APPENDIX 5

MELBOURNE METRO PUBLIC TRANSPORT CUSTOMER DEMAND FORECASTS FOR BUSINESS CASE (2015)

Melbourne Metro

Public Transport Demand Forecasts for Business Case

19 February, 2016

PUBLIC TRANSPORT VICTORIA

Contents

Executive Summary

1.1 Melbourne Metro and report overview

This report provides an overview and key insights into the demand modelling forecasts undertaken to accompany the Melbourne Metro Rail Business Case. It places these forecasts in a historical and current public transport demand context. It also considers the influence of economic, demographic and land use factors on current and future travel behaviour.

Public Transport Victoria (PTV) has prepared this report for the Melbourne Metro Rail Authority (MMRA). PTV will ultimately be responsible for the customer experience, procurement of additional trains and subsequent investments to realise full benefits and operation of Melbourne Metro. It therefore has a direct interest to deliver demand forecasts to aid in setting the requirements and expected outcomes of Melbourne Metro.

Melbourne Metro responds to two key needs:

- The need to deliver a substantial increase in capacity to a number of lines across the metropolitan train network in order to meet the demand for travel generated by Melbourne's growing population.
- The need to open up train access to key precincts in central Melbourne and along the corridors that benefit from Melbourne Metro to ensure Melbourne's ongoing economic prosperity.

The scope of the Melbourne Metro Program includes:

- The project:
    - Twin nine kilometre tunnels from South Kensington to South Yarra, linking the Sunbury and Cranbourne/Pakenham train lines
    - Five new underground stations at Arden, Parkville, CBD North (interchange with Melbourne Central), CBD South (interchange with Flinders Street) and Domain
    - New train/tram interchanges at Parkville and Domain
- Wider Network Enhancements, including track, signalling and other small to medium scale works across the train network to support the initial service plan.
- New High Capacity Metro Trains (HCMTs) to deliver the initial service plan upon tunnel opening.

The Melbourne Metro Extended Program includes the Melbourne Metro Program, along with key investments that are enabled by Melbourne Metro on the Sunshine-Dandenong corridor, and that will be required soon after Melbourne Metro is delivered, including:

- Extended HCMTs (10 cars) to use the full length of the new stations
- Introduction of suburban services to Melton that will use the new tunnel
- Additional tracks between Sunshine and Deer Park to improve service quality for commuters on the Geelong, Ballarat, Wyndham Vale and Melton lines

These changes to the rail network also enable upgrades to the tram network, taking advantage of the train capacity delivered by Melbourne Metro on the north-south corridor along Swanston Street. The upgrades will enable a better distribution of north-south tram routes in the CBD and better serve growing western parts of the CBD, Southbank, South Melbourne and Docklands.

1.2 Context

1.2.1 Melbourne's growth and change

In recent years Melbourne has experienced strong population growth, particularly in the outer suburbs, and substantial growth in knowledge and service sector jobs within central Melbourne. The geographical separation between these population and employment growth areas has created pressures on Melbourne's transport networks, as people travel between home and work, particularly on routes into central Melbourne.

Melbourne's population is expected to grow to 7.8 million residents by 2051. By 2031, nearly half of that growth is expected to occur in new developments in the northern, western and south-eastern growth corridors. Employment growth in central Melbourne will continue as well, in line with the expected rise in knowledge-intensive service jobs. The central business district (CBD) will require expansion, making the most of renewal areas on the edge of the growing central city, such as Arden.

There will also be growth in the National Employment Clusters and connectivity between central Melbourne and key activity centres, including Footscray, Sunshine, Caulfield and Monash, will be important in supporting connections between residents, workers and businesses.

1.2.2 Influence of Melbourne's growth on transport networks – trains

Melbourne's train network is carrying more travellers than ever before, with 228 million trips taken in 2014/15. As more and more people travel to central Melbourne for work and education, the morning peak will remain the busiest time for travel on the network. Over the last few years, the number of public transport users coming into the city in the morning peak has been growing at over 3 per cent each year, and this is forecast to continue.

By 2031, average weekday boardings are forecast to double compared to 2011, reaching 1.5 million, while the number of people travelling into the city in the morning peak is expected to grow by around 90 per cent. Subsequent growth on the train network will be strongest on lines that currently pass through North Melbourne Station, as well as on the Cranbourne/Pakenham rail corridor.

It is not surprising that lines that have experienced the most rapid growth (50-120 per cent in the last ten years) are those serving Melbourne's population growth areas.

With a limited capacity to introduce new services on the on these lines using the current infrastructure, it is forecast that the Sunbury line will experience strong demand pressures, followed by the Werribee, Craigieburn, Upfield and Cranbourne/Pakenham lines through the 2020s (as measured by when the average demand across the morning peak two hours is in excess of the rolling stock load standard). At this point the majority of commuters travelling on these lines will be standing for long periods and at risk of experiencing uncomfortable and over-crowded conditions.

The strongest crowding impacts will be felt as services approach and leave North Melbourne station, making it harder for people living in areas along the north and west lines, which converge through North Melbourne, to use public transport to access jobs and education in the inner suburbs. Lines to the south east will also be close to being overcrowded at this time.

1.2.3 Influence of Melbourne's growth on transport networks – stations

The demand for train travel has created pressures on existing City Loop stations and key interchange stations (such as North Melbourne and Richmond), creating intense crowding, especially at peak times.

Busy and congested stations have a higher chance of producing increased dwell times, greater unreliability, reduced customer experience and increased safety risk. The current forecasts show the number of travellers using the five CBD stations each day is projected almost double by 2031,

while the number of travellers using Richmond and North Melbourne stations is projected to grow by more than 70 per cent and 140 per cent over the same period respectively.

1.2.4 Influence of Melbourne's growth on transport networks – trams

The Swanston Street/St Kilda Road tram corridor provides key access between the St Kilda Road, CBD and Parkville precincts. It is complemented by the tram routes on Elizabeth Street travelling from the CBD to Parkville.

Currently tram services on both corridors are heavily loaded at busy times of the day. Without Melbourne Metro this demand will continue strongly. Tram corridors in the west of the city will also experience strong growth in demand.

The current tram network is focussed on meeting the heavy demand for services in the Swanston Street and Elizabeth Street corridors. This setup limits the ability for the tram network to service job catchments, which are distributed across the whole of the CBD.

Melbourne Metro will reduce the reliance on Swanston Street and Elizabeth Street trams by providing a rail alternative to travel to Parkville and the Domain precincts. This will enable the re-alignment of the tram network and the provision of services on north-south tram routes to provide a closer match to the distribution of jobs across the CBD, Southbank and South Melbourne, as well as to better service entertainment, activity and growing residential precincts in Southbank and South Melbourne.

1.2.5 Influence of Melbourne's growth on transport networks – regional trains

Regional train lines are also experiencing demand pressures, in particular those that service areas undergoing metropolitan-style growth, such as Melton, Wyndham North and Wallan. The number of travellers coming into central Melbourne from the Ballarat/Melton corridor will increase approximately fourfold from 2016 to 2031.

Even with the Melton line duplication, demand is expected to exceed capacity on that line in the early 2020s, and will continue to grow on the Geelong (North Wyndham) and Seymour (Wallan) corridors.

The Melbourne Metro Extended Program includes the introduction of suburban services to Melton. It is also an important step towards supporting the Wallan Electrification (via Upfield).

Further information about the influence of Melbourne's growth on the public transport network is outlined in Section 3.

1.3 Methodology

To develop the transport demand forecasts, PTV used the Victorian Integrated Transport Model (VITM) as its primary transport network forecast model. Zenith was used as a second reference point to inform the development of scenarios. Both of these models develop forecasts for each mode of public transport and for private vehicles.

A third model, ClicSim, was used to produce station and interchange demand forecasts as well as some crowding analysis, to help predict how train passengers will move around the network.

The forecasts were prepared using the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) Reference Case, which covers future road and public transport networks, demographics, and land use and model parameters such as parking costs and vehicle operating costs. Assessment of Melbourne Metro involved comparison of the Program and Extended Program against a 'base case' which assumes a public transport network where Melbourne Metro and dependant projects have not been built. Land use forecasts were also updated for the base case and Program case, to incorporate the constraints on central city employment growth resulting from the constraints on the public transport networks in these scenarios.

Transport demand forecasts have been developed for 2011, 2021, 2031 and 2046. The majority of results presented in this report have focussed on impacts in 2031, as it represents the period shortly after Melbourne Metro is expected to be completed, when behaviour change impacts are likely to have taken effect and the broader benefits have been realised. Program and Extended Program results are presented for VITM and Zenith. Program results have been prepared and presented for ClicSim.

The forecasts undertaken for Melbourne Metro have been prepared under the governance structures maintained by DEDJTR, including an independent peer review process.

Refer to Section 4 for more information about the methodology underpinning PTV's demand forecasting.

1.4 Impacts

1.4.1 Growth in trips to central Melbourne

A key outcome of Melbourne Metro is to increase capacity on the public transport network and make it easier for more people living along Melbourne's busiest and faster growing train lines to travel into central Melbourne.

Linking the Sunbury and Cranbourne/Pakenham lines through the new tunnel with its extended platforms that are over 40% longer than today's station platforms will enable substantial capacity increases on those lines.

The lines that currently interact with the Sunbury and Cranbourne/Pakenham lines will also have an increase in capacity as they will no longer share the same track.

The additional capacity delivered by the Melbourne Metro Program will be sufficient to meet the forecast demand on the Werribee and Craigieburn lines until the mid-2030s and on the Frankston line beyond the mid-2040s[1]. The Extended Program is expected to provide capacity to meet forecast demand on the Sunbury and Cranbourne/Pakenham lines until the 2040s based on demand modelling and inputs undertaken for this assessment.

A key component of the extended program is to electrify and introduce metropolitan train services to Melton, as Melbourne Metro enables the creation of independent rail lines and increases capacity on the metropolitan network.

The extended program will also deliver the ability to accommodate increased demand as outlined in this report. This is reflected in projected crowding relief on the train network, which is strongest on the Werribee, Melton, Sunbury and Cranbourne/Pakenham corridors.

More information on the increased capacity delivered by Melbourne Metro and the extended program is detailed in Section 5.

1.4.2 New station impacts

Melbourne Metro will provide new stations in three precincts not currently served by heavy rail: Arden, Parkville and Domain.

Arden has been identified as a key urban renewal precinct to facilitate the ongoing growth of central Melbourne. Parkville is a world-class higher education and health precinct, which will benefit from direct connections with other health and university precincts along the Melbourne Metro corridor. St Kilda Road is an important employment precinct, and the new station will serve as a gateway to the tram network with connections to the Alfred Medical precinct and through South Melbourne and Southbank.

[1] Includes upgrades to those lines to enable this, such as rolling stock and infrastructure on these corridors

These new stations will reduce travel times to these locations from many parts of Victoria. The new stations will provide a substantial increase in public transport travel to these precincts, and increase the numbers of people living in close proximity to transport connections, principally along the Melbourne Metro corridor. Table 1 details the forecast use of the new stations.

Table 1: Forecast use of Arden, Parkville and Domain stations (2031) (Melbourne Metro Program)

Station	Jobs accessed in precinct (within 800m)	Jobs accessed in broader precinct (via short tram ride*	Residents accessed in precinct (within 800m)	Tertiary students accessed in precinct (within 800m)	People using station per day	Additional people living within 30 minutes of public transport travel time of precinct
Arden**	12,000**	n/a	7,000**	n/a	3,500**	-
Parkville	45,000	65,000	14,000	70,000	55,000	740,000
Domain	33,000	110,000	17,000	n/a	38,000	814,000

*Access to these jobs will be enabled by tram network changes that Melbourne Metro enables, which will improve access to South Melbourne and Southbank
** Note: this forecast is based on the Reference Case land use which does not incorporate urban renewal impacts at Arden. It is considered conservative and further consideration of land use impacts in the Arden area will be undertaken as part of the development of the Arden Urban Renewal Business Case.

While the Parkville and Domain areas are served by tram and bus, providing train access means that many people will have shorter travel times, more public transport options and aims to better manage demand growth and therefore provide crowding relief to those tram and bus services, particularly north-south trams currently concentrated on the St Kilda Road/Swanston Street and Elizabeth Street corridors.

Public transport travellers on the Sunbury/Melton and Cranbourne/Pakenham rail corridors will have a direct train connection to the Parkville and Domain precincts for the first time. Travellers on the Newport, Ballarat, Bendigo and Geelong corridors will have the opportunity to transfer at Footscray to access the new stations, while Frankston corridor passengers will be able to access them by transferring at Caulfield.

A detailed analysis of how the new stations will impact public transport use in the affected precincts is contained in Sections 3 and 6.

1.4.3 Impacts at existing stations

By introducing two new CBD stations, CBD South and CBD North, Melbourne Metro complements the capacity at the current CBD stations and helps to relieve overcrowding issues. A large number of passengers will benefit from this as the new Sunshine to Dandenong corridor which will use the new Melbourne Metro alignment and the new stations, carries the most passengers coming into the city compared to other metropolitan lines, providing significant relief to crowding at existing stations.

The network changes introduced by Melbourne Metro will also affect where people decide to interchange between train services and rail lines. Currently, most interchanges occur at Footscray, North Melbourne, Southern Cross, Flinders Street, and Richmond stations. Once Melbourne Metro is completed, CBD North, CBD South and Caulfield stations will also become major interchanges. Domain will also become an important rail to tram interchange station. This distribution across a greater number of interchanges will help alleviate station crowding.

There will also be increases in activity at Footscray, Caulfield, Clayton and Huntingdale stations as more people will have direct public transport access to these activity and education precincts due to the linking of the Sunbury and Cranbourne/Pakenham lines.

Refer to Section 6 for further detail on Melbourne Metro's impact to existing stations.

1.4.4 Public transport network impacts

Over 16,000 more people will use the metropolitan train network in the morning peak as a result of the Melbourne Metro Program compared to the modelling case without it (with a further 21,000 using it in the Extended Program) in 2031. Overall, an additional 52,000 public transport trips will be made each day, with a corresponding decrease of 50,000 private vehicle trips. This increases to an additional 90,000 public transport trips and 87,000 fewer car trips in the Extended Program. These benefits will continue to grow into the future.

The modelling indicates a net decrease in bus boardings when Melbourne Metro is completed, reflecting a reduction in demand for bus services (on Route 401 servicing the Parkville area from North Melbourne Station). There are also increases in bus boardings in other parts of Melbourne due to some new train passengers using a bus to get to a station.

Melbourne's current tram network is catering for the strong demand to travel along the north-south spine between St Kilda Road/Flinders Street and Parkville, along Swanston Street and Elizabeth Street in the CBD. However, the current configuration has led to an imbalance between tram services and key employment corridors in central Melbourne, with western corridors being underserved.

Melbourne Metro provides an alternative north-south transport option, and reduces passenger loads on outbound trams to Parkville and St Kilda Road on this corridor by around 25-35 per cent. This enables a rebalancing of tram rolling stock to other routes, improving public transport across central Melbourne.

Demand for trams south of Domain Station will continue to be strong. Passengers will use the new interchange point to access tram services to Southbank and South Melbourne, as a result of the proposal to divert selected St Kilda Road tram services to Park Street, Kingsway/William Street and Clarendon/Spencer Street. There will also be an increase in the number of travellers using the tram travelling south along St Kilda Road from Domain Station to access employment and education destinations, such as the Alfred Hospital Precinct and schools.

Melbourne Metro also produces improved access to key activity areas along the Sunshine to Dandenong corridor, including the Monash National Employment Cluster, Sunshine National Employment Cluster, Footscray Metropolitan Activity Centre, Caulfield Activity Centre and Melton.

Further detail about Melbourne Metro's impact on the public transport networks is contained in Section 7.

1.4.5 Road network

Melbourne Metro will have a positive impact on the road network as it attracts people from car to public transport. New car users will in turn be attracted to the extra capacity for travel into inner Melbourne that this provides. This response moderates the traffic reductions due to Melbourne Metro.

The reduction of private vehicle trips once Melbourne Metro is implemented complements the increase in the number of public transport trips in the same period. It is estimated that about 780,000 private car kilometres, or 39,000 hours, will be saved on an average weekday in 2031 as a result of the Melbourne Metro Extended Program.

Road users across the breadth of Melbourne will feel the benefit of Melbourne Metro as there will be a reduction in private vehicles travelling to and from central Melbourne and along the rail corridors.

Improvements for road freight vehicles will be modest as reductions in hours travelled by freight vehicles across Melbourne are somewhat limited by induced traffic re-congesting roads, particularly in central Melbourne.

More information on Melbourne Metro's impact on the road network is contained in Section 8.

1.5 Comparison with the secondary model

Forecasts using the Zenith model as secondary forecasting model was also undertaken. In general, forecasts from Zenith results in higher rates of public transport travel, in particular on the Cranbourne/Pakenham rail corridor. VITM can therefore be viewed as providing a conservative view of the public transport improvements as a result of Melbourne Metro.

This means that assessment of the economic benefits of Melbourne Metro using the Zenith outputs will result in a higher level of benefit.

While the greatest variation in demand for travel into central Melbourne is present on the south east rail corridors with Zenith indicating higher forecasts, there are limited implications for planning as the need for extended rolling stock deployment will be driven by stronger demand pressures on the Sunshine end of the Melbourne Metro corridor.

2 Introduction

2.1 Melbourne Metro overview

Melbourne Metro responds to the need to deliver a substantial increase in capacity to a number of lines across metropolitan train network in order to meet the demand for travel generated by Melbourne's growing population. It also significantly improves access to the Parkville and St Kilda Road precincts, and enables urban redevelopment of the Arden precinct to accommodate growing population and employment in central Melbourne.

Melbourne Metro will transform the rail network by addressing existing capacity constraints and operational issues across the train network, while also enhancing access and intermodal connectivity into and throughout central Melbourne. It will support new patterns of economic development, residential growth and urban renewal, and deliver substantial economic benefits to the Victorian and national economies.

Melbourne Metro will start to transform Melbourne's rail network into an international-style metro system and lay the foundation for future expansion of the overall public transport network. Metro-style systems are strongly passenger-focused and characterised by:

- Stand-alone, end-to-end lines, that prevent service disruptions on one line from cascading across other lines.
- Simple timetables with 'turn up and go' frequency and consistent stopping patterns.
- Frequent services designed to facilitate interchange with other train lines at stations, as well as connecting with trams and buses.
- Separate train fleets, maintenance and stabling facilities for each line.
- Modern high capacity signalling technology to maximise the number of trains that can operate on each line.
- HCMTs designed to minimise boarding and alighting times by the use of wide doors and clear areas around doors.
- Grade separations of level crossings.

This will change how people use the rail network and allow more Victorians to change services more easily to access a greater number of inner Melbourne destinations (Parkville, Arden and Domain), and improve service reliability.

Melbourne Metro will also improve capacity and service quality to allow more Victorians to access a range of key destinations along the corridor, including those making cross-city trips. This includes access to major universities and medical precincts located at Sunshine, Footscray, Parkville, Caulfield, Clayton and Berwick. Metropolitan services to the rapidly growing Melton corridor will also be enabled, as well as potential service improvements to Wallan and extensions potentially to Melbourne Airport and Rowville.

By increasing capacity on the metropolitan network, Melbourne Metro also helps to accommodate growth that many regional services that would otherwise have affected the levels of crowding and reliability. If travellers living in outer Melbourne are unable to get onto metropolitan services, they may consider using the regional services on the Geelong, Ballarat and Seymour rail corridors which stop at outer metropolitan Melbourne stations.

The scope of the Melbourne Metro Program includes:

- The project:
    - Twin nine kilometre tunnels from South Kensington to South Yarra, linking the Sunbury and Cranbourne/Pakenham train lines
    - Five new underground stations at Arden, Parkville, CBD North (interchange with Melbourne Central), CBD South (interchange with Flinders Street) and Domain

  - These stations will be able to accommodate longer ten-car trains proposed to be introduced as part of the Extended Program that will enable about 50 per cent more passengers to use each service than today's trains
  - New train/tram interchanges at Parkville and Domain
  - Wider Network Enhancements, including track, signalling and other small to medium scale works across the train network to support the initial service plan.
- New High Capacity Metro Trains (HCMTs) to deliver the initial service plan upon tunnel opening, and associated stabling, maintenance facilities and power upgrades.
- Realignment of some of the tram routes along Swanston Street to better serve CBD West, Southbank and South Melbourne.

The Melbourne Metro Extended Program includes the Melbourne Metro Program, along with key investments that are enabled by Melbourne Metro on the Sunshine-Dandenong corridor, and that will be required in the short term after Melbourne Metro is delivered, including:

- Extended HCMTS (10 cars) to use the full length of the new stations
- Introduction of suburban services to Melton that will use the new tunnel
- Additional tracks between Sunshine and Deer Park to improve service quality for passengers on the Geelong, Ballarat, Wyndham Vale and Melton lines.

This report considers the impacts of the Melbourne Metro program as well as the Extended Program, as these investments enable the capacity created by the tunnels to be more fully exploited.

Melbourne Metro also enables upgrades to Melbourne's tram network. Demand for travel on the critical north-south tram corridor from St Kilda Road to Parkville along Swanston Street (and complemented by Elizabeth Street) will decrease due to the new stations at Domain and Parkville. This means that trams can be redistributed on the north-south tram routes in the CBD, to better serve growing parts of the CBD, Southbank and Docklands. The Swanston Street corridor will continue to be well served by trams as well as the new stations.

The proposed project alignment is represented in Figure 1.

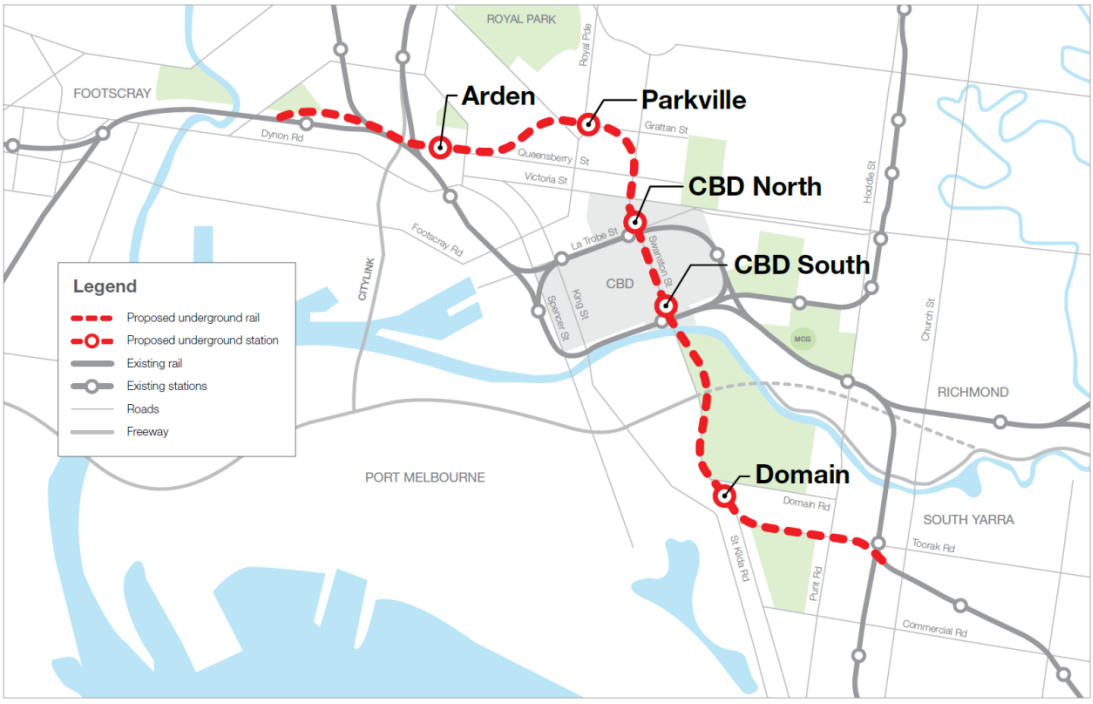


Figure 1 Melbourne Metro Rail Project proposed alignment

Over the last ten years, successive Victorian Governments have examined alternative responses to boosting public transport capacity to meet Melbourne's current and forecast travel demand. Previous demand forecasting reports have been developed to respond to these investigations and were submitted to Infrastructure Australia in 2010 and 2013 (an update of the 2010 work).

This current report provides new transport demand forecasts and outcomes associated with Melbourne Metro, developed with the latest demand forecasting models, which have updated model inputs such as revised land use forecasts.

2.2 Objectives

The Melbourne Metro business case identifies a set of high-level objectives:

- To meet customer needs by providing additional capacity on Melbourne's rail network that meets projected medium term demand and supports long term patronage growth, as part of a program of investment.
- To move towards a metro-style train system with end-to-end rail lines which optimises the efficiency and reliability of services and improves the customer experience.
- To deliver a project that supports the long term plan and vision for the development and operation of Victoria's rail network.
- To improve access to and reduce congestion of the tram system within central Melbourne and the road network in the north, west and south-east by diverting travel to the rail network.
- To improve access to jobs, education and other social and economic opportunities and enable the growth and more effective use of land within Melbourne.
- To provide a value for money transport solution that delivers strong productivity, sustainability and liveability benefits.
- To contribute to a safe rail network that supports the health and wellbeing of users.

This report presents transport demand forecasts to accompany the business case and inform the economic evaluation of the program.

In particular, it considers the following:

- How Melbourne Metro will help to meet projected demand growth on critical train lines.
- The impact of crowding on trains, stations and trams when Melbourne Metro is delivered.
- How Melbourne Metro will change access to jobs and opportunities for people in Melbourne's west, south-east and outer growth areas (Wyndham, Melton, Hume, Casey, Cardinia, Brimbank).
- The impacts of Melbourne Metro on access changes and increased services to Parkville, Domain, Arden and other key precincts.
- How Melbourne Metro will change how people move around the rail network, including who is interchanging more, who is interchanging less, and what it means for station use.
- How public transport travel times will change across Melbourne in terms of access to the CBD, Parkville, Domain and other key centres, and there are better travel outcomes for public transport users when Melbourne Metro is delivered.
- How road conditions will change for private and freight vehicles.

2.3 Purpose and structure of the report

This report provides an overview and key insights into the demand modelling forecasts undertaken for the Melbourne Metro to accompany the Melbourne Metro Rail Business Case. It

places these forecasts in a historical and current public transport demand context while also considering economic, demographic and land use factors. The results examine the changes to public transport journeys resulting from the completion of Melbourne Metro and the new direct access to the locations served by the new stations – Parkville, Domain and Arden.

This report covers:

- Melbourne Metro's context
- methodology
- Melbourne Metro's impacts on enabling trips to central Melbourne
- precinct and station forecasts
- tram and bus impacts
- road network impacts
- comparison with other models
- sensitivity analysis

2.4 PTV's role in growing patronage

PTV's main objective is to lead our public transport network for all Victorians, today and tomorrow. A desired outcome of this objective is to improve and grow the public transport network to support the growing travel need spurred by Victoria's economic and population growth whilst enhancing liveability and inclusion. By supporting this growth, PTV expects to see an increase in the number of people choosing to use public transport.

Melbourne Metro directly addresses the travel needs of current and potential public transport users. It opens up access to central Melbourne to better accommodate demand at busy times, the morning peak period in particular, and facilitates better inner-city travel by enabling realignment of the tram network and improving capacity on the busy St Kilda Road-Parkville corridor. The capacity it provides will reduce pressure on regional rail services and enable the expansion of the train network to growing outer areas.

MMRA has been set up to oversee the planning and delivery of Melbourne Metro. When Melbourne Metro is completed, it will be handed over to PTV to manage as part of the public transport network.

PTV holds expertise in areas such as public transport demand forecasts and modelling, economic assessments of public transport infrastructure and operations, and engineering and technical standards for public transport infrastructure.

PTV is providing transport demand forecasts and the predicted changes in public transport behaviour to MMRA to ensure that when Melbourne Metro is completed, the final outcome meets PTV's long term objectives to grow and improve the public transport network. PTV will ultimately be responsible for the customer experience, the procurement of additional trains and subsequent investments, the operation of Melbourne Metro and the realisation of many of the benefits the program provides, so has a strong interest in making sure the right scope and benefits are delivered.

3 Context

3.1 Metropolitan context

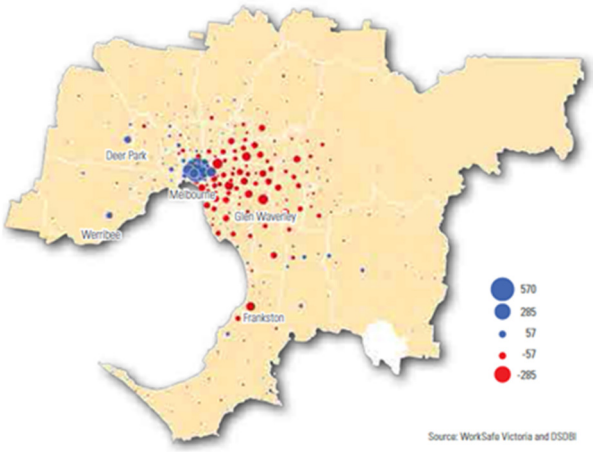
3.1.1 Melbourne's recent growth and change

In recent years, Melbourne has experienced strong population growth and a shift in economic activity that has, in turn, shaped how Melburnians travel between home, work, school and other activities.

In the past two decades, residential growth has seen a mix of city-centre regeneration and outer suburban development. There has been strong residential growth in inner suburbs, such as Southbank and Docklands, but Melbourne's outer suburbs have also become some of the fastest-growing municipalities in Australia. Over the past decade, the city has added over 600,000 new residents, with almost 60 per cent making their home in the outer suburbs. As Melbourne continues to grow, municipalities on the fringe of Melbourne, such as Melton, Wyndham, Mitchell (towards Wallan) and Casey/Cardinia, will continue to take up this growth and will need their transport networks to become increasingly integrated with the rest of Melbourne.

Melbourne's economy has also shifted over the past two decades, with the growing knowledge and services sector generating more jobs for Victorians. This has seen a shift in jobs to central Melbourne, as knowledge and service sector firms seek to take advantage of the benefits of being in close proximity to collaborators, suppliers, and clients. By being based in central Melbourne, these firms maximise their access to a metropolitan wide catchment of people, improving their chances of finding the most suitable skilled employees. As a result, inner Melbourne now contributes almost one third of the state's GDP.

Figure 6.8: Change in knowledge intensive services industries business establishments, Melbourne, 2000-01 to 2010-11



Source: DSDBI (2013) Industry Atlas of Victoria

Figure 2: Change in knowledge intensive services industries business establishments 2000-01 to 2010-11

Population growth and the economic shift are reflected in changes to travel, with more people travelling from across Melbourne, including from growth suburbs, to access jobs and education opportunities in the inner suburbs. The central location of these jobs also means that most Victorians have the opportunity to access them, as long as there is capacity on the rail network to meet the travel demand.

