ballarat Road

Regular congestion is experienced on the route linking Ballarat Road to the Eastern Freeway, via Smithfield Road, Racecourse Road, Elliott Avenue, Macarthur Road, Cemetery Road, Princes Street and Alexandra Parade. This is due to a limited number of alternate east-west routes across inner-northern Melbourne and the Eastern Freeway terminating onto the arterial network.

- East-West route in the inner city heavily congested

Key east-west routes into and around the CBD experience heavy delays in the peak periods. Some examples are Victoria Parade/Victoria Street, Alexandra Avenue/City Road and Wellington Parade/Flinders Street. These routes connect the eastern suburbs to, and beyond, the CBD and carry large volumes of traffic due to the funnelling effect of the eastern suburbs grid network. Victoria Parade also experiences additional delays due to a number of north-south public transport routes which cross it and are given priority over traffic movements.

The screenlines for 2031 show that a number of key routes are expected to carry traffic volumes in excess of their available capacity. This may result in additional delays to all road users and may create peak spreading in both peak periods.

Figure 3.20 and Figure 3.21 show the AM peak growth and the daily growth between 2006 and 2031. The majority of the growth in the AM peak occurs along the M1 corridor and the Tullamarine Freeway/CityLink. This can be attributed to the additional capacity provided along the M1 corridor as part of the current upgrade, which also provides some congestion relief along the Tullamarine Freeway/CityLink. Figure 3.20 also suggests that the small growth seen on other major roads could be due to these roads currently operating at or near capacity in the AM peak.

**Figure 3.20: AM Peak growth 2006 to 2031**

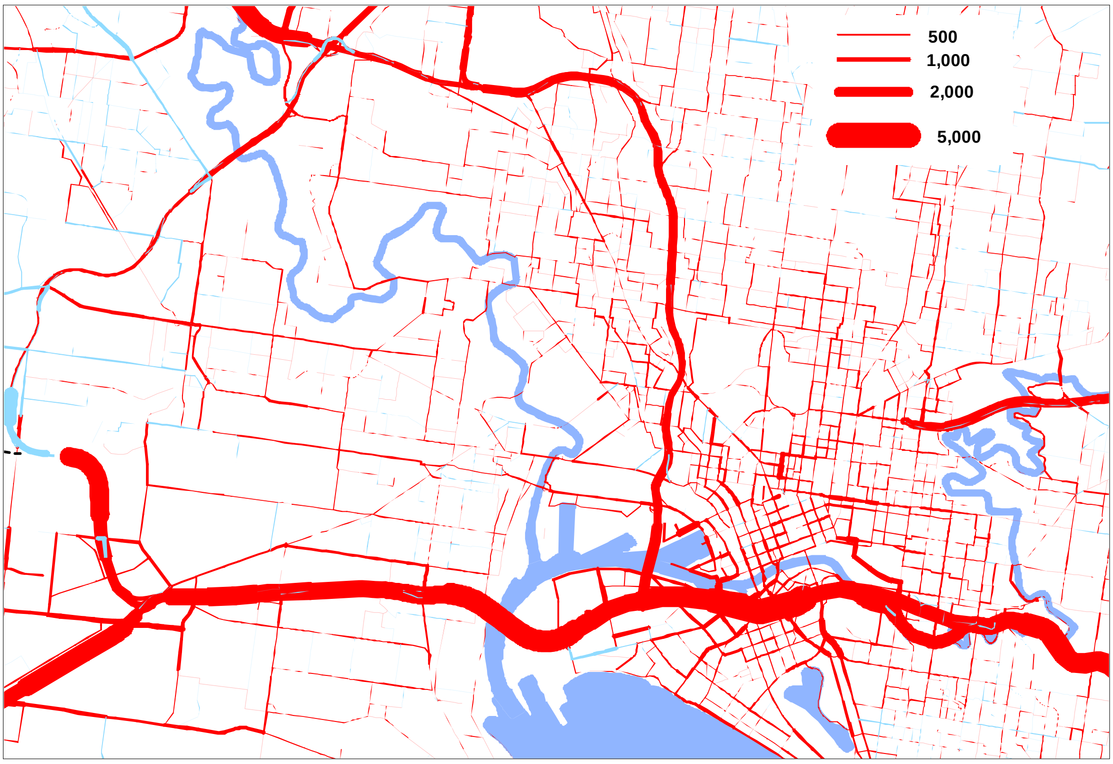
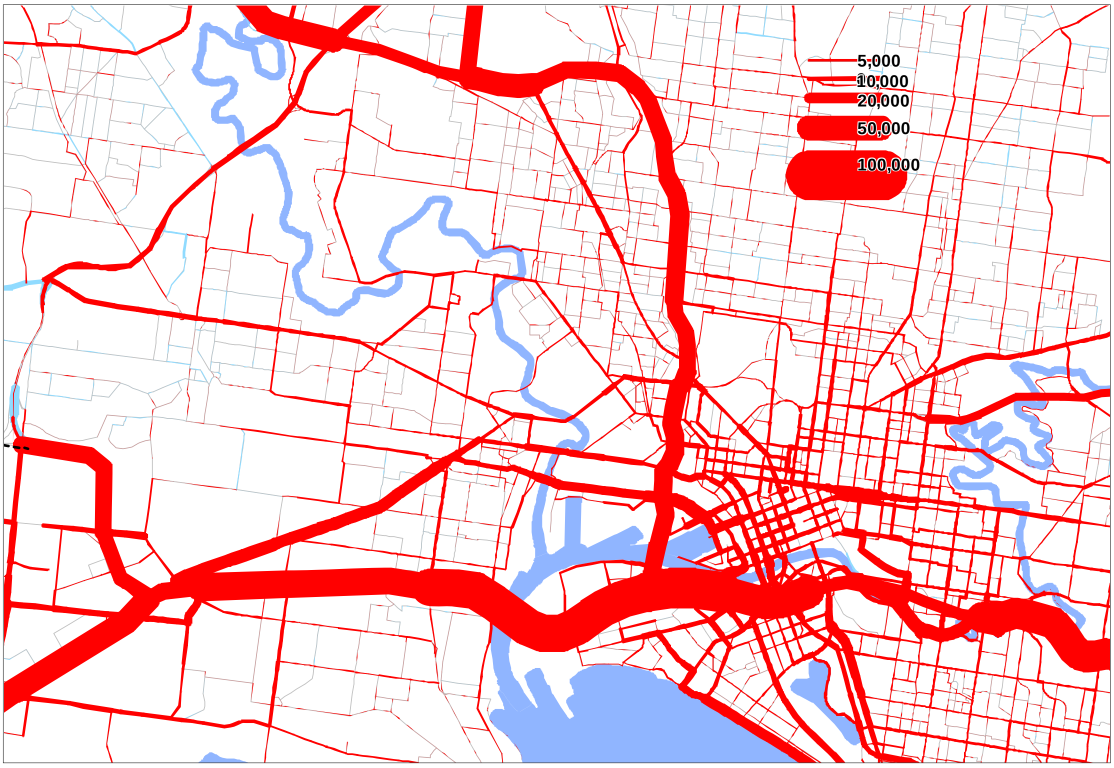



Figure 3.21 shows the daily growth across the network between 2006 and 2031. It differs from Figure 3.20 as more of the key roads have higher levels of growth outside of the peak period. This would reinforce that the majority of roads operate at capacity during the peak periods, however they have a large amount of spare capacity in the off-peak periods.

**Figure 3.21: Daily growth 2006 to 2031**




It is expected that the peak spreading will increase traffic volumes throughout the day, potentially generating a peak period that extends for the greater part of the day. These additional traffic volumes and longer peak periods will extend travel time on key routes, particularly from the outer suburbs as delays spread across the network.

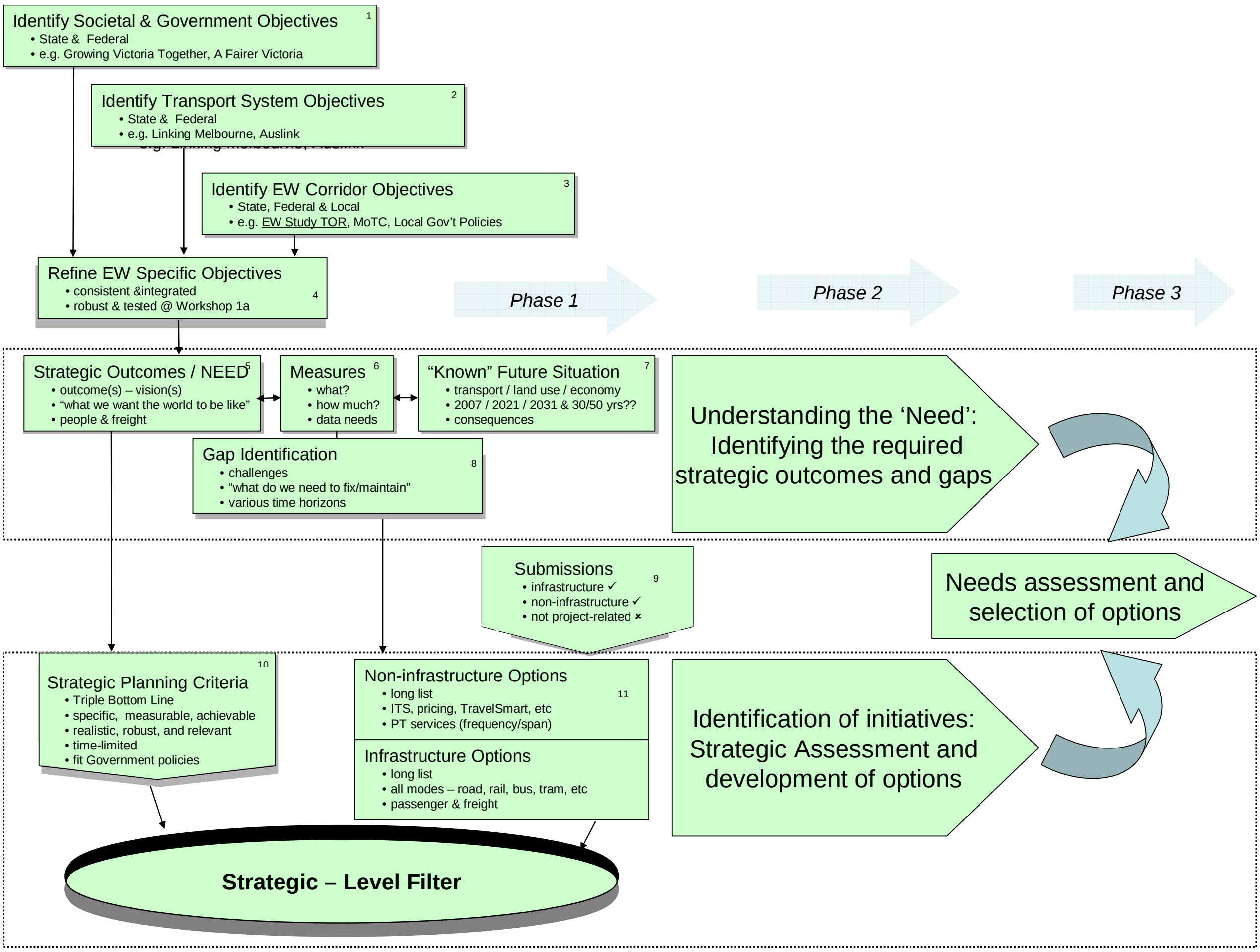
Despite the high congestion levels expected to be experienced on the road network, it must be understood that an increase in road capacity would provide some relief in the peak period, however it will not completely remove congestion. Instead it is considered that expansion of the public transport network and services would provide the best opportunity to significantly increase the people-moving ability of the transport network as a whole, and in turn provide some degree of congestion relief to the road network, particularly during peak periods. Any expansion of the road network should instead be focussed on improving road network connectivity for freight and business travel for all hours of the day and not just the peak periods.

# 4 Context for Transport Options

This chapter discusses the possible transport options which could be considered in the East-West Needs Study to address the gaps identified.

The evaluation process to undertake analysis of possible options from a transport perspective is summarised in Figure 4.1. The process is based on the *National Guidelines for Transport System Management in Australia.*

**Figure 4.1 Outline Study Process**




## 4.1 Phase 1

The purpose of Phase 1 was to develop objectives, an assessment framework and initial options. This phase examined the current situation in the Study Area, explored existing and future drivers of transport demand and identified gaps and problems in meeting demand along the east-west corridor. Phase 1 drew together nearly 100 potential options sourced from public submissions and work undertaken by the Study Team and specialist consultants.

Phase 1 used the National Guidelines Strategic Merit Test to review these options and identify those that did not meet the identified strategic requirements or the Study Terms of Reference.

The Strategic Merit Test is largely a qualitative assessment of 'strategic fit', testing how well an option would play a part in achieving transport system objectives or need; whether there are any obvious 'fatal flaws' or key risks; and how an option is broadly likely to measure up under a Triple Bottom Line assessment.

## 4.2 Development of "Long List"

It was recognised that many discrete options that had been identified could not reasonably be differentiated at this stage due to the limited detailed analysis that had been undertaken.

For instance it was not yet possible to differentiate between a wide range of east-west road link options of differing lengths, construction and interchange configurations. Similarly, there are many possible ways to provide a transit link to Doncaster utilising the Eastern Freeway.

Where sensible, some individual options were therefore grouped into representative options i.e. east-west road links were generically grouped, as were the Eastern Freeway transit links. The resultant amalgamated options were then considered in the initial assessment.

A summary of the "long list" of options developed from the above processes is shown in Table 4-1.

**Table 4-1: Options "long list" Summary**

| Option | Description |
|---|---|
| EWC1-21 | New East-West road, various alignments and interchange combinations |
| CR1-8 | New road links between various arterial roads |
| EWF1-7 | New road links between various arterial roads and Melbourne Ports |
| HF1 | Hastings Freight |
| EWP1-7 | New East-West public transport services, various modes and alignments |
| NI1-11 | Non-infrastructure solutions eg. CBD/CAD cordon charging, public transport priority and service improvements, travel behaviour change program, road pricing, traffic management measures, revamp of government taxes and charges, carbon trading/rationing/tax, intelligent transport systems, land use planning changes |
| EWF101-3 | New road links for freight in west |
| RF101-4 | New rail freight lines |
| EWC101-7 | New and/or upgraded road schemes addressing various constraints across Melbourne |
| EWP101-17 | New and/or upgraded public transport schemes addressing various constraints across Melbourne |
| EWB101 | Strategic Bike Links |
| EWNI101 | Freight Curfews |

## 4.3 Strategic Merit Test

The long list of options was assessed in order to identify those options with the greatest potential to address the transport needs in the study area.

The Strategic Merit Test is particularly valuable when applied to proposals that have been developed outside a clear strategic planning process, which in this case include some options arising from the study team or from the submissions.

The assessment framework was developed in a Workshop through specialist group discussions for each of the following key areas and associated criteria:

*Economic & Financial*

- Impacts on direct, indirect and wider economic benefits;
- Impacts on employment growth;
- Impacts on the cost of economic journeys;
- Possible levels of BCA;
- Proportion of budget transport funding required.

*Environmental & Heritage*

- Impact on or opportunities to enhance or connect existing areas of natural ecosystems / assets;
- Impacts on GHG emissions;
- Impact on air quality in the corridor;
- Impact on the acoustic environment in the corridor;
- Impact on surface and ground water flows and water quality;
- Potential for exposure to contamination.

*Social*

- Impacts on accessibility to jobs and services;
- Impacts related to heavy / commercial vehicles on residential streets;
- Impacts on travel cost and time.

*Transport Needs*

- Impact on management of future demand;
- Impact on optimising modal distribution;
- Impact on making best use of existing assets;
- Impact on freight needs;
- Impact on the support of strategic transport links.

The discussions centred on:

- confirming/critiquing the overall objectives;
- refining and adding to sub-objectives;
- drafting performance indicators and measures;
- identifying availability of data;
- deciding which indicators/measures are strategic level (threshold) criteria for the initial options filter.

Following identification in the workshops, some refinement and testing of the framework and criteria was completed with the consultant teams, with the final version subsequently used for all levels of analysis.

It was also recognised that some options may have potential value as a supplement to other options despite not ranking highly in the above process. In recognition of the potential utility or interest in these options, all options not meeting any of the above tests were "parked" (rather than eliminated) for consideration in later phases.

Following the Strategic Merit Test the options shown in Table 4-2 were shortlisted. They were further explored and developed in the next phase of the study.

**Table 4-2: Shortlisted Options**

| Basic Option | Included variations |
|---|---|
| A new East – West road | ▪ with and without specific CBD access<br>▪ full tunnel vs. mixed tunnel / surface / elevated<br>▪ shorter tunnels from the east &/or west<br>▪ northern or southern alignments<br>▪ tolled vs. untolled |
| Upgrading of existing east-west roads | ▪ addressing local issues vs. improving a whole EW route |
| A new Bayside east-west tunnel | ▪ connection options<br>▪ tolled vs. untolled |
| A new east-west CBD rail tunnel | ▪ alignment options<br>▪ station options<br>▪ operating/service options |
| A new transit link to Doncaster | ▪ rail, light rail or bus rapid transit<br>▪ via existing links or new links<br>▪ stop/station locations |
| Rail capacity upgrades from the West | ▪ incremental capacity improvements<br>▪ electrifications to Melton, Sunbury & Geelong<br>▪ long underground Regional Rail in conjunction with road tunnel |
| A new Caroline Springs rail line | ▪ route options |
| Amenity improvements in Yarraville | ▪ alternative freight routes around residential areas |
| Non-infrastructure policies | ▪ pricing<br>▪ public transport priority/road space allocation<br>▪ travel demand management<br>▪ freight management |

## 4.4 Phase 2

This phase comprised a Rapid Appraisal of the shortlisted options brought forward from Phase 1. Rapid Appraisal is intended to be a cost effective way of gauging whether an initiative is likely to pass a detailed appraisal. The methodology used for rapid appraisal is similar to a detailed appraisal; however the estimates and detail for a rapid appraisal are less precise because of the conceptual nature of the option development.

During Phase 2, the identified options were developed to a level of detail allowing a quantification of as many benefits and costs as possible to establish whether the option was worth developing further. As part of this exercise, options were developed to engineering feasibility stage, giving consideration to physical and geometrical constraints and construction requirements. Construction and operational costs, at an order of magnitude level, were applied to each of the options. Preliminary modelling was also undertaken to ascertain the impacts of each option. The appraisal incorporated an indicative assessment of the main benefits and costs, as well as establishing a 'confidence level' to identify areas where information may not be as robust as required for a detailed appraisal.

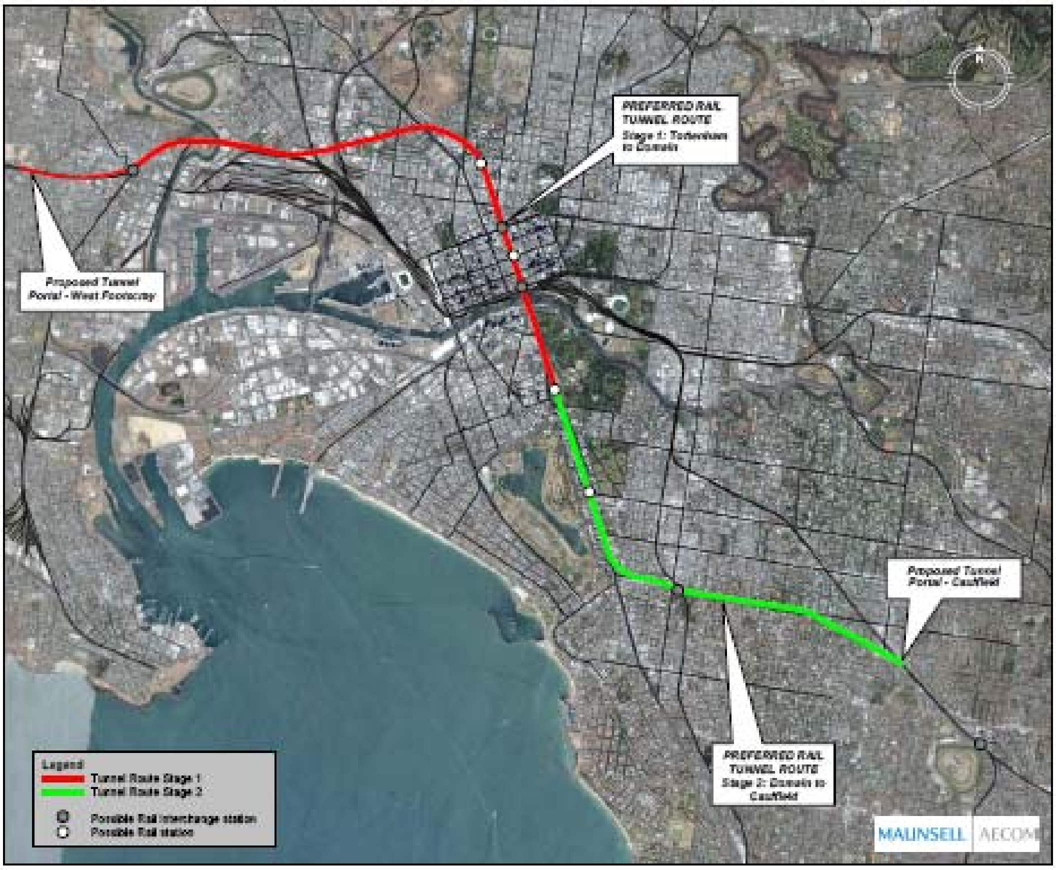
The following list of options resulted from the initial stage of Phase 2:

### *4.4.1 Major Public transport infrastructure improvements*

***CBD Rail Tunnel***

This option involves the construction of a new pair of underground tunnels running from west of West Footscray station on the Sunbury corridor to the down side of Caulfield (refer to Figure 4.2). Tunnelling would commence near West Footscray station and run under the existing rail reserve to Footscray. After Footscray the tunnel would travel under various land uses to a new station near Melbourne University. From there it would continue under Swanston or Elizabeth Streets to Melbourne Central and Flinders Street stations before running under St Kilda Road. After this point the line would travel under Dandenong Road or Balaclava Road to Caulfield station.

