



MELBOURNE METRO BUSINESS CASE FEBRUARY 2016



Economic Development,
Jobs, Transport
and Resources

Note: Commercial-in-confidence information has been redacted prior to publication

Melbourne Metro

Project Overview

Melbourne Metro represents a generational change to the metropolitan rail network. Melbourne Metro responds to the growth needs of Melbourne's most heavily congested lines and provides long term capacity for the Sunshine – Dandenong Line into the middle of this century. At an estimated cost of \$10.9bn, Melbourne Metro will be one of the largest public transport projects ever undertaken in Australia. It is the first major investment in the CBD metropolitan rail infrastructure capacity since the City Loop was completed 30 years ago.

Melbourne's population is expected to almost double by 2051 and average weekday boardings on metropolitan trains are forecast to more than double by 2031. To maintain Melbourne and Victoria's liveability and prosperity, Melbourne Metro is designed to alleviate a public transport system that is under considerable strain and provide viable public transport options to Melbourne's growing population.

Melbourne Metro will deliver:

- Capacity to accommodate over 39,000 passengers in each two-hour peak period each morning and afternoon from the first day of operation
- Twin nine-kilometre rail tunnels from South Kensington to South Yarra as part of a new Sunshine – Dandenong Line
- New underground stations at Arden, Parkville, CBD North, CBD South and Domain with longer platforms to accommodate longer High Capacity Metro Trains (HCMTs)
- High Capacity Signalling (HCS)
- A new transport interchange at Domain
- A range of signalling upgrades, civil and track works across the network (Wider Network Enhancements) to fully deliver wider network capacity and performance benefits.

Melbourne Metro is a transformative project providing capacity on opening for 39,000 passengers to and from Melbourne's CBD in peak periods and enabling further capacity increases in the future.

Melbourne Metro connects the Cranbourne / Pakenham and Sunbury Lines, the metropolitan lines that service two of Melbourne's largest growth corridors to the north west and south east to create the Sunshine – Dandenong Line. Melbourne Metro creates capacity to increase the number of services on this new dedicated corridor and enables expansion of the metropolitan network in the future, particularly to Melton.

Melbourne Metro also creates capacity through the inner core of the network for five other metropolitan lines, namely the Werribee, Frankston, Craigieburn, Upfield and Sandringham Lines. The new Melbourne Metro tunnel for the Cranbourne / Pakenham and Sunbury Line services releases inner core capacity to be shared amongst these five other lines, enabling an increase in services to better meet demand requirements across the metropolitan rail network.

The new Melbourne Metro rail tunnel will also:

- Improve access to the CBD supporting Victoria's growing knowledge economy and increasing employment opportunities
- Through the proposed alignment, link the health, education and technology centre in the city's north through the civic and cultural spine of the CBD and on to Domain and improve access to these precincts from the broader metropolitan area
- Provide relief to tram crowding on Swanston Street / St Kilda Road by using the alignment provided by the new rail service to free up trams and redistribute tram services to better serve growth in the western area of the CBD
- Catalyse significant urban renewal in the Arden-Macaulay Precinct, facilitating expansion of the central city and supporting Melbourne's economic prosperity. Direct access to mass transit will facilitate high value, knowledge-based employment in Melbourne's inner west providing a new professional jobs location for Melbourne's key growth corridor to the north-west. With the site's potential to accommodate 25,000 residents and in excess of 43,000 jobs, Arden station has the potential to stimulate over \$7bn of development value in today's dollars
- Reduce road congestion on key roads in the north, west and south east for both passenger and freight users by encouraging a number of motorists to move to public transport.

The economic case for Melbourne Metro is strong with a Benefit to Cost Ratio (BCR) of 1.1 using the standard 7 per cent discount rate and before considering Wider Economic Benefits (WEBs). If a lower discount rate of 4 per cent is applied, the BCR increases to 2.4 before WEBs.

The economic case for Melbourne Metro is further strengthened with a BCR of 1.5 to 3.3 when WEBs are included. Melbourne Metro is a once in a generation, city shaping project, that has the potential to significantly alter the urban geography of Melbourne. In many ways, Melbourne Metro is similar to the UK's Crossrail project. It enables workers to commute to and from the CBD with relative ease, increasing accessibility to economic opportunities, high quality jobs and services. It also enables businesses in the CBD to access a broad range and wider pool of workers. By enabling more workers (and businesses) to locate in highly productive, employment-dense areas, Melbourne Metro generates a range of WEBs, principal among those are the agglomeration economies (benefits which flow to firms and workers located in close proximity).

The economy wide modelling demonstrates that Melbourne Metro is expected to create 3,900 additional jobs (net) across Victoria and approximately 4,700 (net) nationwide at the peak of construction. The construction and operation of Melbourne Metro is expected to increase Victoria's GSP by between \$7bn and \$14bn in present value terms (using a 7 per cent and 4 per cent discount rate respectively).

Melbourne Metro also provides the backbone for further improvements to the network in the future, by incorporating features such as longer platforms and high capacity signalling, which allows a logical staged approach to expanding the rail network. When the costs and benefits of an Extended Program (i.e. future projects enabled on the Sunshine – Dandenong Line) are taken into account the BCR increases to 1.5 to 3.2 excluding WEBs and 2.1 to 4.5 including WEBs.

The Melbourne Metro Rail Authority (MMRA) will oversee the delivery of the project. Major works are expected to commence in 2017, subject to planning approvals, and be completed by 2026. The government will work closely with the private sector to apply global best practice and experience to the construction and delivery of the project and achieve optimal outcomes for the community in the short, medium and long term.

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Executive Summary

Why is major investment in rail needed?

Melbourne's public transport system is under significant pressure and requires urgent investment to meet the needs of our growing city

In the last decade, Melbourne has experienced unprecedented public transport growth putting considerable strain on a system which is now approaching capacity.

The rail networks' struggle to meet capacity requirements will impact Melbourne's future in three key areas:

- **Reducing Melbourne's liveability and access to job and key activity precincts due to chronic overcrowding and unreliability of rail services.** Unprecedented patronage demand is exceeding the capacity of metropolitan rail services during peak times and capacity constraints will intensify within the next five to ten years, exacerbating overcrowding and delays. This will lead to negative customer experiences, reduce the reliability and quality of train services, and reduce accessibility to economic opportunities, jobs and services. In turn, this will undermine Melbourne's reputation for liveability, making it harder to attract new businesses, investors and skilled workers.
- **Reducing Melbourne's economic prosperity and productivity due to the physical constraints of the transport network.** There is a misalignment between legacy public transport networks and growing job catchments that affects the mobility of Melbourne's labour force, erodes employers' access to a broader and deeper workforce, and constrains economic growth and productivity.
- **Limiting access to Central Melbourne and the potential for urban renewal due to insufficient public transport.** Central Melbourne is established and will continue to be a strong key service-based employment hub. More efficient public transport services and connectivity are required to support access into and around Central Melbourne to accommodate employment and business growth (especially in knowledge-based sectors), open up new commercial floor space within proximity of the CBD and facilitate development in urban renewal areas, such as the Arden-Macaulay Precinct.

As accessibility and connectivity are the hallmarks of a successful city, there is a clear need to transform Melbourne's metropolitan rail network to provide the capacity needed to meet the demand generated by the city's growing population and changing economy.

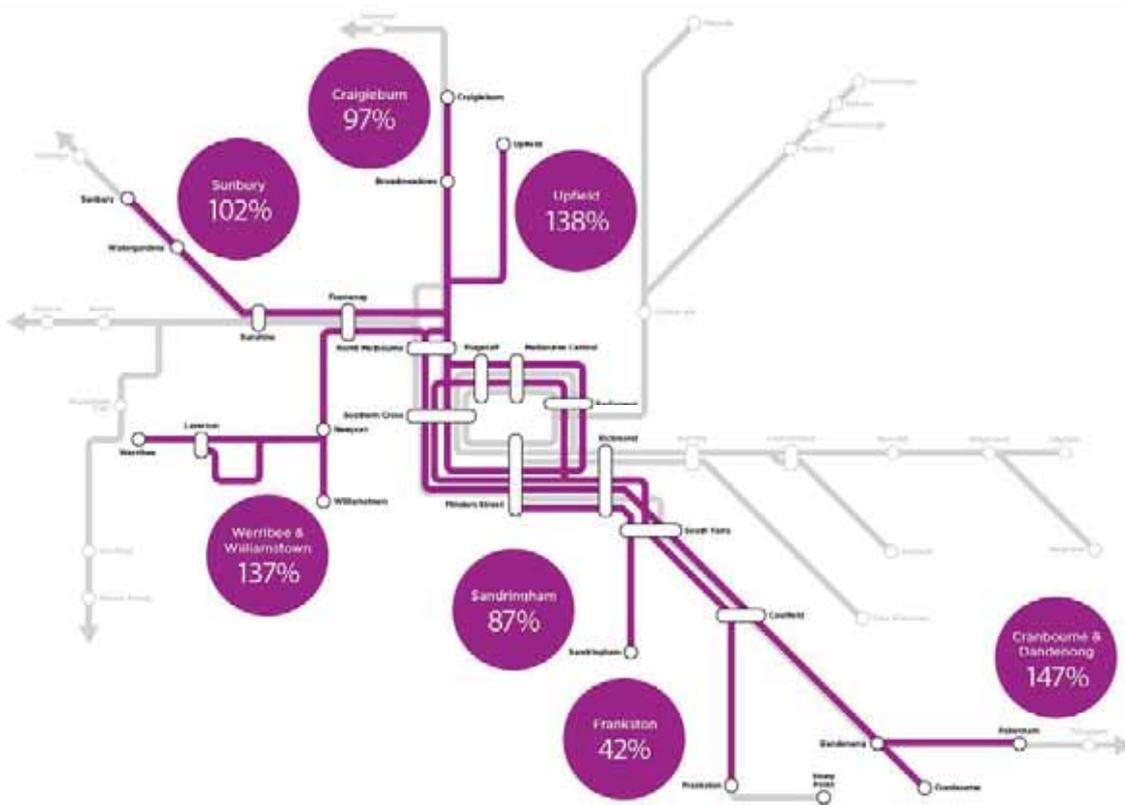
As shown in the following diagram, patronage across a number of the metropolitan rail lines affected by the project is expected to more than double over 20 years. This makes addressing these problems a priority to avoid compounding, long-term impacts to Melbourne's liveability and prosperity.

London Crossrail project

By 2001, the Greater London Authority had recognised the need to boost the number of jobs in central London to remain internationally competitive and knew that its rail network did not have the capacity to support that growth.

The £14.8bn Crossrail project, now nearing completion, was the response. Melbourne faces similar challenges and Melbourne Metro is designed to address them.

Forecast 20 year (2011-2031) total patronage volume growth in AM Peak (by line)¹



'Doing nothing' is not an option

- Average weekday boardings on metropolitan trains are forecast to more than double from 750,000 to 1,500,000 by 2031
- Central Melbourne is planned to become Australia's largest commercial and residential centre by 2040[^]
- By 2031, over 40% of Melbourne's population growth is expected to occur in greenfield residential developments in the north, west and south eastern growth corridors, however the highest levels of employment growth continue to be recorded in Central Melbourne. Existing inner city stations and associated infrastructure will be incapable of managing the associated change in travel and travel patterns
- The City Loop is already at capacity on three of the four lines (Northern, Burnley and Caulfield Groups), closely followed by the fourth line (Clifton Hill Group) which is also approaching capacity.

[^] Department of Transport, Planning and Local Infrastructure, Plan Melbourne (May 2014), 23.

¹ PTV. This figure reflects growth on lines impacted by Melbourne Metro (as opposed to all lines across network).

What solutions were investigated to meet Melbourne's rail capacity needs?

After exploring numerous options over more than a decade, Melbourne Metro provides the best solution

A number of potential options to increase Melbourne's rail capacity were identified, analysed and compared. These ranged from technology-based solutions and the expansion / enhancement of existing infrastructure to the provision of new rail infrastructure.

Some of these options, such as adopting more modern railway signalling technologies, are cost effective and expected to be delivered, regardless of Melbourne Metro. Whilst HCS is a core component of Melbourne Metro, a pure technology-based option cannot meet medium term demand requirements without significant further investment in infrastructure.

While other options, such as expanding / enhancing existing infrastructure may deliver immediate capacity to the network, such options were generally expected to cause more prolonged disruptions during implementation, result in congestion issues around existing CBD stations (as these options do not provide new stations) and lack the benefits associated with improving access to CBD fringe areas and decongestion of busy tram routes.

A significant investment in new rail infrastructure, in contrast, can meet immediate, medium and long-term demand. In addition to Melbourne Metro, the new rail infrastructure options analysed included a stand-alone metro system, rail link bypasses via Hoddle Street or Fishermans Bend and tunnels under the city linking North Melbourne to Richmond, Kensington to Caulfield or the City Loop to South Yarra.

Melbourne Metro is the preferred option as it provides the best solution to meet Melbourne's needs over the coming decades, including:

- New services and additional capacity to accommodate over 39,000 passengers in the two-hour peak period from the first day of operation and two new CBD stations to more evenly distribute passenger flow and interchange movements in the inner core of the network
- Purpose-built stations that are designed to accommodate longer 10 car trains through the central part of the network, which deliver the highest long-term infrastructure capacity
- The foundation to split the City Loop in the future to meet patronage demands with minimal rail operation disruption
- A new rail line, which will remove the need for planned interactions to work around congestion on other routes, and improve the resilience, punctuality and overall reliability of the network through six dedicated lines
- Effective and direct congestion relief to trams running to and through the CBD along the Swanston Street / St Kilda Road tram corridor and a foundation for reconfiguring the tram network to better serve areas to the west of the CBD
- The greatest number of new stations in areas not currently serviced by heavy rail (such as Arden, Parkville and Domain), with a combined catchment of over 200,000 jobs, enrolments and residents, more than double the next best option
- Significant potential for stimulating urban renewal and redevelopment, focused mainly around a new Arden station
- A lower cost long-term investment pathway on a present value basis for expanding the core of the rail network and involves less disruption than the alternatives considered.

What is Melbourne Metro?

Melbourne Metro is a once in a generation project that will facilitate the transformation of Melbourne's rail network into an international-style metro system

Melbourne Metro is one of the largest transport infrastructure projects ever undertaken in Australia. It will:

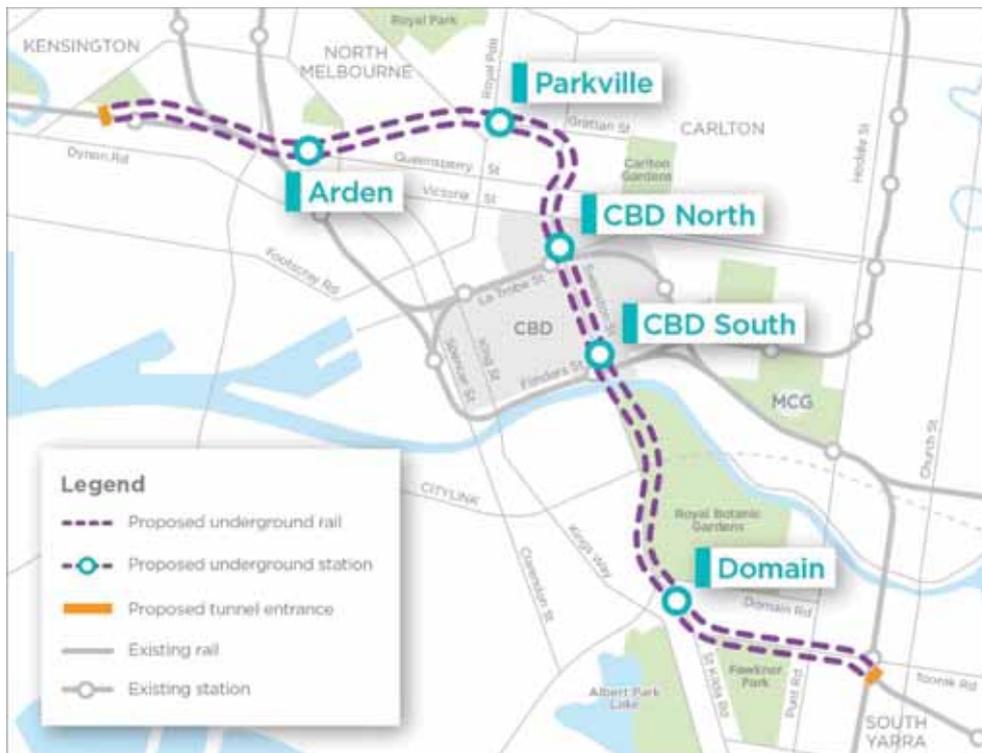
- Facilitate the transformation of Melbourne's rail network into an international-style metro system
- Act as a catalyst for significant urban renewal, particularly in the Arden-Macaulay Precinct
- Open up opportunities for new housing, commercial development and jobs close to the CBD.

As shown in the following diagram, the project will include:

- Twin nine-kilometre rail tunnels from South Kensington to South Yarra to create a new Sunshine – Dandenong Line
- New underground stations at Arden, Parkville, CBD North, CBD South and Domain
- High Capacity Signalling
- A new transport interchange at Domain
- Tunnel entrances (portals) in the vicinity of South Kensington and South Yarra.

Melbourne is Australia's fastest growing city, and our public transport system needs to grow with it to maintain the liveability and prosperity of our city and State.

Melbourne Metro proposed tunnel alignment



Source: AJM.

The project connects the metropolitan lines that service two of Melbourne's largest growth corridors to the north west and south east (Sunbury and Cranbourne / Pakenham Lines). Moreover, other lines can better meet demand requirements by using the significantly increased capacity that removing these services from the inner core enables.

A metro style system that focuses on passengers

Metro style systems have a strong focus on passengers and are characterised by:

- Simple timetables with 'turn up and go' frequency and consistent stopping patterns
- Frequent services that facilitate easy interchange with other train lines, trams and buses
- Separate train fleets, maintenance and stabling facilities for each line
- Stand-alone, end-to-end lines that prevent service disruptions on one line from affecting other lines
- Modern signalling technology to maximise the number of trains that can operate on each line
- HCMTs designed to minimise boarding and alighting times
- Grade separations of level crossings.

To take full advantage of the wider network capacity and performance opportunities created by the Melbourne Metro rail tunnel, a range of signalling upgrades, civil and track works (Wider Network Enhancements) are proposed. These will optimise the broader network benefits by increasing the frequency of train services on the new alignment as well as the Werribee, Craigieburn, Upfield, Sandringham and Frankston Lines.

25 HCMTs² and associated works including stabling, platform extensions and power supply works will also be required to deliver the new services on the opening of Melbourne Metro. This rolling stock and associated works will be subject to a separate funding submission.

Melbourne Metro will incorporate features to accommodate future increased capacity demands by, for example:

- Providing platform lengths at the five new stations that can cater to longer HCMTs, which can carry approximately 600 more passengers than trains used today
- Installing High Capacity Signalling to increase the number of trains that can run on the line per hour by reducing the headway (interval) between trains.

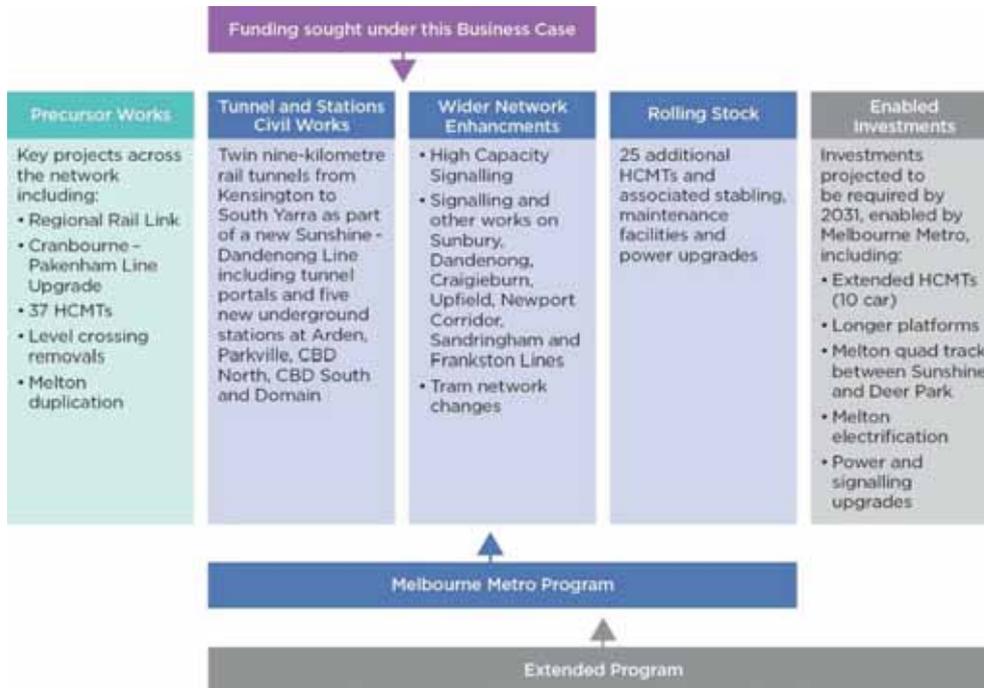
These features will be essential to the successful delivery of a number of Enabled Investments (including Melton electrification) which are expected to be required shortly after the opening of Melbourne Metro.

The following diagram illustrates:

- The various categories of works associated with Melbourne Metro
- Categories of works and funding that this Business Case covers
- Future projects that Melbourne Metro directly enables.

² These trains are in addition to the 37 HCMTs already being purchased to augment the existing fleet (see *Trains, Trams, Jobs 2015-2025: Victorian Rolling Stock Strategy*). The rolling stock and associated works will be subject to a separate funding request. For completeness, it is also noted that the rolling stock and associated works are included in the presentation of the Melbourne Metro Program.

Melbourne Metro – Scope overview



What alignment will Melbourne Metro follow?

Melbourne Metro connects the existing Sunbury rail corridor in the vicinity of South Kensington to the Dandenong corridor in the vicinity of South Yarra

A number of horizontal alignments for the tunnel and stations were considered, including alignments along Swanston, William, Elizabeth and Russell Street. Swanston Street is the preferred horizontal alignment as it:

- Provides the best service to key city destinations
- Enables direct interchanges from new CBD stations with Melbourne Central and Flinders Street stations
- Provides the greatest relief to the road and tram network.

Two vertical alignment options beneath Swanston Street were considered. The deeper of the two alignments is preferred, because under this solution:

- Trams will continue to run through the heart of the city along Swanston Street during construction
- Many major utility relocations will be avoided
- The surface disruption to many businesses and CBD visitors will be greatly reduced.

The project also includes five new underground stations at Arden, Parkville, CBD North, CBD South and Domain. A variety of options for station locations were analysed to demonstrate that each of the identified locations optimises passenger benefits and transport outcomes for the associated costs and impacts. These five new stations offer opportunities for improved passenger experiences, new urban landmarks and precincts, and new residential and commercial developments.

What benefits will Melbourne Metro deliver?

Melbourne Metro will transform the rail network and play a key role in supporting Melbourne and Victoria's economic prosperity and liveability

The key benefits it will deliver include:

- Providing new and higher capacity services on opening to expand the peak capacity of the network by **over 39,000 passengers each peak period** each morning and afternoon
- Melbourne Metro provides the backbone for further improving the network in the future by incorporating features such as long platforms and HCS that allow a staged approach to expanding the metropolitan rail network. The Extended Program if delivered would enable **further capacity for an additional 41,000 passengers per peak period** to be introduced on the Sunshine – Dandenong Line progressively from 2031 as required
- **Easing congestion and facilitating future growth** by connecting and creating a new dedicated higher capacity corridor for two of the busiest rail lines on the metro network (Sunbury and Cranbourne / Pakenham) that serve two of Melbourne's largest growth corridors to the north west and south east
- **Freeing up critical City Loop and inner core capacity** for other lines to meet the ever increasing demand by removing the Sunbury and Cranbourne / Pakenham services from the City Loop
- **Minimising the overall impact of incidents and improving the resilience, punctuality and reliability of services** for passengers to travel to and around Central Melbourne throughout the day by facilitating the transformation of Melbourne's rail network into an international-style metro system that uses independent line operations across the network
- **Easing road congestion** for vehicle and freight travel on key roads in the north, west and south east as more people use public transport
- **Improving access to the CBD** to better support Victoria's growing knowledge economy, increase employment opportunities through the civic spine of the city and linking key health, education and technology precincts in the north to cultural, sporting and entertainment facilities around Domain
- **Relieving tram overcrowding** on Swanston Street / St Kilda Road by using the alignment provided by the new rail service to free up trams and redistribute tram services to better serve growth in the western area of the CBD
- **Upgrading rail capacity into key growth areas** including growth corridors (north, west, and south east), five out of six existing and emerging national employment clusters (Parkville, Monash, Dandenong South, Sunshine, and East Werribee), and six out of nine existing metropolitan activity centres (Sunshine, Footscray, Broadmeadows, Dandenong, Fountain Gate / Narre Warren, and Frankston)
- Providing a **lower cost long-term investment pathway** on a present value basis with less disruption than the alternatives considered.

Once complete, Melbourne Metro will:

- Support demand into and around an expanding CBD
- Provide effective and direct congestion relief to trams and trains
- Provide access to jobs
- Improve passenger flows each day
- Deliver a better customer experience.

Melbourne Metro will also deliver significant city-shaping benefits and is expected to influence land use around the new stations and more broadly along the rail corridors that experience a boost in capacity. For example, the new Arden station will:

- Act as a catalyst for significant urban renewal in the Arden-Macaulay Precinct
- Facilitate the expansion of Central Melbourne and support Melbourne's economic prosperity
- Facilitate high value, knowledge-based employment in Melbourne's inner west by providing an intervening professional jobs location for Melbourne's key growth corridors to the north west

- Stimulate over \$7bn of end development value in today's dollars using the area's potential to accommodate 25,000 residents and in excess of 43,000 jobs.

What is the economic case for Melbourne Metro?

Melbourne Metro has strong economic credentials, with a BCR of 1.1 using the standard 7 per cent discount rate and 2.4 based on a 4 per cent discount rate using conventional economic benefits

The economic analysis shows the project is economically viable, with a Net Present Value (NPV) of \$0.6bn to \$10.6bn before considering Wider Economic Benefits (WEBs) and using a 7 per cent and 4 per cent real discount rate respectively.³

As shown in the table below, the economic case for Melbourne Metro is strengthened further, with a BCR of 1.5 to 3.3 when WEBs are included.

Economic Benefits of Melbourne Metro

| | 7% Discount Rate | 4% Discount Rate |
|-----------------------------------|------------------|------------------|
| Conventional Economic Benefits | 1.1 | 2.4 |
| Including Wider Economic Benefits | 1.5 | 3.3 |

Melbourne Metro is a once in a generation, city shaping project, that has the potential to significantly alter the urban geography of Melbourne. Without Melbourne Metro, the ability of workers to commute to the CBD, the most productive area in Victoria and second most productive area in the whole of Australia, will be constrained. In many ways, Melbourne Metro is similar to the UK's Crossrail project, as it enables workers to commute to the CBD with relative ease, provides greater accessibility to economic opportunities, jobs and services and provides businesses in the CBD with access to a broad range and wider pool of employees.

This in turn enables the CBD to continue to grow and realise its full job growth potential. By enabling more workers (and businesses) to locate in highly productive, employment-dense areas, Melbourne Metro increases labour productivity through agglomeration economies (benefits which flow to firms and workers located in close proximity). Increased agglomeration provides more opportunities for input and output sharing and more importantly, opportunities for knowledge sharing through formal face-to-face interactions as well as chance encounters and impromptu meetings. Similar to the UK's Crossrail project, the impact of Melbourne Metro on the commuting capacity was assessed and WEBs, which include agglomeration economies, quantified.

Economic analysis was also undertaken including the costs and benefits of future projects directly enabled by Melbourne Metro and required to meet ongoing demand requirements. Under this Extended Program the BCR results are 1.5 to 3.2 excluding WEBs and 2.1 to 4.5 including WEBs.

The economy wide modelling demonstrates that the Melbourne Metro Program is expected to create 3,900 additional jobs (net) across Victoria and approximately 4,700 (net) nationwide at the peak of construction. The construction and operation of the Melbourne Metro Program is expected to increase Victoria's GSP by between \$7bn and \$14bn in present value terms (using a 7 per cent and 4 per cent discount rate respectively).

³ The lower end of the range reflects a 7 per cent discount rate consistent with DTF and Infrastructure Australia guidelines. This rate may be considered relatively conservative in the context of emerging practice and as such a 4 per cent discount rate has also been presented.

How long will Melbourne Metro take to build?

Melbourne Metro is expected to take up to eight years to build

Subject to receiving all necessary approvals, major construction is expected to commence in 2017, with new rail services commencing by 2026.

Projects of the scale and complexity of Melbourne Metro require long lead times to develop and construct, as shown in the diagram below, which makes it imperative to make this investment now.



What will Melbourne Metro cost?

The estimated cost of Melbourne Metro in nominal terms is \$10.9bn

A summary of the estimated cost, on a real and nominal basis, is provided in the table below.

Melbourne Metro – Estimated cost

| Item | Real (\$m) | | Nominal (\$m) | |
|--|--------------|--------------|---------------|---------------|
| | P50 | P90 | P50 | P90 |
| Total project risk adjusted capital costs | 8,887 | 9,480 | 10,154 | 10,837 |

Opportunities exist to partially defray the capital cost of the project using integrated development opportunities such as air rights development over and around new station infrastructure (see further below).

The cost of the HCMTs and associated works required for Melbourne Metro operations is the subject of a separate funding submission.

How will Melbourne Metro be delivered?

The Melbourne Metro packaging and procurement assessment has been conducted in line with government guidelines and reflects the current scope of construction works to be undertaken on the network

The Melbourne Metro delivery approach focuses on achieving value for money outcomes by:

- Allocating risks to the party, or parties, best placed to manage them
- Maximising opportunities to work with the private sector in an efficient and cost effective manner
- Delivering the project on time and on budget.

The packaging and procurement options assessment was conducted according to the Victorian Department of Treasury and Finance's (DTF) High Value High Risk Guidelines⁴ and Infrastructure Australia guidelines.⁵

The following table outlines the packaging and procurement strategy for the project.

Melbourne Metro packaging and procurement strategy

| Works Package | Procurement Model |
|--|---|
| Early Works Utility service relocations, tram infrastructure works, construction power, and works to prepare construction sites | Combination of managing contractor, Yarra Trams led and State led |
| Tunnel and Stations Main tunnelling works, five underground stations, station fit-out, mechanical and electrical systems, specific operation and maintenance services for the infrastructure delivered by the package and commercial opportunities at the new stations | Availability based Public Private Partnership |
| Rail Infrastructure Works at the eastern and western portals including cut and cover tunnelling, decline structures and local reconfiguration and realignment of existing lines | Competitive alliance |
| Rail Systems Rail systems design (including conventional signalling, HCS, train and power control systems and ICT), installation works, rail systems integration and commissioning | Competitive alliance |
| Wider Network Enhancements Proposed to include works which are required across the wider network including track modifications, station upgrades and signalling system upgrades | Case by case |

In addition to the above:

- The metropolitan rail franchisee will operate the services through the infrastructure delivered by the project as there are significant advantages to maintaining a single operator across the metropolitan network
- The HCMTs that will operate on the Sunshine – Dandenong Line will be procured separately to the project. PTV is procuring HCMTs that will be deployed initially on the Dandenong Line to meet current capacity requirements.

The proposed delivery strategy was validated with the market as part of a market sounding process. This process confirmed there is broad private sector support for the delivery strategy, including contractor and financier appetite for the Tunnel and Stations PPP. A structured process of further market testing of the delivery strategy will be progressively undertaken as part of the detailed pre-procurement activities for the project.

What integrated development opportunities does Melbourne Metro provide?

A comprehensive review of relevant value capture opportunities for integrated development has been undertaken and opportunities will be considered, assessed and managed over the life of the project

The Department of Economic Development, Jobs, Transport and Resources (Department) has analysed the relevant opportunities associated with Melbourne Metro to identify, evaluate and, where appropriate, implement integrated development and other commercial opportunities. This Business Case focuses on identifying opportunities for Melbourne Metro to directly generate and capture value through integrated

⁴ Department of Treasury and Finance, Investment Lifecycle and High Value High Risk Guidelines.

⁵ Infrastructure Australia, National Public Private Partnership Guidelines Volume 1: Procurement Options Analysis.

development and other commercial opportunities. It does not consider potential value capture mechanisms such as tax increment financing, new levies or new contributions.

Quantified opportunities include:

- The sale of surplus land and over site developments at CBD North and CBD South (with the characteristics of the Domain and Parkville sites providing less scope for over site development)
- In-station retail and advertising.⁶

Additional opportunities that are yet to be quantified include:

- Use of new telecommunications infrastructure to drive revenue
- Redevelopment of surplus land at Arden as part of the broader urban renewal of the Arden-Macaulay Precinct.

The Tunnel and Stations PPP package will be responsible for delivering over site developments at CBD North and CBD South as well as retail and other commercial opportunities within the new stations. The Department will therefore be seeking private sector innovation in relation to value capture opportunities as part of the competitive tender process for this package.

Integrated development opportunities will be monitored, assessed and managed over the life of the project.

What are the social and environmental impacts of Melbourne Metro?

Melbourne Metro will give rise to positive environmental and social effects in the long term and there is a commitment to achieving excellence in sustainability and climate change resilience

Melbourne Metro will give rise to positive, metropolitan-wide, environmental and social effects, including:

- Improved accessibility to key services, health, education, jobs and opportunities
- Stronger retail and commercial development opportunities through higher density residential development in and around train stations and activity centres
- Increased residential development opportunities and greater housing choice in Melbourne's established areas.

The project's main short-term disruption impacts are confined largely to the construction phase, mostly localised, and will be mitigated and managed through performance requirements that will require delivery partners to use best practice environmental and project management practices during construction and to leave a high quality urban design legacy.

The most significant short-term environmental and social impacts include:

- Impacts associated with tunnelling relating to construction noise and vibration, ground water and contamination
- Temporary loss of public open space and some displacement or altered community facilities during construction
- Land acquisition for the project's infrastructure and to support construction
- Disruption to businesses in the CBD and inner Melbourne
- Impacts on broader surface transport networks, including the existing rail network.

Sustainability management and targets for the project will cover a range of themes including: excellence, urban ecology and vegetation, climate resilience, supply chain, communities, workforce, energy, materials and waste and water.

Melbourne Metro will achieve appropriate social, economic and environmental sustainability outcomes across all phases of the project by developing a strategic plan and targets, in conjunction with its delivery

⁶ This is included in the Revenue figure presented in Chapter 12.

partners. Disruption impacts will be managed with appropriate mitigation strategies and the application of environmental performance requirements in order to deliver an integrated outcome that connects the community in an environmentally sustainable manner.

As a declared project under the *Major Transport Projects Facilitation Act 2009*, Melbourne Metro has access to a wide range of powers to streamline delivery in relation to the rail tunnel and stations. The Victorian Minister for Planning has agreed to a planning and approvals pathway that involves an assessment of key components of Melbourne Metro, including the tunnel and stations, under an Environment Effects Statement (EES) in accordance with the *Environment Effects Act 1978*.

Work has commenced on the EES to examine all potential impacts of the project, provide guidance on how adverse impacts can be mitigated and inform planning consultation and approval decisions.

How will Melbourne Metro be managed?

The Melbourne Metro Rail Authority will manage the delivery of Melbourne Metro

The Melbourne Metro Rail Authority (MMRA) was established in February 2015 to oversee the delivery of Melbourne Metro. The Coordinator-General, Major Transport Infrastructure Program, is Head of MMRA and the Chief Executive Officer of MMRA has been appointed to lead the delivery of the project.

MMRA is an Administrative Office in relation to the Department.

A strong governance framework is in place to manage and deliver Melbourne Metro. Through the Secretary to the Department, the Victorian Government has established the Major Transport Infrastructure Board to provide stewardship of Melbourne Metro.

The Major Transport Infrastructure Board oversees major transport infrastructure projects to ensure delivery is in accordance with approved business cases and project scope and technical requirements. Additional arrangements are in place to manage the interfaces between Melbourne Metro, the Level Crossing Removal Project and HCMT procurement.

Melbourne Metro's strong history of engaging the community and stakeholders

Between 2008 and 2013, a range of engagement activities were undertaken that identified strong community support for Melbourne Metro. Following the Victorian Government's commitment to the project in early 2015, wide consultation has continued.

Using a phased communications and stakeholder engagement approach, the public have and will continue to participate at key points in the planning, development and delivery of Melbourne Metro. This approach uses tools including direct meetings with key stakeholders, briefings with peak bodies and community groups and the provision of online materials and questionnaires to communicate with, inform and seek the input of the wide range of stakeholders interested in the project (including government departments and agencies, local councils, utility providers, local residents, businesses, community organisations and interest groups).

As part of the risk management process, a comprehensive project risk identification and assessment was conducted according to the Victorian Department of Treasury and Finance's High Value High Risk Guidelines⁷ and Infrastructure Australia guidelines.⁸

Risk mitigation / management strategies were identified for each identified risk and recorded in a project risk register. The risk register will be updated on an ongoing basis as the project proceeds through the EES process, design and construction.

Following the government's consideration of this Business Case, the next phase of Melbourne Metro will include developing a detailed Risk Management Plan for risks retained by the State under the respective procurement models for each work package.

⁷ Department of Treasury and Finance, Investment Lifecycle and High Value High Risk Guidelines.

⁸ Infrastructure Australia, National Public Private Partnership Guidelines Volume 4: Public Sector Comparator Guidance.

What are the recommendations of this Business Case?

It is recommended that the Victorian Government approves this Business Case and proceeds to full implementation of Melbourne Metro

This Business Case presents an extensive analysis which demonstrates that Melbourne Metro is the most appropriate solution to respond to the challenges facing Melbourne's rail system and the growth needs of Melbourne.

Melbourne Metro:

- Aligns with the strategic policy objectives of Commonwealth, Victorian and Local Governments
- Meets a pressing need to increase capacity of the metropolitan rail network
- Represents the best option identified to deliver the objectives of rail investment
- Delivers substantial social, environmental and economic benefits
- Is economically viable and backed by a strong strategic case
- Is deliverable within the cost and timeframes proposed
- Is widely supported by stakeholders and the community.

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PART A

DEFINING THE BUSINESS NEED AND STRATEGIC RESPONSE

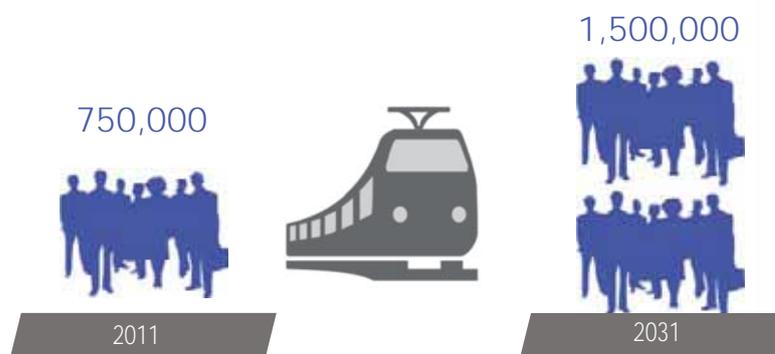
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CHAPTER 1

Melbourne: A growing and changing city – Chapter Summary

- Melbourne's population is projected to almost double by 2051. Much of this population growth will take place away from the city centre in greenfield residential developments along growth corridors in the city's north, west and south east.
- Melbourne's public transport demand is rapidly outstripping the capacity of the existing metropolitan rail network. As shown in the diagram below, patronage will continue to increase over the next two decades and average weekday boardings on metropolitan trains is forecast to double from 2011 levels to 1.5 million by 2031.

Growth in average weekday boardings on metropolitan trains



Source: PTV.

- Melbourne's economic prosperity and liveability will be impacted without significant investment to improve the network, which is already under intense pressure, to keep pace with demand and to support a highly accessible and well connected city.
- To deliver the required increase in capacity to meet the city's growing rail travel need, the strategic case for Melbourne's rail system demonstrates that Melbourne Metro will best deliver this capacity.



1 Melbourne: A growing and changing city

1.1 Introduction

Melbourne's liveability and economic prosperity will be adversely impacted without an increase in the capacity and efficiency of the rail network. Insufficient network capacity and poor efficiency not only impacts productivity and accessibility to jobs in Central Melbourne, it negatively impacts regional Victorians' access to key cultural and health destinations and experiences within the State's capital, such as sports and the arts.

Melbourne's population is projected to grow by one third by 2031 and almost double by 2051.¹ Within 40 years, Melbourne is expected to be home to around eight million people, with much of this population growth concentrated in greenfield residential developments along growth corridors through the city's north, west and south east with strong growth also forecast for the city centre.

Melbourne's economy is forecast to continue to shift away from a traditional reliance on manufacturing to one based around knowledge-based services. The distribution of employment across the city is also expected to change, with growth in service based jobs concentrated in the CBD and manufacturing based industries shifting to the west.

As Melbourne's population increases, so does the demand for travel. Increasing numbers of people are using public transport to access employment, health, education, sport and leisure amenities every day. More services are also delivered around the city and more goods are moving through the city's roads, ports, airports and freight terminals.

Melbourne's current public transport system network is under considerable strain, particularly the metropolitan train network, which has the highest levels of annual patronage when compared to other public transport modes. The impact of an increasingly constrained rail network include:

- Overcrowding during peak commuting periods
- Reducing access to the CBD, affecting visitors, businesses and Victorians making daily or weekly trips to access education, health, services, shops and other activities
- Undermining business and jobs growth in the CBD, affecting Melbourne and Victoria's ability to attract and retain skilled workers
- Little to no incentive for people to reduce their car travel.

As accessibility and connectivity are the hallmarks of a successful city, there is a clear need to transform Melbourne's metropolitan rail network to provide the capacity needed to meet the demand generated by the city's growing population and changing economy.

Changes in the rate and pattern of population and jobs growth will place increasing pressure on Melbourne's infrastructure and services. This must be addressed to sustain Melbourne's future liveability, productivity and competitiveness.

Major investments in transport infrastructure lay a solid foundation for a highly liveable and well-connected city. Growth demands transformative solutions, pragmatic approaches, and a willingness to invest in the right infrastructure to secure the city's future success.

¹ Based on a current population of four million. See Department of Transport, Planning and Local Infrastructure, Victoria in Future 2014 Projections, Greater Melbourne GCCSA.

1.2 Key drivers for Melbourne Metro

1.2.1 Melbourne's population is growing at unprecedented levels

In recent years, Melbourne has experienced significant population growth, a trend which is expected to continue into the future.

During the periods 2012-13 and 2013-14, Melbourne experienced consistent annual population growth of 2.2 per cent, which is slightly higher than the 2.0 per cent average (compound) annual population growth over the past decade.²

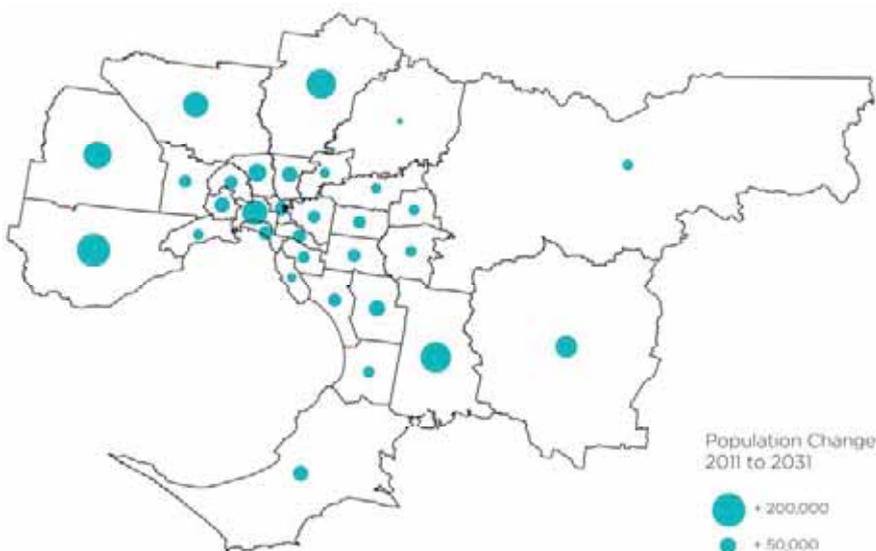
According to Victoria in Future 2014 projections (VIF 2014), Melbourne's population is expected to reach 6 million by 2031 and 7.8 million by 2051³ from a current population of 4 million.

1.2.2 Greenfield residential growth to the north, west and south east

To accommodate further population growth, Melbourne will require at least 1.6 million new dwellings by 2050.⁴

As illustrated in Figure 1-1, over 40 per cent of Melbourne's population growth is expected to occur in greenfield residential developments in the northern, western and south eastern growth areas. These include Local Government Areas (LGAs) such as Hume, Melton, Wyndham, Cardinia and Whittlesea, which are already experiencing average annual percentage population growth ranging from 2.5 per cent to nearly 6.0 per cent (in comparison with Greater Melbourne's overall average growth of approximately 2.2 per cent p.a.).⁵ For example the Melton LGA has been forecast to grow at 4.2 per cent per year between 2011 and 2031. As newly developing residential areas, these LGAs do not yet have mature public transport links and connectivity.

Figure 1-1 – Forecast population growth by Local Government Area (2011 – 2031)



Source: VIF, 2014.

² Australian Bureau of Statistics, *Regional Population Growth, Australia, 2013-14* (cat.no. 3218.0).

³ Department of Transport, Planning and Local Infrastructure, *Victoria in Future 2014: Population and Household Projections to 2051* (2014), 4.

⁴ Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (May 2014), 5.

⁵ Department of Transport, Planning and Local Infrastructure, *Victoria in Future 2014: Population and Household Projections to 2051* (2014), 1.

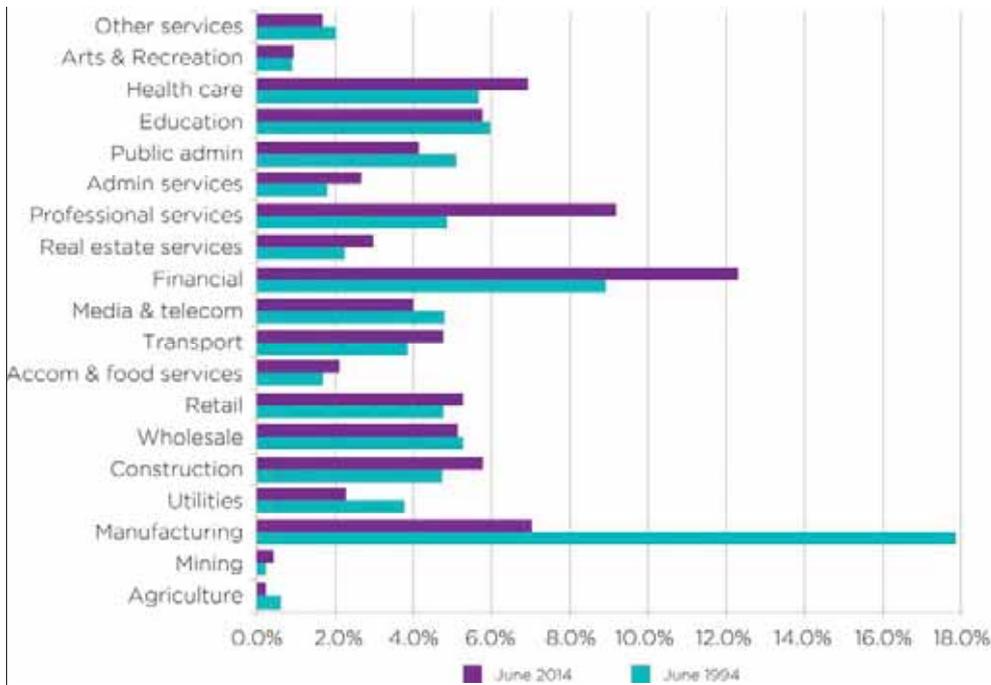
1.2.3 Employment is growing strongly in Central Melbourne

Melbourne employment and economic activity has shifted to a range of industries within the services sector and particularly to key 'knowledge-based' (financial and insurance, professional, scientific and technical services) and education services. Knowledge-based services now account for 21.6 per cent of Gross State Product (GSP), up from 17.8 per cent two decades earlier,⁶ and these services are forecast to be increasingly important drivers of Melbourne's prosperity.⁷

There has also been a steady, sustained decline in the manufacturing sector in Victoria. Since 1994, the manufacturing sector's share of employment has fallen to 11 per cent from 20 per cent⁸ and its share of GSP has fallen to 7 per cent from 17.8 per cent.⁹

Figure 1-2 depicts the change in Melbourne's industry structure over the two past decades, measured by industry gross value added share of total Melbourne industry value added (excluding dwelling ownership). As the graph shows, the value of Melbourne's manufacturing industry relative to the industry value as a whole has reduced by more than 50 per cent over this period.

Figure 1-2 – Share of value added industry, Melbourne (June 1994 – June 2014)



Source: SGS Economics & Planning.

Figure 1-3 illustrates the changes to the Victorian industry structure over time and shows the manufacturing industry's value added share of the State's total industry has steadily declined.

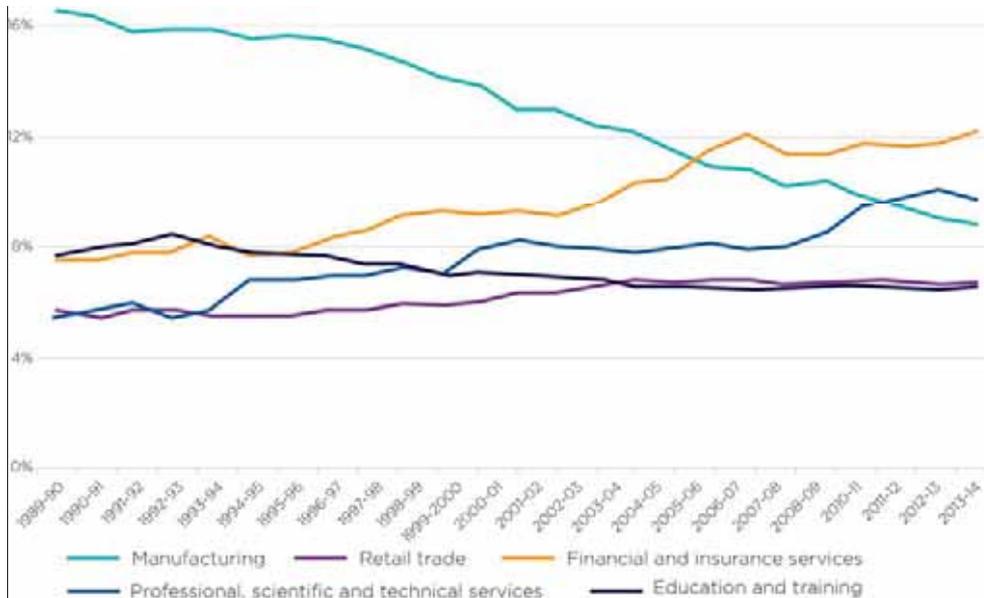
⁶ SGS Economics and Planning, *Australian Cities Accounts 2013-14* (November 2014), 15.

⁷ Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (May 2014), 5.

⁸ Australian Bureau of Statistics, *Labour Force, Australia, Detailed, Quarterly, Feb 2015* (cat.no. 6291.0.55.003).

⁹ SGS Economics and Planning, *Australian Cities Accounts 2013-14* (November 2014), 14.

Figure 1-3 – Share of value added industry, Victoria (1989-90 to 2013-14)



Source: ABS, 'Share of value added industry, Victoria 1989/90 to 2013/14', 5220.0 Australian National Accounts: State Accounts. Excludes ownership of dwellings, taxes less subsidies on products and statistical discrepancy.

The pace of change appears to be increasing and is being influenced by a variety of factors. Competitive pressures on the manufacturing sector and other trade-exposed industries have escalated over recent years while, at the same time, Victoria is pursuing new trade agreements with key trading partners in Asia and seeking out high value emerging markets in industries such as education, agriculture, processed foods and beverages, environmental services, Information Communications and Technology (ICT) and health care. The digitisation of the global economy is also influencing the Victorian and Melbourne economies by transforming how goods and services are designed, produced and distributed.

Government policies have been established to support the changing economic landscape. For example, the \$200m Future Industries fund was created to support six key high-growth sectors that have the potential for extraordinary growth and the capacity to create high-skill, high-wage jobs. These key high-growth sectors include professional services, medical technologies and pharmaceuticals, transport, defence and construction technologies, and new energy technologies.

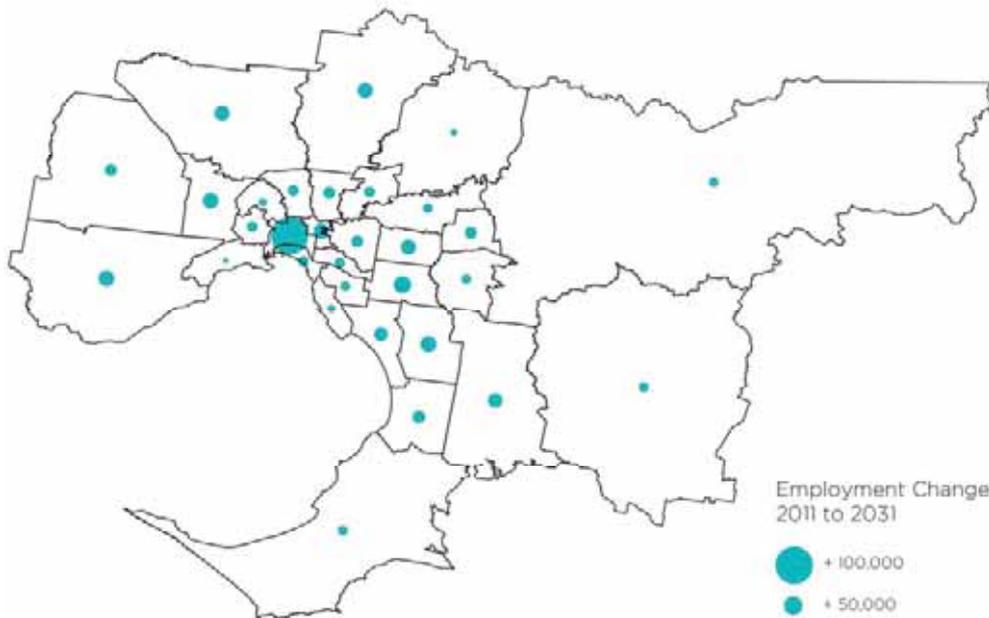
Growth and subsequent targeted investment in knowledge-based services, education services and healthcare services are influencing Melbourne's economic base and impacting the way Melbourne develops.

The Arden-Macaulay Precinct in North Melbourne is an example of a significant opportunity for urban renewal and central city expansion. For example, manufacturing businesses today are clustered increasingly in Melbourne's outer north, west and south east, where they can take advantage of large and relatively inexpensive parcels of land with good (and improving) access to the major road network.

As the manufacturing sector is closely aligned with the transport, warehousing and wholesale trade sectors, these are also moving from inner Melbourne to the outer north, outer west and south east of the city. This shift of industrial activity has freed-up land in inner urban areas to accommodate Melbourne's growing knowledge-based economy.

As illustrated in Figure 1-4 below, as the transition towards professional services strengthens this will prompt a corresponding shift in the geographic concentration of employment opportunity towards Central Melbourne where the majority of professional services firms and other service-based employment opportunities will be located.

Figure 1-4 – Forecast employment growth by LGA (2011 to 2031)



Source: SGS Economics & Planning.

Over the past decade, Central Melbourne has been responsible for around one third of the growth in GSP, illustrating the importance of the knowledge-based services sector to Victoria and the important economic and employment role played by the inner core of the city.¹⁰

By 2051, over 1.7 million new jobs are projected to be created in Melbourne, with a large share in the CBD and adjacent inner suburbs.¹¹

More efficient public transport services and increased connectivity are required to:

- Support access into and around Central Melbourne
- Accommodate employment and business growth in key knowledge-based precincts such as Arden, Parkville, CBD North and Domain
- Open up new commercial space within proximity of the CBD and support significant urban renewal.

Central Melbourne, which includes the CBD, is set to become Australia's largest business centre, with jobs projected to grow from 435,000 in 2011 to almost 900,000 jobs by 2051.

Source: Plan Melbourne (2014).

1.2.4 Rail patronage is outstripping network capacity

As illustrated in Figure 1-5, rail patronage grew strongly from 89 million trips in 1980-81 to 227.5 million trips in 2014-15.

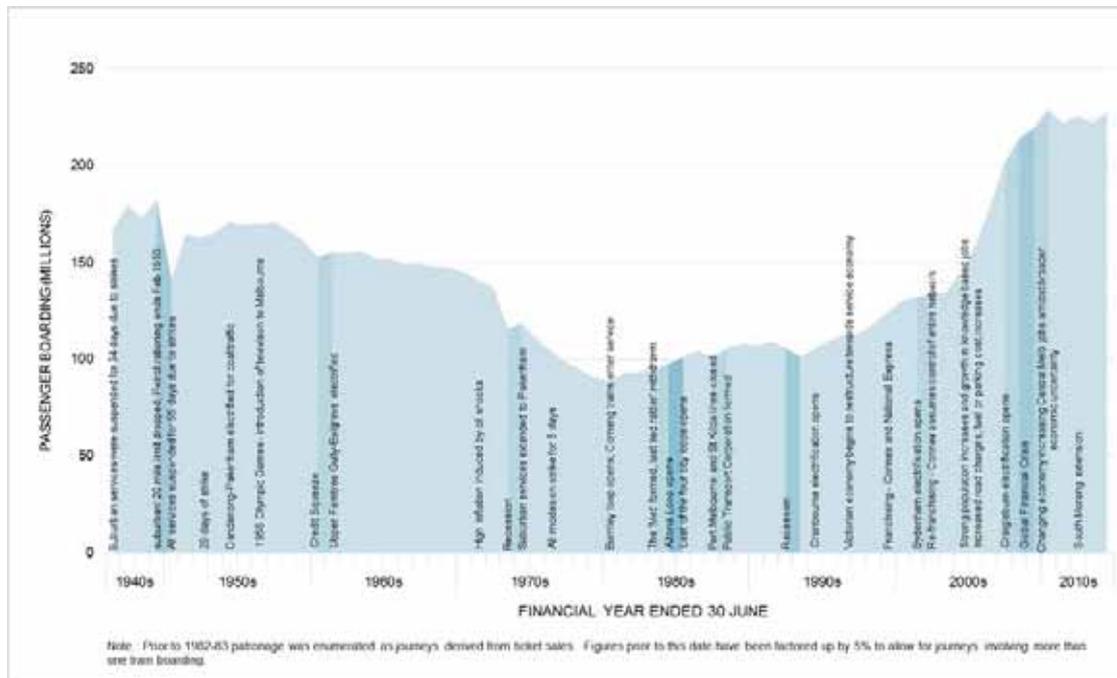
The combination of population growth and employment growth in the CBD (which is more difficult to access by car, particularly during business hours) has driven patronage to historical highs.

Even as overall patronage growth has fluctuated in recent years, there has been continuing strong patronage growth on trains coming into the city during the morning peak period, when trains are busiest and capacity constraints are most strongly felt.

¹⁰ Victorian Government, *Victoria's 2012 Priority Infrastructure Submission to Infrastructure Australia*, (2012).

¹¹ Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (2014), 23.

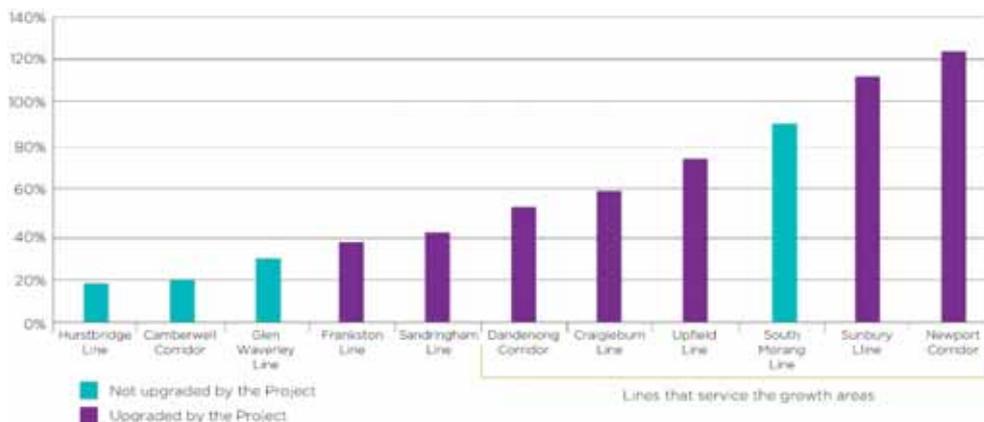
Figure 1-5 – Events affecting metropolitan train patronage (1946-47 to 2014-15)



Source: Public Transport Victoria (2015), Melbourne Metro Public Transport Customer Demand Forecasts for Business Case (2015), 17.

Patronage on the lines servicing Melbourne's growth areas has grown more rapidly than those servicing other areas of Melbourne. As shown in Figure 1-6 below, peak period growth (measured at the cordon) from 2005-15 on those lines servicing the growth areas ranges between 50 per cent and 120 per cent. Melbourne Metro increases capacity on seven of the eight fastest growing rail corridors: the Frankston Line, Sandringham Line, Dandenong Corridor, Craigieburn Line, Upfield Line, Sunbury Line and Newport Corridor.

Figure 1-6 – 2 hour AM Peak period growth 2005 to 2015 – metropolitan train corridors (Total Cordon Load)



Source: PTV.