Central Melbourne is also the cultural capital of the State, with an array of destinations located in and around the city, including sports, entertainment, retail, social and recreational facilities. Providing metropolitan (and state wide) access for all Victorians to access and visit these destinations and places is important.

3.1.2 Recent metropolitan rail trends

The growth in population and change in employment sectors has been reflected in changing patterns of train patronage. From a low point of 89 million trips in 1980-81, recent years have seen Melbourne's train network carrying more passengers than ever before, with 228 million trips taken in 2014-15.

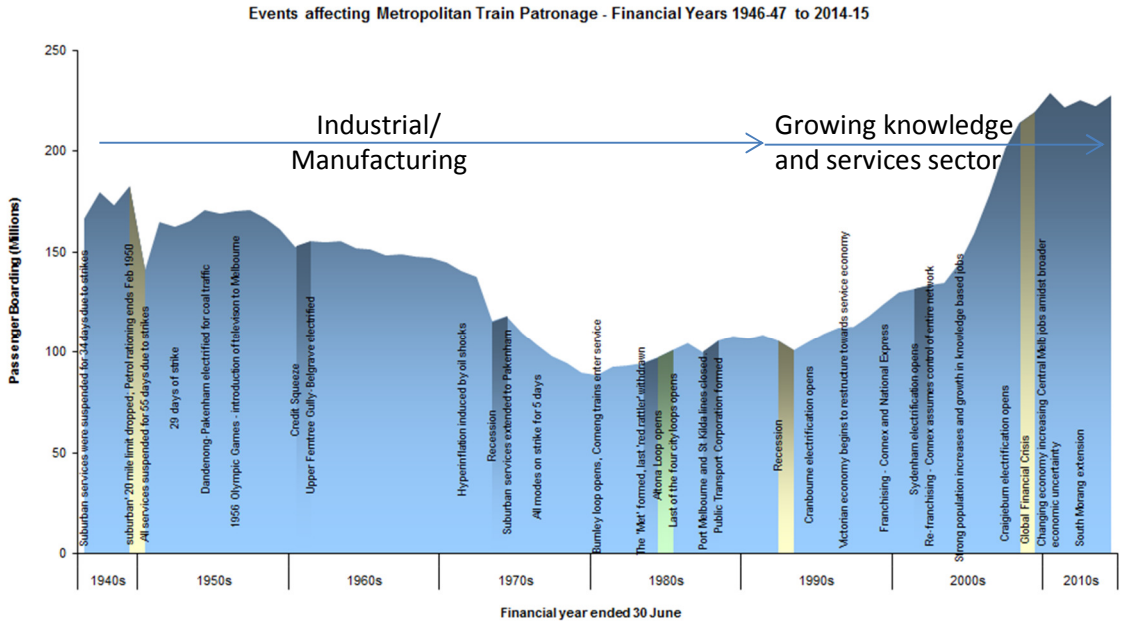


Figure 3: Events affecting Metropolitan Train Patronage - financial years 1946-47 to 2014-15

The increasing need for more people to travel to work and study in central Melbourne has kept demand for train travel in the morning and afternoon peak strong, even as overall growth has fluctuated in recent years. The morning peak is the busiest time for travel on the network, when trains are their busiest and capacity constraints most strongly felt. Meeting public transport demand in this travel time period is therefore a key element of future network planning.

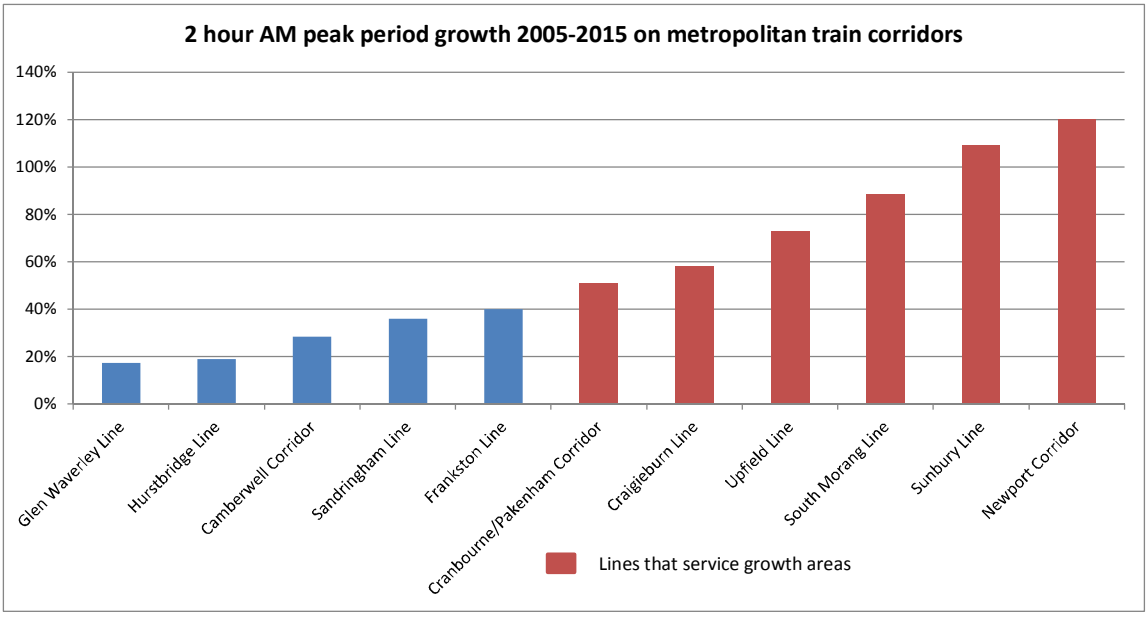


Figure 4: 2 hour AM peak period growth 2005-2015 into Central Melbourne

Note: Newport Corridor includes Werribee, Altona and Williamstown lines

Lines that have experienced the most rapid growth are those serving Melbourne's growth areas. Over the 2005-2015 period, growth on the corridors serving those areas has ranged from 50 per cent to 120 per cent.

3.1.3 Drivers of future growth

Melbourne is expected to grow from around 4 million people today to 7.8 million residents by 2051. By 2031, approximately 40 per cent of Melbourne's population growth is expected to occur in greenfield residential developments in the northern, western and south-eastern growth corridors, most significantly in the Wyndham, Casey, Melton and Hume municipalities[2].

Melbourne's 2.2 million jobs are distributed across the metropolitan area, with 14 per cent located in the CBD, Docklands and Southbank. Overall, around 30 per cent are located in the City of Melbourne, Port Phillip and Yarra municipalities. As knowledge-based industries continue to grow, it is anticipated that they will continue their trend of clustering in more defined locations. Updated employment projections (as outlined in the Methodology section below), show that employment within Melbourne, and particularly central Melbourne, is projected to continue growing solidly over the forecast horizon. This is in line with the expected rise in the number of knowledge intensive and service sector jobs which derive significant agglomeration benefits from being located within central Melbourne.

There are also other suburban locations that provide employment clusters and areas of activity. In addition to central Melbourne, there are a number of important destinations including the National Employment Clusters identified in Plan Melbourne located at East Werribee, Sunshine, Parkville, Monash and Dandenong, as well as Latrobe University. With growing activity and more intensive development, public transport becomes a more attractive option to these locations. Connectivity between central Melbourne, Employment Cluster and other key activity areas, including Footscray, Sunshine and Caulfield, will be important in supporting connections between residents, workers and businesses in these areas to support their ongoing development.

[2] These growth areas directly benefit from Melbourne Metro. Whittlesea is a fifth growth area that is served by the South Morang/ Mernda line.

The following maps illustrate the projected growth in population and employment in Melbourne by Local Government Area (LGA). The mismatch between the two types of growth illustrates a key influence on growing travel demand as people will need to travel between home and work.

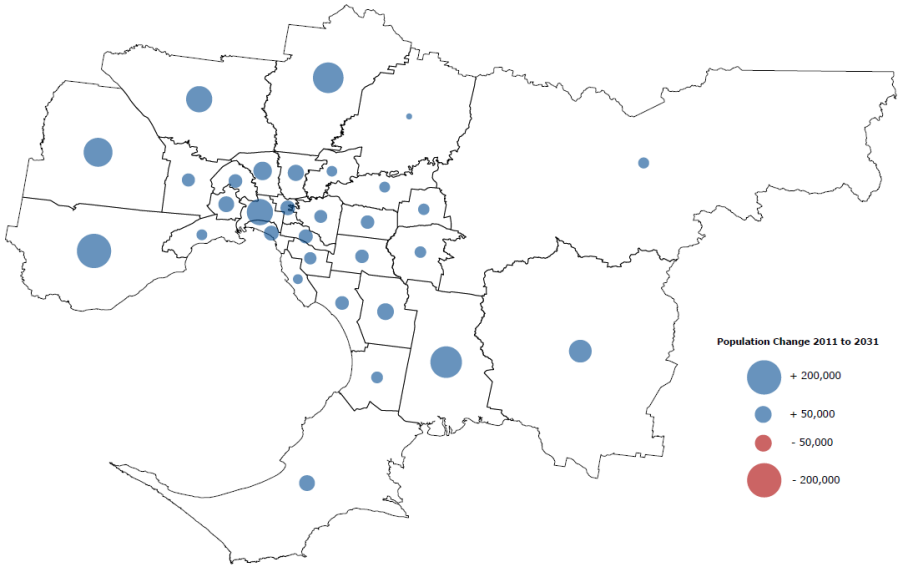


Figure 5: Population growth by Local Government Area

Source: Melbourne Metro Small Area Land Use Projections Reference Case (SGS, July 2015)

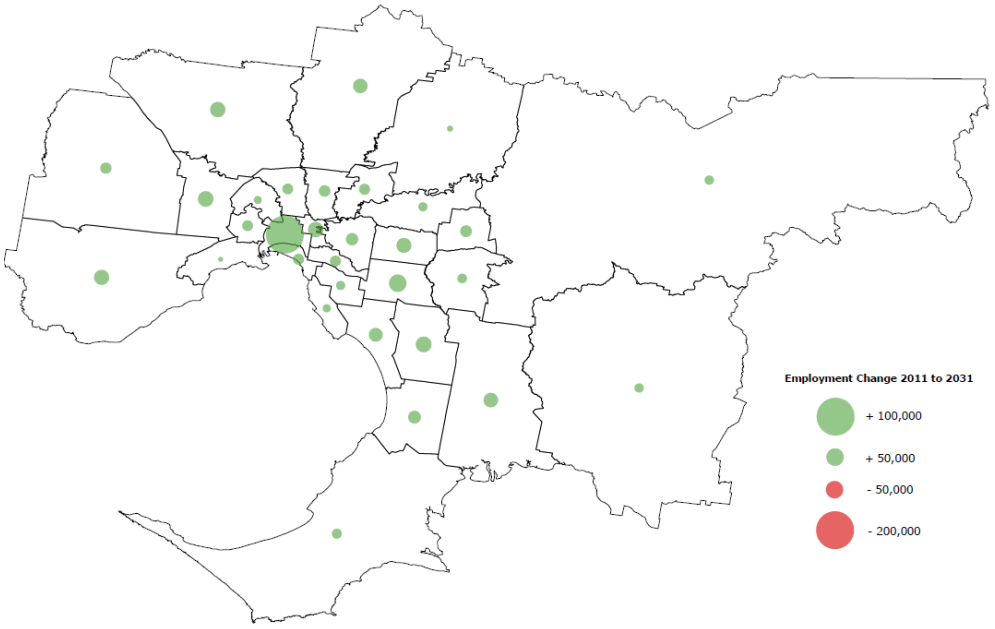


Figure 6: Employment growth by Local Government Area

Source: Melbourne Metro Small Area Land Use Projections Reference Case (SGS, July 2015)

With the transition to a service-based economy, access to education remains important, both to develop skills needed for knowledge-intensive and service sectors, and as an export industry.

The foundation of a skilled and competitive economy is education. Over recent decades there has been an increasing number and proportion of Victorians attending higher education. There has also been a dramatic increase in the number of international students over the past decade, making it a key driver of jobs within the education sector. A large share of these students are enrolling into universities, TAFEs and other educational institutions in inner Melbourne, in particular the University of Melbourne and RMIT. As a result, education has become one of Victoria's largest export sectors, and it is expected to continue to grow.

With limited road space into central Melbourne (57 inbound traffic lanes), and land constraints inhibiting the ability to expand roads, the use of private vehicles in the inner suburbs has steadied and the mode share of public transport has increased.

There is also limited scope to increase parking in inner Melbourne, particularly because parking requires land that may be suitable for other uses. These uses include road space for trams, cars, bicycles and pedestrians in places where people want to travel and spend time as well as more productive off-road land uses (particularly in the case of off-street parking).

These constraints have seen a relative decrease in mode share for private vehicle travel in central Melbourne, as shown in Figure 7, with vehicle travel staying relatively constant, even as train loads increase.

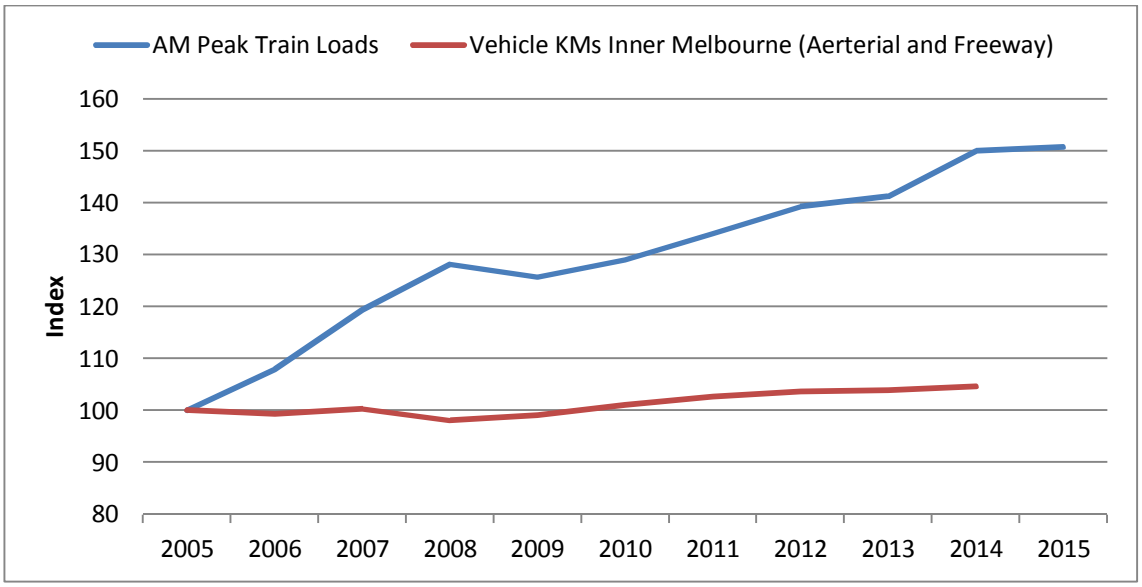


Figure 7: Growth in public transport and private vehicle travel in central Melbourne 2005-2015

With these trends expected to continue, the share of travel to inner Melbourne for work in the peak period by public transport is forecast to increase, driven by the patterns of housing and job growth.

3.1.4 Metropolitan train network forecasts

PTV's Metropolitan Rail Network forecasts provide an overview of growth on the train network. These forecasts are based on the following:

- The impacts of expected public transport and road investments on travel demand, reflecting the realistic and achievable travel response to expected improvements services and infrastructure. Results are constrained in line with the transport capacity provided by these expected investments.

- An average growth trend over time, where actual demand in individual years may be higher or lower based on market conditions.
- Long term trends in key drivers of patronage (discussed above and in the Methodology section).
- Consistent forecasting data across PTV's portfolio of major projects (including Melbourne Metro, Cranbourne Pakenham Line Upgrade, Mernda rail extension).

According these forecasts, average weekday boardings on metropolitan trains are forecast to double from 750,000 in 2011 to 1.5 million in 2031.

A key consideration in planning future capacity in order to meet public transport travel demand is to understand the existing numbers of passengers on trains crossing key thresholds, or cordons, as they come into stations immediately outside of the CBD – North Melbourne, Richmond and Jolimont. The demand forecasts at these cordons are critical when planning for capacity.

This is often the busiest section of a train line and provides a good way of understanding how a proposed project may change crowding on services and/or at stations as well as the number of people travelling into central Melbourne, which is a core function of the train network.

Across the rail network, the number of people travelling into the city in the morning peak period (across the cordon between 7am and 9am) is expected to grow by around 90 per cent by 2031 (from 2011). When taking into account patterns of growth, this will be felt more strongly on particular lines.

Table 1: Forecast AM peak metropolitan rail growth into central Melbourne by group 2011-2031

Rail group	2011	2031	Total growth (2011-31)	Compound annual growth rate (2011-31)
Northern	40,000	104,000	160%	4.9%
Clifton Hill	17,300	30,000	73%	2.8%
Burnley	31,000	37,000	19%	0.9%
Caulfield	38,200	71,000	86%	3.1%
Total	126,500	242,000	91%	3.3%

Note: VITM outputs include Werribee-Williamstown in the Northern Group and Sandringham and Frankston in the Caulfield Group. These services are now considered as the Cross-city Group.

The lines serving growth areas in Melbourne's north, west and south-east will continue to experience the highest rates of growth. For example, overall passenger numbers on the Northern Group, the lines to Melbourne's travelling north and west that pass through North Melbourne Station (including Werribee), are projected to grow by 160 per cent between 2011 and 2031.

The Clifton Hill Group will continue to grow, particularly driven by residential growth in the outer suburbs of the City of Whittlesea and infill at selected locations in Darebin. The Burnley group serves mainly established areas and therefore is forecast to grow more modestly.[3]

Cordon forecasts on the lines upgraded by Melbourne Metro are presented in Table 2. It illustrates that, in particular, the Werribee, Sunbury, Craigieburn, Upfield and Cranbourne/Pakenham lines will be experiencing strong growth. As discussed in Chapter 4, this will cause increasing problems with passenger crowding on these lines unless additional capacity

[3] Melbourne Metro does not directly affect services on the Burnley and Clifton Hill Rail Groups. The project evaluation for Melbourne Metro therefore includes proposed projects to enable patronage to continue grow on these lines, such as the Mernda Rail Extension, in both the Program/Extended Program and base cases. Whilst MM primarily affects the Northern and Caulfield Groups, it will have benefits that will influence patronage on the Clifton Hill and Burnley Groups, such as improved accessibility to Parkville and Domain.

is provided. In the shorter term, the Cranbourne Pakenham Line Upgrade project will assist in meeting the growing public transport travel demand from the south-east.

Table 2: Forecast rail growth on lines affected by Melbourne Metro 2011-2031 (AM Peak Cordon)

Rail Line	2011	2031	Total growth (2011-31)	Compound annual growth rate (2011-31)
Werribee	10,000	28,000	173%	5.1%
Williamstown	3,500	4,000	7%	0.4%
Sunbury	11,500	23,500	102%	3.6%
Craigieburn	12,000	23,000	97%	3.4%
Upfield	3,000	7,000	138%	4.4%
Cranbourne/ Pakenham	15,000	37,500	147%	4.6%
Frankston	14,500	20,500	42%	1.8%
Sandringham	7,000	13,500	87%	3.2%

Figure 8 shows the forecast growth in public transport trips made to the City of Melbourne in 2031 in the AM Peak. It indicates particularly strong demand in the north and west of Melbourne, as well from the Cranbourne/Pakenham rail corridor.

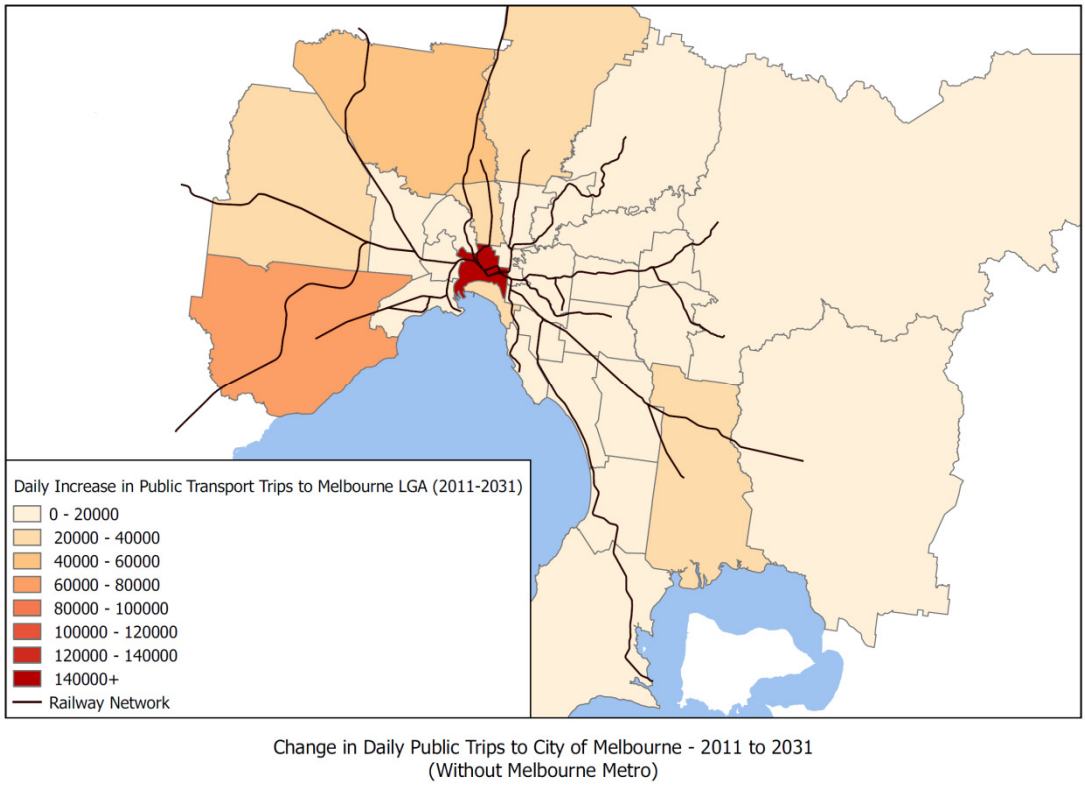


Figure 8: Growth in public transport travel to the City of Melbourne (Daily, 2011-2031)

This is also reflected in Figure 9, which illustrates the distribution of forecast train patronage in the AM peak by 2031. Consistent with growth trends, the number of people travelling into the city is particularly strong on lines coming in from the west, as well as from the south-east. Activity on the busiest corridors stretches into the outer suburbs, particularly on the Sunshine corridor (which includes Sunbury and Melton), indicating strong demand for train travel along the entire route.

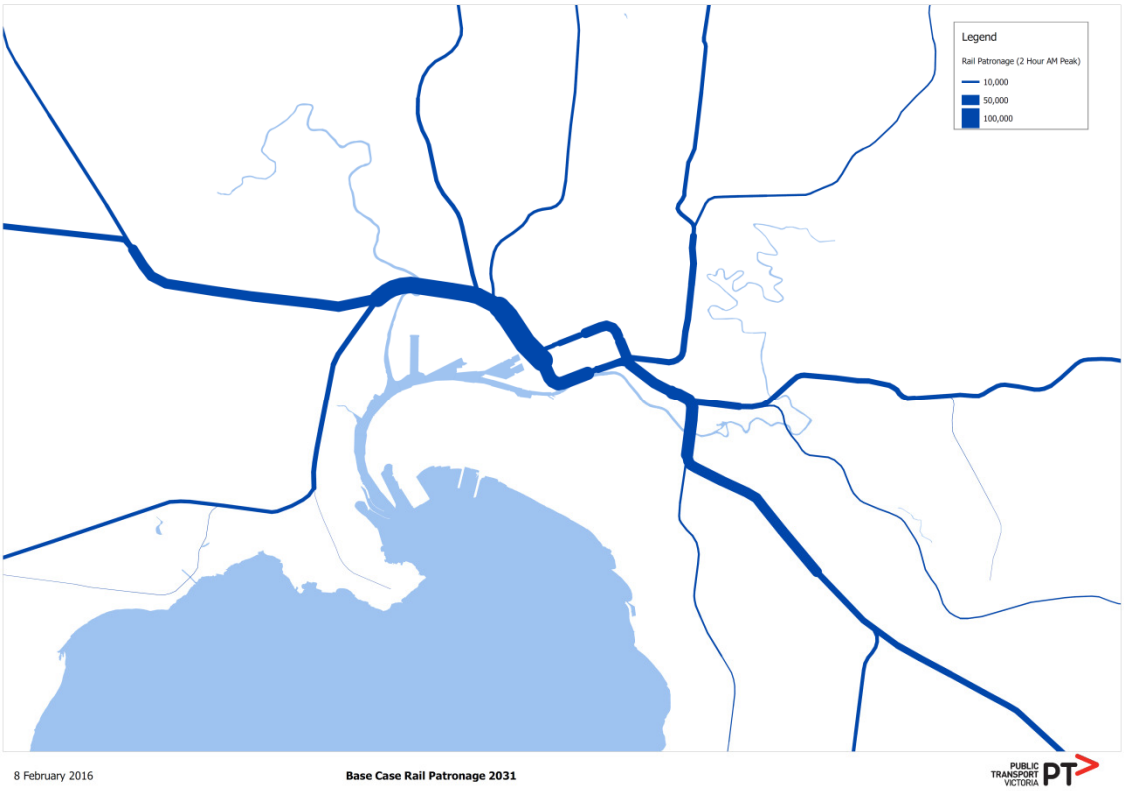


Figure 9: Rail loads in 2031 without Melbourne Metro (metropolitan and regional, AM peak)

As discussed in Section 5.4, if Melbourne Metro (or a similar project that boosts capacity) is not delivered, these rail lines will eventually run out of capacity. In the interim (as reflected in the base case), some capacity will be delivered by the Cranbourne Pakenham Line Upgrade and the Victorian Rolling Stock Strategy to introduce new train sets to provide additional services on the network. .

3.1.5 The need for relief for central Melbourne stations – Melbourne Metro

CBD stations are already experiencing crowding issues, in particular at peak times, and this is projected to intensify over time. Growing patronage means that central Melbourne stations will have to cater for more passengers boarding, alighting and transferring between train services.

This issue is particularly acute in central Melbourne as all metropolitan and regional lines converge towards the five City Loop plus Richmond and North Melbourne Stations. This is in contrast to other cities with a metro network whereby separated lines have different alignments served by a multitude of stations as they cross the city. This means that central Melbourne is currently highly reliant on seven stations functioning efficiently and safely.

The following number of boardings, alightings and transfers on a typical weekday in 2031 has been forecast:

- Southern Cross and Flinders Street stations will have about 430,000 and 350,000 passenger movements respectively. This means that each station will be catering for passenger movements that are more than double the number of vehicles currently crossing the West Gate Bridge on a typical weekday.
- Melbourne Central will cater for almost 150,000 passenger movements – around 50% more people than the capacity of the MCG. Parliament will have about 130,000 movements and Flagstaff about 70,000 movements.

- Key gateway stations will also be busy. Richmond will cater for about 100,000 movements, many of them transfers between services; whereas Footscray and North Melbourne will have a combined 140,000 movements. These stations will cater for about the same number of passenger movements as there are vehicles coming into and out of the city end of the Eastern Freeway across a weekday.

The consequences of not upgrading stations to match increases in train capacity presents a number of issues including:

- increased time taken for the greater number of passengers to board and alight a train (dwell time), which increases journey times
- increased dwell times impact on train reliability and could become so long that it reduces the capacity of the entire affected rail corridor by limiting the number of trains that can operate during certain time periods
- delays/wait time for trains to access platforms
- increased unreliability and operational fragility
- increased safety risk
- poorer customer experience attributable to longer access and egress times
- increased disruptions or incidents

The number of passengers using the five CBD stations each week day is projected to almost double by 2031, from 580,000 passengers (transfers, entries and exits) in 2011 to 1,100,000 in 2031. The number of passengers using Richmond and North Melbourne stations is projected to grow by more than 70 per cent and 140 per cent over the same period.

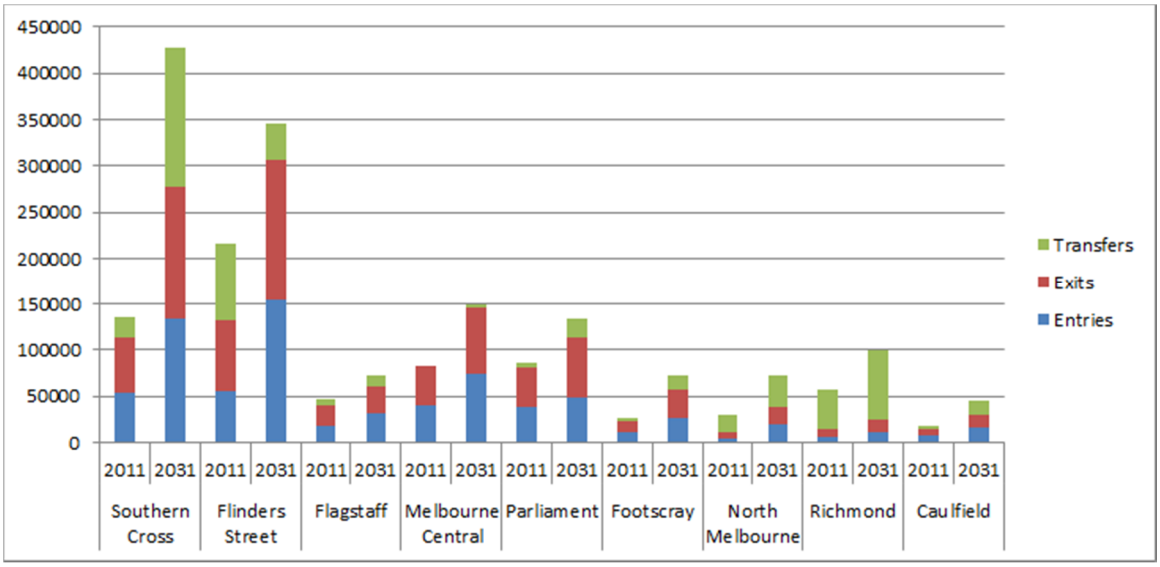


Figure 10: Current and projected patronage at key Central Melbourne and interchange stations (average weekday)

This growth in station patronage will exacerbate overcrowding issues. For example, at Flinders Street Station there are expected to be 60% more passenger movements (boardings, alightings and transfers) in 2031 than there were in 2011. This will lead to:

- more crowded platforms and concourse, particularly on platforms and access paths to Northern Group, Cranbourne/Pakenham and Frankston line services
- greater waiting times for ticket barriers and escalators

- high levels of crowding in the Elizabeth Street and Degraves Street subways, with more crowding on the Swanston Street concourse and access points.