**Figure 4.2: Proposed alignment of CBD rail tunnel options**



New platforms could be located at the following stations:

- Footscray;
- a new station at Melbourne University;
- Melbourne Central;
- Flinders Street;
- A new station at Domain;
- A new interchange station with the Sandringham line at Windsor or Balaclava;
- Plus, potentially, further additional new stations depending on the chosen alignment.

The new underground tracks would be linked to existing suburban corridors at both ends of the tunnel with all trains from the Dandenong corridor connecting to the Sunbury line in the west to form a new cross-city group. Alternatively the CBD tunnel could be connected to the Werribee/Williamstown corridor in the west or Frankston line in the east; for simplicity, this report assumes Sunbury / Dandenong connections.

The benefits of constructing a new CBD tunnel and connecting into the existing network at each end are:

- significantly improved capacity for Northern and Caulfield groups enabling higher service frequencies on all lines, particularly those serving growth areas;
- release of a dedicated track pair for V/line services from West Footscray into Southern Cross terminals, improving reliability for metro and V/line services;
- provision of rail service to new catchments and high demand area such as Melbourne University and St Kilda Road;
- provision of capacity for rail network expansion into other areas eg. Melbourne Airport, Rowville.

The construction of the new CBD tunnel could be staged. Stage 1 could be to construct a tunnel from West Footscray to Domain Interchange station on St. Kilda Road. Stage 2 could involve the construction of the remainder of the new tunnel from Domain Interchange to Caulfield. It must be noted that the benefits delivered by the CBD tunnel cannot be fully realised without the supporting infrastructure provided by the Tarneit line (detailed below), and similarly, the full benefits of the Tarneit line cannot be realised without the provision of a new track pair into the CBD

Details of the train operations through the new CBD tunnel are provided below.

### *4.4.2 Ancillary public transport improvements*

***Tarneit Rail Line***

Current operations on the Werribee line see all Geelong line V/Line services mix with Werribee and Williamstown trains as they approach Melbourne. The different stopping patterns and relatively high frequency of metro trains reduces the potential capacity of the entire corridor and results in adverse impacts on all trains when one train is late.

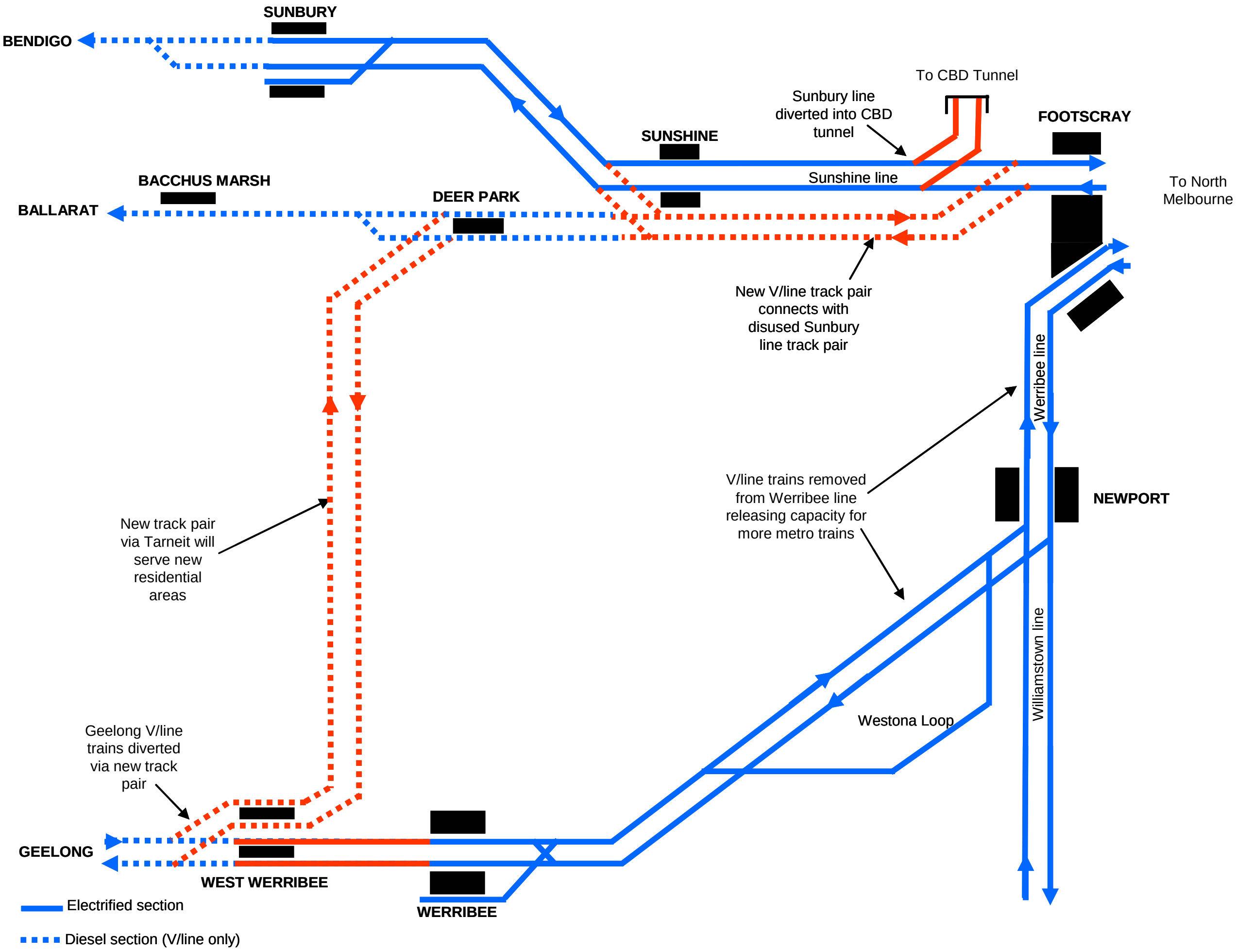
The Tarneit line proposes a new rail corridor between Footscray and West Werribee via Deer Park and Tarneit. This new corridor would separate Geelong services from Werribee metro services, improving capacity and reliability for both. The new alignment would service an entire new regional area and provide an opportunity for new stations at locations within new growth corridors.

This option would involve the construction of a new track pair from Browns Road Werribee West, through existing and proposed residential estates before joining with the Melton line at Deer Park. The proposed line would follow the transport corridor detailed in the 1990 Werribee Growth Area Plan. A new track pair would also need to be built between Sunshine and Footscray, as detailed in MOTC, which in turn would be connected with an existing track pair between Footscray and Southern Cross. Figure 4.3 shows an indicative alignment of the proposed Tarneit line.

**Figure 4.3: Proposed Tarneit rail line alignment**


The construction of the Tarneit line would complement the construction of the CBD tunnel and its subsequent connection to the Sunbury line. Minimal works would be required between West Footscray and Southern Cross because the diversion of the Sunbury trains into the CBD tunnel would release the existing Sunbury line from West Footscray for exclusive use by V/line trains (see Figure 4.4). Furthermore, the new line via Tarneit would avoid the need for 3rd track schemes on the Werribee line as listed in MOTC, which may be difficult to implement, particularly between Newport and Footscray. It would also provide greater increases in capacity for both metro services on Werribee / Williamstown lines and Geelong V/Line services.

**Figure 4.4: Infrastructure works for Tarneit operations (with CBD tunnel connected to Sunbury line)**

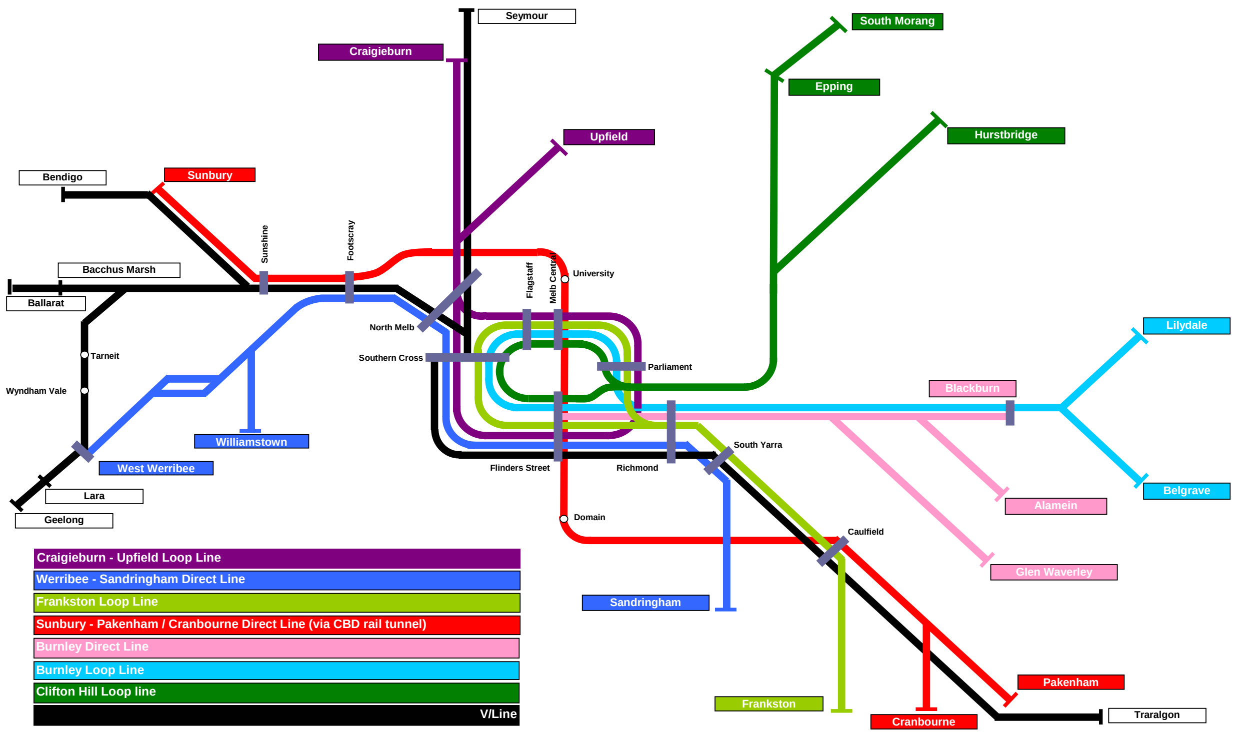



The benefits of providing a new line via Tarneit are:

- provision of significantly improved metro capacity in the form of increased service frequency for Werribee, Williamstown and Sunbury lines;
- improved capacity for higher frequency V/Line services from Bendigo, Ballarat and Geelong;
- servicing of new residential areas in growth areas in Wyndham and Melton;
- vastly improved service reliability for metro and V/Line services;
- avoiding construction of additional tracks on the Werribee line in well-established areas.

From an operational perspective, the construction of the CBD rail tunnel (connecting to Sunbury and Dandenong lines) and the Tarneit line would result in the following operational arrangement for the rail network (see Figure 4.5).

**Figure 4.5 Network operation diagram**




V/line trains from Geelong would branch off from the Werribee line at Browns Road, West Werribee and follow the new line through to Deer Park, joining with other V/line trains from Ballarat, Bendigo and Melton. Only metro trains would operate on the Werribee line (apart from freight trains using the standard gauge track). In addition, some additional V/Line diesel services could commence journeys from West Werribee or Lara and provide suburban services on the new Tarneit line, similar to existing Sunbury and Melton services. The separation of express V/Line services from stopping all stations metro services will improve reliability and reduce journey times for all train types as well as significantly improving capacity on the Sunbury and Werribee lines.

The provision of the new CBD tunnel removes all Sunbury, Pakenham and Cranbourne line trains from the existing CBD network. All Craigieburn and Upfield trains would run via the Northern loop. Werribee/Williamstown trains would be routed direct to Southern Cross and Flinders Street and then on to Sandringham. V/line trains from the west (Bendigo, Ballarat and Geelong lines) would take over exclusive use of the disused Sunbury line tracks from Footscray, running into and out of Southern Cross.

The removal of the Dandenong trains at Caulfield would allow all Frankston trains to run into the Caulfield loop. If the new CBD tunnel is limited to 20tph then any extra Dandenong trains could continue to run into the Caulfield loop with Frankston trains. The direct line into Flinders Street would only be used by 2tph V/line services, leaving spare capacity for future growth in metro and V/Line services as well as freight movements.

Burnley and Clifton Hill group services would remain unchanged.

### *Doncaster Rapid Transit*

Following rapid appraisal, the best solution for public transport to Doncaster is considered to be expansion and enhancement of the proposed Smartbus network, which is a MOTC scheme.

However further investigation of rapid transit issues in the greater Doncaster area will be undertaken by the Study Team as a separate exercise to ensure all opportunities and constraints are well understood.

### *4.4.3 Major road infrastructure improvements:*

Following on from the analysis leading to the gaps identified in section 3.4, the projected growth in traffic across the study area would exacerbate existing transport congestion and amenity issues and may also result in new pressures growing in adjacent areas.

The existing road network, even with the M1 upgrade, is unlikely to be able to adequately meet the demand for travel across the west and inner north areas, particularly in the peak. Modelling results for future years also indicate that the growth during the period between the AM and PM peaks is substantially increasing, with peak-like conditions likely to be experienced for much of the day, particularly in the inner west, which will impact on the efficiency of freight vehicles during the day.

A link connecting the existing freeway network across the north of the city is considered to be an effective solution to achieving more efficient travel throughout the day. Particularly, a link between the Eastern Freeway and the west may be the most appropriate way to meet the growing demand for cross-city travel in these areas.

There were two possible options developed that would provide freeway standard links across the city and another that would provide an upgraded network for the same movements.

*Eastern Freeway to West Gate Freeway via Royal Park and the Port*

This option provides a freeway standard link, predominantly within tunnels, comprising three lanes in each direction from the Eastern Freeway at Hoddle Street to Royal Park and two lanes from Royal Park to West Gate Freeway. From the Port to West Gate Freeway, the new link would be constructed on elevated structure over the Maribyrnong River and connecting to the elevated structure of West Gate Freeway (see Figure 4.6).

The link has connections to the existing road network as follows:

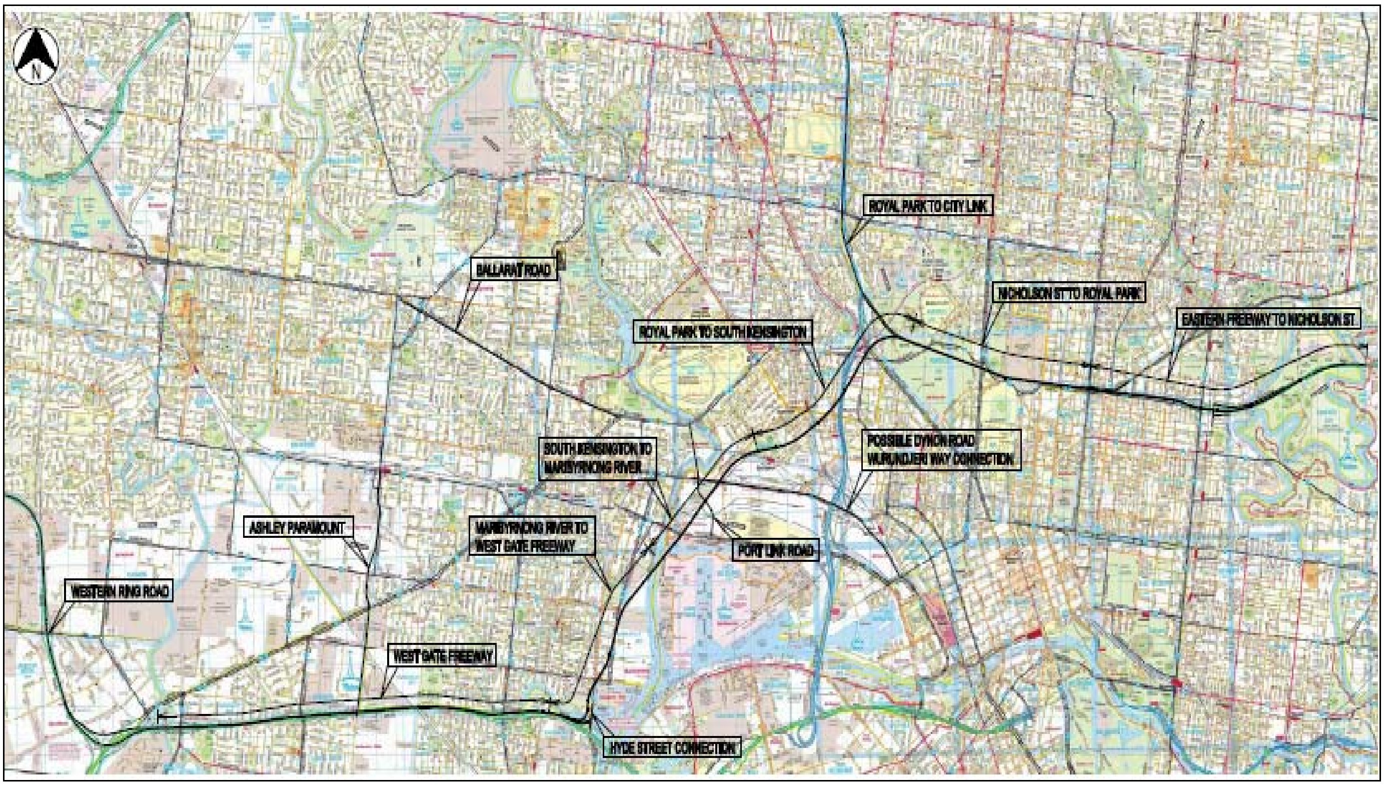
- Eastbound exit to Queens Parade and westbound entry from Hoddle Street, near Queens Parade;
- North bound exit to CityLink and east bound entry from CityLink;
- Full connectivity within the Port area, including a new link road between Dynon Road and Footscray Road; and
- Westerly oriented connections to Hyde Street within the connection to West Gate Freeway.

There is also a longer term component to Option A, which involves the widening of the West Gate Freeway between Williamstown Road, where the new east-west link intersects with the West Gate Freeway, and the Western Ring Road.

Interchanges providing direct links to the CBD eg. Nicholson Street, Royal Parade, were not included in the options as they were considered to be difficult and costly to implement and also would provide little benefit to traffic. Specifically, the aim of the road tunnel would be to cater for through trips between the east and west, thereby improving network connectivity and efficiency. With the tunnel in place, these through trips would be removed from existing surface streets, which in turn could be reconfigured to provide greater priority for public transport. Providing CBD exits would only further encourage peak hour commuting trips by single occupant vehicles through the tunnel, resulting in queueing at the CBD exits (located in tunnel) and delays for all users, particularly through traffic.  None of these outcomes are considered to be desirable.

Construction of a new east-west link could be staged over time to provide the additional capacity when required.

**Figure 4.6 Eastern Freeway to West Gate Freeway via the Port of Melbourne**




The traffic benefits of constructing a new freeway standard link along this alignment are:

- significantly improved capacity for traffic over the Maribyrnong River and through the inner north;
- caters for significant growth expected in the outer west associated with the growth areas;
- provision of a more efficient link for freight through the west and across the north of the city, removing this traffic from residential areas;
- provision of more efficient linkages into the Port of Melbourne for freight vehicles;
- relief on the existing road network that may be able to be used for more efficient operations within the framework of VicRoads network management plans, by the application of non-infrastructure options; and
- reductions in travel time and greater reliability for journeys across the city.

*Eastern Freeway to Western Ring Road via Royal Park, the Port and Sunshine Road*

This option provides a freeway standard link, predominantly within tunnels, comprising three lanes in each direction from the Eastern Freeway at Hoddle Street to Royal Park and two lanes from Royal Park to Geelong Road / Sunshine Road (see Figure 4.7).