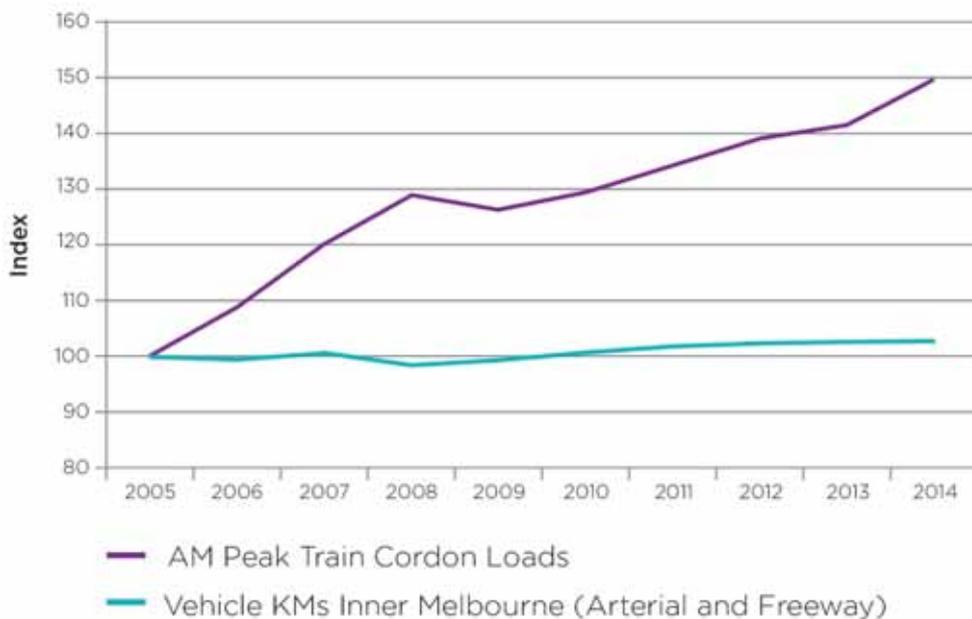
Across the network, the number of people travelling into the city in the morning peak period (across the cordon between 7am and 9am) is expected to grow by 65 per cent between 2015 and 2031. This growth will be felt more strongly on lines serving growth corridors in Melbourne’s north, west and south east.

Over the last decade, the level of AM Peak train loads rose significantly when compared to the vehicle kilometres travelled in inner Melbourne. Since 2005, as shown in Figure 1-7, AM Peak train loads have increased by over 50 per cent whereas the level of private vehicle kilometres in inner Melbourne (arterial and freeway) remained static. This significant level of growth demonstrates that more people are opting to travel on trains than private vehicles, and that Melbourne needs a modern public transport system to accommodate this choice.

By the early 2030s, the number of passengers coming into the city from the north and west in the AM Peak period will have more than doubled.

Melbourne’s population and resulting public transport demand is outstripping the capacity of the city’s existing rail network, which was designed to serve a much smaller population.

Figure 1-7 – Index of AM Peak Train Cordon Loads vs Vehicle KMs in Inner Melbourne (2005 to 2014)



Source: PTV and VicRoads Online Traffic Monitor.

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CHAPTER 2

Background to the Business Case – Chapter Summary

- The Department prepared this Business Case in consultation with Public Transport Victoria and input from the Department of Treasury and Finance (DTF) and Department of Premier and Cabinet (DPC).
- This Business Case reports the results of current investigations and the latest refinements in the proposed scope, program, benefits and costs of the project.
- The primary purpose of the Business Case is to:
 - Define the problem to be solved
 - Articulate the key benefits that result if the problem is solved
 - Assess alternative strategic responses and solutions, including demand and productivity based solutions and opportunities to increase supply
 - Define and assess alternate alignment options
 - Recommend a solution that includes an analysis of transport network, financial, risk, economic, environmental and social impacts
 - Provide guidance on the implementation and delivery of the recommended solution.
- The Business Case seeks funding for:
 - Two nine-kilometre rail tunnels from South Kensington to South Yarra as part of a new Sunshine – Dandenong Line, five new underground stations at Arden, Parkville, CBD North, CBD South and Domain, a new transport interchange at Domain and tunnel entrances (portals) at South Kensington and South Yarra
 - HCS from Watergardens to Dandenong
 - Small to medium scale rail system and other works across the rail network to capitalise on the opportunity created by the project to increase capacity, reliability and efficiency on other rail lines.
- The Business Case identifies a number of key projects (e.g. new rolling stock) that are subject to separate funding requests, which need to be delivered to operate the proposed services on day one, as well as other projects that Melbourne Metro will enable which will increase the capacity of the system.



2 Background to the Business Case

2.1 Introduction

Melbourne's metropolitan rail network has served the city well. The growing population is generating an increasing demand for travel and the network is coming under intense pressure (as discussed in Chapter 1). Major changes are needed to ensure the network continues to meet Melbourne's transport needs into the future.

Against this background, the Victorian Government has committed to building Melbourne Metro, a 'city shaping' investment that constructs a new inner urban underground rail tunnel and five new underground stations.

The project resolves major existing capacity constraints which will enable operational issues to be addressed, and will start to transform Melbourne's rail network into an international-style metro system while enhancing accessibility and intermodal connectivity into and throughout Central Melbourne. In turn, this will support new patterns of economic development, residential growth and urban renewal, and deliver substantial economic benefits to the Victorian and national economies.

2.2 Melbourne Metro objectives

The following high-level objectives establish the broad strategic direction for the project:

- Provide additional capacity on Melbourne's rail system to meet customer needs that, as part of a program of investment, meets projected medium-term demand and supports long-term patronage growth
- Optimise the efficiency and reliability of operations and improve the customer experience by moving towards a metro-style rail system
- Support the long-term plan and vision to develop and operate Victoria's rail network
- Improve access and reduce congestion of the tram system in Central Melbourne and the road network in the north, west and south east by diverting travel to the rail network
- Improve accessibility to jobs, education and other social and economic opportunities by enabling the growth and more effective use of land in Melbourne
- Deliver strong productivity, sustainability and liveability benefits by providing a value for money transport solution
- Contribute to a safe, accessible rail network that supports the health and wellbeing of users.

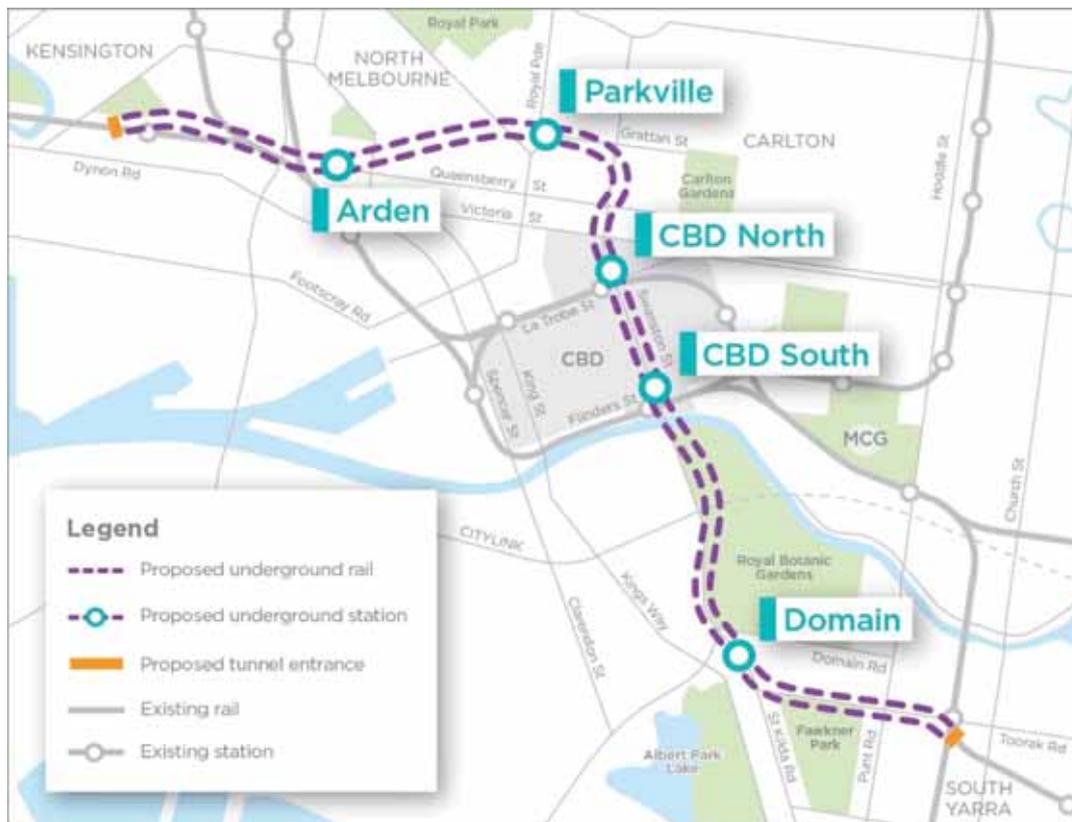
2.3 Scope of Melbourne Metro and related projects

The scope of works of the project includes:

- Twin nine-kilometre running tunnels, from South Kensington to South Yarra, linking the Sunbury and Cranbourne / Pakenham Lines
- Tunnel entrances (portals) at South Kensington and South Yarra
- New stations at Arden, Parkville, CBD North (interchanging with Melbourne Central station), CBD South (interchanging with Flinders Street Station) and Domain with longer platforms to accommodate HCMTs
- HCS from Watergardens to Dandenong
- New train / tram interchange at Domain.

The proposed alignment of the Melbourne Metro rail tunnel is outlined in Figure 2-1.

Figure 2-1 – Melbourne Metro proposed tunnel alignment



Source: AJM.

The project connects the metropolitan lines that service two of Melbourne's largest growth corridors to the north west and south east (Sunbury and Cranbourne / Pakenham Lines). Moreover, other lines can better meet demand requirements by using the significantly increased capacity that removing these services from the inner core enables.

To take full advantage of the wider network capacity and performance opportunities created by the Melbourne Metro rail tunnel, a range of signalling upgrades, civil and track works (Wider Network Enhancements) are proposed. These will optimise the broader network benefits by increasing the frequency of train services on the new alignment as well as the Werribee, Craigieburn, Upfield, Sandringham and Frankston Lines.¹

The procurement of 25 HCMTs² and associated stabling and power supply works will also be required to deliver new services on the opening of Melbourne Metro. This rolling stock and associated works will be subject to a separate funding submission but are included in the economic evaluation of the Melbourne Metro Program.

Melbourne Metro will incorporate features to accommodate future increased capacity demands by, for example:

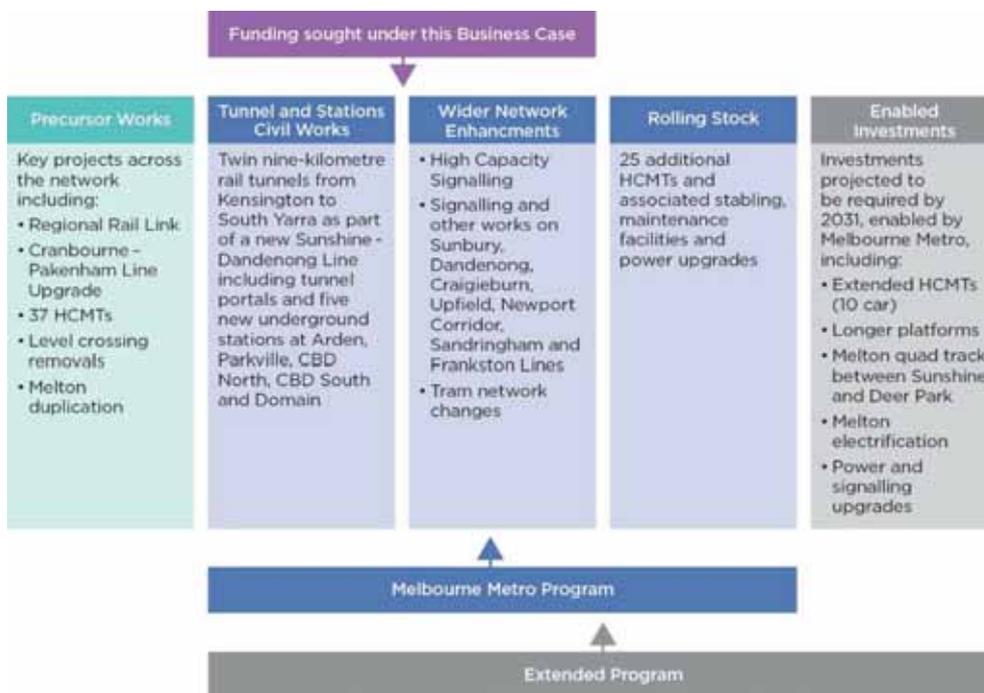
- Providing platform lengths at the five new stations that can cater to longer HCMTs that have more carriages and can carry approximately 600 more passengers than trains used today
- Installing HCS along most of the corridor to increase the number of trains that can run on the line per hour by reducing the headway (interval) between trains.

These features will be essential to the successful delivery of a number of Enabled Investments (primarily Melton electrification), which are expected to be required shortly after the opening of Melbourne Metro.

Figure 2-2 illustrates:

- The various categories of works associated with Melbourne Metro
- Categories of works and funding that this Business Case covers
- Future projects that Melbourne Metro directly enables.

Figure 2-2 – Melbourne Metro categories of works and associated funding



¹ An additional investment in rolling stock and associated stabling and power supply is also required to commence operations in 2026, which will be subject to a separate funding request.

² These trains are in addition to the 37 HCMTs currently being purchased to augment the existing fleet.

2.4 Business Case development and purpose

2.4.1 High Value High Risk process

Melbourne Metro will be subject to Victoria's High Value High Risk (HVHR) Investment Framework assurance process for capital projects. The aim of this process is to achieve greater rigour in investment development and oversight with the Treasurer of Victoria and DTF being involved across the investment lifecycle and rigorous assessment undertaken at each stage.

This Business Case was developed according to the HVHR Investment Framework. Therefore, the process outlined in Figure 2-3 was followed to develop this Business Case.

Figure 2-3 – DTF Business Case process



Source: DTF HVHR Guidelines.

2.4.2 Development of this Business Case

This Business Case acknowledges, but does not rely on, earlier work undertaken in relation to Melbourne Metro, including extensive prior technical investigations and business case work. This Business Case is consistent with the HVHR Investment Framework and reflects the results of current investigations and the latest refinement in the proposed scope, program, benefits and costs.

This Business Case has been subjected to a Gateway 2 review. The Gateway process provided a robust and independent peer review of the progress of the project and provided advice on key actions that the project team needs to undertake to provide assurance that Melbourne Metro is ready to proceed to the procurement phase. The recommendations of this review are addressed in this Business Case.

The scope of the analysis contained within each Chapter of this Business Case is set out in Figure 2-4.

Figure 2-4 – Scope of analysis in this Business Case

| Scope item | | Relevant analysis / chapters in this Business Case | | | |
|------------------|-------------------------|--|--|---|--|
| Precursor Works | | | | | |
| Extended Program | Melbourne Metro Program | The project | Melbourne Metro Program (Chapters 2-8) Risk analysis (Chapter 11) Financial analysis (Chapter 12) Preliminary environmental and social assessment (Chapter 13) | Melbourne Metro Benefits (Chapter 9) | |
| | | Tunnel and Stations Civil Works + Wider Network Enhancements | Packaging and procurement options analysis (Chapter 14) Value capture – integrated development opportunities (15) Budget impacts (Chapter 16) Stakeholder engagement (Chapter 17) | Economic evaluation (Chapter 10) Implementation (Chapter 18) | Melbourne Metro Benefits (Chapter 9) Economic evaluation (Chapter 10) |
| | | Rolling Stock | | | |
| | | Enabled Investments | | | |

As shown earlier in Figure 2-2, a range of Wider Network Enhancements and rolling stock are required to achieve the proposed 2026 service plan. While funding for the rolling stock will be sought separately to this Business Case, the costs and benefits are inextricably linked to the project and are therefore included in the economic assessment.

Funding for the Enabled Investments will be sought separately to this Business Case. The Melbourne Metro benefits and economic analyses are also provided on the basis of an Extended Program in the relevant chapters to illustrate the enabling nature of the investment in Melbourne Metro in facilitating future projects.

2.4.3 Previous work and studies

Over the last ten years, successive Victorian Governments examined alternative responses to boosting public transport capacity to meet Melbourne’s current and forecast travel demand including, for example:

- 2008: ‘Investing in Transport – East West Link Needs Assessment’ report — This major transport study undertaken by Sir Rod Eddington recommended commencing with the staged construction of a new 17-kilometre Melbourne Metro rail tunnel to link Melbourne’s western and south eastern suburbs
- 2009: Infrastructure Australia (IA) assessment — IA released its first assessment of the Melbourne Metro Stage One project and classified it as ‘ready to proceed’
- 2010-11: Completion of business cases for Melbourne Metro Stage One to Domain (2010) and subsequently (following value engineering) South Yarra (2011)
- 2012-13: IA assessment — following further value engineering of the 2011 alignment and variation in scope and initial operations from the former Melbourne Metro Stage One to Domain business case, IA classed Melbourne Metro as a new ‘threshold’ project.

2.4.4 Purpose of this Business Case

The Department developed this Business Case in consultation with PTV and MMRA with input from DTF and DPC.

The primary purpose of this Business Case is to:

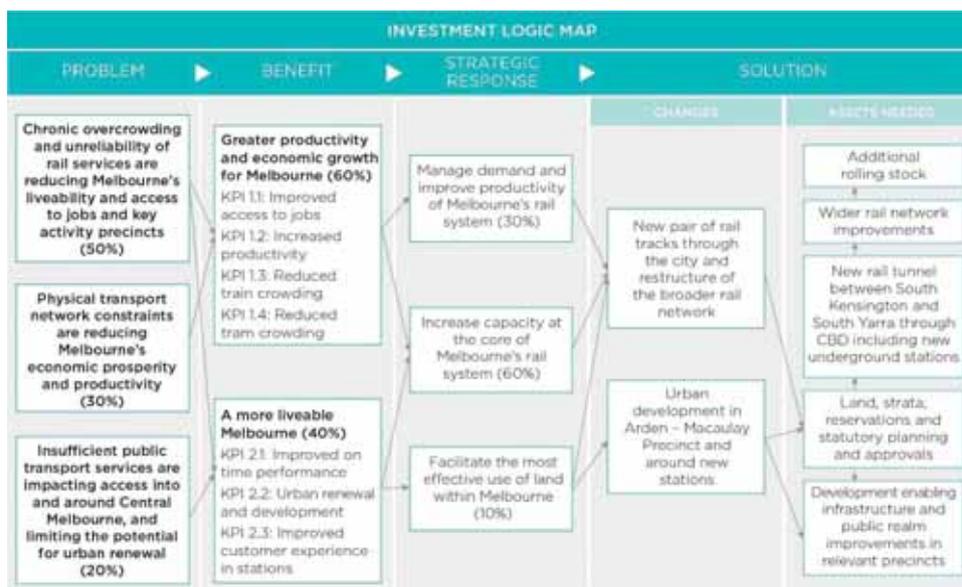
- Define the problem trying to be solved
- Articulate the key benefits that result if the problem is solved
- Assess alternative strategic responses and solutions, including demand and productivity-based solutions and opportunities to increase supply
- Define and assess alternate alignment options
- Recommend a solution that includes an analysis of transport network, financial, risk, economic, environmental and social impacts
- Provide guidance on the implementation and delivery of the recommended solution.

2.5 Investment Logic Map

To improve the transparency of decision-making in relation to complex major projects, DTF has developed an Investment Logic Map (ILM) framework that summarises the rationale behind a particular investment. The ILM developed for Melbourne Metro was developed in consultation with relevant Victorian Government departments and the Department's external advisors and builds on the ILMs developed for former Melbourne Metro-related business cases and alternative rail capacity projects.

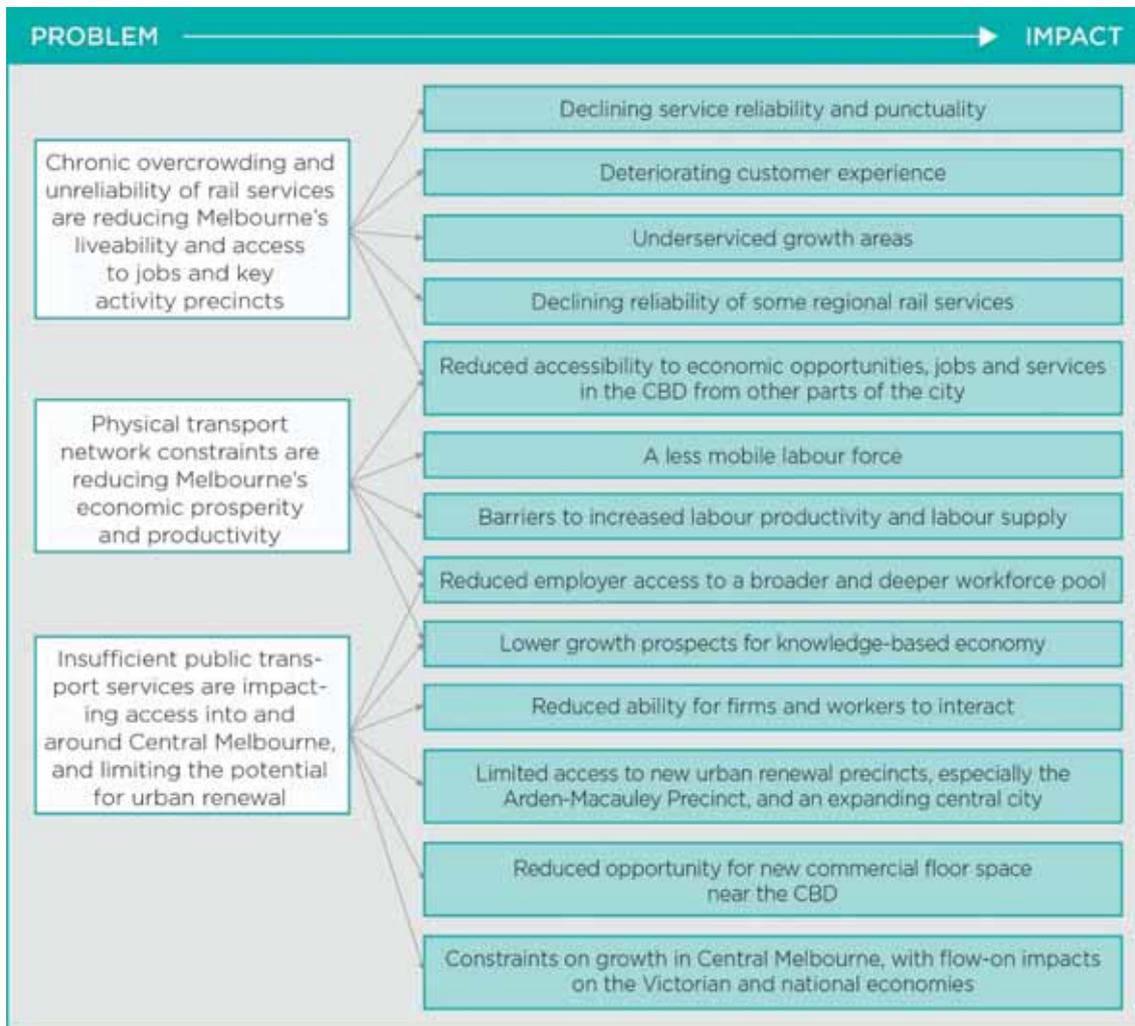
As shown in Figure 2-5, the ILM nominates and applies weightings to three high-level problems that the Government is seeking to address. The percentages indicate the relative importance or weighting provided to each problem, benefit and strategic response, respectively. It identifies the key benefits that will be realised from tackling these problems successfully, the strategic responses required to achieve these benefits and the potential solutions to deliver these responses.

Figure 2-5 – Investment Logic Map



The three problems identified in the ILM and their impacts are summarised in Figure 2-6 and described in more detail in Chapter 3.

Figure 2-6 – Problems and impacts



Benefits of 'city shaping' investments

Broader 'city shaping' context informed the development of the ILM and objectives for Melbourne Metro, as studies demonstrate that city-shaping transport projects deliver specific benefits that can trigger shifts in land values, housing density and commercial development. These include, for example:

- Improving business-to-business synergies
- Removing or reducing transport constraints to expand high-value added industries in advantageous locations
- Improving labour participation and productivity³
- Allowing greater household choice, with improved access to work, education and services
- Reducing household travel costs, freeing up finances for other activities
- Improving equity and social inclusion.

To realise these benefits actions must take advantage of the improved accessibility offered by these investments, such as land use planning changes, support for business clusters and employment areas and urban renewal initiatives.

For example, the City Loop (built in the 1970s and early 1980s) facilitated considerable commercial and residential development, specifically expanding the (then) northern end of the CBD grid, increasing productive capacity of the central city.⁴

Melbourne Metro will improve accessibility of the Arden, Parkville and Domain precincts to the CBD and improve Central Melbourne accessibility using two new underground stations at CBD North and CBD South. This provides the next opportunity to shape the development of Central Melbourne.

³ SGS Economics and Planning, *An Infrastructure agenda for Australian cities, Presentation to 7th International Urban Design Conference, Adelaide* (September 2014).

⁴ It is currently estimated to contribute \$10bn p.a. to Victoria's GSP.

CHAPTER 3

Problem – Chapter Summary

- Melbourne's rail network is approaching capacity and experiencing considerable pressure due to various factors including unprecedented population growth, record public transport patronage growth over the last decade (particularly during peak travel times), the geographic separation of employment growth from areas of residential population growth, and the increasing demand for access to and in an expanded Central Melbourne.
- Current limitations in operating the rail network cause unreliability and are a significant constraint on increasing the number of train services to address these factors and meet the growing demand for rail travel.
- Three key problems are driving the need for government intervention:
 - **Risk to Melbourne's liveability and reduction in access to job and key activity precincts due to chronic overcrowding and unreliability of rail services** – unprecedented patronage demand is exceeding the capacity of metropolitan rail services during peak times, and capacity constraints will intensify within the next five to ten years, exacerbating overcrowding and delays. This will lead to negative customer experiences, reduce the reliability and quality of train services, and reduce accessibility to economic opportunities, education and cultural and social amenities.
 - **Reduction in Melbourne's economic prosperity and productivity due to the physical constraints of the transport network** – there is a misalignment between legacy public transport networks and growing job catchments that affects the mobility of Melbourne's labour force, erodes employers' access to a broader and deeper workforce, and constrains economic growth and productivity.
 - **Limited access to Central Melbourne and the potential for urban renewal due to insufficient public transport with limited transport capacity** – Central Melbourne is projected to be a key service-based employment hub. More efficient public transport services and connectivity are required to support access into and around Central Melbourne to accommodate employment and business growth (especially in knowledge-based sectors), to enhance accessibility to education and cultural opportunities, and to open up new commercial floor space within proximity of the CBD and facilitate development in urban renewal areas, such as the Arden-Macaulay Precinct.
- Growth is so rapid on some rail lines that even upgrades, such as the Regional Rail Link and introduction of HCMTs, will only extend the capacity to manage growth to a point. The network is carrying more passengers than ever before, is reaching a point of full utilisation on the fastest growing lines, and can no longer satisfactorily meet growing demand. Population growth forecasts for Melbourne indicate that this situation will deteriorate further without significant intervention.
- Addressing these problems is a matter of priority to avoid long-term impacts to Melbourne's liveability and prosperity, as these problems continue to compound with time.



3 Problem

3.1 Context of the Problem

As outlined in Chapter 1, a growing population and a changing economic landscape are creating challenges for Melbourne's transport networks. In particular, the metropolitan rail network is under significant pressure, with demand rapidly outstripping capacity. This situation will worsen as patronage continues to rise over the next 20 years.

Melbourne's rail network was built to serve patterns of travel and demand that vary markedly from current and anticipated future requirements. The city's metropolitan rail infrastructure is a significant legacy asset, dating back to the mid-1800s when Melbourne was establishing itself as one of Australia's leading cities.

As Melbourne's population continued to grow over the following decades, governments responded with significant modernisations and expansions, such as electrifying the network in the 1920s and building the City Loop between 1971 and 1985. Recently, the Regional Rail Link delivered extra capacity by removing major rail bottlenecks and untangling metropolitan and regional tracks as they travel through Melbourne's west into the heart of the city. Other projects to boost capacity included the electrification of the network to Craigieburn and Sunbury and the extension of the metropolitan network to South Morang.

3.1.1 Demand for access to Central Melbourne will continue to grow

As Central Melbourne grows and economic activity intensifies into the future, there will be considerable growth in travel demand for access to Central Melbourne. Not only will access to Central Melbourne continue to grow based on economic drivers, it will also be driven by tourist (overseas and local) movements, overseas demand for Australian education institutions and the need for cross-city travel in general.

With limited road space into Central Melbourne (57 inbound traffic lanes¹), 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 often competes with other uses. These uses include provision for flows of trams, cars, bicycles and pedestrians amidst distinctive and high amenity places and more productive land uses (particularly in the case of off-street parking).

To maintain the city's liveability and accessibility, this demand will need to be met largely by walking, cycling and public transport,² putting increasing pressure on these networks. Cars will continue to provide access to the central city, but travel by car is already becoming a smaller part of the overall transport task for these areas over time.

Over the last decade, the level of AM Peak train loads rose significantly when compared to the vehicle kilometres travelled in inner Melbourne. Since 2005, as shown in Figure 3-1, AM Peak train loads increased by over 50 per cent³ (whereas the level of private vehicle kilometres in inner Melbourne (arterial and freeway) remained largely stagnant.⁴

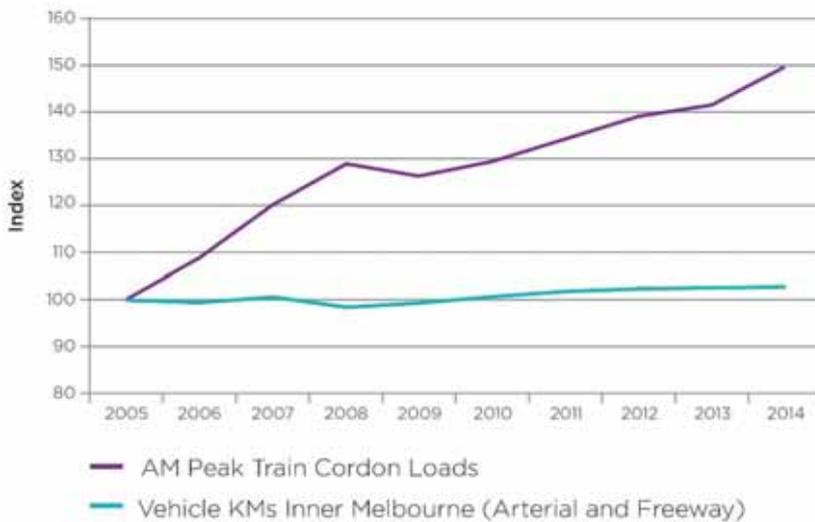
¹ Comprising freeway and arterial lanes. Source: PTV.

² Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (2014), 114.

³ From over 94,000 in 2005 to over 142,000 in 2015.

⁴ From 3.07 in 2005 and 3.21 in 2014.

Figure 3-1 – Index of AM Peak Train Cordon Loads vs Vehicle KMs in Inner Melbourne



Source: PTV and VicRoads Online Traffic Monitor.

With these trends expected to continue, travel to inner Melbourne for work in the peak period in a private vehicle is forecast to drop substantially by mid-century, driven by the patterns of housing and job growth.

3.1.2 The divergence of population growth and new jobs will require efficient and reliable public transport connections

As discussed in Chapter 1, Melbourne is now the fastest growing capital city in Australia, with a current population of approximately 4 million and projected growth to 7.8 million by 2051.⁵ By 2031, over 40 per cent of Melbourne’s population growth is expected to occur in greenfield residential developments in the north, west and south-eastern growth corridors, most significantly in the Wyndham, Casey, Whittlesea, Melton and Hume municipalities.

Poor public transport options result in:

- Limited access to a diverse employment base, health, cultural and social amenities, knowledge hubs and other services for greenfield residential developments
- Increased motor vehicle dependence, travel inefficiency and reduced accessibility to employment opportunities in Central Melbourne where the highest levels of employment growth continue to be recorded
- Limited access to a wider choice of education services, which is detrimental to the human capital necessary for our knowledge economy
- Economic and employment vulnerability in outer suburbs due to limiting access to a wider range of opportunities.

The majority of new knowledge-based employment is projected to occur in Central Melbourne,⁶ as these industries prefer to have opportunities to build face-to-face relationships and facilitate informal knowledge sharing to capture benefits, such as economies of scale and access to a diverse pool of clients and skilled labour.

Providing efficient and reliable public transport connections between Central Melbourne and Melbourne’s north, west and south eastern growth corridors, is critical to the future economic growth and productivity of Melbourne and Victoria as these trends will accelerate the spatial divergence of population growth corridors and the location of new employment.

⁵ Department of Transport, Planning and Local Government, *Victoria in Future 2014: Population and Household Projections to 2051* (2014).

⁶ Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (2014), 25.

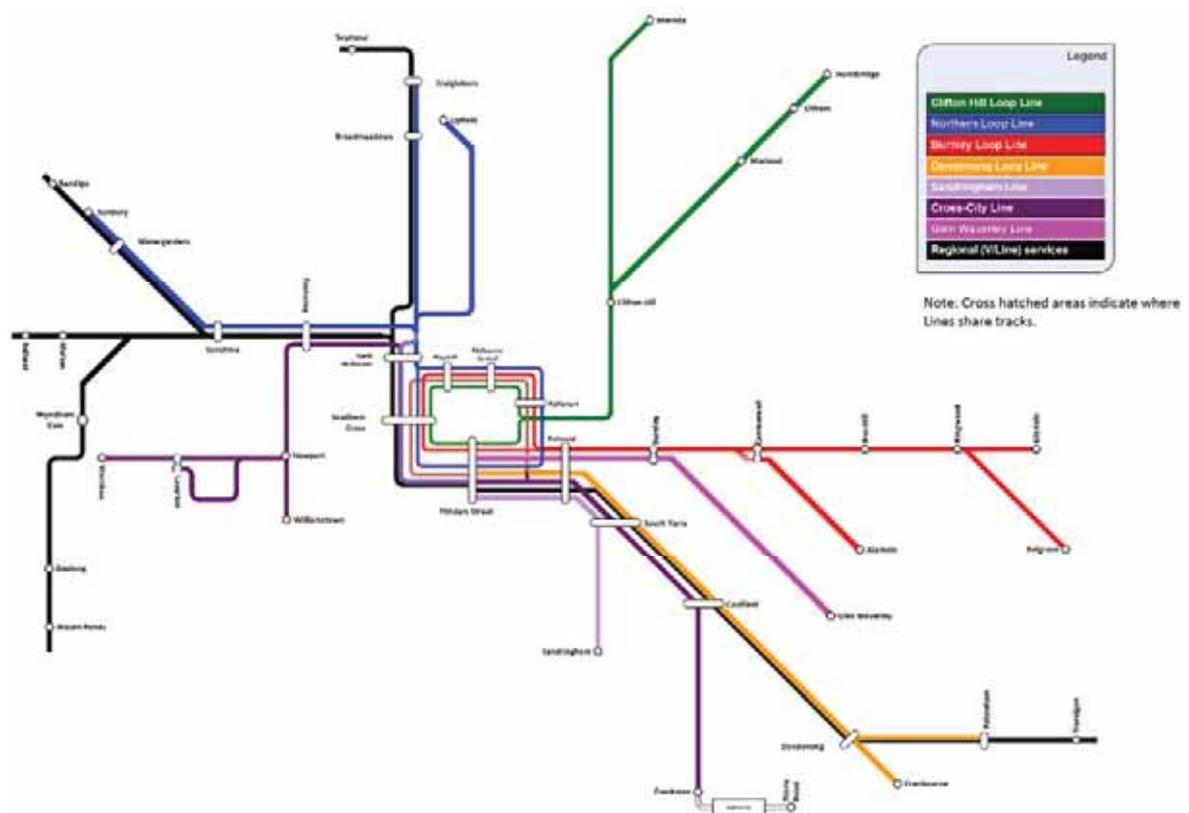
3.1.3 The existing network has significant capacity constraints

Melbourne's metropolitan train lines are broadly assembled into five groups serving distinct geographical areas:

- Trains operating through North Melbourne (incorporating the Craigieburn, Sunbury and Upfield Lines in Melbourne's north and north west)
- Cross-City Group (incorporating the Werribee, Williamstown, Frankston and Sandringham Lines in Melbourne's west and south east)
- Dandenong Group (incorporating the Cranbourne / Pakenham Lines in Melbourne's south east)
- Clifton Hill Group (incorporating the South Morang and Hurstbridge lines in Melbourne's north and north east)
- Burnley Group (incorporating the Glen Waverley, Alamein, Belgrave and Lilydale Lines in Melbourne's east).

Figure 3-2 shows the current arrangement of the metropolitan rail network across Melbourne.

Figure 3-2 – Current metropolitan rail network



Source: PTV.

The current network configuration includes a number of line convergences which prevent the five groups from operating as independent metro style lines.

Inner city capacity to support full operation of only two metropolitan tracks is allocated for services from North Melbourne through the CBD:

- The Craigieburn and Upfield Lines to the north converge with the Sunbury Line at North Melbourne, utilising one track pair (around the City Loop)

- With insufficient capacity in the City Loop, some Craigieburn Line services converge with the Werribee and Williamstown services, utilising the other track pair (direct to Southern Cross and through to Flinders Street).

There are capacity constraints on the Sandringham and Frankston Lines, primarily due to platform capacity at Flinders Street Station. Issues at Flinders Street arise as the station is relied on to manage complex interactions between lines, with competing priorities associated with turnback, termination and independent operation of services.

The Dandenong Group is constrained by the nine level crossings between Caulfield and Dandenong and an outdated signalling infrastructure, other rail systems along the corridor and the merger of the Frankston and Dandenong Lines into the City Loop, which limits the number of trains that can operate. The Cranbourne Pakenham Line Upgrade (CPLU) project will address these constraints by grade separating the nine level crossings and deploying 37 HCMTs to boost capacity by 42 per cent on the Cranbourne / Pakenham Line each day⁷ and accommodate an additional 11,000 customers in the morning peak, as well as boosting capacity across the network by freeing up existing trains.⁸

These network convergences and other limitations make the rail network unreliable, and represent a significant constraint to increasing the number of train services to accommodate growing rail patronage.

Train and station overcrowding, deteriorating punctuality and unreliability will increase due to current rail network constraints

Melbourne Metro, including Wider Network Enhancements, will upgrade the suburban lines running through North Melbourne station (including Craigieburn, Upfield, Sunbury, Werribee and Williamstown lines operating via Northern Loop and Cross City routes) and Dandenong Group (comprising the Cranbourne / Pakenham Lines).

The capacity of the Craigieburn, Upfield, Sunbury, Werribee and Williamstown lines are limited by junctions around North Melbourne, the capacity of the City (Northern) Loop and the Cross-City Line from Southern Cross to Flinders Street. The capacity of Dandenong Group is limited in the by constraints south of Caulfield, but subsequent to completion of the CPLU project, will be predominantly constrained by limitations of the City (Caulfield) Loop and conventional signalling system.

By 2021, patronage demand will be exceeded on the Craigieburn and Sunbury Lines, and Werribee trains will also be experiencing significant capacity constraints. By 2031 demand will exceed capacity by 20-30 per cent on these lines, and also exceed capacity on the Upfield, Cranbourne and Pakenham lines.

This overcrowding will increasingly lead to congestion and poor amenity in stations and on-board trains, deteriorating punctuality and unreliability of services.

3.1.4 Rail patronage is increasing, especially in peak periods

Patronage on Melbourne's trains has experienced unprecedented growth over the past decade. As discussed previously, rail patronage grew strongly from a low point of 89 million trips in 1980-81⁹ to 227.5 million trips taken in 2014-15.¹⁰

As Figure 3-3 shows, peak period cordon loads have been growing steadily, even as all-day patronage growth has fluctuated in recent years. This growth was even stronger on the suburban lines to the north and west that operate through North Melbourne station and service three out of four metropolitan growth corridors (Northern, Sunbury and Western growth corridors).

⁷ For completeness it is noted that the CPLU project as a whole (including grade separations, track works, power upgrades and signalling duplication) achieves the 42 per cent increase in capacity. This capacity increase is not attributed to the HCMTs alone.

⁸ PTV, Cranbourne Pakenham Line Upgrade project website, see <http://ptv.vic.gov.au/projects/rail-projects/Works-to-transform-the-Cranbourne-Pakenham-corridor>.

⁹ Public Transport Victoria, *Melbourne Public Transport Patronage Long Run Series 1945-46 to 2010-11* (2011), 8.

¹⁰ Public Transport Victoria, *Station-by-station Fact Sheet* (2015).

Figure 3-3 – Peak period growth 2004 to 2015 – All suburban trains that operate through North Melbourne station and Network Average (Total cordon load, inbound 7-9am)



Source: PTV.

Looking to the future, PTV patronage demand forecasting estimates the number of average weekday boardings on metropolitan trains will double from 750,000 in 2011 to 1.5 million in 2031.

Across the 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 up to 65 per cent by 2031 (from 2015), although as reflected in existing patterns of growth, this will be felt far more strongly on particular lines.

Those lines serving growth corridors in Melbourne’s north, west and south east will continue to experience the highest rates of growth. For example, passenger numbers on the lines to Melbourne’s north and west (which pass through North Melbourne station) are projected to grow by up to 120 per cent.¹¹

3.2 Definition and evidence of the Problem

3.2.1 Problem 1: Chronic overcrowding and unreliable rail services are reducing Melbourne’s liveability and access to jobs and key activity precincts

Patronage growth continues to exert considerable pressure across Melbourne’s rail network. Over recent decades, the rail network has experienced unprecedented patronage demand, which is outstripping the capacity of services during peak times.

Even if all the current committed projects are delivered, demand on lines to Melbourne’s north and west will start to exceed capacity within five years and within 10 to 15 years on the Dandenong Line. Existing capacity constraint issues, including overcrowding and delays, will intensify and have significant negative impacts on customer experience.¹²

Across the network, the number of people travelling into the city in the morning peak period is expected to grow significantly on certain lines. Those lines serving growth corridors in Melbourne’s north, west and south east will continue to experience the highest rates of growth. For example, overall passenger numbers on the suburban lines running through North Melbourne station are projected to grow by 100 per cent between 2015 and 2031.

¹¹ Public Transport Victoria, *Metropolitan Patronage Demand Forecast Report* (2015).

¹² Public Transport Victoria, *Metropolitan Patronage Demand Forecast Report* (2015).

3.2.2 Evidence and impacts of Problem 1

Shortfalls in capacity and overcrowding on the rail network

The capacity of the rail network is determined by a mix of factors, including:

- The design of the rail network (i.e. track and junctions)
- Length of trains and station platforms
- Scheduled operating patterns and station dwell times
- Operational systems used to control the movements of trains.

Currently, the network is limited by a number of these factors. A number of projects will be implemented to maximise the number of services that can operate without major or new investment in rail capacity in Central Melbourne. These projects will improve the capacity, reliability and operation of the rail network and include:

- CPLU – will relieve some pressure on the Dandenong Group to provide additional supporting capacity to alleviate peak hour demand (as discussed earlier)
- RRL – will provide extra capacity for services on the Ballarat, Bendigo, Geelong, Werribee, Sunbury, Craigieburn, Upfield and Dandenong Lines
- Level Crossing Removal Project
- HCS technology deployment
- Procurement and deployment of HCMTs.

Shortfalls in capacity on trains

The shortfalls are projected to be greatest on the suburban lines running through North Melbourne station, the Clifton Hill Group and the Werribee Line in the medium and longer term.

The capacity shortfalls will increase:

- Overcrowding as passengers squeeze onto the available services
- The number of ‘load breaches’ that occur on the network¹³
- Passengers’ general discomfort during their rail journey as overcrowding worsens
- Embarking and disembarking times and passengers’ ability to board their trains at all.

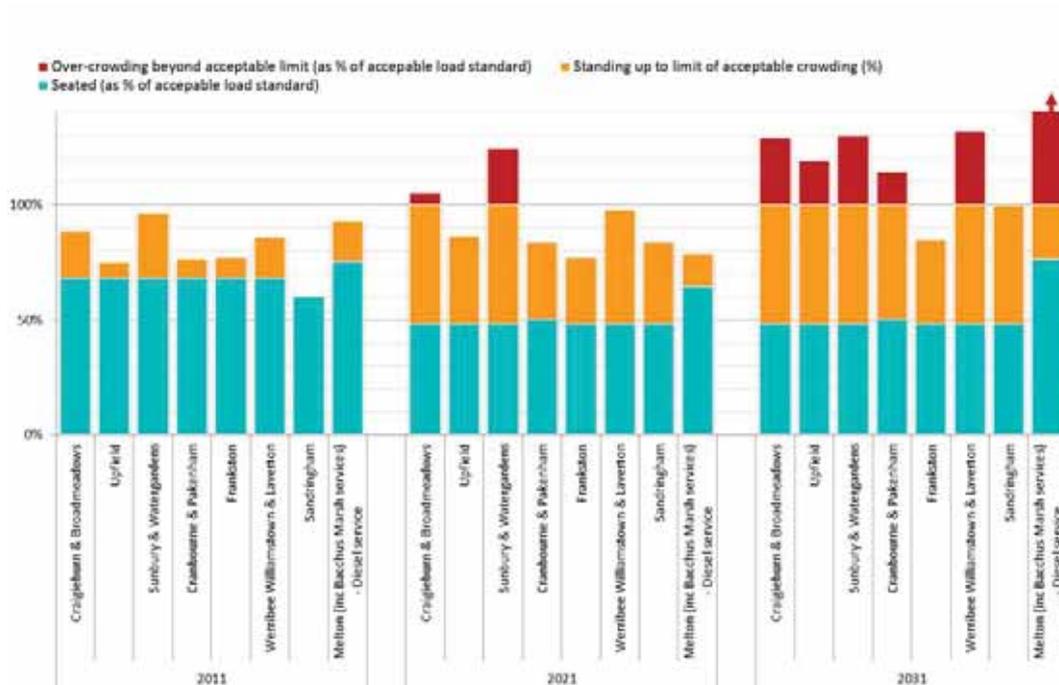
Figure 3-4, which is based on PTV’s network forecasts, shows the proportion of excess demand compared to capacity:

- Blue indicates lines where passengers would in most cases have an option of a seated journey
- Orange indicates lines where average services will have standing up to ‘planning load’ (the maximum load that can be carried without substantially impacting network operations)¹⁴
- Red indicates that loading levels over the peak hour on all lines (except Frankston and Sandringham) are forecast to breach the capacity of the lines by 2031, in most cases by 20 per cent to 30 per cent.

¹³ A ‘load breach’ is defined as more than a rolling average of 798 people on board for existing rolling stock, however is being increased to an average of 900 people per train prior to 2021 by a project to reconfigure the interior of existing trains. A load breach for the new High Capacity Metro Train will be considered to occur when the rolling average exceeds 1,100 passengers train.

¹⁴ The ‘planning load’ is defined as a rolling average of 900 people on board for existing rolling stock, or 1,100 for HCMTs.

Figure 3-4 – Core hour capacity demand (load standard) compared to available capacity without Melbourne Metro for the metropolitan lines affected



Source: PTV.

The projected levels of overcrowding will have a significant effect on the customer experience, in terms of the quality of the customer journey where passengers board a crowded train and, increasingly at peak times, when customers cannot board overcrowded trains at all. In these circumstances, customers have a particularly negative experience by:

- Having to wait on train platforms until there is capacity to board
- Taking an alternative non-preferred mode of transit
- Considering moving the location of their homes or jobs.

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 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, providing a further cost to users of these services.

In practice, where crowding reaches these levels, patrons will be deterred or prevented from using this mode of transport, leading to a build-up of latent demand.

Shortfalls in capacity within stations

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

This issue is particularly acute in Central Melbourne, as all metropolitan and regional lines converge towards the five City Loop stations plus Richmond and North Melbourne. 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 forecast number of boardings, alightings and transfers on a typical weekday in 2031 at:

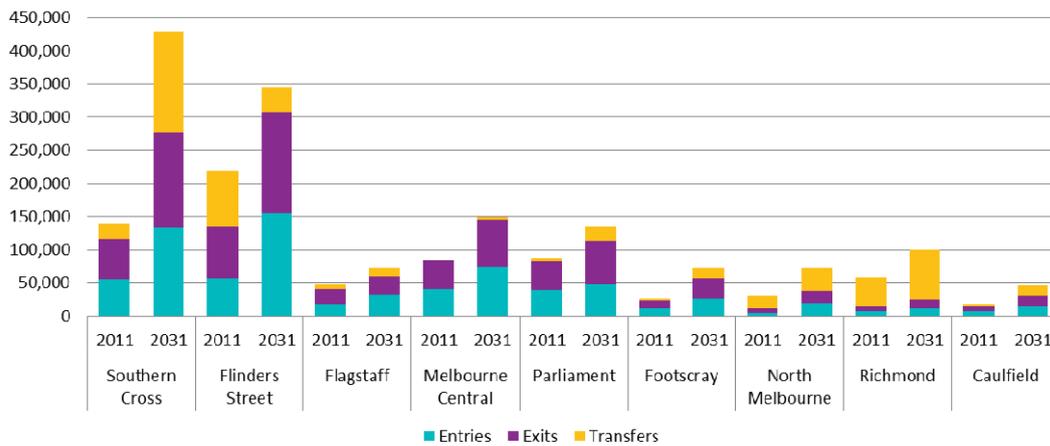
- Southern Cross and Flinders Street Stations will be about 430,000 and 350,000 passenger movements respectively. This means that each station will be catering for passenger movements that are more than double the number of vehicles crossing the West Gate Bridge on a typical weekday
- Melbourne Central will cater for almost 150,000 passenger movements which is approximately the same as the number of vehicles that use the West Gate Bridge on a weekday currently. 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 or relieving stations to match increases in rail capacity include:

- Increased dwell times for trains which may reduce the number of trains that can operate along the entire corridor
- Delays for trains to access platforms which will affect the overall train schedule
- Increased unreliability of service
- Increased safety risk due to crowded platforms and access / egress points
- Poorer customer experience attributable to longer access and egress times
- Increased disruptions or incidents.

As illustrated in Figure 3-5, the number of customers using the five CBD stations is projected to almost double by 2031, from 580,000 customers (transfers, entries and exits) a day in 2011 to 1.1 million in 2031. The number of customers using Richmond and North Melbourne stations is projected to grow by 72 per cent and 143 per cent over the same period.

Figure 3-5 – Projected patronage at key Central Melbourne and interchange stations (without Melbourne Metro)



Source: PTV.

This growth in station patronage will exacerbate overcrowding issues. For example, at Flinders Street there are expected to be 60 per cent 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 to train lines operating through North Melbourne, Dandenong and Frankston Line services
- Greater waiting times at ticket barriers and for escalators
- High levels of crowding in the Elizabeth Street and Degraeves Street subways, with more crowding on the Swanston Street concourse and access.

This forecast increase in station crowding will extend travel times for customers to get between the train and station entries and exits, thereby eroding customer experience. This increase in passengers in stations makes it likely that it will take longer for passengers to exit the stations, and may require more complex arrangements to ensure passenger safety.

The projected increase in station crowding will extend travel times and erode customer experience. The increase in passengers in stations makes station evacuation and passenger safety more complex.

Impact on reliability and punctuality of the rail network

Service reliability is fundamentally important to public transport customers. It affects:

- Their propensity to choose public transport
- The quality of their experience when they do
- Their ability to access key services and employment opportunities in a timely and regular manner.

Reliability will decline in the future if no further investment is made in rail network capacity.

The value customers place on reducing unexpected wait time (for example, when a service is cancelled or delayed) is six times higher than the value they place on reducing on-board travel time.¹⁵

The reliability of Melbourne's rail network is influenced by a variety of factors that relate to infrastructure and operations. There are, however, two broad issues relevant to this Business Case:

- The extent to which crowding on the network impacts on operational performance
- The knock-on effects that result from a network where many lines interact with each other.

Crowding impacts on punctuality

As passenger loads tip past the planning load capacity of trains, the ability to provide rail services within five minutes of the scheduled arrival and departure times declines rapidly.¹⁶ While many factors affect service performance, the busiest lines on the network are generally not punctual.

Some specific examples of recent punctuality performance include:

- The Belgrave (87.2 per cent), Lilydale (89.0 per cent), Cranbourne (89.4 per cent) and Frankston Lines (89.4 per cent) were the worst performing lines in the July to September 2015 peak period¹⁷
- Only 93.34 per cent of metropolitan trains through North Melbourne arrived within five minutes of schedule during the January to March 2015 peak period.¹⁸

Figure 3-6 and Figure 3-7 illustrate the Metropolitan train punctuality and reliability record for the 12 month to January 2016 period. As indicated in each figure, the services to the west, north and south east are the lowest performers.

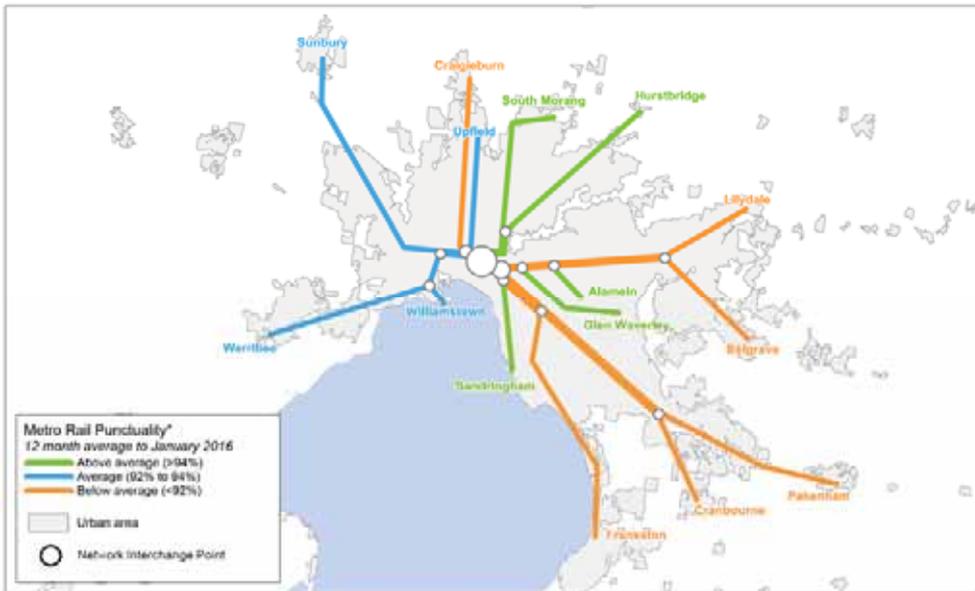
¹⁵ Australian Transport Council, *National Guidelines for Transport System Management in Australia* (2006), Volume 4: Urban Transport.

¹⁶ PTV, *Rail simulation and the assessment of capacity: a good practice guide* (2013).

¹⁷ PTV, *Public Transport Performance: July to September* (2015).

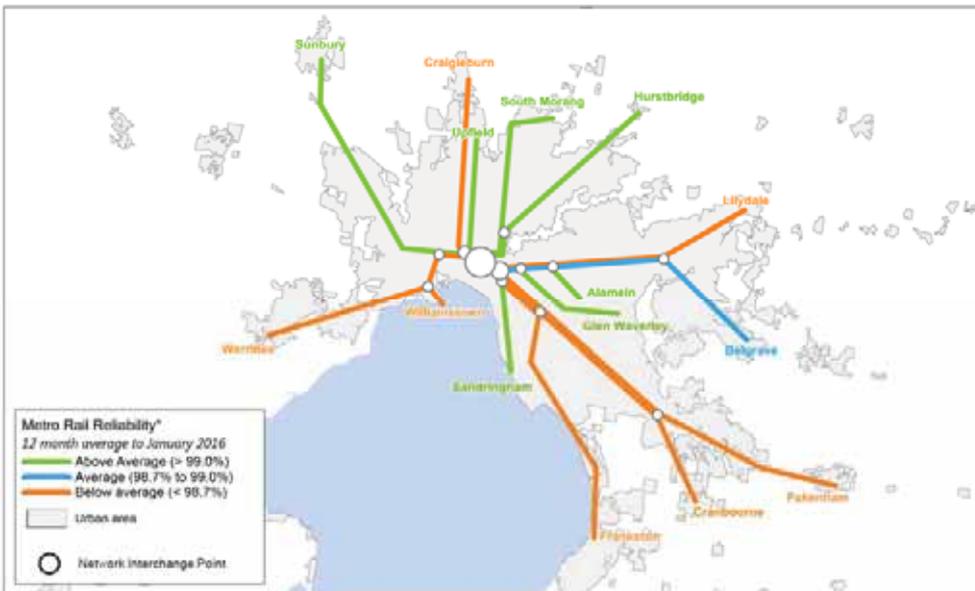
¹⁸ PTV, *Public Transport Performance: July to September* (2015).

Figure 3-6 – Metropolitan train performance – Punctuality



Source: PTV.

Figure 3-7 – Metropolitan train performance – Reliability



Source: PTV.

In the third quarter of 2015, 92.8 per cent of metropolitan train services achieved on-time performance¹⁹ overall, but only 92.3 per cent as a network total achieved on-time performance during peak periods.²⁰ Based on existing trends, increasingly overcrowded train services and platforms at key inner area stations will continue to cause prolonged and variable ‘dwell times’ at stations.

Dwell times are the length of time the train is stopped at the platform with doors open. The length and variability of dwell times is a key driver of the capacity and reliability of the rail network.

¹⁹ Metropolitan trains are considered on-time if they arrive no more than four minutes and 59 seconds after their scheduled time in the timetable.

²⁰ P PTV, *Public Transport Performance: July to September (2015)*, 5.

Melbourne's dwell times are long by international standards, because unlike many metro-style systems serving larger central city areas, Melbourne's train network serves a highly concentrated travel task, with around 60 per cent of all station entries in the PM Peak period taking place at the five CBD stations (out of more than 200 stations in the network).²¹

Growth in patronage will therefore contribute to progressive deterioration in reliability, customer experience and overall service quality, and have flow-on consequences for the regional network, where it interacts with metropolitan services. These issues are compounded during peak periods when more passengers seek to crowd onto existing services.

Interdependence of train lines impacts on reliability

Incidents that cause service disruptions on one line, can also cause a considerable cascading effect throughout the network. The impact of these incidents is difficult to contain because of the degree that the lines currently intersect and merge with each other. As a result, service disruptions on one line readily impact other lines.

In recent years, significant effort has been made to reduce this interdependence on the rail network within given infrastructure constraints. As set out earlier in this Chapter, the network comprises five groups, but there is still a degree of interaction between these groups.

For example, due to a lack of capacity on the lines that pass through North Melbourne station, some Craigieburn Line services merge with the Cross-City Group in peak periods. This means that the Craigieburn, Upfield, Sunbury, Werribee, Williamstown, Sandringham and Frankston Lines are linked and an incident on one line can have cascading effects on the others.

For a delay on a given line, on average 10 per cent of the resulting time losses experienced by passengers are actually on other lines.²²

Impact on regional rail services

The regional rail network is currently under significant pressure. Patronage on regional trains has grown by 93 per cent since 2003-04, with the regional network now carrying about 13.2 million passengers each year.²³

Two key issues that impact on the regional rail network are relevant to this Business Case:

- The increasing challenges associated with serving metropolitan growth areas with regional rail services
- The impact of metropolitan reliability issues on regional rail services, where these networks still interact.

As illustrated in Figure 3-8, regional areas such as Melton and Wallan are experiencing urban-style growth and demand for rail services, with the Western Growth Area to Melton extending 30 kilometres beyond the metropolitan network at Sunshine and the Northern Growth Area to Wallan extending 20 kilometres beyond the metropolitan network at Craigieburn.

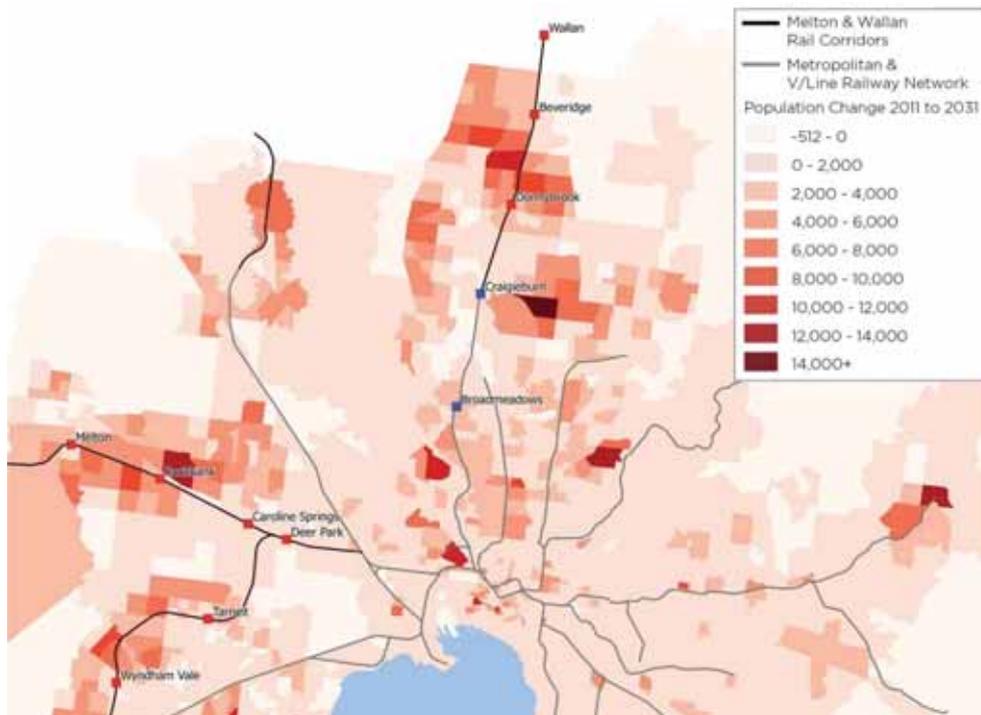
However, these areas are still served by diesel regional rail services that are not designed to meet metropolitan demand, including sections of single track. For example, maximum passenger capacity on regional rolling stock is half that on metropolitan rolling stock, as services are designed for medium to long distance commuting, with passengers seated. Given the constraints on the metropolitan rail network described earlier, there is currently no capacity for these lines to be electrified and serviced by metropolitan trains.

²¹ PTV station entries data, 2011-12, with PM Peak defined as 3:00pm to 7:00pm.

²² PTV, *Operations and Performance Analysis*, (2014).

²³ PTV, Train station patronage data.

Figure 3-8 – Growth corridors served by regional trains



Source: PTV.

This interaction means that ongoing unreliability across the metropolitan network can lead to fluctuations in performance across the regional network.

Impact on Melbourne’s liveability

Liveability forms a key part of the Transport Service Outcomes Framework developed by the Department as a framework for policy and project decision-making and associated monitoring.

The Department’s vision for a liveable Victoria focuses on safety, sustainability and health, and incorporates the concepts of connectivity and prosperity.

Key factors used to assess ‘liveability’ under the framework include:

- Safety of the transport system
- User satisfaction with networks and services
- Environmental sustainability of the transport system
- Accessibility and the degree to which the system supports active transport (walking, cycling and active transport mode share).