This projected increase in station crowding will extend travel times getting into and out of stations and erode customer experience. The increase in passengers in stations may require more complex arrangements to manage how passengers move safely around the station.

3.2 Central Melbourne context

3.2.1 An expanding central Melbourne – recent trends

The City Loop opened progressively from 1981. Providing stations in the eastern and northern precincts of the Hoddle Grid, in addition to Flinders Street and Spencer Street (now Southern Cross) stations, has opened up direct connections to the train network to a much larger portion of the city's centre. This is recognised as a key contributing factor to the renaissance of inner Melbourne over the past few decades.

This transition has seen rapid increases in employment in the knowledge and service sector industries, which are drawn to and benefit from Melbourne's central location and connectedness across the metropolitan area and with major regional centres, as well as new residential growth in the inner city. Melbourne is also the host of a range of major events. It is now a key destination for workers, students and recreational visitors.

As the city has grown, the demand for increasing amounts of affordable office and residential spaces has been complemented by firms in other sectors relocating out of central Melbourne. Transport, warehousing, manufacturing and wholesale trade industries now seek sites that benefit from efficient supply chains, access to customers and suppliers, land availability and road access. While these industries have historically had central locations, particularly near the Port of Melbourne, firms are progressively relocating out of central Melbourne and concentrating in outer-industrial areas where there is cheaper land with good access to road transport infrastructure, such as freeways.

Investment in areas such as Southbank and Docklands by successive Victorian Governments, has unlocked relatively affordable land that is strategically located with high amenity compared to other cities. This has provided private sector investment opportunities, strengthened the productivity benefits that come from greater knowledge-sector density, and enabled Melbourne to better compete for global capital and jobs.

The CBD is expected to continue to experience strong employment and residential growth, but adjacent precincts will also be a key part of inner Melbourne's future strength. Precincts surrounding the CBD specialise in particular industries, such as bio-medical and education at Parkville. Very few cities internationally have such a significant cluster on the fringe of the CBD.

Within the City of Melbourne, close to 60 per cent of projected employment growth is expected to be located in the CBD. The remaining 40 per cent of employment growth is fairly evenly distributed across the surrounding precincts such as Southbank, Docklands, City North and Parkville.

3.2.2 Areas with increased public transport access due to Melbourne Metro

With the City Loop reaching the limits of its capacity and ability to accommodate more train services, Melbourne Metro will be an important investment to enable the next wave of central city growth. It will provide capacity for more people to travel into central city locations, as well as opening up new areas to the heavy rail network for the first time.

Melbourne Metro will deliver five new stations. Three of these, Arden, Parkville and Domain stations, will directly connect these precincts to the heavy rail network for the first time. CBD North and CBD South stations provide new entry points to the CBD. They will be located next to Melbourne Central and Flinders Street stations, increasing the overall capacity of these already busy locations and providing another opportunity for travellers to interchange with other train lines.

Even for areas are already well served by other public transport services, providing a new station delivers a step change in the number of public transport users able to travel to these areas in peak times, as well as providing more efficient travel options from an increased range of locations. The step change delivered by the Melbourne Metro underpins the changes in public transport demand to these places.

Improving access to areas on the edge of the CBD will help to meet the increased demand for travel, stemming from the ongoing growth in employment and consequent CBD expansion.

Figure 11 illustrates growth in employment in inner Melbourne between 2031 and 2051, compared to 2011 levels, according to the reference case projections used in the forecasting for Melbourne Metro. It shows that Parkville, St Kilda Road and Southbank are key employment destinations outside of the Hoddle Grid and will continue to develop into the future. Docklands will also grow. Although Docklands is not directly affected by the Melbourne Metro tunnel and stations, the area will benefit from the program as it will enable more peak rail services on lines that serve Southern Cross Station.

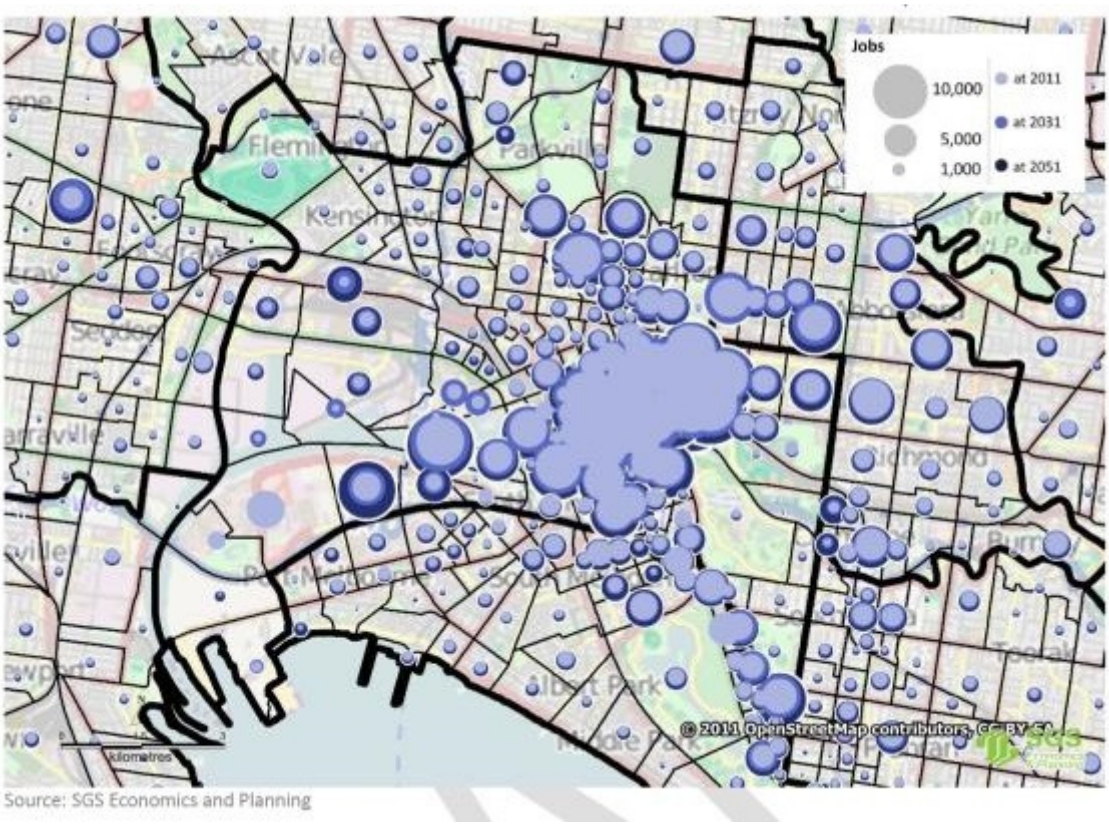


Figure 11: Employment projections in Inner Melbourne, 2011 to 2051 (DEDJTR Reference Case)

3.2.3 Arden

Urban renewal precincts, such as Arden-Macaulay, will be key to accommodating the future growth of Inner Melbourne. Arden-Macaulay is a 147 hectare area bordering North Melbourne, Kensington, Melbourne's CBD and Footscray that is primarily characterised by low-density manufacturing, wholesale and storage activities.[4] It has been recognised as a key urban renewal site that could catalyse a new CBD-fringe mixed-use office precinct. Its proximity to the CBD, Footscray and Parkville place it well within the future corridor of development through to the west.

[4] City of Melbourne, *Arden-Macaulay Structure Plan* 2012.

Critically, the area is in close proximity to existing CBD employment and markets, particularly in Parkville, capitalising on the benefits of agglomeration essential to knowledge-based industries. The core Arden precinct, in the southern part of the site, is particularly well suited to accommodating a major employment hub, with a large parcel of Government-owned land.

Part of the success of Arden's renewal, however, will rest on its accessibility and connectivity to neighbouring precincts, to deep pools of employees for its businesses and to jobs and education opportunities for its residents.

Currently the precinct relies on public transport connections on its periphery, including North Melbourne and Macaulay stations, tram routes 55 and 57 and bus routes 401 and 402. The new Arden Station will provide direct train access on Melbourne's future busiest rail corridor to the precinct in close proximity to urban renewal sites, creating a focal point and catalyst for development within the precinct, suitably supported by planning and policy. Urban renewal planning is underway for the Arden Precinct.

3.2.4 Parkville

The Parkville precinct is a hub comprising education, research, health, professional and technical industries. It includes Melbourne University, which has sites north and south of Grattan Street. It also includes major medical facilities running from Grattan Street along Flemington Road. It is already an internationally renowned cluster that benefits from its close connections to inner Melbourne and capacity to facilitate continued growth and development. Many leading institutions and organisations are expanding or plan to expand within the cluster.

Currently the precinct is served by frequent tram services along Elizabeth and Swanston Streets. Public transport users accessing the precinct from inner Melbourne must do so by interchanging to those trams at Melbourne Central or Flinders Street Stations, or by catching the high-frequency 401 bus from North Melbourne or 402 bus from Footscray. A growing number of passengers are using these services as this area continues to grow, which will place pressure on these services.

3.2.5 Domain and the central city spine

The growing employment precincts along St Kilda Road will also contribute to the strong demand for north-south travel between this precinct, the CBD and Parkville. Furthermore, growth in the Southbank and South Melbourne precincts to the west of St Kilda Road, as well as in the western end of the CBD, will create demand for more diverse public transport connections, which can be easily created with some relatively small track upgrades to the tram network (such as a new connecting tram track on Park Street from the Domain Interchange).

This north-south travel pattern takes in the cultural, retail and entertainment spine of the city. While the need for Melbourne Metro is driven by employment and education, Melbourne Metro's Swanston Street alignment improves access to these activities, providing better access for those who come to the city for reasons other than work or study.

By providing a new north-south public transport trunk route, trams currently meeting the heavy public transport demand along this spine can be freed up and deployed to other tram routes to better balance the availability of services with demand.

Domain Station will serve as a gateway to the south of the city, with people able to use the station to transfer to trams that service South Melbourne, Southbank and CBD west, as well as to travel south to places such as the Alfred Medical precinct.

3.3 Tram network context

Currently, north-south travel is heavily focussed on the Swanston Street-St Kilda Road tram corridor. This corridor provides key access between St Kilda Road, the CBD and Parkville precincts. It is complemented by services on Elizabeth Street between the CBD to Parkville, which is also heavily loaded at busy times of the day. As shown in Figure 12, these are some of Melbourne's busiest tram corridors, serving journeys that are not currently possible by train.

St Kilda Road-Swanston Street is served by a large number of lower capacity trams, which leads to congestion and reliability issues.

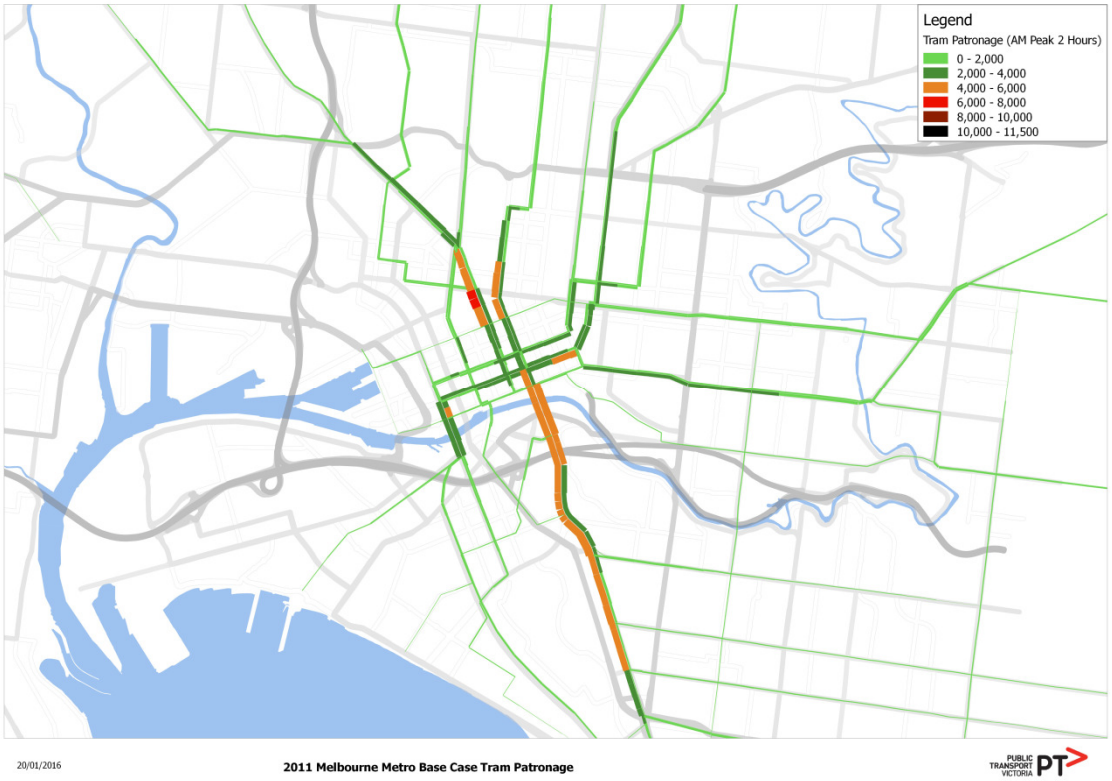


Figure 12: Tram patronage in 2011

With its current focus on meeting the heavy demand for north-south travel via the Swanston Street and Elizabeth Street through the CBD, Melbourne's current tram network is limited in its ability to service the growing job catchments, which are distributed across the CBD, as shown in Figure 13.

With Parkville continuing to develop as an education and employment precinct, there will be increasing demand for travel along the central north-south spine, at the same time job catchments in the west and south of inner Melbourne will continue to experience growth and increasing demand for travel.

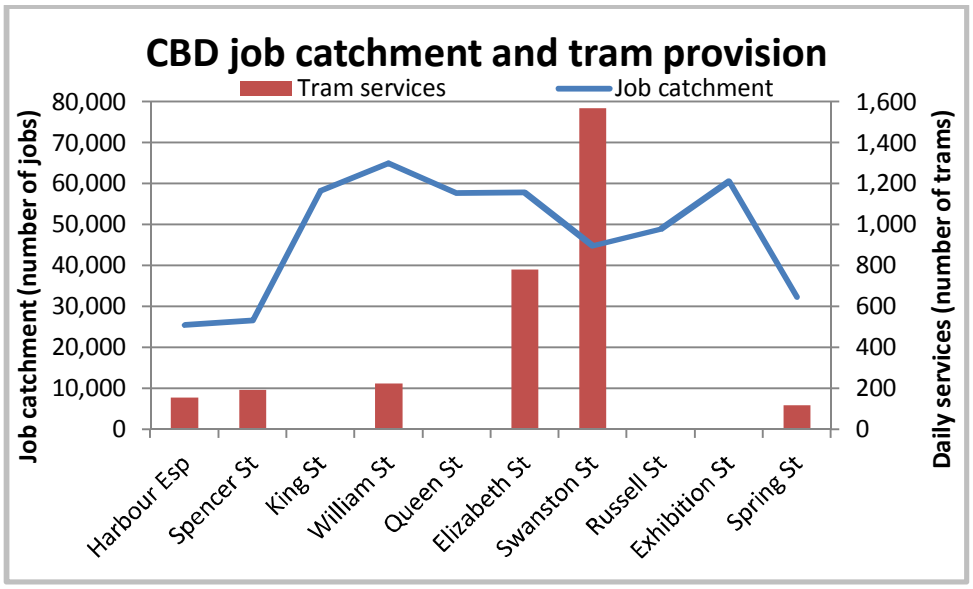


Figure 13: Comparison of current job catchment in the CBD and the corresponding distibution of North-South tram routes.

Without the alternative high capacity north-south public transport option provided by Melbourne Metro, tram use along the Swanston Street/St Kilda Road and Elizabeth Street corridors will continue to grow strongly, along with demand on tram corridors in the west of the CBD, as illustrated in Figure 14.

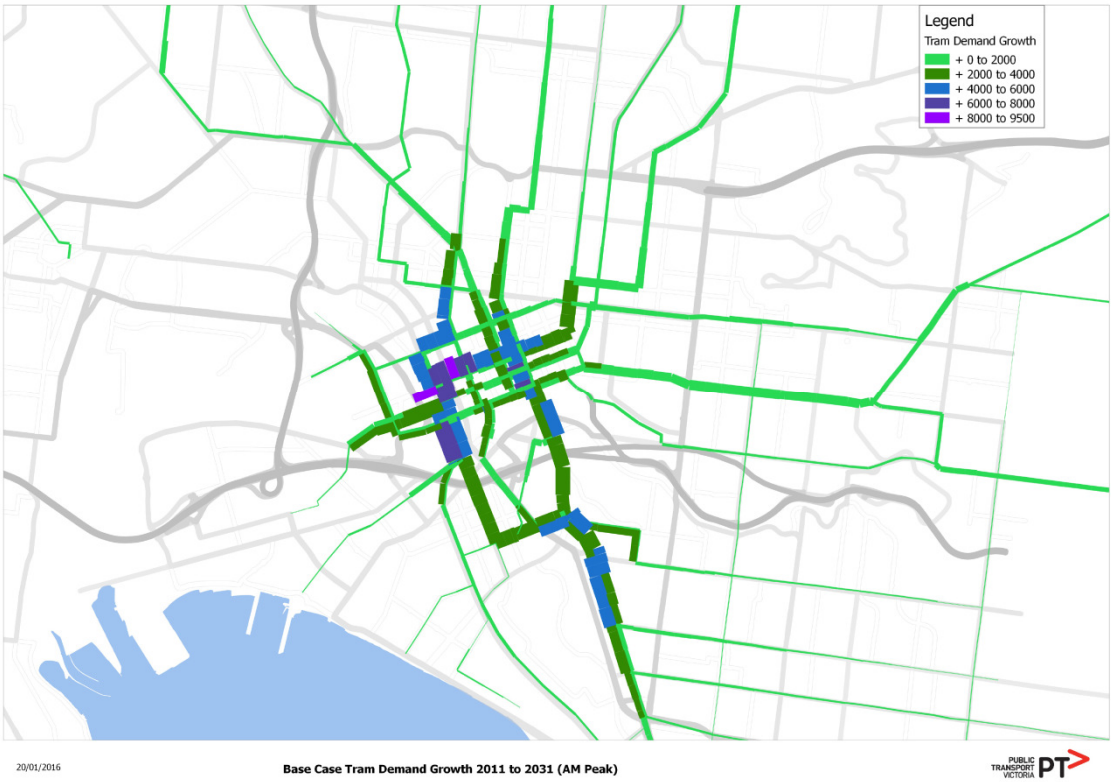


Figure 14: Growth in tram patronage 2011-2031

Tram loads travelling north between Melbourne Central and Melbourne University along Swanston Street and Elizabeth Street (as measured at Haymarket Roundabout/Lincoln Square)

are expected to grow by 1.9 per cent per annum in the morning peak period between 2011 and 2031, growth of over 45 per cent across the period. Tram loads travelling southwards on Swanston Street (between Federation Square and the Arts Centre) are expected to grow by 3.3 per cent per annum (over 90 per cent across the period), and by 2.8 per cent travelling northwards on the same stretch in the morning peak (more than 70 per cent across the period).

Loads at the busiest point on these corridors (Franklin Street) are expected to reach 18,000 passengers in the north bound direction in the two hour morning peak period by 2031. This is similar to passenger loads on the Frankston line approaching Richmond Station today.

The Victorian Government's *Rolling Stock Strategy: Trains, Trams, Jobs 2015-2025* outlines a plan to increase the number of E-Class trams in service to 150 by 2022. These larger trams will enable the retirement of older, smaller trams, helping to build the capacity of the tram network and mitigate against the growing demand for tram travel resulting in additional crowding.

Melbourne Metro will enable change on the north-south tram routes through the CBD. By reducing the reliance on Swanston Street and Elizabeth Street services to meet the heavy demand for travel between the CBD, St Kilda Rd and Parkville, it will be possible to re-align the travel patterns of tram routes to provide a closer match to the distribution of jobs across the CBD, Southbank and South Melbourne. This involves some tram routes currently operating on Swanston Street being re-routed westwards to either Elizabeth, William or Spencer Streets.

3.4 Growth implications in regional Victoria

The number of passengers using regional train services has grown by 93 per cent since 2003-04, with the regional network now carrying about 13.2 million passengers in 2015. The population growth in regional Victoria is underpinning the increase in public transport travel demand.

Future regional patronage growth is expected to be driven by strong population growth in nominated growth corridors, including:

- Tarneit and Wyndham Vale in the Geelong Corridor
- The Armstrong Creek area served by Marshall and Waurn Ponds stations in the Geelong Corridor
- Melton in the Ballarat Corridor
- The Ballarat West area served by Ballarat and Wendouree stations in the Ballarat Corridor
- Growth on the north west corridor, including at Bendigo
- The Beveridge/Wallan area in the Seymour corridor

A number of these areas are in outer Melbourne are currently experiencing, and will continue to experience, urban-style growth, as illustrated in Figure 15. This is leading to increasing demand for more frequent train services with more capacity to provide metropolitan-style access to Melbourne.

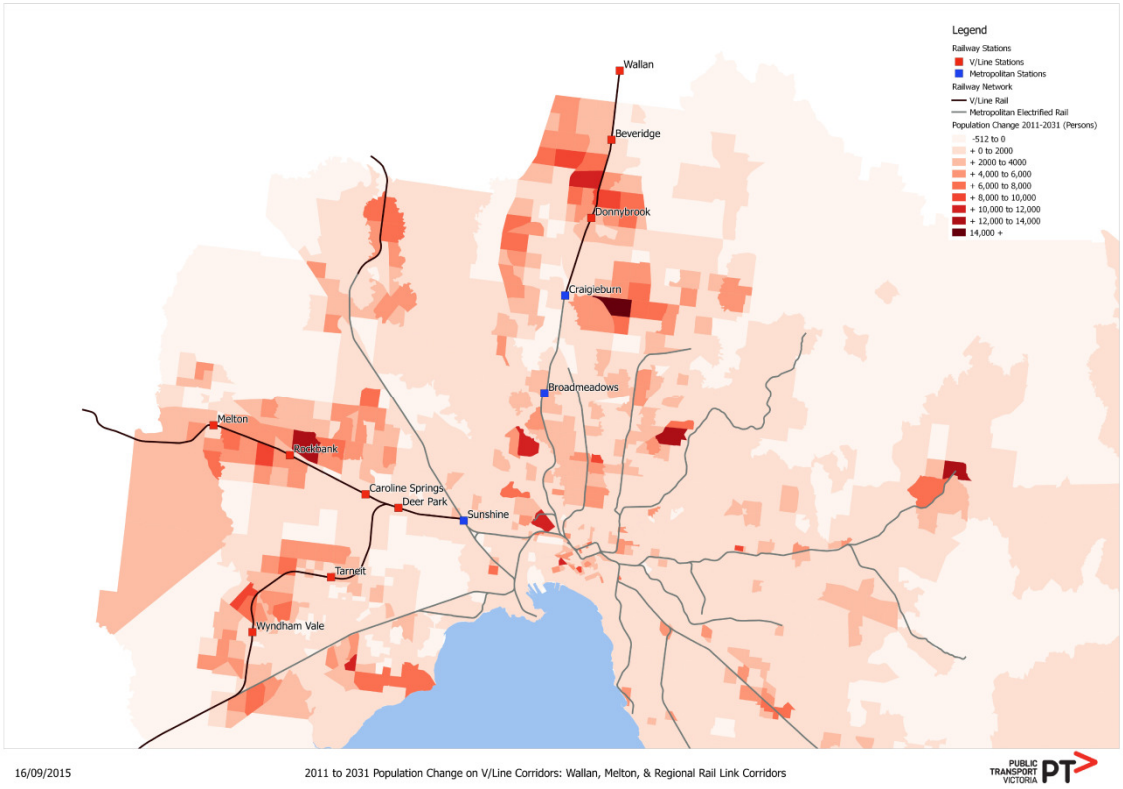


Figure 15: Population change on rail corridors 2011-2031

The western growth corridor traverses of the state's fastest growing major industrial and employment regions. Nearly half of all jobs in the western region of Melbourne are situated in the western corridor focused on the Sunshine, Laverton and Truganina industrial precincts.

Over time, the western corridor will continue to play a key role in contributing to the national economy. It is expected that employment will grow to between 160,000 and 170,000 jobs and 350,000 to 400,000 additional residents by 2031, alongside strong population growth forecast in Geelong and Ballarat. Collectively, there will be over one million Victorians that will live in the Geelong/Wyndham/Werribee and Ballarat/Melton corridors.

The public transport network in the western corridor reflects its historical rural development, with a single section of track on of the Ballarat line in the Melton urban growth and only two stations. The future duplication of the Melton line and providing trains that can carry more passengers is mooted to occur prior to the opening of Melbourne Metro. These initiatives are expected to provide sufficient capacity to meet demand until the 2020s as outlined in the Metropolitan Rail Network Development Plan (NDP). The road network is also constrained and forecast to encounter increasing congestion. In particular, road connections to central Melbourne and the south-east are limited.

The northern growth area towards Beveridge will continue to play a key role in contributing to the national economy and Australia's global position, with an expectation that employment will grow by over 80,000 jobs. The northern growth corridor traverses the state's major industrial and employment region, containing nearly one quarter of all jobs in the northwest region of Melbourne.

The corridor will also add 250,000 to 300,000 additional residents. As the northern corridor continues to grow over the next five to 15 years, the existing infrastructure will be unable to accommodate the forecast employment growth, and there will be a significant impact on congestion on the road and public transport networks.

The Metropolitan Rail Network Development Plan also anticipates that the reinstatement of the Upfield-Roxburgh Park Rail Link will increase the capacity of metropolitan services to Craigieburn

and V/Line services from Seymour via Wallan using the Upfield corridor to cope with the forecast public transport demand driven by population growth.

When completed, Melbourne Metro will create the network capacity needed to extend metropolitan services to these key areas of growth, helping to meet the expected increase in demand for travel. In the interim, the potential duplication of the rail corridor to Melton prior to the delivery of Melbourne Metro will provide the ability to run some more services on the Geelong/Wyndham Vale and Ballarat/Melton corridors until the 2020s.

If Melbourne Metro Extended Program (which includes introducing suburban services to Melton) is not delivered, and V/Line services continue to operate on these corridors, there will not be sufficient capacity to meet forecast public transport demand. As the demand for public transport travel exceeds capacity on the corridors, services to regional Victoria and metropolitan Melbourne will become progressively overcrowded and unreliable. Victorians will be put off from using public transport with consequential effects on the road network and flow on effects for access to jobs, education, services and traffic congestion. This will impact the number of jobs that are attracted to Central Melbourne.

Even with Melton duplication, demand is expected to continue to grow and ultimately exceed capacity on this line, as well as on the Regional Rail Link and Wallan corridors.

Not only does the Melbourne Metro Extended Program includes the introduction of services to suburban Melton, it will also enable additional services to Wallan (via Upfield) to be considered as a separate project.

4 Methodology

4.1 Governance

4.1.1 DEDJTR

Governance arrangements have been established by DEDJTR to provide scrutiny and oversight of transport demand modelling in Victoria. These arrangements aim to ensure a high degree of rigour and consistency in transport modelling undertaken on behalf of the Victorian Government.

The Lead Deputy Secretary – Transport is responsible for transport modelling approaches, including all demand modelling undertaken by or on behalf of the transport portfolio. To support the Deputy Secretary, a Transport Modelling Steering Committee has been established with further support from a Technical Advisory Group, an Economic Appraisal Working Group and a Land Use Working Group.

The Transport Modelling Steering Committee agrees policy and technical modelling issues, including the reference case, and provides recommendations to the Deputy Secretary for authorisation.

DEDJTR develops, improves and maintains the state-wide VITM model. For Zenith, Veitch Lister Consulting (VLC) develops, improves and maintains the validation of their state-wide model. DEDJTR also develops scenarios and manages the reference case.

4.1.2 Peer review

The transport demand forecasting prepared for Melbourne Metro has been subject to peer review. A peer review involves a small, independent team reviewing the transport modelling with key people on the project team, reviewing available documentation and preparing a short report with recommendations.

The focus and scope of the peer reviews includes the different approaches to modelling, the in-built project-level reviews and benchmark modelling, and previous modelling and economic reviews undertaken for other investigations.

The independent modelling peer reviews are engaged and managed by the DEDJTR Transport Group.

The peer review provides initial commentary throughout the review period so that improvement can be made before the final review.

4.1.3 PTV

PTV manages the development of Melbourne Metro-specific forecasts within the framework established by the department. These forecasts are being undertaken by transport demand modelling consultants, managed by PTV.

PTV's role in Melbourne Metro is to develop forecasts that will be used to:

- Allow PTV to develop public transport (train, tram and bus) service plans.
- Allow PTV to determine benefits to inform the economic evaluation of Melbourne Metro.
- Underpin the development of requirements that specify scope and the design of new train infrastructure including stations to MMRA.
- Provide a starting point for MMRA to develop more detailed localised project related forecasts.

4.1.4 MMRA

MMRA's role is to utilise the public transport forecasts produced by PTV to inform the design of the project and demonstrate to what extent the design meets PTV's requirements.

MMRA will also use PTV's forecasts as a starting point to develop more localised forecasts, such street-based forecasts in precincts around proposed stations. MMRA has refined the data and model provided by PTV so that they are fit for purpose at that localised level.

4.2 Forecasting inputs – the DEDJTER Reference Case

4.2.1 Reference Case description

The PTV forecasts have been developed using a set of inputs that represent scenarios that have been deemed to best represent the future outcomes of key factors influencing travel behaviour in Victoria. This scenario is defined in the DEDJTR Reference Case. The reference case demographic and land use projections are common set of land use assumptions underpinned by the state's Victoria in Future population forecast, which have been created with the intention of providing a consistent set of inputs to be used when undertaking transport demand modelling, including for the assessment of major transport infrastructure projects.

The Reference Case covers:

- road and public transport networks
- demographic and land use data
- model parameters, including changes to costs such as parking costs and vehicle operating costs

4.2.2 Public transport in the Reference Case

The Reference Case public transport network reflects key planned and potential future investments. By 2021 these include:

- delivery of HCMTs
- Cranbourne Pakenham Line Upgrade project
- upgrades to the tram network
- additional bus services in middle and outer Melbourne

Evaluation of Melbourne Metro involves a base case run (the Reference Case, including the public transport network without Melbourne Metro and subsequent projects that rely on the capacity it enables), to provide a basis against which to evaluate Melbourne Metro's impacts. This includes uplifts to public transport capacity that do not rely on network constraints being relieved by Melbourne Metro, enabling some future uplift in public transport services without Melbourne Metro.