The link has connections to the existing road network as follows:

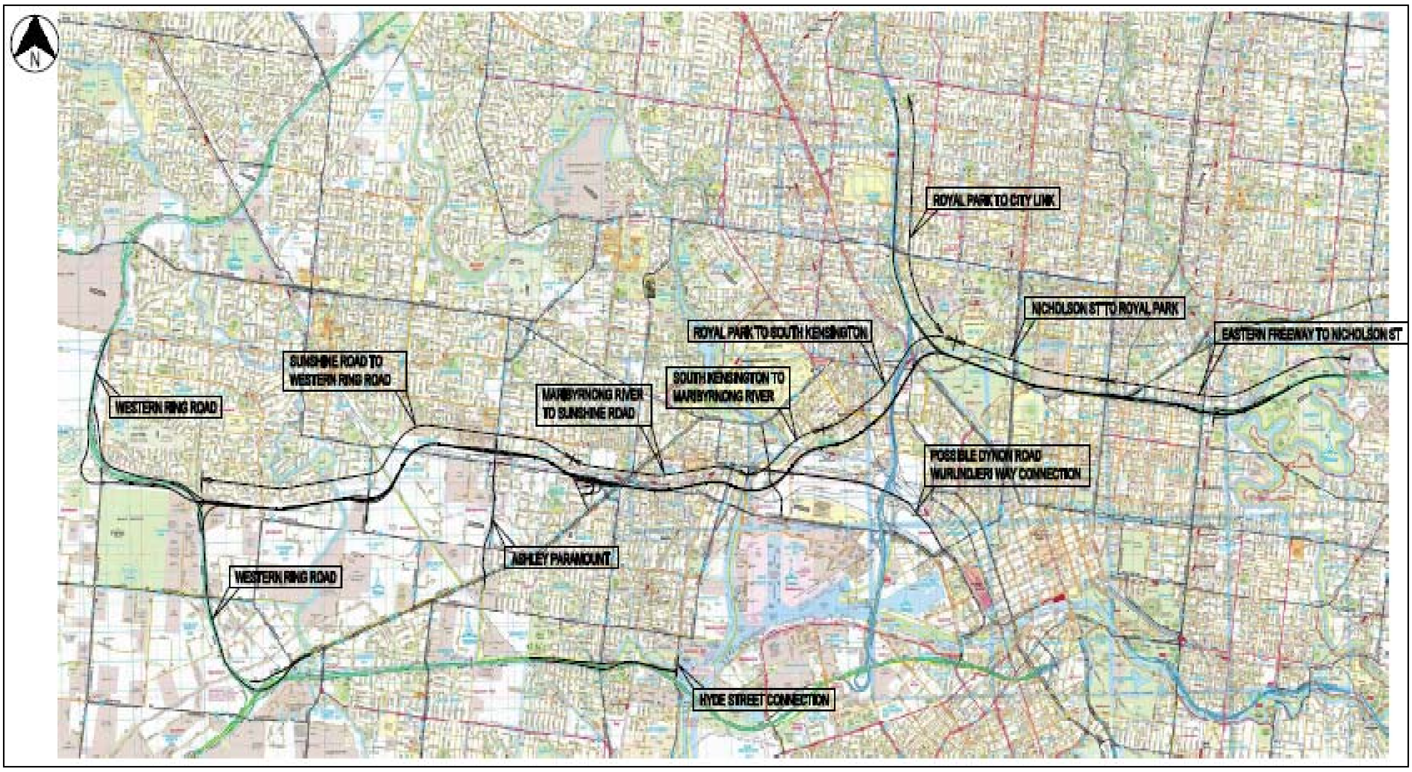
- East bound exit to Queens Parade and west bound entry from Hoddle Street, near Queens Parade;
- North bound exit to CityLink and east bound entry from CityLink;
- Full connectivity within the Port area, including a new link road between Dynon Road and Footscray Road;
- Connections to Sunshine Road / Geelong Road;
- Connections to Market Road.

There is also a longer term component to this option which involves the extension of the east-west link from Geelong Road / Sunshine Road to the Western Ring Road. This would involve the construction of an elevated structure over the Tottenham Rail Yards and possible at-grade construction to Western Ring Road

No CBD interchanges would be provided for the same reasons detailed for the previous option.

Construction of a new east-west link could be staged over time to provide the additional capacity when required.

**Figure 4.7 Eastern Freeway to Western Ring Road via the Port of Melbourne**




The traffic benefits of constructing a new freeway standard link along this alignment are the same as the previous option, specifically:

- significantly improved capacity for traffic over the Maribyrnong River and through the inner north;
- caters for significant growth expected in the outer west associated with the growth areas;
- provision of a more efficient link for freight through the west and across the north of the city, removing this traffic from residential areas;
- provision of more efficient linkages into the Port of Melbourne for freight vehicles;

- relief on the existing road network that may be able to be used for more efficient operations within the framework of VicRoads network management plans, by the application of non-infrastructure options; and
- reductions in travel time and greater reliability for journeys across the city.

*Existing road network upgrades*

An alternative to providing a freeway standard link across the west and north of the city is to upgrade the existing cross-town routes, focussing on current and future constraints in the network (see Figure 4.8).

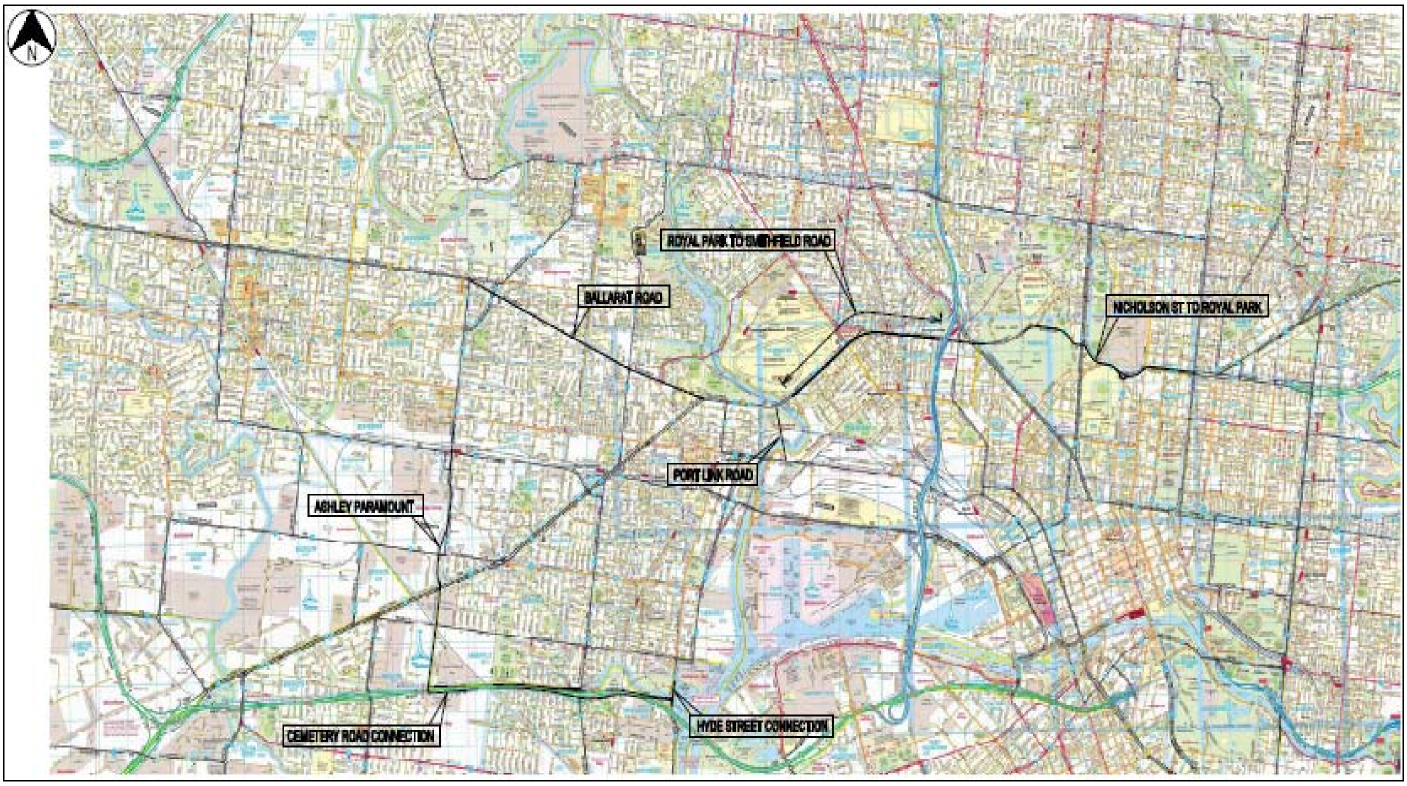
The most appropriate route to upgrade is the current east-west route across the city:

- Eastern Freeway to Flemington Road; along Alexandra Parade, Princes Street, Cemetery Road, Macarthur Road and Elliot Avenue; and
- Flemington Road to Ballarat Road; along Racecourse Road and Smithfield Road.

This alternative involves:

- widening of Princes Street from the constraint point at Nicholson Street to Cemetery Rd;
- widening of Cemetery Road from Princes Street to Royal Parade;
- widening of Macarthur Road from Royal Parade to Elliot Avenue;
- a tunnel under Kensington, from Flemington Road to Smithfield Road; and
- widening of the constrained section of Ballarat Road from Geelong Road to Ashley St;

**Figure 4.8 Existing Arterial Road Network Upgrade**



Due to development and land use constraints and the extent of possible land acquisition required through Kensington, widening was not considered a viable solution through this area, so a short tunnel section was added to the option from Flemington Road to Smithfield Road.

The traffic benefits of upgrading the existing network are:

- Improvements to travel times across the north of the city;
- Considerable cost savings associated with reduced civil works required;
- The possibility of more efficient use of existing road network assets;

### 4.4.4 Ancillary road infrastructure improvements:

*Dynon Road widening*

This scheme involves the widening of Dynon Road between the Port Interchange and Citylink.

*Wurundjeri Way connection*

This scheme would link Dynon Road to Wurundjeri Way via a six lane road. This may be required if expansion of the port impacts on the operation of Footscray Road.

*Truck Action Plan*

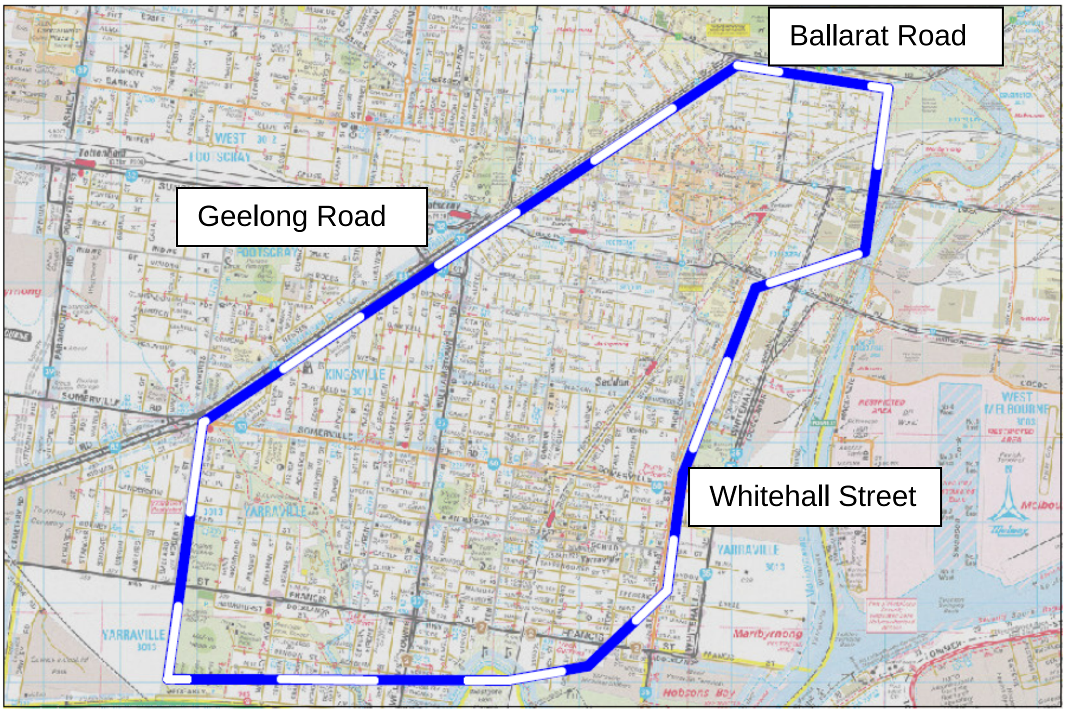
Heavy vehicle volumes impacting on amenity in the inner west are considered to be unsustainable in the longer term. Due to the population and industrial growth expected to the west and in the port, and the serious capacity constraints over the Maribyrnong River, this issue will not be resolved by existing management measures. Longer term solutions are required which provide alternative access across the city and to the Port of Melbourne.

The requirement to better provide for freight movements in the inner west, whilst considering the amenity of the residential and retail/business areas has resulted in the following infrastructure and non-infrastructure options being considered:

- Widening of Ballarat Road between Ashley Street and Geelong Road;
- Widening of the Ashley Street/Paramount Road route to provide a four lane connection from Geelong Road to Ballarat Road, with a possible connection from West Gate Freeway to Geelong Road in the longer term (providing an alternative to Millers Road);
- A direct connection from Hyde Street to West Gate Freeway, obviating the need for vehicles to use other east-west routes such as Francis Street, Somerville Road and Buckley Street;
- A direct connection from Ballarat Road to Dynon Road, as an alternative to a widening of Moore Street through Footscray.

The combination of these physical infrastructure options provides an effective alternative for freight vehicles currently travelling straight through the inner west area. These physical measures will need to be reinforced by expansion of the existing truck bans to remove all non-local freight traffic from residential areas in the west (see Figure 4.9).

**Figure 4.9 Proposed Truck Ban Area**




## 4.5 Phase 3

Phase 3 further developed the options remaining after the Phase 2 analysis and subjected them to a Detailed Appraisal. The framework used for this appraisal was the same as that used for the Strategic Merit Test; however, further development of the options meant that more detailed analysis was possible using transport model outputs, high level costing information and further detailed analysis of the impacts of the options. Options for financing, delivery and governance were explored during this phase.

A review of options 'parked' during phase 1 was undertaken to ensure that further analysis and understanding of east-west transport issues would not alter the initial strategic merit test assessment. As a result of this, a number of initiatives were included in the final options packages.

The Study Team then looked at a combination of these separate modal solutions to form a series of multi-modal options for development and consideration. Options were combined in such a way as to ensure a truly integrated transport solution that optimised the use of both the rail and road networks, acknowledging the legitimacy of both modes and the roles most appropriate to the use of each, and which would assist with addressing the gaps identified in section 3.4.

As a result of the above considerations and review of the previously parked transport solutions, four multi-modal options were identified for further development.

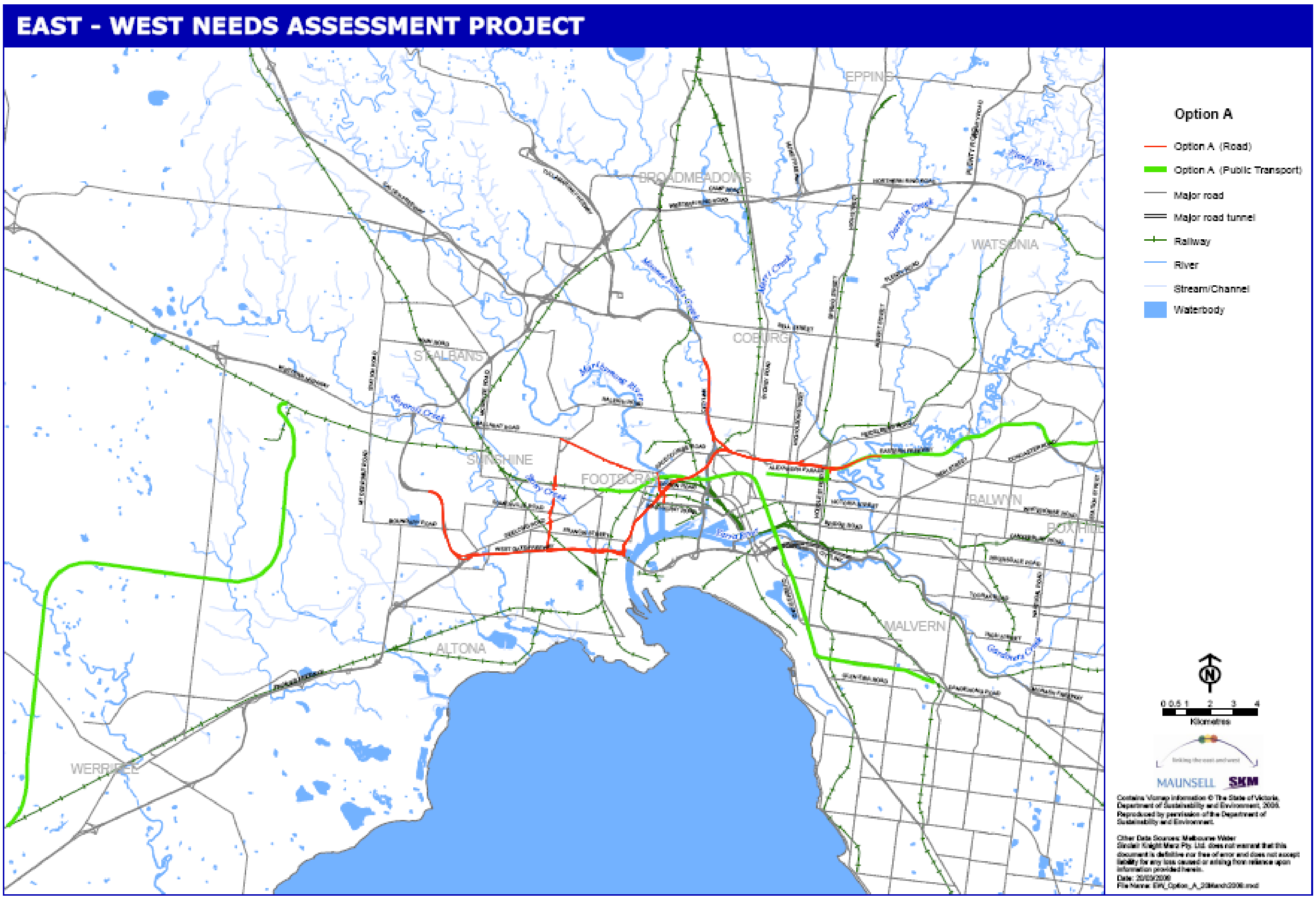
**OPTION A:**

Main components:

CBD Rail tunnel
East-West road – southerly

*Ancillary components:*
Doncaster rapid transit options
Tarneit rail deviation
Truck Action Plan including all components
Connection of Dynon Road to Ballarat Road
Widening of Dynon Road and extension of Wurundjeri Way