Overcrowding and unreliability have the following impact on liveability:

- Increased journey times decrease the time available for other recreational activities, including spending time with family and friends
- Increased journey times decrease accessibility to services, including access to health and education services
- Customer dissatisfaction.

The concept of liveability is generally viewed as the quality of living (and lifestyle) supported by a city or region.

Crowding and unreliability causes stress

A study conducted by the Trinity College in Dublin found that commuters who experience crowded public transport journeys experience higher levels of commuting stress that are likely associated with increased invasion of personal space and uncomfortable and cramped conditions.

The study also found that high stress levels were greater with commuters using unreliable public transport services. Long wait times also induced stress due to a lack of reliability and a diminished sense of control.

Source: Mairead Cantwell, Brian Caulfield and Margaret O'Mahony, 'Examining the Factors that Impact Public Transport Commuting Satisfaction' (2009) 12(2) Journal of Public Transportation 1, 18.

Supporting and strengthening Melbourne's reputation for 'liveability' is important for several reasons:

- As an indicator of the quality of life (or lifestyle) Melbourne offers its residents. This encompasses a range of concepts ranging from access to social and recreational activities, standards of health and education to household incomes and economic opportunities (as reflected in the extensive and wide-ranging factors usually assessed to examine liveability)²⁴
- As a determinant of economic performance. A more liveable city attracts and retains workers and human capital, which in turn increases its economic efficiency. In an increasingly globalised economy, the smartest and brightest knowledge workers are attracted to cities that can provide them with high value employment and are diverse and liveable. 'Liveable' cities can compete better for knowledge workers and Victoria's liveability is cited as a key measure that influences the decision of businesses to invest in Melbourne and Victoria, rather than competing locations.²⁵

3.2.3 Problem 2: Physical transport network constraints are reducing Melbourne's economic prosperity and productivity

As noted in Chapter 1, Melbourne's rapidly increasing population in key growth corridors is expected to continue without commensurate growth in employment in these regions. This places a greater reliance on travel into Central Melbourne for employment. As a result, physical public transport network constraints will impact Melbourne's productivity and prosperity if employees cannot be transported efficiently to and from Central Melbourne.

3.2.4 Evidence and impacts of Problem 2

Ongoing congestion on the transport network significantly impedes labour productivity and other drivers of economic prosperity, particularly in knowledge-intensive industries. The costs of overcrowding and unreliability influence Melbourne's productivity by:

- Increasing the likelihood that passengers are unable to board services, which increases effective waiting and travel times
- Detrimentially affecting the use of on-board time. Rail users would be precluded from reading or working in overcrowded conditions
- Increasing journey times and reducing accessibility to jobs and other economic opportunities located in the CBD, particularly for people living in the outer suburbs
- Reducing accessibility and limiting the pool of employees that employers can access and vice-versa, thereby worsening job matches and reducing labour productivity. As people switch from public transport to car travel, road congestion worsens and travel times increase. This exacerbates journey time and labour productivity issues, for both public transport and road users.

²⁴ For a detailed discussion on liveability, see Infrastructure Australia, *Our Cities, Our Future - A National Urban Policy for a productive, sustainable and liveable future* (2011), and Victorian Competition and Efficiency Commission, *A State of Liveability: An Inquiry into Enhancing Victoria's Liveability* (2008).

²⁵ Victorian Competition and Efficiency Commission, *A State of Liveability: An Inquiry into Enhancing Victoria's Liveability* (2008).

Table 3-1 outlines the social, economic and environmental opportunity costs associated with the physical transport network constraints.

Table 3-1 – Social, economic and environmental opportunity costs

| Who is impacted | | Explanation |
|---|---------------------------------|---|
| Public transport user costs | | |
| Less reliability | Existing public transport users | Where there is significant variability in journey times, transport users may be required to allow more time for the journey to reduce the probability of arriving late at their destination. Customers value wait time highly, and thus unreliability has a relatively high cost. |
| Increased discomfort from more overcrowding | Existing public transport users | The cost of crowding reflects the discomfort passengers feel from travelling in varying levels of crowded conditions. As crowding levels on both trains and stations increase, the valuation of crowding also increases. |
| Increased waiting times | Existing public transport users | Capacity constraints on the network are limiting service frequency, and this is compounded when services are too crowded to board. |
| Increased travel times | Existing public transport users | All of the above factors combine to increase the total perceived travel time that public transport users experience. |
| External costs | | |
| Increased road congestion | Road users | Increased congestion costs through greater travel time requirements on private and commercial road users as a result of some public transport users diverting to road use. |
| Increased vehicle accidents | Road users and community | The increase in distance travelled by vehicles as a result of some public transport users diverting to road use leading to a corresponding increase in vehicle accidents. |
| Increased environmental and noise impacts | Community | The increase in distance travelled by vehicles and congestion as a result of some public transport users diverting to road use leading to a corresponding increase in air, noise and water pollutants and additional greenhouse gas emissions. |

In addition, having a more reliable and effective train network that is well equipped to meet peak demand creates an array of benefits to the freight network and movement of freight around Melbourne (and more broadly, Victoria) by reducing road congestion.

Impact on Melbourne’s productivity and the broader economy

Melbourne’s productivity growth has been falling in recent years.²⁶ While the constraints on the existing public transport network are not the sole cause of this trend, the flow-on effects of public transport efficiency on the labour force (as discussed above) are, and will continue to be, a contributing factor. The quality of Melbourne’s transport system is reflected to some degree in Melbourne’s productivity and the state of the city’s economy. The presence of better public transport access improves access to better matched jobs and participation rates which in turn has a positive effect on labour productivity, employment satisfaction and the wealth creating potential of individuals.

As a result of the clustering of knowledge based jobs in Central Melbourne and the agglomeration benefits businesses enjoy from this, Central Melbourne makes a disproportionately large contribution to the Victorian and Australian economies. In 2015, Central Melbourne’s economy, measured by the Gross Local Product (GLP), was \$90.6bn. This accounts for 27 per cent of Victoria’s Gross State Product (GSP) and 6 per cent of Australian Gross Domestic Product (GDP).²⁷ Constraints that impact Central Melbourne, or measures to support growth, can therefore have substantial flow-on impacts on the overall State and national economies.

²⁶ Australian Bureau of Statistics, Australian National Accounts: State Accounts, Cat. No. 5220.0.

²⁷ City of Melbourne, *City of Melbourne Economic Profile*, <http://melbourne.geografia.com.au/>.

Productivity is the cornerstone of future economic growth, and accessibility to knowledge based jobs in Central Melbourne, including precincts such as Domain and Parkville, improves business-to-business interaction. This drives agglomeration benefits. In dense urban environments, knowledge and technology is exchanged, both formally and informally, between firms and individuals. This sharing of knowledge and technology offers firms that locate in such environments a competitive advantage, and is one reason why, for example, finance and insurance firms cluster around one another.

This advantage extends to the sharing of infrastructure and inputs, such as transport networks, banking and professional services and legal services, which brings down per unit cost of production through economies of scale. Deep labour pools also offer employers access to more workers with a wider variety of skills and experience. Cities with larger labour pools can better match skills with demand, as well as matching employees with jobs that complement their abilities and work aspirations.²⁸ The economy further benefits as individuals are able to pursue a greater variety and volume of jobs which potentially increases their earning capacity and ability to participate in the economy (e.g. through greater discretionary income).

In the face of falling productivity growth rates, Table 3-2 sets out a range of opportunities to positively impact productivity growth. Each of these opportunities, however, has a barrier related to the capacity of transport networks to enable access to Central Melbourne.

Table 3-2 – Opportunities to positively impact productivity growth and transport barriers

| Opportunity | Description | Barrier |
|-------------------------------|---|--|
| Increased labour productivity | Business-to-business interactions improve productivity and these can be facilitated by increases in the 'effective density' of employment that is, reducing the time required for travel to meetings and other business interactions, by reducing distance and/or improving transport networks. | Travel times for business-to-business interaction are too great and dissuade this interaction from occurring, due to distance or quality of transport networks. This is: <ul style="list-style-type: none"> • Relevant to Problem 2 regarding interaction of Central Melbourne businesses with those across the broader metropolitan area • Also relevant to Problem 3 regarding quality of transport networks to support expanded Central Melbourne area. |
| Improved land productivity | As the economy restructures, there is a shift towards more productive jobs such as knowledge intensive industries. These industries get a productivity boost from clustering and being located in Central Melbourne (or other major central city areas nationally or globally). | One of the key advantages of Melbourne (for example, relative to Sydney) is the availability of suitable land for businesses to locate within and close to Central Melbourne. Despite access to suitably located land, the number of businesses that can efficiently locate in highly productive areas is limited, due to transport capacity constraints: <ul style="list-style-type: none"> • Enabling more businesses to locate in Central Melbourne will assist the growth of highly productive knowledge intensive industries • However, if transport constraints impact on access of these businesses to high skilled labour or to interact with other businesses, fewer such businesses may choose a Central Melbourne location, instead being located in an area in which they achieve lower levels of productivity, or indeed in another city, nationally or globally. |

²⁸ KPMG, *Developing productivity elasticities for estimating WEBS in Australia – Scoping Study* (2015), Commissioned report undertaken for Department of Infrastructure and Regional Development, available from https://bitre.gov.au/publications/2015/files/cr_002.pdf.

| Opportunity | Description | Barrier |
|--|--|---|
| Increased labour supply | Reducing the cost of commuting (including the perceived cost of travel time delays and crowding / congestion) leads to improved net wages (after netting out the cost of commuting) and encourages more people to enter the workforce, or work longer hours. More specifically, reducing perceived travel time to a given location (e.g. Central Melbourne) provides employers in that location with access to a broader and deeper workforce pool. | Travel times for workers to access employment is too great, due to distance or quality of transport networks: <ul style="list-style-type: none"> • Key areas in which population (and therefore potential labour force) is growing are distant from Central Melbourne employment and therefore require high quality transport links • The capacity of transport links (particularly rail lines to the north, west and south east) constrains the ability for these potential workers to readily access a wider variety of jobs • This is relevant to Problem 3, as travel times by public transport to access employment in an expanded central city are longer for people who need to interchange to a tram or bus rather than exiting from a rail station. These workers therefore may choose to leave work early to get home on time. |
| Improved access to better quality employment opportunities | Reducing the cost of commuting (including perceived cost of travel time delays and crowding / congestion) broadens the number and variety of jobs available to an employee as employees can travel more widely for the same commuting cost as before. More specifically, improving accessibility to a wider variety and number of jobs means that the employee is less likely to settle for the 'second best job'. This results in better skills matching, thereby likely improving levels of meaningful employment and labour productivity. | Travel times for workers to access employment is too great, due to distance or quality of transport networks: <ul style="list-style-type: none"> • Key areas in which population (and therefore potential labour force) is growing are distant from Central Melbourne employment, where the majority of the higher order, knowledge intensive jobs are located • The capacity of the transport links constrains the ability of workers to 'fully' match their skills with the jobs on offer. In addition, businesses hire workers with skills that may not be directly suited to the job. Businesses employing workers with skills / qualifications that are not directly relevant to the job has a negative impact on the productivity of businesses and workers satisfaction / wellbeing. |

3.2.5 Problem 3: Insufficient public transport services are impacting access into and around Central Melbourne, and limiting the potential for urban renewal

Central Melbourne will continue to be a key service-based employment hub. It requires more efficient public transport services and connectivity to support access to and around Central Melbourne, and develop urban renewal areas. Currently, there is insufficient public transport service coverage across key expansion areas in Central Melbourne. Where legacy networks do provide sufficient coverage, they are struggling to meet demand.

The tram network in particular plays a key role in providing complementary transport connectivity to the rail network, but the current network does not have the capacity to adequately service access from St Kilda Road and the inner south east to the growing job catchment areas west of Swanston Street.

Delivery of urban renewal projects in Central Melbourne are also being limited by a lack of high capacity transport options in relevant precincts, particularly those that have the potential to support significant employment growth. This deters necessary investor interest, resulting in underutilisation of valuable Central Melbourne land.

As set out in Problem 2, businesses' ability to easily interact is a key advantage of a Central Melbourne location. However, current transport networks do not sufficiently support workers to move efficiently within Central Melbourne, impacting businesses' ability to take advantage of the economies of agglomeration.

3.2.6 Evidence and impacts of Problem 3

One of Melbourne’s strategic advantages is the availability of land to support central city expansion, which has enabled more businesses to exploit the agglomeration benefits of a central location without substantially driving up rents. This has a number of positive benefits for business, including:

- Increased productivity from deeper labour pools from which to draw workers
- Wider markets allowing greater specialisation
- Knowledge spill-overs that lead to increased idea generation and innovation.

In turn, the community will also benefit by having access to better quality and higher skilled employment.

Employment growth has been facilitated by targeted, planned expansions of the CBD and through business redevelopments included in urban renewal projects, such as the expanding the CBD to include new precincts such as Southbank and Docklands.

Plan Melbourne sets out an expanded CBD, including St Kilda Road in the South, Fishermans Bend, Docklands, E-Gate and the Arden-Macaulay Precinct in the west, and City North to the north of the CBD, as shown in Figure 3-9. Since the opening of the City Loop, public transport has amply supported the growth of the CBD. However, Melbourne’s CBD is now expanding into areas that have a much lower level of public transport accessibility. As illustrated in Figure 3-9, a number of the expanded CBD urban renewal opportunities would benefit from greater public transport options.

Figure 3-9 – An expanding CBD



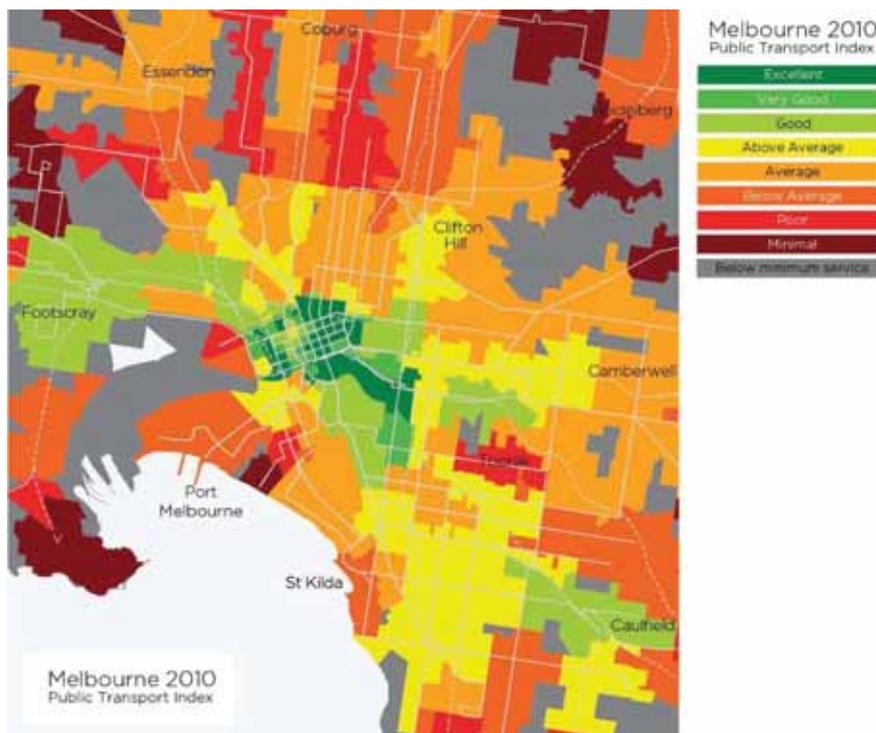
Source: Plan Melbourne.

According to analysis undertaken for the City of Melbourne Transport Strategy, connectivity to the north and west of the CBD score at below-average to average level on a metropolitan-wide scale (see Figure 3-10). This compares poorly with the rating of excellent identified for the CBD and points to a problem of accommodating CBD-type development without expanding public transport.

The ability of these precincts to contribute to an effective expanded CBD is compromised without a significant boost in transport services because:

- The additional travel time needed to access the northern and western expansion areas of the CBD from the broader metropolitan area reduces the labour catchment available to businesses in those locations
- Without catalysing infrastructure, investment will be more likely to be fragmented across a number of inner city locations, making it difficult to overcome the existing constraints that prevented redevelopment of these precincts in the past (such as contamination, flooding, site consolidation, etc.)
- Car-based development prevents high-density clustering. This reduces the ways in which businesses can interact with one another and people can access jobs, it requires greater land take and erodes the productive value that can be extracted from these central city locations.

Figure 3-10 – Public Transport Index, 2010



Source: RMIT Dr Jan Scheurer, *Spatial network Analysis for Multimodal Urban Transport Systems*, (2010).

Tram overcrowding and network distribution

The existing tram network within the CBD is heavily focused on Swanston Street as the predominant north to south public transport access corridor. This corridor provides a key access route, which links Parkville, CBD locations and St Kilda Road. It is complemented by the Elizabeth Street tram connection from the CBD to Parkville. The high demand for travel along this corridor requires trams to operate frequently and are heavily loaded at busy times. While this means that customers travelling along this corridor or alighting at Flinders Street and Melbourne Central stations have a high frequency service to access Parkville and Domain, it increases congestion and unreliability on these corridors.

The levels of demand projected on the tram network will not only impact the punctuality and reliability of services, but it will also detrimentally impact access to and from jobs, education, services and other socio economic opportunities.

Patronage on trams travelling north between Melbourne Central and Melbourne University along Swanston Street and Elizabeth Street is expected to grow by 1.9 per cent per annum in the morning peak period between 2011 and 2031. Patronage on trams travelling southwards on Swanston Street (between Federation Square and the Arts Centre) is expected to grow by 3.3 per cent per annum in the same period. By 2031, the number of customers on trams on Elizabeth and Swanston Streets heading north to Parkville during the two hour AM Peak is forecast to reach 18,000, equivalent to the number of people on the Frankston Line today.

Figure 3-11 illustrates the unconstrained growth projected along tram routes in and adjacent to the CBD. It shows the continued reliance on the St Kilda Road / Swanston Street corridor as well as strong growth on corridors in the west of the CBD.

Figure 3-11 – Map of tram patronage difference, 2011 to 2031

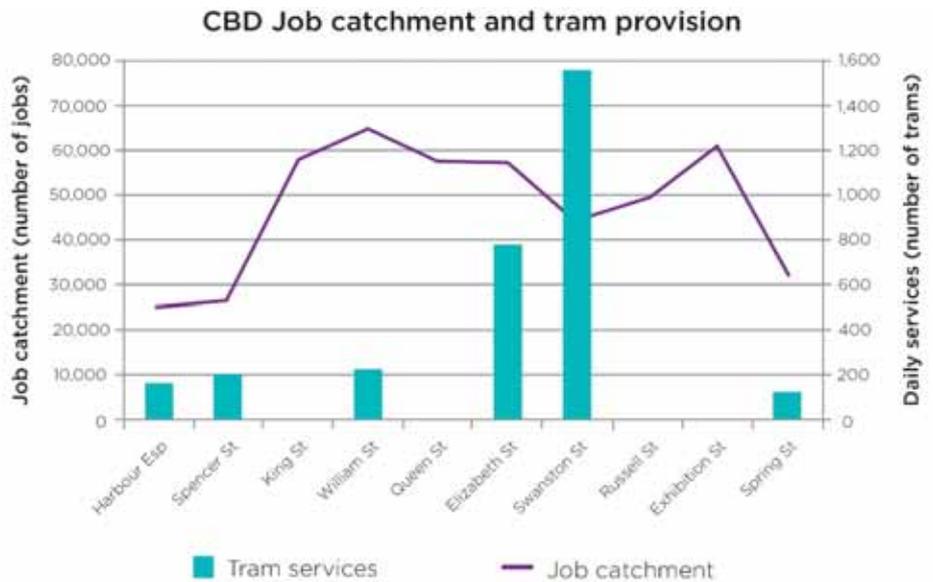


Source: PTV.

Job catchments in the west and south of the CBD will continue to experience growth and increasing demand for travel.²⁹ However, even today, the current tram network does not match the distribution of employment, with westerly streets (Harbour Esplanade, Spencer Street, King Street and William Street) generally under serviced, as illustrated in Figure 3-12. If the north-south tram corridor between Parkville, CBD and Domain could be relieved, this would release trams to better serve the employment growth trends.

²⁹ Public Transport Victoria, Metropolitan Patronage Demand Forecast Report (2015), 28.

Figure 3-12 – Comparison of job catchment in the CBD and corresponding distribution of north-south tram routes



Source: PTV.

As Central Melbourne continues to grow, the importance of having sufficient tram network connections across the city to complement the metropolitan train network will increase. Melbourne’s tram network faces dual challenges of an overstretched trunk route serving St Kilda Road and Parkville and a (consequential) consumption of resources that could be deployed to the under-served western parts of the CBD.

Ensuring sufficient multimodal links to support the rail network to move people into and around Central Melbourne is a significant challenge. Without any changes to the layout of the tram network, overcrowding and unreliability will be exacerbated on this mode of transport.

The need to accommodate diverse employment

Another challenge confronting the expanding Central Melbourne area is that existing supplies of office space are unsuitable to accommodate diverse businesses and employment.

Recent trends indicate a growing and significant market appetite for large floor plate buildings, which have attracted significant financial and professional services tenants in Docklands. Existing building stock in the Hoddle Grid is far more constrained (with sites mostly offering floor plates between 1,000 square metres and 2,500 square metres in size). Whilst 1,000 to 2,500 square meter floorplates in varying classes will continue to be in demand, for which Hoddle Grid is ideally placed, it is unable to offer larger floorplates and/ or add to the diversity of office space required by the knowledge economy. The emerging markets in the expanded central city area are important contributor to supplying large floor plate buildings and combined with the Hoddle Grid offer the international businesses variety and options that is important in maintaining and enhancing Melbourne’s competitiveness as a destination for global organisations.

Melbourne’s office stock has grown strongly over the past decade from 3.1 million to 4.3 million square metres to accommodate the city’s employment growth.

Investing in new, accessible urban renewal sites adjacent to the existing CBD, such as the Arden-Macaulay Precinct, Fisherman’s Bend and E-Gate, would provide an opportunity to create new, fit-for-purpose office space that can cater to changing market demands in close proximity to the CBD.

The Arden-Macaulay Precinct 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.³⁰

There is increasing market interest in the precinct with a number of recent high-quality residential developments taking advantage of redundant industrial land. This key development opportunity has the capacity to shape the urban landscape of Melbourne by accommodating employment growth in inner Melbourne and forming part of the North Melbourne to Melton employment corridor identified in Plan Melbourne.

The Victorian Government³¹ and Local Government³² identified Arden-Macaulay Precinct as a key urban renewal site that could catalyse a new CBD-fringe mixed-use office precinct with a potential to accommodate 25,000 residents and in excess of 43,000 jobs.³³ Critically, the area is in close proximity to existing CBD employment and markets, particularly in Parkville (see Figure 3-13), promoting 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.

Figure 3-13 – Arden-Macaulay Precinct (highlighting core Arden Precinct) in relation to employment clusters



Source: Melbourne Planning Authority and MGS Architects, *Arden Urban Renewal Precinct Vision* (2015).

³⁰ City of Melbourne, *Arden-Macaulay Structure Plan* (2012).

³¹ Department of Transport, Planning and Local Infrastructure, *Plan Melbourne* (2014), 39.

³² City of Melbourne, *Arden-Macaulay Structure Plan* (2012).

³³ SGS Economics and Planning, *Central City Narrative Final Report* (September 2015), 28, 24.

Melbourne City Council has adopted the Arden-Macaulay Structure Plan that provides a 30-year vision for the growth of the northern part of the precinct. Plan Melbourne also highlights the Arden-Macaulay Precinct as a key urban renewal area. Transport is available at the periphery of the precinct, which would be suitable for medium density residential development. However, without direct access to mass transit, the appeal of Arden as an employment hub and private sector investment attractor is substantially reduced, along with the opportunity to provide new office space for high value, knowledge-based employment. This is evidenced by the high priority that companies attach to 'good transit access' when selecting their location:

“ When drilling down to the specific attributes of a building, location to public transport, excellent indoor air quality and thermal comfort, and cutting edge IT and communications capabilities, ranked as the top three attributes in building selection for staff attraction and retention.”

Colliers, Office Tenant Survey 2010.

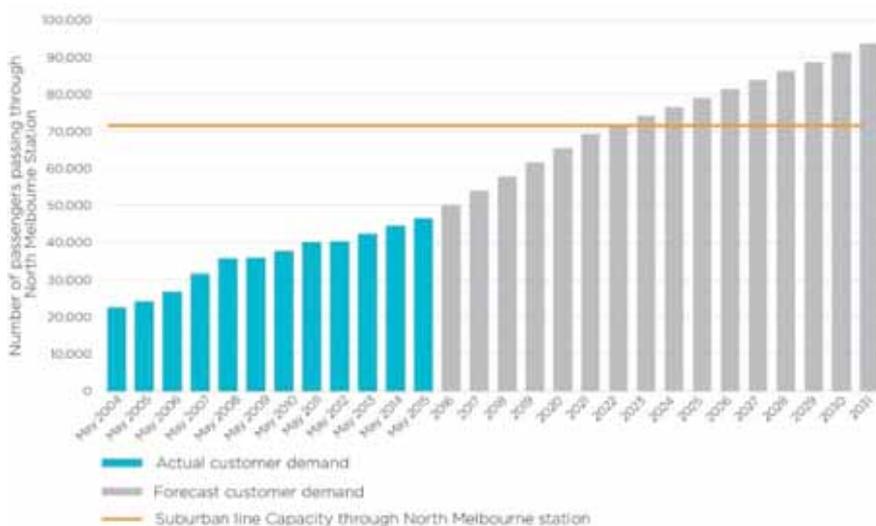
Without a significant expansion to public transport access, making Arden accessible to broader metropolitan labour catchments, the area could still offer the opportunity for significant residential development, but the opportunity to support employment growth would be lost.

3.3 Timing considerations

The capacity problems in Melbourne and Victoria have been growing over the past decade and will continue to escalate over time, with the capacity shortfall on Melbourne’s rail network expected to reach over 40 trains in the two hour AM Peak by 2021.

As illustrated in Figure 3-14, the capacity of trains running on tracks through North Melbourne is forecast to experience strong demand pressures soon after 2020. This is based on the capacity of tracks through North Melbourne post RRL, which is the practical extent of capacity until a major infrastructure investment such as Melbourne Metro is made (considered in terms of the planning load standard). Other projects that will alleviate peak hour demand, including the CPLU, can also only relieve some capacity pressures from the Dandenong Group with these resurfacing by around 2030.

Figure 3-14 – Capacity of tracks through North Melbourne station and patronage growth, 2004 to 2031



Source: PTV.

Previous patronage growth could be accommodated in the short term by using available capacity across the existing public transport network. However, the network is:

- Carrying more passengers than it ever has before
- Reaching a point of full utilisation on the fastest growing lines
- No longer able to satisfactorily meet growing demand.

In light of population growth forecasts, this situation will deteriorate further without significant intervention.

Given the expected time to implement a project of the scale and complexity required to address the Problems and the potential costs of failing to address the Problems, substantial progress needs to be achieved as a matter of priority.

CHAPTER 4

Benefits – Chapter Summary

- The benefits presented in this Chapter relate to the Benefits that will be realised should the Problems (Chapter 3) be addressed. The Benefits associated specifically with the Melbourne Metro project are presented in Chapters 9 and 10.
- Overcoming the chronic overcrowding and unreliability problems impacting the performance of, and passenger experience on, Melbourne's rail network will generate a range of benefits, including:
 - **Greater productivity and economic growth for Melbourne** – by accommodating forecast population growth, allowing a greater population to access jobs and services, and increasing rail network reliability, Melbourne and Victoria will have the tools to continue to be an economic leader. By providing greater access to universities and the Parkville research knowledge precinct, Melbourne and Victoria can also continue to attract international talent and students
 - **A more liveable Melbourne** – by increasing access to a greater number and range of social services and economic opportunities, and increasing the time people across the city and regions can spend with their family and friends, Victoria and Melbourne will continue to retain its strong liveability status, domestically and globally.
- The Benefits that can be realised by addressing the Problems set out in the previous Chapter are substantial, and align with a range of policies and objectives of the Commonwealth Government, Victorian Government and Local Governments.
- The Benefits Management Plan (BMP) has been developed in accordance with DTF requirements which:
 - Specifies the Benefits which the Melbourne Metro Program will need to deliver to successfully address the Problems identified in Chapter 3
 - Sets out an overall approach to manage the Benefits for the broader program
 - Includes the Key Performance Indicators (KPIs) and measures which will be used to assess whether the Benefits were delivered and the dates by which the Benefits are expected to be delivered.



4 Benefits

4.1 Benefits to be delivered

Melbourne Metro will deliver substantial benefits as a standalone project and as an integral element of a re-organised metropolitan rail network. The project will start to transform Melbourne's rail network into an international-style metro system and lay the foundation for the future expansion of Melbourne's public transport network. In particular, by addressing the Problems identified in Chapter 3, two key potential benefits will be delivered to the Victorian community (collectively, the Benefits):

- Greater productivity and economic growth for Melbourne
- A more liveable Melbourne.

4.1.1 Benefit 1: Greater productivity and economic growth for Melbourne

Increasing capacity on the rail network will alleviate overcrowding on Melbourne's most congested rail lines, improving the reliability and quality of services and enhancing the experience of customers. This is vital to meet the travel needs of a growing population and to address the continuing and increasing demand for access to jobs and services. These improvements in accessibility and connectivity will have a widespread impact across the city, supporting economic and employment growth and delivering greater productivity for Melbourne.

Improved access to CBD and the west

- Enable efficient overall travel to and within Central Melbourne to support the changing spatial distribution of employment in the city (which is shifting to the western part of the CBD) to places such as the emerging National Employment Clusters at East Werribee and Sunshine
- Improve tram network operational efficiency by restructuring the network to better serve emerging employment patterns and facilitate new connections across and within the expanding CBD (including Parkville, Domain, western parts of the CBD and South Melbourne)
- Improve access to education and research opportunities, particularly the Parkville education and biomedical precinct. This supports Australia's trajectory as a knowledge-based employment economy
- Open up greater accessibility to job opportunities and services within a given travel time. Employers will have access to a greater pool of potential employees, particularly people living beyond Melbourne's city boundaries and in nearby regions. Employees will be closer to accessible employment resulting in greater commute mode options and work-life balance
- Improve efficiencies longer term throughout Melbourne and the regions. This can be achieved by linking the labour force and employment growth areas to increase business profitability and draw new business investment into Melbourne and Victoria, further boosting employment and incomes.

Melbourne's changing west

Melbourne's west is undergoing a major transformation. Once the location for heavy industries, the west is now a popular residential location, fuelled by its proximity to Central Melbourne, relatively affordable housing and much improved amenities.

Improved access to an expanded Central Melbourne from the west – as well as the presence of a major new urban renewal project on the west's 'doorstep' at the Arden-Macaulay Precinct – will support economic development in and around Footscray (a metropolitan activity centre highlighted in Plan Melbourne as strategically important for the western subregion's catchments) and help to drive business, employment and residential growth in the inner west. It will open up opportunities for Footscray to become more closely integrated with an expanded Central Melbourne and part of the new services-oriented CBD economy.

More reliable, punctual and efficient travel

- Reduce travel times, crowding and waiting times for both metropolitan and regional train passengers, especially for travel to the CBD
- Improve the resilience, punctuality and reliability of the network by having the lines across the metropolitan rail network interact less and quarantining the flow-on impact of delays and cancellations
- Increase productivity by reducing employee commute times and enabling people to spend more time at home with their families or allocate greater time to labour output.

Lower congestion and freight costs

- Increase in public transport usage diverts some use from private vehicles, leading to reduced road network congestion and travel times
- Provide modest improvements for both journey times and perceived vehicle operating costs, which together make up most of the generalised cost of travel for road freight trips
- Potentially improve road freight productivity and costs, providing savings to Victorian businesses and households by providing more efficient freight movements.

Efficient public transport encourages job growth

Efficient public transport allows workers to travel to employment precincts regardless of where they live. Expanding employment opportunities in precincts such as Arden, Parkville and St Kilda Road will enable businesses to leverage synergies and maximise agglomeration benefits.

Catalyse and support urban renewal in and around Central Melbourne

- Provide greater access to Central Melbourne from the city's main residential growth corridors
- Catalyse and support urban renewal in and around Central Melbourne by establishing complementary public transport services
- Open up opportunities to provide accessible and affordable office space in the CBD and expanded Central Melbourne area, an advantage that has underpinned Melbourne's relatively strong growth in high-value, knowledge-based services
- Strengthen and expand the knowledge economy, which drives growth in labour productivity by creating opportunities to develop urban renewal sites
- Facilitate material growth in investment, jobs and residents in the area by building a new station at Arden
- Support emerging national employment clusters in Melbourne's western subregion, such as Sunshine and East Werribee, by addressing the connectivity issues facing the existing network.

4.1.2 Benefit 2: A more liveable Melbourne

In addition to the economic outcomes outlined above, Melburnians and Victorians will benefit in ways that are not captured in standard economic measures. In particular, as noted in Chapter 3, ensuring a more liveable Melbourne is crucial to supporting the city's prosperity.

Reducing travel and waiting times for people using the public transport network (including the rail network and tram network) and reducing congestion on the road network will generate a range of benefits. Increasing accessibility to health services and recreational centres leads to increased social welfare benefits. These were mapped against the Department's key objectives for 'liveability'.

Foster positive experiences of public transport journeys

- Increase the levels of customer satisfaction with the public transport system and encourage more Melburnians to use public transport by providing more efficient and punctual train and tram services
- Increase the amount of time some people across the city and in adjacent regions can spend with their family and friends by reducing trip times and providing more reliable services
- Relieve associated discomfort on trains and trams and deliver a better customer experience, especially during peak travel periods, by reducing overcrowding.

Support active transport

- Help increase the potential number and range of social services and economic opportunities available to people within a given travel time (taking into account active transport, such as walking and cycling, as well as public transport including combinations thereof) from their homes. This includes services that are critical to people's wellbeing and level of opportunity, such as health and education
- Increase opportunities to use active transport for part of their journeys to work and other destinations by increasing the potential of having more people living within the walking catchments of train stations.

Improve environmental sustainability of the transport system

- Deliver a more sustainable urban form. A more sustainable transport system will have positive impacts on communities and suburbs, and enhance the city's overall liveability.

Improve access, health and wellbeing

- Supports the pursuit of meaningful employment by providing better access to jobs and education opportunities
- Improve personal wellbeing and societal welfare by improving access to goods and services, sport, cultural and recreational activities
- Improve social inclusion by increasing the availability and reach of the public transport network, thus minimising barriers to access for people to social and economic opportunities to support individual and community wellbeing
- Improve health outcomes by increasing the accessibility to a wider range of health services (including hospitals, diagnostic centres and allied health services), community centres and public amenities.

Growth in health knowledge and outcomes

Improvements to public transport will provide better access to health facilities for student interns, teachers, patients, nurses and other health professionals, particularly for Melbourne Health, the Victorian Cancer Centre and the medical facilities in Parkville and at the University of Melbourne.

In turn, the community will have better access to health professions leading to better health outcomes. For many patients, the choice of specialists will be broader as there will be greater public transport access to the Parkville education and biomedical precinct than ever before.

The project will also likely increase demand for hospital services due to the improved accessibility as patients increasingly select hospitals based on access as opposed to reputation. As a result, health jobs (particularly in Parkville) are expected to increase significantly.

The value of these outcomes in their own right to the community should not be underestimated. In combination, they can make an enormous contribution to the enjoyment Melburnians derive from the places they live and the opportunities they can access to improve their lives.

A more liveable Melbourne will also provide a further impetus to productivity and economic growth. A highly liveable city is a more attractive destination for skilled workers and the businesses that need them, and is pivotal in attracting interstate and international students to Victoria.

Chapter 10 of the Business Case outlines the full economic evaluation of the Recommended Solution for addressing the Problems, including an assessment of the economic benefits listed above.

A multi-modal transport system is vital for a liveable city

A 2015 study by the McCaughey VicHealth Wellbeing Unit at the University of Melbourne reports that access to a multi-modal transport system is a critical social determinant of health, facilitating access to employment, education, food, health and social services, and family and friends. The presence of transport-related infrastructure (e.g. footpaths, controlled crossings, proximal public transport stops etc.) impacts levels of physical activity and this benefit is becoming a popular area of study in medical, urban policy and liveability related literature.

Source: Badland, H, Robert, R, Butterworth, I, Giles-Corti, B., *How Liveable is Melbourne?* (2015) McCaughey VicHealth Wellbeing Unit, The University of Melbourne.

4.2 Importance of the Benefits to government

Resolving the Problems identified in Chapter 3 will help the Victorian and Commonwealth Governments deliver a range of key policy initiatives, strategic directions and priorities that benefit the Victorian and national economies. Productivity improvements, economic growth and enhanced standards of living are among governments' top infrastructure priorities. Resolving the Problems would also make a contribution to Local Government policies and plans.

Table 4-1 maps the project against Commonwealth, State and Local policies.

Table 4-1 – Program's relationship with Commonwealth, State and Local policies

| Key policies and themes | Relationship with Problems and Benefits |
|---|--|
| Commonwealth Government | |
| Commonwealth Infrastructure Reform and Investment framework | |
| <p>IA established the Reform and Investment Framework to enable decision-making that is coordinated, long-term focused and driven by national objectives and priorities. Initiatives are assessed against the below criteria to reach a classification which is published on the Infrastructure Priority List (IPL).</p> <ul style="list-style-type: none"> • <i>The initiative's strategic fit and profiling</i> – the extent to which the proposal addresses national infrastructure priorities and is supported by data rich evidence of the scale and causes of underlying problem(s) to enable consideration of effective and targeted solutions • <i>Economic viability</i> – the proposal's lifetime benefits must significantly outweigh its lifetime costs to society • <i>Deliverability</i> – the proposal must have a clear and robust delivery plan to ensure its successful realisation. | <p>The project was assessed against this framework and was classified as a Threshold Project on the 2013 IPL Update. Essentially, this means that the project was considered ready to proceed, save for a few outstanding details. Further submissions will be made to IA over time, including this Business Case.</p> <p>The project enables a number of other initiatives published on the IPL, including the Melton rail line upgrade (later stage that would see electrification of the Melton Line).</p> <p>The project provides significant opportunity for private sector involvement. It delivers large economic returns through its integration with the plans and strategies for Victoria's long term development.</p> |

| Key policies and themes | Relationship with Problems and Benefits |
|-------------------------|---|
|-------------------------|---|

| Council of Australian Government (COAG) National Objectives and Criteria for Future Strategic Planning of Capital Cities | |
|--|--|
|--|--|

| | |
|--|---|
| <p>The overarching objective of this policy document is “ to ensure Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive, and are well placed to meet future challenges and growth.”</p> <p>The objective is supported by criteria against which the appropriateness of city strategic planning systems can be measured. The criteria includes consideration of:</p> <ul style="list-style-type: none"> • Levels of integration • Consistent hierarchy of future orientated and publicly available plans • Provision of nationally-significant infrastructure • Ability to address nationally-significant policy issues • Ability for planned, sequenced and evidence based land release • Appropriate balance of infill and greenfield development. | <p>The project is consistent with this framework in that it:</p> <ul style="list-style-type: none"> • Is a key project in Victoria’s infrastructure program • Will deliver strong national and economic productivity benefits • Enhances a city of national importance • Is strongly supported by the community and industry. |
|--|---|

| Economic Action Strategy | |
|--------------------------|--|
|--------------------------|--|

| | |
|--|---|
| <p>As part of the 2015-16 Commonwealth Budget, the Commonwealth Government is investing \$50bn to build world-class infrastructure for a stronger Australia.</p> <p>This significant investment is a crucial part of the Government’s Economic Action Strategy to boost economic growth and prosperity, increase productivity and support thousands of new jobs.</p> | <p>Although the Commonwealth Government has not committed to fund public transport programs at this time, the project is fundamentally aligned with the Economic Action Strategy, which broadly seeks to improve the efficiency and quality of road and rail links, help ease congestion, boost productivity, create jobs and build a stronger and more prosperous economy.</p> <p>The project is consistent with the Government’s commitment to build Australia’s future through investment in 21st century infrastructure, transforming the Melbourne metropolitan network into a metro- style system that is on par with public transport infrastructure elsewhere in the developed world.</p> <p>By improving the capacity and reliability of the network, this will enable greater connectivity between employers and employees, particularly in relation to opportunities located in urban development areas, which will support economic growth and increase productivity.</p> |
|--|---|

| Infrastructure Australia Urban Transport Strategy | |
|---|--|
|---|--|

| | |
|--|--|
| <p>The National Urban Transport Strategy includes roads, railways and interchanges that support passenger and freight transport in Australia’s cities. The Strategy seeks to direct investment towards improved city planning, better infrastructure use and management and selective investment in new infrastructure that enhances productivity.</p> <p>Key issues identified include: integrating transport systems; integrating long term infrastructure planning and land use planning; the impact of urban transport systems on productivity; the importance of urban access and equity; coherent and consistent funding and financing; consistent measurement and reporting of results.</p> <p>The strategy also identifies a requirement for the right balance between private car use and public transport use as a key issue that impacts not only on general travel, but also on freight.</p> | <p>By addressing the Problems identified in Chapter 3, a range of benefits will be delivered:</p> <ul style="list-style-type: none"> • Enhanced productivity and economic growth for Melbourne • Facilitation of direct CBD access and cross-city connectivity thereby increasing accessibility to employment and services • Improved public transport for inner city development sites, thereby better integrating public transport systems with long term land use plans. |
|--|--|

| Key policies and themes | Relationship with Problems and Benefits |
|---|---|
| Australia Infrastructure Plan | |
| <p>IA is developing an Australian Infrastructure Plan, responding to the problems identified in the Australian Infrastructure Audit (May 2015). The Australian Infrastructure Audit identified a range of jurisdictional problems faced by Victoria:</p> <ul style="list-style-type: none"> • Capacity between the Melbourne CBD and Tullamarine Airport • Connectivity between Melbourne's west and the CBD • Capacity on the metropolitan rail network • Efficiency on the road and rail networks in suburban Melbourne • Connectivity between Melbourne's south-east and the CBD • Population growth in Melbourne's outer north • Connecting goods to markets. | <p>The project is the centrepiece of the response needed to address capacity constraints on the metropolitan rail network. The project directly addresses a number of the key jurisdictional problems identified by IA as follows:</p> <ul style="list-style-type: none"> • Expands capacity at the core of the metropolitan rail network • Expands the capacity of the rail network on lines to Melbourne's north, west and south east and enables the future extension of metropolitan services to Melton, creating connectivity from Melbourne's west and south east to the CBD • Improves reliability and reduces crowding on the metropolitan rail network and reduces potential congestion on the road network, supporting efficiency on the rail networks in suburban Melbourne • Expands the capacity of the rail network on lines to Melbourne's north, west and south east; connects the Sunbury and Cranbourne / Pakenham Lines; and enables the future extension of metropolitan services to Melton and Wallan • Enables future construction of Melbourne Airport Rail Link and reduces road congestion. |
| State Government | |
| 2015 – 2016 Victorian Budget | |
| <p>The 2015-2016 Victorian Budget is committed to funding projects that will transform our public transport system, reduce congestion on our roads and improve safety and services for the community. Specifically, the Budget has committed \$1.5bn to deliver Melbourne Metro.</p> <p>The Victorian Government is also committed to making Victoria the 'Education State' and for education to be the State's number one export. The Government recognises that Victoria relies on the skills and ingenuity of students and workers to grow the economy. There is a strong need to ensure that students are engaged and supported in their learning and that Victoria continues to provide lucrative learning opportunities for international students.</p> | <p>The project is a cornerstone initiative for the Victorian Government. The project will address the current overcrowding and unreliability issues associated with network capacity constraints and will enable more passengers to be transported to and around Central Melbourne. The project will support economic growth into the future and enhance the liveability of Melbourne and Victoria by providing high capacity transport that efficiently transports people to key activity centres and employment opportunities.</p> <p>The project will also deliver greater connectivity for students and enhance access to the Parkville precinct, a key hub for research, medical services and tertiary education, and will also enhance connectivity to a number of universities including Victoria University, The University of Melbourne, RMIT, Monash (Caulfield and Clayton and Berwick).</p> |
| Metropolitan Planning Strategy (Plan Melbourne)¹ | |
| <p>Plan Melbourne is the Victorian Government's metropolitan planning strategy that will guide the city's growth to 2050. It seeks to integrate long-term land use, infrastructure and transport planning to meet the population, housing and employment needs of the future. It seeks to identify the infrastructure, services and major projects which need to be put in place to service that growth.</p> <p>The plan envisages an integrated transport system connecting people to jobs and services, and goods to market. The key transport challenges identified in the plan</p> | <p>The focus on delivering an integrated transport system is pivotal in addressing unreliability and rail network capacity issues.</p> <p>By addressing capacity and unreliability, network performance will be improved, which will enhance the rail passenger experience and contribute to greater economic productivity and growth. With a move towards a knowledge-based service economy predominantly located in and around Central</p> |

¹ The government has committed to refreshing Plan Melbourne; a revised version is proposed for release in the first half of 2016.

Key policies and themes

are to ensure sufficient commuter capacity on public transport and road systems and to ensure Victoria maintains a competitive advantage in freight and logistics.

The CBD is a critical component of the plan, supported by employment clusters. The plan envisages a significant expansion of the CBD through a staged release of land for urban renewal.

The plan notes that Melbourne's liveability and competitiveness over the coming decades could be undermined if a number of issues are not addressed, including congestion on road and public transport systems during peak periods and accessibility to employment, services and recreational opportunities.

A strategic principle to make the plan happen is 'Infrastructure investment that supports city growth'.

Relationship with Problems and Benefits

The staged release of land will also contribute to the achievement of a more productive and economically successful city. The redevelopment of staged land, including sites such as E-Gate and Arden, into mixed-zone areas will generate employment growth and private investment. High capacity public transport is critical to achieving these aims.

Melbourne's liveability will also be enhanced as the project will deliver greater access to health care.

Transport Integration Act 2010

The *Transport Integration Act 2010* requires that all decisions affecting the transport system be made within the same integrated decision-making framework to support the same objectives. The Act's six transport system objectives are:

- Social and economic inclusion
- Economic prosperity
- Environmental sustainability
- Integration of transport and land use
- Efficiency, coordination and reliability
- Safety and health and wellbeing.

By addressing the Problems identified in Chapter 3, a range of benefits will be delivered:

- Social and economic inclusion as more people are able to use the public transport system to access jobs and services
- Greater accessibility to jobs, improved freight efficiency and employment growth in the CBD, leading to economic prosperity
- Promotion of environmental sustainability by empowering public transport use and alleviating vehicle traffic
- Integrated transport and land use in the CBD area
- Improved transport efficiency and reliability.

Local Government

City of Melbourne Transport Strategy

The Transport Strategy promotes the vision of a connected city with great streets linked by a well-designed transport system. The Transport Strategy seeks to realise this vision by 2030 by adopting an integrated approach, linking all modes of transport and coordinating city development with urban renewal.

The key strategy directions include integrating transport and land use planning; round the clock public transport for inner Melbourne; and the development of high-mobility pedestrian and public transport streets in the CBD.

The re-engineering of the suburban rail system to provide a metro-style system is classified as a key objective of the Transport Strategy.

The Transport Strategy specifically identifies working with Government to achieve the conversion of a suburban rail network into a metro-style system as a priority action.

The project is cited as the enabling project which will transform the CBD into a modern and integrated, metro-style hub which would offer convenient, reliable and safe train travel to and within the CBD.

Arden-Macaulay Structure Plan 2012

The City of Melbourne has identified the Arden-Macaulay Precinct as an urban renewal area that will accommodate significantly more residents and employment growth over the next 30 years.

The Arden-Macaulay Structure Plan provides a 30-year vision to guide this growth. It includes a series of strategies and actions in relation to land use, including the delivery of new and improved open spaces and attractive and safe streetscapes. The plan also contains actions relating to transport, community infrastructure and sustainable infrastructure.

The Arden-Macaulay Structure Plan provides local Government support for the long-term development of the precinct, including creating transport links and seeking to develop sustainable infrastructure in the area.

4.3 Evidence of Benefit delivery

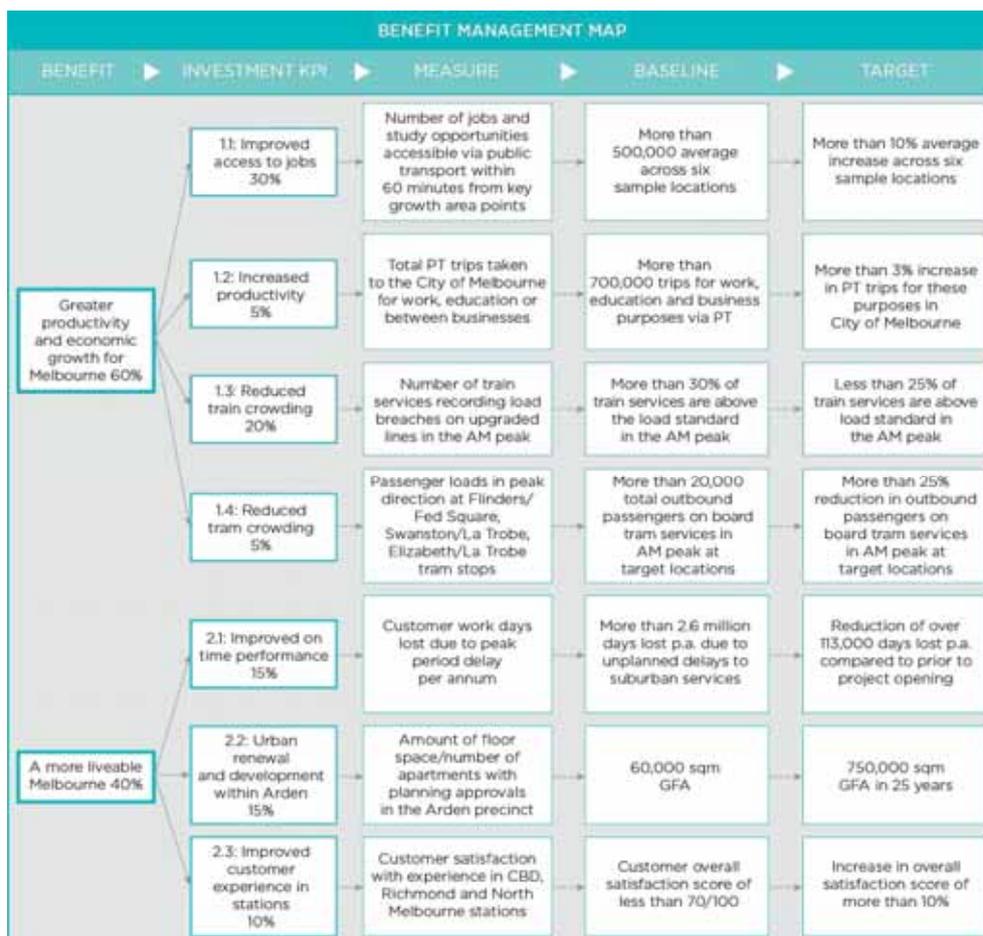
Benefits management identifies, tracks and measures benefits to ensure that a project’s potential and anticipated benefits are actually delivered. An effective benefits management process is critical to achieving the outcomes sought from investments and is considered mandatory for all complex infrastructure projects.

4.3.1 Benefits Management Map

The BMP is presented in Figure 4-1 and:

- Specifies the Benefits which Melbourne Metro will need to deliver to successfully address the Problems identified in Chapter 3
- Sets out an overall approach to manage the Benefits for the broader program
- Includes the Key Performance Indicators (KPIs) and measures which will be used to assess whether the Benefits were delivered and the dates by which the Benefits are expected to be delivered.²

Figure 4-1 – Benefits Management Map



² The weightings attached to the KPIs in the Benefits Management Map have been multiplied out to total 100%, adjusted roughly in proportion to the magnitude of the preliminary benefits, and rounded to the nearest 5%.

4.3.2 Key Performance Indicators

Benefit 1: Greater productivity and economic growth for Melbourne

- *KPI 1.1: Improved access to jobs* – measures the change in the number of jobs and study opportunities located within 60 minutes from key growth area points.³
- *KPI 1.2: Increased productivity* – measures the increase in number of journeys taken by public transport to work and educational institutions, and between businesses in the City of Melbourne.
- *KPI 1.3: Reduced train crowding* – measures the number of train services recording load breaches on upgraded lines.
- *KPI 1.4: Reduced tram crowding* – measures the change in passenger loads in peak direction on trams arriving at the cordon points between 7am and 9am at the following stops: Federation Square, corner of Swanston / La Trobe Street and corner of Elizabeth / La Trobe Street.

Benefit 2: A more liveable Melbourne

- *KPI 2.1: Improved on time performance* – measures the change in the number of customer work days lost due to peak period delay per annum.
- *KPI 2.2: Urban renewal and development within Arden* – measures the amount of floor space and/or number of apartments with planning approvals in the Arden-Macaulay Precinct.
- *KPI 2.3: Improved customer experience in stations* – measures customer satisfaction with their experience in CBD, Richmond and North Melbourne stations. As this KPI is difficult to forecast and existing data does not provide a robust basis to develop accurate performance measures at this time, the Benefits Management Plan will undertake a survey in the year before the project opens to collect the data to inform the measure of customer experience and identify the appropriate target to be applied under this KPI.

Table 4-2 outlines the proposed KPI measures.

³ Key growth area points are Melton, Wyndham, Hume (Sunbury, Craigieburn), Casey, Cardinia, Melbourne.

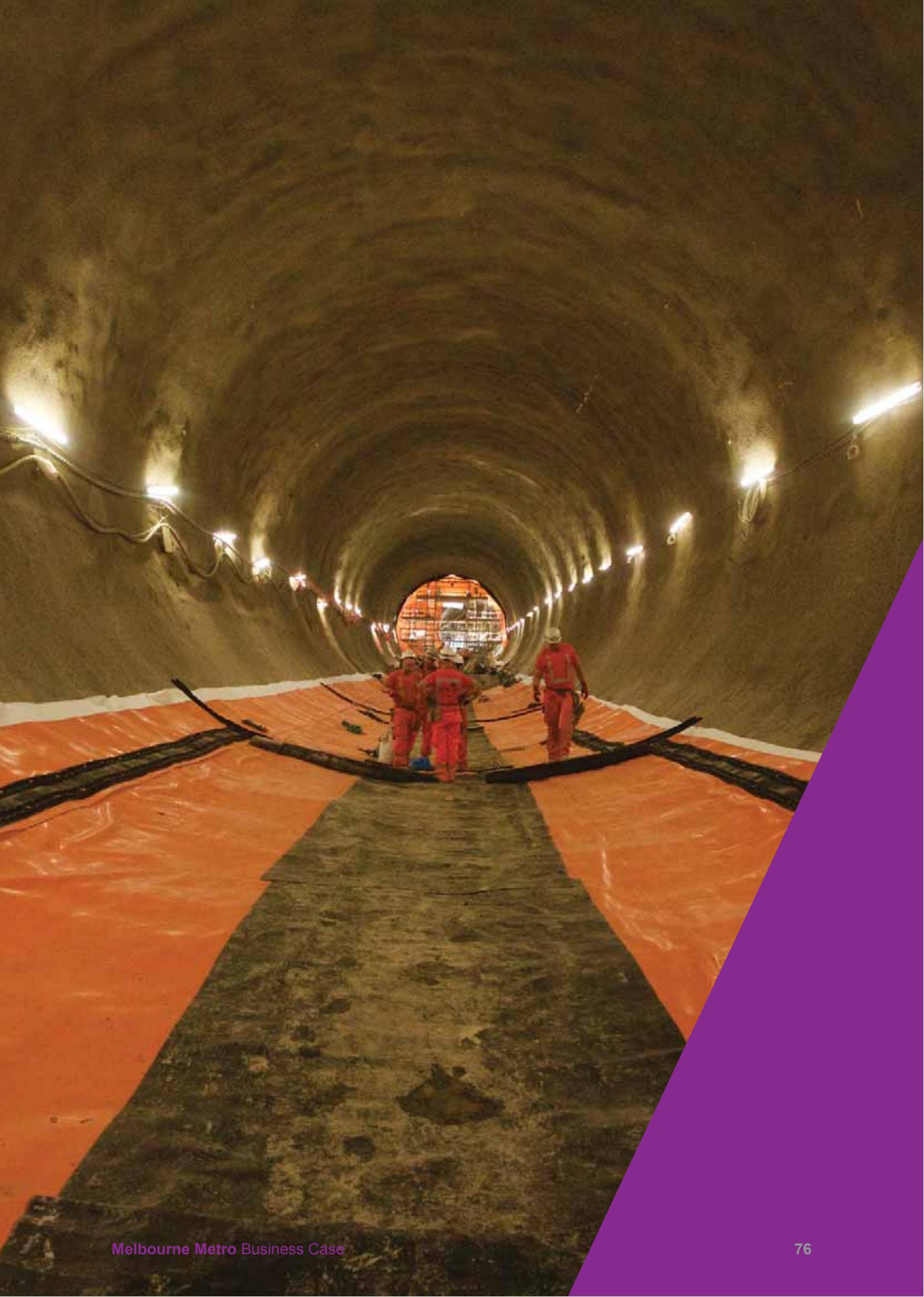
Table 4-2 – KPIs and measures

| Key Performance Indicators | Existing baseline measures | Target measures | Target dates | Department responsible | Data source from |
|---|--|--|-----------------------|------------------------|------------------|
| Greater productivity and economic growth for Melbourne | | | | | |
| KPI 1.1: Improved access to jobs | More than 500,000 average across six sample locations | More than 10% average increase across six sample locations | 1 year post-opening | PTV | PTV |
| KPI 1.2: Increased productivity | More than 700,000 trips for work, education and business purposes via public transport | 3.5% increase in public transport trips for these purposes in City of Melbourne | 1 year post-opening | PTV | PTV |
| KPI 1.3: Reduced train crowding | More than 30% of train services are above the load standard in the AM peak | Less than 25% of train services are above the load standard in the AM peak | 1 year post-opening | PTV | PTV |
| KPI 1.4: Reduced tram crowding | More than 20,000 total outbound passengers on board tram services in AM peak at target locations | More than 25% reduction in average passenger loads | 1 year post-opening | PTV | PTV |
| A more liveable Melbourne | | | | | |
| KPI 2.1: Improved on time performance | More than 2.6 million days lost ⁴ p.a. due to unplanned delays to suburban services | Reduction of over 113,000 days lost per annum compared to prior to project opening | 1 year post-opening | PTV | PTV |
| KPI 2.2: Urban renewal and development | 60,000 sqm GFA | 750,000 sqm GFA | 25 years post-opening | MIPA | MIPA |
| KPI 2.3: Improved customer experience in stations | Customer overall satisfaction of less than 70/100 | Increase in overall satisfaction of more than 10% | 1 year post-opening | PTV | PTV |

⁴ 'Work days lost' refers to the equivalent total person minutes lost whilst waiting on trains that are delayed.

Strategic response – Chapter Summary

- Eight strategic interventions were identified as being available to government to address the Problems identified in the ILM and realise the Benefits. By packaging these interventions together, three strategic options (or responses) were developed:
 - **Strategic Option 1 – Current state** — current operations with productivity improvements not requiring significant investment beyond currently planned expenditure
 - **Strategic Option 2 – Demand and productivity management** — demand management and productivity improvements on existing assets or systems without significant investment
 - **Strategic Option 3 – Increase supply** — increasing capacity for access to the CBD through significant capital investment in public transport assets or road alternatives.
- A robust assessment of these strategic options considered the benefits, cost, time, risk and dis-benefits of each option. This assessment identified Strategic Option 3 – increase supply as the most effective option for addressing the Problems and realising the Benefits because:
 - It is the only medium to long-term solution that can meet increasing patronage demand and capacity constraints on the network
 - It provides better public transport for priority CBD development precincts that should, in turn, deliver growth in high-value jobs and enable productivity benefits
 - It is the best approach to enhance Melbourne’s liveability and generate greater productivity and economic growth.
- The ‘increase supply’ strategic option is recommended to progress for further investigation, comprising the following possible interventions from the eight considered:
 - **Intervention 5 – HCMTs** — introduce High Capacity Metro Trains to increase passenger capacity and expand the fleet
 - **Intervention 6 – Wider Network Enhancements** — upgrade the existing rail corridors (including track and signal works, outside the central core of the network) to enable more trains to operate
 - **Intervention 7 – New inner-city rail capacity** — increase in rail capacity, such as via an underground railway through the CBD, to relieve overcrowding and cater for future growth, accessibility to jobs and services and to reduce road congestion.
- While ‘increase supply’ is the recommended strategic option, government should continue to explore opportunities to implement elements of Strategic Option 2, to drive short to medium term capacity and reliability improvements from the existing infrastructure.



5 Strategic response

5.1 Introduction

DTF's High Value High Risk Guidelines require business cases to address questions about the possible strategic responses to the identified problems. A robust business case should positively answer the following key questions:

- Have a sufficient range of strategic responses been explored?
- Is it clear what strategic responses are proposed and the rationale for their selection?
- Are the proposed responses the most effective response to the problem(s) identified?

A range of strategic options were identified and analysed according to the HVHR Guidelines, including interventions that could:

- Improve productivity (of existing public transport assets or systems), or
- Increase supply (of public transport assets or road alternatives).

Consideration was given to the project objectives outlined in Chapter 2 when identifying strategic interventions available to government.

Strategic options were constructed as separable and distinct packages of strategic interventions based on a number of factors including:

- A review and update of the results of previous investigations into potentially feasible strategic options
- Cross-disciplinary project team agreement of the potential range of outcomes and impacts.

5.2 Strategic options analysis

5.2.1 Strategic interventions

Eight strategic interventions were identified as being available to government to respond to the Problems identified in Chapter 3 and to deliver the Benefits described in Chapter 4. Table 5-1 outlines the potential strategic interventions.