Key public transport projects in the Reference Case between 2021 and 2031, other than those enabled by Melbourne Metro, include:

- high capacity signalling at selected line sections
- Mernda Rail Extension
- Melton Duplication
- Seymour Corridor Upgrade, including Upfield to Roxburgh Park Link for Vline services
- regional rolling stock
- further tram and bus network enhancements

Further details are presented in the Department's Reference Case.

4.2.3 Reference case road networks

The Reference Case adds future road projects into the network to reflect the likely road network capacity in the future. These networks do not represent commitments to investing in future roads and may include road upgrades that may not occur.

Key road projects include:

- a motor way through the western suburbs
- North East Link and Outer Metropolitan Ring Road
- various road upgrades in the growth areas

Further details are presented in the Department's Reference Case.

4.2.4 Land use

The 2011 (base year) land use data for population, employment and education enrolments were based on the following sources:

- Australian Bureau of Statistics (ABS)
- DEDJTR, previously Department of Transport, (DTPLI)
- Department of Environment, Land, Water and Planning, previously DTPLI
- Department of Education and Early Childhood Development

Land use data for future years of the Reference Case (2021, 2031 and 2046) was developed by SGS Economics and Planning. It was developed at a small area level for the 3,000 transport zones used in developing Melbourne's transport demand forecasts and used to update the Reference Case for the purposes of Melbourne Metro's demand forecasting. The update was based on a number of inputs, including:

- historical trends in employment, population and enrolments
- changes in the economic structure of Melbourne (as influenced by local and global factors)
- strategic land use planning documents
- official state government population and dwelling forecasts (Victoria in Future)
- consideration of expected future trends based on this this context

These forecasts underpin analysis of the general land use and related trends used in this report, including in Chapter 3.

Internationally, techniques to more fully understand the benefits and outcomes of major projects are being improved. A key recent example is Crossrail in London.[5] The evaluation of Melbourne Metro has followed international examples in using techniques to capture the benefits of the future employment growth in central Melbourne enabled by the capacity uplift delivered with Melbourne Metro. This growth in jobs in the city would not be possible without Melbourne Metro.

Developing long term land use forecasts requires taking a point of view on long term trends and whether plans and projects are in place to enable these forecasts to be realised. Developing these forecasts involves taking into account historical trends and current understanding and expectations of the impact of future influences on these patterns.

[5] Colin Buchanan Consulting and Volterra (2007),"The Economic Benefits of Crossrail Final Report"

The Reference Case land use projections, including employment growth, should be regarded as realistic potential development, given a reasonable set of assumptions, which include transport infrastructure investment. To achieve this potential land use development therefore requires the associated outlook to be realised in plans and projects.

When undertaking transport demand forecasts for a given scenario, land use and transport networks should relate to each other. The Reference Case includes transport networks that assume an increase in public transport capacity to central Melbourne into the future. This increase is needed to help support the Reference case land use projections, which forecast employment in the CBD more than doubling to 500,000 by 2046.

Melbourne Metro is a city-shaping project that will facilitate the future development and economic growth of Melbourne through enabling more intense development in central Melbourne and the realisation of associated agglomeration benefits. Without Melbourne Metro, capacity constraints in road and public transport networks will constrain future employment growth in central Melbourne, as some people simply will not be able to travel into this area at peak times. This has been taken into account in developing a base case land use forecast.

To more fully understand the benefits of Melbourne Metro, it is important to understand how many jobs would be deterred from locating in central Melbourne if the project is not delivered. Traditional appraisal techniques used in Victoria do not capture this, as they assume employment and population remain constant between the "base" and "project cases", irrespective of whether or not the project to provide capacity to enable this jobs growth is delivered or not.

The base case transport networks do not include the Melbourne Metro Extended Program or other projects that are dependent upon the Melbourne Metro Extended Program being delivered. Therefore, the base case land use projections have been accordingly adjusted to reflect this reduced commuting capacity.

The Melbourne Metro Program case land use has been also developed as an interim land use stage that takes into account the public transport capacity delivered before the full capacity of the Extended Program.

For the purposes of developing base case and program case land use projections, jobs growth that is constrained by transport networks in central Melbourne has been assumed to occur in other suburban locations in Melbourne. Total employment across Melbourne therefore remains constant in each scenario. No other changes in land use were made between the scenarios. However, it is plausible that a number of these jobs may not locate in Victoria at all. Firms may opt to locate these jobs at other cities in Australia and abroad with better access to Central Melbourne. Central Melbourne competes in national and global economic markets, competing with other cities as a place for firms to locate, develop and grow employment. Some of these jobs may therefore be located in other cities if transport networks do not support the development of central Melbourne.

Global companies take a range of factors into account where considering where to locate. These include regulatory environments, availability of skilled staff, and lifestyles on offer to employees. The quality of local transport networks is a key contributor to a number of these factors, as it facilitates access to broader pools of skilled staff, and makes a material contribution to staff lifestyles.

It is also important to recognise that these scenarios do not represent sequential development from base to program and extended program cases, rather they represent alternative scenarios of how Melbourne can be expected to develop under particular conditions.

Notwithstanding that other cities compete with Central Melbourne for jobs; this evaluation has kept the number of jobs in the project and base case the same. The base case land use locates 47,000 jobs from the Reference case land use projections to locations other than the CBD in 2046. The Program case enables 28,000 of these to develop in the CBD by 2046 (or 19,000 jobs

in locations other than the CBD).The Extended Program case is consistent with the Reference Case.[6]

4.3 Model selection and use

4.3.1 Models used

PTV used three demand forecasting models to inform its transport demand forecasts.

Primary transport network forecasts were undertaken using the Victorian Integrated Transport Model (VITM). Secondary transport network forecasts were undertaken from the Zenith model and have been used as a check and comparison to inform potential outcomes relative to the primary forecasts.

Both of these models are 'four-step' transport network-wide models that develop forecasts for each mode of public transport and private vehicles and produce similar outputs. VITM and Zenith use the same inputs, but differ in the details of their process. Differences between the models are discussed in more detail in Section 4.3.4

Broadly speaking, four-step models involve:

- trip generation to identify the number of trip ends at a particular location
- trip distribution to identify where these trips are destined
- mode choice to identify what proportion of trips use car, public transport, etc.
- service selection to identify what combination of services are used to complete public transport trips

Both models were considered to be appropriate to use on the project during the validation process. VITM was selected as a the primary forecast model due to its model performance and validation.

ClicSim, the third forecasting model, was used to produce station and interchange forecasts, and some crowding analysis. ClicSim is a mesoscopic model that aims to predict how train passengers will move around the network with a particular focus on central Melbourne. It provides insight at a level of detail that the four-step models cannot provide. ClicSim relies on outputs from VITM or Zenith to provide growth rates, which it then applies to a station-to-station matrix of observed passenger behaviour.

ClicSim allows this to be done on a dynamic basis, and provides a much higher level of rigour and detail than would be able to be calculated in a traditional spreadsheet process.

ClicSim provides deeper insights into the entire train journey of passengers, giving insights into loads in individual trains, passenger transfers, the busiest time or 'peak of the peak', and pedestrian movements through stations.

4.3.2 Model application

Broadly speaking the results have been applied as follows:

[6] These land use scenarios have been incorporated into VITM and Zenith forecasts, they have not been incorporated into the ClicSim or station specific outputs (which are based on the Reference Case land use projections in the base and project cases).

- Service planning and transport network impacts (including road network impacts) are primarily informed by VITM, which provides public transport loads on each mode.
- Engineering design and requirements, which focus on peak loads and station forecasts, are driven by ClicSim.
- The economic assessment draws on outputs from all three models, primarily VITM. Zenith helps to validate the benefits, and ClicSim to estimate station benefits.

Local area and construction impacts, including traffic, meso- and micro-simulation models and station precinct impact assessment, and detailed station modelling are being undertaken by MMRA.

4.3.3 Crowding impacts on public transport

The VITM and Zenith models provide the option to place constraints on public transport patronage so that as public transport services become more crowded, they also become less attractive. This constraint provides an indication of how the transport network will function under particular provisions of public transport capacity.

Constrained runs are therefore of value in evaluating project impacts, though they may underrepresent any latent demand for public transport travel that is not able to be accommodated on the public transport network. Unconstrained runs provide a fuller picture of the extent of demand for public transport travel and have been used to shape the public transport service offering.

4.3.4 Difference between VITM and Zenith

PTV has previously undertaken patronage forecasting studies for a Melbourne Metro rail tunnel. These studies involved developing two four-step models: the Melbourne Integrated Transport Model (as VITM was known at the time) and Zenith. Considerable changes have been made to both models between this previous phase and the current models.

Zenith was used as the primary model for the 2010 business case and subsequent updates due to its level of development, coverage of all time periods within a weekday, geographic coverage and performance in validation. It has since been recalibrated to the ABS 2011 census and household travel surveys, and the results are not directly comparable to prior forecasts.

There has been considerable development of the VITM model over recent years, including coverage across all time periods, development of public transport crowding functionality and improved trip distribution and mode choice.

The key differences between the two models are the approaches to:

- distributing trips:
    - Zenith has a greater tendency to forecast higher public transport mode share to key trip attractors, such as the CBD.
    - Zenith does not try to balance trip attractions and productions, whereas VITM constrains both, balancing demand between the two.
    - Zenith also tends to create a greater reliance on central Melbourne for specialised knowledge and service jobs compared to VITM for people in south eastern and eastern suburbs, resulting in higher public transport demand along these corridors.
- modelling overcrowding on public transport:
    - VITM does not allow additional passengers onto public transport vehicles beyond crush capacity whereas Zenith does.
    - Zenith differentiates the in-vehicle penalty between seated passengers and standing passengers, which tends to encourage longer train trips.

    - An advantage of the VITM approach is that it takes into consideration additional waiting time at the station where a traveller is unable to board a train. This is reflective of observed traveller behaviour. In Zenith, there is no additional waiting time as travellers are able to board trains even if they are at crush capacity.

- estimating road traffic conditions:
    - VITM has greater differentiation of vehicle types and traffic flow impacts.
    - Whilst different, both models have their merits, particularly in light of roads accepting additional traffic resulting in volume capacity ratios greater than one.

4.4 Forecasting model enhancements and validation

4.4.1 Forecasting model enhancements

Since the last set of Melbourne Metro forecasting data was prepared (2009-2012) there have been considerable changes to VITM and Zenith. These include:

- The Reference Case has been updated, including significantly increased population, employment and education forecasts through Victoria in Future 2014.
- Both models have been recalibrated, improving model performance and alignment with existing network performance.
- Both models have been enhanced over the past few years, including addressing comments from peer reviews of major road and rail projects.

To further improve performance in the modelling for Melbourne Metro, further specific enhancements were made to the models. These were made with a particular view to enhancing performance on measures directly relative to project performance. They include land use updates to support base and project case scenarios for the specific purpose of Melbourne Metro forecasts, as identified in Section 4.2.4.

Details of these enhancements are documented in the VITM and Zenith modelling reports. Broadly speaking the enhancements focussed on improving model performance and refining the model in the vicinity of areas affected by the project. The VITM and ClicSim enhancements also improved the representation of stations and alignment with the timetable.

4.4.2 Validation and model confidence

The models used have been validated to assure confidence in results, focussing on key findings that have the strongest relationship to project outcomes and network constraints to which Melbourne Metro is responding.

In particular, pressures will be most strongly felt on the network during the busiest, most concentrated period of activity (the morning peak), both in terms of public transport loads and passenger movements at stations.

Broadly speaking, the results of the validation on key assessment criteria were within the desired validation performance, ranging from being reasonably indicative to very good. In particular, VITM train cordon forecasts validated to a very high standard.

The results reported in this document reflect outputs that were prioritised in validation and met validation criteria.

4.5 Scenarios

4.5.1 Forecast years

The models were run for years 2011, 2021, 2031 and 2046. These are standard modelling years across the transport portfolio, which allows consistency in reporting across projects.

Runs undertaken for 2011 enable validation of the model against current network performance, and can serve as an indication of current network behaviour where data is not collected.

The majority of results presented in this report are for the year 2031.

Changes to travel behaviour do not all take place immediately after the completion of a new project and the modelled behaviour is likely to reflect actual behaviour a couple of years after project delivery. The way the network operates in 2031 is therefore considered a good measure of the initial impacts and changes in travel behaviour due to Melbourne Metro. Results are presented for both the Melbourne Metro Program and Extended Program.

Less attention has been placed on 2046 results for this report, as the focus is on understanding the impacts of due to the delivery of Melbourne Metro. These 2046 results are a key input into economic evaluation and project design, and have been documented as part of these processes.

Unconstrained and constrained runs were undertaken in the primary model. Unconstrained forecasts assume that there is an unlimited number of passengers that can use public transport, not taking into account how many passengers a train can actually accommodate. It therefore provides an understanding of the potential market, including latent demand. Unconstrained results are indicated and explained; otherwise it should be assumed constrained results are being presented.

4.5.2 Core scenarios

Base case scenarios without the Melbourne Metro Extended Program were run for 2011, 2021, 2031 and 2046.

VITM and Zenith forecasts were then undertaken for both the Melbourne Metro Program Case and the Extended Program. ClicSim forecasts prepared for this report have been undertaken for the Melbourne Metro Program only.

The Melbourne Metro Program Case refers to the services that are available upon the first day of the Melbourne Metro tunnel opening. It includes:

- Melbourne Metro tunnel from South Kensington to South Yarra
- high capacity signalling along the Sunshine-Dandenong corridor
- roll out of seven-carriage HCMTs on the combined Sunshine-Dandenong corridor; these have about 550 seats and a carrying capacity of 1100 passengers
- tram network changes

The Extended Program builds on the Melbourne Metro Program to deliver:

- Partial deployment of extended high-capacity rolling stock (ten car HCMTs) on the Sunshine-Dandenong corridor. Ten-car trains are planned to have about 800 seats and a carrying capacity of around 1570 passengers.
- Electrification to Melton, extension of Albion services to Melton, and track quadruplication from Sunshine to Deer Park.

By 2046, this program includes full deployment of extended HCMTs along the Sunshine-Dandenong corridor and cascade of rolling stock across the network.

Similar to the base case, modelling forecasts have been developed for 2021, 2031 and 2046 for both the Program and Extended Program cases. The core results presented in this report are from the 2031 Melbourne Metro Program case and Extended Program case.

5 Enabling growth in public transport trips to central Melbourne

5.1 Network overview

A core benefit of Melbourne Metro is the capacity it provides to bring more people living along Melbourne's busiest and faster growing train lines into central Melbourne.

Currently the metropolitan train network is broadly assembled into five groups, serving geographical areas across Melbourne:

- Northern Group (Craigieburn, Sunbury and Upfield lines)
- Cross-city Group (Werribee, Williamstown, Frankston and Sandringham lines)
- Dandenong Group (Pakenham and Cranbourne lines)
- Clifton Hill Group (South Morang and Hurstbridge lines)
- Burnley Group (Glen Waverley, Alamein, Belgrave and Lilydale lines).

The ability to increase capacity on the current train network is limited as its configuration includes a number of constraints, in particular line convergences resulting in multiple lines sharing the same track alignment. This places restrictions on the number of services that can be operated on shared sections of track and impact reliability and punctuality.

The Regional Rail Link project has largely untangled regional and metropolitan lines running into central Melbourne. However, there are still some sections of shared tracks resulting in interaction between regional and metropolitan services, including:

- Seymour via Wallan line services interact with Craigieburn line services.
- Bendigo line services interact with Sunbury line services north of Sunshine (linking the timetabling and performance of the RRL services to the Northern Group services).
- Gippsland line services interact with Pakenham and Cranbourne line services.

In addition, the Melton services currently operated by V/Line, also interact with Ballarat and Geelong/Wyndham Vale services.

5.2 Network constraints addressed before Melbourne Metro

The train network is already under pressure from the rapid growth in patronage experienced in the past decade, with crowding felt on trains coming in through North Melbourne Station and from Dandenong. Projects being delivered before the completion of Melbourne Metro will provide some capacity and crowding relief as demand grows between now and then. The following projects are a mix of committed and planned projects and form part of the base case scenario, to provide a picture of travel behaviour on the network if Melbourne Metro is not built.

These base case projects include:

- Upgrades to the Cranbourne/Pakenham line, which will relieve some pressure on the Dandenong Group through the removal of level crossings, provide new and upgraded infrastructure and the purchase and deployment of rolling stock that is able to carry more passengers. Many of the trains currently operating on the Cranbourne/Pakenham corridor will then be used to operate additional services and improve capacity on other lines.
- Fleet procurement and deployment of new regional and metropolitan trains.

- Project assumed in the Metropolitan Rail Network Development Plan including Melton duplication (Deer Park to Melton) and the Wallan line – Upfield to Roxburgh Park Link. This link involves diverting Seymour/Wallan V/Line trains from operating along the Craigieburn corridor to the Upfield corridor to enable additional trains to operate to serve Wallan and Craigieburn.

In addition, there are a number of future initiatives that are not linked to the development of Melbourne Metro, which are included in both the Program/Extended Program and base case. These initiatives serve areas that are not directly impacted by the Melbourne Metro Extended Program, including:

- Projects to enable growth on the Clifton Hill and Burnley Groups as per the Metropolitan Rail Network Development Plan.
- Road projects, including CityLink Tulla Widening, a major road capacity improvement project from the west to the city fringe, amongst others. These are included in DEDJTER's Transport Modelling Reference Case.

5.3 How the base case network meets public transport demand growth

Even with the base case projects in place, the forecasts predict shortfalls in capacity are likely to develop.

Figure 16 shows the implications of the network forecasts if there is no other project to provide the significant boost in capacity that will be delivered by Melbourne Metro in coming years. It shows that services on suburban lines will increasingly experience numbers of passengers in excess of the load standard across the morning peak over time. This travel period will grow increasingly uncomfortable for passengers by 2031, and on some lines services will become very overcrowded and unreliable unless capacity is added to the system.

The graph shows average passenger numbers as a percentage of hourly capacity. Sections in green indicate lines where an option of a seated journey exists in most cases, lines extending into the orange show where the typical peak services have standing up to 'planning load'.[7] Lines forecast with demand extending to red are expected to be operating beyond the maximum sustainable capacity of the line (with implications for both amenity and operations). The forecast demand over the peak hour on all lines (except Frankston and Sandringham) will breach planning load capacity by 2031, in most cases by 20% to 30%.

It is important to note that these levels of crowding will have a significant effect on passenger experience. On lines where capacity is exceeded, the majority of passengers on-board services approaching or leaving the city will have been forced to stand. In many cases, crowding on the busiest services will make standing quite uncomfortable, making reading or other on-board activities difficult due to the proximity of other passengers in the standing areas. Crowding levels also affect dwell times, resulting in a deterioration of reliability and journey times, and providing a further cost to users of these services

Even as the average load approaches the planning load across the peak period, some trains within the morning or afternoon peak period may be particularly crowded and unpleasant for passengers, or even exceed acceptable crowding limits. In some cases, travellers may be unable to board a crowded train at all, forcing them to wait for another service or to seek alternative means of travel. Crowding also affects the reliability of the train network as more people are trying to squeeze on and off trains increasing dwell times the train has to spend at stations.

The chart also indicates particularly strong pressures on the Melton Corridor. While the growing demand is anticipated to be met in the shorter term by the assumed Melton duplication project

[7] The 'planning load' is defined as the maximum load of passengers that can be carried without substantial impact on network operations. It is calculated as a rolling average across any hour of 900 people on board for existing rolling stock, or 1100 for HCMTs.

(which will enable an uplift in services) the growth in this region is so strong that unless the capacity to electrify the Melton corridor is provided by Melbourne Metro, the line will encounter demand well in excess of available capacity.

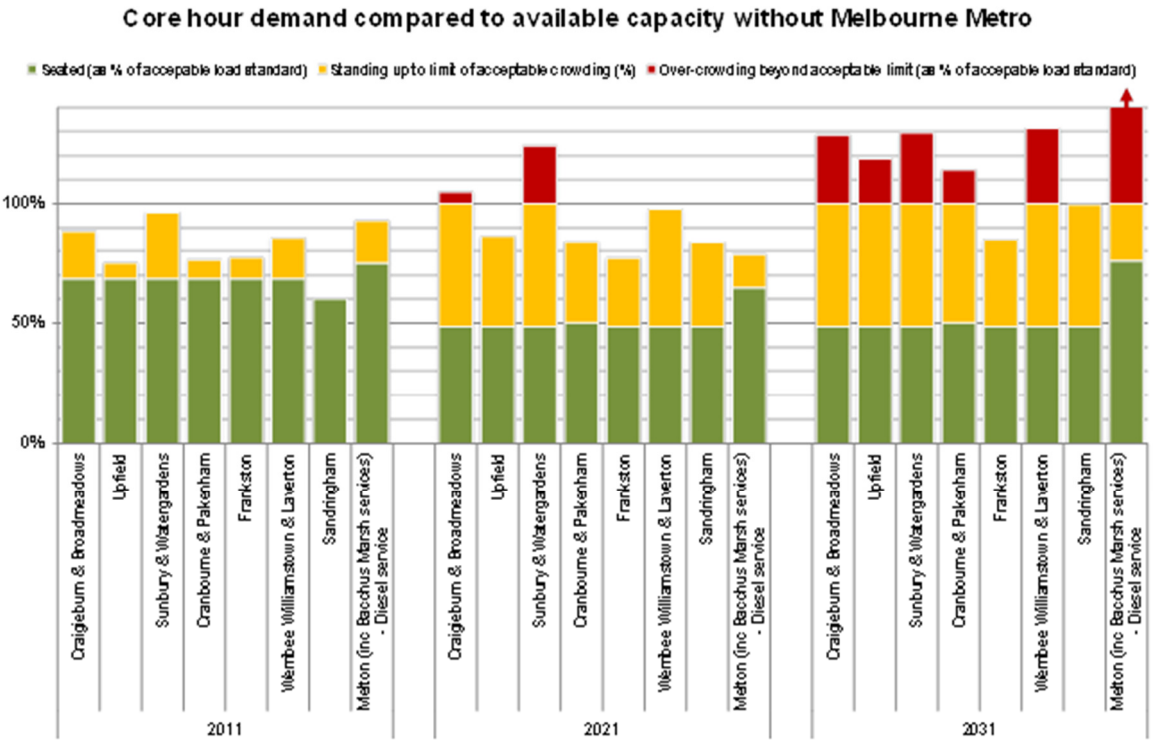


Figure 16: Forecast demand growth compared to capacity without Melbourne Metro for people travelling into central Melbourne in AM Peak (busiest hour)

Figure 17 illustrates the sections of the train network where crowding will be the strongest if Melbourne Metro isn't built (i.e. the base case) in 2031. It shows where the number of people wishing to use the rail network will cause trains to regularly exceed PTV's planning load standards across the morning peak period. The thickness of each line reflects the number of services operating.

These effects are strongest along the corridors that will receive capacity improvements from Melbourne Metro. With passenger loads building quickly along these lines, the effects of heavy loads will be felt along most of their lengths. This will make it harder for many people living in the growth areas and established suburbs along these lines to access jobs and education in the inner suburbs by the public transport network.

The constraint imposed as lines from the north and west converge through North Melbourne is particularly evident, with the strongest crowding impacts felt on the approaches and immediately after North Melbourne station. This includes the capacity of tracks travelling through North Melbourne Station as delivered by RRL (which separated metropolitan and regional train services), which is the practical extent of capacity for metro lines through the Northern Group until a major infrastructure investment such as Melbourne Metro is made.

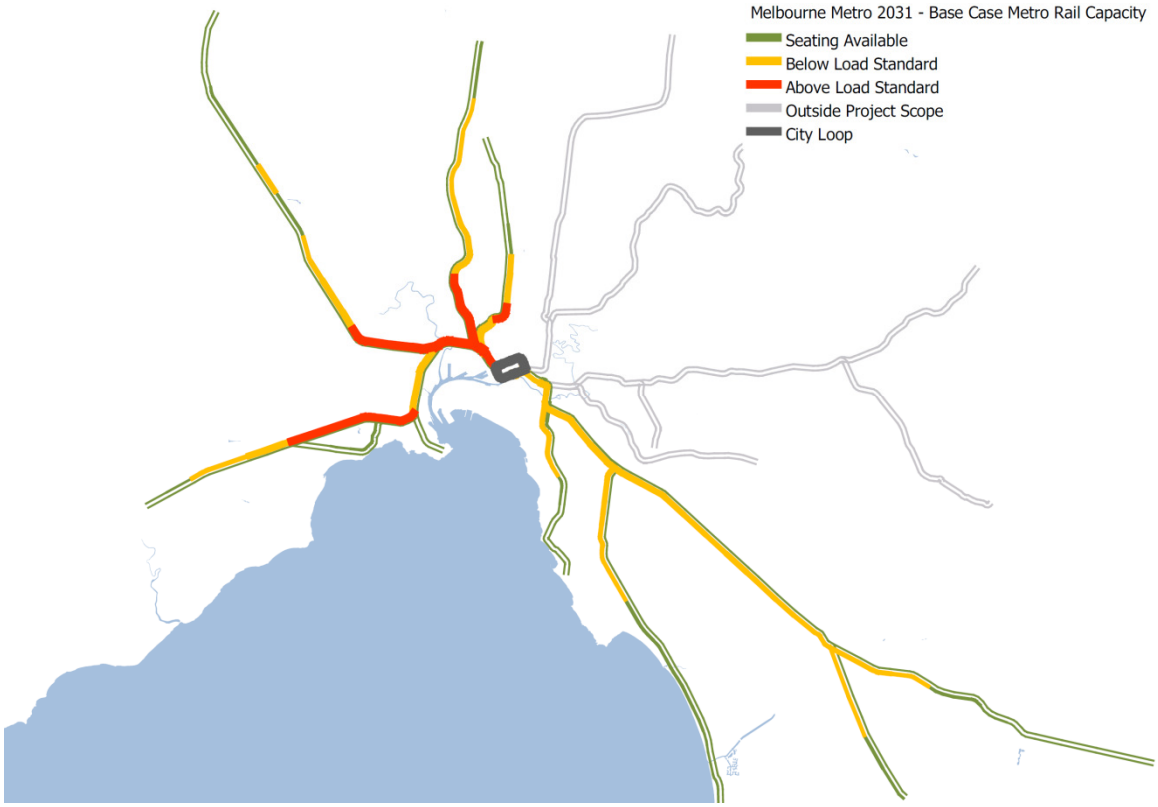


Figure 17: Crowding on the metropolitan train network 2031 base case (volume/capacity ratio)

Note: Ratio reflects the forecast number of passengers on board a train relative to the load standard, averaged across all of the trains operating across the two hour AM peak. In reality, some trains will be more heavily loaded than others.

The above analysis of the 2031 Base Case indicates that if capacity is not increased, the outcome for many trains during the AM Peak will be above load standard. This includes that all trains travelling in the AM peak direction on the:

- Werribee line will be above load standard from Laverton,
- Sunbury line will be above load standard from Albion, and
- Craigieburn line will be above load standard from Essendon.

5.4 Impact of the Melbourne Metro Program and Extended Program on capacity and crowding

Melbourne Metro addresses the constraints on trains that currently travel through North Melbourne, as well as from the Cranbourne/Pakenham, Sandringham and Frankston lines. Figure 18 and Figure 19 illustrate the network following the delivery of the Melbourne Metro Program and Extended Program.

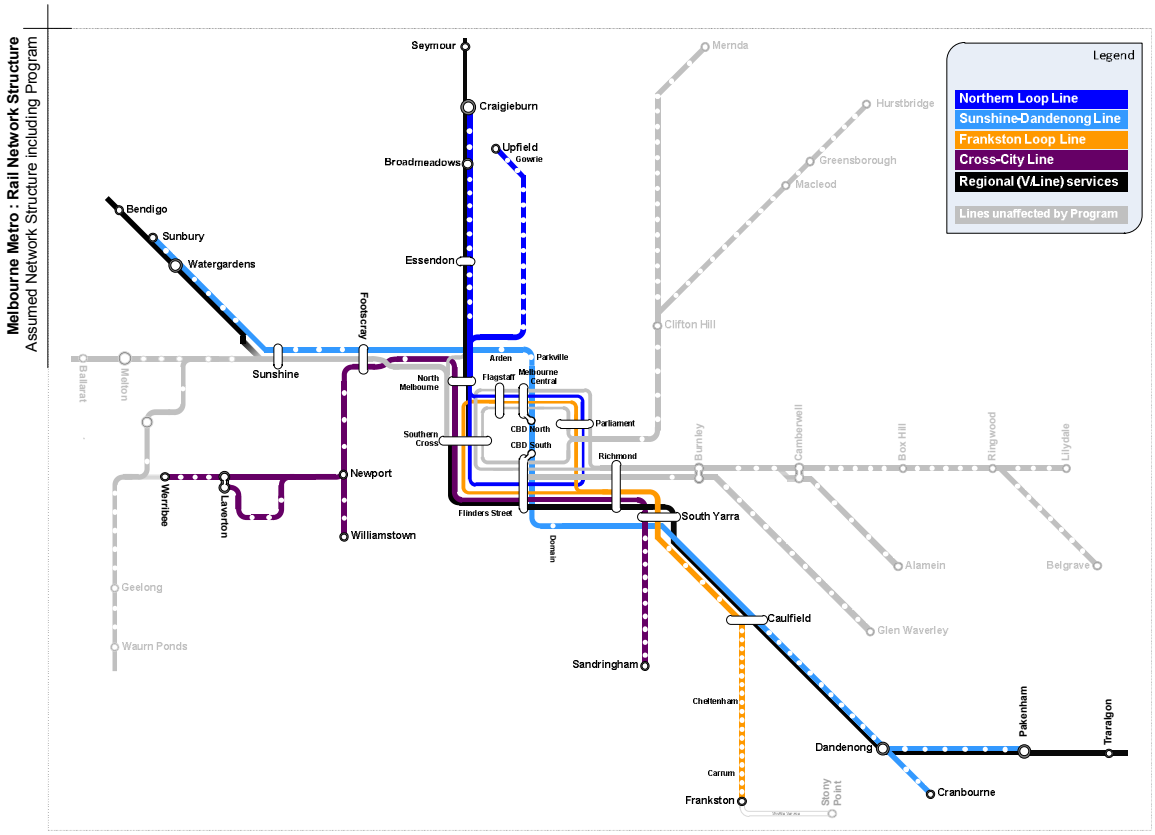


Figure 18: Metropolitan train network including Melbourne Metro in 2026

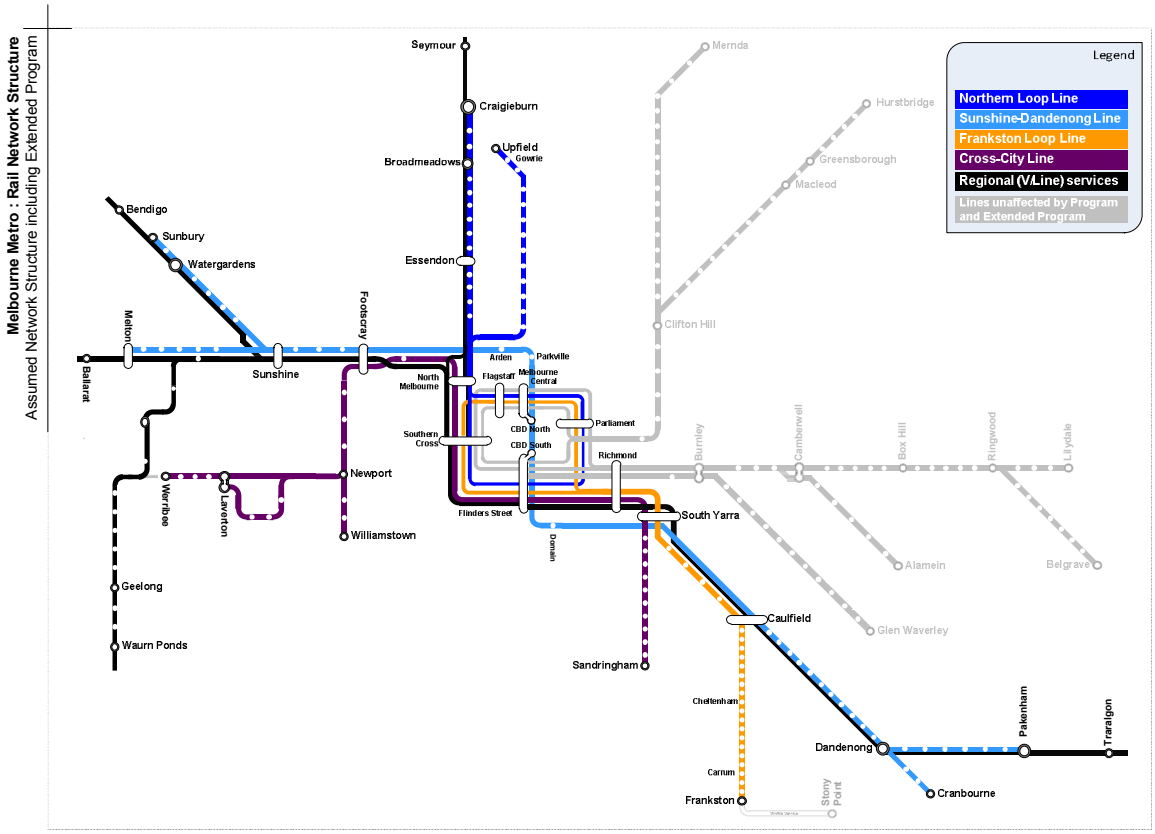


Figure 19: Metropolitan train network with Melbourne Metro Extended Program

Without Melbourne Metro, demand pressures are expected to build on lines that are currently travelling through North Melbourne Station, particularly the Sunbury corridor around 2020, and then on the Werribee and Craigieburn lines shortly thereafter. Prior to the time Melbourne Metro is due to open, all of these four corridors through North Melbourne will have reached capacity.