**Figure 4.10 Option A**

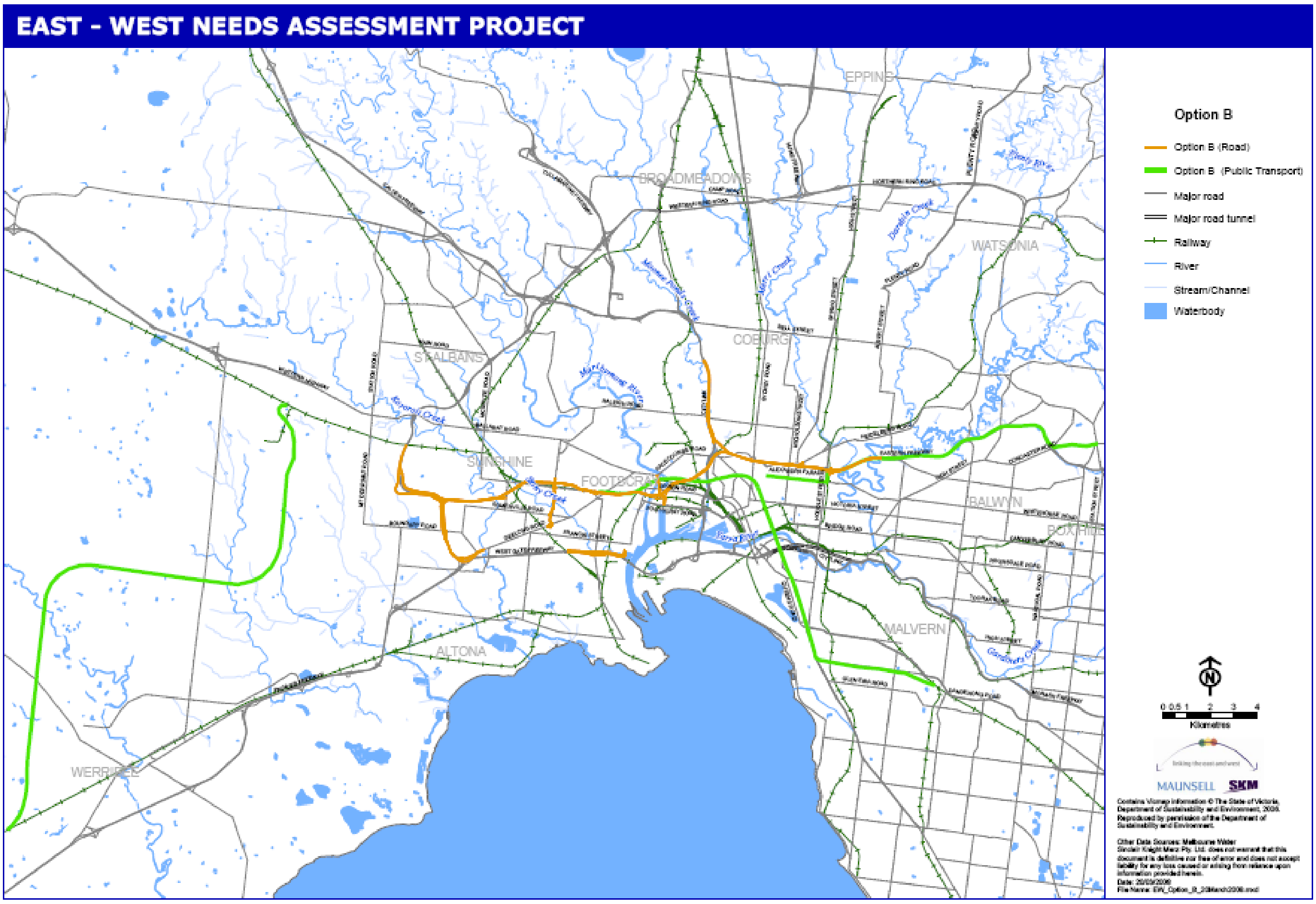


**OPTION B:**

Main components:
CBD Rail tunnel
East-West road – northerly

*Ancillary components:*
Doncaster rapid transit options
Tarneit rail deviation
Truck Action Plan excluding Ballarat Road widening and connection from West Gate Freeway to Geelong Road via Cemetery Road
Connection of Dynon Road to Ballarat Road
Widening of Dynon Road and extension of Wurundjeri Way

**Figure 4.11 Option B**

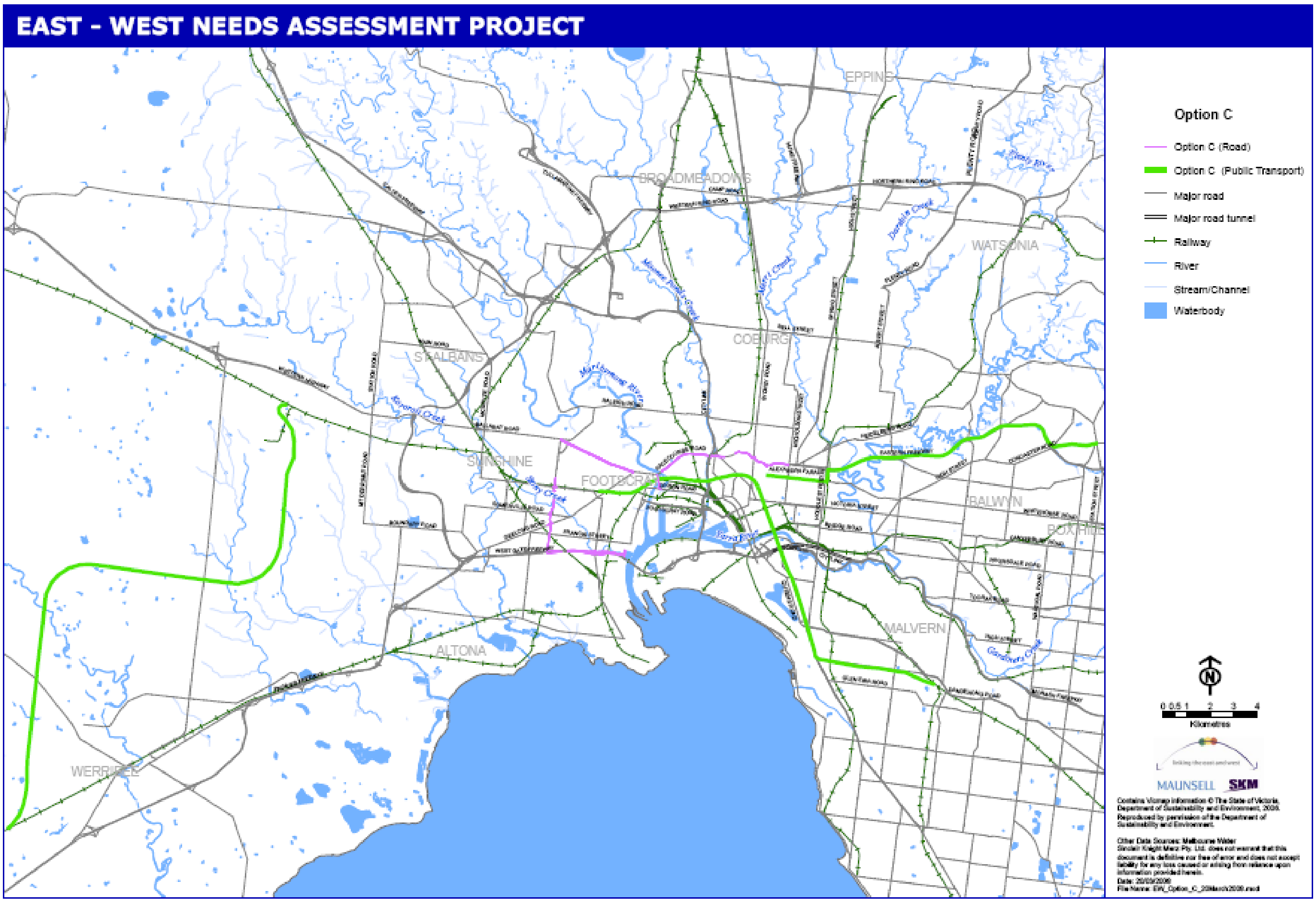


**OPTION C:**

Main components:
CBD Rail tunnel
Upgrade of the existing road network

*Ancillary components:*
Doncaster rapid transit options
Tarneit rail deviation
Truck Action Plan including all components
Connection of Dynon Road to Ballarat Road
Widening of Dynon Road and extension of Wurundjeri Way

**Figure 4.12 Option C**



**OPTION D:**

Main components:
CBD Rail tunnel

*Ancillary components:*
Doncaster rapid transit options
Tarneit rail deviation

**Figure 4.13 Option D**

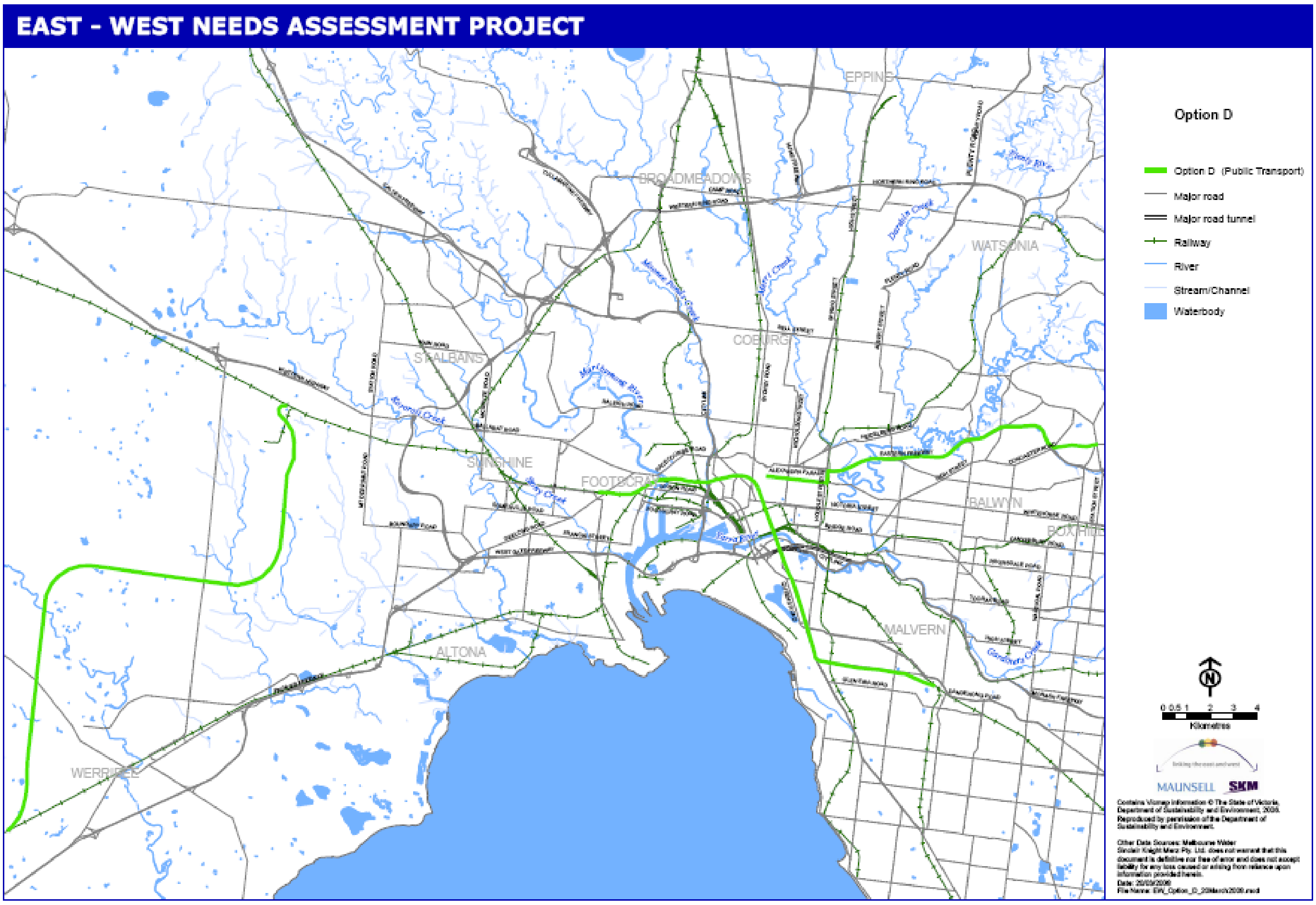


**Table 4-3 Summary of gaps addressed by each option**

| Option | Gaps addressed |
|---|---|
| A | • Greater capacity and reliability for the metro rail network to accommodate future patronage levels, particularly from the west and south-east, as well as network extensions to areas unserved by rail<br>• Increased capacity and reliability on the V/Line network to accommodate future patronage levels, particularly Geelong and Ballarat lines<br>• Enhanced public transport capacity and levels of service in the Doncaster corridor<br>• Reduced journey times for tram passengers through improved priority measures<br>• Increased capacity and improved connectivity on the road network between east and west<br>• Relief of congestion on key arterial roads during the day, particularly across the inner north and Maribyrnong River<br>• Improved road links between Port of Melbourne and freeway network<br>• Reduce impact of trucks on residential areas in west |
| B<br><br>(same as for A) | • Greater capacity and reliability for the metro rail network to accommodate future patronage levels, particularly from the west and south-east, as well as network extensions to areas unserved by rail<br>• Increased capacity and reliability on the V/Line network to accommodate future patronage levels, particularly Geelong and Ballarat lines<br>• Enhanced public transport capacity and levels of service in the Doncaster corridor<br>• Reduced journey times for tram passengers through improved priority measures<br>• Increased capacity and improved connectivity on the road network between east and west<br>• Relief of congestion on key arterial roads during the day, particularly across the inner north and Maribyrnong River<br>• Improved road links between Port of Melbourne and freeway network<br>• Reduce impact of trucks on residential areas in west |
| C | • Greater capacity and reliability for the metro rail network to accommodate future patronage levels, particularly from the west and south-east, as well as network extensions to areas unserved by rail<br>• Increased capacity and reliability on the V/Line network to accommodate future patronage levels, particularly Geelong and Ballarat lines<br>• Enhanced public transport capacity and levels of service in the Doncaster corridor<br>• Increased capacity on the road network between east and west<br>• Relief of congestion points on identified arterial roads during the day<br>• Reduce impact of trucks on residential areas in west |
| D | • Greater capacity and reliability for the metro rail network to accommodate future patronage levels, particularly from the west and south-east, as well as network extensions to areas unserved by rail<br>• Increased capacity and reliability on the V/Line network to accommodate future patronage levels, particularly Geelong and Ballarat lines<br>• Enhanced public transport capacity and levels of service in the Doncaster corridor<br>• Relief of congestion on key arterial roads during the day |

# 5 Assessment of Shortlisted Options

## 5.1 Modelling Methodology

When analysing the impact of transport schemes, typically one forecast is provided of future conditions. This has usually been based on a continuation of existing trends i.e. business as usual, possibly with allowances for policy interventions.

However the chance of future conditions exactly matching the assumed future is small. This is because there is the potential in those circumstances for decisions to be made that may be valid for the forecast future, but seriously deficient should a different future eventuate. Therefore, as part of the assessment of options, the Study Team developed a number of future scenarios to test the sensitivity and robustness of options being considered.

The purpose of constructing different scenarios representing the future transport task for Melbourne is to ensure that the Study considers a reasonable range of different outcomes, having regard to relevant forces and variables. While consideration will be given to the risk of more extreme cases, the primary analysis is to be undertaken by comparison to more likely outcomes.

It is important to note that the scenarios have no purpose other than to test the performance of various options under widely different conditions – and to indicate how these options support (or affect) existing government policies, strategies and programs.

A series of workshops conducted by the Study Team suggested the following scenarios. The scenarios are described at 2031, which is the test year adopted for all modelling. The scenarios to be tested will be:

- The Reference Case (= Median Growth)
- Carbon Constrained (= Strong Urban Consolidation/High Oil Price)
- High Population Growth (= High Growth)
- Low Population Growth (= Low Growth)

*The Reference Case*

The Reference Case was used for the major part of the development and assessment of the options being considered by the Study Team. The Reference Case is a well-developed and understood scenario as it is based on extensive detailed land use, employment and economic forecasts developed by Victorian Government agencies.

However, the Reference Case is not necessarily the most likely outcome for Melbourne and Victoria. For example, if high levels of population growth continue to 2031, the High Population Growth Scenario is more likely. The Reference Case assumes Melbourne's population will reach 4.54 million by 2031. Under this scenario, trip-making behaviour will change only marginally

*Carbon Constrained Scenario*

The Carbon Constrained Scenario tests the implications of a world where the free availability of carbon-based fuels is constrained by high prices and/or limited supply. This could mean high market prices for carbon-based raw materials (especially oil and gas) due to supply limitations (such as 'peak oil') or it could mean the imposition of high end carbon pricing.

The scenario assumes the same population growth as the Reference Case and marginally lower economic growth. The scenario assumes there will be an orderly increase in carbon prices and that the economy can adjust to this increase while maintaining economic growth. From a transport perspective, such an orderly progression could be encouraged by early government action designed to reduce the impact of carbon constraints on individuals and the economy – such as introducing road pricing, offering incentives for the development of alternative fuels, providing more public transport and educating people about travel choices. Recent studies – and the recognition of the need for action at the state, federal and international levels – suggest that an orderly approach is feasible and becoming more likely.

The headline assumption behind this scenario is a doubling in the cost of road transport relative to other household expenditure items. The scenario also assumes a 25 per cent reduction in the cost of public transport and increased urban density.

*High Population Growth Scenario*

The High Population Growth Scenario was developed to provide an upper limit of demand for transport. This scenario enabled an assessment to be made about whether the proposed options can cater for travel demands in a high population growth situation.

The scenario assumes higher employment and population growth, based on the headline assumption of Melbourne's population reaching around 5 million people by 2031.

While higher population growth may increase the need for some additional transport infrastructure in fringe areas, the Reference Case Transport network assumptions have been used for simplicity.

*Low Population Growth Scenario*

This scenario was developed to provide a lower boundary of demand. The scenario provided a view about whether the recommended options would be needed even in a low population growth environment or if improvements to the transport network could be deferred under a low-growth scenario.

The headline assumption behind this scenario is a Melbourne population of around 4.3 million people by 2031in real terms (in line in with the Reference Case) and the Reference Case Transport network is assumed.

While it is almost certain that the future will not match precisely any of the scenarios outlined above, the range of possibilities covered by the scenarios provided the Study Team with a tool for measuring the robustness of options under different circumstances.

Note that the Reference Case has formed the basis for this transport needs assessment report. It has also been used for the early development and assessment of options as it is the best developed scenario. It is based on extensive detailed land use, employment and economic forecasts that have previously been developed by Government agencies reflecting current policy positions.

However, it is not necessarily the most likely outcome. For instance, if recent high levels of population growth continue through to 2031, the High Population Growth scenario may eventuate. Alternatively, population growth could revert to more traditional levels for the Reference Case, or slow further and lead to the Low Population Growth scenario. However, the different scenarios should provide an indication as to the robustness of the recommended actions in the face of different circumstances.

Key issues for the consideration in formulating the scenarios include:

- demographics
- economy
- transport investment
- technology
- sustainability
- lifestyle / social / mobility
- policy framework
- freight & logistics

It is also worth noting that the model is strategic in nature, covering the whole of Melbourne and beyond. A number of assumptions have been made regarding the transport network capacity and its operation, some of which may not cover issues such as site-specific intersection parameters, detailed rail operations, and behaviour of road and public transport users with regards to their route chosen and time of travel. Further, the public transport network is not constrained, so the number of passengers allocated to peak services may be overestimated, particularly for some rail services. Therefore, the modelled results showing passenger numbers for individual public transport routes as well as vehicle numbers for individual roads need to be read as indicative figures only, and not detailed forecasts.

Any recommendations arising from this study which involve major transport network or service changes may result in a scenario that is different to the four modelled scenarios. This is because significant transport infrastructure is likely to influence the way Melbourne functions in terms of people's travel behaviour and decision-making, settlement patterns, land uses, overall economic activity and, ultimately, Melbourne's success as an economic centre. For example, the new rail tunnel would provide access to new destinations and/or enable direct access to existing stations which was previously not possible, which may encourage passengers to board or alight at a different station in future compared to today.

It is also important to note that the modelled number of trains is the maximum achievable with the proposed network configuration, and not necessarily the maximum number that could be operated on a particular track section. It is likely that lower service frequencies would be operated initially in the new tunnel, gradually increasing as demand requires. In addition, the new rail infrastructure would provide capacity for potential network extensions to other corridors, such as Rowville, Melton and Melbourne Airport.

All of the issues raised above have been considered in streams of work including investigations into accessibility impacts on land use and wider economic benefits.

## 5.2 Reference Case Scenario Options Analysis

### 5.2.1 Screenline Analysis

Screenlines have been extracted from the Zenith model to assess the shortlisted options. These screenlines have been compared to the base case (business as usual) model for the year 2031 for each option to identify the impacts each option has on travel demand (refer to Figure 3.16).

Previously, the screenline analysis was used to show the level of demand against the future base case capacity along the key routes which crossed each screenline for 2006 and 2031 (refer to section 3.3). For the public transport network, modelled demand was compared with actual service provision in 2006, and maximum achievable service provision (capacity) in the case of rail in 2031. For the road network, the spare capacity was based on the theoretical capacity of the road and the modelled volumes. It does not take into consideration predicted delays or queues.

The following analysis will compare the demand for each of the shortlisted options against the predicted spare capacity in the 2031 base case model. For the public transport network, the modelled passenger demand will be compared with the maximum achievable capacity for both existing and new rail lines. The four options contain the same public transport network upgrades i.e. the main difference between options is the new and/or upgraded road links, therefore the peak 1 hour capacity on the public transport network does not vary between options. For the road network, modelled traffic volumes will be compared with available capacity. An increase in spare capacity will result from lower traffic volumes in the peak period, and vice versa.