Table 5-1 – Summary of strategic interventions

| Strategic intervention | Description |
|--|---|
| Limited material investment | Current state maintained, with investment only incurred to keep the network operating. Government makes limited material capital investment. |
| Transport congestion pricing | Pricing strategies (such as ‘early bird’ rail tickets, shoulder peak service incentives or peak period price increases) to reduce transport demand in peaks. |
| Planning instruments and/or legislation | Planning instruments, land consolidation and enabling infrastructure to: <ul style="list-style-type: none"> • Support intense urban development in locations accessible to public transport • Limit new housing in outer suburban growth areas • Limit employment growth in Central Melbourne. |
| Reconfigure timetable and operations | New City Loop operating strategies and timetables and supporting infrastructure to enable independent, end-to-end, high frequency train operations. |
| HCMTs | Introduce HCMTs to increase train-carrying capacity and expand the fleet. |
| Wider Network Enhancements | Upgrade the existing rail corridors (including track and signal works, outside the central core of the network) to enable more trains to operate. |
| New inner-city rail capacity | Increase in rail capacity, such as via an underground railway through the CBD or otherwise, to relieve overcrowding and cater for future growth, accessibility to jobs and services and to reduce road congestion. |
| New CBD road capacity | Expansion of arterial / local roads and/or construction of a freeway to increase city access by car, increase accessibility to jobs and services, and reduce road congestion to accommodate growth in freight. |

5.2.2 Strategic options

By packaging together the identified strategic interventions, three strategic options (or responses) were developed:

- Current state – current operations with productivity improvements not requiring significant investment beyond currently planned expenditure
- Demand and productivity management – demand management and productivity improvements on existing assets or systems without significant investment
- Increase supply – increasing capacity for access to the CBD through significant capital investment in new rolling stock, signalling and/or rail infrastructure, or roads.

These options are described in further detail below.

Strategic Option 1: Current state

This option assumes that government will make limited material capital investment in existing or new rail assets.

This option therefore assumes:

- Continued operation of the current rail infrastructure and public transport network
- Inclusion of committed investments in network or infrastructure upgrades, as expressed in current Victorian and Commonwealth policy and budgets
- Limited government and private investment in existing public transport infrastructure (in particular rail) over time to ‘sweat assets’, to maintain or slightly increase current capacity and maintain service levels, but not otherwise respond to demand growth (i.e. assumes that historical levels of rail funding will continue).

Strategic Option 2: Demand and productivity management

This option combines demand and productivity management initiatives to assist chronic overcrowding and deliver additional capacity to key growth areas. It includes implementing elements focussed on productivity, such as timetabling, and policies and strategies to reduce or manage demand and to promote closer geographic, residential and employment relationships.

This option could include one or a combination of the following:

- Continued operation of the current rail infrastructure and public transport network
- Direct government policy intervention using demand management and pricing initiatives, such as 'early bird' rail tickets or shoulder peak service incentives and peak period price increases
- Introduction of planning instruments and/or legislation to limit new housing in outer suburban growth areas and to move residential growth closer to where employment growth is strongest, such as Central Melbourne (although in the longer term this measure would rely on increasing public transport to these areas, as chronic overcrowding will increase in and around the CBD)
- Introduction of planning instruments and/or legislation to move job growth closer to residents and constrain growth in travel to the city, e.g. restrain employment growth in Central Melbourne and facilitate employment by building employment centres in middle and outer suburban growth areas such as Monash, Dandenong, existing employment precincts and proposed precincts such as East Werribee (although, as above, in the longer term this measure would rely on increasing the supply of public transport to these nodes)
- Reconfiguration of operations and associated timetables to establish metro-style train operations on existing infrastructure. Without a major investment to increase supply of rail capacity, this would include all initiatives currently planned to 'sweat the asset'. Given that demand already exceeds capacity on the Melton Line and the same situation will be faced by Craigieburn, Broadmeadows, Sunbury and Watergardens by the early 2020s, a more immediate response is required.

Strategic Option 3: Increase supply

This option includes significant capital investment to increase the capacity of the rail network. This option could include one or a combination of the following:

- Introduction of HCMTs to operate on the existing network
- Upgraded infrastructure¹ to enable higher frequency operations on the existing rail infrastructure outside the core of the network
- Construction of a new underground rail line and additional wider network investments to relieve overcrowding and cater for future growth by providing material additional network capacity
- Construction of new arterial / local roads, a new freeway and/or additional CBD car park construction to provide an alternative means of transport into Central Melbourne and around the greater Melbourne area.

In considering the role of new road capacity for CBD access, it is apparent that the scale of capacity that roads can offer in a dense urban environment is relatively limited compared to the capacity delivered by a new underground rail line. A new pair of tracks through Central Melbourne has the long-term peak direction capacity to move a similar number of people in the two-hour peak.

Even if expanding the road network feeding inner Melbourne were feasible, the distribution of people in the dense core of the CBD would require an abrupt change in direction in terms of the use of road space, as well as a significant increase in car parking capacity.

Local and Victorian Government policies are increasingly moving to prioritise Central Melbourne road space for use by pedestrians, cyclists and public transport, as the most productive and efficient uses of road space in this type of urban environment.

Given the limited ability for expanded road capacity to address the specific problems identified in the ILM, this particular strategic intervention does not feature as a part of any strategic option. It is noted that there

¹ For example, this may include HCS.

are many other problems facing Melbourne for which expanded road capacity is a viable strategic intervention, and that expansions to road capacity are an important complementary part of the development of the transport network to support Melbourne's growth.

Table 5-2 outlines the strategic interventions available for each strategic option and demonstrates the relative importance (weighting) of each specific intervention in each strategic option. The weightings consider the importance of the strategic intervention in delivering the benefits and the likely effort / cost involved.

Table 5-2 – Strategic interventions available for each strategic option and relative importance in delivery benefits ²

| Strategic Interventions | Strategic Options | | |
|---|----------------------------|---|------------------------------|
| | Option 1: Current state | Option 2: Demand and productivity management | Option 3: Increase supply |
| Intervention 1: Limited material investment | 80% | | |
| Intervention 2: Transport congestion pricing | | 25% | |
| Intervention 3: Planning instruments and/or legislation | | 25% | |
| Intervention 4: Reconfigure timetable and operations | 20% | 50% | |
| Intervention 5: HCMTs | | | 20% |
| Intervention 6: Wider Network Enhancements | | | 10% |
| Intervention 7: New inner-city rail capacity | | | 70% |
| Intervention 8: New CBD road capacity | | | 0% |

5.2.3 Analysis and ranking of strategic options

The strategic options have been assessed and prioritised based on the identified benefits, cost, time, risk and dis-benefits. This analysis is outlined below. In the analysis, in accordance with Victorian Government guidelines, the 'percentage of full benefit to be delivered' is calculated by:

- Awarding a score of 0 to 5 for the contribution of each option to each Benefit
- Multiplying the score for each Benefit by the corresponding percentage (from the ILM) to obtain a weighted score against each Benefit
- Adding the weighted scores across all Benefits to arrive at the weighted Benefit
- Expressing the result as a percentage of the maximum score available (100%).

² In the case of Strategic Options 1 and 2, the percentages presented in this table were developed based on each option's indicative contribution to the relevant outcome. In the case of Strategic Option 3, each of interventions 5, 6 and 7 is required to deliver the outcome, and the percentage assigned is based on order of magnitude according to capital cost.

Table 5-3 – Analysis and ranking of strategic options³

| | | Strategic Options | | |
|---|---|--|---|------------------------------|
| | | Option 1: Current state | Option 2: Demand and productivity management | Option 3: Increase supply |
| Percentage of full benefit to be delivered | | 0% | 40% | 92% |
| Benefit 1: Greater productivity and economic growth for Melbourne | 60% | 0 | 2 | 5 |
| Benefit 2: A more liveable Melbourne | 40% | 0 | 2 | 4 |
| Cost | | | | |
| Investment cost (range) | n/a | minimal | \$2.0bn - \$11.0bn | |
| Operational costs if significant (range) | minimal | minimal | \$200m – 300m p.a. | |
| Time to implement (range) | n/a | 1 - 5 years (transport interventions) 5 - 20 years (land use interventions) | 6 - 10 years | |
| Risks | | | | |
| Risk 1 | Demand Risk – strategy fails to meet forecast rail transport demand | Demand Risk – strategy fails to meet forecast rail transport demand | Construction Risk – strategy involves disruptive and costly construction period | |
| Risk 2 | Economic Risk – strategy impacts economic growth or productivity | Economic Risk – strategy impacts economic growth or productivity | Deliverability Risk – technical, environmental, commercial / market barriers | |
| Dis-benefits | | | | |
| Dis-benefit 1 | Increased congestion on Melbourne’s transport network | Increased congestion on Melbourne’s transport network | Requires material government intervention | |
| Dis-benefit 2 | Increased adverse impacts to Melbourne’s liveability | Increased adverse impacts to Melbourne’s liveability | Increased externality impacts | |
| Ranking | | | | |
| (Lowest ranking = preferred response) | | 3 | 2 | 1 |

5.2.4 Summary of strategic options assessment outcomes

Strategic Option 1: Current state

Advantages

- Limits government capital intervention in the short term by relying on more gradual increases in recurrent spending and deterioration of economic productivity associated with congestion to manage growth. This also maximises investment flexibility for future governments by retaining capital to pursue alternative investments based on information gathered over the next five to 10 years.

Disadvantages

- Does not address existing demand and capacity constraints (for example, three of four lines in the City Loop are at capacity, with the fourth approaching capacity)
- Does not meet forecast passenger demand for the mid-term. Projections indicate that capacity will be breached by the early 2020s and this option does not offer a solution to address this. This situation will have far-reaching consequences for the Victorian population and the economy, for instance constraining accessibility to jobs in the CBD, impacting labour productivity and negatively influencing the customer experience. Over time, demand would shift onto other transport modes (such as roads), causing increasing urban congestion across transport networks (including roads)
- Does not deliver additional capacity to key growth areas (western, northern and south east corridors) which is where around 40 per cent of population growth will be located³
- Does not improve station and train crowding which has an undesirable impact on productivity and liveability standards
- Reduces productivity in the economy, growth and liveability (through increased congestion) with flow-on adverse impacts on Victoria's economic growth and competitiveness
- Does not provide support for urban renewal developments or improve access to inner city jobs and services
- Does not support improving reliability (i.e. on-time) performance. There is currently significant variability in journey times and as such, transport users may be required to allow more time for the journey to reduce the probability of arriving late at their destination. The cost of unreliability is relatively high as unexpected wait times have a high cost from a user's perspective
- Does not deploy new technologies across the public transport network (such as HCS and HCMTs), resulting in reliance on responses that are more labour intensive and higher operating costs. Existing costs of this pathway may include deployment of platform staff in peaks, increased labour devoted to incident response crews and more intensive maintenance regimes to increase / maintain reliability of life-expired train sets
- Increased road congestion reduces freight efficiencies and restricts freight growth. Freight transportation is a key input to the production and sale of physical goods and higher freight costs contract the economy by increasing transaction costs and reducing the income that businesses and households would otherwise be able to expend on investment and consumption.

³ Department of Transport, Planning and Local Infrastructure, *Victoria in Future 2014: Population and Household Projections to 2051* (2014).

Strategic Option 2: Demand and productivity management

Advantages

- Provides an internally consistent transport and land use approach, where the lack of increase in transport supply is complemented by demand management policies that reinforce an urban form that becomes less reliant on Central Melbourne over time
- Provides for a small increase in short-term capacity on existing assets over Strategic Option 1 for a low level of investment. It is expected to be relatively easier to implement and require significantly less government capital expenditure than Strategic Option 3, for example, by limiting new housing in outer suburban growth areas to limit the demand on the existing network
- Focuses transport stakeholders (including government, PTV and the rail, tram and bus franchisees) on maximising efficiency from existing infrastructure. If government makes a policy decision that significant investment in new rail infrastructure is not currently required, this effectively 'pushes-down' some of the requirement to meet additional capacity onto the existing transport network and those responsible for its operation
- Allows capacity improvement options to be reassessed and further tested and analysed over the next five to 10 years.

Disadvantages

- Does not address existing demand and capacity constraints (for example, three of four lines in the City Loop are at capacity, with the fourth approaching capacity)
- Does not overcome capacity constraints, crowding or materially improve reliability on the existing rail network. With major changes to urban form taking effect over decades and rail capacity due to be exceeded by the early 2020s, overcrowding and unreliability on the transport network will worsen, and this would have social, economic and environmental costs. Some of the costs accrue to existing transport users impacted by the service quality. Other costs arise because people are deterred from using public transport and instead travel by motor vehicle, which generates a number of external costs to the community
- Fails to comprehensively address increasing journey times, which reduce accessibility to economic opportunities located in the CBD, particularly for people living in the outer suburbs. Furthermore, this limits the pool of employees that employers can access, thereby worsening job matches and reducing labour productivity
- Does not address projected patronage demand for the medium to long term, and therefore would likely shift transport demand onto other transport modes (such as roads), causing increasing congestion across transport networks
- Introducing government policies overly constraining where individuals should reside fails to consider wealth distribution (affordability) and personal choice factors.
- Dispersing jobs so that they are closer to residents may have transport benefits but an overall adverse impact on productivity and job growth as some industries flourish on the agglomeration benefits associated with being located close to the same and/or similar industries. Instead, these industries may seek to locate in other global scale cities, in Australia or overseas
- The impacts of failing to address the issues above are likely to compound over the medium to long term. As people switch from public transport to car travel, road congestion worsens and travel times increase, with those preferring to travel by motor vehicle impacted
- Increased road congestion reduces freight efficiencies and restricts freight growth. Freight transportation is a key input to the production and sale of physical goods and higher freight costs contract the economy, by increasing transaction costs and reducing the income that businesses and households can otherwise expend on investment and consumption.

Strategic Option 3: Increase supply

Advantages

- Provides significant additional increases in rail capacity and reliability over and above Strategic Option 2, reducing train and station crowding, and travel and waiting times for those using the rail network particularly for travel to and from the Melbourne CBD
- Reduces congestion and travel times for users of the road network as people shift to public transport in response to its improved performance
- Enables workers, within a given travel time, to access more job opportunities, or conversely, employers can access a greater pool of potential employees. This extends to people living beyond Melbourne's city boundaries into the regions. This is likely to improve 'job matching' which will increase labour productivity and therefore Victorian economic performance
- Introduces a metro-style rail network, removing capacity constraints on the City Loop and reallocating capacity throughout the network, and improving the reliability of the network by isolating the flow on impact of incidents (cancellation, short-running of service or bypass) on the wider rail network
- Can support and facilitate urban development and inner city employment access by providing greater access to areas currently not serviced by the existing rail network
- Reduces the amount of time required to commute to work in the CBD. This will enable some individuals to spend more time at home with their families or allocate some of this additional time to labour output, thereby increasing productivity
- Improves the efficiency of freight movements on both the rail and road networks. As a critical input to the production and sale of physical goods, lower freight costs will feed through into wholesale and retail prices, delivering savings to businesses and households across Victoria that can be used to grow Victoria's consumption and investment.

Disadvantages

- Requires significant capital investment and is likely to require a significant level of funding contribution
- An increase in supply through a new rail tunnel may disrupt the existing rail, tram and road network during construction as well as some businesses in the CBD
- An increase in supply through a new rail tunnel potentially involves significant compulsory acquisition of both private residences and commercial properties
- Likely to require a significant level of government involvement to manage a complex set of planning, oversight, environmental, delivery and funding / financing risks.

5.4 Recommended Strategic Response

The key conclusions of the strategic options assessment are:

- Strategic Option 1 enables government to defer any significant capital investment in transport infrastructure in the immediate term. However, it does not increase capacity or improve reliability on the rail network to overcome chronic overcrowding and deliver additional capacity to key growth areas. It would likely result in further overcrowding and congestion on Melbourne's key transport infrastructure (including roads) over the medium to long term. This option also conflicts with the current government's stated policy position
- Strategic Option 2 offers short-term productivity and capacity gains at relatively low cost, but these improvements are required in any event in advance of a project to increase supply. It does not overcome capacity constraints or materially improve reliability on the existing rail network over the medium to long term. Restrictive land use interventions of a scale necessary to arrest the growth in demand for travel to Central Melbourne would take time to implement and have negative effects on liveability and productivity
- Strategic Option 3 was ranked first on the basis that it provides the most comprehensive medium to long-term solution to meet increasing demand and capacity constraints on the rail network. In addition, it provides better public transport for priority CBD development precincts that should in turn deliver growth in high-value jobs and enable productivity benefits.

Strategic Option 3: Increase supply is the Recommended Strategic Option. Further investigation based on the analysis undertaken above is most likely to effectively respond to the Problems over the medium to long term. It is comprised of the following interventions:

- Intervention 5 — HCMTs
- Intervention 6 — Wider Network Enhancements
- Intervention 7 — New CBD rail tunnel.

Whilst increasing supply is the recommended Strategic Option, continued consideration of opportunities to implement elements of Strategic Option 2 to continue to drive short to medium term capacity and reliability improvements from the existing infrastructure may also be appropriate.

The new increase of supply options available to government are explored in Chapter 6 of this Business Case, specifically in respect of the central area of the network (i.e. Intervention 7), which is the most significant of the interventions listed above in terms of potential scope and scale.

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PART B
OPTIONS ANALYSIS AND
RECOMMENDED SOLUTION

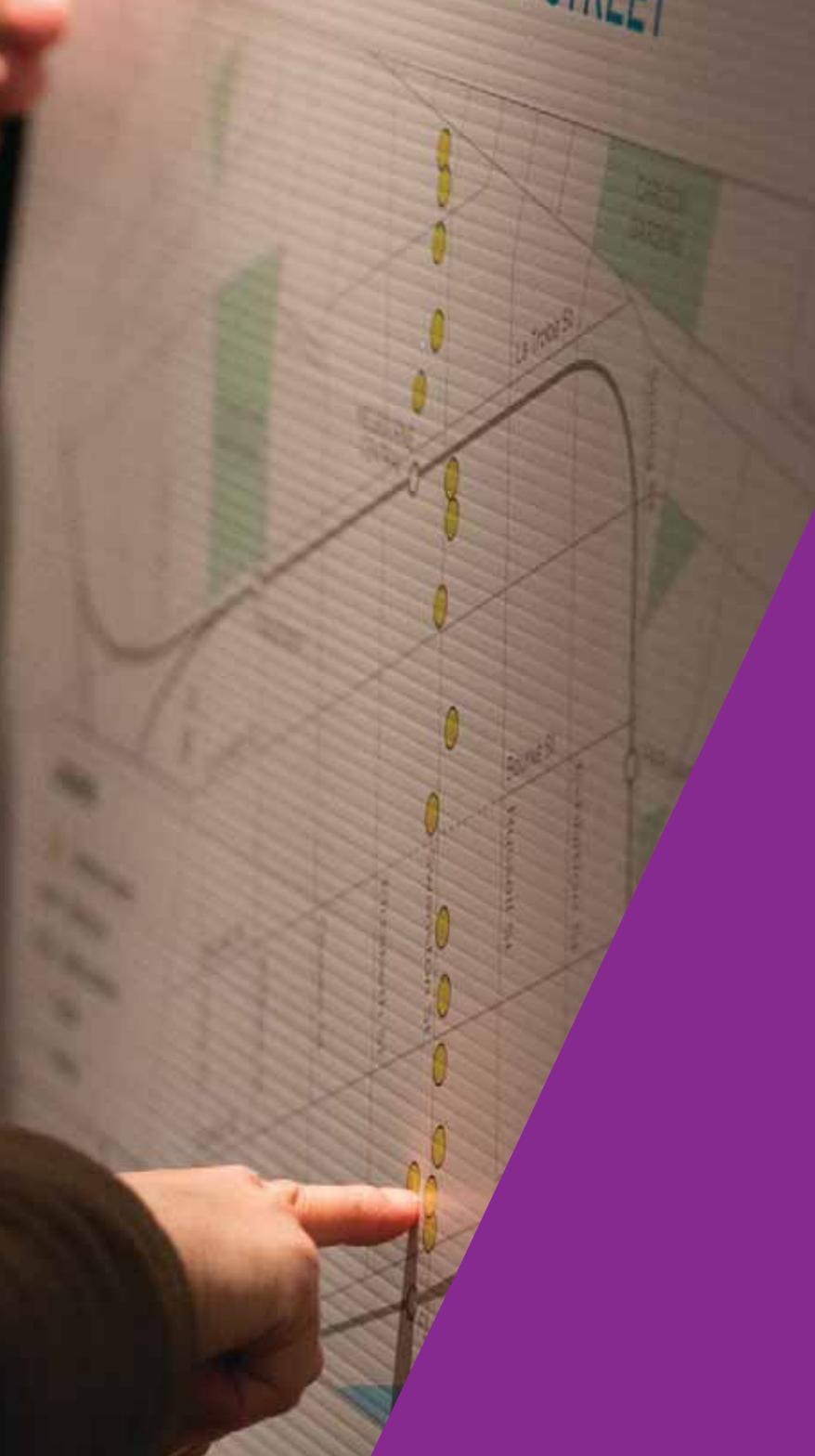
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CHAPTER 6

Capital investment options analysis – Chapter Summary

- A number of potential capital investment options were identified in line with the recommended Strategic Option set out in Chapter 5.
- Thirteen capital investment options were identified and assessed against the following four evaluation criteria:
 - Increasing rail capacity and improving service reliability in time to meet growth
 - Improving access to jobs in Central Melbourne and supporting and stimulating urban renewal
 - Deliverability and extent of disruptions
 - Cost, where a distinguishing factor.
- Two options were shortlisted for further detailed evaluation: Melbourne Metro and Melbourne Rail Link (Fishermans Bend).
- The analysis and comparison of these options identified Melbourne Metro as the recommended capital investment option.
- Melbourne Metro fully addresses the Problems and achieves the Benefits identified in Chapter 3 and Chapter 4 by providing:
 - New services with capacity to accommodate over 39,000 passengers in the two-hour peak period from the first day of operation and two new CBD stations to more evenly distribute passenger flow and interchange movements in the inner core of the network
 - A new rail route through the city, with five new underground stations serving major activity areas
 - Relief to congestion within the existing inner city routes and stations
 - More reliable train services
 - A more even distribution of passenger flow and interchange movements in the inner core of the network
 - The greatest number of new stations in areas not currently serviced by heavy rail, with a combined catchment of over 200,000 jobs, enrolments and residents, more than double the next best option
 - The most effective and direct congestion relief to trams running to and through the CBD
 - Improved rail access to jobs in the Melbourne CBD and in important employment clusters outside the CBD
 - The greatest potential for stimulating urban renewal and redevelopment, focused mainly around a new Arden station.
- Melbourne Metro provides a lower cost long-term investment pathway on a present value basis with less disruption than the alternatives considered.

MELBOURNE METRO RAIL PROJECT GEO-TECHNICAL INVESTIGATION SITES IN THE CBD AND SWANSTON STREET



6 Capital investment options analysis

6.1 Introduction

Chapter 5 concluded that a solution focussed on increasing capacity across the rail network using strategic capital investment will best address the identified Problems and realise the desired Benefits.

This Chapter sets out the potential capital investment options, assesses the relative merits of these and recommends a preferred capital investment option to be progressed for further development.

The analyses outlined in this Chapter build on the 2008 East West Link Needs Assessment (EWLNA) transport study prepared by Sir Rod Eddington. The EWLNA identified and assessed four infrastructure options for expanding rail capacity:

- Expansion of the City Loop (referred to in this Chapter as 'City Loop Duplication')
- New viaduct (further developed and captured in this Chapter as part of the 'Viaduct Widening' option)
- Northern – Burnley loops connected (further developed assuming connection of the Northern and Caulfield loops, and referred to in this Chapter as 'City Loop Split')
- East West Rail Tunnel (referred to in this Chapter as 'Kensington to Caulfield Tunnel').

Further analysis identified and developed thirteen capital investment options, including those outlined above, through a two stage analysis as follows:

- A **preliminary assessment** was conducted on all thirteen options to develop a shortlist
- A more **detailed assessment** was undertaken on the shortlisted options to determine a preferred option.

6.2 Evaluation Criteria

Capital option investment analysis evaluation criteria were developed to:

- Assess the ability of each option to address the Problems and realise the Benefits identified in the ILM
- Identify key points of differentiation to effectively compare the capital investment options.

Based on this approach, four evaluation criteria were identified for this options assessment, as set out in Table 6-1.

Table 6-1 – Evaluation criteria

| Evaluation Criteria | Description |
|--|--|
| 1. Increasing rail capacity and improving reliability | Key considerations include: <ul style="list-style-type: none"> • Network capacity uplift • Improvement in reliability and punctuality of services • Potential to accommodate future network improvements and expansions to provide for future patronage growth. |
| 2. Improving access to jobs and stimulating urban renewal | Key considerations include: <ul style="list-style-type: none"> • Improving rail access to Central Melbourne and key employment hubs • Improving connectivity between public transport modes and relieving tram congestion • Stimulating urban renewal (particularly in identified key urban renewal precincts). |
| 3. Deliverability and minimising productivity impacts caused by disruptions | Key considerations include: <ul style="list-style-type: none"> • The extent to which the options are deliverable • The extent of rail disruptions • The extent of road and other disruptions (including property acquisitions). |
| 4. Cost | Key considerations include: <ul style="list-style-type: none"> • Overall capital costs relating to the new infrastructure in the central area of the network • Timing and magnitude of subsequent capital investment requirements to support long-term objectives (on a present value basis) • Operating and maintenance costs. |

The preliminary assessment considered Evaluation Criteria 1, 2 and 3 outlined above (and Evaluation Criterion 4 only where required to distinguish options) to identify a shortlist of capital investment options.

Further assessment of the shortlisted options, including an assessment against Evaluation Criterion 4, was then undertaken as part of the detailed assessment.

Finally, the analysis considered how well each shortlisted capital investment option addresses the identified Problems and can generate the Benefits set out in the ILM.

More information on this assessment process is provided in Appendix 1.

6.3 Preliminary assessment

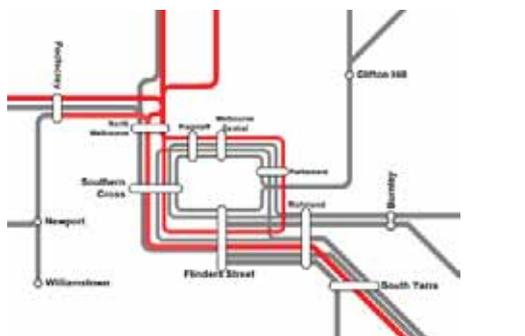
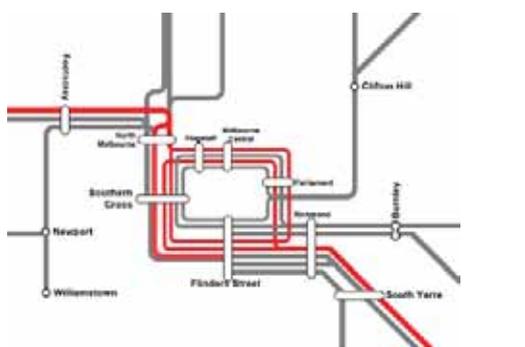
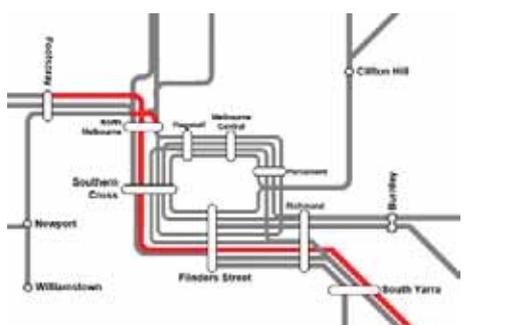
6.3.1 Identification of capital investment options

The capital investment options considered are summarised in Table 6-2, categorised broadly into options that:

- Improve network capacity through the deployment of new technology
- Predominantly expand or enhance existing infrastructure
- Deliver new rail infrastructure routes (in some instances in addition to deploying new technologies and/or modifying existing infrastructure).

Each option is shown schematically in the table, noting that these are provided for illustrative purposes only and are not drawn to scale. In the schematics, the lines or portions of lines subject to improvement are highlighted in red.

Table 6-2 – Capital Investment Options

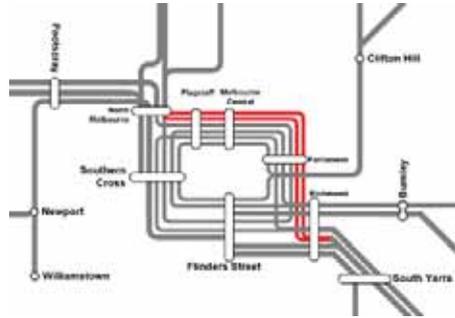
| Option | Summary Description | Schematic |
|-------------------------------|--|--|
| New technology options | | |
| HCS | <p>Introduce HCS on the Northern Group (comprising the Craigieburn, Upfield and Sunbury Lines) and the Cross City Group (comprising the Werribee and Frankston Lines), enabling a modest increase in the number of trains that can operate safely on the network during peak periods.</p> |  |
| HCMTs | <p>Deployment on the Sunbury Line and Cranbourne / Pakenham Lines of HCMTs with capacity of 1,100 passengers per train, the maximum train length that can be accommodated within existing underground stations.</p> <p>HCMTs are longer than existing trains and have a higher passenger carrying capacity than existing trains. Moderate works, such as minor lengthening of station platforms, and changes to signal positions, will be required.</p> <p>These trains will provide a substantial uplift in capacity compared to the existing trains (which provide capacity for 900 per train), but the option will deliver no increase in peak period service levels.</p> |  |
| Extended HCMTs | <p>Deployment on the Sunbury Line and Cranbourne / Pakenham Lines of HCMT with capacity of Extended HCMTs with capacity for up to 1,570 passengers per train (almost double that of an existing train).</p> <p>Such longer train configurations are permitted by the HCMT design, with carriages added permanently within the train to increase capacity. Operation of these long trains requires substantial work such as lengthening station platforms across the network, including through the core of the rail network. Technical constraints almost certainly preclude lengthening underground stations in a cost effective manner.</p> <p>This option will deliver no increase in peak period service levels.</p> |  |

New infrastructure – expanding or enhancing existing inner city routes

City Loop Duplication

Construct an additional pair of tracks and new platforms in new twin tunnels under the existing two City Loop levels at Flagstaff, Melbourne Central and Parliament stations, with portals in the vicinity of North Melbourne and Richmond stations.

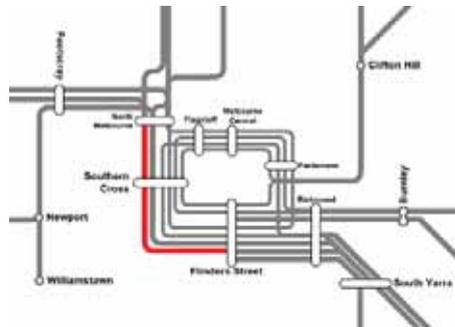
This option will provide additional capacity in and through the CBD by operating services via the new track pair from Richmond to North Melbourne, stopping at Flagstaff, Melbourne Central and Parliament.



Viaduct Widening

Widen the existing Flinders Street viaduct between Southern Cross and Flinders Street Stations to accommodate an additional pair of tracks. Accompanied by associated works, including the electrification of approximately 2.5km of new RRL tracks between North Melbourne and Southern Cross Station, building two new platforms at North Melbourne station, a new rail flyover at Sunshine and flyover in the vicinity of North Melbourne.

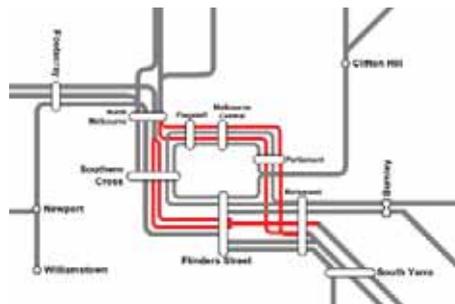
This option will connect the Craigieburn and Sandringham Lines via Southern Cross and Flinders Street Stations and remove Craigieburn services from the City Loop to increase capacity and make capacity available for Sunbury and Upfield services.



City Loop Split

Reconfigure the City Loop by creating new tunnel connections to the tunnel portals at North Melbourne and Richmond to effectively create 'new' capacity through the city using existing tracks.

This will operate services between North Melbourne and Richmond via the City Loop (stopping at Flagstaff, Melbourne Central and Parliament) rather than looping around to Flinders Street via the Flinders Street Viaduct as they currently do. In turn, two tracks over the Flinders Street Viaduct will be available as 'new' capacity.



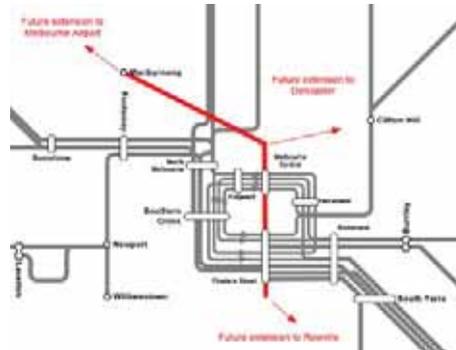
¹ The variant considered through the EWLNA also widened the viaduct to enable a full new loop, via all five existing stations. Recognising the tunnel option delivers the core capacity uplift, the modified variant described has been considered as an improved candidate option for this analysis.

New infrastructure – providing new inner city routes

Stand-alone metro system

Construct a 12km to 13km stand-alone rail tunnel through central Melbourne that runs between Maribyrnong and Domain via Parkville and Swanston Street.

This would be the first stage of a new metro system that could have branch lines extending to inner / middle suburbs including Rowville and Melbourne Airport. Because these lines would be entirely separate from the existing rail network, this option can introduce new technologies and deliver an integrated ‘metro-style’ rail system, as rolling stock, signalling and power will not need to interface with Melbourne’s legacy rail systems.



Hoddle Street bypass

Construct a new pair of tracks in 6km to 7km twin tunnels from the northwest (e.g. South Kensington) to the southeast (e.g. Richmond), bypassing the CBD via Arden, Parkville, Fitzroy, Collingwood and Richmond.

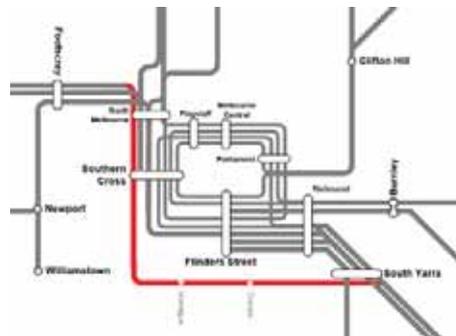
This allows Sunbury to Dandenong services to bypass the City Loop, releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield Lines and longer trains on the Sunshine – Dandenong Line.



Fishermans Bend bypass

Construct a new pair of tracks in 6km to 7km twin tunnels from North Melbourne to South Yarra via a new underground station in the vicinity of Southern Cross and opportunities for new underground stations at Fishermans Bend, Domain and South Yarra.

This allows Sunbury to Dandenong services to bypass the City Loop, releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield Lines and provides for longer trains through the city.

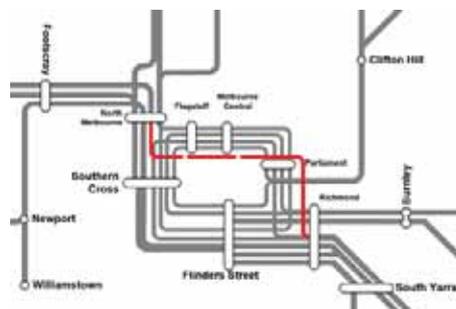


North Melbourne to Richmond tunnel

Construct new 5km to 6km twin tunnels between North Melbourne and Richmond aligned with an east- west CBD street (e.g. Lonsdale Street).

New underground stations could be provided between Spencer and King Street and between Elizabeth and Swanston Street.

New underground platforms could also be provided at North Melbourne and Richmond stations. The new tunnel accommodates Sunbury to Dandenong services, releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield Lines.



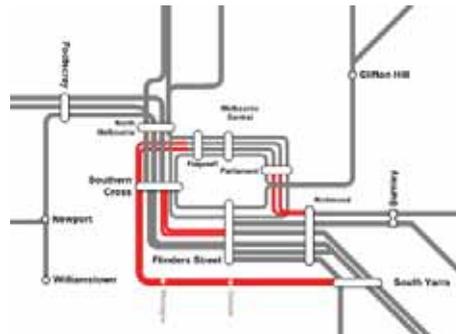
MRL (Fishermans Bend)²

Construct a new pair of tracks in twin 6km to 7km twin tunnels that link the north-west corner of the City Loop (north of Southern Cross) to the existing tracks at South Yarra.

A new tunnel entrance will be created at Jolimont to connect the City (Caulfield) Loop tunnel to the Ringwood Line and new underground stations could be provided at South Yarra, Domain, Montague and Southern Cross.³

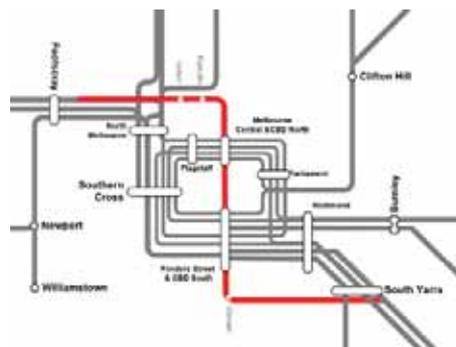
This option creates a cross-city Frankston to Ringwood Line and removes these services from the congested Flinders Street Viaduct. This will release capacity on the viaduct for a cross-city Sunbury to Dandenong Line and remove these services from the City Loop. In turn, this will increase City Loop capacity for Craigieburn and Upfield services and provide a dedicated through-running service for the Sunshine – Dandenong Line. Creating a cross-city Frankston-Ringwood service could also create a Werribee to Sandringham service, increasing capacity on the Werribee and Sandringham Lines.

This option is effectively a hybrid of the Fishermans Bend bypass tunnel alignment (providing a new station in Central Melbourne) and the City Loop Split network reconfiguration (providing capacity uplift).



Melbourne Metro

Construct new 9km twin rail tunnels from South Kensington to South Yarra (South Yarra station is the closest viable portal location to the CBD),⁴ with five new underground stations at Arden, Parkville, CBD North (Melbourne Central), CBD South (Flinders Street) and Domain.⁵ Services will operate on existing tracks from Sunbury to South Kensington before entering the new rail tunnel from South Kensington and then connect to the existing Dandenong corridor at South Yarra. This accommodates Sunbury to Dandenong services via the new tunnels, enables longer trains through the city and frees up existing tracks to restructure the network.



² This option reflects the former Melbourne Rail Link project alignment.

³ While this option has been previously considered as a combined proposal with a link to Melbourne Airport, it has been assessed here regarding the tunnel section only, as this assessment is focused on expanding rail capacity.

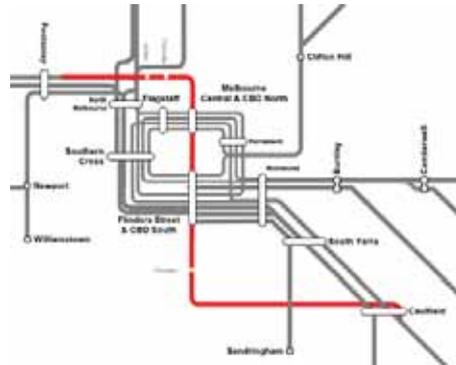
⁴ It should be noted that the option of moving the tunnel portal closer to the CBD in a scenario in which no Domain station is provided has been assessed and found to increase the cost, due to the complex interfaces that would be required with the rail network on the city side of Richmond station, or potential need to construct new underground platforms at Richmond station in order to avoid this rail network interface.

⁵ Additional / alternative station options have also been considered for this option. For the purposes of this Chapter, the options analysis is based on the scope as documented in the previous Melbourne Metro business case in 2011. Further analysis of project options (including alignment and station options) is provided in Chapter 7.

South Kensington to Caulfield tunnel

Construct new approximately 15km twin rail tunnels from South Kensington to Caulfield with seven new underground stations at Arden, Parkville, CBD North (Melbourne Central), CBD South (Flinders Street), Domain, in the vicinity of Alfred Hospital and Windsor station.⁶

This option operates services from Sunbury to Cranbourne / Pakenham via the tunnels so that the services (with longer trains) are 'through-routed' via the CBD. Dandenong corridor trains will operate into the new CBD tunnel at Caulfield.



⁶ This option was first presented in the East West Link Needs Assessment (2008) and subsequently refined in the Department of Transport, Melbourne Metro Two Alignment Options Assessment (2011).

6.3.2 Preliminary assessment and shortlisting of capital investment options

The key findings and outcomes of the preliminary assessment are summarised below. More detail about this assessment and the evaluation criteria is provided in Appendix 1.

Technology options⁷

- While the HCS and HCMT options provide an uplift in capacity that is being pursued as part of business-as-usual development, they cannot meet demand requirements without significant further investment in infrastructure. For example, HCS can only provide four additional trains per hour on the Northern Loop, which carries the Craigieburn, Upfield and Sunbury Lines, less than half the additional capacity being provided at day one to address demand on these lines through provision of Melbourne Metro.
- Introducing Extended HCMTs requires reconfiguring the network to create a dedicated line (such as the Sunshine – Dandenong Line) bypassing the City Loop, as these long trains could not be supported at existing underground stations. Substantial works would also be required to extend surface station platforms, with the option not delivering any service uplifts and only providing capacity uplift to the dedicated route where these longer trains operate.
- These options in isolation would not improve reliability to any significant extent (as they do not deliver major changes to infrastructure or facilitate line segregation) or materially alleviate tram congestion. As they do not provide new stations, these options also do not improve access to key employment centres outside the growing and expanding CBD or stimulate urban renewal, and would exacerbate crowding and unreliability at existing busy CBD stations.

The technology options should be considered in conjunction with (and in addition to) enhanced or new infrastructure options as part of maximising the capacity and value of new infrastructure.

New infrastructure – expanding or enhancing existing inner city routes

- These options all provide additional rail capacity through the CBD by developing major new rail infrastructure within the inner core, following existing routes.
- The options do not provide any new stations to service new catchment areas for a growing and expanding CBD, which means that they do not improve access to jobs outside the CBD or stimulate urban renewal. Overall, this would not support or enhance Melbourne's competitive advantage relative to other cities.
- These options would not alleviate congestion on busy tram routes and would exacerbate crowding at existing CBD stations, as well as North Melbourne and Richmond stations.
- Constructing the City Loop Duplication option would be highly complex and expensive, as it involves the construction of two new tracks below the City Loop, two new platforms at Flagstaff, Melbourne Central and Parliament, and associated track connections. The constructability of this option has not been tested to any level of detail⁸ but is likely to significantly disrupt rail services including potential closures of City Loop stations – which would leave no rail alternative routes across the city and further concentrate passengers around a smaller number of central-city stations.
- The Viaduct Widening and City Loop Split options both provide a material capacity uplift by increasing the number of trains that could operate but would entail significant disruption during construction. These two options would be less expensive to deliver than the new infrastructure options (see below) and are likely to be similar magnitude of cost.

⁷ Chapter 6 assesses the ability of the discrete options within this category to address the Problems and realise the Benefits identified in the ILM. As discrete options, they do not perform strongly in comparison to the other options. However, they are viable complementary projects and are currently being delivered and/or trialled.

⁸ Note that this option was set aside in the EWLNA due to the expected complexity of construction. Refer to *Analysis on Rail Capacity* (PTD, 2008).

- The City Loop Split option provides a better network outcome when compared to the Viaduct Widening option, as it better aligns to future network development and expansion options. However, it removes direct access to Flinders Street and Southern Cross for all passengers using the Frankston, Craigieburn and Upfield Lines, resulting in higher reliance on interchange at Richmond and North Melbourne stations.
- The Viaduct Widening option degrades some benefits of the recently completed RRL upgrade (requiring a new flyover and all regional services to use terminal platforms 1 to 8 at Southern Cross Station). Further, it will have an adverse impact on the North Bank precinct, which is important to the design of the urban environment along the Yarra River.
- Of the enhancement / expansion options, the City Loop Split option provides a comparatively lower-cost and efficient opportunity to immediately increase rail capacity when compared to the suite of new infrastructure options. However, this option would rely on increasing numbers of passengers using existing inner city stations (which are reaching capacity) and, in particular, a large increase in the number of passengers interchanging at Richmond and North Melbourne stations. Operation of longer HCMTs would be limited to surface routes and only if substantial upgrades to inner city stations (as per the Extended HCMT option) were completed, and without this the option would not provide sufficient capacity needed to meet growth on the Sunshine – Dandenong Line to meet demand in the longer term.
- The City Loop Split involves portal and track works which will significantly disrupt City Loop services over several months during delivery. As the current network stands, the capacity of the unaffected underground loop lines would be grossly insufficient to distribute passengers across the city and therefore the required closures would be difficult to accept as they would leave no rail alternatives to cross the city. As a result, this option is impractical to build at this stage of the rail network's life as it would shut down cross-city rail access during the construction phase. This option may be investigated in the future to provide additional capacity but due to the disruption it would create to City Loop services, it would be best completed after the Melbourne Metro or project of a similar nature.

While the City Loop Split does provide a low-cost opportunity to deliver immediate capacity to the core of the network, this option is best suited as a subsequent investment following a project that has created a rail corridor through the city that mitigates construction impacts and disruptions (such as Melbourne Metro).

New infrastructure – providing new inner city routes

- The options that construct new tunnels will involve varying degrees of disruption (and cost) depending on a range of factors, including horizontal and vertical alignment, station locations, ground conditions and constructability.
- The stand-alone metro option increases inner city rail capacity, but does not connect into existing suburban lines and therefore does not make this capacity available where it is needed most in Melbourne (i.e. in the growth areas to the west, north and south east). This option does not therefore address looming capacity pressures for commuters accessing Melbourne or crowding at existing inner city rail stations, and may exacerbate these issues in the future. This option could help to alleviate congestion on busy tram routes and could also enable new line extensions to Melbourne Airport and Rowville. However, these projects would be considerably more expensive as they would require development of a complete new network (likely including long tunnels back to Central Melbourne) rather than making use of existing tracks.
- The stand-alone metro option avoids the need to interface new technologies with a legacy brownfield rail network, making it possible to incorporate new technologies efficiently / more cheaply. However, construction will cause significant road and other disruption (including property acquisitions) along the length of the standalone link alignment and the benefits of the project depend heavily on subsequent expansion of the standalone network, requiring government to commit to a high cost program of works over several decades to make use of the infrastructure delivered by the initial project.

- The Hoddle Street and Fishermans Bend bypasses will not improve rail capacity for access to and within the CBD, Melbourne's most important employment precinct. While both options facilitate access to jobs outside the CBD and open up opportunities for urban renewal through new stations, they are likely to lead to significant crowding issues at inner city stations and on some train and tram services due to the high number of passengers from the Sunshine – Dandenong Line who need to interchange at one or two stations for CBD access on other train lines. Neither option would alleviate congestion on busy tram routes.
- The North Melbourne to Richmond tunnel enables more people to travel by train to jobs in the CBD, but will not improve access to key employment nodes outside the central city. This option will also exacerbate overcrowding at Richmond and North Melbourne stations and do little to alleviate tram congestion. The new tunnel would not provide new stations to serve an expanding Central Melbourne.
- The Kensington to Caulfield tunnel enables almost identical outcomes to the Melbourne Metro option, with the added benefit that it also provides a new track pair between Caulfield and the CBD. This option is considerably more expensive (approximately \$2bn) than the other infrastructure options and most likely requires staged delivery resulting in delayed operations and significantly more lead time (beyond ten years) until the tunnels are operational. It is expected that demand from Domain to Caulfield can be accommodated by improvements to tram services along this alignment between Caulfield and Domain along St Kilda and Dandenong Roads for the foreseeable future. Compared to Melbourne Metro, the option brings forward investment in heavy-rail capacity between South Yarra and Caulfield that can effectively be mitigated by deployment of HCS and longer HCMT trains on the corridor.
- The MRL (Fishermans Bend) option improves network reliability by delivering six dedicated lines, creating four new stations, supporting connectivity to key activity precincts (CBD and South Yarra) and employment hubs (CBD and Domain), and supporting urban redevelopment at Montague.
- The Melbourne Metro option provides network reliability benefits by delivering six dedicated lines, creating five new stations, improving connectivity to key activity precincts (CBD and Parkville) and employment hubs (CBD, Parkville and Domain). It provides significant relief for tram congestion along the Swanston Street / St Kilda Road corridor and supports urban redevelopment at the Arden–Macaulay Precinct.

The Melbourne Metro and MRL (Fishermans Bend) options provide the most significant capacity uplift for access to the CBD while, to varying degrees, also improving reliability and access to jobs via new stations, facilitating urban renewal and alleviating tram congestion.

Preliminary options assessment outcome

Based on the analysis undertaken, the Melbourne Metro and MRL (Fishermans Bend) options provide the most significant capacity uplift for access to the CBD while, to varying degrees, also improving reliability, improving access to jobs through the provision of new stations, facilitating urban renewal and alleviating tram congestion. These two options were short-listed for more detailed analysis as part of the detailed assessment, with key benefits identified as follows:

- **MRL (Fishermans Bend)** – This option will improve network reliability by delivering six dedicated lines, creating four new stations, supporting connectivity to key activity precincts (CBD and South Yarra) and employment hubs (CBD and Domain), and supporting urban redevelopment at Montague⁹
- **Melbourne Metro** – This option provides network reliability benefits by delivering six dedicated lines, creating five new stations, improving connectivity to key activity precincts (CBD and Parkville) and employment hubs (CBD, Parkville and Domain), providing significant relief for tram congestion along the Swanston Street / St Kilda Road corridor, stimulating urban redevelopment at Arden and delivering the greatest capacity uplift in the long term (ultimate infrastructure capacity).

⁹ Note that this does not include the Airport Rail Link, which is considered a separate project.

6.4 Detailed assessment of shortlisted capital investment options

The two shortlisted options underwent a detailed assessment to better understand their ability to provide capacity uplift and improve reliability, access to jobs and stimulate urban renewal, maximise deliverability and minimise disruption, minimise cost and address the Problems identified in Chapter 3.

The key findings of the assessment are summarised below. More information about this detailed assessment is provided in Appendix 1.

6.4.1 Increasing rail capacity and improving reliability

Increasing rail capacity at opening

Melbourne Metro and MRL (Fishermans Bend) are both capable of delivering a similar capacity uplift as part of an initial service plan to meet forecast demand in the mid-2020s, and provide similar inner-city capacity to support medium-term development of the network.

Melbourne Metro provides a significant increase in inner city station capacity, through provision of two new central CBD stations to alleviate congestion at existing city stations, as well as three new stations servicing the surrounding area at Parkville, Domain and Arden. MRL (Fishermans Bend) does not provide the same degree of capacity relief to existing city stations (as this option does not provide new inner city stations), and would significantly increase the numbers of people using Southern Cross, North Melbourne and Richmond. This arises due to reliance on interchange for passengers on the Frankston and Lilydale / Belgrave Lines to access Flinders Street station.

Alleviating station crowding

Melbourne Metro provides two new CBD stations and takes pressure off existing stations that are projected to become more crowded over time.

MRL (Fishermans Bend) would increase the use of existing CBD stations as well as other interchange stations, such as Richmond and North Melbourne.

Project contribution to longer term capacity needs of inner core

Melbourne Metro delivers the capability to operate longer HCMT trains through the inner core on the Sunshine – Dandenong Line as part of the design for the new underground stations. This results in a total infrastructure capacity equivalent to 150,000 peak direction passengers per peak period, providing latent capacity to support future developments such as the Melton Electrification, Melbourne Airport Rail Link and Rowville Rail Link projects and also a pathway to meet rapidly growing demands forecast that arise on the Sunshine – Dandenong Line from the early 2030s.

The MRL (Fishermans Bend) solution, by comparison, provides lower long-term infrastructure capacity than Melbourne Metro; requiring a separate investment to extend platforms at stations in Central Melbourne to accommodate longer HCMTs. These subsequent works required under the MRL (Fishermans Bend) option to extend platforms at North Melbourne, Southern Cross, Flinders Street and Richmond stations, are expected to be complex and disruptive due to constraints associated with work in such a constrained and busy operating corridor.

Future network development implications

The longer term capacity assessment in the previous section highlighted a number of differences with implications for the longer term investment options available to future governments. Analysis of the implications of these differences is presented in Appendix 1 through comparison of the differing investment pathways (post project) associated with each shortlisted capital investment option, should government elect to invest in longer term capacity expansion beyond the project.

Key differences between the options are summarised as follows:

- **Melbourne Metro** – provides purpose built stations through the central part of the network, designed to accommodate longer 10 car trains. The addition of a new heavy rail route through the centre of the CBD then provides the foundation to split the City Loop to meet future patronage demands, with the Melbourne Metro tunnel then providing the ability to better manage rail services and customer flows

during construction. Subsequent investment decisions for the Newport – Clifton Hill tunnel (and Viaduct Widening) are decoupled from growth pressures on other lines, and may be completed when justified by patronage on those lines.

- **MRL (Fishermans Bend)** – defers investment associated with accommodation of longer 10 car trains on the Sunshine – Dandenong Line, but immediately exploits the opportunity to split the City Loop (in this case, the Caulfield and Burnley loops) to achieve similar day one outcomes. The design of the MRL (Fishermans Bend) solution identified a series of future upgrades to surface stations within the inner core to accommodate longer HCMTs, noting these works are considered more complex, higher-risk and likely to involve further commuter disruption due to the constrained environment for the required works. Without the subsequent option to implement the City Loop Split, the network expansion options available to government are likely to require the timing of the need for the next major new rail link from the west (Newport – Clifton Hill tunnel) to be brought forward by approximately a decade (*vis-à-vis* the Melbourne Metro option), with additional works required to enable this project to provide interim capacity relief to the Northern Loop. Ultimately, construction of the Viaduct Widening from Flinders Street to Southern Cross Station, an option which has previously been discounted based on a variety of issues including impact on amenities, cost and disruption, would also be necessary to provide equivalent capacity and segregation as the Melbourne Metro option.

As a result, the MRL (Fishermans Bend) option results in a moderate initial saving (by deferral of works associated with introduction of longer HCMTs) at the cost of greater and more rapid staging of major subsequent investments in the network in order to meet demand over time. Further, the increase in works associated with MRL (Fishermans Bend) in the early-mid 2030s will lead to greater levels of network disruption during this period, which has flow-on consequences for businesses and local amenities in the affected areas.

Expanding the freight network

Both Melbourne Metro and MRL (Fishermans Bend) actively provide for a pair of tracks between South Yarra and Flinders Street to be made available for dedicated freight and regional operations by diverting an existing line (Dandenong or Frankston, respectively) into a new rail tunnel at South Yarra, freeing up existing tracks to the city.

As such, the extent to which the options provide or protect for future freight requirements is not a major point of distinction.

Reliability benefits

Both MRL (Fishermans Bend) and Melbourne Metro are expected to result in positive outcomes for service punctuality and reliability, with substantial improvements expected as a result of reduced congestion and upgraded assets provided as part of the project works.

Operating lines independently delivers consistent, high frequency, reliable (i.e. on time) services that enhance the customer experience. The less the design of the network relies on management of complex interactions between services, the fewer potential conflict points exist – reducing the potential for impacts from incidents and service disruptions to cascade across lines.

Whilst both options provide a similar level of line independence, the configuration of those lines is significantly different with MRL (Fishermans Bend) resulting in higher potential for poor reliability outcomes. These arise due to:

- Connection of the Frankston and Ringwood corridors, resulting in a number of challenges to scheduling and reliability of the operation due to the length of the line and journey time from end to end, the limited terminating facilities on the trunk section, multiple single line and overtake sections and insufficient maintenance and stabling facilities
- Higher dependence on interchanges at already crowded stations, such as Richmond and Southern Cross, resulting in higher variability in the time trains need to spend at these stations to allow for boarding and alighting passengers (dwell times).

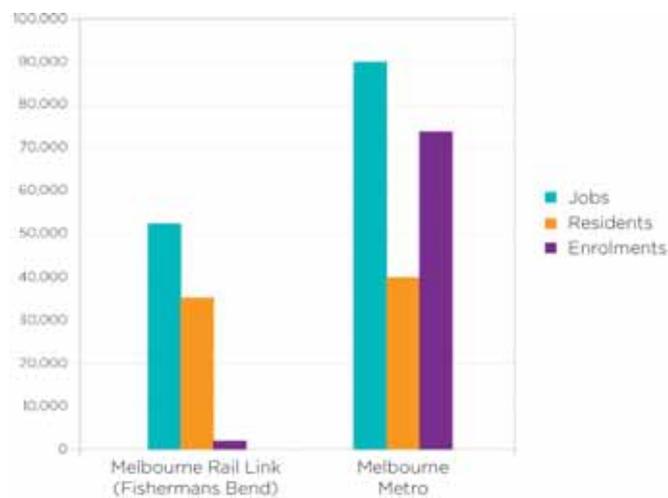
As a result of these factors, punctuality and reliability of the network under the Melbourne Metro option is expected to be better than under the MRL (Fishermans Bend) option.

6.4.2 Improving access to jobs and stimulating urban renewal

The key conclusions around improved access to jobs and stimulating urban renewal are as follows:

- Both options offer more services to the CBD. However, Melbourne Metro provides improved access to CBD jobs while maintaining the most balanced distribution of passenger movements and relieving crowding at existing CBD stations (whereas MRL (Fishermans Bend) would exacerbate crowding).
- Both options would increase cross-city connectivity, better linking people with jobs from the north and west to the south east.
- Melbourne Metro provides the greatest number of new stations in areas not currently serviced by heavy rail (Arden, Parkville and Domain), and more than double the number of jobs, students and residents within walking distance of the new stations. As illustrated in Figure 6-1, these new stations are expected to have a combined catchment of over 200,000 jobs, student enrolments and residents in 2031 – compared to the combined catchments of under 100,000 jobs, education enrolments and residents for the MRL (Fishermans Bend) (Montague and Domain).

Figure 6-1 – Catchments of new stations in areas not already served by rail within 800m by 2031



Source: PTV.

- Melbourne Metro also provides the greatest congestion relief to the Swanston Street / St Kilda Road tram corridor and Parkville tram and bus networks, including the 401 bus route which provides a vital multimodal link between North Melbourne station and the Parkville education and biomedical precinct. MRL (Fishermans Bend) offers less relief to St Kilda Road trams and provides no station at Parkville to support this growing education and biomedical precinct or to provide 401 bus route relief.
- Both Melbourne Metro and the MRL (Fishermans Bend) can provide a new station to support major urban renewal. Montague station as part of the MRL (Fishermans Bend) could play a key role in supporting the extensive residential development already approved in this precinct. However, Arden station as part of Melbourne Metro could have a more transformative role, as it would stimulate a major new employment-oriented development in the area. Arden station provides an intervening opportunity to connect Melbourne's highest growth corridor in the north and west to a new expanded central city employment zone. The Arden-Macaulay Precinct contains several large parcels of government owned land that are well located to facilitate expansion of the research, education and clinical care capacity of Parkville, together with the City North employment zone. Importantly, Arden station provides the opportunity to appropriately bridge the growth of Melbourne's west together with the development of Footscray and growing knowledge workforces and residential communities of Docklands and E-Gate, as well as the future development of Dynon.
- Melbourne Metro supports the reconfiguration of the tram network from the current system, which is heavily focused on Swanston Street, into a more evenly distributed network that runs into the west of the CBD and supports deployment of higher capacity, 33m trams on Swanston Street routes. This improves tram network access to key employment growth areas in the CBD and the west, and supports efficient north-south connectivity.

Leveraging the urban renewal potential of rail investment

As Melbourne’s population grows, urban renewal projects can provide new housing in locations with good access to public transport, retail and services, walking and cycling links and recreational and social activities. By combining new residential development with commercial development, these inner city precincts can offer attractive and interesting places to live and work, with a range of housing choices and jobs close to home.

Providing a new train station in an urban renewal precinct is most efficient where there is potential for significant employment-oriented development, as stations provide a high-capacity link between jobs and the wider metropolitan labour market.

Melbourne’s Arden-Macaulay Precinct has significant potential for redevelopment to support a growing number of jobs in the knowledge sector. Currently an industrial area, the Arden-Macaulay Precinct can leverage the combination of a new station provided by Melbourne Metro and proximity to the Parkville education and biomedical precinct into a high quality, highly liveable mixed use precinct, with medium density residential development built around a commercial core.

6.4.3 Deliverability and minimising shut-downs caused by disruptions

Construction of rail infrastructure involves significant complexities, and both shortlisted options would cause disruptions to existing train services and some parts of the inner city road network.

The major disruption works associated with each option are summarised in Table 6-3.

Table 6-3 – Major disruptions

| Option | Major disruption |
|------------------------------|---|
| MRL (Fishermans Bend) | <ul style="list-style-type: none"> • Closures of two out of four City Loop tunnels – the Caulfield Loop (Cranbourne / Pakenham Lines) and Burnley Loop (Belgrave, Lilydale and Alamein Lines) – with flow-on effects to other lines depending on re-routing or early termination options, indicatively expected to extend for 3–5 months • Due to the implications of the reconfiguration works associated with the Burnley and Caulfield tunnels, passengers on the Ringwood and Dandenong Lines would be severely impacted by the disruption works associated with MRL (Fishermans Bend). Over an extended period of disruption, construction works would require these services to operate directly between Richmond and Flinders Street stations, operating with significantly reduced service levels and not servicing the underground stations • Construction works in the rail reserve north of Southern Cross Station. Impact would depend on construction method. If TBM construction is feasible this would be limited to a significant impact on V/Line operations, but if cut and cover works are necessary this would involve a number of occupations, progressively affecting the majority of the metropolitan network • Cut and cover works at Brunton Avenue are likely to require 10 to 20 weekend occupations with reduced weekend access to City Loop for all Burnley services • The works at South Yarra to construct the portal, station and reconfiguration of the tracks are likely to require a significant number of weekend occupations and several extended occupations affecting the Sandringham, Frankston, Cranbourne / Pakenham Lines • Staged portal configuration works between Richmond and Flinders Street requiring varying degrees of disruption to Ringwood services for a number of years • Prolonged significant disruption of road traffic conditions and property acquisitions at Wurundjeri Way, Montague, Domain and South Yarra due to the cut and cover construction works for new stations • Several station and tunnel alignment options have been identified in the Montague – Yarra River precinct and impacts would depend on the selected alignment. However, these may require partial demolition (and rebuild) of Charles Grimes Bridge (Wurundjeri Way) and/or significant and complex commercial interfaces (potentially involving property acquisitions) including the South Wharf precinct and Melbourne Exhibition and Convention Centre expansion, other significant developments (e.g. Batman Hill) and the Southern Cross Station Public Private Partnership • Very high risk sequencing works related to portal and City Loop match in works at Southern Cross, South Yarra and Jolimont, involving interfaces between new and legacy rail systems, requiring time critical execution in the context of a major rail network occupation |

| Option | Major disruption |
|------------------------|--|
| Melbourne Metro | <ul style="list-style-type: none"> • Comparatively limited rail service disruptions over the life of the construction programme compared to MRL (Fishermans Bend), as the new tunnel would be constructed largely separate to the existing rail network • The most significant rail disruption would arise as a result of the portal construction and track reconfiguration works at South Yarra, likely to require a significant number of weekend occupations and several extended occupations affecting the Sandringham, Frankston, Cranbourne and Pakenham lines • There would be comparatively minor disruption to Sunbury line services with occupations required as a result of the works at the South Kensington portal • Other comparatively limited disruption would be required in relation to signalling upgrades and civil works on the existing network, although it is expected that disruption would be managed by coordinating these with other works affecting the network (for example, level crossing removals) • Prolonged disruption of road traffic conditions at South Kensington, Arden, Parkville, CBD, Domain and South Yarra. However, CBD disruption is comparatively limited as a result of the cavern construction methodology, meaning that the CBD stations will be constructed almost entirely underground (rather than cut and cover from the surface) |

The key conclusions when comparing deliverability and minimising productivity impacts caused by disruptions are:

- Both MRL (Fishermans Bend) and Melbourne Metro involve constructing new stations. This will require varying levels of surface disruptions in central Melbourne, including property acquisition, disruption to surface transport networks and business disruption
- MRL (Fishermans Bend) will significantly disrupt rail services due to construction of tunnel portals at South Yarra and near Richmond, and particularly due to the connections to the existing City Loop tunnels near Southern Cross. As a result, this option will involve major disruption to the core of the rail network. Many lines will be disrupted and a significant effort will be needed to accommodate a very large number of affected customers
- Due to the implications of the reconfiguration works associated with the Burnley and Caulfield tunnels, passengers on the Ringwood and Dandenong lines are severely impacted by the disruption works associated with MRL (Fishermans Bend). Over an extended period of disruption, construction works would require these services to operate directly between Richmond and Flinders Street stations; operating with significantly reduced service levels and not servicing the underground stations
- Melbourne Metro would require comparatively limited rail service disruptions over the life of the construction program as the new tunnel will be constructed largely separate to the existing rail network.