The Melbourne Metro Program delivers sufficient capacity to meet the longer term needs of many of these corridors. The Melbourne Metro Program will enable demand to be met on the Upfield corridor into the 2040s . It will enable around an additional 10 years of demand growth on the Werribee/Williamstown and Craigieburn and demand to be met on the Sunbury corridor until the late 2020s at which time the Extended Program will then be needed.[8]

Subsequent capacity improvements will then be needed to enable future growth. These improvements can be implemented on an individual corridor basis as Melbourne Metro has enabled most of these lines to operate independently.

The subsequent investments in the Melbourne Metro Extended Program will deliver further capacity uplifts on the Sunbury corridor, and are designed to make use of the capacity delivered in the new tunnel, including platforms that can accommodate extended high capacity trains. This will enable demand to be met on the Sunbury line through to the 2040s. Delivery of suburban services to Melton will also relieve overcrowding on the Ballarat/ Melton corridor.

Following the Cranbourne Pakenham Line Upgrade, this corridor will be experiencing capacity pressures by the early 2030s. The Melbourne Metro Program will enable some additional services on this corridor. Delivery of the full scope of the Melbourne Metro Extended Program enable extended high capacity trains to run on the corridor, which will accommodate the demand on these corridors through to the 2040s.

Figure 20 and Figure 21 provide a geographical representation of the improved capacity relative to forecast patronage across the network in the Melbourne Metro Program and Extended Program. This is most pronounced in the north and west, i.e. the location of the busiest train services should Melbourne Metro not be built.

As illustrated, when Melbourne Metro is delivered, more people will be able to travel from across the suburbs to reach jobs and education by train. Services in the west which were exceeding the load standard without Melbourne Metro in particular are relieved. Services to the south east also see increasing numbers of passengers boarding services with available seating and capacity.

This reduction in crowding strengthens with the Extended Program, both on the existing Sunshine-Dandenong services, which will have expanded trains that are much longer than those in use today, and with extension of the metropolitan rail network to Melton, where passengers will have services using the Melbourne Metro tunnel. The strongest crowding relief will be felt by people on the highest growth lines to the north and west and those in the outer suburbs. These people have the longest journeys, and as identified previously, some lines were experiencing crowding along the majority of their length, which will be now substantially relieved.

[8] Future planning has identified reconfiguration of the Craigieburn and Upfield suburban lines to extend suburban services to the Beveridge/Wallan growth corridor as a potential option to address forecast congestion on regional services and improve public transport service to this area. This has not been assumed in this analysis - however it is noted this option would be available to Governments post MM at the expense of accelerating growth on these suburban lines and ultimately bringing forward capacity constraints from the dates shown.

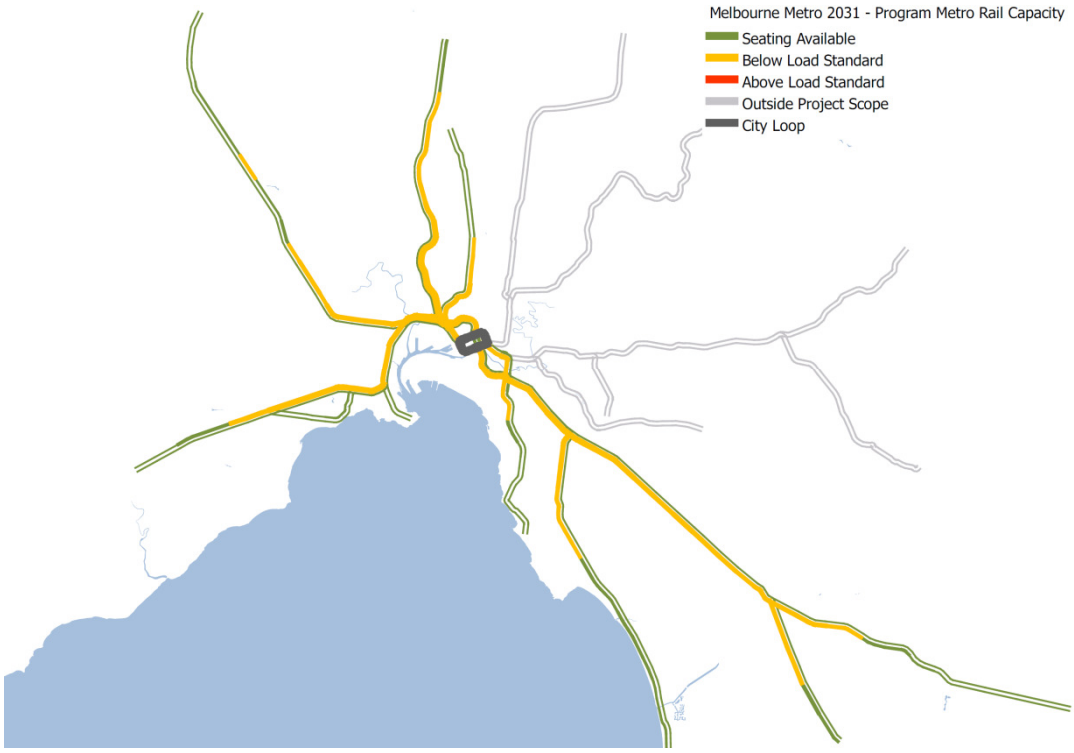


Figure 20: Crowding on the train network in 2031 with Melbourne Metro Program (volume/capacity ratio)

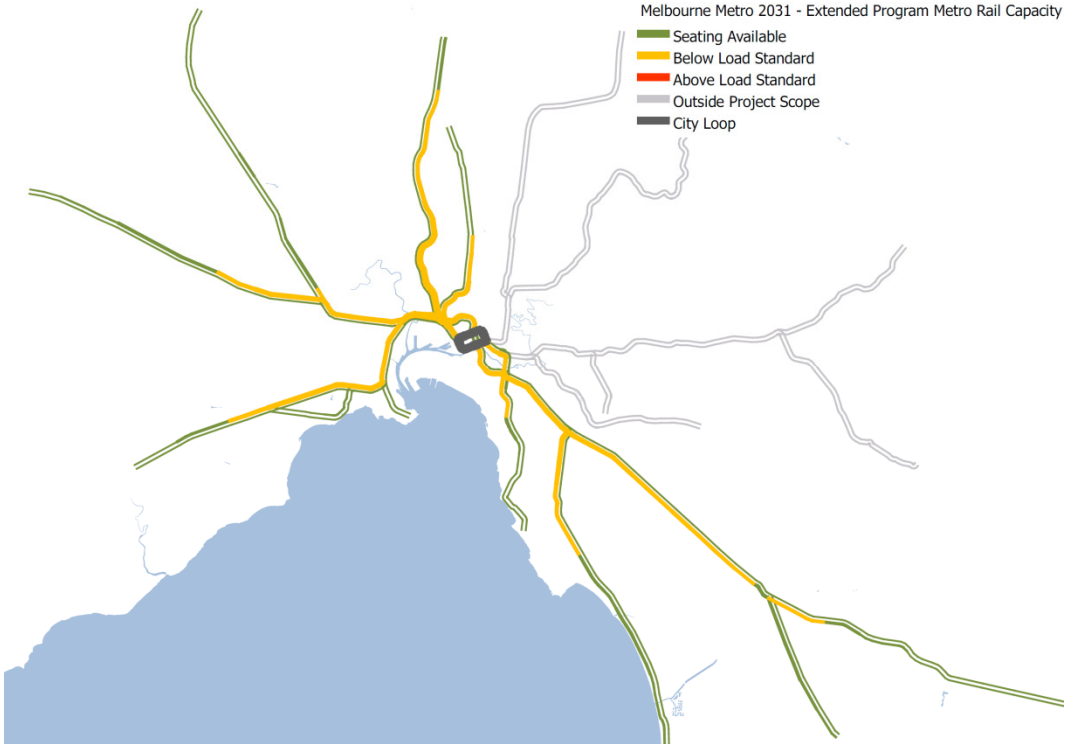


Figure 21: Crowding on the train network in 2031 with Melbourne Metro Extended Program (volume/capacity ratio)

Note: Ratio reflects the forecast number of passengers on board a train relative to the load standard, averaged across all of the trains operating across the two hour AM peak. In reality, some trains will be more heavily loaded than others

The public transport passengers who will experience crowding relief are illustrated in Figure 22 and Figure 23. The shading represents the scale of the outcome for people travelling from that localised area of Melbourne (which is a transport zone in the model), with the shades of green representing the net benefit to all passengers in that area that the Melbourne Metro provides. Consistent with the demand to train capacity plot above, benefits are felt along the lines upgraded by Melbourne Metro. The strongest effects will be felt by people on the most crowded lines and those in outer suburbs. These people have the longest journeys, and as identified previously, some lines were experiencing crowding along the majority of their length which will be now substantially relieved.

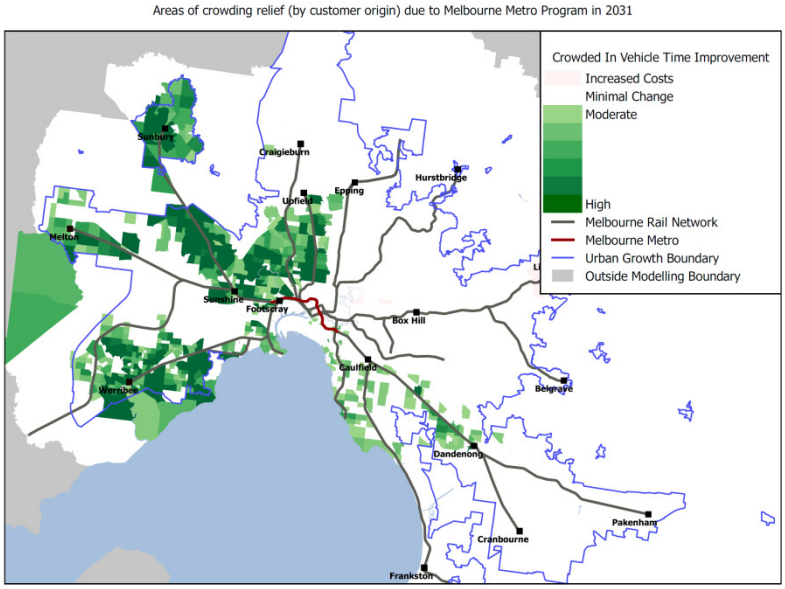


Figure 22: Locations of crowding relief (passenger origins) due to Melbourne Metro Program

The Extended Program enhances crowding relief, especially in the west where extension of metropolitan services to Melton provides further relief to neighbouring corridors (in addition to the extended trains on the Sunbury corridor), as commuters are now able to take advantage of metropolitan services closer to home.

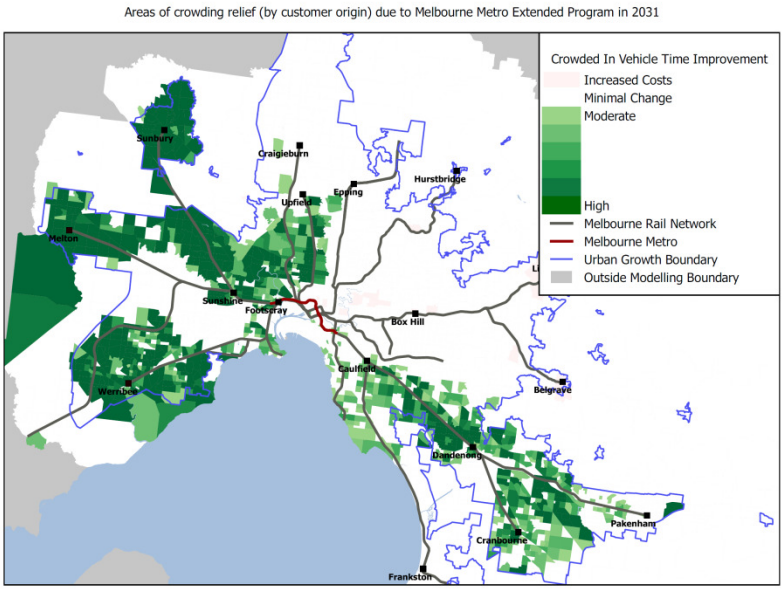


Figure 23: Locations of crowding relief (passenger origins) due to Melbourne Metro Extended Program

5.5 Impact on number of people travelling into Melbourne

The increased capacity provided by Melbourne Metro provides the opportunity for more people to travel to and from the city during the busiest travel periods. This is reflected in the increased numbers of people travelling into central Melbourne during the morning peak two hours in the Program and Extended Program cases compared to the base case. It is also reflected in faster growth in public transport travel demand into the CBD, than would otherwise occur, as indicated in Table 3.

Overall, an additional 16,000 people would be travelling into central Melbourne by rail in the Melbourne Metro Program case in the 2031 AM peak period. This represents an 11 per cent increase, and is equivalent to the number of people who can be accommodated in 5 inbound lanes of freeway traffic. This additional travel is fairly evenly distributed between lines to the north and west and lines to the south east.

With the delivery of the Extended Program, a further 13,000 people would be travelling into central Melbourne by rail (29,000 compared to the base case). This is a 20 per cent increase in travellers compared to the base case, or 9 lanes of freeway traffic (8 per cent compared to the number of people who would be travelling into Melbourne in the Program case).

Once the Extended Program is delivered, more than two thirds of the additional people travelling into central Melbourne are being carried on trains coming in from the north and west, which includes people travelling on the suburban services extended to Melton. There is a 111 per cent increase in passengers on these lines between the Melbourne Metro Program and Extended Program cases (with a 43 per cent increase on lines to the south east between the same two scenarios).[9]

This growth continues to increase in the future and by the mid-2040s the number of additional people travelling into central Melbourne in response to the capacity delivered by the Melbourne Metro Extended Program increases to 59,000.[10]

[9] The morning peak hour is taken to represent 60 per cent of the travel in the two hour peak period. Road volumes are based on VicRoads traffic monitor data, and assume 800 vehicles per lane per hour on arterials & 1,900 per lane on freeways, with average occupancy of 1.1 people per car.

[10] This is forecast based on the Melbourne Metro extended program and does not include potential further major upgrades to capacity on these lines that may be delivered through other future projects. As shown in Section 5.4 lines to the north and west of Melbourne will be feeling capacity constraints prior to this time.

Table 3: Cordon throughput AM peak 2 hours – Melbourne Metro Program and Extended Program compared to Base Case

		Travellers into central Melbourne without Melbourne Metro (base case)		Travellers into central Melbourne with Melbourne Metro Program			Travellers into central Melbourne with Extended Program		
Rail Group	2011	2031	Compound Annual Growth 2011-2031	2031	Compound Annual Growth 2011-31	Difference Base-Melbourne Metro Program	2031	Compound Annual Growth 2011-2031	Difference Base-Extended Program
Services which currently travel through North Melbourne (Northern Group, including Melton Electrification)	40,000	85,000	3.8%	94,000	4.4%	9,000	104,000	4.9%	19,000
Services which currently travel through South Yarra (Caulfield Group)	38,000	61,000	2.4%	68,000	3.0%	7,000	71,000	3.2%	10,000
Total	78,000	146,000	3.2%	162,000	3.7%	16,000	175,000	4.1%	29,000

As Table 3 and Section 5.4 show, in addition to the extra people travelling into central Melbourne, Melbourne Metro represents a step change in capacity. Beyond meeting the immediate need for more capacity on the network, Melbourne Metro, including through delivery of the Extended Program, accommodates additional growth up to or well beyond the early 2030s.

5.6 Impacts on regional corridors

The demand forecasts indicated there is strong growth on the Melton corridor. As the Melbourne Metro tunnel is being designed with longer platforms to enable extended electrified trains to serve the Sunshine (Melton and Sunbury) to Dandenong corridor, these benefits have been included in the assessment of Melbourne Metro Extended Program.

5.6.1 Customer growth on the Ballarat/Melton corridor

The population and economy of Ballarat and Melton are growing. Population forecasts for the City of Melton indicate that it will grow from about 130,000 residents to 259,000 by 2031, a growth rate of over 4 per cent per annum. Ballarat is forecast to grow from about 100,000 to almost 140,000 over the same period, representing a growth rate of 2.4 per cent per annum.

As a result of this growth, the number of customers using services on the Ballarat/Melton corridor to travel into central Melbourne is anticipated to quadruple between 2016 to 2031. This will make it busier than the Frankston rail corridor is today and this growth is expected to further continue beyond 2031.

In addition, demand on other regional lines is also growing. In particular, the Geelong line will need to accommodate growth at Wyndham North and the Seymour/Shepparton line will need to accommodate growth in the Donnybrook and Beveridge growth areas. It will become increasingly challenging to accommodate all of this growth on V/Line trains. The western regional rail corridor from Southern Cross to Deer Park corridor will come under pressure as it tries to accommodate growing demand from Geelong, Wyndham North, Ballarat, Melton and Bendigo. There also will be considerable growth pressures at Southern Cross – the one central Melbourne station that accommodates demand from all regional lines.

5.6.2 Improving access and capacity to more job and education opportunities – Melbourne Metro services to Melton

The local economy along the Melton corridor is not as strong as other parts of Melbourne. This makes the area more dependent on other parts of Melbourne for job and education opportunities and drives the demand for train services.

A key component of the Melbourne Metro Program is to electrify and introduce metropolitan train services to Melton.

Services from Melton will use the Melbourne Metro tunnel to access a greater choice of destinations for customers along the Melton corridor across central Melbourne and to the south east. This provides people with more opportunities to directly access a higher number of jobs and study placements in a number of metropolitan locations, compared to a V/Line service going directly to and terminating at Southern Cross.

Introducing metropolitan train services to Melton will also help to alleviate growing pressure on V/Line services, which up until then would need to accommodate growth in the number of customers from Ballarat as well as to Melton.

5.6.3 Better services and more capacity for regional services

The introduction of longer trains on the Sunshine to Dandenong Corridor and future metropolitan services to Melton (through electrification) and additional track infrastructure between Sunshine and Deer Park will benefit customers on the Geelong/Wyndham North and Ballarat lines.

This is because the trains that were previously used to provide services to Melton will be reallocated to provide an additional service to Wendouree (Ballarat). The additional track capacity enables a number of services to run to Wyndham North.

Existing pressures will continue to grow if no additional capacity is provided on the Melton corridor. PTV is currently considering options to create additional capacity on the Melton corridor prior to the delivery of Melbourne Metro.

However it is currently anticipated that these options will only provide sufficient capacity until the mid to late 2020s. The upgrades delivered by the Melbourne Metro Extended Program will provide additional capacity and involves:

a) Constructing two additional tracks between Sunshine and Deer Park

b) Introducing suburban services to Melton, including standard length (7 car) HCMTs

c) Introducing extended (10 car) HCMTs onto the Melton/ Sunbury and Cranbourne/ Pakenham corridor

Melbourne Metro is therefore important in helping to grow capacity and patronage on the regional rail network.

6 Precinct and station impacts

Melbourne Metro will deliver five new stations. Three of these, Arden, Parkville and Domain stations, will directly connect these precincts to the heavy rail network for the first time. CBD North and CBD South stations will provide new entry points to the CBD. They will be located next to Melbourne Central and Flinders Street stations, increasing the overall capacity of these already busy locations and providing another opportunity for travellers to interchange with other train lines.

Even for areas already well served by tram and bus services, such as Parkville and Domain, providing a new station delivers a step change in the number of public transport commuters able to travel to these areas in peak times, as well as providing more efficient travel options from an increased range of locations. This will provide relief to north-south tram services, which currently have to focus on the St Kilda Road/Swanston Street corridor. Access to this new infrastructure underpins the forecast changes in public transport demand to these precincts as a result of Melbourne Metro. Improving public transport access to areas on the edge of the CBD will help to meet the increased demand for travel stemming from the ongoing growth in employment and consequent CBD expansion.

Melbourne Metro will also change how people use existing stations, i.e. travellers may use the new CBD stations rather than the existing City Loop stations. People may vary where they transfer between train services in response to the network changes and new travel opportunities delivered by Melbourne Metro.

The following sections describe each precinct and include maps with information about public transport journey improvements expressed in terms of total generalised travel time and cost. Total generalised travel time and cost is determined by measures such as travel time improvements, changes to crowding and wait times. The analysis therefore reflects a more comprehensive representation of a person's travel experience than simpler measures, such as changes to public transport travel times.

6.1 Newly served precinct: Arden

According to the Reference Case land use forecasts Arden Station will provide train access to 12,000 jobs and 7,000 residents (within 800 metres of the station) in 2031. This land use forecast and associated transport demand forecasts represent the 'business as usual' scenario and is the same in the Program/Extended Program and base cases. Higher station use would be expected to occur with proposed urban renewal plans and initiatives generate further development around the new station.

Under this scenario, the station will be used by about 3,500 people every day in the early 2030s. The relatively higher number of people exiting the station in the morning peak (compared to people entering it), indicates that, while not busy compared to Parkville and Domain, it will be used as a destination station for people travelling to the area for day time activities.

More than 90 per cent of people using the station will access Arden Station on foot in the morning peak two hour period, with the remainder using local bus and tram services.

This station has been recognised to have the potential to serve as a catalyst for renewal in the surrounding precinct. However, the land use forecasts in the Reference Case represent a '"policy neutral"' scenario. These forecasts does not incorporate the station demand that would result if the full urban renewal potential of Arden Station is developed by supportive initiatives to realise its full benefits. These initiatives will be subject to a separate business case for the Arden urban renewal area.

Figure 24 illustrates the change in the total generalised travel time and cost for people travelling to Arden Station. It demonstrates that these journey improvements are concentrated in the west and inner south-east along the lines connected by Melbourne Metro, and that these effects increase in the Extended Program.

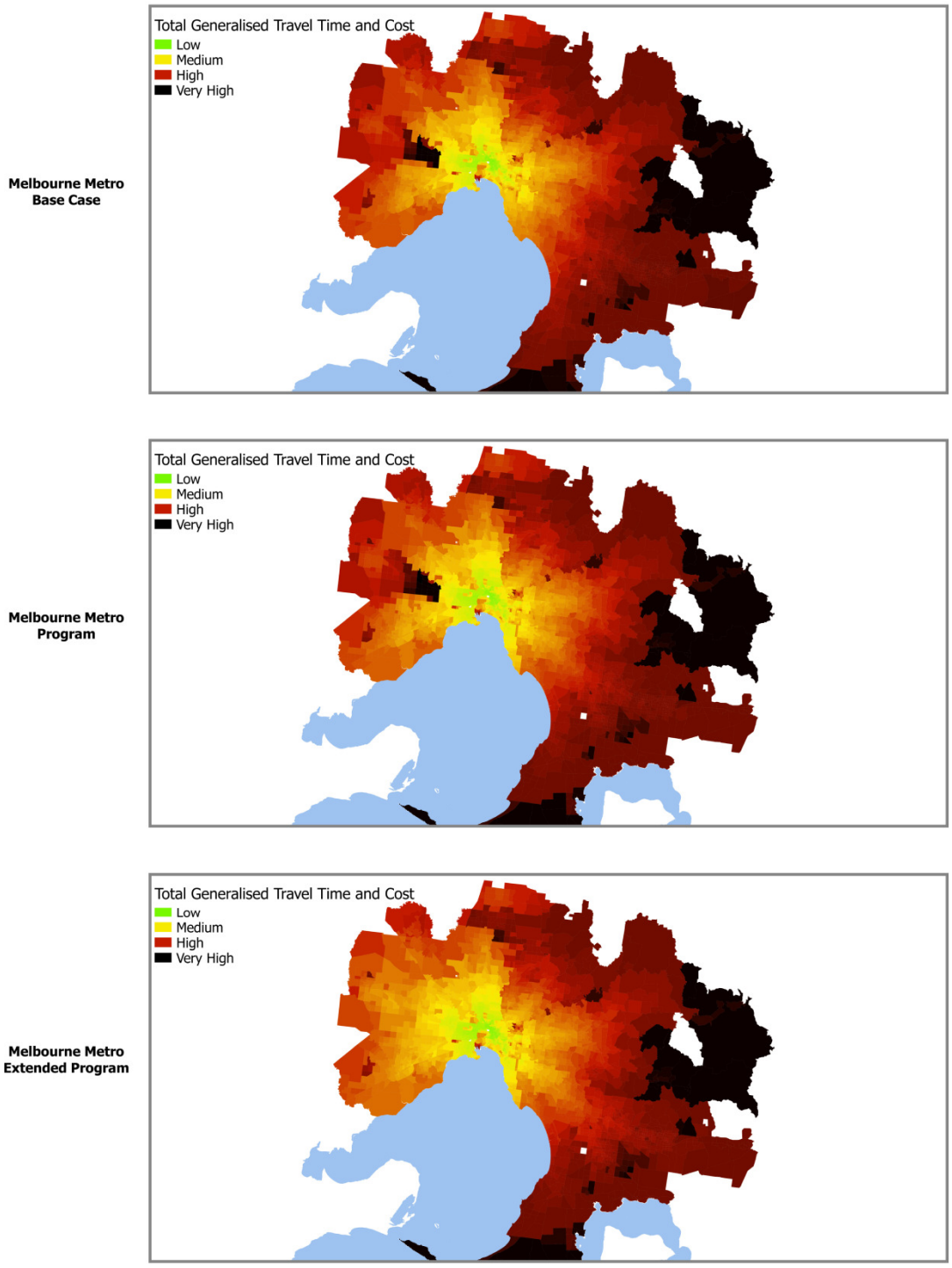


Figure 24: Total generalised travel time and cost to Arden Station with and without Melbourne Metro

6.2 Newly served precinct: Parkville

Parkville Station will provide access to around 45,000 jobs, 14,000 residents and 70,000 tertiary students (within 800 metres of the station). The job catchment increases to 65,000 jobs when taking into account that, with a short tram trip, travellers will be able to access destinations north along Royal Parade and Flemington Road, such as the Royal Children's Hospital.

It will be used by nearly 55,000 passengers each day in 2031 – making it much busier than Flagstaff Station is today. The majority of people arriving via Parkville Station will do so in the morning and inter-peak periods. This is reflective of the station's function as a destination for both workers and students. The relatively high level of entries in the off-peak period is understood to be reflective of the evening activity at the nearby university, as well as shift workers from the hospital precinct.

Table 4: Parkville Station Entries and Exits 2031

	Entries	Exits
Morning Peak	400	12,400
Afternoon Peak	15,900	1,500
Daily	27,900	27,000

Source: Jacobs (ClicSim). Afternoon Peak figures have been presented for 3-6 pm for consistency with VITM outputs.

Around five in six passengers will walk to or from the station, with the rest accessing it by bus and tram.

Analysis of the ultimate destinations of passengers that transfer onto bus and tram when they exit the new station shows that they will use it to connect to destinations along Royal Parade and Sydney Road, as well as the Royal Children's Hospital and other nearby locations on Flemington Road.

Table 5: Parkville Station access by mode 2031

Mode	Access	Egress
Walk	81%	83%
Bus and Tram	19%	17%

Source: AECOM/Arup (VITM)

While it is currently served well by tram and bus, providing rail access to Parkville means that many people will experience shorter public transport journeys when traveling to the precinct and provide crowding relief to nearby tram and bus services.

Public transport passengers on the Sunbury/Melton and Cranbourne/Pakenham rail corridors will have a direct train connection to the precinct. Passengers on the Newport, Ballarat, Bendigo and Geelong and Frankston corridors have the opportunity to transfer at Footscray and Caulfield respectively to access this service.

Passengers on other lines are able to change at CBD North or CBD South to access train services, complementing the tram or bus options already available. These benefits are demonstrated in analysis of access changes to the precinct.

Building the Melbourne Metro program will result in over 740,000 more Melburnians living within 30 minutes of public transport travel time of the precinct, thanks to the new Parkville Station, and 1.2 million more Melburnians living within 60 minutes of travel by public transport. The Extended

Program will increase the number of people living within 30 minutes of the precinct by another 5 percent. Melbourne Metro will increase the motorised mode share of public transport for people travelling to the area in the morning peak period from 66 per cent in 2011 to 83 per cent in 2031.