***Public Transport***

The analysis of public transport demand and capacity for the major public transport corridors across selected screenlines is shown in Table 5-1. Note that the modelled peak 1 hour passenger demand columns for the base case and Options A, B, C, D have been highlighted; the various colours represent the level of demand for these years as a ratio of the capacity provided. The colours indicate the following demand / capacity ratios:

- Green: Demand / Capacity 0 - 74%
- Yellow: Demand / Capacity 75 - 90%
- Red: Demand / Capacity > 90%

**Table 5-1 Public Transport Screenline Analysis – 2031 (Base Case and Options A, B, C, D)**

| Location | 2031 peak 1 hr capacity - base case (pass.) | 2031 modelled peak 1 hr demand - base case (pass.) | 2031 peak 1 hr capacity - Options ABCD (pass.) | 2031 modelled peak 1 hr demand | | | |
|---|---|---|---|---|---|---|---|
| | | | | Option A (pass.) | Option B (pass.) | Option C (pass.) | Option D (pass.) |
| *SCREENLINE 2* | | | | | | | |
| Melton, Ballarat, Geelong via Tarneit (Options ABCD) rail | 2000 | 3200 | 7000 | 6300 | 6400 | 6500 | 6700 |
| Werribee, Geelong via Werribee (base case) rail | 8800 | 8400 | 10200 | 5200 | 5300 | 5400 | 5600 |
| Queen Street bus 411, 412, 415 | 225 | 850 | 225 | 800 | 750 | 800 | 850 |
| Cherry Lane bus 414 | 75 | 50 | 75 | 50 | 50 | 50 | 50 |
| Forrest Road bus 400, 451 | 300 | 100 | 300 | 100 | 100 | 100 | 100 |
| Western Hwy bus 215, 216, 456 | 500 | 350 | 500 | 350 | 350 | 350 | 400 |
| *SCREENLINE 3* | | | | | | | |
| Watergardens, Sunbury, Bendigo rail | 7800 | 9200 | 14600 | 8700 | 8800 | 9100 | 9500 |
| Melton, Ballarat, Geelong via Tarneit (Options ABCD) rail | 2000 | 3200 | 7000 | 6300 | 6400 | 6500 | 6700 |
| Werribee, Geelong via Werribee (base case) rail | 8800 | 10600 | 10200 | 7100 | 7100 | 7300 | 7600 |
| Ballarat Road bus 215, 220, 410 | 750 | 200 | 750 | 250 | 250 | 250 | 250 |
| South Road bus 216, 219 | 400 | 250 | 400 | 250 | 250 | 250 | 250 |
| Geelong Road bus 411, 412, 414 | 225 | 200 | 225 | 300 | 250 | 250 | 300 |
| West Gate Fwy bus 232 | 400 | 50 | 400 | 50 | 50 | 50 | 50 |
| *SCREENLINE 4* | | | | | | | |
| Watergardens, Sunbury, Bendigo rail | 7800 | 12200 | 14600 | 7700 | 7700 | 7900 | 8200 |
| Melton, Ballarat, Geelong via Tarneit (Options ABCD) rail | 2000 | 3200 | 7000 | 6300 | 6400 | 6500 | 6700 |
| Werribee, Williamstown, Geelong via Werribee (base case) rail | 12200 | 13800 | 17000 | 13800 | 13900 | 14200 | 14900 |
| Wests Road tram 82 | 400 | 150 | 400 | 150 | 150 | 150 | 150 |
| Dynon Road bus 216, 219, 402 | 700 | 100 | 700 | 100 | 100 | 100 | 100 |
| Footscray Road bus 220 | 400 | 50 | 400 | 50 | 50 | 50 | 50 |
| West Gate Fwy bus 232 | 400 | 50 | 400 | 50 | 50 | 50 | 50 |
| *SCREENLINE 5* | | | | | | | |
| New rail line (Options ABCD) | 0 | 0 | 17000 | 11000 | 11000 | 11200 | 11200 |
| Park Street tram 112 | 1000 | 100 | 1000 | 100 | 100 | 100 | 100 |
| St Kilda tram 96 | 1000 | 950 | 1000 | 850 | 850 | 850 | 850 |
| St Kilda Road tram 3, 5, 6, 16, 64, 67, 72 | 4300 | 3500 | 4300 | 2700 | 2700 | 2700 | 2700 |
| St Kilda Road bus 216, 219, 220 | 400 | 50 | 400 | 50 | 50 | 50 | 50 |
| *SCREENLINE 6* | | | | | | | |
| Belgrave, Lilydale, Alamein, Glen Waverley, Pakenham, Frankston, Cranbourne, Sandringham rail | 73700 | 57000* | 58800 | 49000* | 49000* | 49200* | 49400* |
| Epping, Hurstbridge rail | 17000 | 14200 | 17000 | 14200 | 14200 | 14200 | 14400 |
| Domain Road tram 8 | 800 | 550 | 800 | 300 | 350 | 300 | 350 |
| Swan Street tram 70 | 700 | 350 | 700 | 350 | 350 | 350 | 350 |
| Wellington Parade tram 48, 75 | 1800 | 1400 | 1800 | 1500 | 1500 | 1500 | 1500 |
| Victoria Parade tram 24, 109 | 1800 | 1800 | 1800 | 1500 | 1500 | 1600 | 1600 |
| Queens Parade tram 86 | 1100 | 1300 | 1100 | 1200 | 1200 | 1300 | 1300 |
| Swan Street bus 605 | 200 | 50 | 200 | 50 | 50 | 50 | 50 |
| Victoria Parade bus 30x, 31x, 340, 350 | 2700 | 1000 | 2700 | 1400 | 1400 | 1400 | 1400 |
| Johnston Street bus 20x | 600 | 250 | 600 | 250 | 300 | 250 | 250 |
| Queens Parade bus 546 | 100 | 50 | 100 | 50 | 50 | 50 | 50 |
| Rushall Street bus 250, 251 | 300 | 50 | 300 | 50 | 50 | 50 | 50 |

Source: Derived from VLC model outputs

Notes:
Shading:

- Red: Demand > 90% Capacity
- Yellow: 75% < Demand < 90%
- Green: Demand < 75% Capacity

Assumed vehicle capacity:

- Metro train: 850 passengers
- V/Line train: 500 passengers
- Tram: 100 passengers
- Bus: 50 passengers

Tram, bus and V/Line rail base case capacity assumed to be unchanged.
* In the base case and Options ABCD, this figure is obtained by factoring up the 2006 patronage counts using reference case growth rates.

*Melton/Ballarat/Geelong rail corridor*

The analysis of the base case for screenlines 2, 3 and 4 carried out earlier showed that the Melton/Ballarat line passenger demand in 2031 was well above capacity for the peak 1 hour, with demand exceeding capacity by 60%. Likewise for Geelong services, demand exceeded capacity by 50% for trains running via Newport at all screenlines.

The construction of the new rail infrastructure for all options would result in the diversion of Geelong trains onto the Melton/Ballarat corridor via Tarneit, and the separation of Sunbury metro trains from V/Line services at Sunshine. By removing the constraints imposed by Werribee and Sunbury metro trains, additional Geelong, Melton and Ballarat services can be operated. Analysis at screenline 2 shows the effects of this new infrastructure, with combined total demand on the Melton/Ballarat/Geelong corridor increasing by about 3000 passengers, predominantly on trains from Geelong.

For all options, the total demand for the Ballarat/Geelong trains ranges from about 90 to 95% of capacity at this screenline. For all trains, this will be the peak load point as they will not be picking up passengers downstream. While the modelled demand almost reaches capacity, this is not as critical as the red-shading in the table may imply, as it would be possible to increase the length of V/Line trains to provide additional capacity if required to cater for future growth (the length of each V/Line train has been assumed to be 6 carriages).

*Watergardens/Sunbury/Bendigo rail corridor*

The base case analysis carried out previously for 2031 modelled results found that demand in this corridor for Sunbury metro trains would be about 20% over capacity at screenline 3, and exceed capacity by 65% at screenline 4. Bendigo trains would be at capacity at both screenlines. It was concluded that many passengers would not be able to board metro trains inbound from Albion station in the peak 1 hour.

The construction of new rail infrastructure would result in Bendigo trains diverting from existing tracks at Sunshine and operating via the new tracks with Melton/Ballarat/Geelong trains. This would enable additional Sunbury trains to operate.

The modelled results for all options shows that peak 1 hour demand for Sunbury metro trains ranges from 65 to 70% of capacity at screenline 3, rising to 80 to 85% on approach to Footscray (prior to screenline 4). At screenline 4 the demand falls to 55 to 60% of capacity for trains on Sunbury metro trains, reflecting the significant level of passenger interchange predicted to occur at Footscray station from city loop services (Sunbury line) onto services running through the new rail tunnel (Werribee/Williamstown line). This implies that sufficient capacity is available for patronage growth into the future, as well as the potential for network extension to Melbourne Airport. Note that while the model assumed that Werribee/

Williamstown trains would operate via the new rail tunnel and Sunbury trains via the city loop, the alternative combination would produce similar results i.e. Sunbury into new rail tunnel, Werribee/Williamstown via city loop.

*Werribee /Williamstown rail corridor*

The base case analysis for Werribee corridor found that the modelled demand for Werribee metro services in the base case was about 80% of capacity across screenline 2. At screenline 3, modelled demand exceeded capacity by 10%, suggesting that passengers at immediate upstream stations (Westona, Altona, Seaholme) would not be able to board. At screenline 4, the demand exceeded capacity by 5%, demonstrating that the additional capacity provided by the Williamstown trains at this screenline would not meet demand. Most passengers at Footscray would not be able to board Werribee/Williamstown trains due to overcrowding.

The construction of the new rail infrastructure for all options will enable Geelong trains to operate via Sunshine, freeing up the Werribee corridor for metro trains only. Analysis of screenline 2 demonstrates the effects of this new infrastructure, with combined total demand on the Werribee corridor dropping by about 3000 passengers during the peak 1 hour (number of passengers on Geelong trains), with the demand transferring to the line via Sunshine.

The resulting demand on the Werribee lines ranges from 50 to 55% of capacity at screenline 2 during the peak 1 hour, compared to 80% in the base case, freeing up considerable capacity for downstream passengers. This increase in available capacity demonstrates the effects of diverting Geelong trains via Tarneit and running extra Werribee trains. It is also likely that some passengers residing in areas such as Wyndham Vale and Tarneit will transfer to trains on the new line via Tarneit rather than use the Werribee metro services. At screenline 3, modelled demand will rise to a range between 70 and 75% of capacity on the Werribee corridor, reflecting the significant number of boardings at Westona, Altona and Seaholme. On approach to Footscray station (prior to screenline 4), the demand ranges from 60 to 65% of capacity, displaying the impact of the additional capacity provided by Williamstown trains. At screenline 4, modelled demand ranges from 80 to 85% of capacity, reflecting the significant passenger interchange at Footscray from Sunbury trains (city loop) to Werribee/Williamstown trains (new tunnel). Overall, the screenline analysis of this rail corridor implies there is sufficient capacity for the significant number of additional boarders, while also providing for further growth in metro ridership into the future.

As mentioned above, the model assumed that Werribee/Williamstown trains would operate via the new rail tunnel and Sunbury trains via the city loop. Swapping the combinations would produce similar results.

*Caulfield and Burnley rail groups*

The analysis at screenline 6 revealed that demand in 2031 would be over capacity during the peak 1 hour using the base case capacity for the Caulfield group, while for the Burnley group this figure would be about 70%.

The main changes to public transport across this screenline for each of the four options modelled are the additional bus services operating along Johnston Street and Victoria Parade, and the construction of a major bus-rail interchange at Victoria Park station. There is also a significant change in train operations with Dandenong line trains diverted into the new rail tunnel, resulting in reduced train numbers in the Richmond corridor. Each option has differing road configurations, although the impact on public transport usage is negligible.

Analysis of the modelled results for the four options reveals a drop in patronage on the Caulfield and Burnley rail groups due to the diversion of Dandenong line trains into the new rail tunnel. Demand for the remaining rail lines i.e. Burnley group plus Caulfield group without Dandenong line, is about 80% of capacity. When combining this demand with that for the Dandenong line in the new rail tunnel, the total demand is about 3,000 higher than the base case, reflecting the increased attractiveness of using rail to access new destinations via the new rail tunnel (eg. St Kilda Road, Melbourne University).

*Clifton Hill rail group*

Analysis of the base case at screenline 6 revealed that demands on the Epping/Hurstbridge corridor would be about 85% of peak 1 hour capacity.

Despite the infrastructure changes evident in each of the options, there was virtually no change to modelled demand on this rail corridor, remaining at about 85% of capacity.

*New rail corridor*

Rail demand in the new tunnel is about 80-85% of capacity over the peak 1 hour for all options across screenline 4 (near Footscray), and 65% of capacity at screenline 5 (St Kilda Road), suggesting that there is sufficient capacity for patronage growth into the future as well as potential network extensions to Melbourne Airport and Rowville.

Further analysis of screenline 4 revealed that a significant degree of interchange would take place at Footscray, resulting in a net rise in patronage on trains entering the new rail tunnel. Modelled demand would range from 80 to 85% of capacity, up from 65-70% on approach to Footscray.

*Bus corridors*

The modelled demands for the bus routes in the base case suggested that in general there was ample capacity on the bus network. As mentioned previously, it is possible that the demand for buses was underestimated due to the parallel rail lines, which the model assumed would be more attractive to passengers. The modelling results infer that the new infrastructure schemes for each of the options will have no impact on bus use.

For all options, the modelled results imply that demand for bus travel is broadly similar to base case demands. The main change in demand for bus travel is on Victoria Parade (screenline 6), with a 40% increase for all options over the base case, reflecting the increase in service levels for bus routes originating from Doncaster (as described above, modelled demand is underestimated. Similarly on the Johnston Street corridor, where significant improvements were proposed to bus services levels and priority measures, no change was observed between base case and all options, however these network and service improvements would be expected to attract additional patronage as seen in other bus improvement projects).

*Tram corridors*

Across screenlines 5 and 6 in the base case, the analysis revealed that there was spare capacity across most tram corridors. The exceptions were Queens Parade trams (route 86), with demand above capacity, and Victoria Parade trams which were at capacity. St Kilda light rail (route 96) demand was 95% of capacity, while demand for St Kilda Road and Wellington Parade trams was at 70% capacity.

With the inclusion of the new rail line under St Kilda Road, modelled demand for St Kilda Road trams reduced by about 20% compared to the base case demand for all options, while for the St Kilda light rail (route 96), demand was also predicted to fall by about 15%. This translates to demand on St Kilda Road trams being about 65% of capacity (compared to 80% in base case), and 85% for light rail (95%). Demand for Wellington Parade routes rose slightly, while for Victoria Parade the demand fell, with both corridors at 85% of capacity. The demand for the Queens Parade route was still higher than capacity, as per the base case. Modelled demand for other tram routes showed negligible change compared to base case.

***Road***

The analysis of road network demand and capacity for the major traffic corridors across selected screenlines, compared to each option is shown in Table 5-2. Note that the modelled AM peak 1 hour demands for the total volume across each screenline for 2006 and 2031 have been highlighted. The various colours represent the level of demand for these years as a ratio of the capacity provided (base case used for 2031). The colours indicate the following range of demand / capacity ratios:

- Green: Demand / Capacity 0 - 74%
- Yellow: Demand / Capacity 75 - 90%
- Red: Demand / Capacity > 90%

Table 5-2 shows that traffic volumes in the AM peak period are generally greater than the capacity of the key routes across Melbourne. The construction of the proposed link is not expected to provide full congestion relief in the peak period on the road network, but provide additional capacity and improved network connectivity during the off-peak period. As mentioned previously, the upgraded public transport system is expected to carry out the bulk of the people-moving task into the central area during the peak period.

Review of model runs for 2021 indicate that the new links provide spare capacity across the network (for all of the options) due to the lower population and traffic growth for the earlier period. Furthermore, the network would be expected to experience its most significant transport benefits in the period immediately after construction of the link. As the population and transport growth increases over time across Melbourne the more immediate benefits experienced will be taken up. These benefits are considered within the economic analysis conducted by Meyrick and Associates.

**Table 5-2: Road screenline option comparison AM peak**

| Road Name | Typical Peak 1 Hour Capacity | Volume - Capacity Ratio 2031 Base Case AM peak | Volume - Capacity Ratio Option A AM peak | Volume - Capacity Ratio Option B AM peak | Volume - Capacity Ratio Option C AM peak | Volume - Capacity Ratio Option D AM peak |
|---|---|---|---|---|---|---|
| SCREENLINE 2 | | | | | | |
| Ballarat Road | 2,800 | 126% | 114% | 119% | 132% | 124% |
| Western Ring Road | 5,400 | 124% | 110% | 108% | 123% | 124% |
| Princes Freeway | 9,000 | 90% | 91% | 90% | 90% | 89% |
| Other roads across screenline | 6,900 | 124% | 121% | 124% | 125% | 119% |
| **Total across screenline** | **24,100** | **111%** | **107%** | **107%** | **112%** | **109%** |
| SCREENLINE 3 | | | | | | |
| Ballarat Road | 4,200 | 82% | 85% | 81% | 89% | 81% |
| Geelong Road | 4,200 | 96% | 98% | 124% | 104% | 93% |
| Westgate Freeway | 7,200 | 117% | 114% | 99% | 106% | 99% |
| Other roads across screenline | 10,800 | 117% | 103% | 122% | 111% | 115% |

| Road Name | Typical Peak 1 Hour Capacity | Volume - Capacity Ratio 2031 Base Case AM peak | Volume - Capacity Ratio Option A AM peak | Volume - Capacity Ratio Option B AM peak | Volume - Capacity Ratio Option C AM peak | Volume - Capacity Ratio Option D AM peak |
|---|---|---|---|---|---|---|
| **Total across screenline** | **26,400** | **108%** | **102%** | **110%** | **105%** | **102%** |
| SCREENLINE 4 | | | | | | |
| Ballarat Road | 2,000 | 118% | 121% | 103% | 155% | 115% |
| Dynon Road | 2,400 | 110% | 93% | 96% | 103% | 105% |
| Footscray Road | 3,200 | 124% | 103% | 102% | 112% | 118% |
| Westgate Bridge | 10,000 | 105% | 100% | 101% | 102% | 103% |
| New Link | 4,000 | 100% | 46% | 36% | 100% | 100% |
| Other roads across screenline | 9,100 | 82% | 83% | 81% | 84% | 82% |
| **Total across screenline** | **26,700** | **101%** | **89%** | **86%** | **101%** | **99%** |
| SCREENLINE 5 | | | | | | |
| Beaconsfield Parade | 2,700 | 94% | 93% | 93% | 94% | 94% |
| Queens Road | 3,600 | 116% | 113% | 113% | 114% | 114% |
| St Kilda Road | 3,000 | 109% | 107% | 107% | 107% | 108% |
| Other roads across screenline | 2,600 | 112% | 105% | 104% | 109% | 108% |
| **Total across screenline** | **11,900** | **109%** | **105%** | **105%** | **106%** | **107%** |
| SCREENLINE 6 | | | | | | |
| Bell Street | 2,700 | 76% | 72% | 73% | 75% | 76% |
| Brunswick Road | 1,600 | 64% | 55% | 55% | 59% | 61% |
| Victoria Street | 2,700 | 96% | 96% | 99% | 106% | 104% |
| Burnley/Domain Tunnels | 5,400 | 113% | 105% | 106% | 111% | 112% |
| New Link | 4,000 | 100% | 75% | 75% | 100% | 100% |
| Princes Street | 2,700 | 106% | 102% | 106% | 143% | 102% |
| Other roads across screenline | 21,200 | 74% | 71% | 73% | 71% | 74% |
| **Total across screenline** | **36,300** | **84%** | **79%** | **81%** | **85%** | **83%** |

It must be noted that the screenline analysis for Options A and B was based on the shorter version of the road options i.e. without the West Gate Freeway widening or the extension from Geelong Road / Sunshine Road to Western Ring Road respectively. This is demonstrated by the results at screenlines 2 and 3, which show that roads crossing these screenlines are predicted to operate beyond their capacity.

Inclusion of these additional works in the screenline analysis would impact on the results for Options A and B in Screenlines 2 and 3. As such, an additional analysis across these screenlines has been performed. Options A and B both have an additional 'long' option which extends the new link further to the west. At screenline 2, the long option is only present on Option B, while at screenline 3, the long option is present on both options.

Table 5-3 shows that there would be benefits of extending options A and B further west by 2031 for both screenlines. The volume-capacity ratio at Screenline 2 reduces to 88% for Option A and 78% for Option B from a predicted 111% for the base case. This is also lower than the 107% predicted for both options in Table 5-2. Ballarat Road has a large improvement in operating conditions, with a predicted operating level of 126% in the base case reduced to between 30-40% at screenline 2. At screenline 3, both Ballarat Road and Geelong Road have improvements to their operating conditions. This highlights the need to extend options A and B further west before 2031.

**Table 5-3: Road screenline long option for A and B comparison AM peak**

| Road Name | Volume - Capacity Ratio 2031 Base Case | Volume - Capacity Ratio Option A Long Length | Volume - Capacity Ratio Option B Long Length |
|---|---|---|---|
| SCREENLINE 2 | | | |
| Ballarat Road | 126% | 46% | 30% |
| Western Ring Road | 124% | 112% | 92% |
| Princes Freeway | 90% | 93% | 90% |
| Other roads across screenline | 124% | 84% | 85% |
| New link | | | 65% |
| **Total across screenline** | **111%** | **88%** | **78%** |
| SCREENLINE 3 | | | |
| Ballarat Road | 82% | 69% | 60% |
| Geelong Road | 96% | 61% | 59% |
| Westgate Freeway | 117% | 67% | 99% |
| Other roads across screenline | 117% | 43% | 41% |
| New link | | 73% | 74% |
| **Total across screenline** | **108%** | **60%** | **67%** |

*Ballarat Road Corridor*

The previous screenline analysis showed that Ballarat Road was expected to operate beyond its capacity at screenline 2 and 4, while it would operate within its capacity at screenline 3.