6.4.4 Cost

Preliminary capital cost estimates for each shortlisted capital investment option have been completed, and are provided in Table 6-4 below both for the initial project investment and also for longer term investment pathways relating to infrastructure requirements in the central core of the rail network. It should be noted that this assessment has been conducted to compare material differences between the two options.

Table 6-4 – Costs associated with stages of expanding capacity in the core of the rail network for the different shortlisted capital investment options

| Stage | Network Change | Indicative timing | Shortlisted capital investment options – investment pathway (2015\$, P90) | |
|-------|---|-------------------|---|-------------------------------------|
| | | | Melbourne Metro | MRL (Fishermans Bend) ¹⁰ |
| A | This project | Early-Mid 2020s | ~\$9.5b | ~\$8.9b |
| B | Introduce Extended HCMTs on Sunshine – Dandenong Line to accommodate extension and growth area demand | Early 2030s | ~\$0.8b | ~\$2.4b |
| C | Additional capacity to north / west (new pair of central city tracks) | Mid-2030s | ~\$2.7b | ~\$12.2b |
| D | Additional capacity to north / west (further new pair of tracks) | Mid-2040s | ~\$11.8b | ~\$1.0b |

While MRL (Fishermans Bend) and Melbourne Metro options represent comparable initial investments, the MRL (Fishermans Bend) option requires significant capital investment in the network approximately a decade sooner than Melbourne Metro. As such, on a net present value basis Melbourne Metro represents a lower cost to Government.

This assessment has not valued disruption during construction. Taking these factors into account is likely to favour Melbourne Metro, as the MRL (Fishermans Bend) option would require both a greater number of significant construction stages in subsequent periods and more disruption due to construction works in the live transport corridor in order to expand the rail network in line with projected patronage demand.

Note that operating cost is not expected to be a significant differentiator between options, however, the MRL (Fishermans Bend) option is regarded as likely to have slightly higher operating and maintenance costs as a result of less efficient pairings of lines.

¹⁰ The costs for MRL (Fishermans Bend) exclude the costs associated with the Airport Rail Link.

6.4.6 Addressing identified Problems

Table 6-5 provides a summary of the extent to which each option addresses the identified Problems and therefore can generate the Benefits set out in the ILM.

Table 6-5 – Extent to which Problems are addressed

| Option | Problem 1: Chronic overcrowding and unreliability of rail services are reducing Melbourne's liveability and access to jobs and key activity precincts | Problem 2: Physical transport network constraints are reducing Melbourne's economic prosperity | Problem 3: Insufficient public transport services are impacting access into and around Central Melbourne, and limiting the potential for urban renewal |
|-----------------------|---|--|--|
| Melbourne Metro | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| MRL (Fishermans Bend) | ✓✓✓ | ✓✓✓ | ✓✓✓ |
| ✓✓✓✓ | Shortlisted capital investment option fully addresses the Problems as set out in the ILM | | |
| ✓✓✓ | Shortlisted capital investment option makes a substantial contribution to addressing the Problems as set out in the ILM | | |
| ✓✓ | Shortlisted capital investment option partially addresses the Problems as set out in the ILM | | |
| × | Shortlisted capital investment option insufficiently addresses the Problems as set out in the ILM | | |

The extent to which the shortlisted capital investment options address Problem 1 and 2 relates strongly to the extent to which they overcome the capacity constraints in the core of the rail network. Melbourne Metro offers the following advantages compared to the MRL (Fishermans Bend) option:

- Melbourne Metro provides predominantly new inner city capacity supporting long-term network growth. This compares to MRL (Fishermans Bend), which relies on significant reconfiguration and upgrades to the existing central area network (both initially and as future investments) to achieve a similar long-term outcome in terms of total increase in inner city capacity. The long-term network infrastructure capacity uplift from Melbourne Metro in future equates to approximately 150,000 during the two-hour AM Peak. Melbourne Metro enables extended HCMT trains on the newly created Sunshine – Dandenong Line, whereas MRL (Fishermans Bend) will require this to be a separate investment to extend platforms at stations in Central Melbourne. This is a complex project that would involve extending platforms and increasing siding capacity at North Melbourne, Southern Cross, Flinders Street and Richmond stations
- Melbourne Metro provides two new CBD stations, taking pressure off other stations and improving access to the civic spine of the city, whereas MRL (Fishermans Bend) provides no new CBD stations, requires passengers on the Frankston and Lilydale-Belgrave Lines to interchange to access Flinders Street Station, resulting in increased crowding at existing stations
- MRL (Fishermans Bend) will involve major disruptions to the core of the rail network, including shutting two out of four City Loop tunnels for a period of time to support the reconfiguration of the City Loop. Due to the implications of the reconfiguration works associated with the Burnley and Caulfield tunnels, passengers on the Ringwood and Dandenong Lines are particularly impacted by the disruption works associated with MRL (Fishermans Bend). Melbourne Metro does not result in the same level of disruption to the core of the existing network
- Melbourne Metro provides more new stations in areas not currently serviced by heavy rail and the most relief to the Swanston Street / St Kilda Road tram corridor and Parkville tram and bus networks. MRL (Fishermans Bend) offers less relief to St Kilda Road trams and no station at Parkville to support this growing international education and biomedical precinct
- Both Melbourne Metro and MRL (Fishermans Bend) can provide a new station as part of major urban renewal, however Arden station as part of Melbourne Metro will have a more transformative role stimulating a major employment-oriented development

- The MRL (Fishermans Bend) option leads to a long-term network configuration that would be significantly less cost effective to implement than the investment pathway offered by Melbourne Metro to expand the capacity of the network in the future
- Melbourne Metro results in six dedicated lines which deliver better reliability and overall customer experience benefits.

The MRL (Fishermans Bend) and Melbourne Metro options address Problem 3 in similar ways. Both create new stations in Central Melbourne to improve accessibility and reduce crowding on trams. On balance, the Melbourne Metro option is rated higher due to the larger catchment served by the new stations, better relief to trams, and stronger role in stimulating urban redevelopment. Melbourne Metro also provides timely additional capacity on the Sunshine – Dandenong Line without separate additional investment.

6.5 Recommended capital investment option

Melbourne Metro is the recommended capital investment option because it:

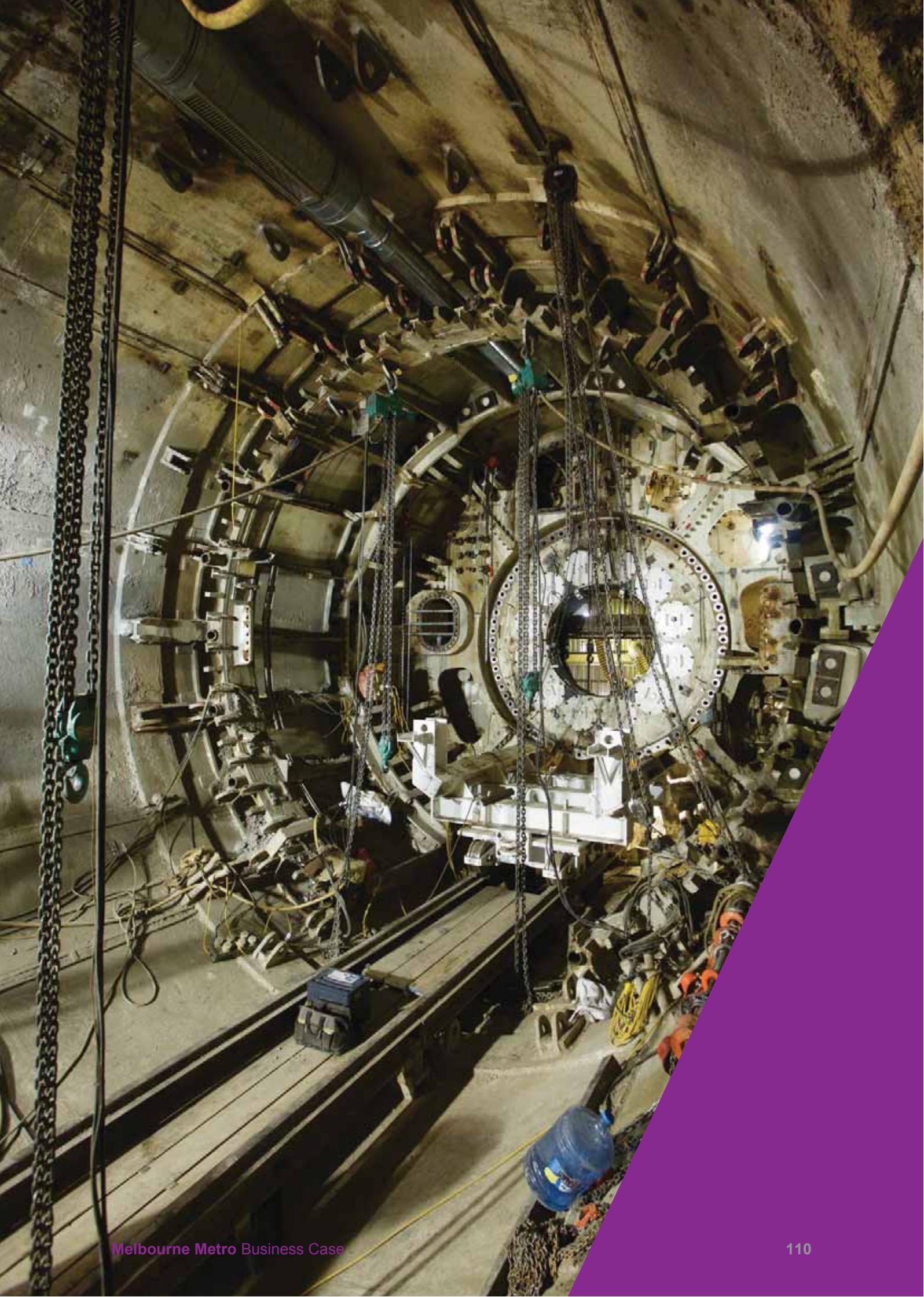
- Addresses the Problems and achieve the Benefits identified in Chapter 3 and Chapter 4
- Represents a better option to deliver these outcomes than the other capital investment options assessed.

Melbourne Metro offers significant transport and network benefits, can drive higher levels of productivity to support economic and employment growth, and improves liveability by giving people greater access to social and economic opportunities.

CHAPTER 7

Project options analysis and Recommended Solution – Chapter Summary

- Melbourne Metro was identified as the preferred capital investment option.
- This Chapter presents the results of a detailed assessment of the optimal scope and alignment for Melbourne Metro rail tunnel, including the location of stations along the length of the proposed route.
- Key decisions were assessed against the following key evaluation criteria:
 - Improving access to jobs in the Melbourne CBD and key employment hubs outside the city centre, and supporting and stimulating urban renewal
 - Deliverability and extent of disruptions
 - Cost (including upfront capital costs and operating and maintenance costs).
- The assessment identified a Recommended Solution that includes:
 - A western tunnel entrance (portal) at South Kensington, connecting to the Sunbury Line, with an eastern portal at South Yarra
 - An alignment through the CBD that travels along a Swanston Street route, under the existing City Loop
 - Five new underground stations to serve major areas of activity in the city and interchange with existing transport services:
 - Arden station – located to stimulate and support the Arden–Macaulay Precinct
 - Parkville station – located under Grattan Street within the Royal Melbourne Hospital / Melbourne University Precinct
 - CBD North station – located under Swanston Street, broadly between La Trobe and Franklin Street, with a direct interchange to Melbourne Central station
 - CBD South station – located under Swanston Street, broadly between Flinders and Collins Street, with a direct interchange to Flinders Street Station
 - Domain station – located under St Kilda Road, near the intersection of Albert Road and Domain Road.



7 Project options analysis and Recommended Solution

7.1 Introduction

Chapter 6 identified Melbourne Metro as the preferred capital investment option and was recommended for further development in this Business Case.

This Chapter sets out the key options for Melbourne Metro (including station locations and vertical and horizontal alignment variations), assesses the relative merits of these options and recommends a preferred solution.

7.1.1 Overview of approach

This Chapter focuses on significant scope and alignment issues, including material differences in horizontal and vertical tunnel alignments, if certain stations should be included or excluded and where certain stations should be located, rather than on matters related to construction methodology (for example, tunnelling techniques) or more detailed design issues (such as station entrances, refinement of tunnel alignments or the potential range of engineering requirements or systems options).

The Department worked with PTV, MMRA and other relevant stakeholders to comprehensively analyse project options.

Given the scale and complexity of the project, the options analysis did not simply compare several mutually exclusive options, but conducted a multifaceted analysis with particular focus on key decision points along the alignment and the impacts of these decisions on the ability to address the Problems and achieve the Benefits set out in the ILM.

Options analyses were undertaken for five identified geographical areas (Study Areas), as shown in Figure 7-1, including the interdependencies between these areas.

Figure 7-1 – Melbourne Metro Study Areas



Study Area A

- Decision A1: What is the preferred corridor through South Kensington / Arden-Macaulay?
- Decision A2: Is a South Kensington station investment justified?
- Decision A3: What is the preferred alignment, including Arden station location and portal configuration, at South Kensington?
- Decision A4: Is an Arden station investment justified?

Study Area B

- Decision B1: What is the preferred alignment and station location at Parkville?
- Decision B2: Is the station investment justified?

Study Area C

- Decision C1: What is the optimal horizontal alignment through the CBD?
- Decision C2: What is the optimal vertical alignment?

Study Area D

- Decision D1: What is the preferred alignment and station location at Domain and South Melbourne?
- Decision D2: Is the station investment justified?

Study Area E

- Decision E1: What is the preferred alignment and station location options for South Yarra?
- Decision E2: Is the station investment justified?

Key decisions within each Study Area, including station location and preferred alignment, were assessed against the following evaluation criteria:

- Improving access to jobs in the Melbourne CBD and key employment hubs outside the city centre and supporting and stimulating urban renewal
- Deliverability and extent of disruptions
- Cost¹ (including upfront capital costs and operating and maintenance costs).

Detailed analysis of the Recommended Solution is provided in Part C of this Business Case. Further information on the project options evaluation is provided in Appendix 2.

¹ Option costs in this Chapter are presented in P90, nominal.

7.2 Study Area A: South Kensington and Arden-Macaulay Precinct

7.2.1 Context

As outlined in Chapter 3, the Arden-Macaulay Precinct in North Melbourne is potentially one of Melbourne's largest urban renewal projects and a key strategic area for the proposed future employment expansion of central Melbourne, as well as significant residential intensification. Historically, the Arden-Macaulay Precinct has primarily consisted of industrial land uses, supporting Melbourne's economy through manufacturing. In recent decades, as manufacturing has moved to outer urban areas and central Melbourne has expanded, the Arden-Macaulay Precinct has become relatively underutilised given it still consists predominantly of industrial land uses (including light manufacturing, warehousing and industrial services).

State and Local Government own a significant amount of land within the area, with the key landholding being a large parcel of VicTrack land of approximately 14 hectares (referred throughout as the Arden Government Land).

Plan Melbourne identifies the Arden-Macaulay Precinct as an expanded central city urban renewal area and City of Melbourne has identified the southern part of the Arden-Macaulay Precinct, focused around the Arden Government Land, as suitable for more intensive redevelopment should a station be provided. A recent study prepared by Urbis identified significant demand for commercial office space in the Arden-Macaulay Precinct, focused in and around the Arden Government Land, commencing from 2026.²

The Arden-Macaulay Precinct is serviced by existing public transport suitable for supporting medium-density residential development and, without a station, higher-density residential development in the precinct would be unlikely. The opportunity to provide any significant employment in this location would also be lost.

Public transport options currently include:

- Macaulay station (supporting the north-western extent of the precinct)
- North Melbourne station (a 10-minute walk to the southwest of the centre of the Arden-Macaulay Precinct)
- The Route 57 tram to the east and north of the precinct
- The Route 401 and 402 buses.

As the former industrial uses that once characterised the precinct move out, there is the opportunity to create a new employment centre to support both the CBD and the growing western region of greater Melbourne. As such, a station central to the Arden-Macaulay Precinct would attract and concentrate significant urban renewal and investment.

The large government land holdings in the precinct can specifically support the development of a commercial activity centre. A station could reposition Arden as a significant destination that can be easily accessed from the wider metropolitan area, enabling the development of a substantial new commercial precinct as part of the broader growth and expansion of Central Melbourne.

Further west, the Dynon Precinct is also identified in Plan Melbourne as an urban renewal opportunity.³ Redeveloping this precinct depends on the longer-term decentralisation of port-related activities that currently occupy this land. The Dynon Precinct would be supported by the South Kensington station to the north and potential options are available for tram connections. The north side of South Kensington station consists of medium density residential and recreational land uses.

² Urbis, Arden Assessment Development Report (2015).

³ Department of Transport, Planning and Local Infrastructure, Plan Melbourne (2014), 48.

7.2.3 Decision A1: What is the preferred corridor through South-Kensington / the Arden-Macaulay Precinct?

Three broad corridor options were identified through the Study Area, each with a different station location opportunity in the Arden–Macaulay Precinct as shown in Figure 7-2:

- A station central to the Arden-Macaulay Precinct focused on stimulating and supporting major urban redevelopment
- A station interchanging with the existing North Melbourne station supporting redevelopment in the southern extent of the Arden–Macaulay Precinct
- A station interchanging with the existing Macaulay station supporting redevelopment in the northern extent of the Arden–Macaulay Precinct.

Figure 7-2 – Corridor options in Study Area A



The North Melbourne interchange station has some minor advantages for some customers on the Upfield, Craigieburn and Seymour Lines in respect of interchange opportunities and travel time. However, in almost all regards an alternative interchange option is available two stops further along the line in the CBD and the travel time savings are relatively minor. The Macaulay interchange station provides fewer such advantages, as it would only interchange with the Upfield Line.

The North Melbourne and Macaulay interchange stations have smaller land use catchments than the Arden–Macaulay Precinct and, because they are positioned at locations already serviced by a station, would have a significantly smaller role in stimulating redevelopment, missing the major redevelopment opportunity in the central Arden–Macaulay Precinct.

Both the North Melbourne and Macaulay interchange stations would add significant cost to the project, at an increase of approximately \$880m and \$1.9bn, respectively. The cost associated with a North Melbourne interchange station accounts for a deep station box as well a connection to the existing North Melbourne station concourse. This interchange station would also require significant property acquisition.

The Macaulay interchange station option is particularly expensive in part because it would require significant additional tunnel length as it continue west under the Maribyrnong River to a portal in Footscray (assumed in cost above) where poor geology is present, or would involve a new permanent structure bisecting JJ Holland Park (excluded from consideration). The cost also accounts for difficult underground station construction along Macaulay Road with connectivity to Kensington station. This interchange station would also require significant property acquisition.

The North Melbourne and Macaulay interchange stations would both require a much greater degree of urban disruption compared to the Arden–Macaulay Precinct, which positions the station in a predominantly industrial area, within the government owned Arden Government Land. It is also proposed that the Arden Government Land site form the largest single construction site for the Melbourne Metro project, including supporting tunnelling operations for the project. Accordingly, station construction and

potential TBM launches at alternative sites available for other options would result in considerably more disruption to local communities.

It is recommended that the project adopt a corridor option that supports a station central to the Arden–Macaulay Precinct.

7.2.4 Decision A2: Is a South Kensington station investment justified?

This decision considered if it was appropriate to add additional Sunbury Line platforms at South Kensington station.

The existing South Kensington station provides a suitable level of service to support the medium-density residential catchment and, depending on the scale and form of a potential redevelopment of the Dynon Precinct, would likely be sufficient to support that longer-term proposition (given the existing high quality frequency of services on the Werribee Line, supplemented by improvements to station infrastructure and access that may be required as part of a future development).

Adding a new station as part of Melbourne Metro would cost in the order of \$1.65bn. The cost accounts for a new underground station (pair of platforms) with a connection from the underground station platforms and concourse to the above ground platforms. The space required for the underground platforms would force the western portal tunnel back to the east of Footscray, require tunnelling under the Maribyrnong River and involve major disruption to the surrounding residential and recreational land uses.

It is recommended that the scope does not include new platforms at South Kensington station.

7.2.5 Decision A3: What is the preferred alignment, including Arden station location and portal configuration, at South Kensington?

Given the primary role of a station in the Arden-Macaulay Precinct is to stimulate significant land use change, a number of potential station entrance locations and supporting alignments were considered to identify the best technical solution to catalyse urban renewal and support a significant new commercial destination.

An initial high level option filtering process identified the three potential solutions is shown in Figure 7-3:

- Construction of an underground station on the southern side of Arden Street in private land immediately adjacent to the Arden Government Land (assumes a western portal location proximate to Childers, Tennyson and Bakehouse Drive in South Kensington)
- A viaduct rail alignment with a partial open air and underground station between Barwise Street and Munster Terrace (requires the reconstruction of the existing Essendon flyover and assumes a new Craigieburn viaduct over the new Melbourne Metro viaduct tracks)
- Construction of an underground station within the Arden Government Land in the vicinity of Queensberry Street (assumes a western portal location proximate to Childers, Tennyson and Bakehouse Drive in South Kensington).

Figure 7-3 – Arden-Macaulay alignment and station options



Key findings of the options analysis undertaken in relation to this decision are:

- Although the viaduct solution avoids significant disruption to South Kensington residents and businesses by not requiring a South Kensington portal, the costs are expected to be similar to the costs of constructing an underground station in the Arden Government Land and the benefits are outweighed by its compromised urban renewal outcomes. The viaduct solution would likely dislocate Arden Government Land development outcomes, which would require significant additional investment in urban integration initiatives (offsetting the projects savings), as well as continuing noise and light impacts on surrounding land users. Further, the construction requires a greater number of occupations and the reconfiguration of additional tracks when compared with the beneath ground solutions (only impacting the Sunbury services)
- The Arden Street station option represents a minor cost saving (approx. \$30m) as a result of a more direct alignment when compared with an underground station in the Arden Government Land. However, the proposed station box location does require acquisition of existing commercial properties on the southern side of Arden Street, resulting in greater disruption. The projected development outcomes are greatest under this option due to its station entrance on the northern boundary of the Arden Government Land, best supporting development further north in the Arden-Macaulay Precinct and facilitating early activation of the Arden street frontage. This option also provides the least overlap within 800 metre catchments of existing stations
- The Queensberry Street station option assumes a station entrance in the centre of the Arden Government Land, creating an internal development focus that has less reliance on the development and activation of private land, hence providing the opportunity for greater government control of development outcomes.

Given the complex interface required with the rail network to construct the viaduct solution (resulting in occupations of all lines that pass through North Melbourne station as well as additional impacts on V/Line services and freight), impact on the Moonee Ponds Creek environs and the compromised development outcomes, it is recommended that an underground option with a station located in or immediately proximate to the Arden Government Land be adopted.

In support of this recommendation, further work has been undertaken to identify the final station location and alignment which has included continuing consideration of the Arden Street and Queensberry Street alignment options as well as a potential alignment located in between those two options, to best support proposed station entrances that:

- Optimise urban renewal throughout the Arden-Macaulay Precinct
- Support a significant new commercial destination central to the Arden Government Land

- Provide an appropriate day one access and egress point which appropriately connects with existing land use, capable of operating independently⁴ of the future significant development to occur within the Arden Government Land.

The final alignment that was determined to best support the above station entrances, while continuing to perform well against the technical requirements is identified in Figure 7-4. It is recommended that a day one station entrance be provided near the corner of Barwise and Laurens Street, south of Arden Street. It is also recommended that provision be made to the western end of the station box to facilitate future entrances that optimise development outcomes, with exact entrance locations to be determined as the area develops.

Figure 7-4 – Arden station location and associated alignment



7.2.6 Decision A4: Is an Arden station justified?

Capital cost savings of approximately \$200m are generated by not including (or future proofing for) a station at Arden. However, to remove the station from the project would miss a substantial opportunity to reposition Arden as a significant destination that can be easily accessed from the wider metropolitan area, enabling the development of a substantial new commercial precinct as part of the broader growth and expansion of Central Melbourne.

Providing a station at Arden is expected to stimulate significant urban renewal and catalyse the creation of a new commercial core supported by a metro station.

7.2.7 Conclusion

It is recommended that the project proceed with a new underground station within the Arden Government Land, south of Arden Street in the vicinity of Laurens Street. It is proposed that provision be made for ultimately three entrances to Arden station with an initial day one entrance near the corner of Barwise and Laurens Street, between Queensberry and Arden Street. Providing a new station at Arden will:

- Facilitate the development of significant urban renewal
- Allow the Arden-Macaulay Precinct to fulfil its designation as a key strategic area for the proposed future employment expansion of Central Melbourne
- Support significant residential intensification.

⁴ Masterplanning of the Arden Government Land is yet to occur and as such the initial entrance should allow sufficient flexibility to accommodate eventual design and development outcomes, as well as be designed to facilitate minimal disruption to the Arden station operations, during the future development of the precinct.

7.3 Study Area B: Parkville

7.3.1 Context

As a designated national employment cluster under Plan Melbourne, Parkville is an eminent education, health and research precinct. Development in the area has been targeted to improve:

- Growth of business activity (and therefore jobs) of national significance
- Businesses' ability to leverage export and innovation potential to grow jobs in a number of industry sectors.

The cluster has a critical mass of nationally leading institutions and organisations including:

- Australia's highest-ranking university (The University of Melbourne)
- Victoria's second largest university (RMIT University)
- Monash University's Pharmacy Faculty
- Global biotherapy industry leader CSL Limited
- Royal Melbourne Hospital
- Royal Children's Hospital
- Royal Womens' Hospital
- The Australian Medical Association
- The Bio21 Institute.

Many leading institutions and organisations are expanding, or plan to expand, within the precinct. This includes the \$1bn Victorian Comprehensive Cancer Centre, which will have world-leading cancer research and treatment activities and facilities. The University of Melbourne and RMIT are expanding their facilities to incorporate greater collaboration and joint projects with industry. This blend of education and biomedical industry generates significant economic activity for the nation. The universities and research institutes are expected to continue to develop and expand around these existing nodes, drawing users from across the metropolitan area and Victoria, and attracting firms, researchers and investors from national and global marketplaces.

Approximately 32,700 people⁵ are currently employed in this centrally-located cluster that has access to a:

- Wide catchment of workers across metropolitan Melbourne
- Range of knowledge industries and professional services, essential to driving innovation.

The Parkville precinct is serviced by a series of north-south tram routes that run via Elizabeth, William and Swanston Street that are projected to come under increasing pressure from crowding. It is not currently serviced by rail; however, the route 401 bus is a popular connection to North Melbourne station.

The growth and consolidation of the Parkville precinct is important to the success of an expanded central city and critical to Victoria's and Australia's leadership in industries such as biotechnology, medical research, education and health services.

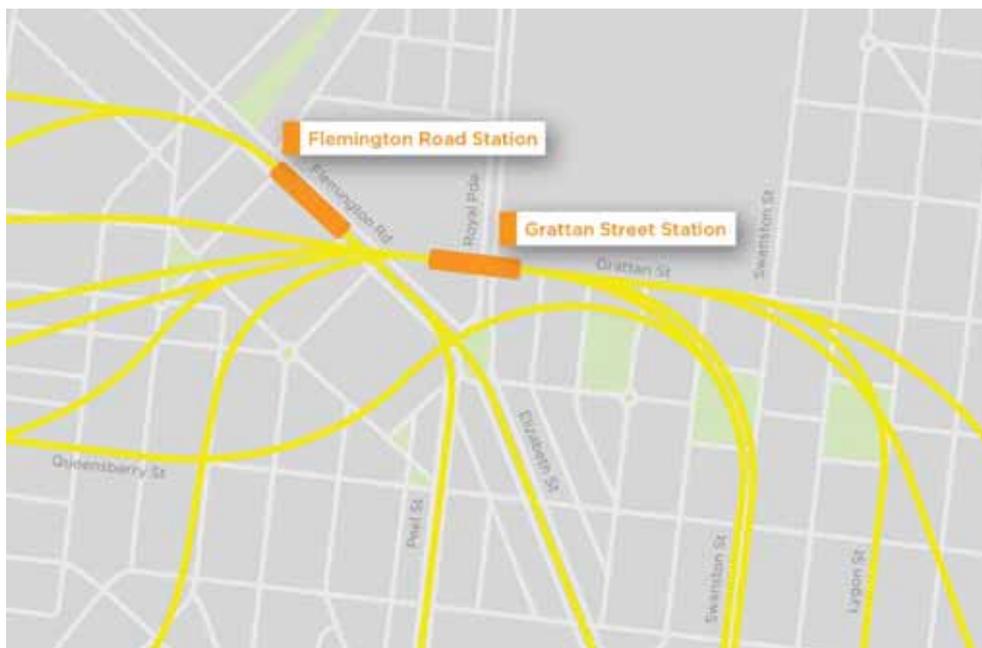
Parkville station will provide access to around 45,000 jobs, 14,000 residents and 70,000 tertiary students (within 800 metres of the station) in 2031.

⁵ See: <http://www.mpa.vic.gov.au/planning-activities/employment-clusters/>.

7.3.3 Decision B1: What is the preferred alignment and station location at Parkville?

Two key options were considered for this options assessment, as shown in Figure 7-5: the construction of an underground station on Flemington Road or on Grattan Street.

Figure 7-5 – Parkville alignment and station location options



The Grattan Street location is preferred as this location places the highest number of workers, students and residents in the station catchment.

Flemington Road is located furthest away from the central part of the University of Melbourne (e.g. Faculty of Engineering and Faculty of Business and Economics) which potentially increases student and teacher travel time. Flemington Road is also positioned on the periphery of the Parkville precinct away from key areas of demand and detracts from the developing role of Grattan Street as the central hub for the Parkville precinct.

From an engineering and cost perspective, there is no significant difference between the Grattan Street and Flemington Road station locations. However, a station at Grattan Street is closer to Lygon Street (a key destination in its own right) and Carlton South districts, offers favourable interchange with tram route 19 (North Coburg) and a reasonable walk-interchange with Flemington Road and the Swinston Street tram routes. This location will likely:

- Minimise journey times
- Maximise relief to trams
- Divert some private vehicle trips to transit.

The Grattan Street location can best meet the forecast demand of the University of Melbourne (the largest single trip attractor in the area) and commuter needs of hospital staff and researchers.

By servicing a larger catchment, the Grattan Street option also provides greater relief to north-south trams.

Based on this analysis, the Grattan Street station location is identified as the preferred horizontal alignment.

7.3.4 Decision B2: Is the station investment justified?

Providing a station at Parkville is expected to provide significant connectivity benefits for students, employees and patrons seeking to access this education and hospital precinct and relieve the contested St Kilda Road / Swanston Street corridor. Capital cost savings generated by not including a station at Parkville are around \$400m, however, to remove the station from the project would miss a substantial opportunity to improve access to this important education and research precinct and national employment cluster.

7.3.5 Conclusion

It is recommended that the project proceed with a new station at Parkville at the Grattan Street location. Providing a station at Parkville is expected to provide significant connectivity benefits for people, including students and employees, seeking to access this education and hospital precinct and relieve the contested St Kilda Road / Swanston Street tram corridor.

7.4 Study Area C: CBD

7.4.1 Context

The CBD is Melbourne's business and financial centre. It encompasses the Hoddle Grid and the area between Victoria and Latrobe Street. The CBD is a hub for retail, financial, educational, recreational, tourist and entertainment activities of State and national importance and services a variety of residents, workers and visitors. In recent years, the area has also experienced high-density residential development in the centre of the CBD and surrounding suburbs.

The area also serves as a vital interchange point for many public transport users, particularly those with destinations in the broader central Melbourne area (including St Kilda Road and Parkville). The CBD is well serviced by public transport, including five existing train stations (Southern Cross, Flagstaff, Melbourne Central, Parliament and Flinders Street) and numerous major tram routes (notably along La Trobe, Bourke, Collins, Flinders, Spencer, William, Elizabeth and Swanston Street). However, as discussed in Chapter 3, this public transport is increasingly under strain.

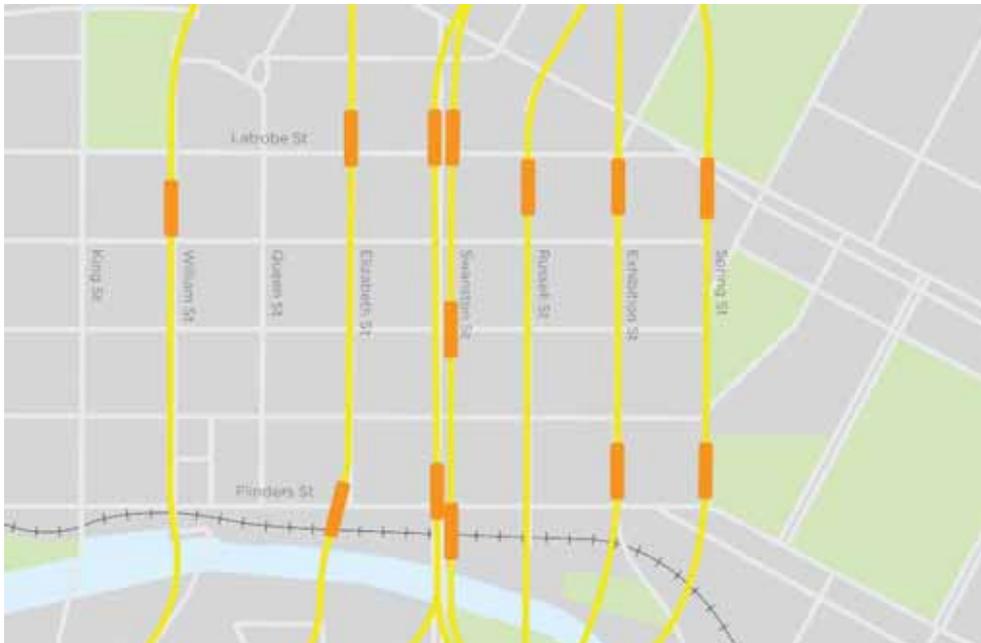
7.4.2 Decision C1: What is the optimal horizontal alignment through the CBD?

Melbourne has a distinct advantage over many other world cities in that its streets are set out in a grid and are relatively wide and straight. The opportunity to tunnel under road reserves through the CBD significantly reduces the constraints associated with tunnelling under tall buildings, and a variety of alignment options that exploit this opportunity were identified.

As shown in Figure 7-6, nine materially different horizontal alignments and station location options were identified and considered for this Study Area:

- Spring Street
- Exhibition Street
- Russell Street
- Swanston Street variations: two stations; one station only, at CBD South; two stations, alignment offset under buildings east of Swanston Street; two stations, CBD South station moved under the Yarra River
- Elizabeth Street
- William Street.

Figure 7-6 – CBD horizontal alignment and station options



The Swanston Street route with two stations is the preferred project option because:

- The Swanston Street alignment offers direct interchange with Melbourne Central and Flinders Street Station, maximising the use of the new Arden, Parkville and Domain stations by making it easy for passengers from all lines to interchange to access them both now and in the future. The only other option offering direct interchange with these stations is Elizabeth Street, which would involve significantly higher capital costs due to complex ground conditions and interaction with tall buildings in Southbank
- When considering interdependencies with other key decision points, the Swanston Street alignment is compatible with the preferred station locations in Parkville and Arden. The Elizabeth Street and William Street options require suboptimal outcomes at adjacent decision points along the alignment
- The single station option on the Swanston Street alignment offers negligible savings when compared to the two station options along Swanston Street as the very high number of passengers using this station means that the single station needs to be substantially larger than either of the two stations under the other options. This option offers significantly reduced benefits for the network both now and into the future
- A single central CBD station will have fewer convenient interchange opportunities with other rail services, affect access to employment and other activities, and reduce the number of customers using Melbourne Metro. While only one station box needs to be constructed, the size of the station required to accommodate customer numbers would lead to additional disruption and property acquisitions at the station location
- The 'offset alignment' option is costly and would involve tunnelling deep under buildings, resulting in significantly greater disruption to property
- The option to shift the CBD South station under the Yarra River significantly increases the capital cost of the project and prolongs the construction program. While it would reduce impacts on Swanston

Swanston Street provides a materially better outcome than most alternative options to provide improved CBD access. For example, it provides better station locations (in terms of catchment) and offers better interchange opportunities with trams.

Street, it would significantly increase impacts on the Yarra River and is more complex to construct, including a greater risk of work in the complex Yarra River ground precincts resulting in settlement and damage to structures

- The Swanston Street alignment involves the lowest capital cost of all options for the creation of two CBD stations.

7.4.3 Decision C2: What is the optimal vertical alignment?

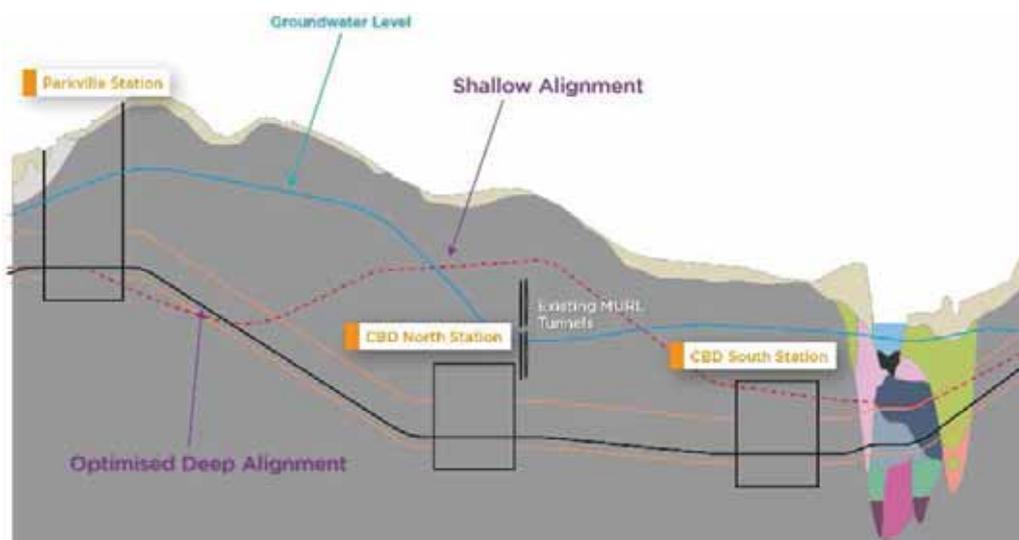
Following the confirmation of Swanston Street with two stations as the preferred horizontal alignment through the CBD, further consideration was given to the optimal vertical alignment.

The vertical alignment of the Melbourne Metro tunnels through the CBD presents a number of complexities and challenges, in particular navigating the City Loop and the complex ground conditions at the Yarra River.

As shown in Figure 7-7, two vertical alignment options were considered for this analysis:

- Shallow alignment passing over the City Loop
- An optimised deep alignment passing under the City Loop.

Figure 7-7 – CBD vertical alignment options



Source: AJM.

The key considerations are outlined below:

- The shallow alignment uses a cut and cover approach for the station boxes and involves a significant amount of disruption, including restricted access across all modes of transport along Swanston Street over a number of years and complete diversion of Swanston Street tram routes through the CBD which will significantly disrupt businesses in the area. The shallow alignment also involves major utility diversions that will disrupt a number of streets adjacent to Swanston Street. In contrast, while some level of disruption associated with the optimised deep alignment (including truck traffic to station construction sites and soil excavation) is inevitable, the degree of disruption to pedestrians, road traffic and business owners is significantly less than with the shallow alignment
- The optimised deep alignment stations will be constructed using mined cavern construction (as opposed to the cut and cover approach for the shallow alignment). This construction significantly reduces surface disruption on Swanston Street to allow trams to continue to run on Swanston Street
- The cost of the optimised deep alignment is not expected to be materially different to the project capital cost of a shallow alignment along Swanston Street, due to significantly less impact on utility services and disruption on Swanston Street
- The shallow alignment provides a slightly better outcome in terms of walking journey times, emergency egress, and station access
- Hydrogeological ground conditions are not considered to be a determining factor for either the shallow or deep optimised alignment and are considered manageable.

By adopting the optimised deep alignment, trams will continue to run along Swanston Street during construction, many major utility relocations will be avoided and the surface disruption to many CBD businesses will be greatly reduced.

The most significant difference between the shallow and optimised deep vertical alignments relates to constructability and disruption (the third criterion considered for the purposes of this options analysis).

A high level summary of the differences is set out in Table 7-1 below. A further detailed analysis is provided in Appendix 2.

Table 7-1 – Vertical alignment summary

| Alignment | | Constructability | Disruption |
|-----------|-----|--|---|
| Shallow | +ve | <ul style="list-style-type: none"> • Simpler construction techniques | <ul style="list-style-type: none"> • N/A |
| | -ve | <ul style="list-style-type: none"> • Longer program duration due to working restrictions and major service relocations • More interfaces with the public | <ul style="list-style-type: none"> • Swanston Street access restrictions for all modes for a number of years • Significantly impacts Swanston Street businesses • 2-3 month closures required of Flinders, Collins and La Trobe Street over the period of construction • Diversion of 10 tram routes from Swanston Street • Major utility diversions – diversions will require disruption of streets adjacent to Swanston Street • Impacts between La Trobe and Collins Street from services affected by shallow tunnelling • Flinders Street impacted for 2-3 months (same as optimised deep) |

| Alignment | | Constructability | Disruption |
|----------------|-----|---|--|
| Optimised Deep | +ve | <ul style="list-style-type: none"> Ability to work around the clock for underground works Fewer interfaces between construction activities and the public | <ul style="list-style-type: none"> Swanston Street largely accessible for all modes throughout construction; Collins Street and La Trobe Street remain as existing Trams through CBD - unchanged Temporary business closures avoided Significant reduction in the services requiring diversion |
| | -ve | <ul style="list-style-type: none"> More complex, although still common, construction techniques | <ul style="list-style-type: none"> Flinders Street impacted for 2-3 months (same as shallow) |

Based on the analysis above, the optimised deep alignment is identified as the preferred vertical alignment.⁶

7.4.4 Conclusion

The optimised deep Swanston Street alignment with two new CBD stations is the preferred solution for this Study Area.

7.5 Study Area D: Domain and South Melbourne

7.5.1 Context

The Domain precinct is of significant strategic importance to the planning and urban development of Melbourne. This area incorporates St Kilda Road, which is acknowledged as a 'change area' by the Melbourne Planning Scheme and a growth corridor by Plan Melbourne, and is surrounded by a mix of high and lower density office, educational and residential uses, which generate a significant volume of road, public transport, walking and cycling trips. The Kings Way precinct of South Melbourne is surrounded by a mix of high- and lower-density office space and high-density residential development owing to its proximity to the CBD.

Domain is serviced by eight tram routes currently operating through the Domain tram interchange onto the St Kilda Road – Swanston Street corridor, which is the busiest tram corridor in the world and is currently experiencing significant crowding issues, as described in Chapter 3. The Kings Way precinct of South Melbourne is serviced by one tram route (which also travels to Domain) which is largely reflective of the historical transport demands of this precinct.

7.5.2 Decision D1: What is the preferred alignment and station location at Domain and South Melbourne?

As shown in Figure 7-8, two key alignment and station location options were considered:

- Domain station, aligned under St Kilda Road
- South Melbourne station, aligned under Kings Way.

⁶ Based on the results of this analysis, the horizontal CBD alignment has been revisited through an iterative process with the Department's technical advisers confirming that the preferred horizontal alignment through the CBD remains Swanston Street with two stations, given the optimised deep alignment is the preferred route.

Figure 7-8 – Alignment and station options of Domain and South Melbourne



A station at Domain would support existing business, tourism and cultural uses and provide significant relief to tram routes and other traffic, generating a range of productivity, liveability and customer experience benefits. It will also be an important interchange station between train and tram services for the area’s residential and business catchment.

The South Melbourne location would also support existing business, tourism and cultural uses, however this location is estimated to cost approximately \$1.4bn (P90, nominal) more than Domain. This cost is driven by the complex ground conditions around the location of the proposed South Melbourne station, additional property acquisition costs, the need to navigate existing structures (including the aboveground section of CityLink), and the additional tunnel length. Further, South Melbourne would benefit from the proximity of a station at Domain and improved access through tram network changes that would be enabled by a station in this location.

Based on this analysis, the Domain station is identified as the preferred horizontal alignment due to the potential to materially relieve tram congestion on the St Kilda Road – Swanston Street tram corridor, its role as a key train / tram interchange point with tram routes serving South Melbourne, Southbank and growing western CBD and given it is approximately \$1.4bn cheaper than a station on Kings Way.

A station at Domain will:

- Support existing business, tourism and cultural uses
- Provide significant relief to tram routes and other traffic
- Generate a range of productivity, liveability and customer experience benefits
- Be an important interchange station between train and tram services for the area’s residential and business catchment.

7.5.4 Decision D2: Is the station investment justified?

Providing a station at Domain is expected to:

- Provide access to 33,000 jobs and 17,000 residents (within 800 metres of the station). 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 would be used by almost 40,000 people each day in 2031, making it about as busy as Flagstaff Station is today
- Deliver a step change in the number of public transport users able to travel to the area in peak times, as well as providing more efficient travel options from an increased range of locations
- Serve as a gateway to the south of the city. Passengers would 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, Kings Way/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.

Capital cost savings generated by not including a station at Domain are in the order of \$350m. However, to remove the station from the project will miss a substantial opportunity to improve access to this precinct, relieve congestion on the St Kilda Road tram corridor and support a restructure of the tram network to better service the west of the CBD.

7.5.5 Conclusion

It is recommended that the project should proceed with a new station at Domain. This location is preferred on the basis that:

- It will relieve tram congestion on the St Kilda Road – Swanston Street tram corridor
- It will establish a key train / tram interchange point with tram routes serving South Melbourne, Southbank and growing western CBD
- It is \$1.4bn cheaper than a station on Kings Way.

7.6 Study Area E: South Yarra

7.6.1 Context

South Yarra is a mature and well-developed residential area and activity centre that incorporates significant commercial activity around the Chapel Street precinct and along Toorak Road. Although South Yarra population is forecast to grow at a slower rate than Greater Melbourne it is an important residential area and activity centre, notably the Chapel Street precinct and along Toorak Road. By 2046, the area within walking distance of South Yarra station is projected to gain around 10,000 jobs and 12,000 residents.

South Yarra is currently well serviced by public transport, including by trains at the existing South Yarra station (Pakenham, Cranbourne, Frankston and Sandringham Lines), tram routes (currently routes 8, 72 and 78) and buses (including major routes along Commercial Road and Punt Road).

7.6.2 Decision E1: What is the preferred alignment and station location options for South Yarra?

Initial assessments considered a broad range of potential station locations including:

- The provision of new platforms under or adjacent to the existing station
- A new station at the Jam Factory (no interchange with the existing station)
- A new station south of Toorak Road.

Options south of Toorak Road were found to be cheaper, less disruptive to build and better able to preserve an alignment consistent with the optimal location for Domain station. Accordingly, further detailed assessment of options focused on potential station locations situated to the south of Toorak Road and within the vicinity of the existing station to provide interchange opportunities, was undertaken.

As depicted in Figure 7-9, two alignment and station options were further developed, namely:

- Indirect interchange south of Toorak Road – a new station with an indirect interchange, located south west of the existing station (with a 140m travel distance from the existing station entrance to the new station entry along Toorak Road)
- Direct interchange under / adjacent to South Yarra station – a new station with a direct interchange, located south of the existing station beneath the existing Sandringham line.

Figure 7-9 – Alignment and station options for South Yarra



The key differences between the options include the local impacts, cost and customer experience. In summary, the direct interchange option would provide improved customer experience and connectivity but come at a greater cost and impact to the local community. Differentiating factors are summarised as follows:

- Local impacts – both options would result in significant rail, road and other disruption during construction, with the direct interchange option impacting the Chapel Street Bridge. Both options would also have a significant impact on people’s homes and livelihoods, impacting both residences and businesses. Most notably the direct interchange option would require the acquisition of 94 homes and the partial acquisition of the Jam Factory, a key commercial hub within South Yarra, while the indirect interchange option impacting at least 82 homes
- Cost – the separate station (without a direct interchange) is anticipated to cost in the order of \$700m, vs the direct interchange option approximating \$970m.
- Customer experience – notwithstanding the relative cost benefit, the lack of a direct interchange would impact the commuter journey, requiring passengers to exit one station and cross Toorak Road at street level. This requirement would add approximately 6 to 7 minutes journey time, compromising the relative intended transport benefits of including an interchange station at South Yarra.

While the above provides an assessment of the relative merits of potential new interchange station options with a range of pros and cons, both options come at a high additional cost, with significant impact on the local community. As such both options have continued to be considered in the context of a station versus no station investment decision.

7.6.4 Decision E2: Is the station investment justified?

The existing South Yarra station plays an interchange role within the metropolitan network and is one of the busiest stations on the network. The introduction of Melbourne Metro, without an interchange station, would remove the Dandenong Line from South Yarra station and reduce congestion at the station, enabling more frequent and reliable services from both Sandringham and Frankston. Passengers impacted on the Cranbourne and Pakenham Lines would instead be able to access Richmond, South Yarra and City Loop stations by interchanging to Frankston Line services at Caulfield. Similarly, passengers from the Frankston Line could access the new Melbourne Metro stations (including the new Domain station) by interchanging with new higher frequency Melbourne Metro services at Caulfield.

When comparing potential interchange station options for South Yarra to a Melbourne Metro alignment that does not include a new station, the following key considerations should be noted:

- Even without a new Melbourne Metro station, South Yarra is well serviced by public transport
- On completion of Melbourne Metro, passengers using South Yarra station will benefit from improved capacity and more frequent services running through South Yarra on the Frankston and Sandringham Lines, including short starter services in the South Yarra area – meaning these trains will be less crowded during peak periods
- A range of alternate interchange options exist at Caulfield, Flinders Street and Melbourne Central stations as well as tram services directly from South Yarra station to Domain station, for those passengers commuting on the Cranbourne / Pakenham Lines wishing to directly access South Yarra and other CBD stations
- Constructing a new station at South Yarra would require significant land acquisition, directly impacting people's homes and livelihoods, particularly the direct interchange option which considers the acquisition of 94 homes and parts of the Jam Factory, a major commercial hub
- Including a new interchange station at South Yarra has limited impact on urban renewal given the extent of development that has already taken place or is currently underway
- Including a Melbourne Metro station at South Yarra is expected to add in the order of \$700m to the capital cost of the project (or \$970m to secure a direct passenger interchange with the existing station).

South Yarra is already well served by public transport and passengers will benefit from improved capacity and more frequent services running through South Yarra on the Frankston and Sandringham Lines.

7.6.5 Conclusion

South Yarra currently enjoys high levels of public transport accessibility and with the introduction of Melbourne Metro, will provide greater frequency and reliability of Frankston and Sandringham services. Alternative interchange stations (namely Caulfield, Flinders Street and Melbourne Central stations) provide opportunities to access the Dandenong line and new Melbourne Metro alignment from South Yarra. On balance, it is considered that the significant cost to the project including property acquisition requirements and the resulting impact on local residents and businesses, is not substantiated by the additional public transport benefits an interchange station at South Yarra would provide. Accordingly, it is recommended that the project proceed without a new interchange station at South Yarra.

7.7 Recommended Solution

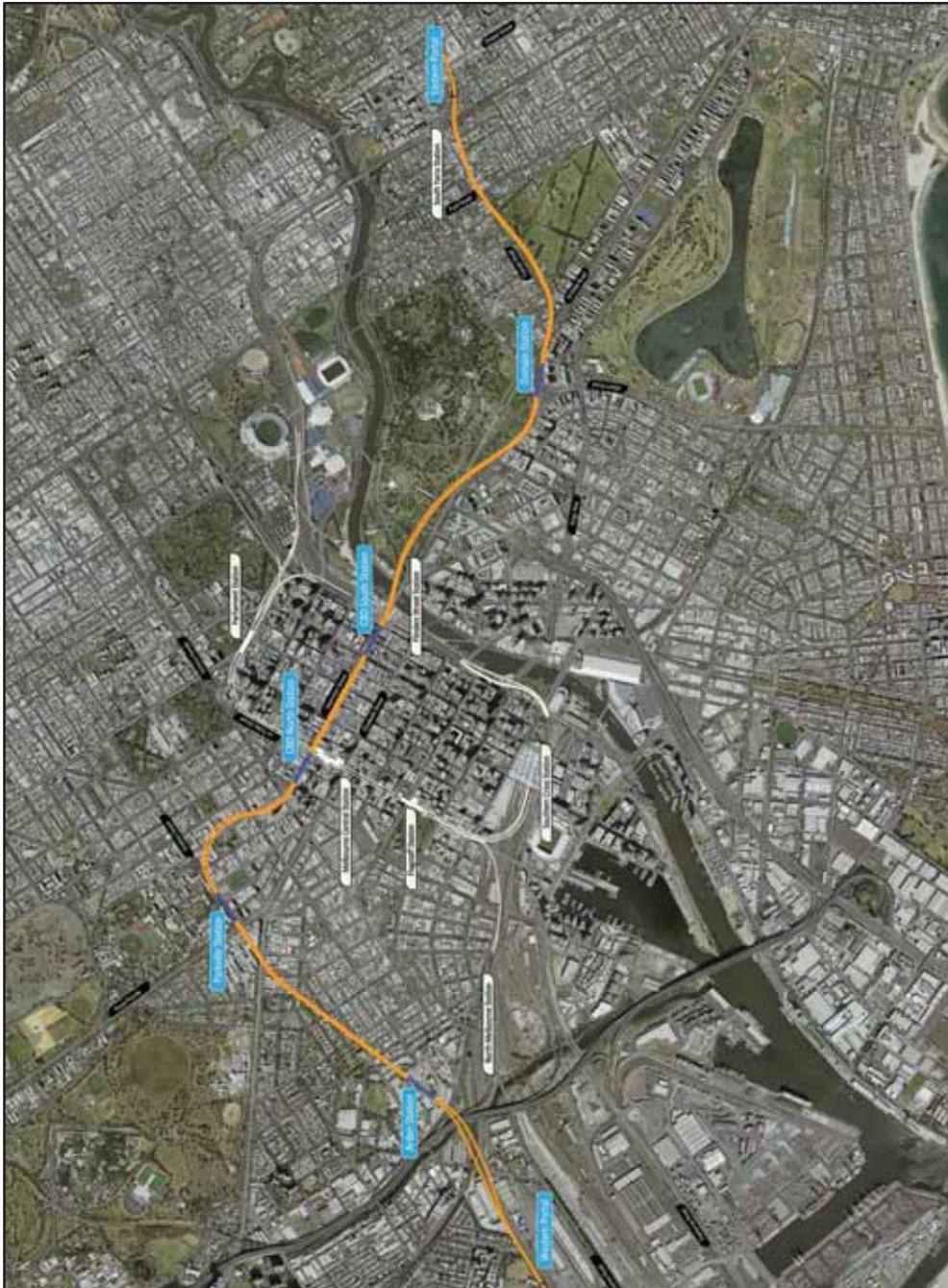
After assessing options across the five key decision points, the scope of the Recommended Solution includes:⁷

- Western tunnel entrance (portal) at South Kensington, connecting to the Sunbury Line with an eastern portal at South Yarra
- An alignment through the CBD that travels along a Swanston Street route, under the existing City Loop
- Five new underground stations to serve major areas of activity in the city and interchange with existing transport services:
 - Arden station – located to stimulate and support the Arden–Macaulay Precinct
 - Parkville station – located under Grattan Street within the Royal Melbourne Hospital / Melbourne University precinct
 - CBD North station – located beneath Swanston Street, broadly between La Trobe and Franklin Street, with a direct interchange to Melbourne Central station
 - CBD South station – located beneath Swanston Street, broadly between Flinders and Collins Street, with a direct interchange to Flinders Street Station
 - Domain station – located beneath St Kilda Road, broadly between Domain and Toorak Road.

The Recommended Solution is illustrated in Figure 7-9.

⁷ Note that the increased service frequencies (which reflect patronage demand) on the Sunshine – Dandenong Line on commencement of Melbourne Metro in 2026 results in a difference in service frequencies between peak period, inter-peak period and off-peak period service levels from the eastern and western ends of the corridor. To balance the service frequencies required on the east and west side of the corridor, turnback locations are required to turn back more frequent trains to the Dandenong end of the corridor. Existing infrastructure will not facilitate the number of turnback moves required and therefore an additional turnback location is required (referred to in this Business Case as the western turnback). Unless otherwise indicated, the western turnback is treated as part of the project for the purposes of this Business Case.

Figure 7-9 – The Recommended Solution



CHAPTER 8

Wider Network Enhancements, network development and dependencies – Chapter Summary

- Melbourne Metro has been identified as the Recommended Solution.
- Melbourne Metro will create a through-running suburban corridor from Sunbury in the west to Cranbourne and Pakenham in the east (the Sunshine – Dandenong Line) through two new 9km tunnels with five new stations. The new twin tunnels connect the existing Sunbury Line to the existing Cranbourne / Pakenham Lines, allowing this corridor to operate independent of the existing City Loop and creating capacity through the inner core of the network to support service growth on other corridors.
- Melbourne Metro will also facilitate delivery of a range of Wider Network Enhancements to capitalise on this additional capacity in Central Melbourne and, together with other planned works, deliver an uplift in service frequencies on the new alignment as well as the Werribee, Craigieburn, Upfield, Sandringham and Frankston Lines.
- The Wider Network Enhancements comprise a range of works, including infrastructure to facilitate access to sidings, turnbacks, signalling headway improvement works, other works to support service frequency across the existing network and some changes to the operation of the tram network. More work is being undertaken to refine various aspects of the works.
- The Wider Network Enhancements will facilitate delivery of the benefits of Melbourne Metro. The nature of the works will be further developed to ensure the benefits are maximised and that interfaces with other Victorian works are coordinated to efficiently deliver an optimal solution.
- In addition to the Wider Network Enhancements, there is additional rolling stock and associated stabling and power supply work that is required for operational commencement in 2026.
- Melbourne Metro plays an important role in facilitating the development of the network and, as such, there are a range of Enabled Investments enabled by Melbourne Metro and included in the Extended Program.
- This Business Case seeks funding for the Wider Network Enhancements. Funding of rolling stock and Enabled Investments will be subject to separate business cases at the appropriate time.
- This Chapter provides an overview of the Wider Network Enhancements and the role they play in capitalising on the increased network capacity to deliver an uplift in service frequencies.



8 Wider Network Enhancements, network development and dependencies

8.1 Introduction

Melbourne Metro will create a through-running suburban corridor from Sunbury in the west to Cranbourne and Pakenham in the east (the Sunshine – Dandenong Line) through two new 9km tunnels with five new stations. The new twin tunnels connect the existing Sunbury Line to the existing Cranbourne / Pakenham Lines, allowing this corridor to operate independent of the existing City Loop and creating capacity through the inner core of the network to support service growth on other corridors.

Melbourne Metro also facilitates delivery of a range of Wider Network Enhancements to capitalise on this additional capacity and, together with other interdependent elements of the network development plan, deliver an uplift in service frequencies on the new alignment as well as the Werribee, Craigieburn, Upfield, Sandringham and Frankston Lines. The Wider Network Enhancements comprising a range of works, including infrastructure to facilitate access to sidings, signalling headway improvement, other works to support service frequency across the existing network and some changes to the operation of the tram network. More work is being undertaken to refine various aspects of the works.

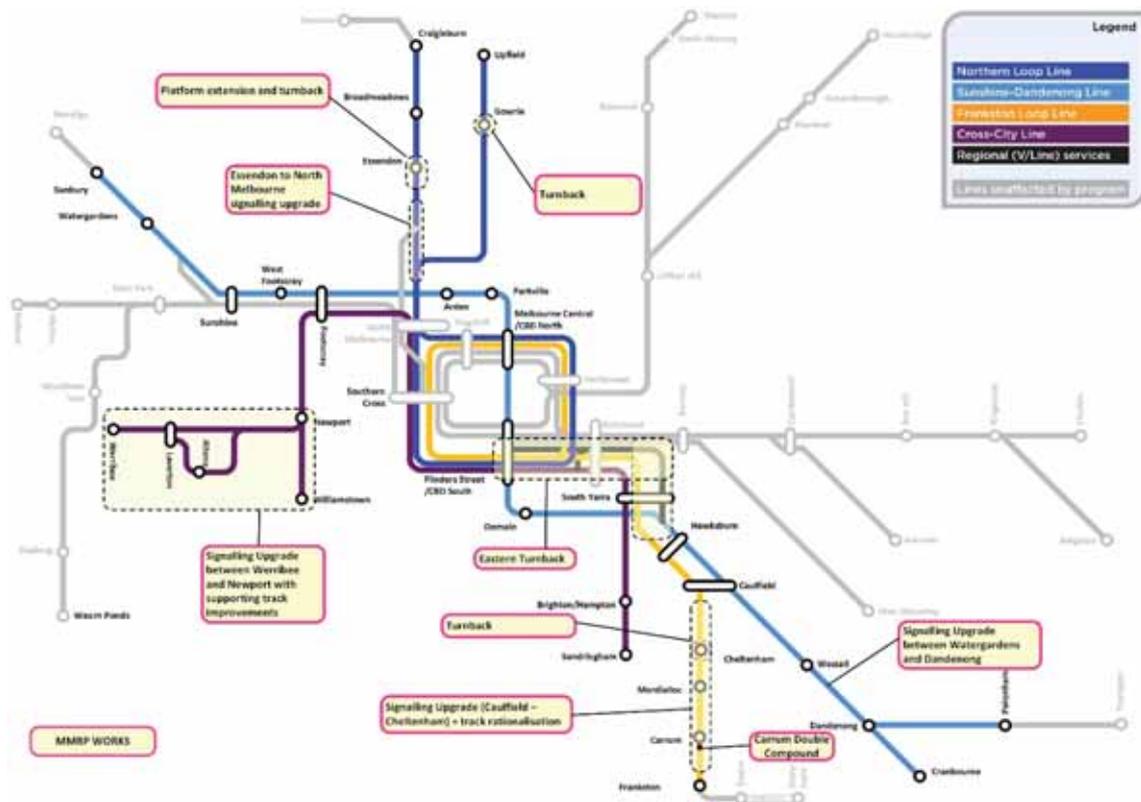
The nature of the Wider Network Enhancements will be further developed to ensure the benefits delivered are maximised and that interfaces with other Victorian works are coordinated for optimal delivery.