The improvements in travel experience to the Parkville precinct are illustrated in Figure 25, which illustrates the change in total generalised travel time and cost to Parkville. It demonstrates that travel time improvements extend furthest in the west and inner south east along the lines connected by Melbourne Metro. The benefits on these corridors are enhanced with the Extended Program, including improved connectivity to the precinct from the Melton corridor. There will also be noticeable travel time improvements along train lines in the north and east as well, as people are able to transfer to a Melbourne Metro service rather than a slower tram service to access the Parkville precinct.

This measure includes effects of wait times and crowding on public transport to provide a weighted cost of travel for people coming to Parkville from any given location. The illustrated improvements therefore incorporate the crowding relief on lines serviced by Melbourne Metro, as well as improved travel times to the precinct, which travellers on many lines will benefit from.

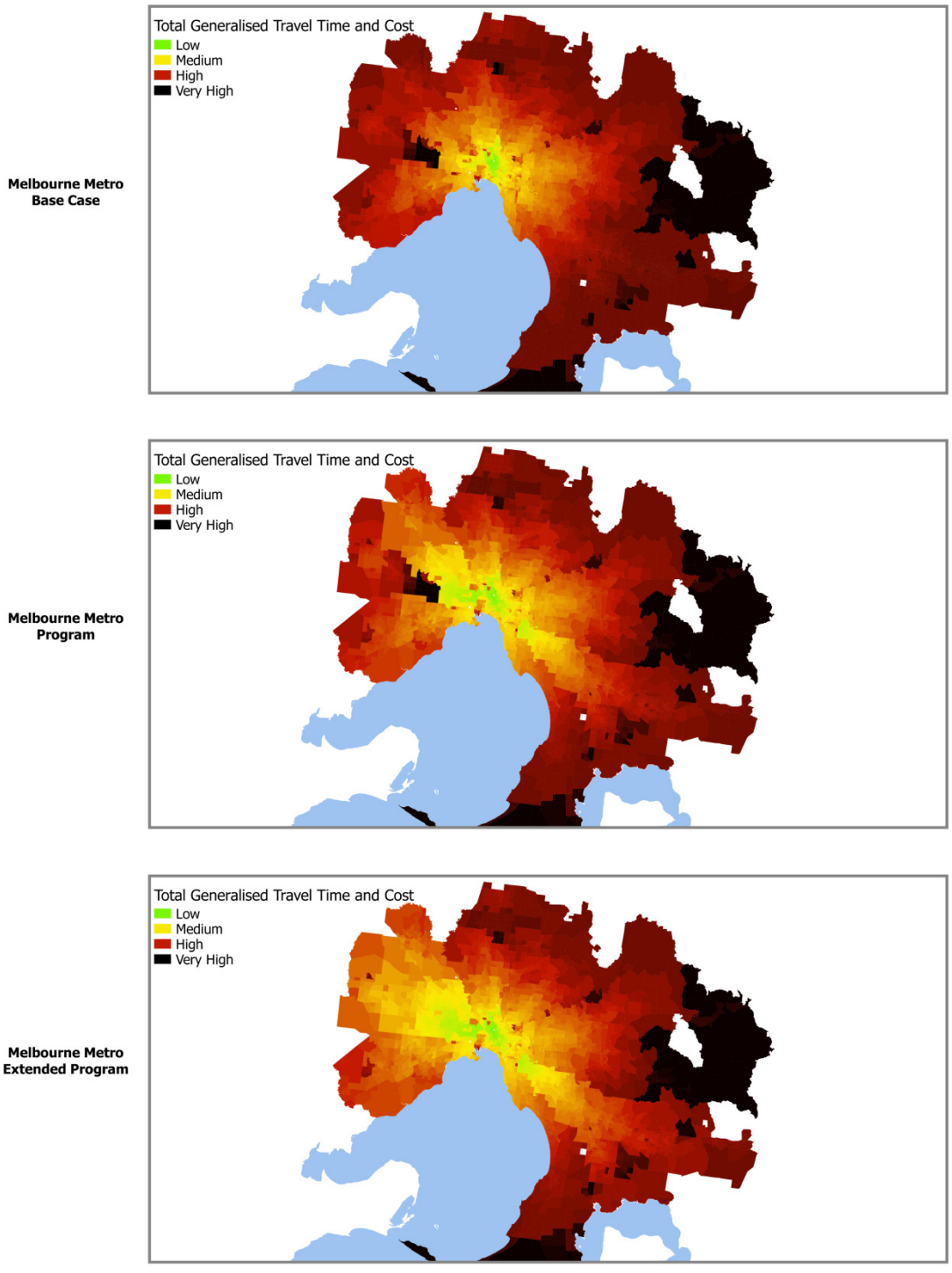


Figure 25: Total generalised travel time and cost to Parkville Station with and without Melbourne Metro

6.3 Newly served precinct: Domain

Domain Station will provide access to 33,000 jobs and 17,000 residents (within 800 metres of the station).

Its location at the convergence of the St Kilda Road tram routes at Domain Interchange will effectively expand its catchment and make it an important tram-train interchange station, providing access to Southbank, South Melbourne and services operating on William and Spencer Streets to the CBD. It will also be an important interchange for those destined for the southern parts of St Kilda Road, such as the Alfred Hospital precinct.

When also taking into account the jobs accessible with a short tram interchange, the job catchment is over 110,000 jobs (excluding jobs in the CBD on William and Spencer Streets).

It will be used by almost 40,000 people each day in 2031, making it about as busy as Flagstaff Station is today. The majority of people arriving via Domain Station will do so in the morning and inter-peak periods. This is reflective of the station's function as a destination for workers travelling to jobs along St Kilda Road.

Table 6: Domain Station Entries and Exits 2031

	Station Entries	Station Exits
Morning Peak	1,300	7,800
Afternoon Peak	9,200	2,100
Daily	18,900	19,100

Source: Jacobs (ClicSim) . Afternoon Peak figures have been presented for 3-6 pm for consistency with VITM outputs.

Given its location at a major tram interchange network where many routes converge, there is a relatively even split between walking and tram (and bus) connections. This indicates that the station provides an important connection to trams travelling through Domain Interchange.

Analysis of the ultimate destinations of these tram and bus trips is showing people are using the station for connectivity with destinations further south along St Kilda Road towards the Alfred Hospital, as well as along Kings Way into the Southbank precinct.

Table 7: Domain Station access by mode 2031

Mode	Access	Egress
Walk	45%	43%
Tram and Bus	55%	57%

Source: AECOM/Arup (VITM)

By providing suburban train access to Domain, many people will experience shorter public transport journeys to the precinct. Public transport passengers on the Sunbury/Melton and Cranbourne/Pakenham rail corridors will now have a direct train connection to the precinct. Passengers on the Newport, Geelong, Ballarat and Bendigo and Frankston corridors have the opportunity to transfer at Footscray and Caulfield respectively to access this service.

Passengers on other lines are able to change at CBD North or CBD South stations to access a faster, less crowded train service than the tram options previously available.

The completion of the Melbourne Metro Program will result in 814,000 more people within 30 minutes of public transport travel time of the precinct, due to the new Domain Station, and more than 1.4 million people will be within 60 minute travel by public transport. The Extended Program will increase the number of people living within 30 minutes of the precinct by another 5 percent.

Melbourne Metro will replace a longer tram leg between Flinders Street Station and Domain than it will between Melbourne Central Station and Parkville.

Melbourne Metro will increase the motorised mode share of public transport for people travelling to the area compared from 33 per cent in 2011 to 62 per cent in early 2030s.

The improvements in travel experience to the Domain precinct are more clearly illustrated in Figure 26, which illustrates the change total generalised travel time and cost to Domain. It demonstrates that while travel time improvements extend furthest in the west and inner south-east along the lines connected by Melbourne Metro, there are noticeable travel time improvements along train lines in the north and east as well, as people are able to transfer to a Melbourne Metro service rather than a slower tram service to access the Domain precinct.

This measure includes effects of wait times and crowding on public transport to provide a weighted cost of travel for people coming to Domain from any given location. The illustrated improvements therefore incorporate the crowding relief on lines serviced by Melbourne Metro, as well as improved travel times to the precinct, which passengers on many lines will benefit from.

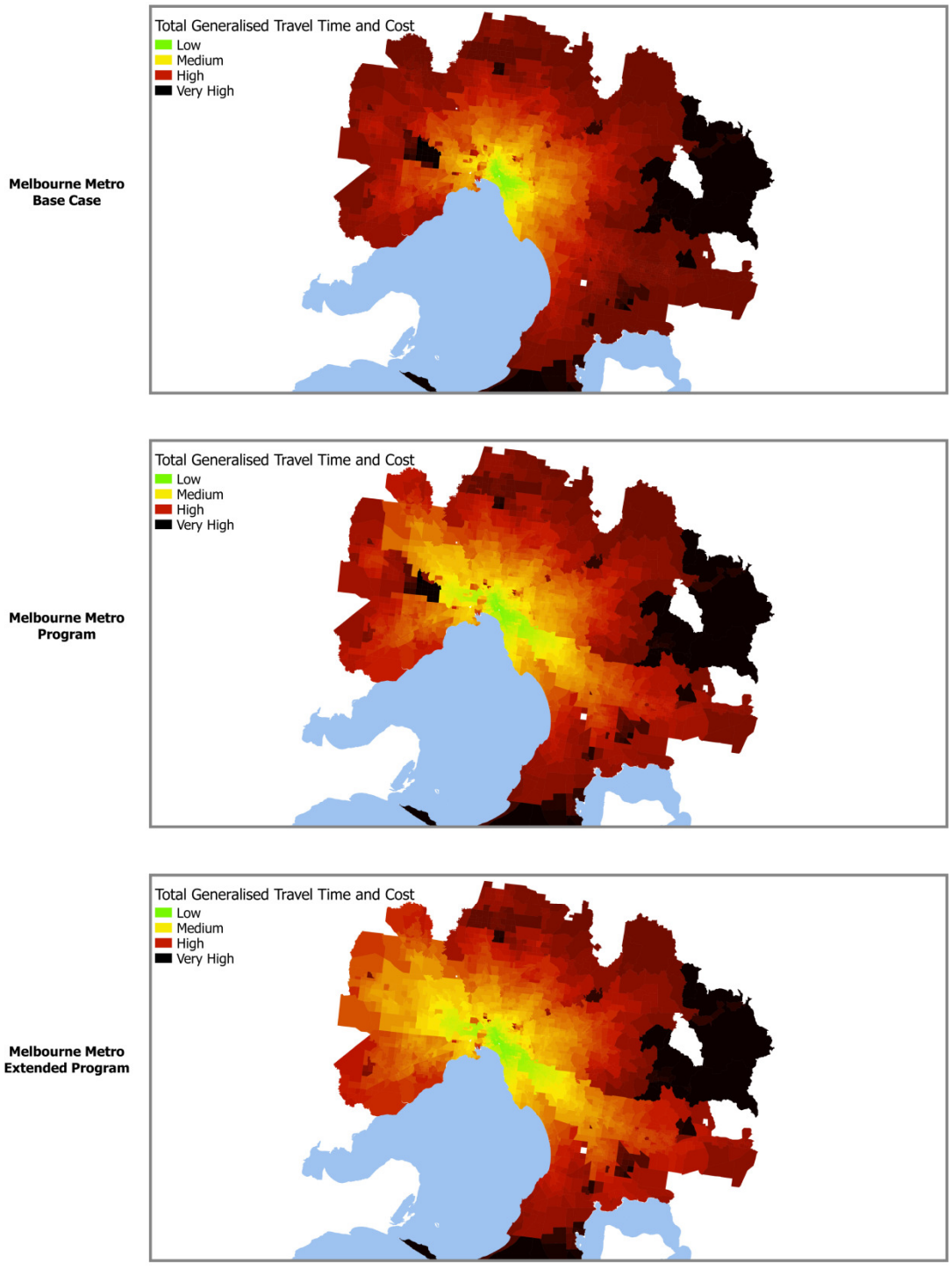


Figure 26: Total generalised time and cost of travel to Domain Station with and without Melbourne Metro

6.4 Changes in station use in the CBD

By introducing two new CBD stations, Melbourne Metro helps to support the growing number of trips into the CBD, including providing relief to current station over-crowding. The network changes introduced by the Melbourne Metro also affect where people will change between services.

The changes in the use of the existing CBD stations (entries, exits and transfers) are outlined in Table 8. The stations with the biggest changes, in terms of the numbers of passengers affected, will be at Flinders Street and Melbourne Central stations, which are now augmented with additional station capacity due to the new CBD South and North stations.

Forecasts also indicate that the Sunshine-Dandenong corridor will be the busiest corridor, with the morning peak loads carrying more passengers than any other corridor. Diverting this line from the City Loop is an effective way to relieve crowding at central city stations.

Parliament and Flagstaff will also experience a reduction in station entries and exits as their catchments will overlap with part of the new CBD North and South catchments. Travellers who currently either walk or make a short tram trip to their ultimate destination will be within the catchment of the two new stations and may decide to use them instead.

Table 8: Changes in CBD station use due to Melbourne Metro (2031)

Station	AM Peak (base)	AM Peak Use (Program)	% Change in AM peak use	Daily Use (base)	Daily Use (Program)	% Change in Daily use
Flinders Street	75,000	61,000	-18	345,000	257,000	-26
CBD South	-	23,000	-	-	95,000	-
Melbourne Central	29,000	20,000	-31	149,000	115,000	-23
CBD North	-	22,000		-	88,000	
Southern Cross	108,000	85,000	-21	428,000	342,000	-20
Parliament	34,000	27,000	-21	135,000	108,000	-20
Flagstaff	16,000	13,000	-17	74,000	66,000	-11

6.4.1 Station crowding

Without the implementation of Melbourne Metro, the forecast growth in patronage at CBD stations by 2031 will exacerbate overcrowding issues. For example, at Flinders Street Station there are expected to be 60% more passenger movements (boardings, alightings and transfers) in 2031 than there were in 2011. This will lead to:

- more crowded platforms and concourse, particularly on platforms and access paths to Northern Group, Cranbourne/Pakenham and Frankston line services
- greater waiting times for access to ticket barriers and escalators
- high levels of crowding in the Elizabeth Street and Degraves Street subways, with more crowding on the Swanston Street concourse and access.

This forecast increase in station crowding will extend the time it takes for passengers to move between the train and station entries and exits, thereby eroding customer experience. This increase in the number of passengers in stations makes it likely that it will take longer for

passengers to evacuate the stations, and may require more complex arrangements to ensure passenger safety.

The implementation of Melbourne Metro provides crowding relief to many of the central city stations by giving passengers an additional two city stations plus direct access to Arden, Parkville and Domain precincts without the need to transfer to tram services, reducing the number of passengers at the existing interchange stations. With this reduction in passengers, crowding significantly decreases at Flinders Street and Melbourne Central stations, replacing it with further interchange options and major passenger movement between CBD South and Flinders Street, and CBD North and Melbourne Central.

6.4.2 Change in total generalised travel time and cost – CBD North and CBD South

Figure 27 presents the change in total generalised travel time and cost between base, Program and Extended Program cases for Melbourne Central and CBD North. It illustrates that lines to the north and west benefit as a result of reduced crowding, as well as lines to the south-east. The Frankston line also benefits as all of its services will operate through the City Loop when the project is implemented. A similar outcome also occurs for CBD South.

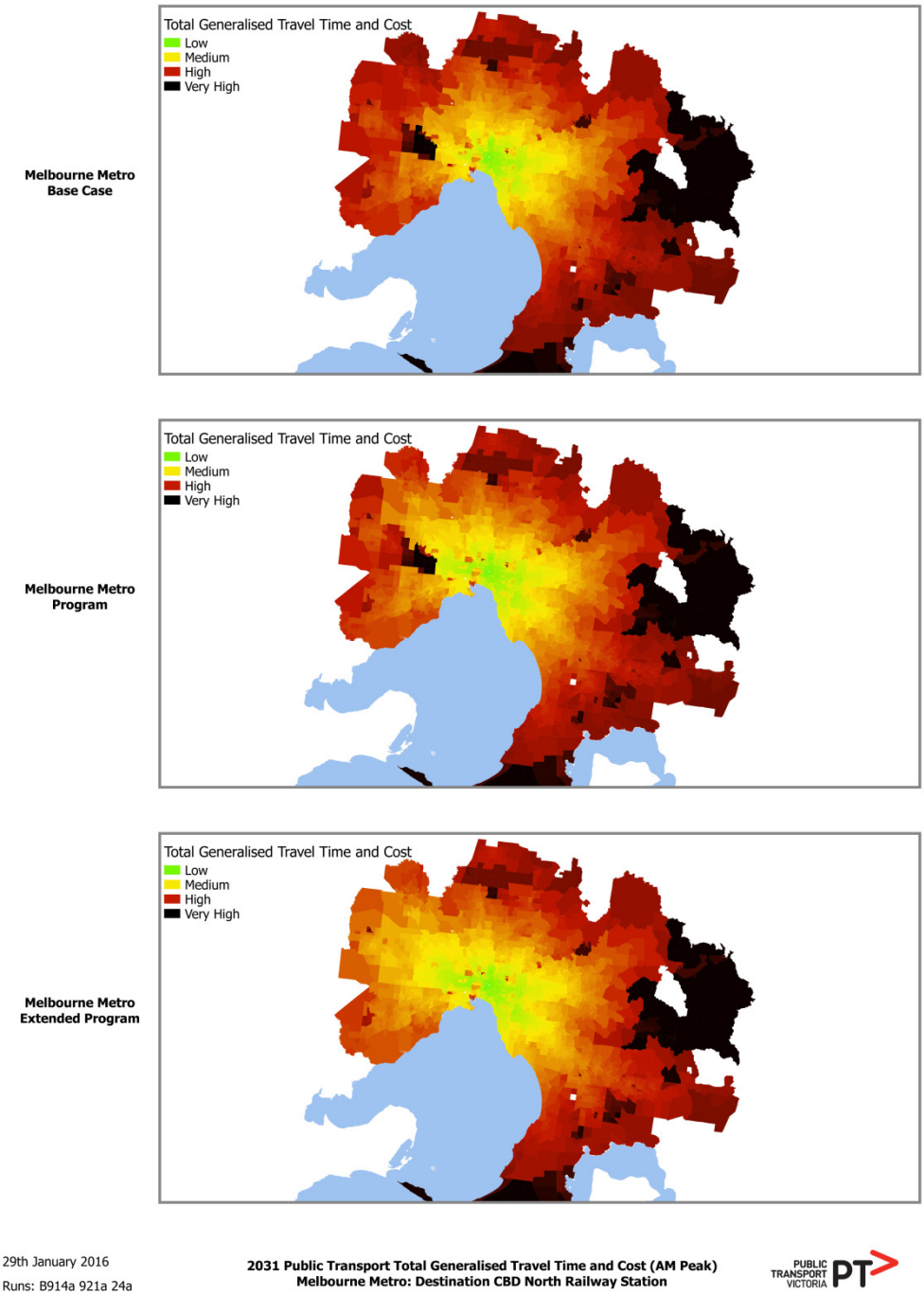


Figure 27: Total generalised travel time and cost to CBD North Station with and without Melbourne Metro

6.5 Change in station use – interchanges

Melbourne Metro opens up new destinations to the train network, but by separating metropolitan lines and creating independent rail corridors, there will also be changes to which rail lines service the various inner city destinations.

This configuration increases the range of destinations that are directly served by trains and opportunities for some people to travel directly to their destination. For example, this means that some passengers may no longer need to change to another train, tram or bus to travel to the Parkville precinct.

However, it also means that some passengers will need to change services to access their ultimate destinations. Melbourne Metro will create more interchange opportunities on the rail network by providing new key interchange stations to travel into central Melbourne the opportunity to interchange across a number of stations.

Although some passengers may need to interchange between services, the creation of independent lines will enable train services to operate more frequently. In some cases, this will allow passengers to get to their destination more quickly even if they need to interchange to do so. For example, if a passenger changed from a Frankston train to an express service on the Melbourne Metro corridor at Caulfield Station, or changed from an Upfield or Craigieburn service at North Melbourne to a service using the Melbourne Metro tunnel to get to the new Domain, the CBD or Parkville stations). These changed interchange patterns are reflected in Figure 29.

At the moment, most interchanges currently occur at Footscray, North Melbourne, Southern Cross, Flinders Street and Richmond. After Melbourne Metro is implemented, CBD North, CBD South and Caulfield stations will also become major interchanges. The distribution over a greater number of interchanges, shown in Figure 28, will help alleviate station crowding.

Sandringham passengers will also benefit from Melbourne Metro as currently, services on this line do not travel through the City Loop and terminate at Flinders Street Station. Once Melbourne Metro is implemented, Sandringham services will run through to Southern Cross Station and directly on to the Werribee line. Sandringham passengers will no longer have to transfer at Flinders Street Station to get to Southern Cross Station.

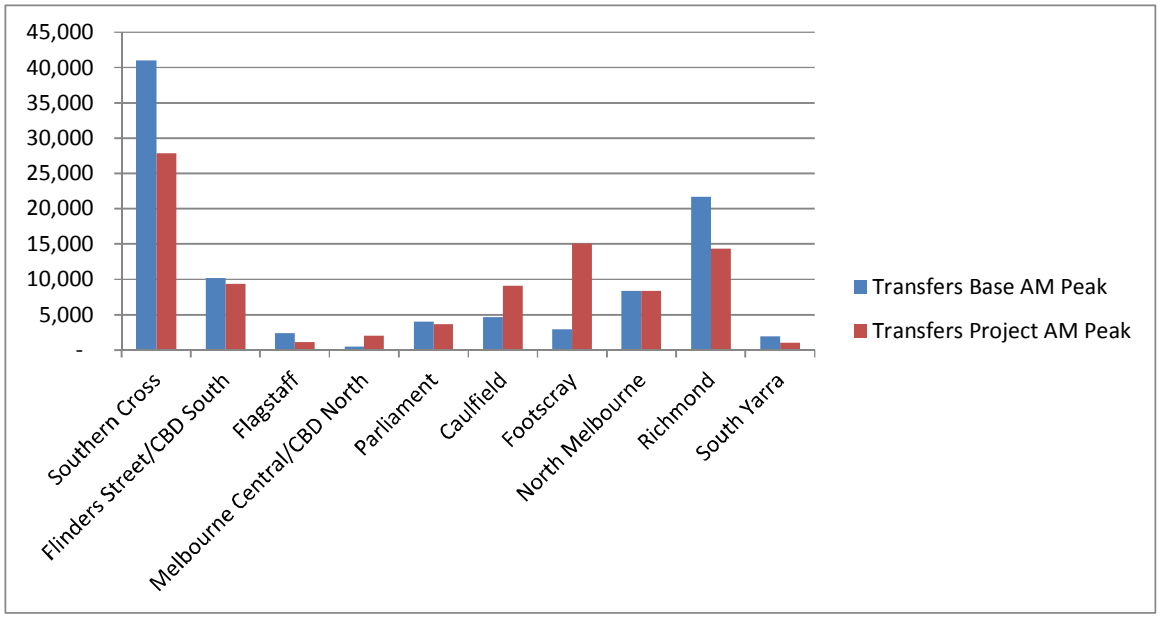


Figure 28: Change in Transfer Behaviour between Train Services (AM Peak 2031)

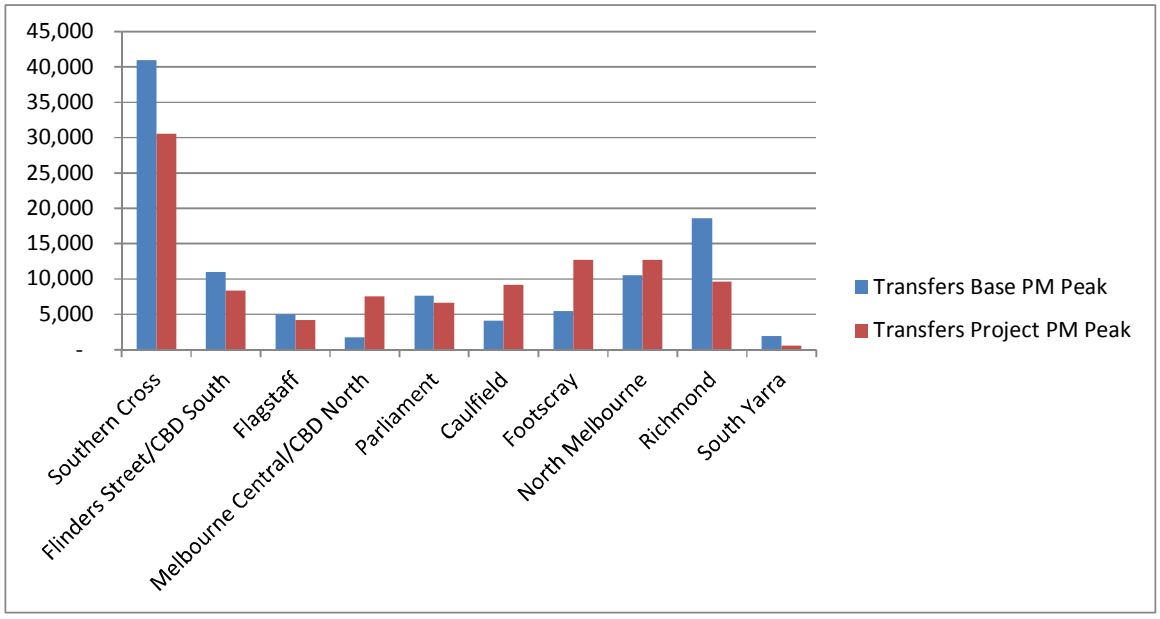


Figure 29: Change in Transfer Behaviour between Train Services (PM Peak 2031)

6.6 Impacts on other stations, clusters and activity areas

Melbourne Metro also impacts the station entries and exits of a number of existing stations across the train network as presented in Figure 30 and Figure 31. In particular, there are a number of destination stations where patronage is forecast to increase. These include:

- Footscray Station (which serves Victoria University)
- Caulfield and Huntingdale stations (which serve the Caulfield and Clayton campuses of Monash University)
- Clayton Station (which serves the Monash medical precinct and the university)

These locations benefit from reduced crowding on services. They also benefit from the joining the Sunshine and Dandenong corridors to become a cross city corridor, making it easier to travel between the west and south-east without interchanging.

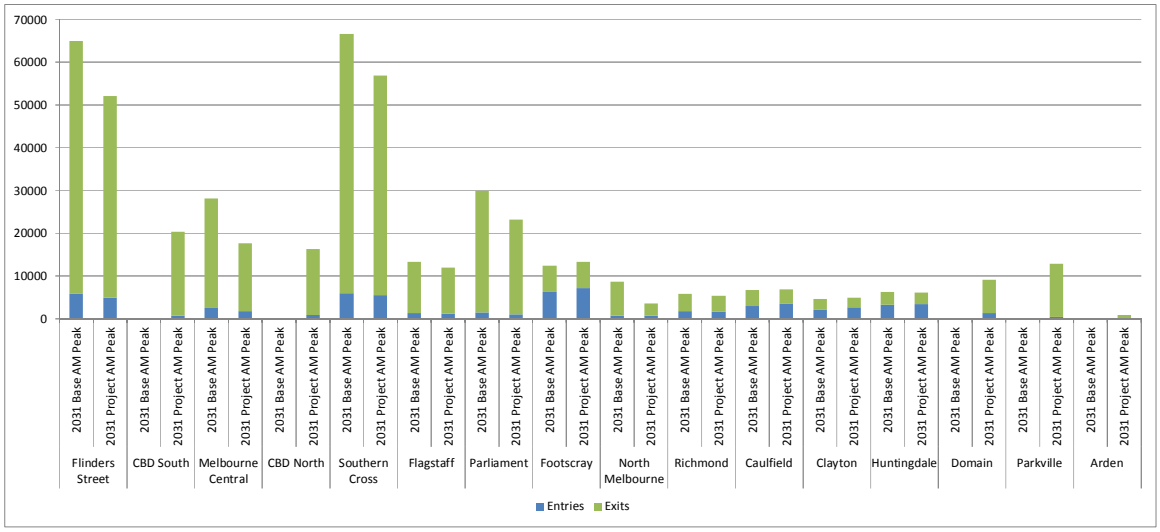


Figure 30: Changes in Station Entries and Exits in 2031 (AM Peak 2031)

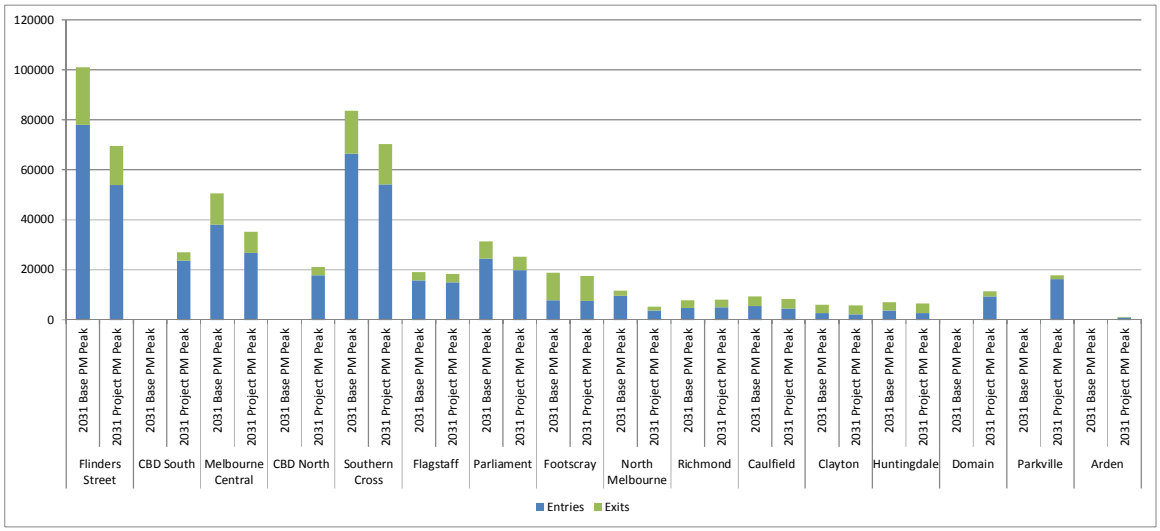


Figure 31: Changes in Station Entries and Exits in 2031 (PM Peak 2031)

6.6.1 Monash National Employment Cluster

The Monash National Employment Cluster will benefit from increased public transport penetration into the western suburbs.