Different options would have a varying impact on Ballarat Road at each of the screenlines. At screenline 2, options A, B and D would reduce the amount of traffic expected to travel along Ballarat Road. However, the amount of diverted traffic would not be enough to allow Ballarat Road to operate within its capacity. Option C would attract additional vehicles along Ballarat Road and would therefore create additional delays and peak spreading.

At screenline 3, options A and C increase traffic flows along Ballarat Road and therefore lower the amount of spare capacity. Options B and D does not have a large impact on traffic flows along Ballarat Road. At screenline 3, Ballarat Road is expected to maintain its spare capacity for all options.

Options B and D remove some traffic from Ballarat Road at screenline 4. In the 2031 base case Ballarat Road would be operating beyond its capacity, but with implementation of option B it would operate at capacity. Options A and C attract additional traffic volumes along Ballarat Road and result in demand exceeding capacity by 20% and 50% respectively. This will cause significantly longer delays and peak spreading.

Table 5-2 shows that Ballarat Road is predicted to operate beyond its capacity at screenline 2 in 2031 in the base case and for all options. This is because no option extends to provide relief at this location. However, modelling of a ‘long’ option has been performed that extends the end of options A and B further west. If this long option was adopted, it is predicted that traffic volumes on Ballarat Road (to the east of the Western Ring Road) would be approximately 50% lower than predicted in the current model for both options A and B.

Freight growth along Ballarat Road is expected to be 36% in the base case at screenline 2, while it is expected to be 18-19% in options A and B (see Table 5-4). This demonstrates that freight volumes are attracted to the new links. The long version of options A and B will result in a net reduction in freight growth on Ballarat Road by 3% for option A and 25% for option B (see Table 5-5). Based on this assessment, the extension to the west of either of the proposed links should be considered before 2031.

*Princes Freeway/West Gate Freeway Corridor*

The base case analysis previously carried out showed that this corridor was operating close to or over capacity in 2031.

The construction of any of these options will not have a major impact on the operation of the Princes Freeway, given the distance from the new link. As such, it is shown that only minor changes in traffic volumes will occur at screenline 2.

At screenline 3 all options provide some capacity relief, however option A and C still results in the West Gate Freeway operating beyond its capacity. Options B and D result in the West Gate Freeway operating close to its capacity.

At screenline 4, on the West Gate Bridge, each option produces some congestion relief. The construction of options A and B would result in the Bridge operating at its capacity. Options C and D still result in the West Gate Bridge operating beyond its capacity.

Freight relief is not as significant for this route compared to other arterial roads as it is still performing as a major freight route.

*Other routes*

The Western Ring Road is expected to operate beyond its capacity in 2031 base case at screenline 2. The construction of options A and B are expected to improve the operation of the Western Ring Road, however it is still expected to operate beyond its capacity even with an additional lane. The construction of options C and D are not expected to have any major impact on the operation of the Western Ring Road.

Geelong Road is expected to operate at 96% of its capacity in 2031 for the base case peak period. The construction of options A, B or C will attract additional vehicles along Geelong Road in the AM peak period. Options B and C will result in Geelong Road operating beyond its capacity, while options A and D will have a minor change in the amount of spare capacity.

Dynon Road is expected to operate beyond its capacity in 2031 at screenline 4. All options are expected to reduce traffic volumes on Dynon Road. This is due to the proposed new link from Ballarat Road to Dynon Road, which will redirect traffic around the location of the screenline. Options A and B provide the best result for Dynon Road, resulting in it operating within its capacity.

Princes Street is expected to operate beyond its capacity in 2031. The construction of options A, B and D are not expected to have a major impact on the operation of Princes Street. Option C attracts a significant amount of additional traffic (approximately 1,000 vehicles in the peak period) which results in Princes Street operating at approximately 150% of its capacity. This will result is severe delays and peak spreading.

*Freight*

Table 5-4 shows the percentage growth of freight across each screenline for the base case and comparisons with the different options.

**Table 5-4: Freight growth option comparison, daily volumes**

| Road Name | 2031 Base Case commercial vehicle growth | Option A commercial vehicle growth | Option B commercial vehicle growth | Option C commercial vehicle growth | Option D commercial vehicle growth |
|---|---|---|---|---|---|
| SCREENLINE 2 | | | | | |
| Ballarat Road | 36% | 18% | 19% | 54% | 30% |
| Western Ring Road | 51% | 63% | 62% | 51% | 52% |
| Princes Freeway | 100% | 104% | 103% | 101% | 102% |
| Other roads across screenline | 121% | 122% | 125% | 124% | 119% |
| **Total across screenline** | **83%** | **88%** | **87%** | **84%** | **83%** |
| SCREENLINE 3 | | | | | |
| Ballarat Road | 6% | 3% | -16% | 26% | 5% |
| Geelong Road | 193% | 52% | 360% | 134% | 186% |
| Westgate Freeway | 57% | 80% | 57% | 66% | 60% |
| Other roads across screenline | 21% | 10% | 19% | 12% | 17% |
| **Total across screenline** | **54%** | **58%** | **62%** | **57%** | **55%** |
| SCREENLINE 4 | | | | | |
| Ballarat Road | 60% | 296% | 74% | 432% | 56% |
| Dynon Road | 37% | -98% | -98% | -98% | 35% |
| Footscray Road | 58% | 17% | 40% | 54% | 55% |
| Westgate Bridge | 57% | 41% | 41% | 54% | 58% |
| Other roads across screenline | 15% | -1% | 11% | 11% | 13% |
| **Total across screenline** | **52%** | **55%** | **53%** | **53%** | **52%** |
| SCREENLINE 5 | | | | | |
| Beaconsfield Parade | 54% | 46% | 46% | 53% | 52% |
| Queens Road | 9% | 6% | 6% | 9% | 10% |
| St Kilda Road | 31% | 28% | 29% | 33% | 32% |
| Other roads across screenline | 90% | 76% | 69% | 86% | 90% |
| **Total across screenline** | **35%** | **30%** | **29%** | **35%** | **36%** |
| SCREENLINE 6 | | | | | |
| Bell Street | 0% | -19% | -18% | 0% | 1% |
| Brunswick Road | 41% | -20% | -18% | 19% | 41% |
| Victoria Street | 51% | 31% | 23% | 56% | 59% |
| Burnley/Domain Tunnels | 59% | 49% | 49% | 60% | 61% |
| Princes Street | 34% | -7% | -7% | 110% | 37% |
| Other roads across screenline | 22% | 11% | 10% | 16% | 20% |
| **Total across screenline** | **39%** | **48%** | **47%** | **40%** | **39%** |

Table 5-4 shows that freight growth is relatively constant across screenline 2 for all options. This is due to the proposed length of the options and the fact that initially they do not extend back to screenline 2. However, modeling of a longer version of Options A and B has been undertaken. The comparison between the 2031 base case and the 2031 long length for Options A and B is shown in Table 5-5.

Screenline 3 shows that freight volumes increase slightly due to the introduction of options A, B and C, with option B having the largest increase. In the base case, Geelong Road is predicted to have a growth of 193% while in option B, freight volumes along Geelong Road are expected to increase by 360%. This is due to the location of the interchange points to the new link, attracting additional vehicles along Geelong Road. Freight volumes remain consistent across screenline 4 and 5. Across screenline 4, Dynon Road has a negative growth in freight volumes in options A, B and C as a new link is proposed to be built between Dynon Road and Ballarat Road. This link will remove freight vehicles from Dynon Road where the screenline is located.

Screenline 6 shows an increase in the growth of freight vehicles on options A and B, while options C and D remain constant. Negative freight growth is expected along Bell Street, Brunswick Street and Princes Street due to the introduction of the new link, which will assist in improving the amenity of areas surrounding these roads.

**Table 5-5: Freight growth – comparison of longer versions of Options A and B**

| Road Name | 2031 Base Case commercial vehicle growth | Option A long length commercial vehicle growth | Option B long length commercial vehicle growth |
|---|---|---|---|
| SCREENLINE 2 | | | |
| Ballarat Road | 36% | -3% | -25% |
| Western Ring Road | 51% | 54% | 41% |
| Princes Freeway | 100% | 110% | 103% |
| Other roads across screenline | 121% | 128% | 130% |
| **Total across screenline** | **83%** | **92%** | **78%** |
| SCREENLINE 3 | | | |
| Ballarat Road | 6% | 0% | -24% |
| Geelong Road | 193% | 32% | 174% |
| West Gate Freeway | 57% | -4% | 52% |
| Other roads across screenline | 21% | 8% | -4% |
| **Total across screenline** | **54%** | **1%** | **42%** |

Table 5-5 shows that the extension of Options A and B is expected to reduce the growth in freight vehicles, particularly across screenline 3. The growth expected on screenline 2 for Option A is due to more vehicles being attracted along the Princes Freeway due to the extended option. However, this has the benefit of reducing the amount of freight vehicles along Ballarat Road. Screenline 3 also has benefits to Ballarat Road with minimal growth expected due to Option A, while Option B will reduce the growth of freight vehicles along Ballarat Road. The West Gate Freeway is also expected to have a reduction in the growth of freight vehicles for Option A, as they would be able to take the new link.

The predicted reduction of freight growth on Ballarat Road and Geelong Road could have a significant improvement on the amenity of the surrounding roads and residential areas.

### *5.2.2 Impact across transport network*

*Option A*

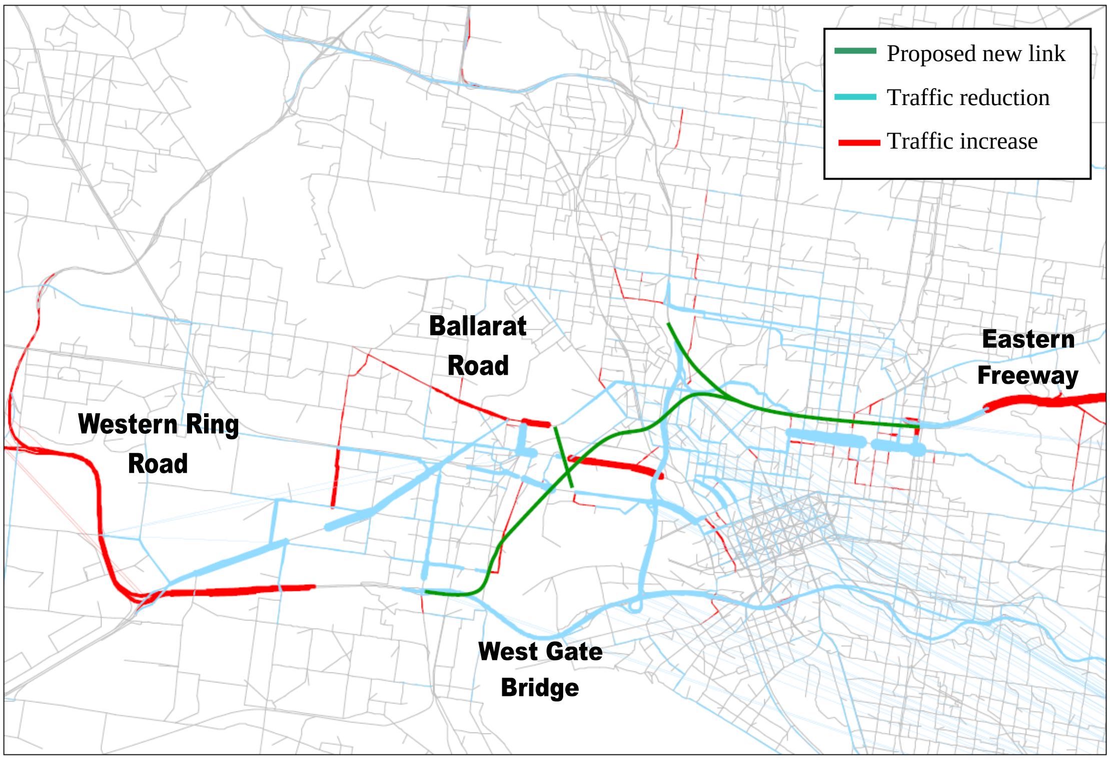
*For the shorter length Option A, the link is predicted to carry between 30,000 and 60,000 vehicles per day with 25-30% commercial vehicles along the route. This equates to approximately 75,000 trips of varying lengths along the link.*

*For the longer length Option A, the link is predicted to carry between 30,000 and 60,000 vehicles per day with 20-27% commercial vehicles along the route. This equates to approximately 100,000 trips of varying lengths along the link.*

Option A provides a connection between the Eastern Freeway, Tullamarine Freeway, Dynon Road and the West Gate Freeway. It also provides a new connection between Ballarat Road and Dynon Road. In addition to the road upgrades, option A includes the new CBD rail tunnel. In the longer term, it also includes an upgrade of the West Gate Freeway from Williamstown Road to Western Ring Road.

Compared to the base case, the introduction of Option A is expected to increase traffic volumes on key routes such as the Eastern Freeway, Dynon Road, Ballarat Road, the Western Ring Road and the West Gate Freeway (see Figure 5.1). This is generally due to the proposed location of interchanges along the link, which will attract additional traffic.

**Figure 5.1 Impact of Option A on Transport Network, 2031**




Traffic will be attracted from the south and west along the Western Ring Road, the West Gate Freeway and Ballarat Road. Traffic from the east will be attracted along the Eastern Freeway. Dynon Road will attract additional traffic which will come from the new link, or the new connection between Dynon Road and Ballarat Road. Option A is expected to relieve pressure on the local road network and assist in channelling traffic onto the arterial network. In particular, it attracts a significant volume of commercial vehicles and has the effect of reducing the growth of commercial vehicle volumes on the existing network.

Traffic volumes are expected to decrease on the key routes of Footscray Road, Geelong Road, West Gate Bridge, Monash Freeway, Sunshine Road, Elliott Avenue and Johnston Street. The decrease in traffic volumes along Johnston Street is due to the introduction of bus lanes which will redirect traffic to alternate routes. As such, traffic volumes along Alexandra Parade are expected to remain constant due to this relocated traffic.

Option A will reduce traffic volumes on the existing Maribyrnong River crossings at Footscray Road and Dynon Road. This will help reduce congestion on these critical locations in the western suburbs and help reduce delays. It is also predicted to reduce freight volumes along Geelong Road, due to the connection between the West Gate Freeway and Dynon Road.

Option A reduces traffic on multiple inner west routes such as Williamstown Road, Buckley Street, Barkly Street, Francis Street and Somerville Road. It also reduces traffic volumes on inner north routes such as Brunswick Road, Elliott Avenue and other local roads in Carlton and Fitzroy. Freight access and connectivity to and from the Port of Melbourne via arterial/freeway routes is enhanced. Importantly it releases capacity on existing Maribyrnong River crossings.

Option A addresses the major problems listed in Section 3.4, which are:

- Capacity issues along the M1 corridor
- Lack of crossings of the Maribyrnong River
- Access into the Port of Melbourne
- Relieving congestion along the route between the Eastern Freeway and Ballarat Road; and
- Relieving congestion on inner city east-west routes

*Option B*

*For the shorter length Option B, the link is predicted to carry between 33,000 and 60,000 vehicles per day with 25-30% commercial vehicles along the route. This equates to approximately 76,000 trips of varying lengths along the link.*

*For the longer length Option B, the link is predicted to carry between 30,000 and 60,000 vehicles per day with 21-25% commercial vehicles along the route. This equates to approximately 125,000 trips of varying lengths along the link.*

Option B provides a connection between the Eastern Freeway, Tullamarine Freeway, Dynon Road and Sunshine Road. It also provides a new connection between the West Gate Freeway and Hyde Street. In addition to the road upgrades, option B includes the new CBD rail tunnel.

The introduction of Option B is expected to increase traffic on the Western Ring Road, Geelong Road (southern end), Sunshine Road, Whitehall Street, Hyde Street, Dynon Road and the Eastern Freeway (see Figure 5.2).

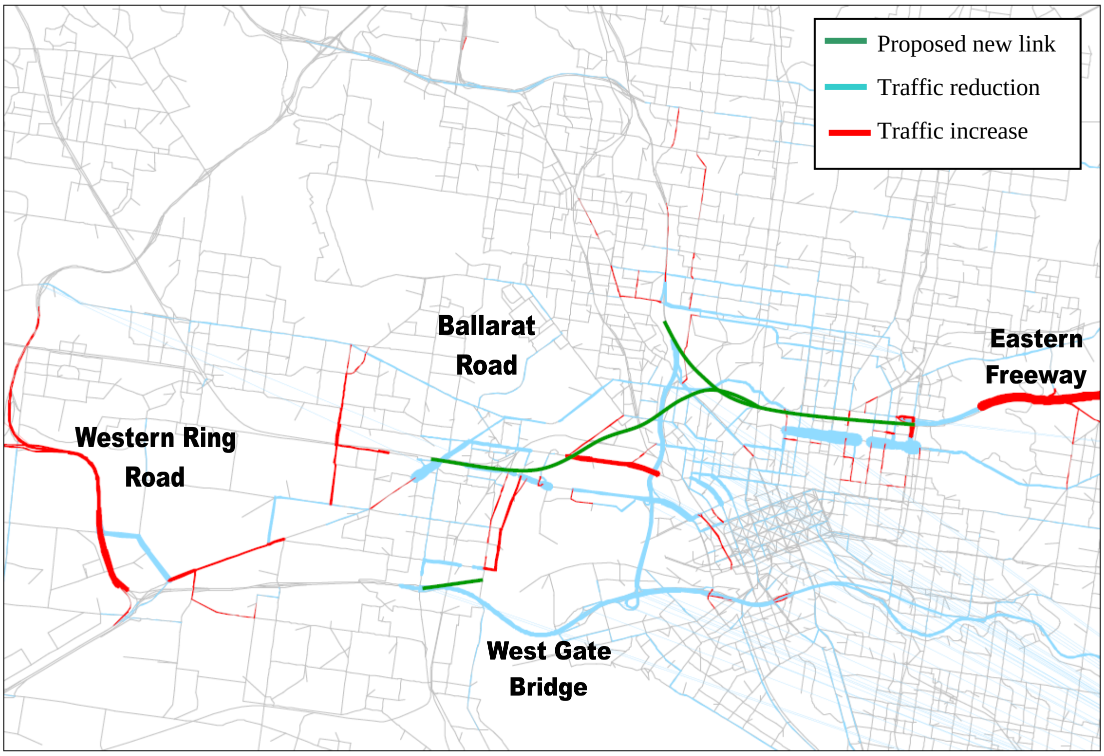
These increases in traffic are generally related to the location of access points onto the proposed link. Traffic from the west and south will be attracted along the Western Ring Road, Geelong Road and Sunshine Road, while traffic from the east will be attracted along the Eastern Freeway. Dynon Road will carry additional traffic from the new link or from the new connection between Ballarat Road and Dynon Road. Whitehall Street and Hyde Street (south of Francis Street) will carry additional traffic due to the new link between the West Gate Freeway and Hyde Street. This additional traffic results from a truck ban which is proposed to be introduced in Yarraville, Seddon and Footscray which will limit freight access to Whitehall Street and Hyde Street (south of Francis Street).

Traffic volumes are expected to decrease on Geelong Road (northern end), the West Gate Freeway, the Monash Freeway, Footscray Road, Elliott Avenue and Johnston Street. The decrease in traffic volumes along Johnston Street is due to the introduction of bus lanes which will redirect traffic to alternate routes. As such, traffic volumes along Alexandra Parade are expected to remain constant due to this relocated traffic. In particular, the link attracts a significant volume of commercial vehicles and has the effect of reducing the growth of commercial vehicle volumes on the existing network.

Option B is predicted to lower traffic volumes on the Maribyrnong River crossing at Footscray Road. However, traffic volumes will be increased in the area of this bridge crossing, along Whitehall and Hyde Streets as a result of the Truck Action Plan, so some delays may still exist. Delays will increase along Dynon Road due to increased traffic volumes from the connection with Ballarat Road.

Option B relieves congestion on multiple inner city routes and enhances freight access to and from the Port of Melbourne via arterial/freeway routes. Importantly it releases capacity on existing Maribyrnong River crossings. It also attracts additional traffic onto a number of feeder arterial and freeway corridors such as the Eastern Freeway, Geelong Road and Western Ring Road. Option B does not provide a freeway-freeway connection until the longer link is provided.