8.2 Wider Network Enhancements

This section provides a brief explanation of the main elements of the Wider Network Enhancements and how they contribute to maximising the benefits of Melbourne Metro.

A schematic of the Wider Network Enhancements is included as Figure 8-1.

Figure 8-1 – Wider Network Enhancements



Source: PTV.

8.2.1 Infrastructure to facilitate short turnback of services in the east to service the Cross City Line

The increased service frequencies (which reflect demand) on the Cross City Line on project opening results in a difference between peak period, inter-peak period and off peak services levels from the eastern and western ends of the corridor. To balance the service frequencies required on the east and west side of the corridor, turnback locations are required to turn back more frequent trains to the Werribee end of the corridor. Existing network infrastructure on the Cross City Line may not facilitate the number of turnback moves required and therefore additional turnback infrastructure may be required.

There are more services from the western side of the Cross City Line as the population and rate of growth is higher at Wyndham/ Werribee, and there are also services from Laverton via Altona and Williamstown. In comparison, the Sandringham line serves an established area and therefore customer demand is not growing as quickly.

A turnback will therefore result in some services from the west being able to turn back to the west without having to travel for a significant length of the Sandringham line. This will reduce the number of train sets required to serve the Cross City Line and associated operating costs.

8.2.2 Infrastructure to facilitate short turnback of services on the Craigieburn Line

The increased frequencies on the Craigieburn Line on opening requires a turnback in the vicinity of Essendon to achieve the most efficient train paths and stopping patterns and maximise the number of services that operate on that line.

To effectively meet customer demand on this corridor, not all services need to go to Craigieburn. Some services can start in the vicinity of Essendon, which is a major interchange station, particularly in the peak periods. This will help to serve customers south of Essendon station, whilst reducing the number of train

sets and operating costs serving the Craigieburn line, as not all services will need to operate all the way to Craigieburn. It also reduces the need to further upgrade infrastructure north of Essendon for a higher number of trains operating in the AM / PM Peak hour.

8.2.3 Infrastructure to facilitate turnback of services on the Upfield Line

Delivering the required uplift in service frequencies on the Upfield Line requires a turnback short of Upfield to mitigate the existing single line section of track between Gowrie and Upfield. This single line, when combined with sharing the Northern Loop with the Craigieburn Line, represents a significant constraint in increasing the number of services operating on that line.

8.2.4 Infrastructure to facilitate short turnback of services on the Frankston Line

Whilst some services on the Frankston line already commence at stations other than Frankston, the increased frequencies on the Frankston Line on opening requires a turnback in the vicinity of Cheltenham / Mordialloc to achieve the most efficient train paths and stopping patterns and maximise the number of services that operate on that line.

To effectively meet customer demand on this corridor, not all services need to go to Frankston. Some services can start in the vicinity of Cheltenham or Mordialloc, which are major interchange stations, particularly in the peak periods. This will help to serve customers north of Cheltenham / Mordialloc station, whilst reducing the number of train sets and operating costs serving the Frankston line, as not all services will need to operate all the way to Frankston. It also reduces the need to further upgrade infrastructure south of Cheltenham / Mordialloc for a higher number of trains operating in the AM / PM Peak hour.

8.2.5 Improvements to access to sidings on the Frankston Line

In order to achieve the increased frequencies on the Frankston Line on opening, efficient access to the limited stabling facilities available on the Frankston line is required to achieve the most efficient train paths, stopping patterns and limit moves that have the potential to impact upon the reliability of the service.

8.2.6 Signalling headway improvement works

Signalling infrastructure will largely determine the frequency of train services that can be run on any given line because it will dictate how close together trains can be scheduled. Conventional signalling works on a system of blocks (defined by lineside signals) where a train may only enter a block or section of track once the train in front has cleared it.

Existing constraints on the network preclude achieving the full uplift potential of Melbourne Metro in service frequencies. Upgrades and improvements are required to reduce the number of minutes between scheduled trains to accommodate the frequencies prescribed for opening of Melbourne Metro and beyond and remove unnecessary constraints on train moves.

These include:

- Signalling improvement works on the Sunshine – Dandenong Line
- Signalling and other rail infrastructure improvement works on the Werribee Line
- Signalling improvement works on the Craigieburn Line
- Signalling improvement works on the Frankston Line.

8.2.7 Infrastructure to support service continuity on the Sunshine – Dandenong Line

In order to mitigate and manage planned, unplanned and emergency disruption to the new Sunshine – Dandenong Line services, infrastructure changes are required to allow services to continue to operate outside the immediately affected area. Without these changes, disruptions could cascade across the length of the Sunshine – Dandenong Line.

8.2.8 Tram network changes

Melbourne Metro provides relief to existing north-south tram services, enabling some services to be realigned to serve the west of the city. To facilitate construction activities in the Domain Station precinct, tram services currently running along Domain Road will be rerouted via new tracks along Toorak Road to/from St Kilda Road. Opportunities to improve the tram network, as a result of Melbourne Metro, will continue to be considered.

8.3 Rolling Stock

Melbourne Metro together with the following interdependent projects will set the network on the path to the metro style system and facilitate operational commencement in 2026:

- 25 HCMTs¹ for dedicated use on the Sunshine – Dandenong Line
- Stabling upgrades and maintenance facilities for the HCMTs on the Sunshine – Dandenong Line (at Sunbury, Calder Park, Dynon Storage Yard, Pakenham East and Westall)
- Traction power enhancement to the Sunshine – Dandenong, Northern Loop, Caulfield Loop and Cross-City Lines to support HCMT rollout.

These investments will complement the new Melbourne Metro infrastructure to deliver a metro style system for the Sunshine – Dandenong Line.

Rolling stock sets that are operating on the Sunshine – Dandenong Line and will be replaced by the 25 HCMTs will then be reallocated to provide additional services and capacity to other lines.

Funding for rolling stock and associated operating and maintenance costs will be sought separately and is not sought as part of this Business Case.

8.4 Future development and Enabled Investments

Melbourne Metro has wider implications for the metropolitan rail network. In particular, the project provides the backbone for future rail network expansion to meet growing demand by enabling the implementation of a range of other initiatives designed to deliver better transport outcomes for Victorians.

To this end there are also a range of Enabled Investments that are included in the Extended Program for the Sunshine – Dandenong Line. These projects include:

- Extended HCMT operation for the Sunshine – Dandenong Line
- Platform extensions to support longer trains
- Traction power enhancements to support extended HCMT deployment
- Melton quad track² between Sunshine and Deer Park
- Melton electrification
- Signalling enhancements to support longer HCMT deployment.

These Enabled Investments do not form part of Melbourne Metro and funding of these investments is not sought as part of this Business Case. The financial analysis presented in Chapter 12 of this Business Case focuses on the costs of delivering and operating the Melbourne Metro Program (tunnels, stations and Wider Network Enhancements). The economic analysis presented in Chapter 10 of this Business Case examines both the costs and benefits associated with implementing the Melbourne Metro (tunnels and stations plus Wider Network Enhancements), along with the purchase of the required rolling stock.

¹ In addition to the 37 HCMTs already being purchased to augment the existing fleet.

² Quad track is used to describe a section of the railway where four trains can operate independently (e.g. in different directions, side-by-side or overtaking each-other) – the railway equivalent of a four-lane road.



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SOLUTION ANALYSIS

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CHAPTER 9

Melbourne Metro Benefits – Chapter Summary

- The project provides new and higher capacity services on day one to expand the capacity of the network by over **39,000 passengers each peak period** each morning and afternoon.
- Melbourne Metro provides the backbone for further improving the network in the future by incorporating features, such as long platforms and high capacity signalling that allows a staged approach to expanding the metropolitan rail network. The Extended Program, if delivered, would enable **further capacity for 41,000 passengers per peak period** to be introduced on the Sunshine – Dandenong Line progressively from 2031 as required.
- The project connects the Sunbury and Cranbourne / Pakenham Lines, the metropolitan lines which service two of Melbourne’s largest growth corridors to the west and south east. Moreover, the Werribee, Frankston, Craigieburn, Upfield and Sandringham Lines can better meet demand requirements by using the significant capacity released by removing the Sunbury and Cranbourne / Pakenham services from the existing inner city core.
- By creating a new inner city line, and reducing the complex interactions of services across multiple lines Melbourne Metro will improve the resilience, punctuality and overall reliability of the network.
- The new rail service will ease crowding on trams along Elizabeth Street and Swanston Street / St Kilda Road and allows the redistribution of tram services to better serve growth in the western area of the CBD.
- By encouraging people to transition from cars to public transport the project will help to ease road congestion around Melbourne in the north, west and south east.
- The Melbourne Metro alignment links key health, education and technology precincts in the north to the St Kilda Road employment precinct and cultural, sporting and entertainment facilities around Domain. It caters for growth in the knowledge economy by improving access to the CBD, leveraging existing trends to intensify employment around the new stations and achieve greater productivity and economic output through business agglomeration.
- Melbourne Metro is a city-changing project that will influence land use around the new stations and more broadly along the rail corridors that experience a boost in capacity. The project upgrades rail capacity into key growth areas including growth corridors (north, west, and south-east), five out of six existing and emerging national employment clusters (Parkville, Monash, Dandenong South, Sunshine, and East Werribee), and six out of nine existing metropolitan activity centres (Sunshine, Footscray, Broadmeadows, Dandenong, Fountain Gate / Narre Warren, and Frankston).
- The project will promote social inclusion by enabling communities in key population growth corridors in the west and north to be better connected to services, community amenities and a greater range and number of job opportunities.
- A new Arden station will catalyse significant urban renewal in the Arden-Macaulay Precinct and facilitate expanding the central city to strengthen Melbourne’s economic prosperity. Direct access to a metro station will facilitate high value, knowledge-based employment in Melbourne’s inner west and provide a new professional jobs location for Melbourne’s key growth corridors to the north west.
- Quantification of the economic benefits associated with the above is included in Chapter 10.



9 Melbourne Metro Benefits

9.1 Introduction

Melbourne Metro is being progressed in the context of a sophisticated and complex public transport network and a pipeline of urban renewal opportunities. It will be integrated with other network infrastructure and projects already implemented, planned or identified.

Most of the analysis set out in this Chapter focuses on the delivery of the Melbourne Metro Program and reports on the PTV modelling that demonstrate the benefits and effects of the project.

9.2 Sunshine – Dandenong Line

Melbourne Metro will create a new inner city rail corridor through the centre of Melbourne using two new 9km tunnels with five new stations that will operate alongside the existing inner city routes.

This new rail corridor will enable creation of a dedicated line from Sunbury in the west to Cranbourne / Pakenham in the east (the Sunshine – Dandenong Line), which will be operated with the latest generation HCMTs. These trains are longer, utilise more available on-board space and carry more passengers (1,100 passengers per train) than existing rolling stock (900 passengers per train).

The new inner city corridor provided by Melbourne Metro will include underground stations long enough to accommodate Extended HCMT trains in the future. This enables future growth and extension of the corridor by enabling the capacity of each train to be boosted by more than 40 per cent (resulting in a total capacity of 1,570 passengers per train).

Currently (before the introduction of Melbourne Metro):

- The Sunbury Line shares the Northern Loop Line with the Craigieburn and Upfield Lines. The Sunbury Line also operates through the North Melbourne cordon station which is also used by the Werribee, Williamstown and Laverton Lines
- The Cranbourne / Pakenham Lines operate on the Dandenong Loop Line and operates through the Richmond cordon station which is shared with the Lilydale, Belgrave, Alamein, Glen Waverley, Frankston and Sandringham Lines.

Removing the Cranbourne / Pakenham and Sunbury Lines from the existing inner core into the new tunnel provides capacity on the network to increase services on the Werribee, Williamstown and Laverton, Sandringham, Craigieburn, Broadmeadows and Essendon, Upfield and Gowrie, and Frankston lines.

This provides the opportunity to refine the network into a coordinated network of simple metro lines, with separate facilities and dedicated tracks for each line enabling higher levels of reliability and more capacity to be provided on each route.

9.3 Network re-configuration enabled by the project

Melbourne Metro will:

- Provide a new inner city route and capacity to accommodate services as part of the newly created Sunshine – Dandenong Line
- Remove unnecessary route interactions between train services on different lines by reconfiguring the Melbourne metropolitan network and streamlining train operations
- Release substantial capacity on the existing inner city network by moving the Cranbourne / Pakenham and Sunbury lines from the routes, thereby enabling new services on the Werribee, Williamstown, Laverton, Sandringham, Craigieburn, Broadmeadows and Essendon, Upfield and Gowrie, and Frankston Lines
- Make it easier for customers to navigate the network by simplifying end-to-end service patterns.

The project re-configures the Northern and Caulfield Groups into four independent Groups:

- **Sunshine – Dandenong Line via Melbourne Metro** – removes the Sunbury and Cranbourne / Pakenham Lines from the inner core network and connects them to operate a through service via Arden, Parkville, CBD North, CBD South and Domain
- **Northern Loop Line** – removes Sunbury services from the Northern Loop to create capacity on the Northern Loop to operate additional services on the Upfield and Craigieburn lines. This provides inner city capacity to support growth in Craigieburn and Upfield Line services
- **Frankston Loop Line** – enables the Caulfield Loop to be dedicated for the Frankston services to provide additional capacity for growth on the Frankston Line. It enables all Frankston trains to operate through the loop independently
- **Cross-City Line** – enables the Cross-City Line to be re-configured to operate additional services from Werribee, Williamstown, Brighton Beach and Laverton via Altona. Services from Werribee, Laverton and Williamstown will operate through to Sandringham and vice versa and will run through North Melbourne, Southern Cross, Flinders Street, Richmond, and South Yarra. It will enable Sandringham passengers with direct access to Southern Cross and onwards instead of terminating at Flinders Street.

Melbourne Metro will also release a track pair between South Yarra and Flinders Street (formerly used by Dandenong line services) for use by V/Line and freight services, providing a staging area for these services to operate independent of suburban trains.

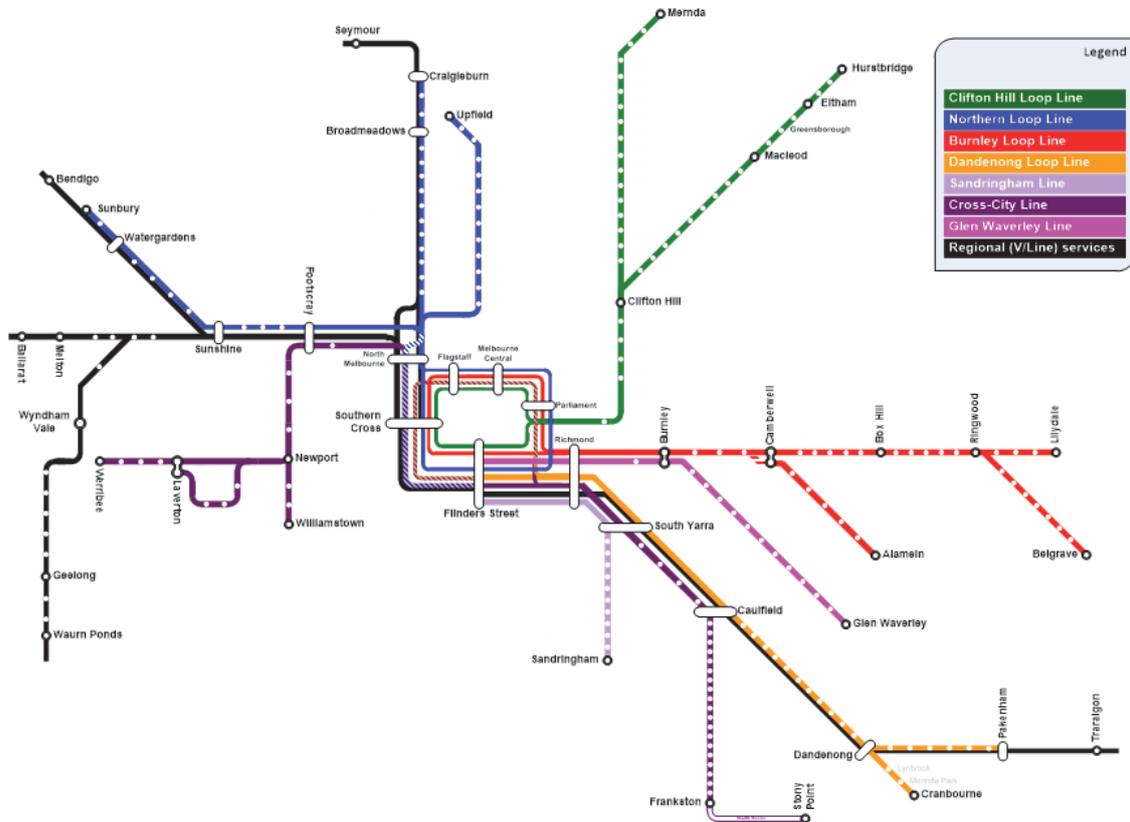
Although Burnley Group, Clifton Hill Group and Glen Waverley Line will remain unchanged by the project, Melbourne Metro will provide passengers with the opportunity to interchange to the Sunshine – Dandenong Line for access to the new stations of Parkville, Domain and Arden.

This re-configuration addresses the Problems, outlined in Chapter 3 that the network is currently experiencing, including:

- Congestion on the Northern Cordon associated with the suburban rail lines operating through North Melbourne station being operationally linked to the Cross-City Group
- Service constraints experienced by the Frankston and Sandringham lines due to limited platform capacity at Flinders Street Station.

Figure 9-1 shows the network configuration without Melbourne Metro, compared to Figure 9-2 which shows the network configuration with Melbourne Metro.

Figure 9-1 – Network configuration without Melbourne Metro



Source: PTV.

Features of a successful metro style system

Metro style systems are strongly passenger-focused and are characterised by the following features:

- End-to-end lines that prevent service disruptions cascading across other lines
- Simple timetables with ‘turn up and go’ frequency and consistent stopping patterns
- Punctual and frequent services designed to facilitate connections between trains at junctions, stations and connecting buses and trams
- Separate train fleets, maintenance and stabling facilities for each line
- Modern HCS technology to maximise the number of trains that can operate on each line and modern HCMTs designed to minimise boarding and alighting times
- Grade separations of level crossings.

Figure 9-2 – Network configuration with Melbourne Metro



Source: PTV.

9.4 Capacity benefits of Melbourne Metro

9.4.1 Overview

Melbourne Metro will fundamentally lift the capacity and reliability of the train network. The project will:

- Alter the routing and operating patterns of a number of lines from the south east, northern and eastern suburbs
- Create the opportunity to immediately increase service capacity on seven existing lines
- Provide the capacity to enable future increase in rail services and expansion of the rail system.

Melbourne Metro is a transformative project providing capacity on opening for 39,000 additional passengers in each peak period and enabling further capacity increases in the future.

Table 9-1 summarises the passenger capacity uplift benefits.

Table 9-1 – Capacity uplift benefits (2 hour peak period)

| Line / Corridor | Melbourne Metro Opening | Extended Program | Other | Total |
|--|-------------------------|--|-----------|--------|
| Sunshine – Dandenong | 12,000 | 41,000* | 35,000 ** | 88,000 |
| Werribee, Craigieburn, Upfield, Frankston, Sandringham | 27,000 | <i>Extra capacity uplift beyond Melbourne Metro day one enabled by future projects (HCS, rolling stock etc.)</i> | | |
| Total | 39,000 | | | |

* Future uplift in capacity to be realised with investment in the Extended Program (refer Section 9.4.3)

** Future uplift in capacity would be realised with further investment in rolling stock and associated works (refer Section 9.4.4)

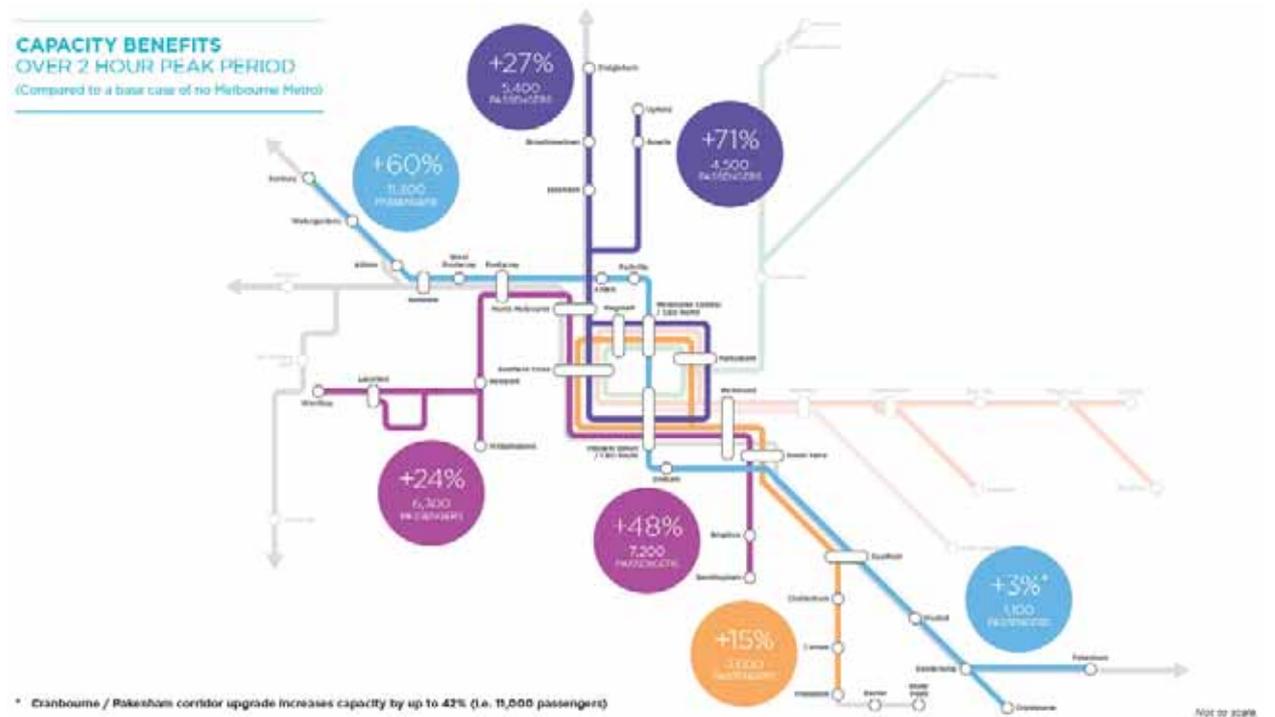
The above table demonstrates the capability the Melbourne Metro tunnel to provide for future demands.

9.4.2 Melbourne Metro Program

The project provides new and higher capacity services on opening that increases the peak service capacity of the network by **39,000 passengers per peak period** each morning and afternoon. Approximately 12,000 of this peak period capacity is delivered on the new Sunshine – Dandenong Line, with the remaining 27,000 passengers capacity uplift benefiting lines operating via the existing network, using capacity released by the move of Sunshine – Dandenong Line services into the new tunnel alignment.

The uplift in capacity on relevant lines is shown in Figure 9-3.

Figure 9-3 – Capacity uplift on opening of Melbourne Metro



9.4.3 Extended Program

Melbourne Metro provides the backbone for further improving the network in the future by incorporating features such as longer platforms and high capacity signalling that allows a staged approach to expanding the metropolitan rail network.

Delivering the Enabled Investments¹ will increase the capacity of services provided by the tunnel alignment by around 41,000² passengers per peak period to accommodate growth on the Sunshine – Dandenong Line and extension of the suburban network to service the Melton growth area. These Enabled Investments are expected to be warranted by demands and delivered from the early 2030s.

Once the Enabled Investments are complete, additional service capacity for around **80,000 passengers each peak period in total** will have been delivered since opening of Melbourne Metro.

Figure 9-4 illustrates the service capacity increases in terms of the proportional uplift on the Sunshine – Dandenong Line compared to the Base Case under the Extended Program.

Figure 9-4 – Capacity uplift during the Extended Program in comparison to the Base Case – Sunshine – Dandenong Line

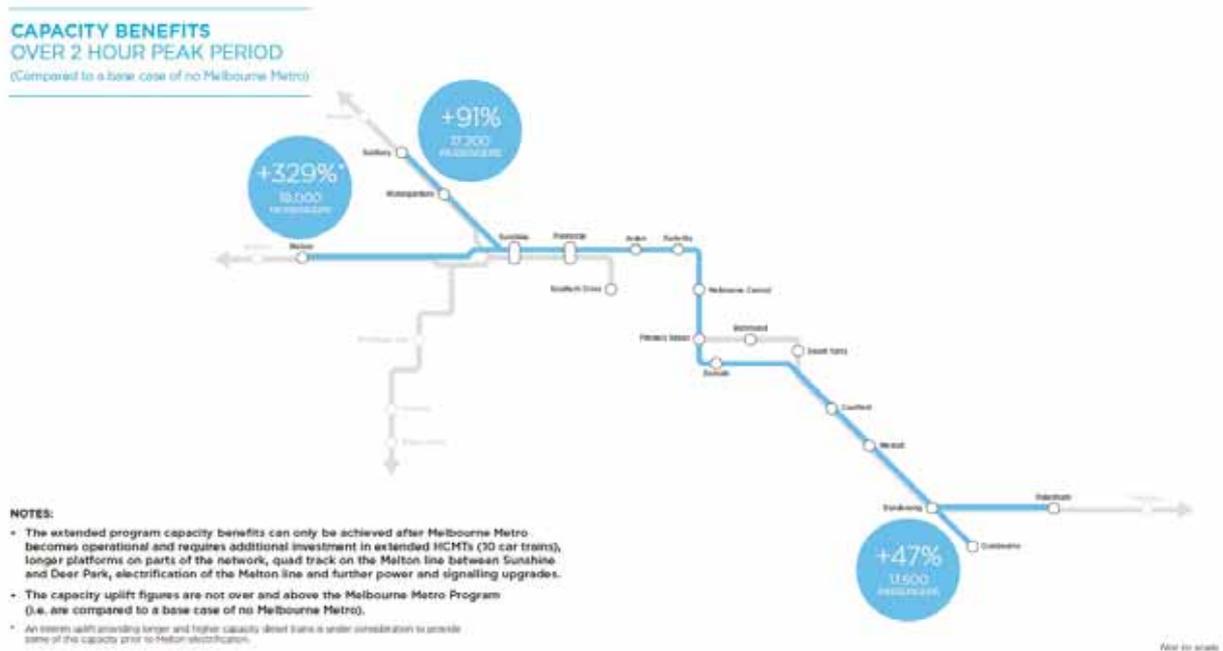


Table 9-2 shows estimates of when the system will reach capacity constraints based on average service loads in the morning peak period coming into the CBD³ with and without Melbourne Metro and under the Extended Program. In addition, the Extended Program will also enable Melton electrification that will overcome capacity constraints on that corridor.

¹ See Chapter 8 for a full description of the Enabled Investments.

² Represents an increase in new passenger capacity of 46,000 per two hour peak delivered by electrified services less capacity of Melton catchment services delivered by V/Line prior to electrification of approximately 5,000 passengers per two hour peak.

³ This represents a scenario where trains are fairly full of people standing solidly across the entire period and the average customer experience will be a standing journey. Some trains within this scenario will be uncomfortably full before this threshold is reached, and some customers may not be able to board some services.

Table 9-2 – Capacity constraints analysis under Extended Program

| Line / Corridor | When capacity constraints are felt without Melbourne Metro | When capacity constraints are felt with delivery of Melbourne Metro | When capacity constraints are felt with delivery of Extended Program [†] |
|---------------------------|--|---|---|
| Werribee | Early 2020s | Mid 2030s | n/a |
| Sunbury | By 2020 | Late 2020s | Mid 2040s |
| Craigieburn ^{**} | Early 2020s | Mid 2030s | n/a |
| Upfield | Mid 2020s | After 2046 | n/a |
| Dandenong ^{***} | Early 2030s | After 2030 | After 2046 |
| Frankston | Late 2030s | After 2046 | n/a |
| Sandringham | Late 2030s | After 2046 | n/a |
| Melton ^{****} | n/a | n/a | Late 2030s |

Source: PTV.

[†] The Extended Program only considers future projects on the Sunshine – Dandenong Line

^{**} Future planning has identified extension and reconfiguration of these suburban lines to service 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 Melbourne Metro at the expense of accelerating capacity constraints on these suburban lines and ultimately bringing forward capacity constraints from the dates shown

^{***} The Dandenong corridor will have already received substantial benefit from the CPLU project. This project augments the upgrades delivered by the CPLU project

^{****} Currently part of regional services

9.4.4 Capacity on the Sunshine – Dandenong Line beyond the Extended Program

Beyond the Extended Program, the infrastructure capacity provided by the new tunnel retains latent capability to move additional passengers to and from Melbourne’s CBD in peak periods to accommodate growth and expansion of the network. Using this capacity will require further investments outside the inner core and can be provided by projects such as Rowville Rail Link, Clyde Extension, Melbourne Airport Rail Link or track amplification to separate remaining regional and suburban train interactions in the suburban area.

9.4.5 Further capacity available on other lines

There is capacity created by moving the Sunshine – Dandenong Line services to the new tunnel alignment which is not utilised immediately. This additional capacity provides short term benefits in respect of reduced congestion on the existing inner core and longer term opportunities for subsequent investments in the wider network to remove bottlenecks in the middle and outer network to activate more of this capacity.

9.5 Improving travel conditions

9.5.1 Rail service punctuality and reliability

Creation of a new inner city route will reduce the reliance on coordination and management of complex interactions between services operating across multiple lines. Prior to Melbourne Metro, interoperation of multiple lines and routes is necessary to enable lines to merge to share the limited inner city capacity available. Although carefully planned, these interactions significantly increase congestion around junctions and the likelihood that incidents (including cancellations, short-running of services or bypass) will cascade

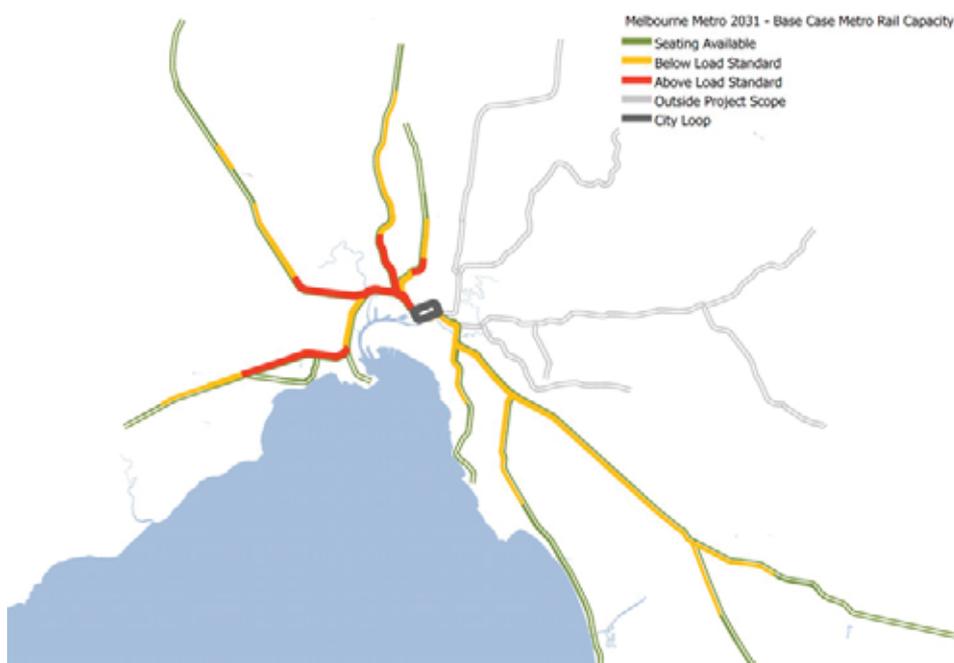
across the network when even small delays occur. By creating a new inner city line, and removing the need for planned interactions to work around congestion on other routes, Melbourne Metro will improve the resilience, punctuality and overall reliability of the network.

9.5.2 Rail crowding relief for rail services

Capacity upgrades will improve passengers' journeys by providing them with less crowding and shorter waiting times, especially on the Sunbury, Craigieburn, Upfield and Werribee Lines.

Figure 9-5 illustrates that if Melbourne Metro is not delivered, Melbourne's rail network will face high levels of overcrowding. Red-coloured parts of the network highlight areas where crowding levels are in excess of the planning load standard experienced in the peak averaged across the two hours. By 2031, passengers in these areas will encounter increasingly crowded journeys unless capacity is added to the system.

Figure 9-5 – Rail crowding in 2031 without Melbourne Metro



Source: PTV.

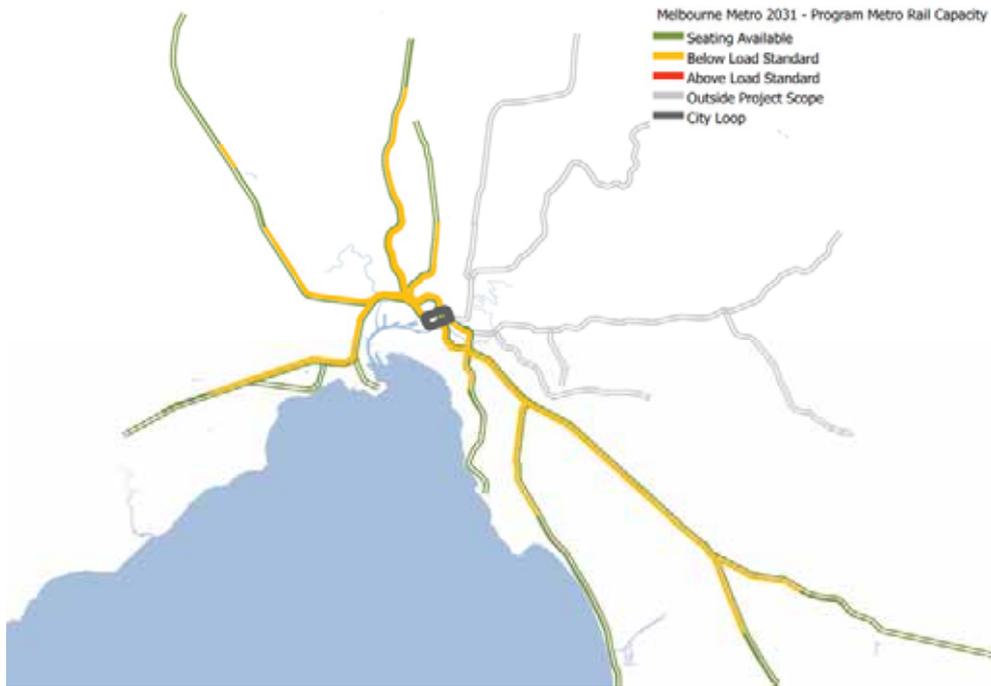
As Figure 9-6 illustrates, the strongest crowding relief will be felt by people on the highest growth lines to the north and west and those in outer suburbs, in particular, the Sunbury, Upfield, Craigieburn, Werribee and Williamstown Lines.

Melbourne Metro will enable more people to travel in from the suburbs to reach jobs and education in Central Melbourne and other activity centres along these corridors, including Sunshine, Footscray and Monash.

As discussed in Section 9.3, the capacity provided by Melbourne Metro will enable greater jobs growth in Central Melbourne to be realised than is possible if Melbourne Metro is not built. This means that more people will be travelling in to Central Melbourne to access these jobs. This will strengthen demand for travel on rail services into Central Melbourne.⁴

⁴ The demand forecast models were run for years 2011, 2021, 2031 and 2046. These are standard modelling years across the transport portfolio, and provide results to inform a range of project analysis, including economic evaluation. Results are presented for 2031, representing a period shortly after the project is delivered when changes to travel behaviour may be considered to have settled following the project changes. Results for the Extended Program are also presented for the 2031 forecast year.

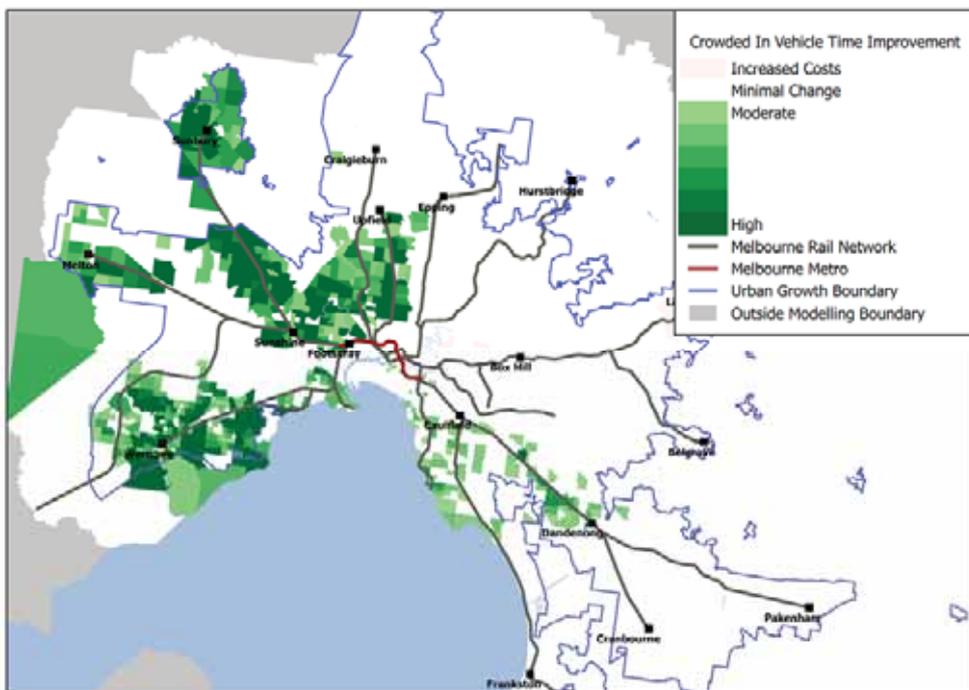
Figure 9-6 – Long term rail crowding in 2031 with Melbourne Metro



Source: PTV.

Figure 9-7 shows the origins of public transport passengers who will experience crowding relief in 2031 following delivery of Melbourne Metro. Areas shaded green show people who will be experiencing significant crowding relief due to Melbourne Metro.

Figure 9-7 – Areas of crowding relief for public transport passengers (by customer origin) due to Melbourne Metro in 2031



Source: PTV.

9.5.3 Rail crowding relief at inner-city stations

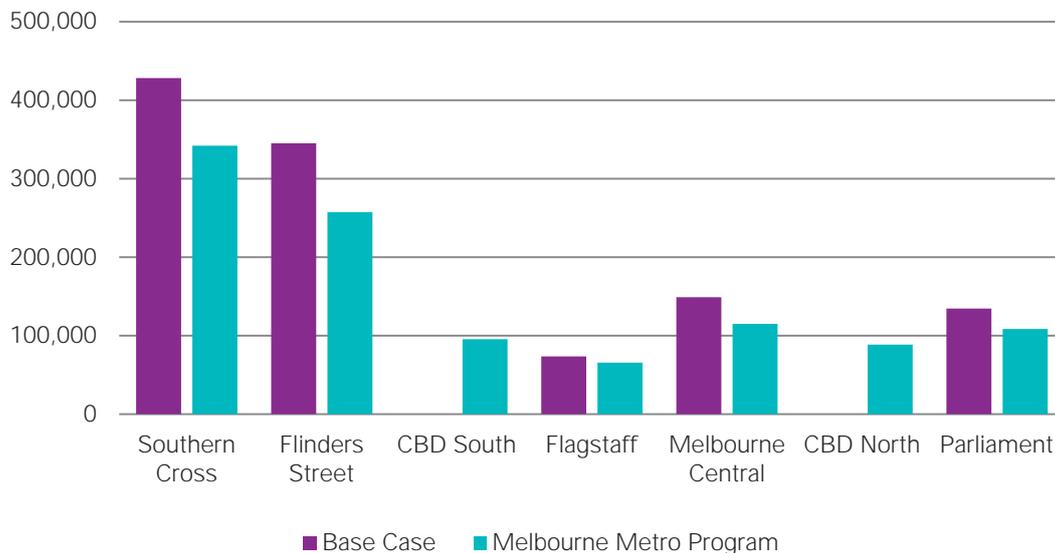
The addition of new CBD stations takes pressure off existing CBD stations. The network changes introduced by the Melbourne Metro affect where people will transfer between services. This is because the project changes which stations are served by particular lines and where lines connect with each other. This is part of the change involved in facilitating the transition to a metro-style network of independent lines. In many cases, these altered interchange patterns provide important relief to stations that are currently busy and congested.

Melbourne Metro will ease crowding for travellers across the city as it will deliver overall improved network connectivity.

Figure 9-8 shows that:

- A change in use of CBD stations will provide about 20 per cent decrease in crowding across all existing CBD stations
- Flinders Street and Melbourne Central stations will have the greatest change in traveller numbers as Melbourne Metro will augment station capacity and transfer opportunities at these locations with CBD South and CBD North
- Station entries and exits at Parliament and Flagstaff will decrease due to CBD North and CBD South's catchments partially overlapping with these stations allowing travellers to walk or make a short tram trip to their ultimate destination
- Fewer station entries and exists will occur at Southern Cross Station as the Sunbury and Cranbourne / Pakenham Lines will no longer operate through this station thereby reducing the total number of people using the station.

Figure 9-8 – Change in total usage (boardings, alightings and transfers) at CBD stations on a typical weekday in 2031⁵



Source: PTV.

⁵ Note that CBD North and CBD South are new stations delivered by the project and so do not have any Base Case data.

Crowding relief for Flinders Street Station

As set out in Chapter 3, Flinders Street Station is already under considerable pressure. During the PM peak, many platforms are very crowded as passengers wait for their services. Melbourne Metro will relieve this issue by:

- Reducing the total number of people using the station
- Increasing the level of network independence to provide platforms with fewer services from different lines to reduce the number of people waiting for other services to pass before they can board their train.

These two changes will provide:

- Greater ease of movement about the station
- Increased feeling of safety on platforms and better access to escalators / stairs
- Less stressful environment by enhancing the feeling of personal space.

9.5.4 Rail crowding relief at key interchange stations

By introducing two new CBD stations, the project provides additional station capacity in the CBD, which relieves existing, already busy stations, and helps to support the growing number of trips using stations across the CBD.

Figure 9-9 shows that the project will relieve North Melbourne, Richmond and South Yarra stations and increase the level of interchange at Footscray and Caulfield stations by changing the distribution of interchanges. Footscray station was upgraded as part of the Regional Rail Link project to accommodate significantly higher interchange. Relief to Richmond and South Yarra is particularly significant given the constrained nature of these stations. Caulfield will also serve as an important interchange for Frankston Line passengers to access express services to the CBD, and for Dandenong Line passengers to access services to the inner south east.

Figure 9-9 – Entries, Exits and Transfers at key interchange stations



Source: PTV.

9.5.6 Road network relief

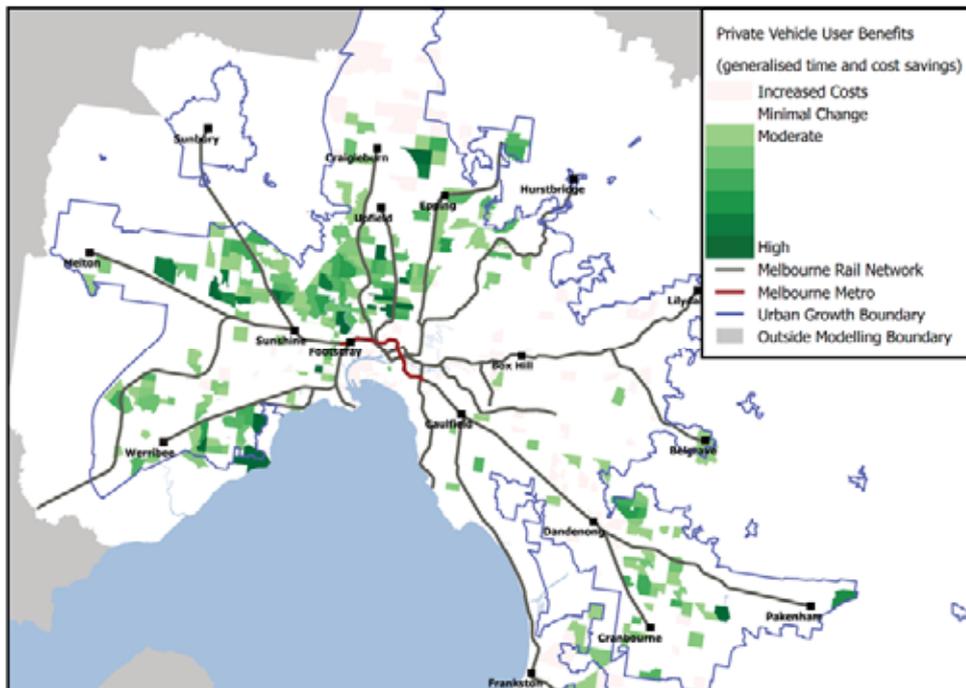
The benefits of the project are not limited to public transport passengers. When Melbourne Metro is operational, some Victorians will find that their journey will be easier by public transport than by car, thus encouraging some car users to switch to public transport.

The more people switch from travelling in private cars to public transport, the more roads will be freed up to make:

- Travel easier for other vehicles
- Reduce travel times
- Travelling to further and/or different destinations more attractive to travellers who were put off from making journeys due to congestion (induced demand).

Figure 9-10 illustrates that the travel improvements for car users are particularly experienced by people in the north, west and south east suburbs.

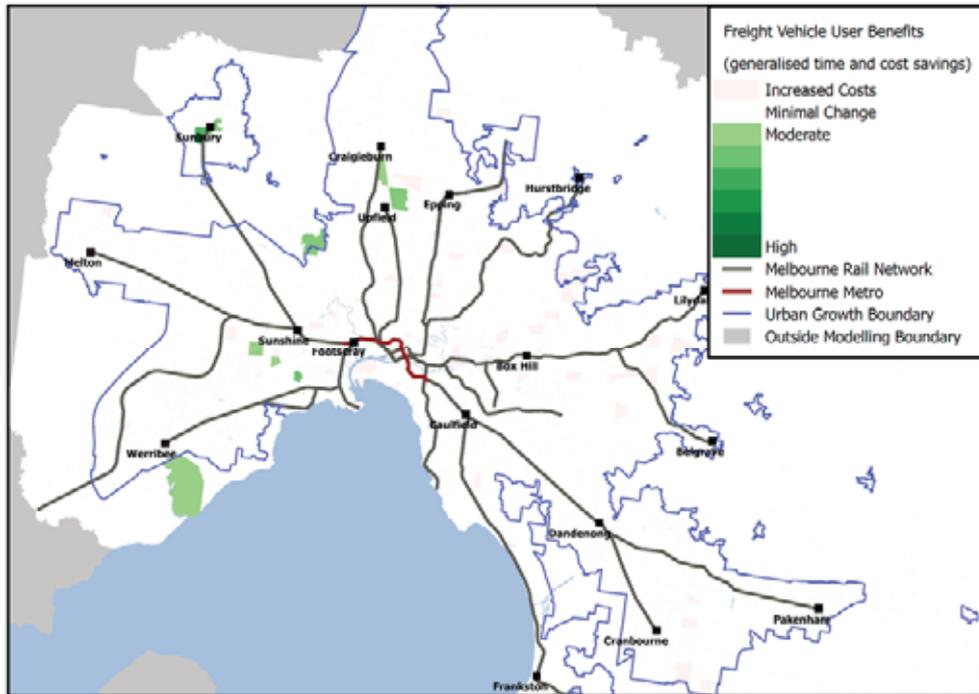
Figure 9-10 – Travel improvements for car users (by origin) due to Melbourne Metro in 2031



Source: PTV.

Figure 9-11 illustrates a similar picture for travel improvements for freight vehicles, with origins concentrated around industrial locations in the north and west of the city. This contributes to the city-wide productivity benefits of Melbourne Metro.

Figure 9-11 – Travel improvements for freight vehicles (by origin) due to Melbourne Metro in 2031



Source: PTV.

9.6 Tram network reconfiguration and relief

9.6.1 Tram network reconfiguration

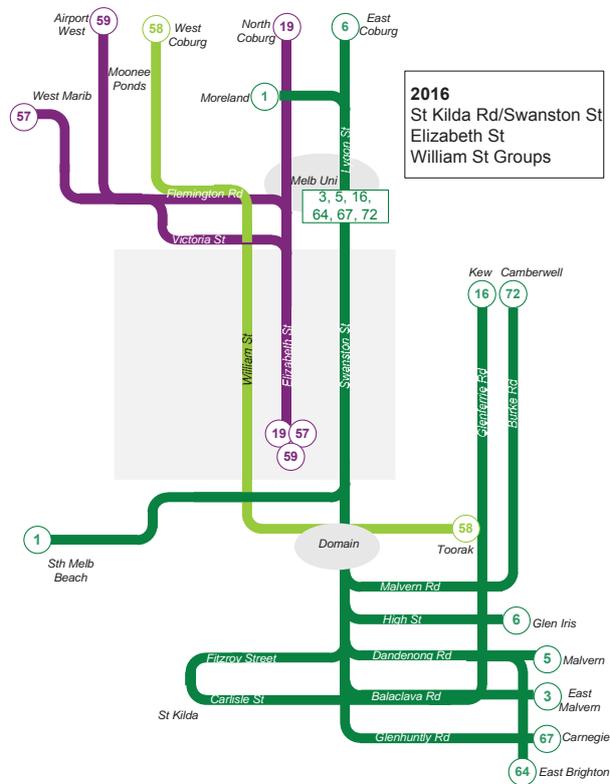
Melbourne Metro provides an opportunity for the tram network to be reconfigured. Once operational, the Melbourne Metro tunnel will perform some of the transport tasks currently undertaken by trams on St Kilda Road and Elizabeth Street / Royal Parade. For example, Melbourne Metro will:

- Release capacity on tram network
- Act as a catalyst for change for the north-south routes through the CBD
- Reduce the reliance on Swanston Street and Elizabeth Street / Royal Parade
- Enable the redistribution of services the west of the CBD.

Figure 9-12 outlines the proposed tram network before Melbourne Metro and Figure 9-13 illustrates the reconfigured tram network after Melbourne Metro is operational.⁶

⁶ Currently subject to outcomes of public consultation.

Figure 9-12 – Proposed Tram network before Melbourne Metro



Source: PTV.

Figure 9-13 – Tram network following the construction of Melbourne Metro



Source: PTV.

9.6.2 Tram relief

The existing tram network within the CBD is focused heavily on Swanston Street as the predominant north to south public transport access corridor. This corridor provides a key access route that links Parkville, CBD locations and St Kilda Road and is complemented by the Elizabeth Street tram connection from the CBD to Parkville.

The high demand for travel along this corridor requires that trams operate frequently and are heavily loaded at busy times. Although this provides customers travelling along this corridor or alighting at Flinders Street and Melbourne Central stations with a high frequency service to access Parkville and Domain, it increases congestion and unreliability on these corridors.

Demand for travel on these corridors will continue to grow. For example, between 2011 and 2031 patronage on trams travelling:

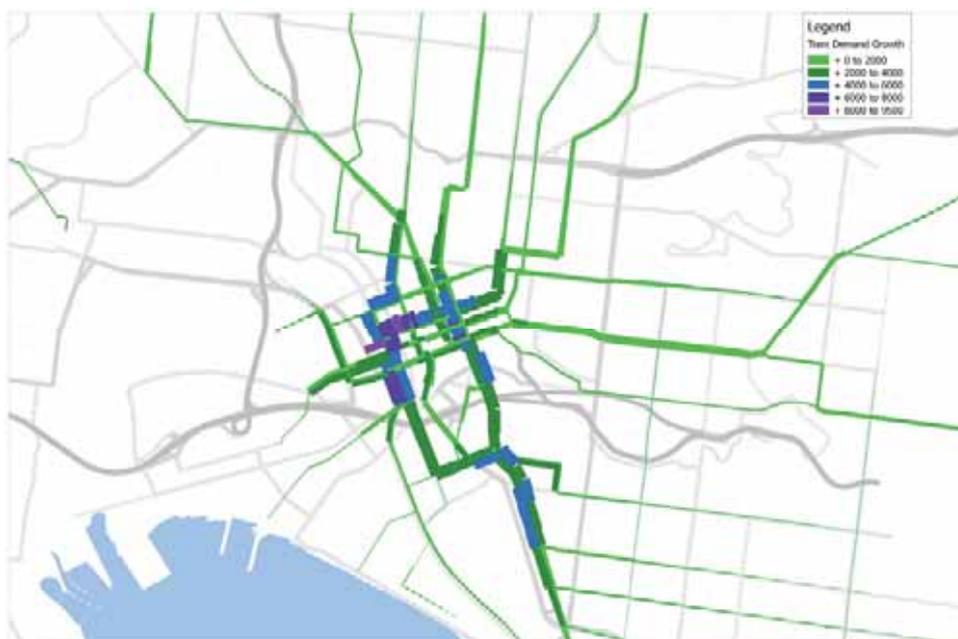
- North between Melbourne Central and Melbourne University along Swanston Street and Elizabeth Street is expected to grow by 1.9 per cent per annum or over 45 per cent over this period in the morning peak period
- Southwards on Swanston Street (between Federation Square and the Arts Centre) is expected to grow by 3.3 per cent per annum, or over 90 per cent over this period.

Figure 9-14 shows:

- The growth projected along tram routes in and adjacent to the CBD
- The continued reliance on the St Kilda Road / Swanston Street corridor
- Strong growth on corridors in the west of the CBD.

By 2031, without Melbourne Metro the number of passengers on trams on Elizabeth Street and Swanston Street heading north towards Parkville during the two hour AM Peak will reach 18,000. This is equivalent to the number of people travelling on the Frankston Line in the two hour AM Peak today.

Figure 9-14 – Map of tram demand growth between 2011 and 2031 (AM Peak)



Source: PTV.

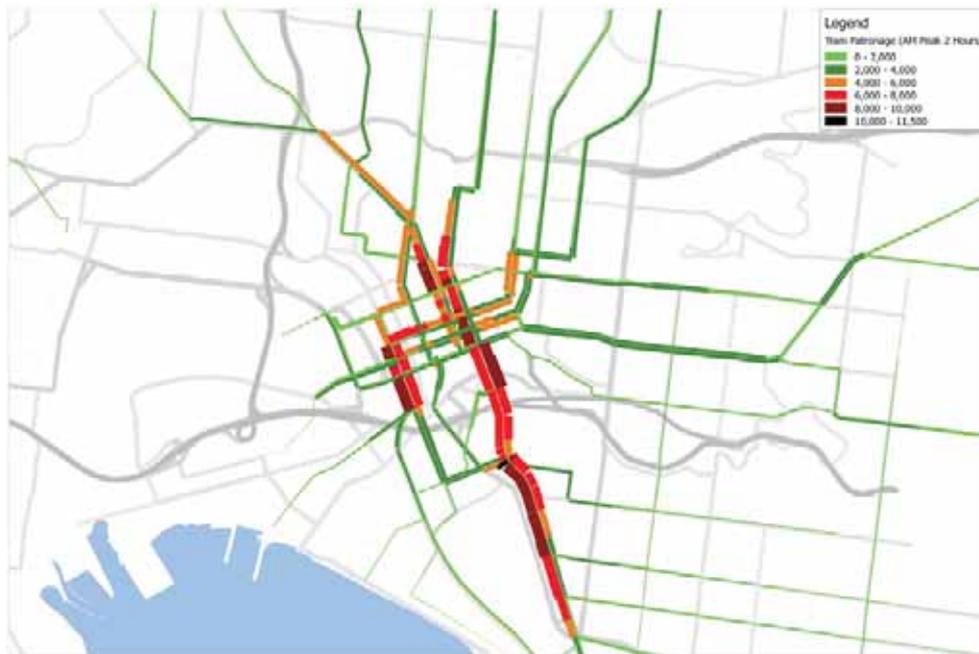
The importance of having sufficient tram network connections across the city to complement the metropolitan train network will increase as Central Melbourne continues to grow.

Melbourne's tram network faces dual challenges of:

- An increasingly busy trunk route serving St Kilda Road and Parkville
- A (consequential) consumption of resources that could be better deployed to the under-served western parts of the CBD.

Figure 9-15 shows patronage levels across the tram network without Melbourne Metro.

Figure 9-15 – Tram patronage in 2031 without Melbourne Metro



Source: PTV.

The peak loads on the Swanston Street corridor are between Federation Square and the Arts Centre. Melbourne Metro will relieve crowding and enable a reconfiguration of the tram network to better serve the western part of the CBD.

By diverting some of the existing Swanston Street routes to the west of the CBD and optimising the deployment of high capacity trams on the remaining Swanston Street routes, the network can better serve emerging employment patterns and improve operational performance by reducing the level of tram congestion and facilitating new connections across and within the expanding CBD.

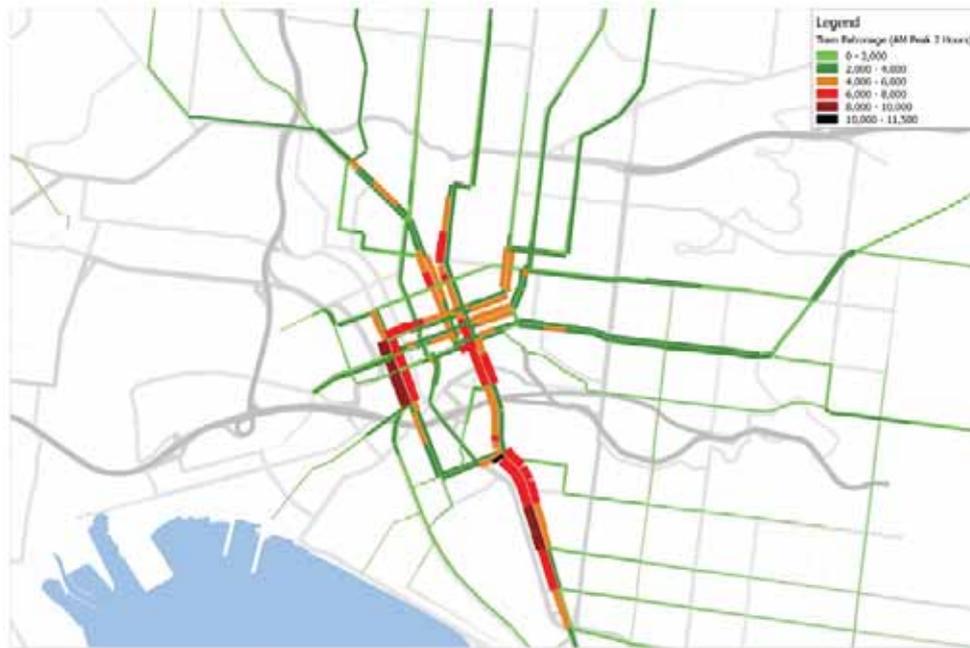
A reconfiguration of the tram network will also allow an increase in services from the Domain Interchange to Park, Kings Way / William and Clarendon / Spencer Street. When Domain station is completed, there will be continue to be strong demand for tram services from this location. Travellers will interchange 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 St Kilda Road and Alfred Hospital Precincts and schools.

Reconfiguring the tram network in this way, including the link to Domain Interchange, also benefits rapidly growing numbers of residents moving into Southbank, including those living beyond walking distance of the CBD. It improves access to the Southbank entertainment precinct and South Melbourne activity centre for people across Melbourne's CBD and train network. It will also provide improved connections to Southern Cross and Flagstaff stations.

The growing CBD West and Southbank can be better served by realigned tram routes with a new interchange at Domain. Trams that were needed to meet demand on Swanston Street prior to Melbourne Metro can be redeployed for these realigned services.

As Figure 9-16 shows how the new Melbourne Metro stations at Parkville and Domain will provide significant relief to north-south trams that serve these precincts by removing the predominance of dark brown and red shading along the Swanston Street / St Kilda Road corridor on the map once Melbourne Metro is operational.

Figure 9-16 – Tram patronage in 2031 with Melbourne Metro



Source: PTV.

There is continued strong demand for tram travel on St Kilda Road to the south of Domain station as people will use this interchange point to take advantage of the network reconfiguration enabled by Melbourne Metro to catch trams to Southbank and South Melbourne and to travel south along St Kilda Road from Domain station to access employment and education destinations, such as the Alfred Hospital Precinct and schools.