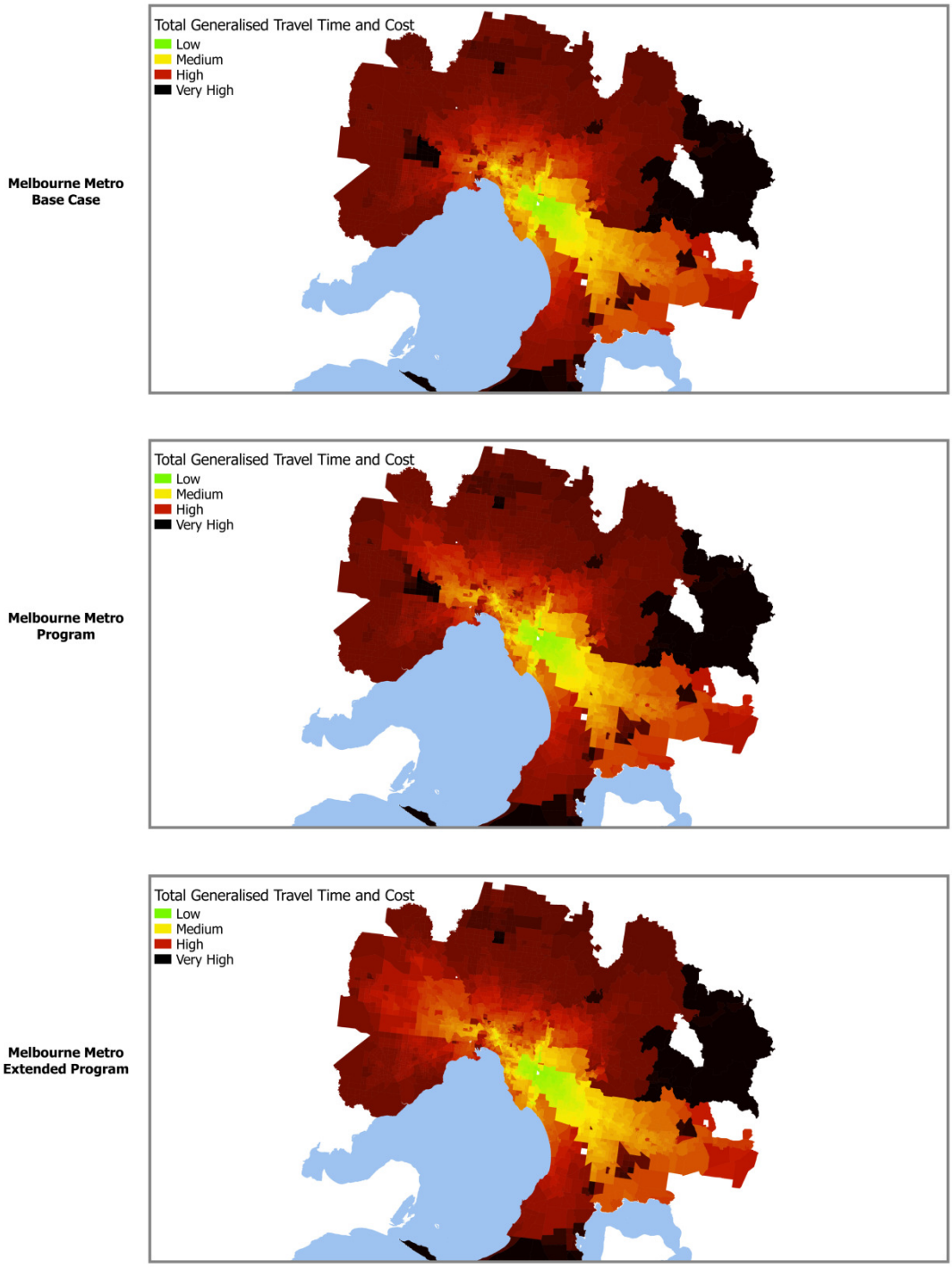


Figure 32: Total generalised travel time and cost to Monash (Huntingdale Station) with and without Melbourne Metro

6.6.2 Sunshine National Employment Cluster

The Sunshine National Employment Cluster clearly shows the benefits of improved east-west train connectivity, with improved access into Parkville and down into the south-east of Melbourne through to Caulfield.

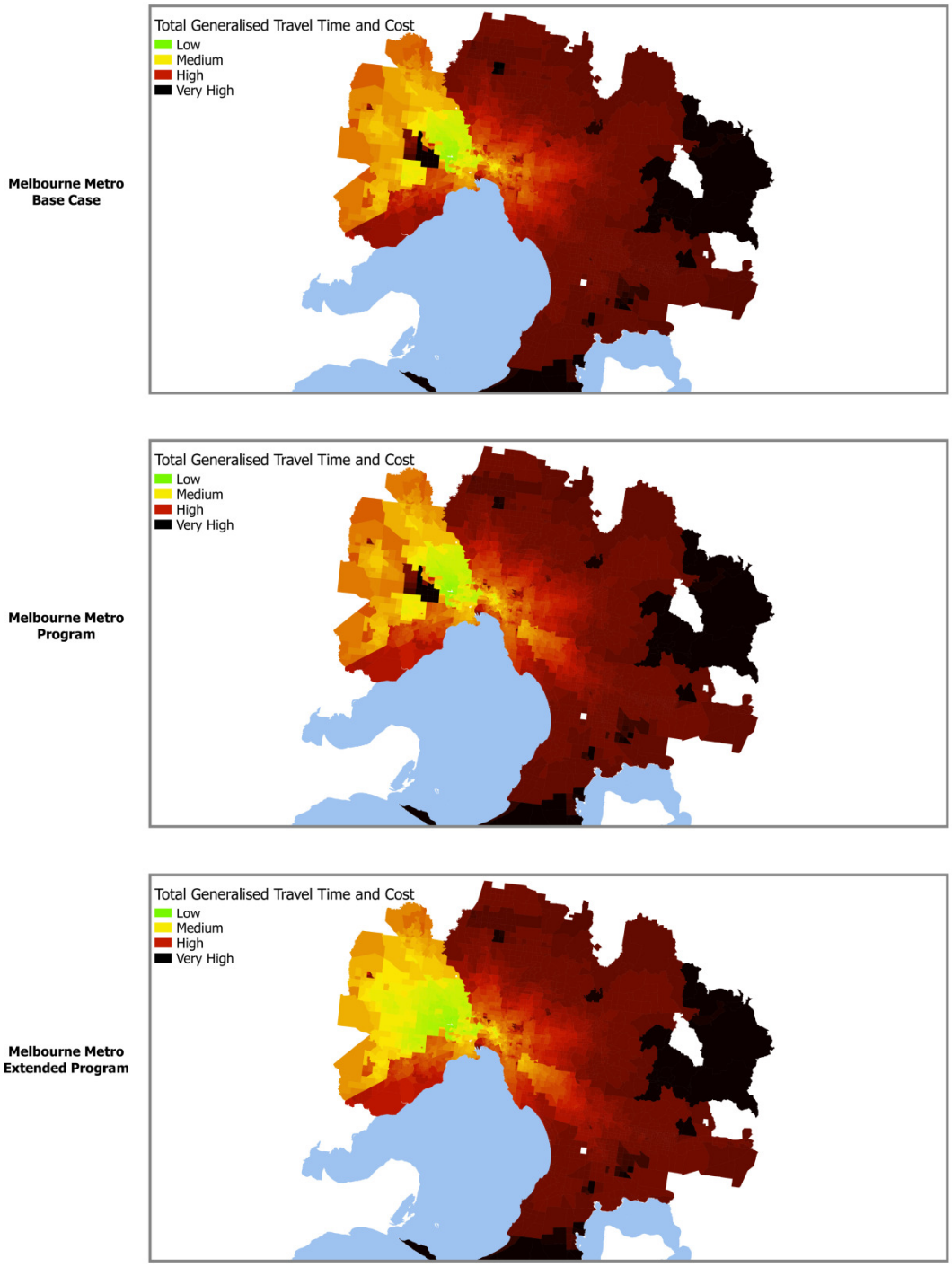


Figure 33: Total generalised travel time and cost to Sunshine with and without Melbourne Metro

6.6.3 Footscray Metropolitan Activity Centre

Due to its proximity to inner Melbourne, the Footscray Metropolitan Activity Centre maintains important connections with the Sunshine Employment Cluster, Parkville and activity centres in the south-east. These connections are strengthened under Melbourne Metro, in particular the Extended Program, which targets the Sunshine-Dandenong corridor.

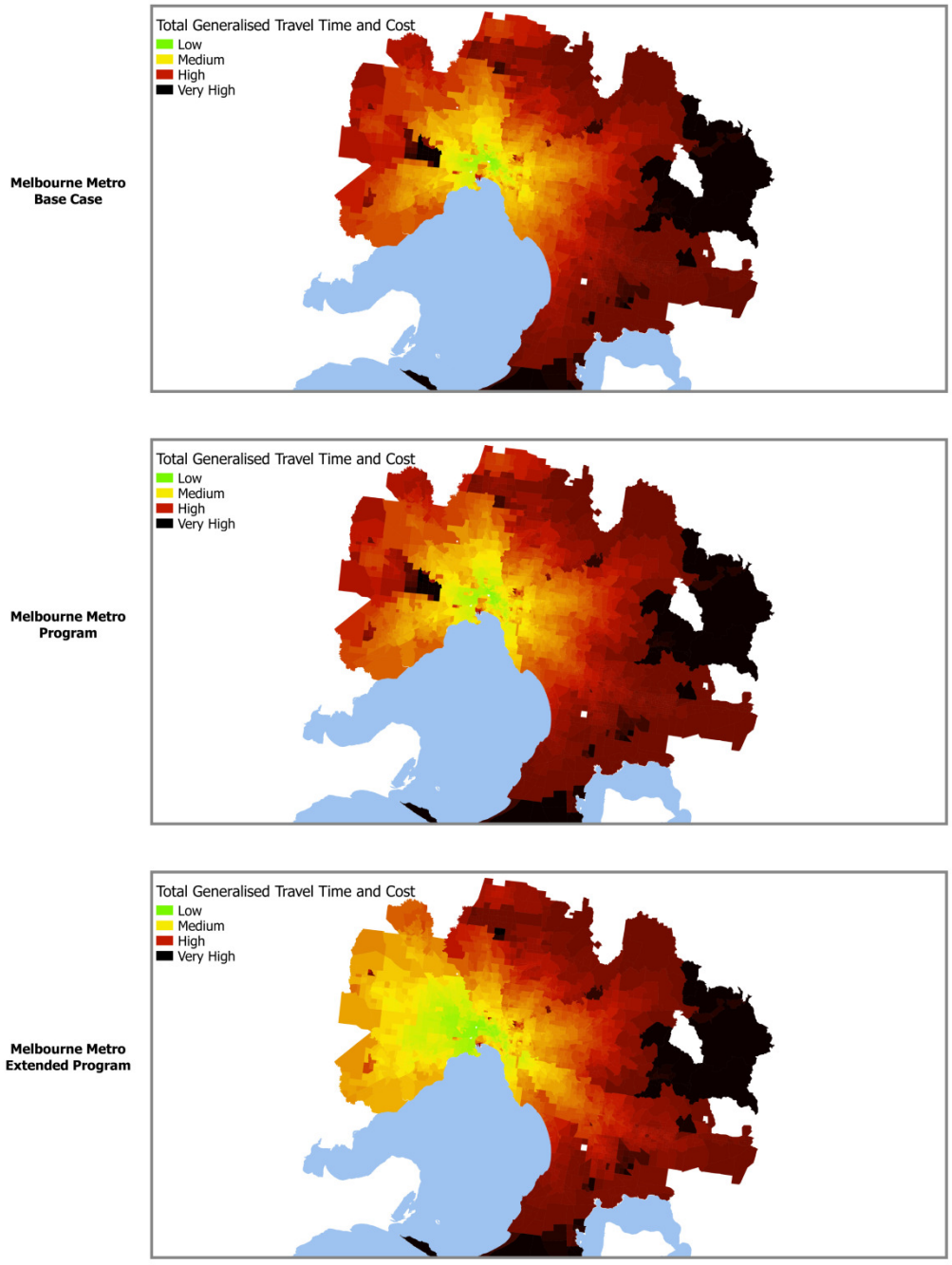


Figure 34: Total generalised travel time and cost to Footscray with and without Melbourne Metro

6.6.4 Caulfield Activity Centre

Due to its proximity to the train network, the Caulfield Activity Centre will benefit from uplifts along the corridors upgraded by Melbourne Metro. There is improved access to Caulfield along the Sunshine-Dandenong corridor, which receives further upgrades in the Extended Program.

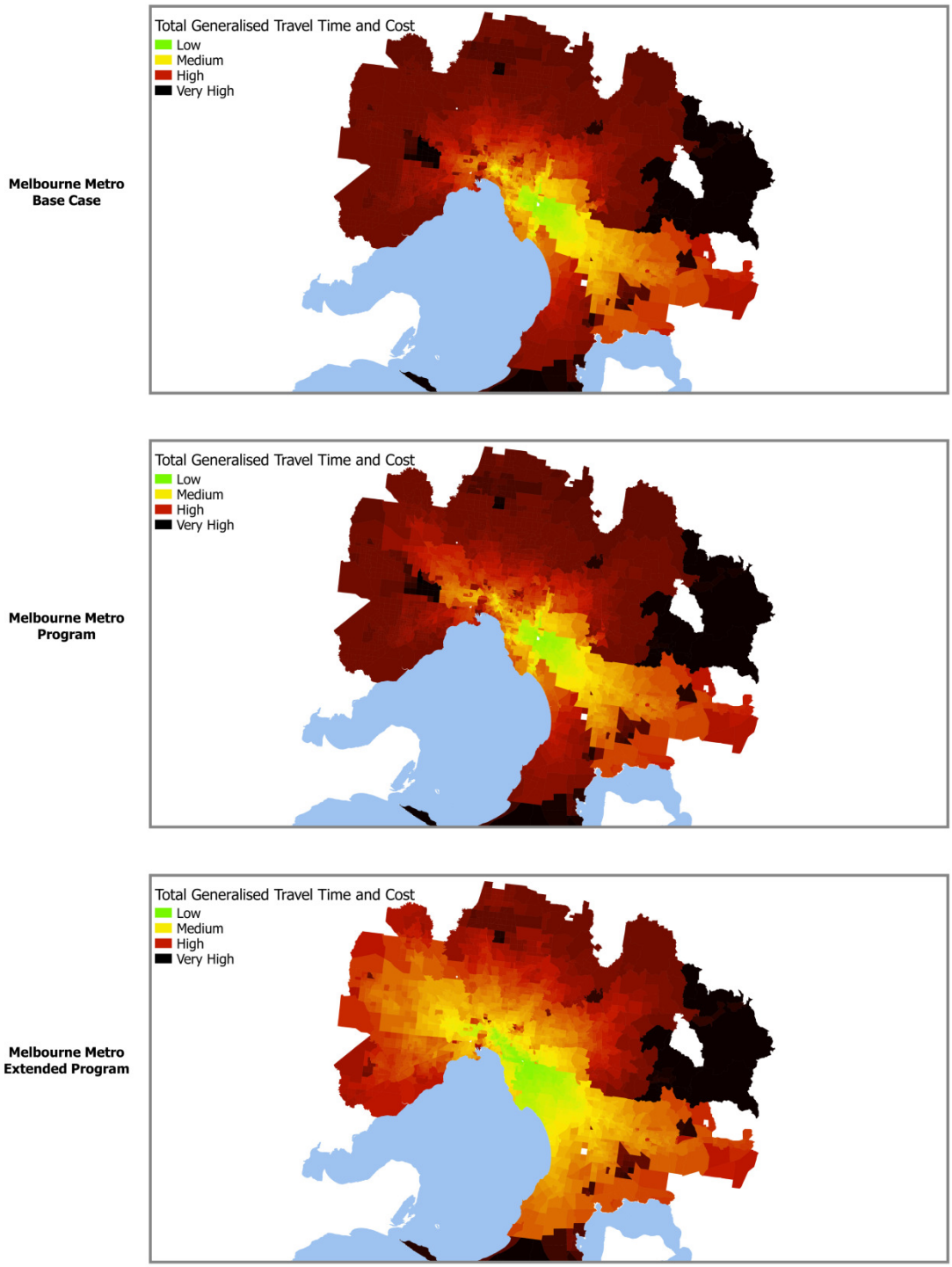


Figure 35: Total generalised travel time and cost to Caulfield with and without Melbourne Metro

6.6.5 Unlocking the west

Accessibility to jobs and study opportunities in Melton is currently restricted by its distance from the CBD. The Melbourne Metro Extended Program increases access to Melbourne's western suburbs and central Melbourne for Melton residents.

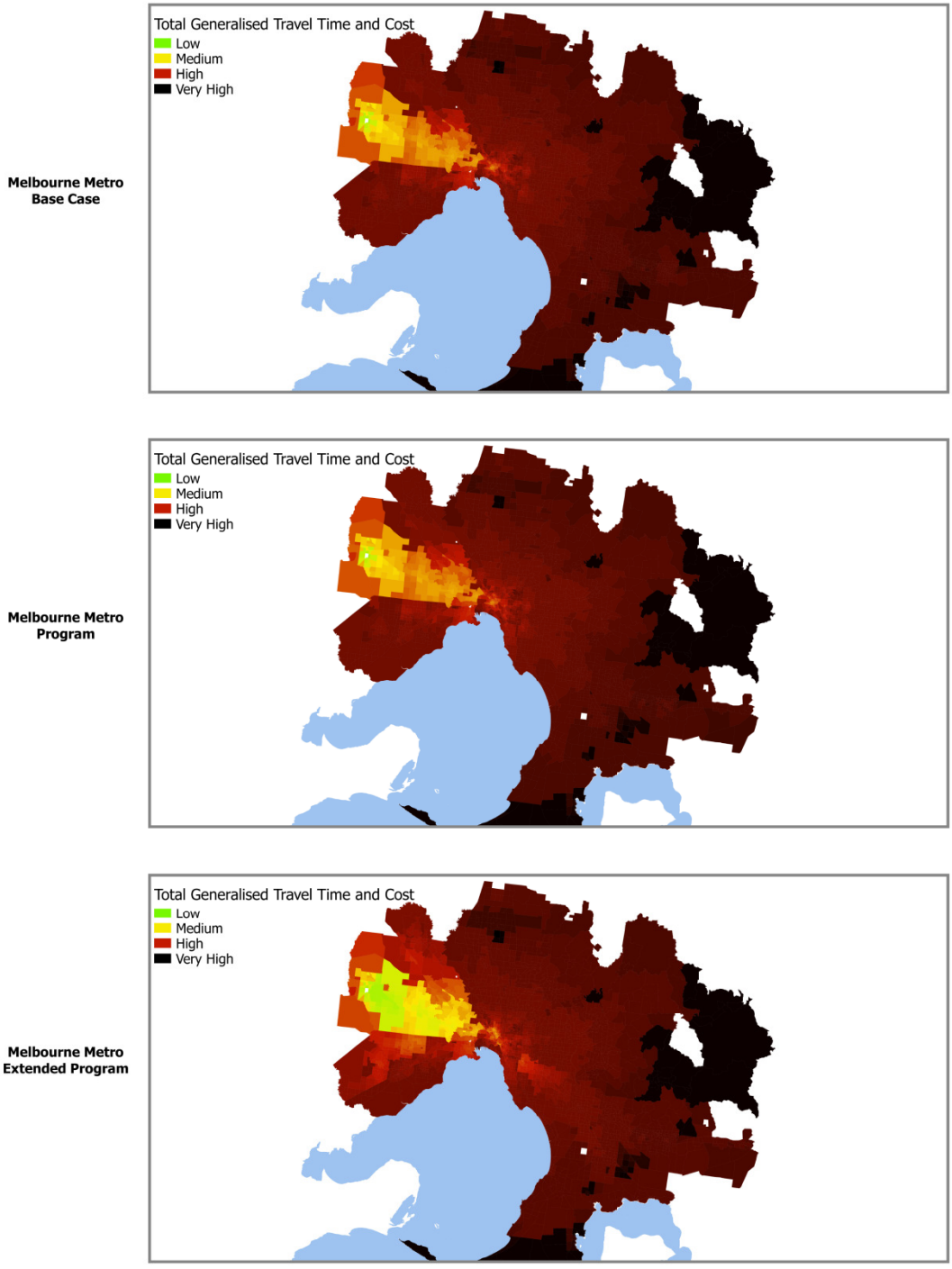


Figure 36: Total generalised travel time and cost to Melton with and without Melbourne Metro

7 Public transport network impacts

7.1 Overall impacts

The Melbourne Metro Program is forecast to increase the number of boardings on the metropolitan train network by over 16,000 in the morning peak period in 2031 compared to the case without the program. The benefits from this increase, which are enabled by the additional capacity delivered by the project, are complemented by the crowding relief this capacity provides to existing passengers on key lines which would otherwise be above load standard as shown in Section 5.4. The Extended Program is forecast to increase this by another 21,000 (or 37,000 additional boardings compared to if Melbourne Metro is not built). This is a result of travellers diverting from other modes to metropolitan train.

The Melbourne Metro Program results in an extra 52,000 public transport trips each day and a decrease of 50,000 car trips each day in 2031. This increases to an additional 90,000 public transport trips and 87,000 fewer car trips in the Extended Program.

There will be a net decrease of 9,000 V/Line boardings in the morning peak period in the Extended Program making these services less crowded (the change in the Melbourne Metro Program is minor). The decrease is a result of the electrification to Melton in the Melbourne Metro Extended Program case, which is offset by an increase in boardings on new services to Wyndham North and a new service to Wendouree (Ballarat) in 2031 (enabled by the redeployment of V/Line rolling stock that served the Melton corridor).

There will also be a decrease in tram boardings as travellers divert from tram services, particularly those travelling the north-south route currently catered to by the Swanston Street and Elizabeth Street tram corridors to train services. This will address crowding issues on the tram network and increase capacity (this is more fully explored below).

There will be a net decrease in bus boardings which is reflective of a combined outcome: a reduced demand for bus services operating on Route 401 (from North Melbourne Station to the Parkville precinct), will be offset by increases in additional bus boardings in other parts of the metropolitan area due to some new train passengers using a bus to get to the station, and an overall improvement in the attractiveness of public transport. This offset is stronger in the Extended Program.

Table 9: Boardings and trips by Mode in AM Peak in 2031

2031 Constrained AM 2 hours	2031 Base	2031 Melbourne Metro Program	2031 Extended Program	Difference Base-Program	Difference Base-Extended Program
Metropolitan rail boardings	418,000	434,000	456,000	16,200	37,500
V/Line rail boardings	52,000	52,000	43,000	200	-8,900
Total rail boardings	470,000	486,000	499,000	16,400	28,600
Tram boardings	193,000	188,000	190,000	-4,900	-3,200
Bus boardings	185,000	183,000	185,000	-2,300	-400
Total PT boardings	848,000	857,000	873,000	9,100	25,100
Total PT trips	514,000	524,000	533,000	10,700	19,200
Total car vehicle trips	1,739,000	1,730,000	1,724,000	-8,700	-15,500

7.2 Tram network impacts

Figure 37, Figure 38 and Figure 39 show the change in tram patronage between the base case, Melbourne Metro Program and Melbourne Metro Extended Program implementation. A comparison of the figures shows that there will be a significant drop in patronage on routes travelling north to Parkville on both Swanston and Elizabeth Streets once Melbourne Metro is delivered (a decrease in loadings of 26 per cent in the Melbourne Metro Program, and marginally more in the Extended Program), as well as south past the Arts Centre and along St Kilda Road (a decrease of 33 per cent in the Melbourne Metro Program, slightly more in the Extended Program).

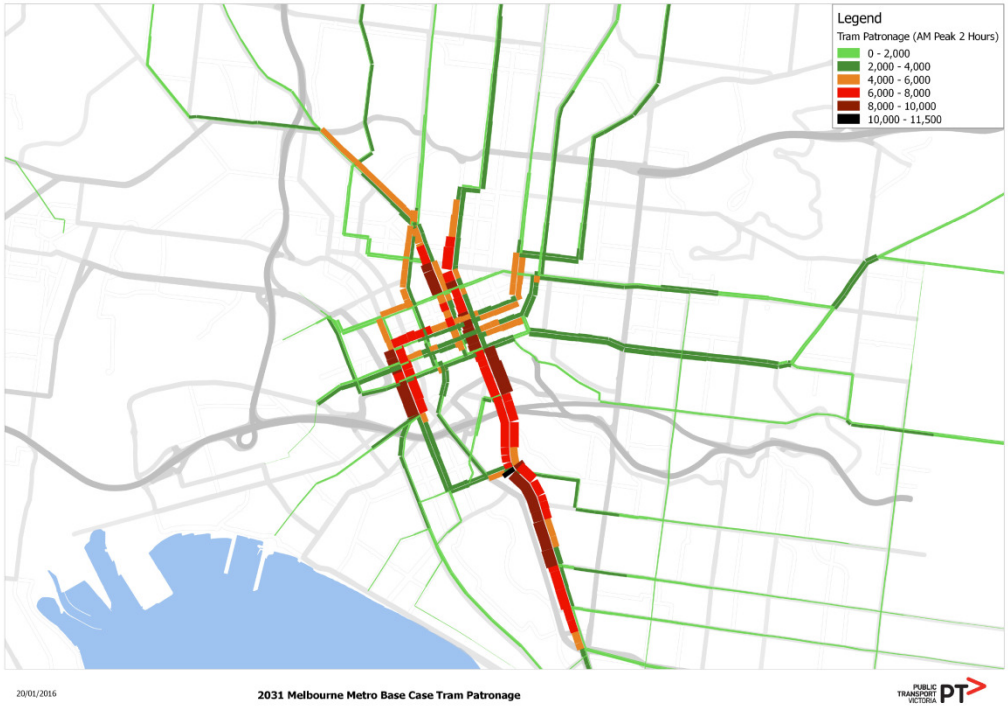


Figure 37: Tram Passenger Loadings – Base Case – 2031 AM Peak

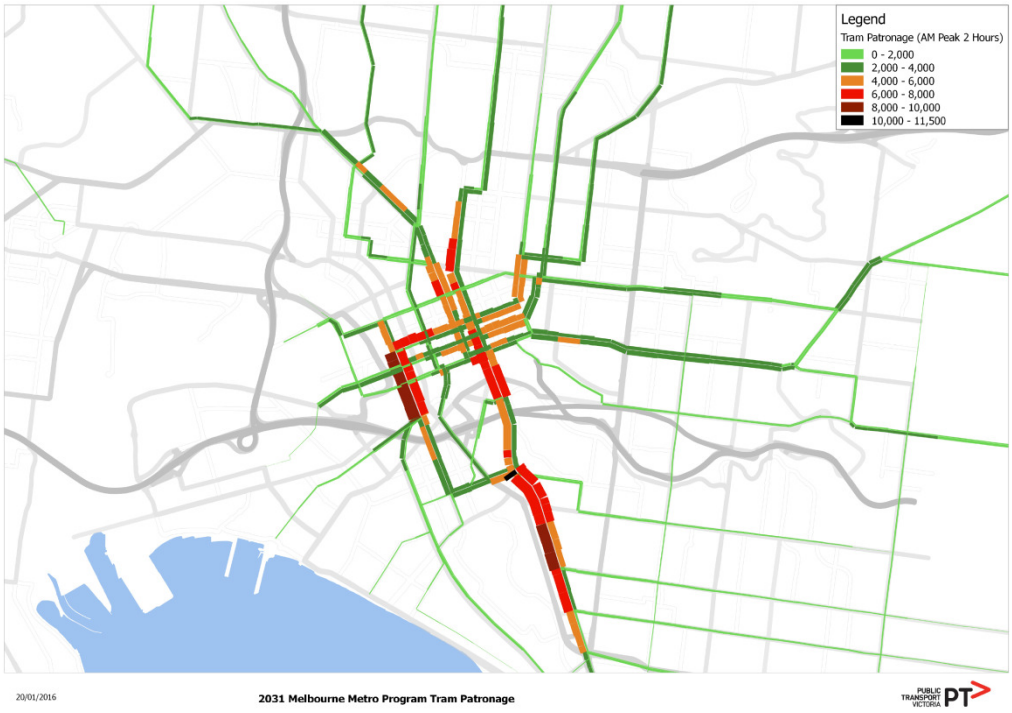


Figure 38: Tram Passenger Loadings – Melbourne Metro Program Case – 2031 AM Peak

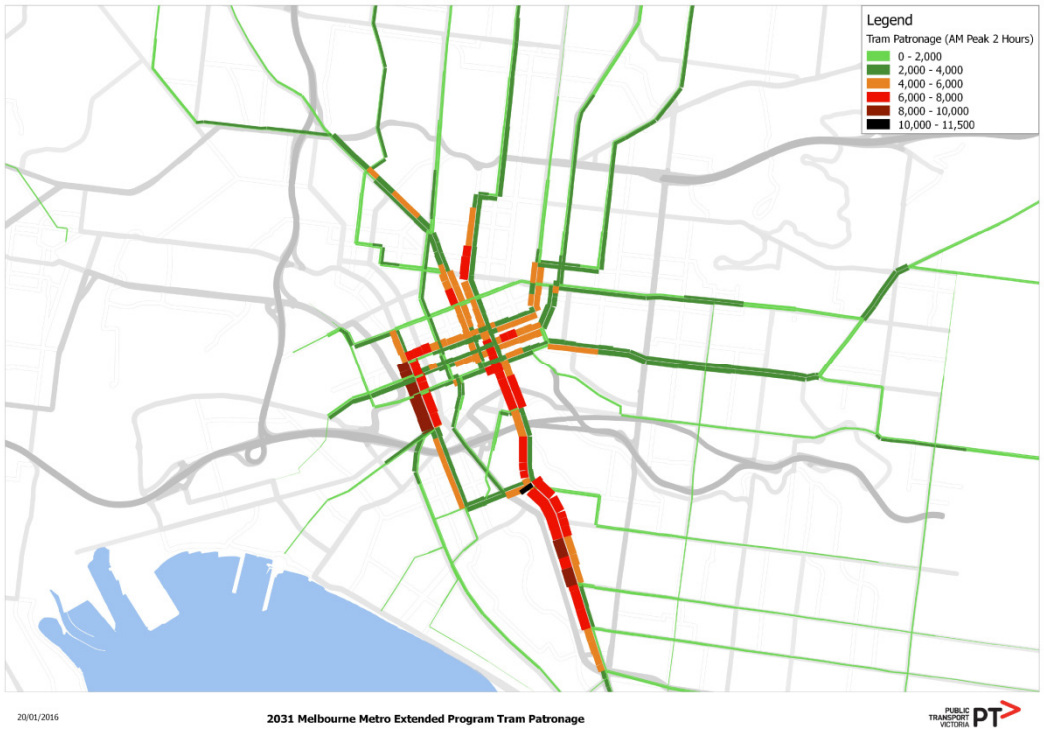


Figure 39: Tram Passenger Loadings – Extended Program Case – 2031 AM Peak

Forecasts also show crowding issues will be improved on other parts of the tram network as people change their travel in response to Melbourne Metro.