**Figure 5.2 Impact of Option B on Transport Network, 2031**




Option B addresses the major problems listed in Section 3.4, which are:

- Relieving some of the capacity issues along the M1 corridor;
- Additional crossing of the Maribyrnong River;
- Provides access into the Port of Melbourne;
- Relieves some of the congestion on the route between the Eastern Freeway and Ballarat Road; and
- Relieves some congestion on inner city east-west routes.

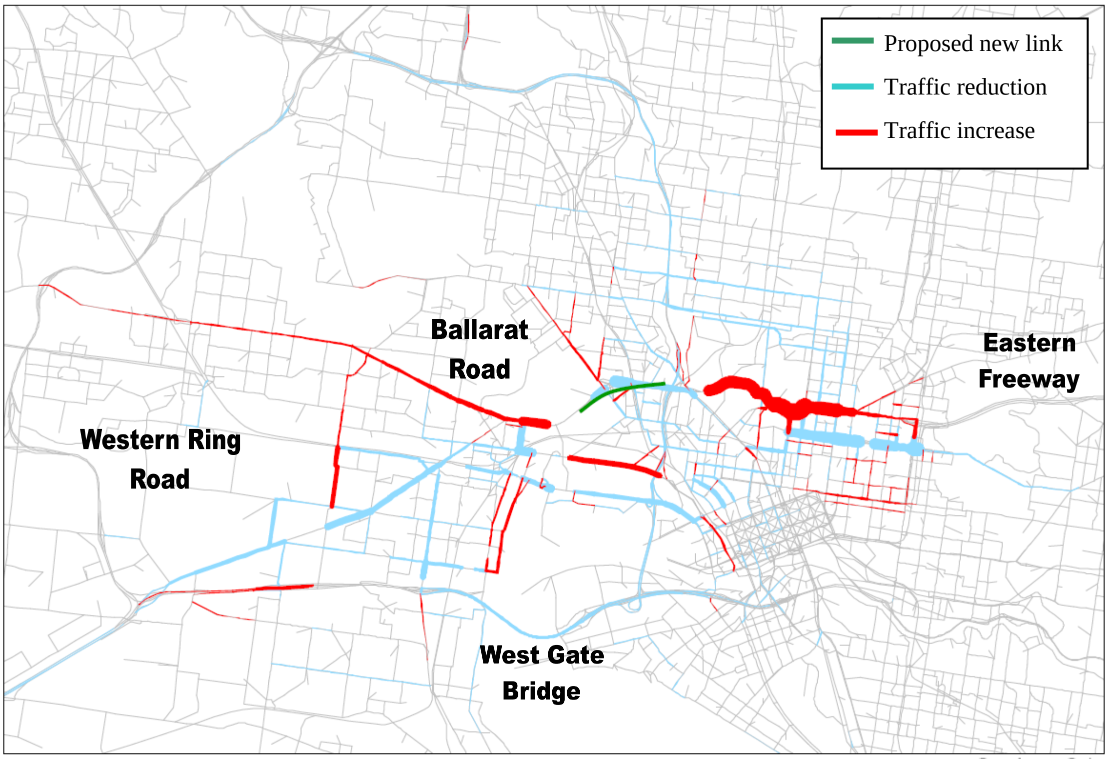
*Option C*

*Predicted to carry approximately 37,000 vehicles per day with 12% commercial vehicles*

Option C provides a connection between Racecourse Road and Smithfield Road. It also provides a link between Ballarat Road and Dynon Road and the West Gate Freeway and Hyde Street. In addition to the road upgrades, option C includes the new CBD rail tunnel.

The introduction of this option is expected to increase traffic volumes on Alexandra Parade, Princes Street, Cemetery Road, Elliot Avenue, Ballarat Road, Dynon Road and the West Gate Freeway (see Figure 5.3). Additional traffic from the west will travel along Ballarat Road to access the new link. Some additional traffic will travel along the West Gate Freeway to access the new link between the Freeway and Hyde Street. Due to the new connection to Hyde Street, additional vehicles will travel along Hyde and Whitehall Streets. From the east, additional traffic will be attracted along Alexandra Parade and Elliot Avenue. Some of this additional traffic will be relocated from Johnston Street due to the introduction of bus lanes.

**Figure 5.3 Impact of Option C on Transport Network, 2031**




Traffic volumes are expected to decrease along the West Gate Freeway including West Gate Bridge, Geelong Road, Footscray Road, Smithfield Road and Racecourse Road.

Similar to Option B, this option will lower traffic volumes on the Maribyrnong River crossing at Footscray Road. However, traffic volumes will be increased in the area of this bridge crossing, along Whitehall and Hyde Streets, so some delays may still exist.

Traffic volumes along Alexandra Parade through to Elliot Avenue are forecast to rise as a result of the increases in capacity along this route. This may have the effect of increasing north-south delays through this area for vehicles and public transport as more green time for this major route may be required.

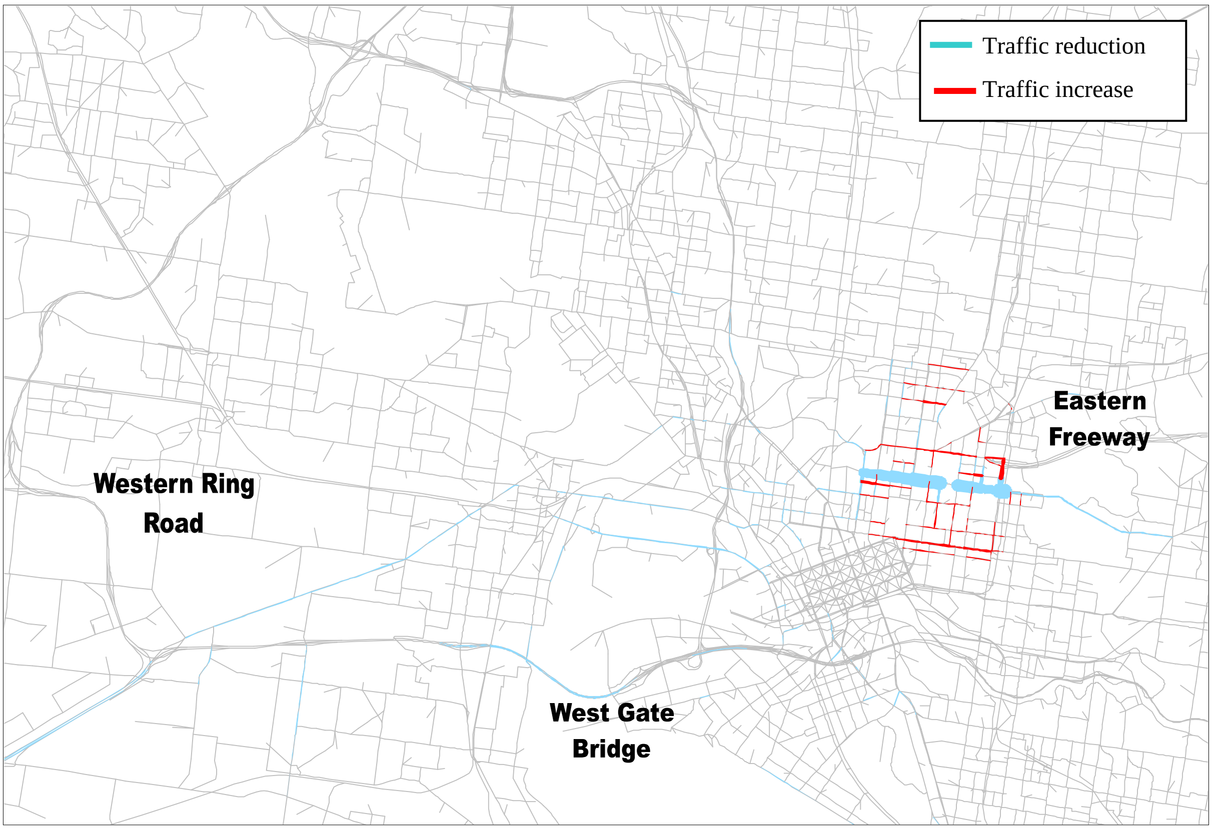
Option C relieves congestion through the Flemington area. However it attracts additional traffic onto a number of feeder arterial and freeway corridors such as the Eastern Freeway, Ballarat Road, east-west routes through inner city Melbourne and the West Gate Freeway.

Option C provides some benefit to the road network, including the relief of some capacity issues along the M1 corridor, however it does not address most of the major problems identified in section 3.4.

*Option D*

Option D provides some benefit to the road network through a modal shift towards public transport (see Figure 5.4). It does not provide any infrastructure upgrades to the road network and as such, does not address the key issues identified in Section 3.4.

**Figure 5.4 Impact of Option D on Transport Network, 2031**



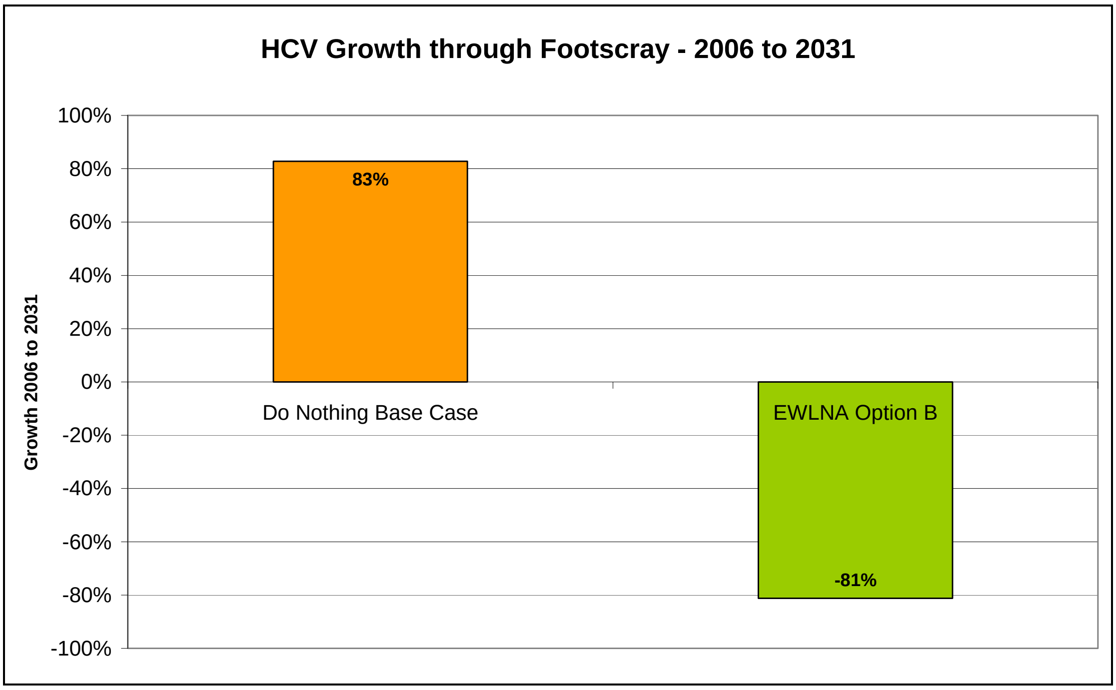

*Truck Action Plan*

Commercial vehicle growth between 2006 and 2031 throughout Footscray, Seddon and Yarraville is predicted to be approximately 83% across numerous local roads, including Stirling Street, Lynch Street, Newell Street, Donald Street, Ryan Street, Byron Street, Hopkins Street, Paisley Street, Irving Street, Buckley Street, Pilgrim Street, Somerville Road, Anderson Street and Francis Street.

The Truck Action Plan incorporated in options A, B and C throughout Footscray, Seddon and Yarraville (described in Section 4.4) is predicted to reduce the growth of commercial vehicles on the local road network. It is predicted that commercial vehicle volumes will decrease by approximately 81% (for option B compared to the base case) with the implementation of the truck ban on the roads noted above. This is due to the implementation of the infrastructure initiatives described in Section 4.4, in combination with truck bans throughout this area. This reduction should improve the amenity of the residential areas along these roads and could assist in improving local road safety.

Figure 5.5 shows the difference in commercial vehicle growth between the base case and option B. This change in growth is similar for options A and C.

**Figure 5.5 Impact of Truck Action Plan**




*Tolling*

A number of different tolling regimes have been trialled as part of the modelling for the different options. These included, but were not limited to, the tolling of different sections of the link and the effect of peak/off-peak tolls. The options analysis above has been conducted using a level of tolling comparable to CityLink and EastLink.

The application of peak/off-peak tolls resulted in an additional 25,000 trips per day on the long length link for a total of 150,000 trips, whilst the application of no tolls on the road network resulted in an additional 75,000 trips per day on the long length for a total of 200,000 trips.

The results of the tolling showed that the higher the toll, the less attractive the link was to traffic in the off-peak periods. However, it also showed that in the peak periods, higher tolls would not necessarily deter vehicles, particularly in the section between the Eastern Freeway and CityLink. Overall, more vehicles relocated from the surrounding network to the link when the price of the tolls was lowered.

## 5.3 Option comparison

When comparing the passenger demands on the public transport network between options, the Option D (no road upgrades) and Option C (arterial road upgrades) configurations result in the greatest public transport patronage, which is to be expected considering the proposed road capacity changes are smaller (refer to Table 5-6). The 24 hour mode share for public transport across the metropolitan area is 7.3% for these options. Option B (new road via West Footscray) and Option A (new road via West Gate Freeway) have slightly lower public transport mode shares of about 7.2%. All options are higher than the mode share for the base case, which is 7.1%. As mentioned previously, it must be noted that one public transport *trip* may involve multiple *boardings* i.e. more than one mode of public transport. The actual number of public transport *boardings* is approximately 50% higher than the number of *trips* i.e. mode shares would be 10-11% based on boardings.

These results are in line with expected outcomes, with more car travel attracted to a major new east-west road link (Options A & B) compared to the other options. There is also a greater number of walking and cycling trips for Option D compared to other options, although the difference between other options is modest.

While the differences in these mode shares may seem small, comparison of the options across screenlines reveals more significant differences. In the west, across screenlines 2, 3 and 4, analysis of the modelled rail demand on the three rail corridors revealed that patronage on Option D (highest) is about 7% higher than Option A (lowest). At screenline 4, this represents about 2,000 trips in the peak 1 hour, suggesting that the road network will attract this many more trips in Option A compared to Option D. It is worth noting that while the new road link in Option A may have sufficient capacity to cater for this number of vehicular trips during the peak, there will also be impacts on other existing roads, with subsequent rises in congestion levels.

Comparisons of rail patronage for each option against the base case reveals that rail patronage for Options B, C and D is higher across screenline 2, while for Option A it is the same. This is probably because the rail corridors experience a significant increase in capacity while the road network is unchanged at this screenline. Closer in to Melbourne, the modelled rail demand for Options A, B and C is slightly lower (ranging from 1-5%) compared to the base case, which suggests that the various increases in road capacity will reduce rail patronage, despite the significant increase in rail capacity and service provision. However it must be noted that the modelled base case rail demand is unlikely to be achieved because the model assumes an unconstrained rail network, as demonstrated in section Figure 3.8. This implies that modelled rail demand will be higher than base case regardless of which road option is selected.

In the east, despite the various upgrades to the road network for each of the options, there is almost no difference in public transport patronage between options. It is worth noting that the difference between Options D and A across screenline 6 in the east is not as large (400 trips or 1.4% of total) compared to screenline 4 (inner west) where the difference is 2,000 trips (7.2%). This would be explained by the more mature development of road and public transport networks and relatively smaller change to rail service provision across this screenline compared to the significant increase in road capacity across screenline 4 for Options A, B and C.

A high-level appraisal has been performed on the four options using performance indicators to measure the transport-related effectiveness and efficiency of each. The appraisal is shown in Table 5-7.

## Table 5-6 Comparison of Option Performance

| Performance Indicators Summary | Base Case 2006 Base Case | Base Case 2031 Base Case | Options 2031 A | Options 2031 B | Options 2031 C | Options 2031 D |
|---|---|---|---|---|---|---|
| **Public Transport** | | | | | | |
| *Total Public Transport System Patronage (per day)* | | | | | | |
| • Tram | 480,199 | 727,435 | 705,129 | 705,563 | 708,426 | 712,019 |
| • Rail-Suburban | 603,563 | 898,901 | 975,004 | 975,787 | 982,088 | 992,298 |
| • Rail - V/Line | 23,274 | 50,151 | 68,190 | 68,447 | 68,961 | 70,416 |
| • Bus | 283,657 | 496,607 | 502,807 | 502,695 | 504,111 | 506,003 |
| **Total** | **1,390,693** | **2,173,094** | **2,251,130** | **2,252,492** | **2,263,586** | **2,280,736** |
| *Passenger Kilometres (per day)* | | | | | | |
| • Tram | 1,766,712 | 2,463,482 | 2,201,482 | 2,202,457 | 2,215,063 | 2,221,607 |
| • Rail-Suburban | 7,713,849 | 12,796,307 | 13,389,793 | 13,401,569 | 13,521,719 | 13,664,949 |
| • Rail - V/Line | 1,138,663 | 2,777,695 | 3,087,613 | 3,098,394 | 3,123,596 | 3,184,944 |
| • Bus | 1,753,306 | 3,477,293 | 3,525,489 | 3,522,331 | 3,535,886 | 3,550,736 |
| **Total** | **12,372,530** | **21,514,776** | **22,204,377** | **22,224,751** | **22,396,264** | **22,622,236** |
| *Passenger Hours (per day)* | | | | | | |
| • Tram | 86,137 | 121,591 | 107,986 | 108,120 | 108,688 | 109,240 |
| • Rail-Suburban | 218,147 | 356,434 | 353,602 | 353,877 | 356,993 | 360,950 |
| • Rail - V/Line | 17,167 | 42,502 | 47,510 | 47,667 | 48,068 | 49,062 |
| • Bus | 58,379 | 116,051 | 116,464 | 116,401 | 116,890 | 117,393 |
| **Total** | **379,830** | **636,578** | **625,562** | **626,066** | **630,639** | **636,645** |
| *No. of Passenger Interchanges (per day)* | 440,729 | 723,116 | 777,159 | 777,330 | 782,680 | 791,765 |
| *No. of Passenger Trips (per day)* | 949,964 | 1,449,978 | 1,473,971 | 1,475,162 | 1,480,906 | 1,488,971 |
| *Revenue (per day)* | | | | | | |
| • Tram | $534,236 | $804,197 | $772,512 | $773,031 | $775,791 | $778,114 |
| • Rail-Suburban | $852,563 | $1,178,817 | $1,227,644 | $1,228,809 | $1,236,731 | $1,247,679 |
| • Rail - V/Line | $79,038 | $178,582 | $205,316 | $206,200 | $207,360 | $211,499 |
| • Bus | $333,444 | $520,950 | $528,693 | $528,167 | $530,488 | $531,711 |
| **Total** | **$1,799,281** | **$2,682,546** | **$2,734,165** | **$2,736,208** | **$2,750,369** | **$2,769,003** |
| **Private/Commercial Vehicles** | | | | | | |
| *Person Trips (per day)* | | | | | | |
| • Private Vehicle ** | 12,102,547 | 15,742,374 | 15,721,726 | 15,720,431 | 15,714,154 | 15,704,919 |
| • Commercial Vehicle ** | 509,346 | 760,974 | 760,974 | 760,974 | 760,974 | 760,974 |
| *Vehicle Trips (per day)* | | | | | | |
| • Private Vehicle ** | 8,535,074 | 11,042,378 | 11,026,111 | 11,025,006 | 11,019,770 | 11,011,991 |
| • Commercial Vehicle ** | 509,346 | 760,974 | 760,974 | 760,974 | 760,974 | 760,974 |
| *Person Kilometres (000's per day)* | | | | | | |
| • Private Vehicle ^ | 142,423.3 | 197,500.4 | 197,039.5 | 197,005.4 | 196,652.3 | 196,395.1 |
| • Commercial Vehicle ^ | 11,489.1 | 17,975.3 | 18,015.0 | 18,026.4 | 17,977.1 | 17,978.2 |
| *Vehicle Kilometres (000's per day)* | | | | | | |
| • Private Vehicle ^ | 100,491.1 | 138,638.3 | 138,250.9 | 138,227.0 | 137,962.4 | 137,779.1 |
| • Commercial Vehicle ^ | 11,489 | 17,975 | 18,015 | 18,026 | 17,977 | 17,978 |
| *Person Hours (per day)* | | | | | | |
| • Private Vehicle ^ | 2,886,752 | 4,116,360 | 4,055,861 | 4,059,184 | 4,069,902 | 4,070,333 |
| • Commercial Vehicle ^ | 193,616 | 317,112 | 311,301 | 311,869 | 314,671 | 315,603 |
| *Vehicle Hours (per day)* | | | | | | |
| • Private Vehicle ^ | 2,039,595 | 2,893,430 | 2,849,581 | 2,851,894 | 2,859,027 | 2,859,233 |
| • Commercial Vehicle ^ | 193,616 | 317,112 | 311,301 | 311,869 | 314,671 | 315,603 |
| *Operating Costs ($000's per day)* | | | | | | |
| • Private Vehicle ^ | $24,915.9 | $34,204.9 | $34,081.8 | $34,079.6 | $34,026.7 | $33,984.1 |
| • Commercial Vehicle ^ | $7,737.6 | $12,001.2 | $11,979.8 | $11,992.6 | $11,992.7 | $11,996.5 |
| *Accident Rate (Crashes per day)* | | | | | | |
| • Number of Accidents (Total per Day) ^ | 31.24 | 41.46 | 41.11 | 41.16 | 41.20 | 41.21 |
| • Accidents Costs ($ per Day) ^ | $5,187,606 | $6,981,079 | $6,935,381 | $6,940,715 | $6,943,306 | $6,939,833 |
| *Fuel Consumption (Litres per Day)* | | | | | | |
| • Private Vehicle | 11,314,563 | 15,643,275 | 15,597,437 | 15,592,899 | 15,555,103 | 15,537,183 |
| • Commercial Vehicle | 3,631,909 | 5,641,484 | 5,654,583 | 5,656,987 | 5,639,068 | 5,641,220 |
| **Sub-Total** | 14,946,472 | 21,284,759 | 21,252,020 | 21,249,886 | 21,194,171 | 21,178,403 |
| **Person Trip Statistics** | | | | | | |
| *PT Passenger Trips (per day)* | | | | | | |
| • AM Peak ** | 225,950 | 340,312 | 343,443 | 343,722 | 345,942 | 349,817 |
| • Off-Peak ** | 549,434 | 829,281 | 845,783 | 846,297 | 847,768 | 848,900 |
| • PM Peak ** | 174,580 | 280,385 | 284,745 | 285,143 | 287,196 | 290,254 |
| *Total Vehicle Trips (per day)* ** | 9,044,420 | 11,803,352 | 11,787,085 | 11,785,980 | 11,780,744 | 11,772,965 |
| *Passenger Trips Categorised (per day)* | | | | | | |
| • Total Persons in Cars ** | 12,102,547 | 15,742,374 | 15,721,726 | 15,720,431 | 15,714,154 | 15,704,919 |
| • Total Persons in Comm. Vehicles ** | 509,346 | 760,974 | 760,974 | 760,974 | 760,974 | 760,974 |
| • Total Persons on PT ** | 949,964 | 1,449,978 | 1,473,971 | 1,475,162 | 1,480,906 | 1,488,971 |
| • Total Persons Walking/Cycling ** | 2,219,024 | 3,201,600 | 3,198,255 | 3,198,359 | 3,198,892 | 3,200,062 |
| **Total** | **15,780,881** | **21,154,926** | **21,154,926** | **21,154,926** | **21,154,926** | **21,154,926** |
| *Mode Splits (per day)* | | | | | | |
| • Total Persons in Cars ** | 79.25% | 77.19% | 77.09% | 77.08% | 77.05% | 77.01% |
| Total Persons in CV ** | - | - | - | - | - | - |
| • Total Persons on PT ** | 6.22% | 7.11% | 7.23% | 7.23% | 7.26% | 7.30% |
| Total Persons Walk/Cycle ** | 14.53% | 15.70% | 15.68% | 15.68% | 15.69% | 15.69% |
| **Total** | **100.00%** | **100.00%** | **100.00%** | **100.00%** | **100.00%** | **100.00%** |