9.6.3 Alignment to job catchments

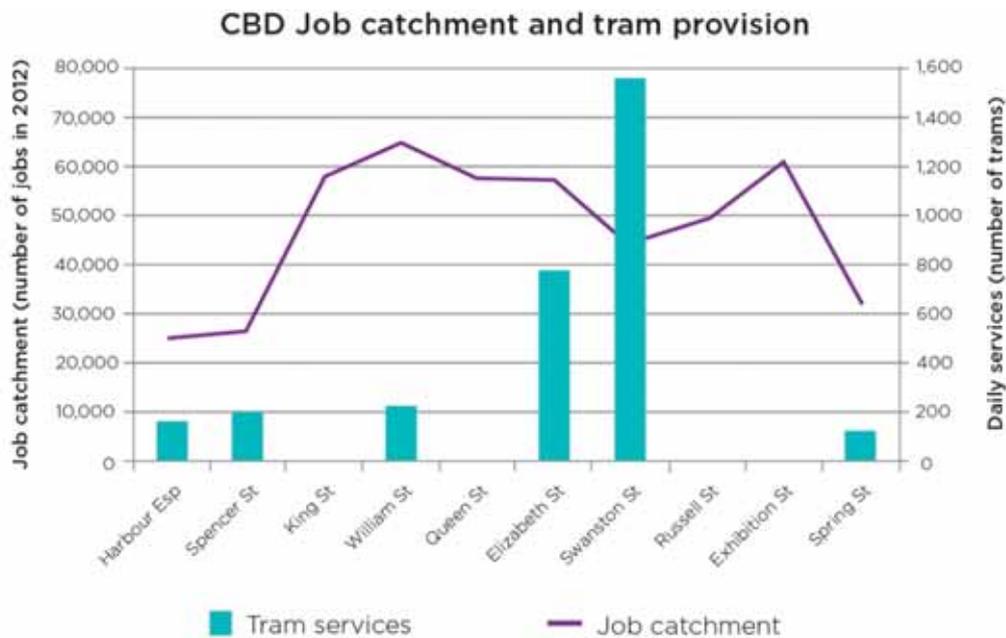
The project will enable the tram network to re-align the services on north-south tram routes to provide a closer match to the distribution of jobs, which is projected to be strongest towards the west of the CBD.⁷

Figure 9-17 and Figure 9-18 illustrate the 'before and after' picture of the alignment of tram services to CBD job catchments.⁸

⁷ Particularly along the east-west axis of Collins Street and the north-west axis of William Street. See: Public Transport Victoria, *Melbourne Metro Public Transport Demand Forecasts for Business Case* (2015), 28.

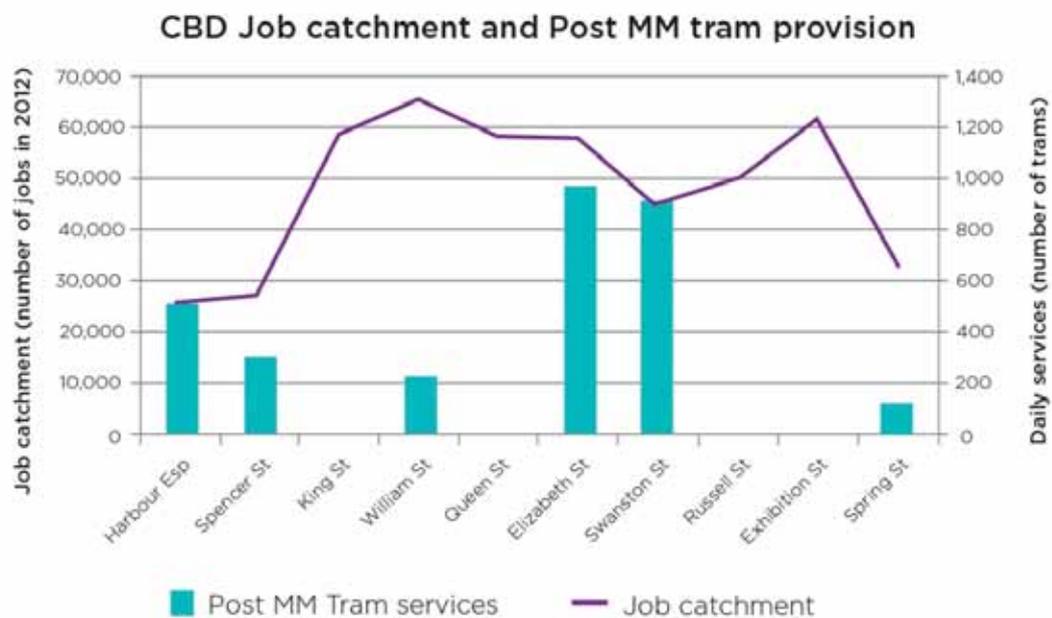
⁸ 2012 job figures have been used as it was the most readily available figures at the time of analysis. The 2012 catchment figures are comparable to the current job catchment trends.

Figure 9-17 – Comparison of the job catchment in the CBD and the current corresponding distribution of north-south tram



Source: PTV.

Figure 9-18 – Comparison of the job catchment in the CBD and the corresponding distribution of north-south tram post Melbourne Metro



Source: PTV.

The reconfigured tram network along with the new CBD South and Domain stations will serve as a gateway to the tram network with connections to the Alfred Hospital Precinct, the St Kilda Road professional services precinct and the Southbank entertainment and professional services precinct. The tram network will also benefit the rapidly growing number of residents moving into Southbank, including those living beyond walking distance of the CBD. Most notably, residents in the vicinity of Domain station and tram interchange will experience significant improvement in their ability to access and travel to various parts of the CBD.

By diverting some of the existing Swanston Street routes to the west of the CBD and Southbank and optimising the deployment of high capacity trams on the remaining Swanston Street routes, Melbourne Metro provides the opportunity to adjust the tram network so that the network can:

- Better serve emerging employment patterns
- Facilitate greater participation in culture and the arts
- Facilitate new connections across and within the expanding CBD
- Provide more accessible transport options
- Improve operational performance
- Reduce the level of tram-tram congestion.

9.7 Improving social resilience and economic outcomes across Melbourne

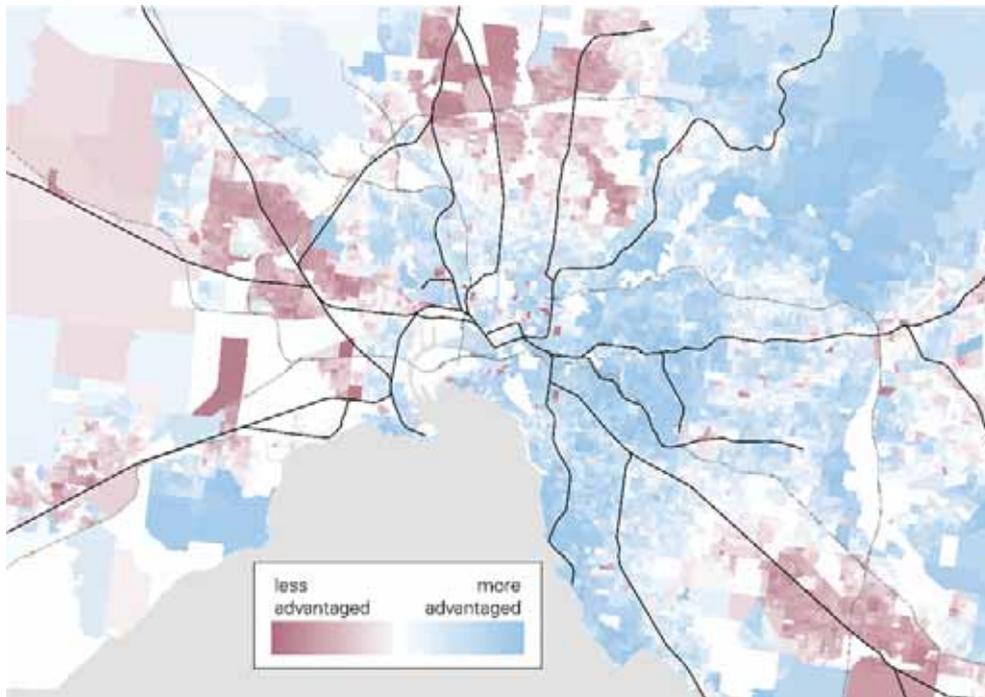
The Australian Bureau of Statistics (ABS) uses Census data to provide Socio-Economic Indexes for Areas (SEIFA) that measure socio-economic advantage / disadvantage by geographic regions.

Relative socio-economic advantage is defined by the ABS broadly as people's ability to participate in society and access resources. This includes factors such as employment rates, income levels, English proficiency and qualifications.

Figure 9-19 shows the spatial distribution of the SEIFA index. The areas of greatest relative lower advantage are located in west, north and south east of Melbourne. These areas are also experiencing high residential growth and is expected to further intensify in the future, particularly in the west and north.

Melbourne Metro will enable communities in key population growth corridors in the west and north to be better connected to a greater range and number of job opportunities, leading to greater income potential.

Figure 9-19 – ABS index of relative socio-economic advantage



Source: ABS.

Without Melbourne Metro, access between expected areas of residential growth and areas of expected future job growth (which is projected to predominantly occur in Central Melbourne) will be limited. Key population growth corridors in the urban fringe will have a deteriorating level of access to Central Melbourne in comparison to others.

Railway lines to these areas of Melbourne are forecast to experience the highest rates of patronage growth. Without Melbourne Metro, demand will outstrip capacity within five years for corridors in Melbourne's north and within 10 to 15 years on the Cranbourne / Pakenham Lines.⁹ This will further ingrain the spatial pattern of socio-economic advantage.

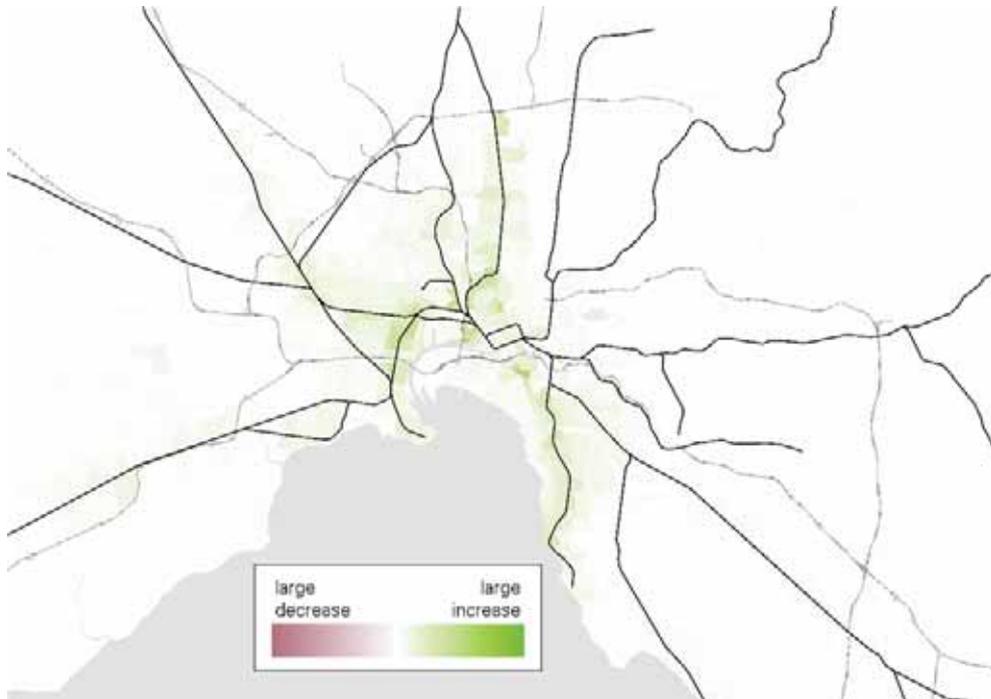
By enhancing the accessibility of metropolitan Melbourne, Melbourne Metro will:

- Improve access to employment clusters
- Reduce commute times
- Provide greater accessibility to Central Melbourne.

Figure 9-20 shows the change in accessibility to jobs with the largest accessibility improvements provided in Melbourne's north and west.

⁹ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case* (2015), 50.

Figure 9-20 – Change in accessibility to employment due to Melbourne Metro, 2046



Source: VITM; KPMG Analysis.

There is significant research that shows that over time improved access to health and education services as well as a broader pool and range of jobs are critical to making communities more resilient.¹⁰ In addition to employment opportunities, Melbourne Metro will provide residents in Melbourne's north and west in particular better accessibility to a greater variety of health and educational facilities in Parkville and Central Melbourne. Specifically, Melbourne Metro will provide:

- A new station serving the Parkville National Employment Cluster, the University of Melbourne and hospital precinct with an anticipated increase in the number of health jobs
- Enhanced accessibility to a number of other higher education facilities including RMIT (CBD North), Monash University (city campus) and Victoria University (city campus).

¹⁰ Stanley, John; Currie, Graham; Stanley, Janet. (2007). 'The way to go?' in *No way to go: Transport and social disadvantage in Australian communities*, pp. 16.1–16.11.

9.8 Guiding and stimulating growth through land use

9.8.1 Metro Wide effects

Given the scale of the project, Melbourne Metro can influence Melbourne's long-term urban form by:

- Expanding Central Melbourne by upgrading rail capacity and providing new stations at Arden, Parkville, Domain, CBD North and CBD South
- Upgrading rail capacity on lines that service:
 - All growth corridors (north, west, and south-east)
 - Five out of six existing and emerging national employment clusters (Parkville, Monash, Dandenong South, Sunshine, East Werribee)
 - Six out of nine existing metropolitan activity centres (Sunshine, Footscray, Broadmeadows, Dandenong, Fountain Gate / Narre Warren, Frankston).
- Enabling future expansion of the rail network to support:
 - Future metropolitan activity centres at Toolern and Lockerie in the western and northern growth corridors respectively
 - Development of the international and national gateway at Melbourne Airport.

Melbourne Metro is a city-changing project. The significant step-up in rail capacity will positively and significantly shape Melbourne, particularly when combined with other supporting interventions.

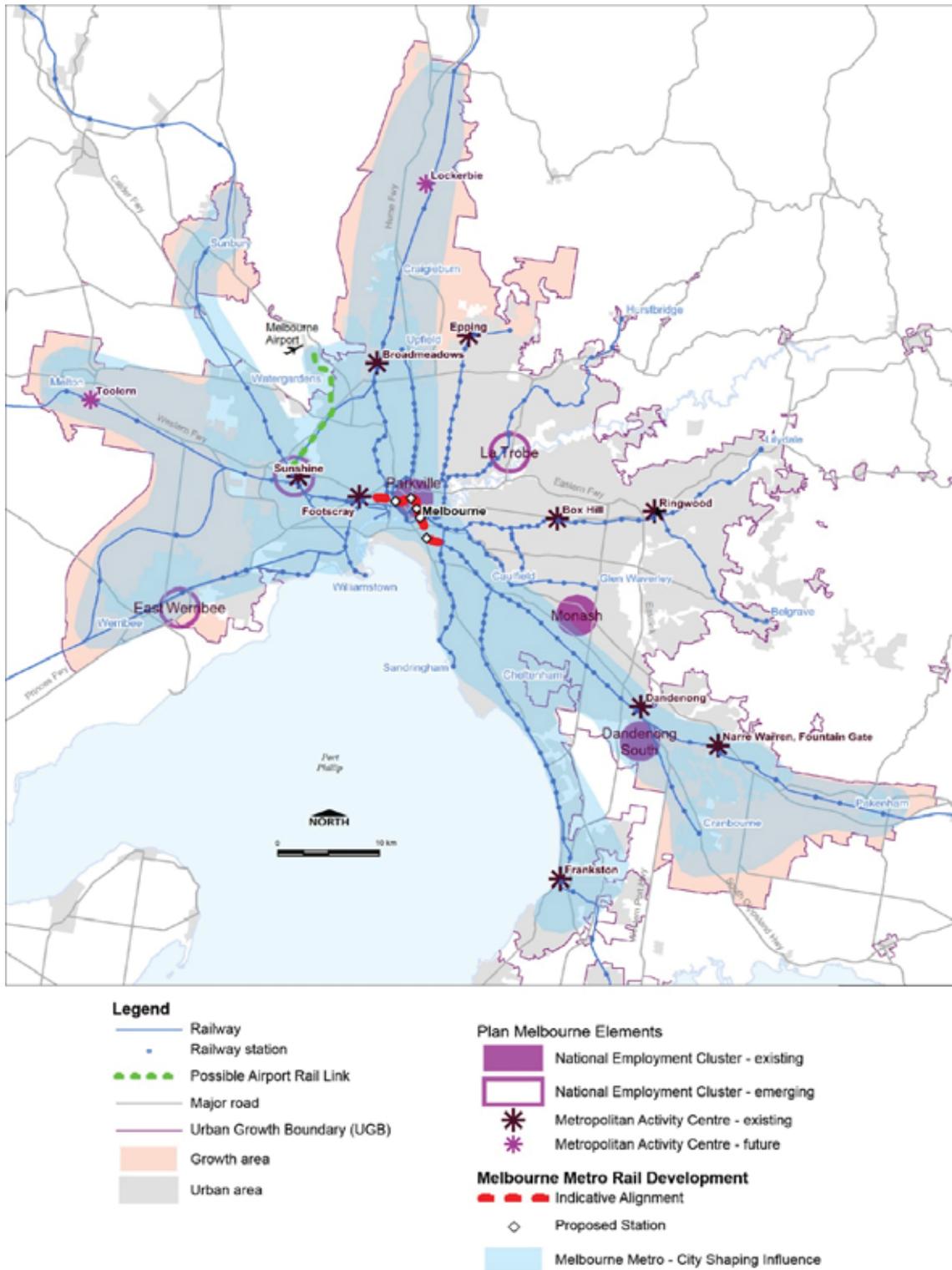
The project supports emerging and future land use patterns in Melbourne, including:

- A longer-term land supply strategy for employment and commercial land to ensure the ongoing productivity of Melbourne, especially Central Melbourne
- Growth areas that have high-quality transport connections that provide access to employment, education, health and cultural opportunities
- New communities in growth areas that will be anchored around high-capacity and high-frequency public transport, providing access to a range of locations and activities in the metropolitan area and region
- Residential renewal and development land in inner Melbourne that relieve pressure on the fringe and maximise the use of existing infrastructure, and along existing corridors, refer to Plan Melbourne which highlights significant lengths of the Sunshine – Dandenong Line for urban renewal (as well as Upfield Line).

Melbourne Metro aligns with key components of Plan Melbourne, a planning strategy that is designed to guide the way the city will develop and change over the next 40 years.¹¹ This planning document is an integrated land use and transport strategy that will shape the economic future for Victoria. Figure 9-21 illustrates the city-shaping reach of the project and its alignment with key components of Plan Melbourne. The project has a wide reaching city shaping influence across metropolitan Melbourne as highlighted by the blue shading which extends from the north west to the south east.

¹¹ The Victorian Government is undertaking a refresh of Plan Melbourne and all references to Plan Melbourne in this Business Case relate to the version released in 2014.

Figure 9-21 – Melbourne Metro city shaping influence



Source: Department of Economic Development, Jobs, Transport and Resources.

From a rail network perspective, the project delivers an independent, end-to-end operation of a Sunshine – Dandenong Line and creates capacity for the Cross-City Line and the suburban lines that operate through North Melbourne station. This enables and promotes:

- More efficient travel to and across the CBD
- Effective inter-modal travel
- Greater access to employment clusters
- Access to a greater variety of health and education services
- Agglomeration of industries (as discussed in Chapter 4).

In addition, Melbourne Metro:

- Positively influences Melbourne CBD, Monash and Dandenong South existing national employment clusters and the East Werribee and Sunshine emerging employment clusters
- Benefits existing activity centres including Sunshine, Footscray, Broadmeadows, Frankston, Dandenong, Narre Warren and Fountain Gate
- Enhances connectivity to employment clusters and activity centres to more sustainably accommodate employment growth
- Further enhance connectivity across the city by creating new concentrations of employment, residential and other activities along the corridor
- Provides an alternative to private transport to access a range of services and facilities to support climate change initiatives and the need for a sustainable and efficient city.

Melbourne Metro is a significant strategic infrastructure investment that has the power to shift relative accessibility in and across the city and influence urban structure.

9.8.2 Support growth in Central Melbourne

The project offers the first opportunity since the City Loop was completed 30 years ago to expand the footprint of the rail network in Central Melbourne beyond the current limits of the five CBD stations.

The project therefore can play a key role in guiding and stimulating growth in Central Melbourne by:

- Catering to growth in the knowledge economy, leveraging off existing trends to intensify employment around the new stations
- Facilitating restructuring of the tram network to better service the western end of the CBD and into Southbank, including areas of Southbank around and to the south of City Road / West Gate Freeway
- Further reinforcing Swanston Street as the primary connection through the city, linking the education spine in the north through the civic spine of the CBD, St Kilda Road business precinct and the cultural spine to Domain
- Further supporting residential development in Central Melbourne.

New stations at Arden, Parkville, CBD North, CBD South and Domain are expected to attract development, although to differing extents:

- The Arden-Macaulay Precinct offers a major opportunity to develop a new commercial precinct focused around Arden station and leverage the agglomeration benefits of a central city location¹²
- Parkville station will also have a significant commercial and residential uplift, although of a more modest scale than Arden given the current level of transport infrastructure and more limited development opportunities. Both population and employment is expected to be drawn from CBD and other districts such as Docklands and Southbank. In terms of employment, health jobs are expected to rise relative to the base reference case due to greater utilisation of existing health facilities
- Domain station already has substantial commercial land uses in the immediate vicinity, and the provision of the station, combined with restructuring of the tram network, is projected to improve the accessibility and attractiveness of the nearby South Melbourne district and many precincts of Southbank, resulting in commercial and residential uplift
- CBD North and CBD South stations are expected to be associated with changes in population and employment. While modest increases in employment and population are projected in travel zones in close proximity to these new stations, the change in population and employment are expected to be much more significant in the precincts around the new Arden, Parkville and Domain stations.

Arden station will catalyse urban growth and development, and connect more people to the CBD and the broader transport network.

Demand is expected to grow rapidly as the area develops, with the Arden-Macaulay Precinct set to be a vibrant extension of the central city with a range of office, community, retail and residential uses.

The new stations are also expected to attract residential development. The future land use impacts of Arden station are high due to improvements in accessibility and the significant development potential as evidenced by the larger net population change in this area. Other complementary urban, infrastructure and service improvements will be needed in the Arden area to fully realise this urban renewal potential. These complementary improvements at Arden will be subject to a separate business case.

The Parkville station leads to medium future land use impacts due to more development potential and changes to accessibility.

Similarly, the Domain station leads to medium future land use impacts associated with increased accessibility and development of South Melbourne / Southbank and St Kilda Road.

A range of economic benefits arise from facilitating residential development in established areas such as the Arden-Macaulay Precinct. Under a scenario where there is a relatively fixed demand for dwellings within a given timeframe, providing additional dwellings in the established areas will commensurately reduce demand from the urban fringe. In addition to the economic efficiency arising from changes in transport patterns, land use intensification will also contribute to benefits. The most significant of these benefits include cost savings from reduced need to extend trunk infrastructure services such as roads, public transport, water and sewerage, drainage and storm water, electricity, gas and other utilities. Other benefits include:

- Reduction in non-urban land consumption
- Amenity and biodiversity impacts.

To avoid double counting, these benefits (and costs) have not been incorporated in the current analysis. It is expected that these will be investigated and formalised in a separate Arden Urban Renewal business case.

¹² Note that the potential for Arden as described in this Business Case is not captured in the land use / reference case scenario. It will be further investigated and formalised in a separate Arden Urban Renewal business case.

9.8.3 New station impacts

Melbourne Metro provides new stations in precincts that are not currently served by the heavy rail network: Arden, Parkville and Domain.

Even where areas are already served by tram and bus services, such as Parkville and Domain, providing a rail station delivers a step change in the number of public transport customers that can travel to these areas in peak times and provides more efficient journey 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.

Arden

Arden station is expected to provide heavy rail access to 12,000 jobs and 7,000 residents (within 800 metres of the station) in 2031.¹³ The relatively higher number of people exiting the station in the morning peak (compared to people entering it) indicates that, while less busy than Parkville and Domain, it is 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 in the morning peak two-hour period will access Arden station on foot, with the remainder using local bus and tram services.

As noted in Section 9.8.2, there is a significant further potential for growth of jobs and residents in this precinct. This growth will be realised by opening this station and planning for the redevelopment of the Arden-Macaulay Precinct.

Parkville

Parkville is a world-class higher education and health precinct that will benefit from direct connections with other health and university precincts along the Melbourne Metro corridor.

Parkville station will provide access to around 45,000 jobs, 14,000 residents and 70,000 tertiary students (within 800 metres of the station).¹⁴

When taking into account that passengers can access destinations north along Royal Parade and Flemington Road with a short tram trip, such as the Royal Children's Hospital, the catchment of jobs increases to 65,000 jobs. It will be used by nearly 60,000 customers each day in 2031, making it busier than Flagstaff station is today.¹⁵

While Parkville is already served well by tram and bus, the Parkville station will provide crowding relief to passengers travelling on tram and bus services in and around this area, as well as:

- A direct rail connection to the precinct for public transport passengers on Sunshine – Dandenong Line
- An access point at Footscray for customers on the Newport, Ballarat, Bendigo and Geelong
- An access point at Caulfield for customers on the Frankston corridor
- A transfer point for customers on other lines at CBD North or CBD South to access train service services, complementing the tram or bus options previously available. These benefits are demonstrated in the analysis of accessibility changes to the precinct.

Melbourne Metro means that over 740,000 more people will be within 30 minutes of public transport travel time of the precinct and that mode share of public transport for people travelling into the area in the morning peak period will increase from 66 per cent in 2011 to 83 per cent in 2031.¹⁶

Domain

St Kilda Road is an important employment precinct and Domain station will serve as a gateway to the tram network with connections to the Alfred Medical precinct and through South Melbourne and Southbank.

¹³ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015). Note that population and employment forecasts are based on the reference case land use forecasts. The Arden Urban Renewal Business Case will further refine these forecasts and assessment.

¹⁴ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

¹⁵ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

¹⁶ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

Domain station will provide access to 33,000 jobs and 17,000 residents (within 800 metres of the station).¹⁷ When taking its transport links to Southbank, South Melbourne and the southern parts of St Kilda Road, such as the Alfred Hospital Precinct, the job catchment is 111,000 jobs (excluding jobs in the CBD on William and Spencer Streets).¹⁸

This station will be an important tram – rail interchange station that provides access to the 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.

It is forecast to be used by 36,000 people per day in 2031, making it busier than 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.

By providing suburban rail access to Domain, many people will experience shorter public transport journeys to the precinct. For example:

- Public transport travellers on the Sunshine – Dandenong Line now have a direct rail connection to the precinct
- Passengers on the Newport, Ballarat, Bendigo and Geelong lines can transfer at Footscray
- Customers on the Frankston corridor can transfer at Caulfield to access this service
- Passengers on other lines can change at CBD North or CBD South to access a faster, less crowded train service than the tram options previously available.

Melbourne Metro means that more than 800,000 more people will be within 30 minutes of public transport travel time of the precinct.

Melbourne Metro will increase the mode share of public transport for people travelling to the area compared to 2011, from 33 per cent to 62 per cent.¹⁹

¹⁷ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

¹⁸ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

¹⁹ Public Transport Victoria, *Melbourne Metro Public Transport Customer Demand Forecasts for Business Case*, (2015).

9.8.4 Arden Urban Renewal Precinct

A new Arden station will catalyse significant urban renewal in the Arden-Macaulay Precinct, facilitating the expansion of the central city and future proofing Melbourne's economic prosperity.²⁰

Importantly, direct access to a metro station will facilitate high value, knowledge-based employment in Melbourne's inner west and provide an intervening professional jobs location for Melbourne's key growth corridors to the north west.

With the potential to facilitate 25,000 residents and in excess of 43,000 jobs, the Arden station is estimated to stimulate over \$7bn in today's dollars of end development value. Accordingly, the new station at Arden presents the most significant opportunity for the project to stimulate urban renewal.

The development potential of the precinct is intrinsically linked to the project. With a new Melbourne Metro station, Arden has the potential to become Australia's premier transit oriented development and a focus for international investment.

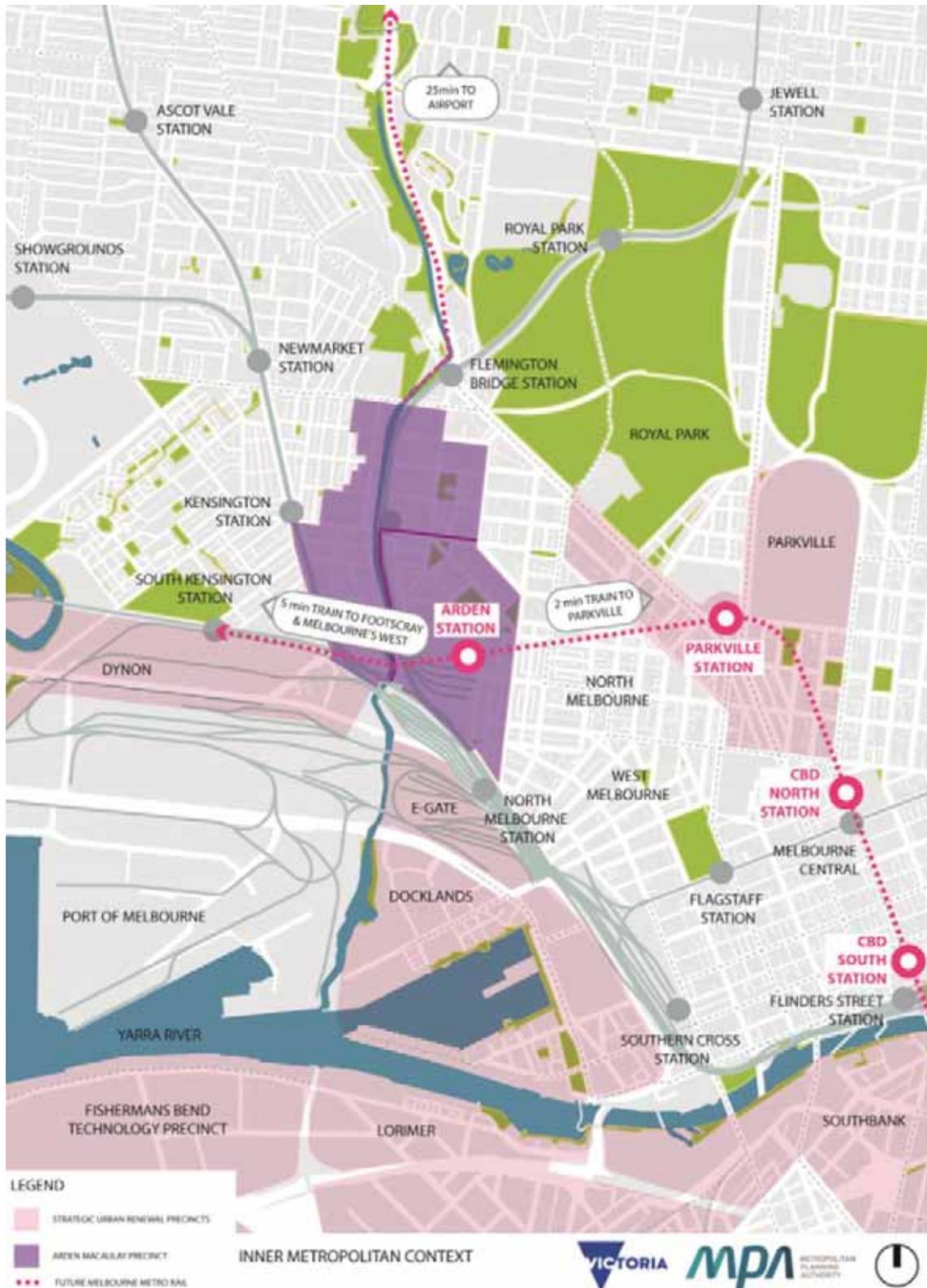
As shown in Figure 9-22, Arden will provide the critical link between planned and existing renewal precincts including Docklands, E-Gate and, in the longer term, Dynon and established areas including the Parkville National Employment Precinct, the CBD and existing communities in North and West Melbourne.

The Arden Urban Renewal Precinct represents the next phase of Melbourne's evolution.

Its geographic location will facilitate the continued expansion of the CBD to the north and west to respond to a rebalancing of metropolitan population growth.

²⁰ Note that the Arden Urban Renewal business case will refine the vision and outcomes for Arden. The costs and benefits associated with a new Arden station given reference case land use forecasts used as the project case have been considered in the economic evaluation.

Figure 9-22 – Inner Metropolitan Context



Source: Metropolitan Planning Authority.

It provides a strategically timed site of commercial and residential land in a Central Melbourne location, making land available for redevelopment from 2026 onward, as Docklands, Southbank and St Kilda Road precincts are anticipated to near their development capacity for commercial space.

With the project connecting Arden directly to the major health / education institutions of RMIT University, the University of Melbourne, the Parkville hospital health and medical research precincts and Victoria University, Arden offers a key opportunity for commercial employment, focused around the knowledge sectors.

Additional rail access combined with better integration with other transport modes (such as buses, trams, cycling) and planned road improvements (such as the Western Distributor) would result in much of Arden having 'CBD like' levels of accessibility to the broader Melbourne labour market increasing the attractiveness of the district to professional services businesses that benefit from agglomeration benefits.

Arden renewal strategic vision

The Metropolitan Planning Authority (MPA) prepared a masterplan, informed by a central city forecast land use assessment (identifying significant demand for commercial, retail, residential and institutional land use). This assessment demonstrates likely market interest in the precinct, commencing from the mid-2020s (coinciding with the proposed completion of the Melbourne Metro), with the development absorption of the remainder of the site anticipated to occur throughout the subsequent 30-year period to approximately 2056.

Building off the Strategic Vision the MPA are now preparing a Draft Framework Plan for the Arden Renewal Precinct with the intention of releasing this for consultation mid-2016.

It is anticipated that the precinct will consist of a mixed use development scaling up from a commercial, retail and residential lower level development around the sites perimeter, building to a commercial central core consisting of high-value institutional and commercial employment.

Given Arden's proximity to the CBD, the land is currently attractive for residential redevelopment. However, the area requires direct access to an integrated metro station to attract commercial development that supports high value, knowledge-based employment.

Arden sits within a mixed use residential and industrial context. One of its strengths is its strong existing character and sense of place which can be built on when developing this area.

Figure 9-23 - Arden-Macaulay Precinct, Boundaries and Local Connections



Source: Metropolitan Planning Authority.

9.9 Urban design strategy

In addition to significantly influencing Melbourne, Melbourne Metro can also contribute positively to the development of the station and portal precincts.

An urban design strategy is being developed to guide the integration of the project into surrounding precincts and surface transport in line with international best practice for developing large scale urban transport infrastructure projects. This strategy will be instrumental in creating vibrant and welcoming precincts around train stations to ensure that the new transport infrastructure makes a positive social, economic and environmental contribution to each place.

The guidance contained in the urban design strategy contributes toward the realisation of the project vision and the urban design vision and is based from the nationally recognised urban design principles contained in *Creating Places for People: an Urban Design Protocol for Australian Cities* developed by the Federal Department of Infrastructure and Transport in 2011.

The principles that underpin the strategy are detailed in the table below.

Table 9-3 – Urban design strategy principles

| Principle | Description |
|--|---|
| Vibrant places for people | <p>An activated and people orientated public realm is to provide a range of engaging experiences that:</p> <ul style="list-style-type: none"> • Create welcoming and inclusive environments that support social and cultural interaction • Deliver memorable and appealing spaces and places • Create a public realm that provides a range of experiences |
| Strong civic identity and well integrated environments | <p>The unique identity of the local area, community and project are to be reflected through a high quality design response that:</p> <ul style="list-style-type: none"> • Creates a strong and distinctive identity throughout the whole project to tie the project together • Responds positively and sensitively to each precinct's local social, cultural, physical and functional elements • Integrates the design response to ensure respect and conservation of indigenous and non-indigenous cultural heritage values where possible. |
| Legibility and ease of movement | <p>Stations and their precincts are to be easily accessed and well-connected to the surrounding precinct and include:</p> <ul style="list-style-type: none"> • Integrating different modes of transport including pedestrian, bicycle and public transport • A pedestrian focussed environment surrounding the station • Intuitive wayfinding, with strong visual connectivity and universal access principles embedded in the design. |
| Resilience and sustainability | <p>Places and project elements are to be environmentally sustainable, enduring and to support and nurture current and future generations, including outcomes that:</p> <ul style="list-style-type: none"> • Are long lasting, durable and consider long-term life cycle • Ensure the efficient use of resources and create places that are able to respond to climate change • Enhance the surrounding environment by designing to mitigate negative impacts, including noise, spilled light and air pollution. |
| Urban experience | <p>All project elements are to contribute to the functionality of the urban environment and add to the range of experiences, including:</p> |

| Principle | Description |
|------------------------|---|
| | <ul style="list-style-type: none"> • Contributing to the economic vitality and improving the liveability of the precinct through appropriate land use and public realm outcomes • Creating adaptable spaces that can perform a variety of functions and cater to the changing needs of the urban area • Capitalising on the investment in the new rail network and meeting the increasing demand for well-located residential, commercial, retail, community and institutional activities. |
| High levels of amenity | <p>Create high quality, inviting urban spaces that provide safe and attractive environments that create a positive experience for all, including:</p> <ul style="list-style-type: none"> • Providing a design that caters for the physical comfort and health and wellbeing of all users • Making a high quality contribution to the local built and landscape environment • Creating a safe environment at all times of the day and night. |

The urban design strategy principles, objectives and local considerations are provided to:

- Ensure excellence in urban design outcomes
- Support the project procurement evaluation process by providing the urban design framework to evaluate whether bid proposals meet the urban design objectives and performance requirements for the project
- Provide guidance to achieve high quality urban design outcomes for development proposals that have a project interface.

Contractors involved in the delivery of the project will be required to demonstrate how designs comply with the principles and outcomes identified in the strategy at the earliest stages of their designs. Incorporating urban design principles and approaches at the outset will help to achieve the highest levels of land use integration, built form, connectivity and amenity.

Ensuring that design quality is maintained during the delivery phase is heavily reliant on the input of appropriately qualified experts on both the procurement and delivery sides. In this way, the Urban Design Strategy is an important signal to the market about the importance of urban design excellence to the project and that design teams should be resourced appropriately.

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CHAPTER 10

Economic evaluation – Chapter Summary

- PTV undertook the economic analysis according to relevant guidelines, including Infrastructure Australia's Reform and Investment Framework, DTF's Economic Evaluation for Business Cases Technical Guidelines and the National Guidelines for Transport System Management.
- The economic case for Melbourne Metro is strong with a Benefit to Cost Ratio (BCR) range of 1.1 using the standard 7 per cent discount rate and before considering Wider Economic Benefits (WEBs). If a lower discount rate of 4 per cent is applied, the BCR increases to 2.4 before WEBs.
- The additional transport capacity provided by Melbourne Metro enables more workers (and businesses) to locate in highly productive, employment-dense areas. Melbourne Metro generates a range of WEBs, principal among those are the agglomeration economies (benefits which flow to firms and workers located in close proximity). The table below shows the economic case for Melbourne Metro is strengthened further with a BCR of 1.5 to 3.3 when WEBs are included.

| | BCR 7% Discount Rate | BCR 4% Discount Rate |
|---|-------------------------|-------------------------|
| Melbourne Metro Program – Conventional Economic Benefits | 1.1 | 2.4 |
| Melbourne Metro Program – including WEBs | 1.5 | 3.3 |

- The economy wide modelling demonstrates that the Melbourne Metro Program will create 3,900 additional jobs (net) across Victoria at the peak of construction. Nationally approximately 4,700 (net) additional jobs are expected to be supported at the peak of construction.
- The construction and operation of the Melbourne Metro Program is expected to increase Victoria's GSP by between \$7bn and \$14bn in present value terms using 7 per cent and 4 per cent discount rates respectively.
- The sensitivity analysis demonstrates that the economic evaluation is resilient to the majority of changes in key assumptions.
- Economic analysis was also undertaken including the costs and benefits of the Extended Program (future projects enabled by Melbourne Metro on the Sunshine – Dandenong Rail Corridor). Under the Extended Program the BCR results are 1.5 to 3.2 excluding WEBs, and 2.1 to 4.5 including WEBs, using a 7 per cent and 4 per cent discount rate.



10 Economic evaluation

10.1 Overview

This Chapter summarises the methodology and results of the economic evaluation.

PTV undertook the analysis¹ according to relevant guidelines including Infrastructure Australia's Reform and Investment Framework, DTF's Economic Evaluation for Business Cases Technical Guidelines, and the latest revision of the National Guidelines for Transport System Management (NGTSM).

Key assumptions used in the analysis were also agreed with the Department and key stakeholders.

Table 10-1 shows the results of the economic evaluation excluding and including WEBs.

Table 10-1 – Summary of economic evaluation results for the Melbourne Metro Program

| | 7% Discount Rate | | 4% Discount Rate | |
|---------------------------------------|------------------|-------------------|------------------|-------------------|
| | BCR | Net Present Value | BCR | Net Present Value |
| Conventional Economic Benefits | 1.1 | \$0.6bn | 2.4 | \$10.6bn |
| Including WEBs | 1.5 | \$3.7bn | 3.3 | \$18.0bn |

Source: PTV.

The economic analysis shows that the Melbourne Metro Program is economically viable with a BCR of 1.1 using the standard 7 per cent discount rate. The BCR increases to 2.4 if a lower discount rate of 4 per cent is applied. The economic case for Melbourne Metro is strengthened further, with a BCR of 1.5 to 3.3 when Wider Economic Benefits (WEBs) are included.

The lower end of the range reflects a 7 per cent discount rate to be consistent with DTF and Infrastructure Australia guidelines. This rate may be considered relatively conservative in the context of emerging practice to use lower discount rates for projects of this nature.

A 4 per cent discount rate was used for the upper end of the range to reflect the long-lived nature of Melbourne Metro (using high discount rates penalises benefits derived by future generations potentially raising issues of intergenerational equity). The selection of discount rates is further discussed in Section 10.4.

Economic analysis was also undertaken on the Extended Program reflecting future projects enabled by Melbourne Metro on the Sunshine – Dandenong Rail Corridor to meet medium term demand requirements, including electrification of the Melton Line and providing Extended HCMTs. Under this Extended Program the BCR results are 1.5 to 3.2 excluding WEBs and 2.1 to 4.5 including WEBs. The Extended Program analysis is discussed further in Section 10.8.

Two different demand models, the Victorian Integrated Transport Model (VITM) and Zenith, were used to assess the network-wide impacts. Both of these models are industry standard, four-step, strategic transport models used in Victoria to assess major transport policies and projects. The headline results presented in this Chapter are calculated using outputs of VITM. Results calculated using the Zenith model, which forecasts higher public transport demand, are also shown for information.

Sensitivity analysis was undertaken to test key assumptions in the modelling. The analysis shows that the economic evaluation is resilient to the majority of changes in key assumptions.

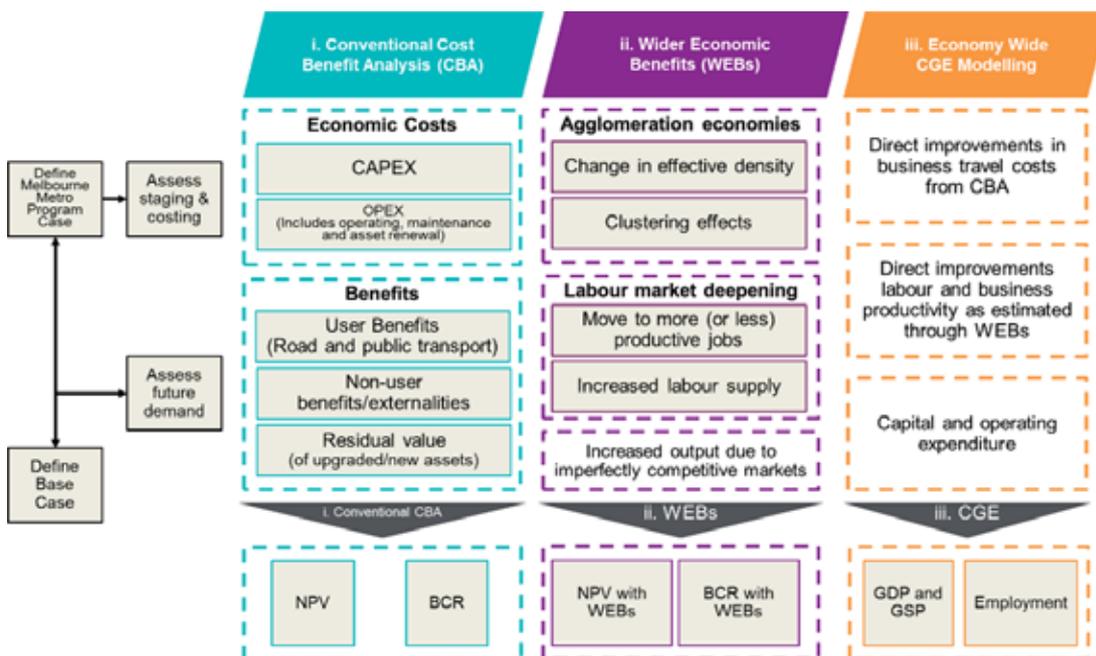
¹ Public Transport Victoria, *Melbourne Metro – Economic Evaluation Report* (2016).

10.2 Economic appraisal methodology overview

The economic evaluation combines demand analysis, economic benefits assessment and economic costs estimation to assess the social, economic and environmental merits. Figure 10-1 illustrates the analytical framework adopted for the evaluation.

The approach and parameters adopted are consistent with relevant project evaluation guidelines published by the Transport and Infrastructure Council², Infrastructure Australia³, DTF⁴ and Austroads.⁵

Figure 10-1 – Economic evaluation framework



Note: WEBs are cumulative to the conventional CBA. CGE modelling is not cumulative to the CBA and WEBs analysis, but provides a complementary view on the net economic contribution and productivity impacts.

10.3 Base Case and Melbourne Metro Program Case definition

The cost-benefit analysis assesses the incremental costs and benefits of the Melbourne Metro Program Case relative to the Base Case.

The Base Case for the economic analysis is founded upon the reference case developed by the Department (Reference Case) which includes:

- Land use projections for population and employment growth
- The transport network assumed to be required to support the land use projections and accommodate forecast population growth.

The Department developed the Reference Case as a framework to evaluate all major transport projects in a consistent manner. It comprises both committed / funded projects and unfunded projects assessed as likely to be delivered over the next 30 years.

² Transport and Infrastructure Council, *National Guidelines for Transport System Management in Australia* (2006, 2015).

³ Infrastructure Australia, *Reform & Investment Framework: Templates for Stage 7 - Solution Evaluation* (2013).

⁴ Victorian Department of Treasury and Finance, *Economic Evaluation for Business Case Technical Guidelines* (2012).

⁵ Austroads, *Guide to Project Evaluation Part 4: Project Evaluation Data* (2012).

The Base Case is the reference point for the economic analysis and consists of the Reference Case transport network but excludes Melbourne Metro and Melbourne Metro-enabled projects. Since the Base Case does not include these projects and in the absence of any other change in CBD transport system capacity, the Reference Case needed to be amended to take into consideration the constraints on commuting capacity and its impact on the employment growth in the CBD. It is estimated that approximately 47,000 jobs could not be accommodated in the CBD due to transport system capacity constraints as commuters would either be unable or unwilling to travel on heavily overcrowded lines. These jobs were redistributed to other suburban activity centres under the Base Case; however, total employment across metropolitan Melbourne remains unchanged.

The delivery of the Melbourne Metro Program is expected to provide transport system capacity to enable an additional 28,000 jobs to be located in the CBD relative to the Base Case. With the delivery of the Extended Program, the extra transport system capacity enables a further 19,000 jobs to locate in the CBD (additional to the 28,000 enabled by the Melbourne Metro Program), bringing the total number of CBD jobs to 47,000 higher than in the Base Case.

The Melbourne Metro Program Case is made up of the Base Case and the program of works needed to deliver the proposed service plan. This includes:

- Melbourne Metro – tunnels, stations and portals (for which funding is sought through this Business Case).
- Wider Network Enhancements – a range of works, including infrastructure to facilitate short turnbacks, access to sidings, signalling headway improvement works, other works to support service frequency across the existing network and changes to the operation of the tram network (for which funding is sought through this Business Case).
- Rolling Stock – rolling stock and associated works (stabling, maintenance and power upgrades), extended platforms on the Sunshine – Dandenong Line (Sunbury to South Kensington) and HCS interoperability (subject to separate funding request).

10.4 Key inputs and assumptions

Key inputs and assumptions used in the economic evaluation include:

- Capital costs – all non-recurrent capital costs that the delivery of the Melbourne Metro Program is expected to incur. Aquenta developed the capital cost estimates for this analysis. The capital costs include adjustments for project risks as detailed in Chapter 11.
- Operation and maintenance costs – all necessary recurrent costs to operate and maintain the asset over the evaluation period. PTV developed the operation and maintenance cost estimates for this analysis.
- Demand analysis – outputs from VITM were used for this analysis. PTV and its advisers, AECOM, undertook the demand analysis.
- Unit rates – for each of the benefits calculated from the modelling outputs. These were primarily derived from NGTSM.
- Applicable evaluation parameters as shown in Table 10-2.

Table 10-2 – Key input parameters

| Parameter | Value | Description |
|---------------------|-----------|---|
| Discount rate, real | 4% and 7% | A 7% discount rate has been used at the lower end of the range of results while a 4% discount rate has been used for the upper end of the range. |
| Cost Certainty | P50 | Costs have been included at the P50 level. This implies that there is a 50 per cent probability that the costs will be lower than the estimate that has been used in the modelling. |

| Parameter | Value | Description |
|---|---|--|
| Evaluation period | 50 years | From first year of operation of Melbourne Metro. 50 years is used in line with NGTSM guidance for rail infrastructure. As per IA and DTF guidance, residual values of assets have been included in the last year of evaluation to incorporate benefits that will continue to be delivered beyond the evaluation period. |
| Base year for discounting | 2015 | To align with price base. |
| Price base | 2015 (Q2) | To align with price base used for construction costs. |
| Construction period | 2018 - 2026 | As per construction schedule. |
| First year of operation | 2026 | As per construction schedule. |
| Value of time | 2015 – As per NGTSM Beyond 2015 – Indexed at 1.5% p.a. real growth (business trips) and 0.75% p.a real growth (non-business trips) | Based on productivity growth forecasts in 2015 Intergenerational Report ⁶ . Indexed as per NGTSM. |
| Public transport expansion factors | Peak to annual demand – 242 Interpeak and off-peak to annual demand – 357 | Based on PTV patronage data. |
| Road expansion factors | Daily to annual demand – 330 | Based on analysis of traffic counts undertaken on CityLink and the West Gate Freeway and is consistent with expansion factors used for other major road projects in Victoria including the Western Distributor project. |
| Demand modelling years | 2021, 2031 and 2046 | Costs and benefits were linearly interpolated between modelled years and extrapolated beyond the last year for which demand data was available (i.e. 2046). No further growth in benefits has been assumed beyond the design year (2056). |

10.4.1 Transport Models

In line with better practice for assessing demand under uncertainty, two different demand models were used to assess the network-wide impacts:

- VITM – Strategic transport model developed and maintained by the Department
- Zenith – Strategic transport model developed and maintained by Veitch Lister Consulting.

VITM and Zenith are both industry standard, four-step, strategic transport models that are used in Victoria to assess major transport policies and projects.

The Zenith model is also used by inter-state government agencies to assess transport projects / policies and was recently used by Infrastructure Australia for its Infrastructure Audit.

Estimating demand and assessing relative performance of the transport network in any event is a complex exercise. This is particularly true for a program of investments that will be developed and delivered over an extensive period.

The headline results presented in this Chapter are calculated using outputs of VITM. Results calculated using the Zenith model, which forecasts higher public transport demand, are also shown for information in Section 10.7.

⁶ The Treasury, *2015 Intergenerational Report: Australia in 2055*. Australian Government (2015), 30.

10.4.2 Discount Rate

The economic analysis adopts the standard discount rate of 7 per cent real and also presents a sensitivity impact using a lower discount rate of 4 per cent. The standard 7 per cent discount rate is consistent with current DTF and IA guidelines to assess infrastructure projects.

There are two main schools of thought on an appropriate basis for discounting the benefits of transport projects: the 'social time preference' (STP) approach and the 'social opportunity cost of capital' (SOC) approach. The STP approach is the rate at which consumers are willing to trade off present against future consumption, while the SOC approach uses a long term average of returns to the private sector. Different jurisdictions internationally adopt different rates based on one or either of these approaches.

While current Victorian and IA guidance for economic evaluation of transport projects recommends the use of a SOC approach, the appropriate discount rate for public projects is a matter of ongoing debate. To reflect the range of approaches currently used across Australia and elsewhere, both the 4 per cent and 7 per cent real discount rates have been presented together in this Business Case. The Victorian Government will continue to review and refine its approach to project discount rates over time to reflect emerging consensus in this complex area.

Local and international large projects have adopted lower discount rates to present economic analysis, including:

- Inland Rail – ARTC's Business Case for Inland Rail used a 4 per cent real discount rate for its headline numbers (with 7 per cent provided for comparative purposes)
- Crossrail (UK) – adopted a 3.5 per cent real discount rate.

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) recently confirmed that discount rates between 4% and 7% should be used for cost-benefit analysis.

Source: Bureau of Infrastructure, Transport and Regional Economics, ND (c2014) BITRE review of the social discount rate for economic evaluation of Nation Building infrastructure projects.

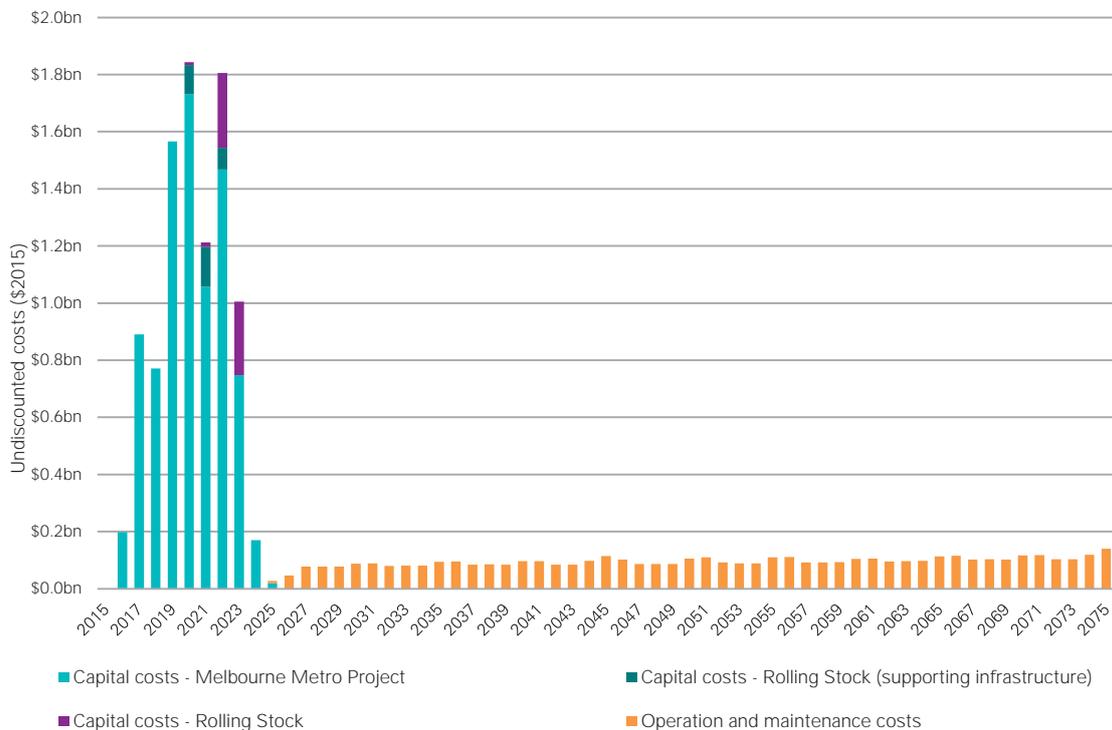
10.5 Costs

The economic evaluation includes:

- Capital costs – all capital expenditure including planning, construction, land acquisition costs, inherent/contingent risk allowance and real escalation
- Operation and maintenance costs – relating to operating and lifecycle maintenance expenditure for the 50-year project evaluation period, including the costs for operating the new stations and train operating costs (incremental to the Base Case).

Figure 10-2 outlines the profile of capital, operation and maintenance costs required over the evaluation period.

Figure 10-2 – Cost profile (\$ real 2015, P50)



Source: PTV.

10.6 Benefits

Economic benefits are categorised into conventional benefits and WEBS.

10.6.1 Conventional economic benefits

Conventional economic benefits include transport-related benefits quantified according to the NGTSM and DTF guidelines where appropriate.

The conventional economic benefits of a transport project fall into three main categories:

- User benefits (public transport and road users) – benefits to public transport and remaining road users as a result of the transport project. User benefits include, for example, reducing crowding and waiting times on public transport, travel time and commercial vehicle operating costs when people switch from travelling by car to public transport. Resource cost corrections need to be applied because, even though certain benefits are unperceived by users, they impact upon the consumption of resources.
- Non-user benefits (externalities) – benefits to society as a whole due to changes in travel behaviour after the transport project is introduced. For example, reducing the number of road crashes, greenhouse gas emissions and improving health (due to increased walking) because people switch from car travel to public transport.
- Infrastructure residual value – the infrastructure delivered will have an economic life beyond the end of the economic evaluation period. The residual value estimates the economic benefit of the infrastructure from the end of the evaluation period to the end of the economic life of the asset.

10.6.3 WEBS

Transport is an enabler of economic growth. Recent work from the UK estimates that if all drivers of growth were to increase by 10 per cent but transport infrastructure were to remain constant, growth in income would be only 9 per cent (1 per cent less than it otherwise would have been).⁷

It is now widely accepted that conventional benefits do not reflect the full economic costs and benefits of improvements in transport infrastructure because conventional analysis assumes perfect competition. WEBS arise due to the presence of external economies, market imperfections (e.g. taxation) and imperfectly competitive markets.

The WEBS were assessed according to guidance developed as part of the NGTSM as at mid-2015, noting that this will not be finalised until late 2016.

The WEBS analysis takes into account the land use impacts of the Melbourne Metro Program. The additional transport system capacity provided by Melbourne Metro enables workers to commute to the CBD with relative ease, and allows businesses in the CBD to access a broad range and wider pool of workers. By enabling more workers (and businesses) to locate in highly productive, employment-dense areas, Melbourne Metro generates a range of WEBS, principal among those are the agglomeration economies (benefits which flow to firms and workers located in close proximity). Additionally, increased employment density leads to a greater number of high productivity CBD jobs being available for workers. This benefit is known as 'move to more productive jobs' and in turn leads to greater tax receipts.

Three categories of WEBS arising from the Melbourne Metro Program have been assessed:

- Agglomeration economies – change in effective density and clustering effects
- Labour market deepening – move to more productive jobs and increased labour supply
- Increased output due to imperfectly competitive markets.

10.7 Results – Melbourne Metro Program

10.7.1 Overview of results

Table 10-3 shows the results of the economic evaluation.

Table 10-3 – Economic evaluation results – Melbourne Metro Program

| | VITM | | Zenith | |
|---|------------------|------------------|------------------|------------------|
| | 7% Discount Rate | 4% Discount Rate | 7% Discount Rate | 4% Discount Rate |
| Present value of capital costs (P50) | \$6.7bn | \$7.7bn | \$6.7bn | \$7.7bn |
| Present value of operation and maintenance costs | \$0.6bn | \$1.3bn | \$0.6bn | \$1.3bn |
| Present value of conventional benefits | \$7.9bn | \$19.7bn | \$10.3bn | \$24.6bn |
| Present value of WEBS | \$3.1bn | \$7.4bn | \$3.0bn | \$6.9bn |
| Present value of total benefits | \$11.0bn | \$27.0bn | \$13.2bn | \$31.5bn |
| Net Present Value (excl WEBS) | \$0.6bn | \$10.6bn | \$2.9bn | \$15.6bn |
| Net Present Value (incl WEBS) | \$3.7bn | \$18.0bn | \$5.9bn | \$22.5bn |
| Benefit cost ratio (excl WEBS) | 1.1 | 2.4 | 1.4 | 3.0 |
| Benefit cost ratio (incl WEBS) | 1.5 | 3.3 | 1.9 | 3.9 |

Source: PTV.

⁷ Venables, A, Laird, J & Overman, I, *Transport investment and economic performance: Implications for project appraisal* (2014), 14.

The key tests of economic viability to consider are:

- The NPV which indicates the magnitude of net benefit to society and is equal to the present value of benefits less the present value of costs. Positive NPVs indicate that an investment is desirable to society as a whole
- The BCR is the economic measure of value for money for public expenditure and is of principal value when government considers spending scarce funds. Governments also consider public policy outcomes and other matters when assessing value for money. The BCR is calculated by dividing the present value of benefits (less the present value of operation and maintenance costs) by the present value of capital costs. BCRs greater than 1.0 indicate that an investment is economically efficient and represents value for money.

This analysis shows that Melbourne Metro is economically viable with a conventional BCR of 1.1 and NPV of \$0.6bn applying a 7 per cent discount rate and a BCR of 2.4 and NPV of \$10.6bn applying a 4 per cent discount rate.

Including WEBs raises the BCR to 1.5 and 3.3 using a 7 per cent discount rate and 4 per cent discount rate respectively.

Economic benefits calculated using outputs of the Zenith model are higher than those of VITM.

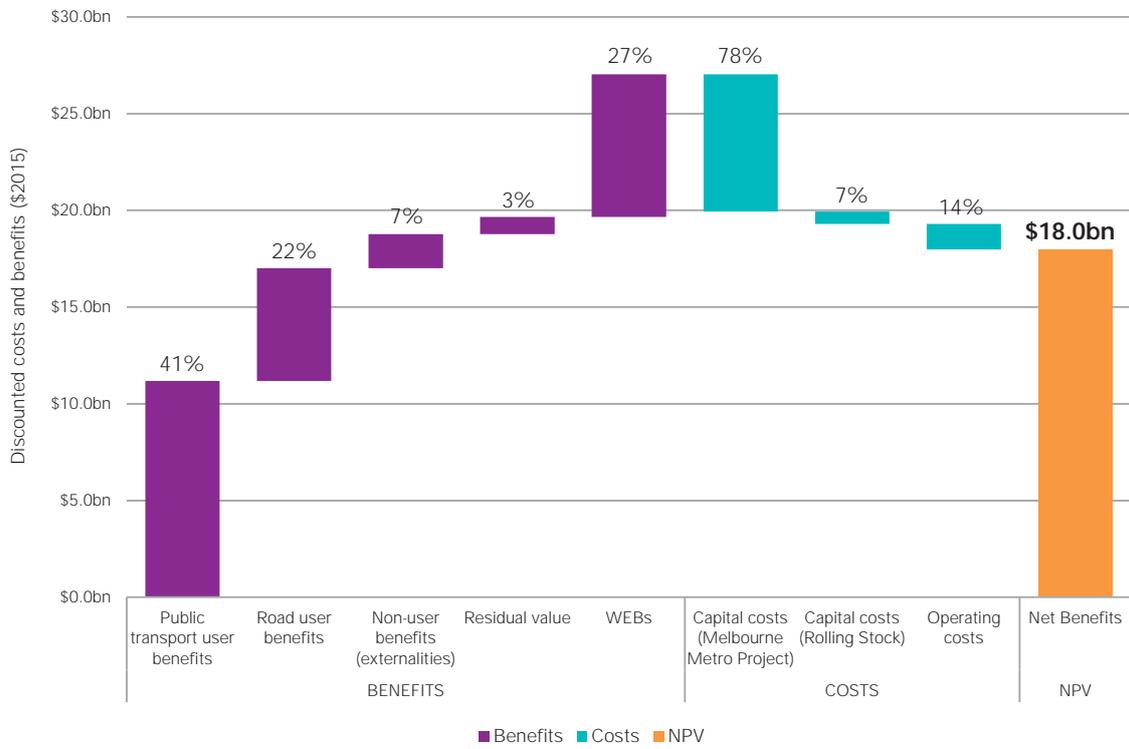
10.7.2 Analysis

Figure 10-3 shows the cumulative benefits and costs for the Melbourne Metro Program Case (assuming a 4 per cent discount rate):

- The largest contributing category of benefit is public transport user benefits which account for 41 per cent of the total benefits
- Road user benefits that arise from decongestion comprise the second largest component of conventional transport benefits of approximately 22 per cent
- Other conventional benefits, including non-user benefits (externalities) and residual value of assets comprise approximately 10 per cent of the benefits.