Melbourne Metro will allow a reconfiguration of the tram network, including an increase in services from the Domain Interchange to Park, Kingsway/William and Clarendon/Spencer Streets. When Domain Station is completed, there will continue to be strong demand for tram services from this location. Travellers will interchange between train and tram to access employment areas in Southbank and South Melbourne and travel south along St Kilda Road to access employment and education destinations, such as the Alfred Hospital Precinct and schools.

The change in demand with and without Melbourne Metro is reflected in key measurement points shown in Table 10.

Table 10: Change in Tram Cordon Loads (AM Peak 2031)

Location	AM peak load – Base	AM peak load – Melbourne Metro Program	AM peak load - Extended Program	Difference Base-Program	Difference Base-Extended Program	% difference (Program)	% difference (Extended Program)
Haymarket Roundabout/Lincoln Square - Swanston and Elizabeth Street services northbound	13,000	9,600	9,400	-3,400	-3,600	-26%	-28%
Federation Square-Arts Centre southbound	9,600	6,400	6,100	-3,200	-3,500	-33%	-36%
Federation Square-Arts Centre northbound	7,300	6,600	6,700	-700	-600	-10%	-8%

These changes indicate that Melbourne Metro will alleviate the significant demand from this north-south corridor. The relief to tram services on this corridor provides the tram network with the flexibility to deploy rolling stock on other corridors to meet growing demand pressures.

7.3 401 Bus – linking North Melbourne to Parkville

The high frequency Route 401 Shuttle Bus (it currently runs every four minutes in the peak) connects North Melbourne Station to Melbourne University and the hospitals in the Parkville precinct. It currently provides a convenient and popular way for passengers on the Werribee, Williamstown, Sunbury, Craigieburn and Upfield lines to access Melbourne University and the Parkville Medical Precinct. Bus route 401 has seen a 147 per cent growth in average weekday trips since 2010-11 to almost 2.5 million passengers per annum, making it Melbourne's fourth busiest bus service.

If Melbourne Metro is not delivered, daily boardings on this route are expected to grow fivefold by 2031 placing considerable pressure on this bus service.

When Melbourne Metro is delivered, passengers on the Sunbury line will have direct rail access to Parkville. Passengers on the Werribee and Williamstown lines will also be able to change to these services at Footscray.

This will result in a reduction in passengers using the Route 401 Shuttle Bus service, although it will still be used by passengers on the Craigieburn and Upfield lines for access to Parkville. Daily boardings on the route are expected to drop from 25,000 to 6,000, based on an assumed 10 minute frequency being introduced when the Melbourne Metro Program is in place. Further refinement of this service offering will need to be undertaken.

8 Road network

8.1 Impacts on private vehicle users

The delivery of Melbourne Metro will have an impact on the road network, as it attracts travellers to public transport by providing extra capacity for travel into inner Melbourne. Car users may be encouraged to switch to public transport if they find that, once Melbourne Metro is built, they are able to make their journey more easily by public transport than by car.

With the implementation of Melbourne Metro the number of public transport trips increases by nearly 11,000 passengers in the morning peak period. The increase in public transport trips includes a number of people switching from travel by private vehicles to train services. Car travel is estimated to reduce by around 9000 vehicle trips in the morning peak by 2031 as a result of the program, noting that on average car vehicle trips carry just over one passenger per trip (Table 11).

There is an overall reduction in the number of motorised trips undertaken by car or public transport (person trips). This is because people switching to public transport tend to trip chain[11] by walking, whereas car users tend to drive when trip chaining. As a result, there is a reduction in the number of car vehicle kilometres and vehicle hours travelled.

It is estimated that about 780,000 private car kilometres – or 39,000 hours – will be saved on an average weekday in 2031 as a result of the Melbourne Metro Extended Program.

Table 11: Change in Car and Public Transport Trips Characteristics compared to base (2031)

	AM Peak – Melbourne Metro Program	Daily – Melbourne Metro Program	AM Peak – Extended Program	Daily – Extended Program
PT trips	10,700	52,000	19,000	90,000
Person trips	500	-8,700	1,000	-15,500
Car vehicle trips	-8,700	-49,900	-15,500	-86,700
Car vehicle kms	-77,000	-371,000	-162,000	-782,000
Car vehicle hours	-4,800	-18,200	-11,400	-39,200

As a result of the reduction in car trips, the number of road kilometres where demand exceeds the capacity of the road across the metropolitan area will reduce marginally in the Melbourne Metro Program and be reduced by around 7 per cent in the AM peak and by nearly 4 per cent across a weekday in the Extended Program (Table 12).

Table 12: Length of Road Where Demand Exceeds Capacity (2031)

	Without MM (kms)	With MM (kms)	Change (kms)	Change (%)
AM Peak – Program	355	349	6	1.7%
Weekday – Program	935	928	7	0.7%
AM Peak- Extended Program	355	330	25	7.0%
Weekday – Extended Program	935	899	36	3.9%

[11] Trip chaining is making an incidental trip along the way, such as doing shopping or getting a coffee.

The model produces a variety of geographic outputs across the metropolitan area that show the relative impacts of Melbourne Metro to travellers on a range of measures. This gives an understanding of where the benefits of Melbourne Metro are felt, providing further context for the cordon counts and other counts of private vehicle trips which include induced demand effects.

As a result of the change in road conditions, many Melburnians will have improved access to jobs and tertiary education by private car, as shown in Figure 40. Some people in the west of Melbourne will have the number of jobs and tertiary destinations accessible within 60 minutes of travel increase by more than 20,000 in the Melbourne Metro Program and more than 50,000 in the Extended Program, as represented by the darkest areas of green on each map.

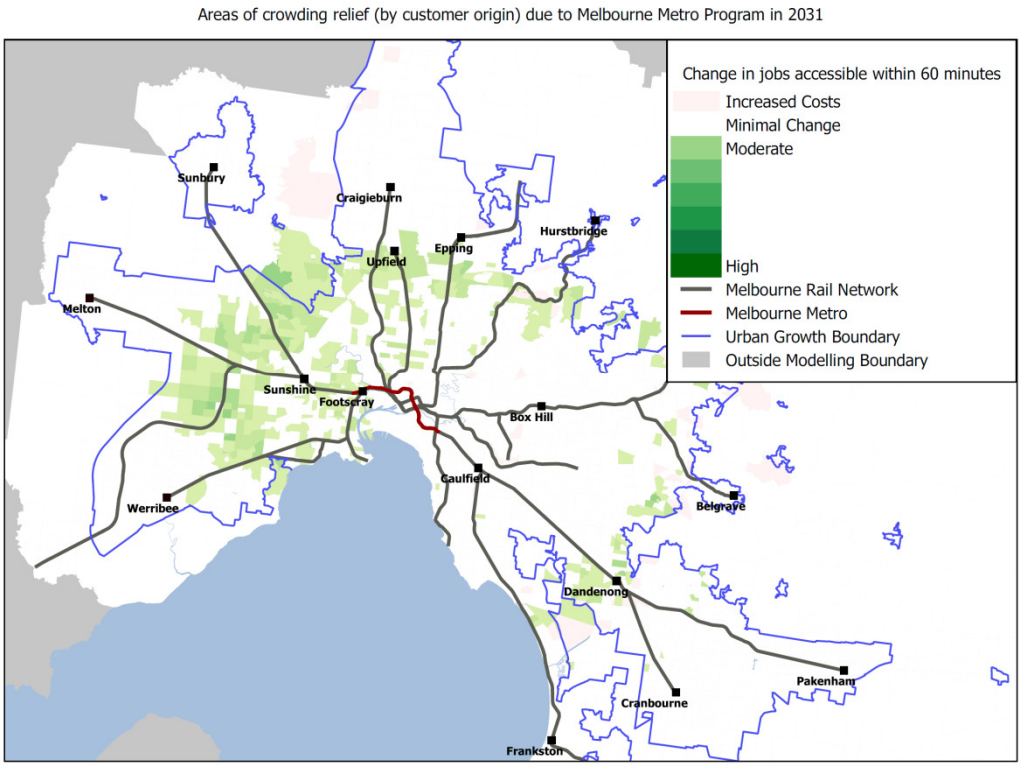


Figure 40: Change in access for people travelling to Jobs and Tertiary institutions for private vehicle users due to Melbourne Metro Program

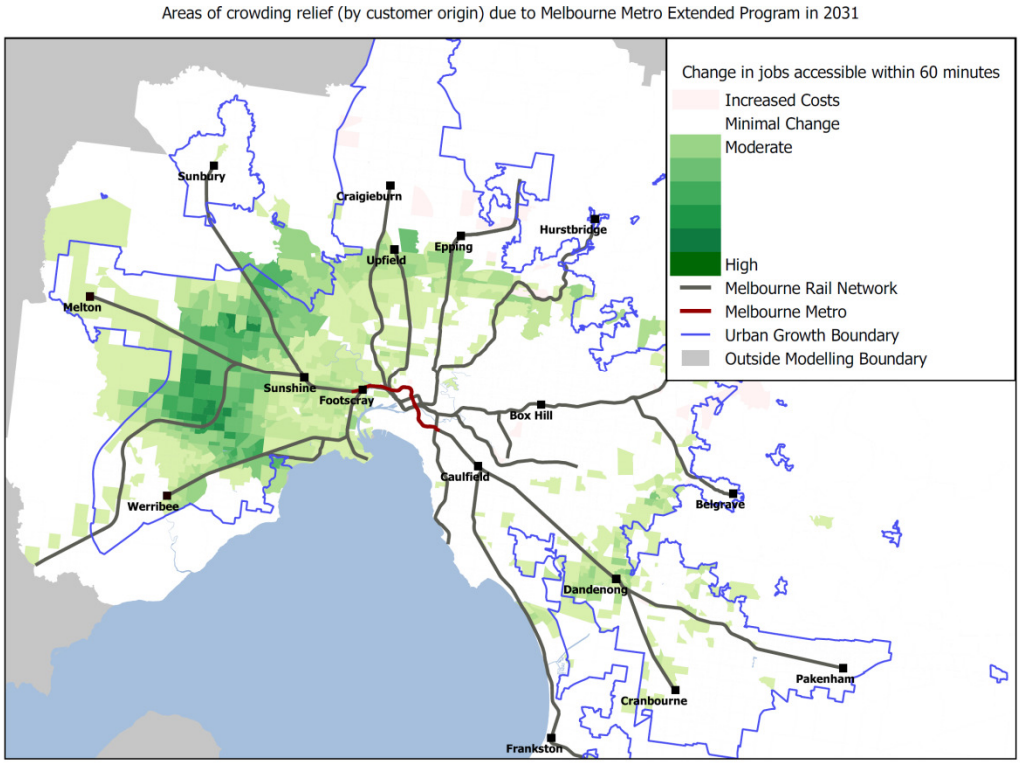


Figure 41: Change in access for people travelling to Jobs and Tertiary institutions for private vehicle users due to Melbourne Metro Extended Program

The benefits to car users will be felt across Melbourne, as cars are used for a more diverse range of journeys than public transport such as cross-town trips, and will benefit from the reduced number of cars heading to and from central Melbourne and along the rail corridors. The overall improvements in travel are shown in Figure 42 and Figure 43.

Both the access to jobs and education and the overall private vehicle benefits maps demonstrate the increased travel network impacts of the Extended Program, with more capacity provision on the rail network providing greater relief to the road network.

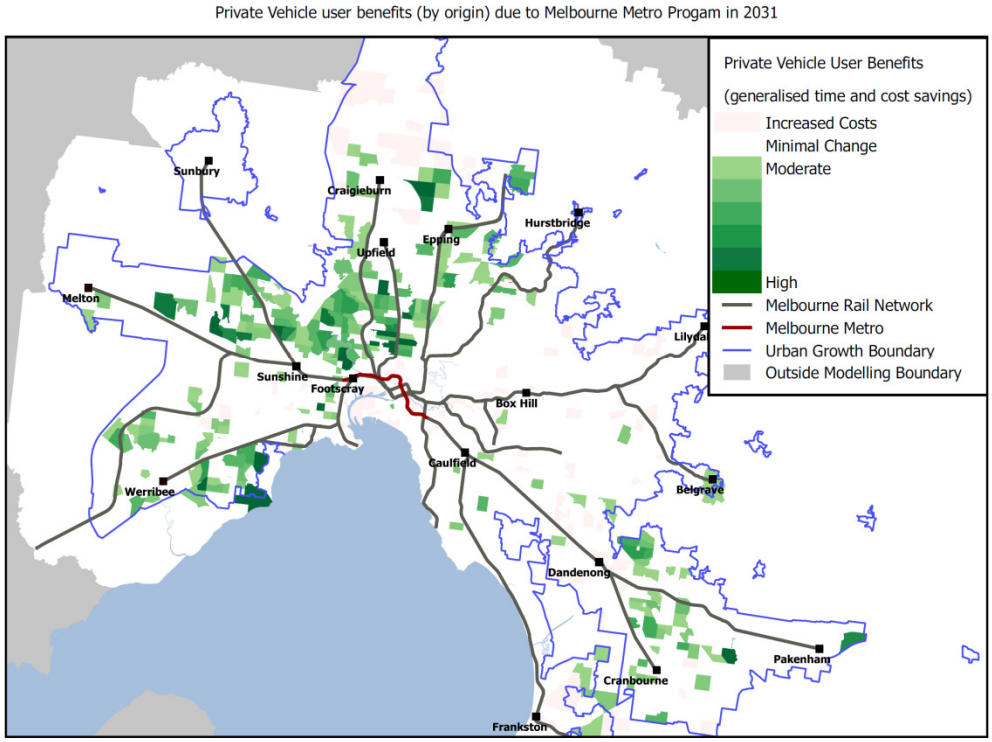


Figure 42: Improvements in private vehicle user benefits (overall cost of travel) for cars (by origin) due to Melbourne Metro Program in 2031

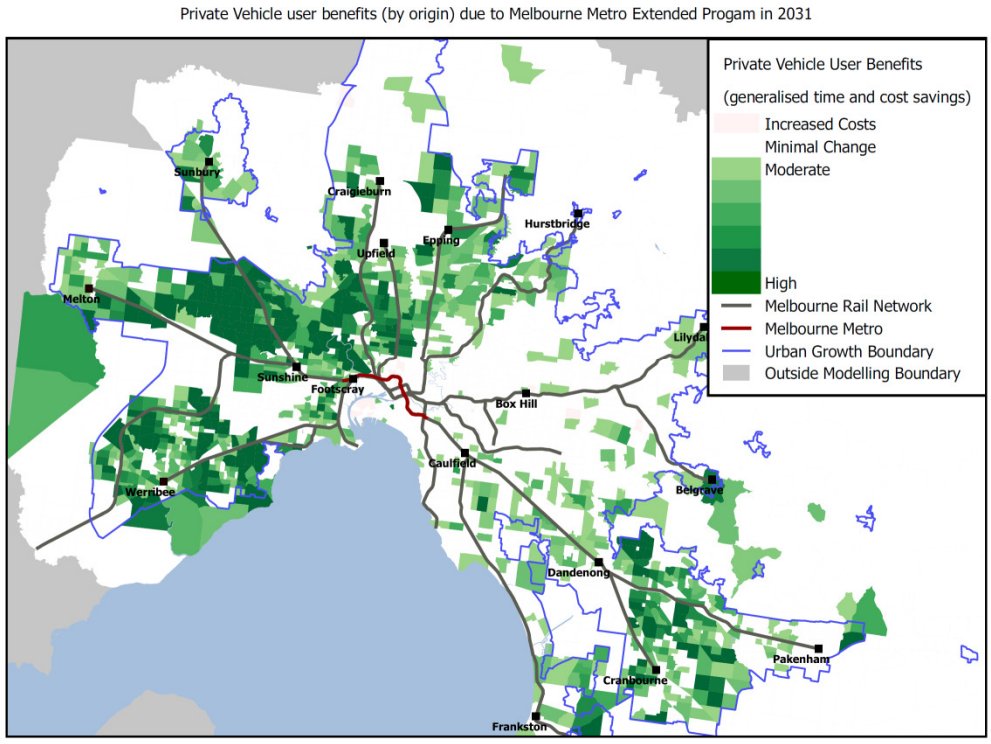


Figure 43: Improvements in private vehicle user benefits (overall cost of travel) for cars (by origin) due to Extended Program in 2031

While there are improvements in the middle and outer areas, there is little impact within central Melbourne with or without the program. In part this phenomenon occurs because of the density of development in the inner city. Roads are operating at capacity and will continue to do so in the future. When capacity is made available by projects like Melbourne Metro, it is quickly utilised by other road users. Table 13 shows the number of people travelling across key inner city road screenlines (both inbound and outbound) in the morning peak period. These screenlines are shown in Figure 44.

It is important to note that a project with the objective of encouraging people to switch from car use to public transport does not necessarily result in a corresponding drop in car travel.

By attracting some private car trips to public transport, travel is made easier for other car users. This means that some car trips will be faster, some people will travel further to a different destination, and some people who were put off from making car journeys because of congestion will now be able to travel[12]. These responses are called induced demand. In particular, high demand areas that are highly congested, such as central Melbourne, are more likely to encounter induced demand. This effect is enhanced by the increased jobs in the Program and Extended Program cases, which increase employment in central Melbourne. This is reflected in the screenline forecasts where there is little difference between the base and cases with Melbourne Metro.

Table 13: Change in Number of Vehicles Crossing the Screen Line in AM Peak - 2031

	2031					
	Base		Program		Extended Program	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
West	33,500	20,500	33,000	20,500	32,500	21,000
North West	20,000	13,000	20,000	13,000	20,000	13,000
North East	23,000	17,500	23,000	17,500	23,000	17,500
East	14,000	11,500	13,500	11,500	13,500	11,500
South	11,000	10,500	11,000	10,500	10,500	10,500
Inner South	8,000	6,000	8,000	5,500	8,000	5,500
Total	131,500	94,000	131,000	93,500	130,000	93,500

There are modest changes in travel across the road cordons if Melbourne Metro is delivered. This is in the context of overall modest growth, or declining car trips across these cordons between 2031 and 2046, which is in line with observed current day trends of flattening private vehicle demand in inner Melbourne.

However, these trends are slightly stronger in the 2046 Extended Program case, suggesting that Melbourne Metro, including the investments that are realised in the Extended Program, will attract an increasing share of car users to public transport compared to the base case in the longer term. This is because there will be capacity on public transport amidst a growing number of road users.

[12] VITM models the first two responses but not the third response.

Table 14: Change in Number of Vehicles Crossing the Screen Line in AM Peak - 2046

2046				
	Base		Extended Program	
	Inbound	Outbound	Inbound	Outbound
West	36,000	21,000	33,500	21,500
North West	20,500	12,000	19,500	12,000
North East	27,000	21,000	27,000	20,500
East	12,000	11,500	11,500	11,500
South	10,500	10,500	10,500	10,000
Inner South	8,000	6,000	8,000	6,000
Total	137,000	97,000	131,000	97,000

Figure 44: Inner city traffic screenlines for Melbourne Metro assessment

While access into central Melbourne is limited to 57 highly congested traffic lanes, the Melbourne Metro Extended Program will encourage an additional 29,000 people to travel into the city by train in the two hour morning peak in 2031 (as demonstrated in Section 4.5). The benefit of this improved access will not be fully realised as a significant proportion of the congestion relief provided with Melbourne Metro will be taken up by induced traffic (there will only be a reduction of 15,500 car trips in the morning peak in the Extended Program and less in the Melbourne Metro Program).

The benefits of improved access to central Melbourne is therefore considered in the context of the Wider Economic Benefits Analysis that is being assessed as part of the project evaluation, particularly with regards to journeys to employment and business-to-business trips.

8.2 Impacts on road freight

There will be modest improvements for road freight vehicles for both journey times and perceived vehicle operating costs, which together make up most of the generalised cost of travel for road freight trips. In 2031, with delivery of the Melbourne Metro Program there will be a reduction of 700 hours travelled by freight vehicles across metropolitan Melbourne on a typical weekday. This would be reduced further, the Extended Program delivering savings of 1500 hours compared the no Melbourne Metro case. These changes are somewhat limited by induced traffic which will re-congest roads, particularly in central Melbourne.

As shown in Figure 45 and Figure 46, the reduction in generalised cost benefits a wide and diverse range of freight trips across the metropolitan area. Benefits to trips originating and finishing at major industrial and freight hubs to the west, north and south-east of Melbourne are evident, amongst other benefits.

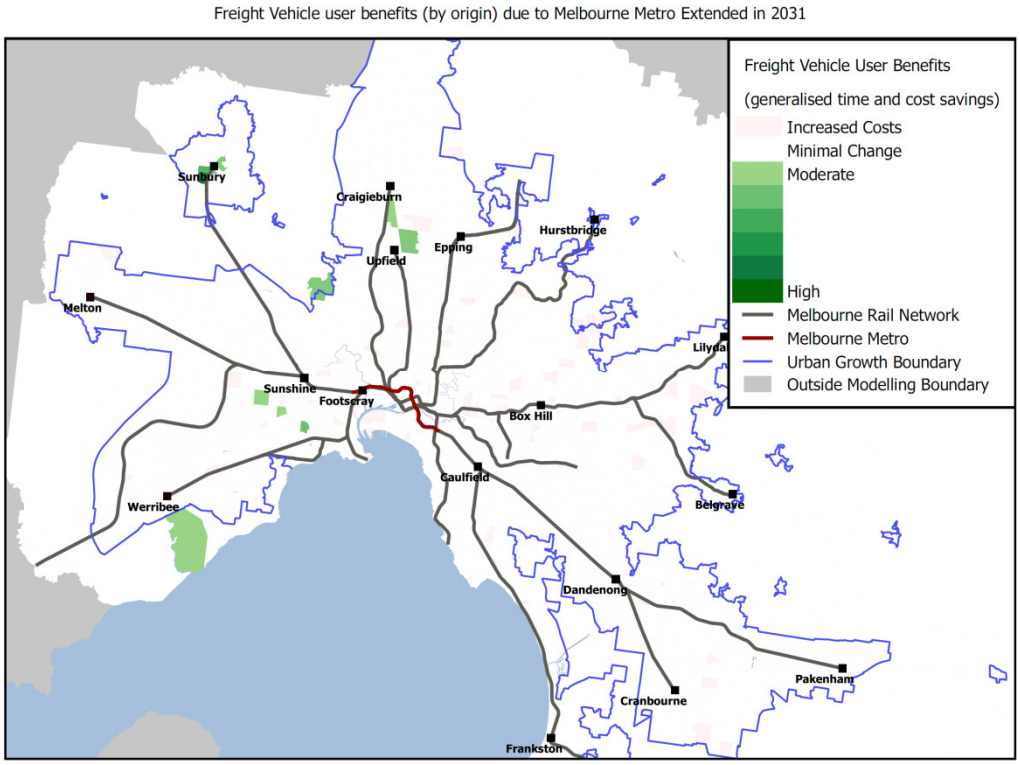


Figure 45: Change in Freight Generalised Costs by Origin with Melbourne Metro Program (AM Peak – 2031)

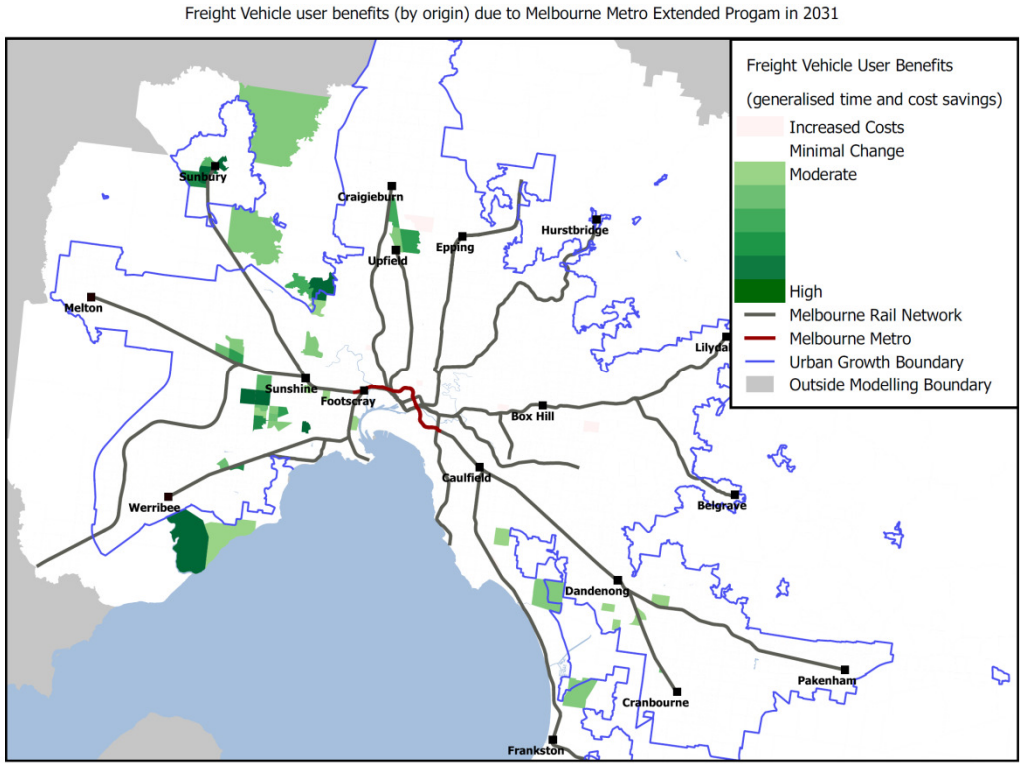


Figure 46: Change in Freight Generalised Costs by Origin with Melbourne Metro Extended Program (AM Peak – 2031)

9 Comparison with the secondary model

This report has focussed on the outputs of VITM for overall forecasts and impacts, and ClicSim for station forecasts. As discussed in Section 4.3, VITM was identified as the primary strategic model based on technical performance and validation. Secondary forecasts have been undertaken with Zenith. Developing primary and secondary forecasts in this way brought both models up-to-date with the Melbourne Metro Business Case, and provided a point of comparison for the VITM results.

9.1 Comparison with Zenith forecast

There are some differences in results between VITM and Zenith, and these are broadly in line with the expectations outlined in Section 4.3.

In the earlier modelled years, VITM produces higher overall travel (public transport and car) than Zenith, although the models converge towards 2046. However, Zenith has more public transport trips in each year than VITM – rising from around 12 to 13 per cent in 2031 to 20 per cent more than VITM in 2046. There is therefore a higher public transport mode share in Zenith.

This difference in public transport trips between the models, and the general higher attractiveness of the CBD for public transport users in Zenith, is captured in the different cordon loads between the models – which demonstrates at a general level the implications for different lines. Public transport is also relatively more attractive for a range of other key destinations around the metropolitan area than VITM.

Table 15 shows the difference in cordon loads between the models, across the forecast years. Key differences are highlighted. The models are broadly aligned to the north and west. The strongest difference between the two models is on the Cranbourne/Pakenham corridor, although loads are also higher by more than one or two train loads on the Sunbury and Frankston corridors.

Table 15: Differences between VITM and Zenith forecasts by year (AM peak)

Line Name	Zenith minus VITM AM Cordon Load 2031 Melbourne Metro Program	Zenith minus VITM AM Cordon Load 2031 Extended Program	Zenith minus VITM AM Cordon Load 2046 Extended Program
Williamstown	1,000	700	1,100
Werribee	-2,400	-2,800	700
Sunbury	800	5,800	6,600
Melton	1,300	1,400	2,600
Craigieburn	1,200	1,600	2,000
Upfield	100	100	900
Cranbourne/Pakenham	11,200	12,200	22,700
Frankston	5,500	5,200	9,900
Sandringham	500	500	2,100

The implications for network planning are indicated in Table 16, which shows when capacity constraints are forecast to be felt in the different models. Although the biggest difference is on the Dandenong corridor, service levels and capacity along the entire Sunshine-Dandenong corridor will be influenced by the stronger demand on the Sunbury/Melton corridors. This is because trains that originate from Sunbury/ Melton, where demand is stronger especially in VITM, form return services from Cranbourne/ Pakenham indicating that this capacity could help to accommodate passengers should there be a higher growth rate than VITM. Additional peak services and trains may also be needed from the south east that could run through to the west should the Zenith forecasts eventuate.

It is noted that the Zenith forecasts do predict constraints being felt earlier on the Sunbury corridor too, however the ability of the infrastructure to progressively accommodate ten car trains helps to mitigate this.

Constraints are also felt much earlier on the Frankston corridor in the Zenith forecast, and loads on all corridors will be subject to ongoing monitoring to inform future upgrades of infrastructure and rolling stock. These constraints represent the scope delivered by the Melbourne Metro program, and do not account for delivery of other potential capacity enhancements, projects and rolling stock on these corridors.

Upon reaching capacity after Melbourne Metro Program and Extended Program, subsequent projects to further increase capacity on different lines will then be needed. The Metropolitan Rail Network Development Plan provides an outline of these initiatives.

Table 16: Capacity constraints under VITM and Zenith

Line	Estimated timeframe when capacity pressures are felt – without Melbourne Metro		Estimated timeframe when capacity pressures are felt – with delivery of Melbourne Metro Program		Estimated timeframe when capacity pressures are felt – with delivery of Melbourne Metro Extended Program	
	VITM	Zenith	VITM	Zenith	VITM	Zenith
Werribee/Williamstown	Early 2020s	Early 2020s	Mid 2030s	Mid 2030s	Mid 2030s	Mid 2030s
Sunbury	Around 2020	By 2020s	Late 2020s	Early 2020s	Mid 2040s	Early 2030s
Craigieburn[13]	Early 2020s	By 2020s	Mid 2030s	Early 2030s	Mid 2030s	Early 2030s
Upfield	Mid 2020s	Early 2020s	After 2046	Mid 2040s	After 2046	Mid 2040s
Cranbourne/Pakenham	Early 2030s	Early 2020s	Early 2030s	Mid 2020s	After 2046	Mid 2030s
Frankston	Late 2030s	Mid 2020s	After 2046	Early 2030s	After 2046	Early 2030s
Sandringham	Late 2030s	Mid 2030s	After 2046	Mid 2040s	After 2046	Mid 2040s

Note: Upon reaching capacity after Melbourne Metro Program and Extended Program, subsequent projects to further increase capacity on different lines will then be needed. The Metropolitan Rail Network Development Plan provides an outline of these initiatives

[13] Future planning has identified reconfiguration of the Craigieburn and Upfield suburban lines to extend suburban services to the Beveridge/Wallan growth corridor as a potential option to alleviate demand pressures and overcrowding on regional services and improve public transport service to this area. This has not been assumed in this analysis - however it is noted this option would be available to Governments post MM . This would increase growth on these suburban lines and ultimately bringing forward capacity constraints from the dates shown.