**Table 5-7 High-level Appraisal of the Options**

| Sub-objective | Performance Indicators | Option A | Option B | Option C | Option D |
|---|---|---|---|---|---|
| Reduced travel costs | Impact on reducing public transport costs | 1 | 1 | 1 | 1 |
| | Impact on reducing freight costs | 1 | 1 | 1 | 1 |
| | Impact on reducing private vehicle costs | 2 | 2 | 3 | 3 |
| Improved safety and security | Impact on public transport safety | 2 | 2 | 2 | 2 |
| | Impact on road safety | 2 | 2 | 1 | 1 |
| | Impact on walking / cycling safety | 2 | 2 | 1 | 1 |
| | Impact on community safety | 2 | 2 | 1 | 1 |
| Improve travel time | Impact on public transport travel time | 2 | 2 | 1 | 1 |
| | Impact on freight travel time | 3 | 3 | 1 | 1 |
| | Impact on private vehicle travel time | 2 | 2 | 1 | 1 |
| Improve travel reliability | Impact on public transport reliability | 2 | 2 | 2 | 2 |
| | Impact on freight reliability | 3 | 3 | 2 | 1 |
| | Impact on private vehicle travel reliability | 3 | 3 | 2 | 1 |
| Manage demand for movement | Impact on demand for public transport | 2 | 2 | 3 | 3 |
| | Impact on demand for rail freight | 2 | 2 | 2 | 2 |
| | Impact on demand for road freight | 0 | 0 | 0 | 0 |
| | Impact on reducing demand for private vehicle | 1 | 1 | 2 | 2 |
| TOTAL | | 32 | 32 | 26 | 24 |

Notes:
0: no impact
1: minor impact
2: medium impact
3: major impact

## 5.4 Sensitivity Testing

In addition to the Reference Case scenario, other modelling scenarios were tested as detailed in section 5.1. This would provide a sensitivity test of the various options for scenarios including lower population growth, higher population growth and a carbon-constrained future. The results are shown in Table 5-8.

In the 'low growth' scenario, the modelled demand for public transport was 6% lower compared to the base case, while vehicle flows were about 4.5% lower. In contrast, for the 'high growth' scenario, public transport demand was 24% above base case demand, while traffic volumes were 9% higher. The results from these two scenarios suggest that the higher the population growth, the greater the growth in public transport patronage, which would probably arise due to the greater congestion on the road network, constraining the growth in vehicular travel.

In the 'carbon constrained' scenario, public transport demand was 3.5% higher than base case, while vehicle use was 5.5% lower, indicating significant mode shift from car to public transport. Overall the number of trips was about 2% less than the base case.

With regards to overall mode share, the 'high growth' and 'carbon constrained' scenarios resulted in significantly greater public transport mode share compared to the base case (7.9% and 7.6% versus 7.1%). Most of the growth in travel demand would be accommodated by the public transport network. As mentioned previously, it must be noted that one public transport *trip* may involve multiple *boardings* i.e. more than one mode of public transport. The actual number of public transport *boardings* is approximately 50% higher than the number of *trips* i.e. mode shares would range from 10-12% based on boardings.

All scenarios indicate the importance of major improvements to the public transport system, particularly rail, in order to cater for the high volume of trips to the CBD and inner areas during peak hours and across the day. Although the 'low growth' scenario suggests that there will be fewer public transport trips compared to the reference case, these will still exceed the available capacity, although this will occur several years later than shown in Table 3-12.

Likewise whilst the 'low growth' and 'carbon constrained' scenarios both indicate lesser growth in road travel, freight growth is the same. The actual growth in road travel will still be significant and this coupled with freight growth will still contribute to the key issues identified, although this will occur several years later than the reference case scenario (medium growth) suggests.

## Table 5-8 VLC model results for each scenario

| Performance Indicators Summary | 2006<br>07-021<br>Y_2006_BC | 2031<br>07-021<br>Z_2031_BC<br>Unconstrained PT patronage | 2031<br>07-021<br>Z_2031_LG<br>Low Growth Scenario | 2031<br>07-021<br>Z_2031_HG<br>High Growth Scenario | 2031<br>07-021<br>Z_2031_CC<br>Carbon Constrained Scenario |
|---|---|---|---|---|---|
| **Public Transport** | | | | | |
| *Total Public Transport System Patronage (per day)* | | | | | |
| • Tram | 480,199 | 715,313 | 676,960 | 902,177 | 805,054 |
| • Rail-Suburban | 603,563 | 918,165 | 857,528 | 1,163,493 | 905,992 |
| • Rail - V/Line | 23,274 | 50,284 | 46,600 | 66,751 | 44,378 |
| • Bus | 283,657 | 496,229 | 468,773 | 570,016 | 497,961 |
| **Total** | **1,390,693** | **2,179,991** | **2,049,861** | **2,702,437** | **2,253,385** |
| *Passenger Kilometres (per day)* | | | | | |
| • Tram | 1,766,712 | 2,385,167 | 2,262,467 | 2,952,908 | 2,570,115 |
| • Rail-Suburban | 7,713,849 | 12,924,247 | 11,989,834 | 16,986,432 | 12,111,112 |
| • Rail - V/Line | 1,138,663 | 2,762,164 | 2,556,099 | 3,641,381 | 2,496,911 |
| • Bus | 1,753,306 | 3,493,649 | 3,309,853 | 4,018,536 | 3,369,725 |
| **Total** | **12,372,530** | **21,565,226** | **20,118,252** | **27,599,257** | **20,547,863** |
| *Passenger Hours (per day)* | | | | | |
| • Tram | 86,137 | 116,838 | 110,306 | 146,734 | 123,785 |
| • Rail-Suburban | 218,147 | 361,192 | 335,613 | 473,516 | 341,735 |
| • Rail - V/Line | 17,167 | 41,989 | 38,769 | 56,063 | 37,514 |
| • Bus | 58,379 | 116,160 | 108,515 | 136,711 | 107,186 |
| **Total** | **379,830** | **636,180** | **593,203** | **813,024** | **610,219** |
| *No. of Passenger Interchanges (per day)* | 440,729 | 725,638 | 678,678 | 919,100 | 725,524 |
| *No. of Passenger Trips (per day)* | 949,964 | 1,454,353 | 1,371,183 | 1,783,337 | 1,527,861 |
| *Revenue (per day)* | | | | | |
| • Tram | $534,236 | $793,916 | $752,720 | $995,433 | $674,621 |
| • Rail-Suburban | $852,563 | $1,194,372 | $1,117,122 | $1,522,409 | $890,375 |
| • Rail - V/Line | $79,038 | $178,932 | $166,131 | $232,575 | $125,439 |
| • Bus | $333,444 | $522,506 | $495,970 | $592,420 | $405,547 |
| **Total** | **$1,799,281** | **$2,689,727** | **$2,531,943** | **$3,342,837** | **$2,095,982** |
| **Private/Commercial Vehicles** | | | | | |
| *Person Trips (per day)* | | | | | |
| • Private Vehicle [**] | 12,102,547 | 15,738,829 | 15,016,139 | 17,153,484 | 14,895,709 |
| • Commercial Vehicle [**] | 509,346 | 760,974 | 708,326 | 818,780 | 751,980 |
| *Vehicle Trips (per day)* | | | | | |
| • Private Vehicle [**] | 8,535,074 | 11,039,477 | 10,534,092 | 12,008,260 | 10,443,799 |
| • Commercial Vehicle [**] | 509,346 | 760,974 | 708,326 | 818,780 | 751,980 |
| *Person Kilometres (000's per day)* | | | | | |
| • Private Vehicle [^] | 142,423.3 | 197,436.3 | 189,476.0 | 212,580.0 | 159,306.3 |
| • Commercial Vehicle [^] | 11,489.1 | 17,975.2 | 17,159.1 | 18,620.8 | 17,836.7 |
| *Vehicle Kilometres (000's per day)* | | | | | |
| • Private Vehicle [^] | 100,491.1 | 138,592.5 | 133,025.2 | 148,926.0 | 111,752.1 |
| • Commercial Vehicle [^] | 11,489 | 17,975 | 17,159 | 18,621 | 17,837 |
| *Person Hours (per day)* | | | | | |
| • Private Vehicle [^] | 2,886,752 | 4,110,886 | 3,841,927 | 4,661,452 | 3,085,052 |
| • Commercial Vehicle [^] | 193,616 | 316,929 | 293,258 | 348,913 | 286,831 |
| *Vehicle Hours (per day)* | | | | | |
| • Private Vehicle [^] | 2,039,595 | 2,889,515 | 2,700,730 | 3,269,345 | 2,166,331 |
| • Commercial Vehicle [^] | 193,616 | 316,929 | 293,258 | 348,913 | 286,831 |
| *Operating Costs ($000's per day)* | | | | | |
| • Private Vehicle [^] | $24,915.9 | $34,191.1 | $32,758.4 | $36,885.5 | $27,517.8 |
| • Commercial Vehicle [^] | $7,737.6 | $12,000.0 | $11,403.8 | $12,535.9 | $11,813.8 |
| *Accident Rate (Crashes per day)* | | | | | |
| • Number of Accidents (Total per Day) [^] | 31.24 | 41.44 | 39.40 | 45.11 | 34.04 |
| • Accidents Costs ($ per Day) [^] | $5,187,606 | $6,978,384 | $6,652,066 | $7,556,563 | $5,742,568 |
| *Fuel Consumption (Litres per Day)* | | | | | |
| • Private Vehicle | 11,314,563 | 15,634,268 | 14,997,559 | 16,859,892 | 12,637,247 |
| • Commercial Vehicle | 3,631,909 | 5,640,557 | 5,389,150 | 5,864,285 | 5,664,572 |
| **Sub-Total** | 14,946,472 | 21,274,825 | 20,386,709 | 22,724,177 | 18,301,819 |
| **Person Trip Statistics** | | | | | |
| *PT Passenger Trips (per day)* | | | | | |
| • AM Peak [**] | 225,950 | 342,604 | 321,368 | 431,874 | 342,188 |
| • Off-Peak [**] | 549,434 | 829,281 | 786,066 | 987,294 | 896,942 |
| • PM Peak [**] | 174,580 | 282,468 | 263,749 | 364,169 | 288,731 |
| *Total Vehicle Trips (per day)* [**] | 9,044,420 | 11,800,451 | 11,242,418 | 12,827,040 | 11,195,779 |
| *Passenger Trips Categorised (per day)* | | | | | |
| • Total Persons in Cars [**] | 12,102,547 | 15,738,829 | 15,016,139 | 17,153,484 | 14,895,709 |
| • Total Persons in Comm. Vehicles [**] | 509,346 | 760,974 | 708,326 | 818,780 | 751,980 |
| • Total Persons on PT [**] | 949,964 | 1,454,353 | 1,371,183 | 1,783,337 | 1,527,861 |
| • Total Persons Walking/Cycling [**] | 2,219,024 | 3,200,770 | 3,045,404 | 3,738,509 | 3,600,977 |
| **Total** | **15,780,881** | **21,154,926** | **20,141,052** | **23,494,110** | **20,776,527** |
| *Mode Splits (per day)* | | | | | |
| • Total Persons in Cars [**] | 79.25% | 77.17% | 77.27% | 75.65% | 74.39% |
| Total Persons in CV [**] | - | - | - | - | - |
| • Total Persons on PT [**] | 6.22% | 7.13% | 7.06% | 7.86% | 7.63% |
| Total Persons Walk/Cycle [**] | 14.53% | 15.69% | 15.67% | 16.49% | 17.98% |
| **Total** | **100.00%** | **100.00%** | **100.00%** | **100.00%** | **100.00%** |

# 6 Summary and Conclusion

This report has identified the present and future travel demand requirements and available network capacity between the east and west of Melbourne, and identified the key gaps in the road and public transport networks where demand will exceed capacity in future years.

This analysis has revealed that in future years, most of the growth in travel during the peak periods will be accommodated by public transport as the road network will have limited capacity to cater for further growth in vehicle numbers. However, without the implementation of the new rail infrastructure, the modelled base case passenger demand infers that severe overcrowding will be experienced on the Melton, Werribee, Watergardens and Geelong lines in 2031. Services travelling to Melbourne in the morning peak period would be overcrowded from middle and outer suburbs. This means that passengers will be unable to board train services at key stations in the west including Melton, Lara, Laverton, Altona, Newport and Footscray. In the east, passengers will have difficulty boarding trains inbound from Caulfield due to overcrowding. It is highly likely that during the peak 1 hour, the modelled passenger demand will not be met and therefore the actual demand will be lower. This would force these passengers to either seek alternate means of travel, which would be a challenge in itself considering the road network constraints, or not travel at all.

Implementation of the new rail infrastructure schemes detailed in Section 4.4 provides a substantial boost to rail capacity in the rail corridors in the western suburbs and also the Caulfield group of lines in the south-east. The Werribee, Watergardens, Melton and Geelong lines in particular will receive a significant increase in capacity, which will enable modelled passenger demand for 2031 to be met, whilst also providing some spare capacity for passenger growth into the future and opportunities for network extensions to other destinations such as Melbourne Airport. The extra capacity for the Caulfield group will also provide space for future patronage growth as well as potential network extensions to Rowville (passenger) and Hastings (freight).

The new rail infrastructure in particular will cater for most of the peak period growth in the number of trips between the west and the inner / CBD areas. This demonstrates the importance of the new rail infrastructure in meeting the people-moving task between the west and inner / CBD areas. The new road infrastructure will also assist in moving additional people during the peak, although its role will not be as significant.

The 2031 model results for tram and bus services suggest that in general, these modes will have enough capacity in 2031 to handle the modelled passenger demand. If demand was higher than capacity for these modes, a range of solutions would be available to increase capacity such as increasing service frequencies and operating larger vehicles i.e. a range of non-infrastructure solutions would be available which could be implemented relatively quickly to satisfy demand.

Of particular interest for the bus networks is the impact of enhanced bus services on the Doncaster corridor. The proposed increased service provision and level of bus priority results in a growth in predicted patronage of nearly 50% during the peak period on Victoria Parade routes. This package of initiatives will result in a ‘journey to work’ public transport mode share approaching similar levels to adjacent rail corridors.

On the road network, the analysis has shown that Melbourne’s road network, particularly the inner city freeway and arterial network, will not be able to cater for the predicted road based travel demand in the 2031 base case. It is predicted that the majority of inner city routes will be operating beyond their capacity in the peak period, which could result in peak spreading and longer delays to vehicles.

In addition to the public transport benefits detailed above, benefits are also attained on the road network for the various options as follows.

Option A provides benefits to the road network by improving the connectivity between east and west and assisting in relieving inner city congestion. It also addresses the key issues listed in Section 3.4.2, which are:

- Limited capacity along the M1 corridor;
- Lack of crossings of the Maribyrnong River;
- Indirect access into the Port of Melbourne;
- Congestion, reliability and indirect connections along the route between the Eastern Freeway and Ballarat Road; and
- Congestion and impacts on amenity on inner city east-west routes.

The longer version of Option A which involves widening of the West Gate Freeway will provide congestion relief along roads such as Geelong Road and Ballarat Road and also assist in significantly reducing the amount of freight traffic along both of these corridors, further improving the local amenity. As such, it would be beneficial to the road network in the west of Melbourne if this extension of option A was provided before 2031.

Option B also provides benefits to the road network, however initially it does not provide a freeway-freeway connection from the end of the Eastern Freeway, unlike option A. The key issues that it addresses are:

- Limited capacity along the M1 corridor;
- Lack of crossings of the Maribyrnong River;
- Indirect access into the Port of Melbourne;
- Congestion, reliability and indirect connections along the route between the Eastern Freeway and Ballarat Road; and
- Congestion and impacts on amenity on inner city east-west routes.

The longer version of option B, which involves the westerly extension of the new road from Geelong / Sunshine Roads to the Western Ring Road provides congestion relief along roads such as Geelong Road and Ballarat Road. As such, it would be beneficial to the road network in the west of Melbourne if this extension of option B was provided before 2031.

Option C provides some benefit to the road network, however it does not address most of the key issues identified earlier.  It addresses some capacity issues along the M1 corridor. However, Option C actually increases traffic volumes along some inner city east-west routes and increases congestion on the route between the Eastern Freeway and Ballarat Road, mainly along Princes Street and Elliot Avenue.

Option D provides some benefit to the road network through a modal shift towards public transport. It does not provide any infrastructure upgrades to the road network and as such, does not address the key issues identified earlier.

The projected population growth and resulting growth in travel demand will exacerbate existing transport congestion and amenity issues and may also result in new pressures in other areas.

On the public transport network, the adverse impacts of capacity constraints within inner Melbourne will be amplified by continuing growth to the west and south-east.  This will result in untenable unreliability and overcrowding of services which will ultimately result in people being unable to travel in the peak period, especially from the west. A step change in passenger rail infrastructure is required to address these capacity constraints and provide for future expansion of the rail network. On the Doncaster corridor, current levels of service are not providing a suitable travel alternative for access to inner Melbourne.

The existing road network is unlikely to be able to adequately meet the demand for travel across the west and inner north areas, particularly in the peak. Modelling results for future years also indicate that the growth during the period between the AM and PM peaks is substantially increasing, with peak-like conditions likely to be experienced for greater periods throughout the day.

From a transport perspective, the most likely schemes which will assist in meeting the projected future east-west travel demand in Melbourne in future years will be an integrated transport package comprising the following schemes (see section 4.4 for details of each scheme):

- New CBD rail tunnel between West Footscray and Caulfield;
- New rail line between West Werribee and Deer Park via Tarneit;
- New east-west road link between Eastern Freeway and the west;
- Upgraded Doncaster Rapid Transit;
- Enhanced bus and tram priority measures in addition to Think Tram works; and
- Truck Action Plan.