WEBs comprise 27 per cent of the total benefits. These arise from economic restructuring and land use changes facilitated by the Melbourne Metro Program due to the removal of constraints on central city growth. The additional transport capacity provided by the Melbourne Metro Program enables the CBD to accommodate a further 28,000 jobs. Enabling additional jobs to locate in the CBD, Australia's second most productive region after Sydney's CBD, facilitates increased interaction between businesses and workers and provides workers with access to a range of employment opportunities. This increased agglomeration of employment in the CBD enhances the productivity of Victoria, generating additional economic benefits being agglomeration economies and labour market deepening.

Figure 10-3 – Cumulative benefits and costs of Melbourne Metro Program using VITM (4 per cent discount rate)



Source: PTV.

10.7.3 Sensitivity analysis

With economic analysis depending heavily on cost planning, transport modelling and a range of other assumptions, including land use forecasts and expected transport network in future, it is important to assess the impact of changes in major inputs and assumptions to the economic viability of the Melbourne Metro.

Sensitivity tests were constructed to test the most crucial assumptions in the economic analysis and were undertaken at the 4 per cent and 7 per cent discount rates. The sensitivity tests demonstrate that the economic evaluation is resilient to the majority of changes in key assumptions.

The ‘upside’ results show that the Melbourne Metro Program could deliver a significantly more positive economic result than the core evaluation result suggests, with some tests showing the BCR (including WEBS and at 4 per cent) exceeding 4.0 and the NPV exceeding \$23.4bn.

The ‘downside’ results demonstrate that the Melbourne Metro Program produces a positive economic outcome for the majority of tests.

The detailed results of the sensitivity analysis is provided in Appendix 6.

10.8 Extended Program

A key feature of Melbourne Metro is that it enables further improvements in capacity and service delivery in the future. The analysis of the Melbourne Metro Program in Section 10.7 includes costs of enabling works (such as constructing longer platforms that will cater for longer (10 car) HCMTs) but does not include any future benefits from this additional investment.

In recognition of this intrinsic value, economic analysis has also been undertaken on the Extended Program which incorporates the costs and benefits of future projects on the Sunshine – Dandenong Rail Corridor which are enabled by Melbourne Metro to meet medium-term demand requirements, including:

- Electrification of the Melton Line
- Melton quad track between Sunshine and Deer Park West
- Introduction of Extended HCMTs on the Sunshine – Dandenong Line.

The additional transport capacity provided by the Extended Program enables the CBD to accommodate a further 19,000 jobs (additional to the 28,000 enabled by the Melbourne Metro Program). Table 10-4 shows the results of the economic evaluation under the Extended Program.

Table 10-4 – Economic evaluation results – Extended Program

| | VITM | | Zenith | |
|---|------------------|------------------|------------------|------------------|
| | 7% Discount Rate | 4% Discount Rate | 7% Discount Rate | 4% Discount Rate |
| Present value of costs (P50) | \$7.8bn | \$9.4bn | \$7.8bn | \$9.4bn |
| Present value of operation and maintenance costs | \$0.8bn | \$1.9bn | \$0.8bn | \$1.9bn |
| Present value of conventional benefits | \$12.4bn | \$31.8bn | \$17.1bn | \$45.0bn |
| Present value of WEBs | \$5.0bn | \$12.0bn | \$4.9bn | \$11.8bn |
| Present value of total benefits | \$17.4bn | \$43.8bn | \$22.0bn | \$56.8bn |
| Net Present Value (excl WEBs) | \$3.7bn | \$20.5bn | \$8.4bn | \$33.7bn |
| Net Present Value (incl WEBs) | \$8.7bn | \$32.5bn | \$13.3bn | \$45.4bn |
| Benefit cost ratio (excl WEBs) | 1.5 | 3.2 | 2.1 | 4.6 |
| Benefit cost ratio (incl WEBs) | 2.1 | 4.5 | 2.7 | 5.8 |

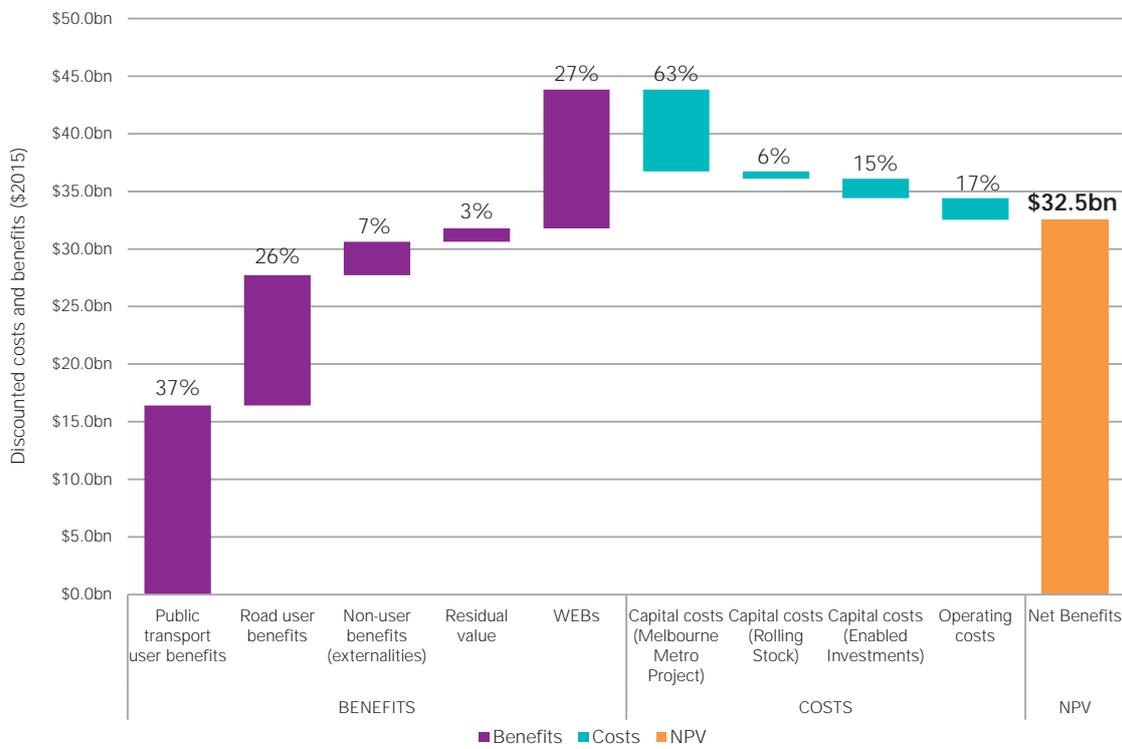
Source: PTV.

This analysis shows that economic results derived from VITM are further improved under the Extended Program, with a conventional BCR of 1.5 and NPV of \$3.7bn applying a 7 per cent discount rate and BCR of 3.2 and NPV of \$20.5bn at a 4 per cent discount rate.

Including WEBs raises the BCR to 2.1 and 4.5 using a 7 per cent discount rate and 4 per cent discount rate respectively.

Figure 10-4 shows the cumulative benefits and costs for the Extended Program (assuming a 4 per cent discount rate).

Figure 10-4 – Cumulative benefits and costs of Extended Program using VITM (4 per cent discount rate)



Source: PTV.

10.9 Economy wide impacts

A key project benefit is the employment and economic growth opportunities enabled by the Melbourne Metro Program and the Extended Program. To understand the economy-wide impact of the Melbourne Metro Program and the Extended Program, Victoria University Centre of Policy Studies (VU-COPS) undertook computable general equilibrium (CGE) modelling. This study estimated the economy-wide effects of Melbourne Metro at the state and national levels.

The analysis draws on and is complementary to the financial analysis and cost benefit analysis (CBA). The CGE model used is a customised version of 'The Enormous Regional Model' of Victoria University (VU-TERM).

A key feature and the benefit of using VU-TERM is the dynamic approach in which the shocks to capital and labour flow through the economy. This is particularly relevant to assessing a project such as Melbourne Metro which will have a significant impact on the capital stock of Victoria as well as the employment.

In order to assess the economy-wide impact, VU-COPS took the direct effects of Melbourne Metro Program and the Extended Program from the financial analysis and CBA and inputted these as economic shocks in the VU-TERM model.

Table 10-5 and 10-6 show the economy wide impact on employment and Gross State Product (GSP) and Gross Domestic Product (GDP) using 7 per cent and 4 per cent discount rates respectively.

Table 10-5 – Economy wide impact of Melbourne Metro using 7 per cent discount rate

| Melbourne Metro Program | | Construction period (2016-2025) | Operating period (2026-2056) | Total (2016-2056) |
|---|-----------|------------------------------------|---------------------------------|----------------------|
| Gross State Product / Gross Domestic Product | Victoria | \$1.9bn | \$5.3bn | \$7.2bn |
| | Australia | \$3.0bn | \$4.2bn | \$7.2bn |
| Jobs, number in peak year | Victoria | 3,900 | 470 | n/a |
| | Australia | 4,700 | 410 | n/a |
| Extended Program | | Construction period (2016-2030) | Operating period (2031-2056) | Total (2016-2056) |
| Gross State Product / Gross Domestic Product | Victoria | \$2.9bn | \$9.2bn | \$12.1bn |
| | Australia | \$3.8bn | \$8.4bn | \$12.2bn |
| Jobs, number in peak year | Victoria | 3,900 | 740 | n/a |
| | Australia | 4,700 | 600 | n/a |

Source: Based on VU-COPS, 2016. GSP/ GDP figures are presented in \$2015, real, present value terms discounted at 7 per cent.

Table 10-6 – Economy wide impact of Melbourne Metro using 4 per cent discount rate

| Melbourne Metro Program | | Construction period (2016-2025) | Operating period (2026-2056) | Total (2016-2056) |
|---|-----------|------------------------------------|---------------------------------|----------------------|
| Gross State Product / Gross Domestic Product | Victoria | \$2.2bn | \$11.7bn | \$13.9bn |
| | Australia | \$3.4bn | \$9.8bn | \$13.2bn |
| Jobs, number in peak year | Victoria | 3,900 | 470 | n/a |
| | Australia | 4,700 | 410 | n/a |
| Extended Program | | Construction period (2016-2030) | Operating period (2031-2056) | Total (2016-2056) |
| Gross State Product / Gross Domestic Product | Victoria | \$3.7bn | \$21.1bn | \$24.7bn |
| | Australia | \$4.7bn | \$19.4bn | \$24.0bn |
| Jobs, number in peak year | Victoria | 3,900 | 740 | n/a |
| | Australia | 4,700 | 600 | n/a |

Source: Based on VU-COPS, 2016. GSP/ GDP figures are presented in \$2015, real, present value terms discounted at 4 per cent.

On an annual basis, the largest economic impacts of Melbourne Metro on employment occur during the construction phase. These are positive as investment ramps up, with increases in the terms of trade leading to gains in both real wages and aggregate employment. The peak construction impacts occur in 2019, when real GSP for Victoria is up \$580m from the baseline and while real GDP is up \$960m.

In Victoria, net job creation peaks at 3,900 while nationally, 4,700 jobs are created at the peak of construction.

Operational impacts increase gradually from 2026, although with a step change in 2031 in the case of the Extended Program. Economic output grows through to 2056, but jobs peak in 2019. During the operation period, employment in Victoria is expected to be higher by around 470 jobs under the Melbourne Metro Program and by 740 jobs under the Extended Program.

Over the evaluation period, the analysis demonstrates that Victorian GSP is \$7.2bn higher with the Melbourne Metro Program and \$12.1bn higher with the Extended Program using a 7 per cent discount rate. Discounting by 4 per cent the Victorian GSP is higher by around \$13.9bn and \$24.7bn for the Melbourne Metro Program and the Extended Program respectively.

For Australia as a whole, the corresponding impacts are slightly lower, reflecting the relocation of some jobs to Greater Melbourne in response to the relatively higher levels of productivity resulting from Melbourne Metro. Productivity benefits of Melbourne Metro are reflected in higher average real wage rates at both state and national levels. By the end of the operational phase, increases in wages are a much more important source of benefits than are increases in employment, especially at the national scale.

10.10 Qualitative benefits excluded from assessment

Other economic effects were identified but have not been quantified. These range from some of the temporary effects of construction through to the potential for Melbourne Metro to enable urban consolidation in established areas. In addition, the benefits of facilitating electrification to Wallan and future rail links to Melbourne Airport and Rowville were not incorporated.

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CHAPTER 11

Risk analysis – Chapter Summary

- A comprehensive risk assessment process was undertaken according to the DTF High Value High Risk Guidelines and IA Guidelines to prepare the Business Case. This process included a series of workshops with key project team members, stakeholders and advisers.
- A comprehensive risk register that identifies and quantifies risks across a number of risk categories was developed.
- The top five quantified risks by value are:
 - Uncertainty and variability in the design and construction capital cost estimates (excluding risk), as a result of variability in the estimation inputs, including pricing, quantities and unit rates
 - The allowance for actual land acquisition is insufficient to deliver the preferred scope
 - A change in requirements during the design, construction and operations phase results in a change in scope
 - Ground conditions encountered during construction differ from those anticipated
 - Interface issues between the work packages are not managed effectively and commissioning interfaces between work packages do not align.
- Initial risk mitigation strategies were developed for all identified risks and are maintained and updated using risk registers.
- As the Risk Management Plan is finalised as part of the MMRA Project Management Framework, the risk registers will be continuously monitored, assessed and managed during the development and implementation of Melbourne Metro.



11 Risk analysis

11.1 Risk assessment process

Risk is defined as the chance of an event occurring that would cause actual circumstances to differ from those assumed when forecasting costs and revenues.¹

A comprehensive risk assessment process was conducted according to DTF's High Value High Risk Guidelines² and IA Guidelines³ to develop the Business Case. Figure 11-1 shows the key inputs, stages and result of this process.

Figure 11-1 – Risk assessment process



11.2 Risk assessment methodology

The risk assessment process was completed in four key steps, outlined below.

11.2.1 Development of the risk register

A risk register was developed referring to the extensive work undertaken in previous studies and supplemented and amended to consider risks associated with comparable large-scale infrastructure projects, including national and international large rail projects.

The risk register groups risks into the three broad categories:

- Inherent risks (capital costs) – inherent risks around the design and construction costs, Department delivery costs and land acquisition / business disruption costs
- Inherent risks (operating costs and revenues) – inherent risks around incremental revenues, operating and maintenance and asset renewal costs
- Contingent risks – contingent risks identified across the development phase. The contingent risks were grouped into categories that relate to: planning and approvals, land and property, stakeholders and community, design and scope, construction, commissioning and operational readiness, operations and maintenance, legal, commercial and procurement.

The risk register is provided in Appendix 7.

¹ While this Chapter focuses on risks that affect costs and revenues, there are other categories of risk, including those that affect benefits and outcomes.

² Department of Treasury and Finance, Investment Lifecycle and High Value High Risk Guidelines.

³ Infrastructure Australia, National Public Private Partnership Guidelines Volume 4: Public Sector Comparator Guidance.

11.2.2 Risk workshops

Numerous risk workshops were undertaken as part of the risk assessment process. These workshops involved key project team members, stakeholders (including representatives from PTV, DTF and DPC) and advisers (including technical, commercial and financial specialists). These individuals were responsible for updating, reviewing and validating the risk register and determining the inputs into the risk quantification calculations.

Risk identification workshops

Risk identification workshops were conducted to review and refine the draft risk register developed in Step 1 (Development of the risk register) above. The risk identification workshops involved:

- Introducing and providing an overview of the purpose of the risk register in the context of the Business Case
- Identifying risks associated with Melbourne Metro
- Agreeing on appropriate definitions for each risk.

When all of the risk identification workshops were completed, the workshop facilitator and key project team members consolidated, reviewed and refined the risk register.

Risk quantification workshops

Risk quantification workshops were conducted after the risk identification workshops. The workshops involved:

- Confirming appropriate definitions for each risk
- Identifying potential mitigation strategies
- Agreeing on drivers (i.e. indicative cost line or delay) to be applied to each quantifiable risk
- Quantifying risk (see below).

When the risk quantification workshops were completed, the workshop facilitator and key project team members again consolidated, reviewed and refined the risk register.

Risk correlation workshop

A risk correlation workshop was conducted after the risk quantification workshops. The workshop involved:

- Identifying key delay and cost risks
- Identifying positive or negative correlation between these risks
- Developing correlation factors to include in the risk quantification process.

When the risk quantification and correlation workshops were completed, the workshop facilitator and key project team members reviewed and refined the risk register.

11.2.3 Risk quantification

Risk was quantified using a three-point estimate to quantify the financial impact of each risk. This estimates the probability of the risk occurring and its impact in the three defined states i.e. best, most likely and worst-case.

Cost risks were quantified by estimating the percentage impact on a cost or revenue if the risk was to occur in each of the three defined states.

Delay risks were quantified by estimating the months of delay the risk would result in for each of the three defined states and applying a dollar value (reflective of increased cost and indexation) depending on when the risk is likely to occur.

The expected value of each risk was then calculated based on the probability of the risk occurring and the sum of the products of the impact (either as a percentage of the cost driver or delay costs) and their probabilities in each of the three defined states. Correlation between key risks was calculated using a correlation matrix. A Monte Carlo analysis was then used to calculate the P50 and P90 values.

11.2.4 Review and refinement

Subsequent to the initial calculation of risk adjustments, further sessions were held with key project team members, stakeholders and specialist advisers to review and refine the risk register.

11.3 Key Melbourne Metro characteristics

Melbourne Metro has a number of defining features that significantly influence the overall risk profile. These key characteristics are:

- Retrofitting major infrastructure into an existing developed urban environment, including construction activities through the CBD and other Central Melbourne areas and managing the surface level disruption and staging solutions during these construction activities
- To deliver the new infrastructure in Central Melbourne, much of the construction works are underground and must contend with geologic formations which are among some of the more complex on a global scale
- Like many large-scale rail projects in cities with established rail networks, Melbourne Metro deploys contemporary rail systems and interfaces with the existing rail network
- The statutory approval process is currently underway and, until it is complete, its outcomes are unknown
- The scale of the works is very large on a national scale and requires careful consideration of market capacity and the need to establish competitive tension through a procurement process.

11.4 Key assumptions

The risk assessment process relied to a large extent on a forward-looking approach that focuses on risks with a relatively high probability of occurring and those that would have a material impact if they were to occur.

Identifying and quantifying the risks is largely shaped by the project team, stakeholders and advisers' collective experience with similar large-scale transport construction and operations projects. Due to the nature of risk, not all circumstances that may influence the project outcomes can be estimated at this stage.

As part of the risk assessment process, a number of unquantifiable risks were identified. A risk is classified as unquantifiable when its cost impact cannot be estimated. An allowance for the unquantifiable risks was not included in the risk adjusted cost forecasts, however these risks can be significant and will be closely managed and monitored during the development of Melbourne Metro.

11.5 Quantifiable risks

Table 11-1 summarises by category the highest value risks identified through the risk assessment process and the risk mitigation strategies developed to respond to these risks. Refer to Appendix 7 for a full copy of the risk register.

Table 11-1 – Melbourne Metro Program key risks

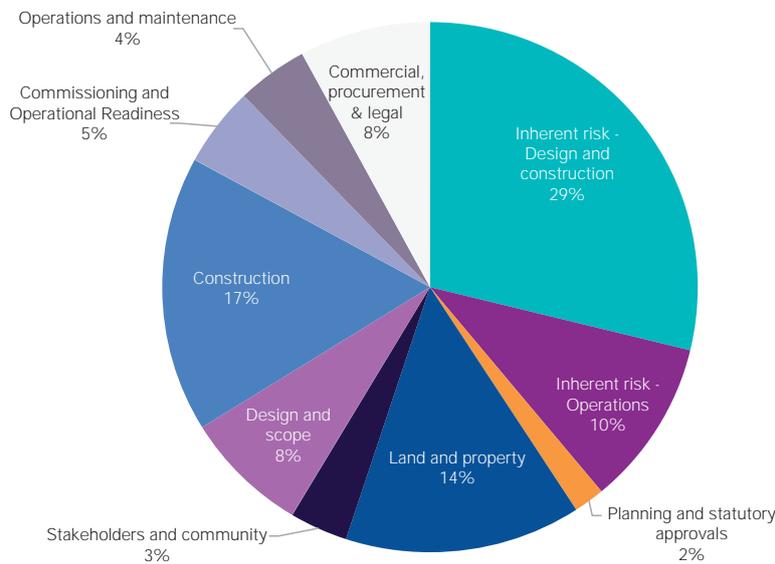
| Risk Category | Key risks | Risk mitigation strategies |
|--|---|---|
| Inherent risk – Design and Construction | Uncertainty and variability in the capital cost estimates (excluding risk), as a result of variability in the estimation inputs including pricing, quantities and unit rates. | Capital cost estimates have been developed by the Department and the Cost Adviser. Estimates have undergone an extensive review and refinement process including peer review and benchmarking. |
| Inherent risk – Operations | Uncertainty and variability in the cost estimates (excluding risk) during operations, as a result of variability in the estimation inputs including pricing, quantities and unit rates. | Operating cost estimates have been developed by PTV and have undergone an extensive review and refinement process, including peer review and benchmarking. |
| Planning and statutory approvals | Necessary planning and statutory approvals are not obtained in the required timeframe (or at all), and/or anticipated form and with the anticipated conditions. | A comprehensive EES will be prepared to inform the Minister for Planning’s assessment of the project. Approvals for the Wider Network Enhancements will be obtained, as required, for each enhancement project. The necessary planning and statutory approval documentation will be drafted and reviewed by the Department and approval agencies to ensure there is awareness of the approvals that are likely to be required. In addition, a detailed planning and statutory approvals program has been developed and is being tracked against other work streams to ensure that approvals will be obtained in a timely manner. |
| Land and property | Inherent risk – land and property. Uncertainty and variability in the land and property cost estimates (excluding risk), as a result of variability in the estimation inputs, including pricing and quantities. | The land requirements have been identified at an early stage and continue to be reviewed at appropriate milestones throughout the design and stakeholder consultation process. |
| Land and property | Proposed land development at specific sites requires additional funding for compensation. | Conduct sufficient design work to confirm early land acquisition opportunities and brief senior executives on these opportunities (mitigating the risk that land will be developed prior to acquisition). The Victorian Valuer-General’s estimates are being used to estimate the value of land for acquisition and compensation payable to land owners. |
| Stakeholders and community | Stakeholder and community concerns on key project elements or project delivery results in delay and/or additional scope. | A communications and stakeholder relations strategy has been implemented to ensure meaningful engagement throughout the planning, development and delivery phases. The strategy aims to mitigate potential risks by: <ul style="list-style-type: none"> • Initiating proactive and early engagement and communication with stakeholders and the community and maintaining contact throughout all phases of the project • Generating stakeholder involvement, understanding and support by raising awareness of the direct and indirect benefits across the rail network and by actively addressing any issues or concerns • Building MMRA’s understanding of stakeholder interests, concerns and preferred outcomes • Eliciting important information from stakeholders about technical, social and community requirements to inform the planning, design and delivery teams. This includes closing the loop with stakeholders to demonstrate how |

| Risk Category | Key risks | Risk mitigation strategies |
|--|---|--|
| | | feedback has been considered and incorporated, if appropriate. |
| Design and scope | A change in requirements during the design, construction and operations phases results in a change to the scope. | A transparent design based process (which includes early engagement and communication with stakeholders), along with the implementation of a change management system to ensure that the scope of design meets the requirements. |
| | The signalling design process does not deliver in accordance with requirements. | The procurement strategy and subsequent contractual arrangements will incorporate a review and evaluation of the detailed design solution to ensure that it addresses the requirements. |
| | Scope of Wider Network Enhancements does not deliver the desired operational outcomes. | The Wider Network Enhancements will be scoped at an early stage, with the involvement of relevant stakeholders. |
| Construction | Early works are not adequately scoped and completed within the specified time frame. | Early works are to be scoped at an early stage, with the involvement of relevant stakeholders. The implementation program for early works will be aligned with the delivery of the main works contract. |
| | Ground conditions encountered during construction differ from those anticipated. | The equipment and techniques assumed for the purposes of the design and construction costs incorporate the ability to deal with a variety of geotechnical conditions that may be encountered. Geotechnical experts and geotechnical studies (subject to peer review) will be utilised to provide greater certainty around the existing ground conditions. Extensive investigations have already been undertaken and are continuing. |
| | The condition of existing assets are worse than expected. | Early studies of existing assets to scope required works. |
| | There is insufficient resource capacity across the key stakeholders and contractors. | Implementation of an appropriate governance system, along with planning and communication with key stakeholders. Provision of resource support by outsourcing responsibilities. |
| | Defects in either the design or construction become apparent during the commissioning phase. | Implement design and construction verification and validation through the delivery phase. Defect responsibility and management is included in the relevant contract / legal documentation. |
| Commissioning and operational readiness | There is inadequate consideration of O&M during detailed design e.g. inadequate access for maintenance and impacts during breakdowns. | Development of safety assurance reports and supporting documentation to demonstrate that project has been designed, constructed and commissioned to be operated and maintained efficiently and safely. Relevant rail operators are embedded in the project team. |
| Operations and maintenance | Scope and technical requirements outline key commissioning milestones and requirements. | Implement design and construction verification and validation through the delivery phase. Defect responsibility and management is included in the relevant contract / legal documentation. |
| Commercial / procurement / legal | The packaging strategy is not optimal and the interface issues between the work packages are not managed effectively. | Implementation of a procurement options analysis, in conjunction with carrying out market sounding with the industry. Develop appropriate interface deeds and commercial incentives in the contracts to encourage and manage interface between work packages. |
| | Change in procurement timelines. | Development, review and approval of the implementation program and procurement strategy. |

| Risk Category | Key risks | Risk mitigation strategies |
|---------------|---|---|
| | | Ongoing communications and stakeholder relations strategy will be implemented to manage stakeholder relationships and expectations. |
| | Allowance for construction period is insufficient and tenderers indicate that construction will take longer than initially estimated. | Development, review and approval of the construction program. |

Figure 11-2 illustrates that the inherent design and construction cost forecast risks are the largest risk category by quantified impact. The inherent design and construction cost forecast risk includes the inherent uncertainties in cost estimates due to potential for changes to factors such as unit prices for project inputs (labour, materials, and equipment), choice of materials and the quantities of inputs required.

Figure 11-2 – Risk by category (percent of total quantified risk)



The results of the risk assessment process were included in the financial analysis presented in Chapter 12 and the economic analysis presented in Chapter 10. The relative magnitude of the risks compared to major cost categories is also illustrated in Chapter 12.

11.6 Unquantifiable risks

A risk is classified as unquantifiable when its cost impact cannot be estimated. An allowance for these risks was not included in the risk adjusted cost forecasts.

A number of unquantifiable risks were identified during the risk assessment process. Table 11-2 provides an outline of the key unquantifiable risks identified and the risk mitigation strategies developed to respond to these risks.

Table 11-2 – Key unquantifiable risks

| Risk Category | Description | Risk mitigation strategies |
|---|---|--|
| Stakeholders and community | The risk that despite community and stakeholder consultation, there are concerns around the impacts of day one train operations, including noise and vibration. | <p>A number of strategies are available to mitigate this risk, including:</p> <ul style="list-style-type: none"> • Appropriate specialist noise and vibration engineering in the design • Undertaking baseline noise and vibration modelling • Implementing the noise policy • Undertaking property condition reports before construction • Providing simple and clear material to the community which explains the noise and vibration impacts and how they are measured and controlled. |
| | Lack of stakeholder and community understanding around the benefits of carrying out early works. | <p>Implementation of a specific early works stakeholder and community engagement strategy.</p> <p>Communication and relationships with the community and key stakeholders are maintained to manage awareness and understanding of the benefits of early works.</p> |
| Construction | Construction activities limit public access to cultural institutions, community facilities (e.g. Arts Centre, State Library, and Federation Square). | Implementation of a communications and stakeholder relations strategy to ensure meaningful engagement throughout the planning, development and delivery phases. |
| Operations and maintenance | The risk that maintenance activities have an adverse impact on other infrastructure. | Engagement with relevant authorities that are responsible for the affected infrastructure to coordinate maintenance activities to minimise adverse impacts. |
| Commercial / procurement / legal | The new franchise agreement does not capture the Melbourne Metro operating model. | Appropriate engagement and level of involvement in the new franchise agreement to ensure the Melbourne Metro operating model and the Franchise Agreement are appropriately aligned. |

11.7 Ongoing risk management and monitoring

Due to the nature of risk, not all circumstances that may influence the outcomes of Melbourne Metro are known or can be estimated at this stage. Risk will be monitored, assessed and managed during the development and implementation of the project according to the MMRA risk management plan and Department guidelines.

The risk register will be updated and refined for:

- Incorporation in the Risk Management Plan: The likelihood and consequence of the risks identified will be assessed to rank and manage those key risks of higher probability and consequence according to Australian Standard AS/NZS ISO 31000 Risk Management Standard and Department guidelines
- Public Sector Comparator for Procurement: Following the completion and refinement of tender documentation, the risk register will be updated, including allocating transferred and retained risks to the party best able to manage them to facilitate a risk adjusted bid comparator for evaluation purposes.

Risk will be identified and categorised as either strategic or operational (project level) risks. Strategic risks are those that are expected to have broader impacts beyond the project, for example, interagency risks and state-wide risks. The Risk Management Committee will review these as a part of the program-wide Risk Management Plan that the Coordinator-General manages. These may have state or region-wide significance and require high levels of management and coordination.

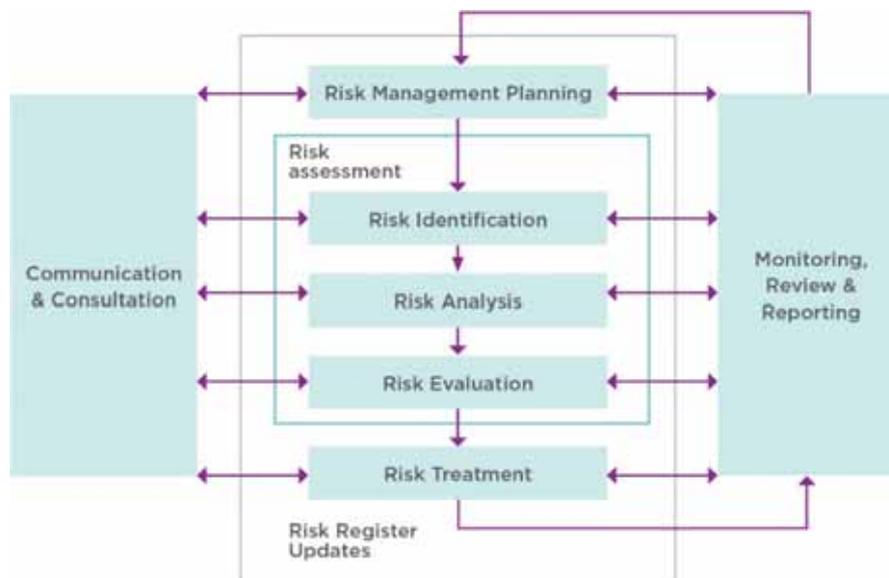
Operational risks are those that have a specific impact on the project’s ability to meet its objectives or operate in the specified constraints.

Key features of the proposed risk identification and management process will incorporate:

- Assigning ownership and treatment actions to all risk treatments in the project risk register(s) (particularly for those risks that require urgent and immediate action)
- Assigning an open or closed status to each risk. Risks will be listed as closed (but not deleted) when they are completely mitigated by some form of treatment or as a project milestone
- Identifying and managing a risk profile for strategic and operational risks using the dedicated risk register.

Figure 11-3 outlines the proposed risk management process.

Figure 11-3 – Proposed Risk Management Process



Risks will be managed in the proposed governance structure for the project:

- The CEO or delegate is responsible for monitoring and re-assessing risks and risk ratings, maintaining and updating the risk register, identifying potential treatments for risks and escalating risk management to the Projects Steering Committee as appropriate
- Strategic, High or Significant rated risks and the proposed treatment will be reported to the Projects Steering Committee, Risk Management Committee or Board as required (see Chapter 18 for details regarding the project Governance Framework).

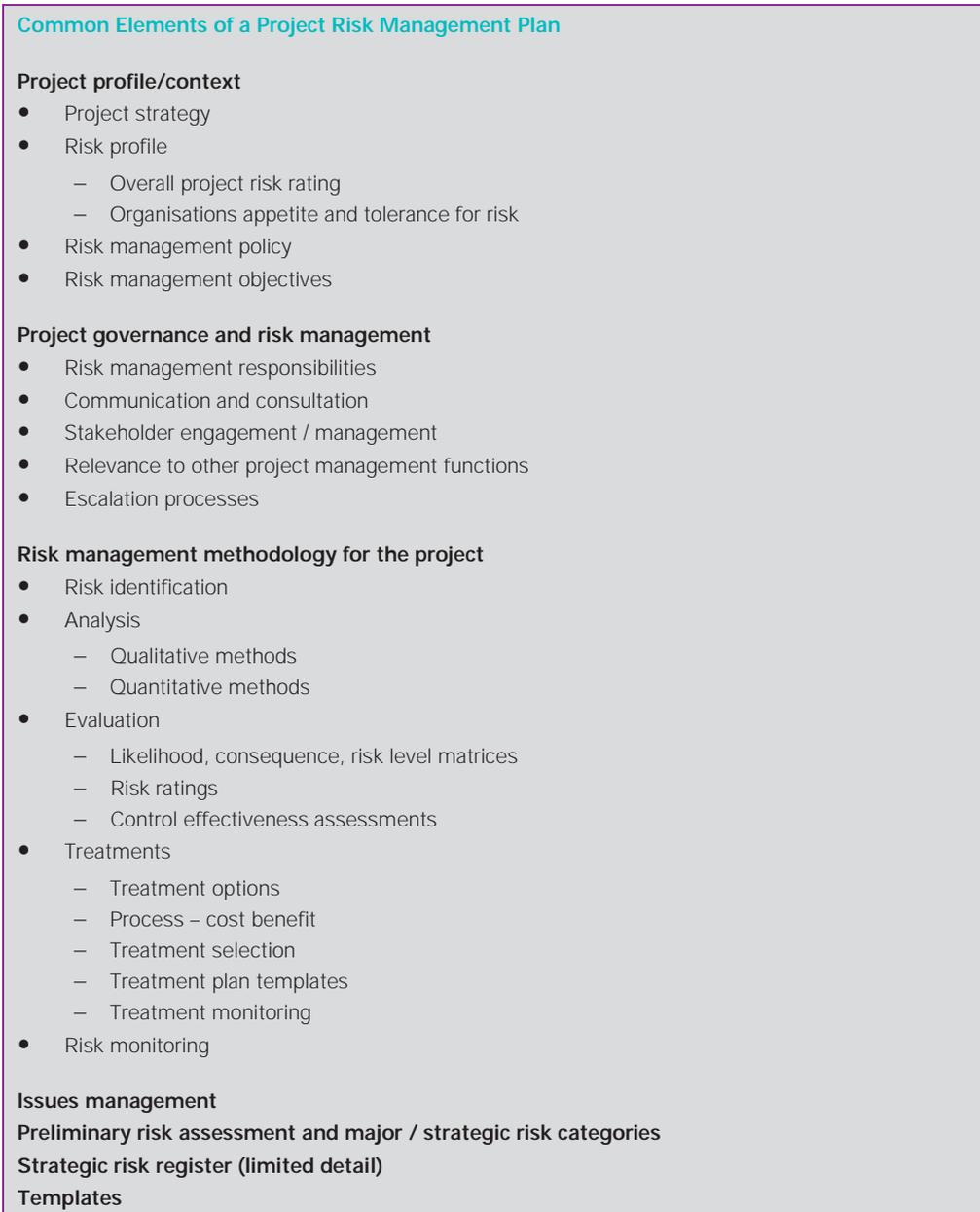
11.8 Risk Management Plan

Figure 11-4 provides an example of the typical outline of a Risk Management Plan.⁴ The plan provides an appropriate risk management framework that facilitates management decisions to allow the delivery of project objectives in the specified constraints (e.g. time, cost and quality).

Once approvals are received for Melbourne Metro, the Risk Management Plan, including the current risk register, will be developed and implemented.

⁴ Investment Lifecycle Guidelines, *Supplementary Guidance - #2. Project Risk Management Guidance*, Department of Treasury and Finance (2009).

Figure 11-4 – Outline of a Risk Management Plan



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CHAPTER 12

Financial analysis – Chapter Summary

- This Chapter provides an overview of the approach to develop the financial estimates, key inputs and assumptions, and the results of the financial modelling.
- The analysis was undertaken on a risk-adjusted basis at the P50 and P90 confidence levels, which means that estimates were adjusted to allow for the variability in forecast project costs and revenues to 50 per cent and 90 per cent certainty levels.
- The total risk adjusted capital cost of the project is summarised in the table below:

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- The risk adjusted capital costs above include Department delivery spend to date that commenced in 2014.
- *Redacted - commercial-in-confidence*
- Opportunities exist to partially defray the operating costs of the project through revenue from station commercial and retail opportunities and advertising revenue.
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- These costs exclude rolling stock (including associated stabling, maintenance and power upgrades) required to deliver the initial service plan proposed for 2026. Rolling stock and Enabled Investments will be subject to separate future funding requests.
- Opportunities to reduce costs and enhance revenues will continue to be identified as the project progresses.



12 Financial analysis

This Chapter provides an overview of the methodology used to develop the financial estimates and the key inputs / assumptions used to prepare the financial analysis and the key results from the financial modelling of the project. It excludes the cost of rolling stock and Enabled Investments which are subject of future, separate funding requests.

The real financial results presented in the Business Case are in 31 December 2015 dollars. Nominal financial results were developed by escalating real financial results to year of expenditure dollars using appropriate indexation rates.

Present values were obtained by discounting nominal project cashflows by the evaluation discount rate of 3.18 per cent to 30 June 2016. This methodology is consistent with the public sector comparator approach used during procurement.

The analysis presented in this Chapter differs from the economic analysis presented in Chapter 10. It does not include estimates of external costs and benefits. Refer to Chapter 10 for further detail as to what is included in the economic assessment.

12.1 Summary of financial results

Table 12-1 provides a summary of project capital costs in real, nominal and present value terms. Capital costs are presented on a:

- Tunnel and stations civil works basis (i.e. where costs relating to the Wider Network Enhancements are excluded)
- Project basis (i.e. where costs relating to Wider Network Enhancements are included).

Table 12-1 – Summary of project capital costs

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Estimates for the total risk adjusted capital costs for the project in nominal terms is between \$10.2bn and \$10.9bn with a 50 per cent and 90 per cent probability respectively that actual project costs will be below these estimates.

Table 12-2 summarises the project cashflows for the 30 year evaluation period following construction completion in real, nominal and present value terms. Cashflows relate to the infrastructure developed as part of the project and exclude incremental farebox revenues and operations of rolling stock (including associated stabling, maintenance and power upgrades).

Table 12-2 – Summary of project cashflows during the operations phase (30 years)

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12.2 Financial analysis methodology

12.2.1 Development of the financial model

A detailed financial model was developed to support the financial assessment of the project. The financial model presents the total financial picture of the project by bringing together all costs and revenues associated with the project delivery that this Business Case seeks an investment decision for (the scope of which is outlined in Chapters 7 and 8).

The evaluation period for the purpose of the financial assessment consists of the project development phase plus 30 years of operations.

The financial model was structured to support the analysis of:

- Risk adjusted whole-of-life costs and revenues of the project on a real, nominal and present value basis
- Timing of risk adjusted project cashflows
- Packaging and procurement strategy.

The financial model was developed according to best practice modelling principles and was internally reviewed and tested.

12.2.3 Key inputs and assumptions

The financial model was prepared using inputs and assumptions prepared and/or provided by key project stakeholders. Table 12-3 sets out the inputs and assumption and the relevant sources used in the financial model.

Table 12-3 – Financial modelling inputs

| Input | Description | Source |
|--|--|----------------------------------|
| Timing | <ul style="list-style-type: none"> Development phase: 2014 to 2025 Operations phase: 2026 to 2056 | Project Team |
| Evaluation period | <ul style="list-style-type: none"> Evaluation period consists of the development phase plus the operations phase (30 years of operations) No terminal value is included. | Project Team |
| Escalation | <ul style="list-style-type: none"> Construction: 2.60% p.a. (to June 2018) and 3.2% p.a. thereafter | Project Team |
| | <ul style="list-style-type: none"> Land acquisition and associated costs: 6.0% p.a. | Project Team |
| | <ul style="list-style-type: none"> Operations and maintenance costs: 2.5% p.a. | Project Team |
| | <ul style="list-style-type: none"> Asset renewal costs: 2.5% p.a. Revenues: 2.5% p.a. | Project Team |
| Discount rate | <ul style="list-style-type: none"> 3.18% (nominal) - Treasury Corporation of Victoria 10 year bond yield for December 2015 | Treasury Corporation of Victoria |
| Capital costs | <ul style="list-style-type: none"> Capital Expenditure Estimate Report, as set out in Appendix 8 | Aqunta |
| Operating and maintenance costs | <ul style="list-style-type: none"> Melbourne Metro Operations Cost Estimate Report, report dated December 2015 | Aqunta / PTV |
| Asset renewal costs | <ul style="list-style-type: none"> Melbourne Metro Operations Cost Estimate Report, report dated December 2015 | Aqunta / PTV |
| Revenues | <ul style="list-style-type: none"> Other revenues (station retail and advertising opportunities) | Project Team |

The analysis outlined in this Chapter is based on a set of assumptions and to the extent that assumptions change the results of the analysis may vary. There will also usually be differences between forecast or projected and actual results because events and circumstances frequently do not occur as expected or predicted and those differences may be material.

12.3 Capital costs

The capital cost estimates consider the development of all aspects of the infrastructure, stations and facilities and land required. The costs comprise the following components:

- Early works – relocation / protection of utilities including sewerage, gas, electricity, water, stormwater and telecommunications, works to prepare construction sites, construction power and tram diversion works
- Tunnels – construction of tunnels along the alignment
- Stations – five underground stations and their associated fit out. This includes equipment and plant, buildings and structures and electrical and mechanical elements
- Western Portal and Eastern Portal – site establishment, structures to support the tunnel portals and reconfiguration and realignment of existing lines
- Rail Systems – signalling, control systems, communications, overhead wiring, electricity distribution and rail installation

- Western turnback – construction of a turnback at the western end of the Sunshine – Dandenong Rail Corridor
- Wider Network Enhancements – works required across the wider existing above ground rail network (outside of the tunnel and beyond the tunnel portals), including turnbacks, signalling outside of the tunnels and minor station works
- Land acquisition and associated costs – land acquisition costs that will be incurred to deliver the project
- Department delivery costs – costs incurred by government to develop the project including: planning and design costs (including procuring and preparing construction contracts and establishing a project management framework to oversee the development of the system) and construction oversight (project management, supervision, documentation and compliance).

Capital cost estimates have undergone an extensive review and refinement process including a full independent cost review of the project to determine if the results are within the expected range when compared against other benchmark projects and first principles rates for labour, plant and materials.

Design and construction cost estimates were developed by the cost estimator on a first principles basis using inputs provided by the technical adviser, the constructability adviser and the Project Team.

Construction costs associated with the alignment were estimated by compiling the data generated by the Technical Adviser (e.g. length of tunnels) and applying appropriate unit rates for each cost component. The unit rates were developed in a bottom-up manner by the Cost Estimator and were benchmarked against recent domestic and international experience.

Other cost components, such as stations, were based on the design specifications produced by the Technical Adviser. Individual unit rates for each cost type reflect current industry norms and were applied against the appropriate units of measurement (area, volume and others). Where design development is not sufficiently detailed, benchmark rates and costs from similar projects were used.

Costs relating to land include all land to be acquired for temporary and permanent purposes, for the construction, development and operation of the project. This includes land for stations, depots and stabling facilities, tunnel ventilation and emergency ingress / egress shafts. The Project Team developed land and property estimates based on Valuer General Assessments plus allowances for professional expenses, replacement property costs and other allowable items such as solatium.

Department delivery costs reflect the proposed project organisational structure, suite of advisers, and key stakeholder costs associated with the development of the reference design, procurement and the delivery phase. This was benchmarked against similar programs such as RRL.

Further details on the Capital Expenditure Estimate Report are provided in Appendix 8.

As there is inherent uncertainty around actual capital costs, risk adjustments were developed using the risk quantification process outlined in Chapter 11 and applied to the capital cost estimates to present risk adjusted project cost estimates and the P50 and P90 confidence levels. More details are provided in Chapter 11.

Table 12-4 outlines the project capital costs at the P50 and P90 confidence levels.

Table 12-4 – Capital costs

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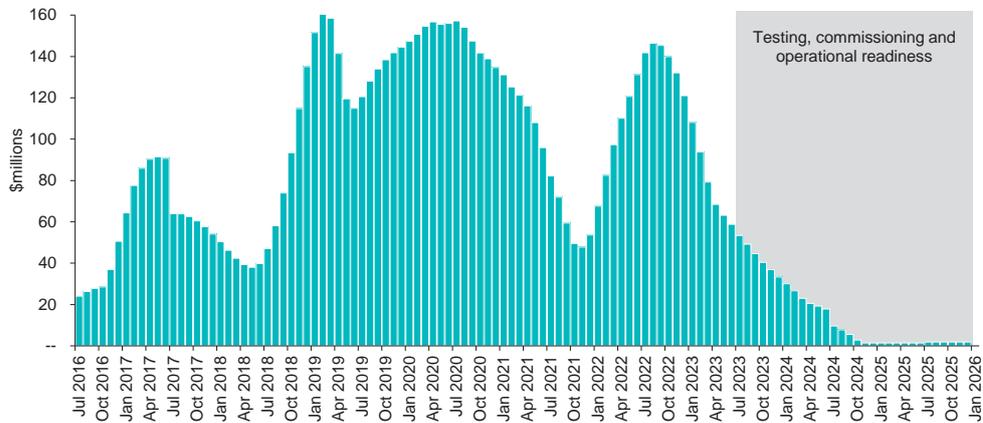
The capital costs above include Department delivery spend to date that commenced in 2014.

It is noted that opportunities exist to partially defray the capital cost of the project through integrated development opportunities. *Redacted - commercial-in-confidence*

Further work is required, however, to refine the value of these opportunities. Further details are provided in Chapter 15.

Figure 12-1 illustrates monthly real risk adjusted capital costs.

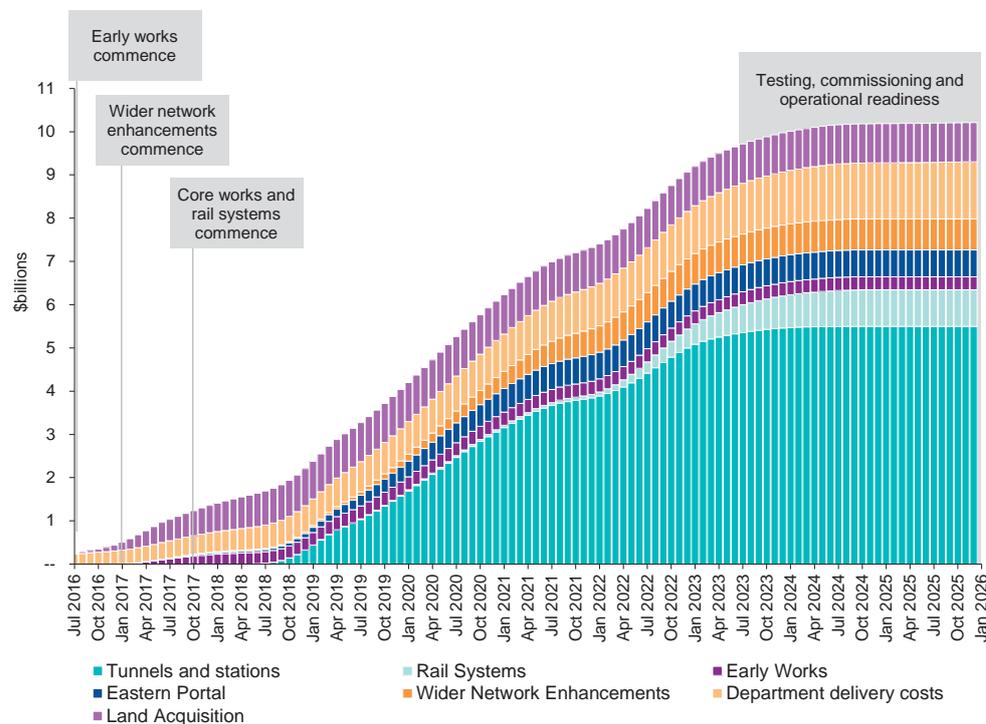
Figure 12-1 – Monthly risk adjusted capital costs (P50)



Source: KPMG analysis.

Figure 12-2 presents the cumulative nominal risk adjusted capital cost of the project over the development phase and includes the timing of a selection of key activities.

Figure 12-2 – Cumulative nominal risk adjusted capital costs (P50)



Source: KPMG analysis.

The profile of the capital costs and when they will be incurred depends primarily on the implementation plan and the timing of the construction of individual work packages. The Early Works package is the first to commence and the Tunnel and Stations package is the largest. Land acquisition will be undertaken early in the delivery of the project and Department delivery costs will be incurred throughout project delivery.

The cashflow levels off towards the end of the project development phase as a consequence of testing, commissioning and operational readiness activities. These activities involve a relatively low spend when compared to construction. This aspect of the profile also represents an allowance of appropriate time contingency.

Figure 12-3 summarises the risk adjustment percentages applied to the project capital costs to derive the risk adjusted project costs at the P50 and P90 certainty levels. Refer to Chapter 11 for an outline of how the risk adjustments were determined.

Figure 12-3 – Summary of capital cost risk adjustment percentages

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Figure 12-4 provides a breakdown of the percentage risk adjustments applied to the key cost elements to derive the risk adjusted capital cost estimate.

Figure 12-4 – Summary of capital cost risk adjustments by project component

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The key areas of risk include land acquisition, Wider Network Enhancements and rail systems. This will inform the overall risk management plan.

12.4 Cashflows during the operations phase

Cashflows during the operations phase refers to the incremental costs and revenues associated with maintaining and operating the infrastructure created by the project (excluding rolling stock and costs of running the services) over the 30 years of operations included in the evaluation period.

Table 12-5 summarises the project cashflows during the operations phase in real, nominal and present value terms over the evaluation period.

Table 12-5 – Summary of cashflows during the operations phase

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Sections 12.4.1 to 12.4.3 provide a further breakdown of the above results.

12.4.1 Revenue

The incremental revenues associated with the project include revenue from retail within the stations and from advertising.

An opportunity may exist to generate additional revenue by providing space for utility services including fibre optic cables, however, further work is required to refine the value of these opportunities. Additional description of these revenue opportunities is presented in Chapter 15.

Incremental farebox revenue was excluded because this is not solely attributable to the project. Revenue from value capture opportunities is also not included in this analysis.

Table 12-6 outlines the risk adjusted revenues.

Table 12-6 – Revenue

*Redacted
commercial-in-confidence*

12.4.3 Operating and maintenance costs

Operating and maintenance costs are the costs associated with the project. These include:

- Stations – operation of the five new stations, including: management, maintenance of lifts and escalators, passenger information displays, station ventilation and air-conditioning, CCTV and recording, fire detection/prevention, cleaning and landscaping, pest control and waste management
- Station utilities – power and water for the five new stations
- Power systems – maintenance of additional substations and power systems in the five new stations
- Track – regular maintenance of track in the tunnel and Wider Network Enhancement areas
- Ticketing – vending machines, gate maintenance, card readers, ticket office terminals, cash clearing and revenue reconciliation
- Direct labour – station labour (Station Masters, Station Officers, Barrier Assistants and Protective Service Officers)
- Overhead contact systems – regular maintenance of overhead contact systems in the tunnel and Wider Network Enhancement areas
- Operating control systems – operation and regular maintenance of train control systems in the tunnel and Wider Network Enhancement areas
- Platform screen doors – operation and regular maintenance of platform screen doors in the stations
- Signalling – operation and regular maintenance of signalling in the tunnel and Wider Network Enhancement areas
- Other – insurance, consultancy and legal services.

PTV developed the operating and maintenance cost estimates using service plan modelling results and current industry data. These estimates were risk adjusted using the risk quantification process as outlined in Chapter 11.

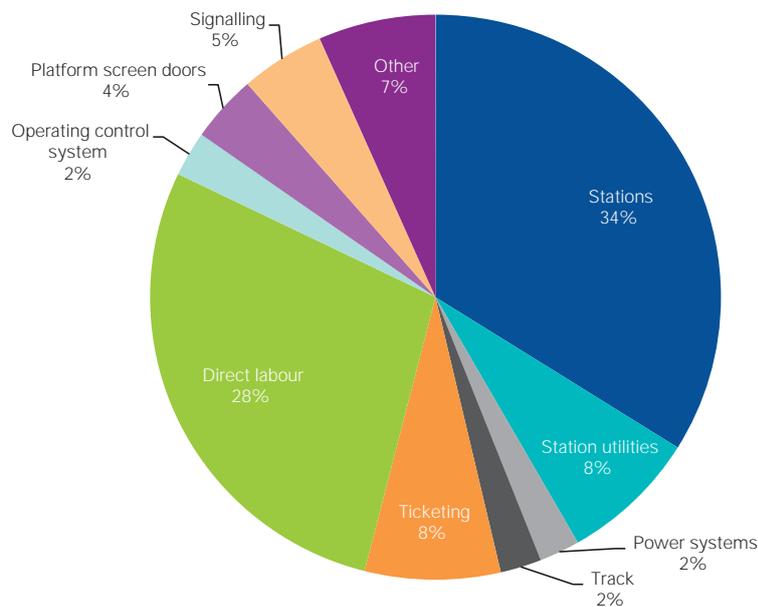
Table 12-7 outlines the risk adjusted project operating and maintenance costs.

Table 12-7 – Operating & maintenance costs

*Redacted
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Operating and maintenance costs are generally fairly constant over time on a real basis and the composition remains relatively static for the proportions of individual cost elements (shown in Figure 12-5). Station operation and maintenance and labour costs account for the majority of the total costs.

Figure 12-5 – Risk adjusted operating and maintenance costs by type (Real)



12.4.4 Asset renewals

Asset renewals are the costs associated with capital maintenance (major maintenance, refurbishment or replacement) of the project infrastructure over the 30 year operating period modelled. These costs include:

- Stations – major maintenance and refurbishment of lifts and escalators, platform screen doors, station lighting and signage, passenger information displays, station ventilation and air-conditioning, CCTV and recording, fire detection / prevention, plumbing and power systems
- Track – major maintenance and replacement of track in the tunnel and Wider Network Enhancement areas
- Signalling – major maintenance or replacement of signalling in the tunnel and Wider Network Enhancement areas
- Operating control systems – major maintenance or replacement of train control systems in the tunnel and Wider Network Enhancement areas
- Tunnel system – major maintenance of tunnel structure, tunnel lighting, pumps, fire detection / prevention, power systems and other miscellaneous tunnel system renewals
- Overhead contact systems – major maintenance or replacement of overhead contact systems in the tunnel and Wider Network Enhancement areas.

PTV developed the asset renewal cost estimates using asset useful lives and industry data. These estimates were risk adjusted using the risk quantification process as outlined in Chapter 11.

Table 12-8 outlines the risk adjusted project asset renewal costs.

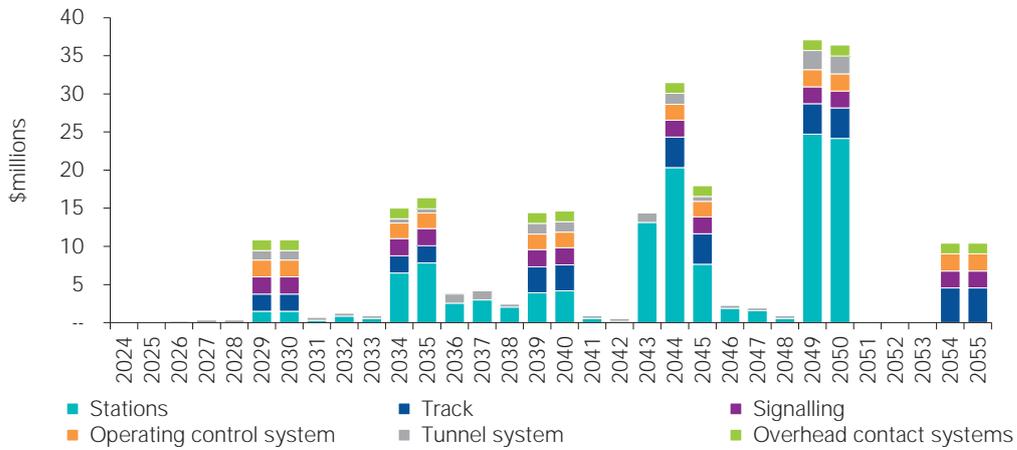
Table 12-8 – Asset renewals

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commercial-in-confidence*

Figure 12-6 illustrates the profile of the risk adjusted asset renewal costs of project over the 30 year operating period and highlights:

- The lumpy nature of asset renewal costs
- Spikes every five years for track, signalling, operating control system, tunnel system and overhead contact systems
- Additional large spikes in asset renewals at years 20 and 25 relating to stations.

Figure 12-6 – Risk adjusted asset renewal costs (Real)



For assets with a very long useful life (e.g. tunnels), limited asset renewal costs are forecast to occur during the 30 year operating period, however maintenance costs are incurred as detailed in section 12.4.2 above.

CHAPTER 13

Preliminary environmental and social assessment – Chapter Summary

- To identify the potential environmental, social and economic effects associated with Melbourne Metro and possible responses to these impacts, a preliminary assessment was undertaken in relation to the tunnel and stations to inform the Project Outline submitted to the Minister for Planning.
- The assessment indicates that the construction of the tunnel and stations potentially has a significant effect on the environment. The potential impacts arise primarily during the construction of the project, and will be temporary and predominately localised. This preliminary assessment informed the Minister for Planning's decision that an EES process be used to assess the project's impacts and provide recommendations to mitigate impacts. The EES process will assess potential impacts and identify project-specific management measures which will inform project approvals.
- The Premier declared the project under Section 10 of the *Major Transport Projects Facilitation Act 2009 (MTPF Act)* for land acquisition and project delivery powers. This will allow land acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986 (LAC Act)* and the *MTPF Act*.
- Melbourne Metro will result in positive, metropolitan-wide environmental and social effects, during the operation phase, including:
 - Improved accessibility to key services, health, education, jobs and opportunities
 - Stronger retail and commercial development through higher density residential development in and around train stations and activity centres
 - Increased residential development and greater housing choice in Melbourne's established areas.
- MMRA has committed to achieving excellent environmental, social and economic outcomes across all phases of the project, managing disruption impacts with appropriate mitigation strategies and the application of environmental performance requirements, and delivering an integrated outcome that connects the community in an environmentally sustainable manner.
- Sustainability themes and targets are currently being developed to guide design and delivery of the project across a range of project elements, including excellence, urban ecology and vegetation, climate resilience, supply chain, communities, workforce, energy, material and waste and water.



13 Preliminary environmental and social assessment

13.1 Overview

A preliminary assessment was undertaken to identify the potential environmental, social and economic effects associated with the project and management measures.¹ This preliminary assessment considered the scope and alignment recommended in Chapter 7.

The preliminary assessment indicates that the construction of the Melbourne Metro tunnel and stations has the potential to have a significant effect on the environment. This preliminary assessment informed the Minister for Planning's decision that an EES process should be used to assess the project's impacts and identify measures to manage or mitigate impacts and realise the benefits.

Overall, this Chapter confirms that:

- When combined with Wider Network Enhancements, the potential project benefits will result in permanent, important and positive environmental and social effects, during the operation phase, to the broader Melbourne region
- The potential impacts arise primarily during the construction of the tunnel and stations, and will be temporary and predominately localised
- The EES process will assess the potential benefits and impacts of the project, determine the appropriate mitigation measures required to manage adverse impacts from the project, and inform approval decisions.

Managing the impacts of tunnelling

While tunnelling reduces surface impacts considerably, it creates other challenges that need to be carefully considered and managed. These include managing building settlement, spoil, noise, vibration and groundwater.

While these challenges are potentially significant, they are common in tunnelling projects in highly-urbanised areas and will be managed using the project's environmental performance requirements, specifically appropriate tunnel design, using proven tunnel construction methods, pre-construction groundwater and geotechnical studies, appropriate traffic management measures and appropriate monitoring programs during construction.

¹ MMRA, Project Overview (2015).

13.2 Environment

13.2.1 Context

The Melbourne Metro tunnel traverses the heart of Melbourne's CBD and passes through the inner suburbs of Kensington, North Melbourne, Parkville and Carlton, from South Kensington in Melbourne's west through to South Yarra in Melbourne's south east. This region is highly urbanised and incorporates a wide range of commercial, residential, retail, industrial and recreational land uses, including significant areas of open space. Historic development of inner Melbourne has meant that remnant flora and fauna values have been largely removed.

13.2.2 Potential benefits

When combined with Wider Network Enhancements, the project's environmental benefits include:

- Increasing the use of public and active transport and associated economic benefits
- Supporting the development of more sustainable urban form in Melbourne by providing better connectivity through public transport
- Enhancing local amenity due by reducing vehicle use at key locations along the alignment
- Reducing ecological impacts on the urban fringe of Melbourne through urban consolidation.

13.2.3 Identification of potential issues

A range of environmental issues and effects were identified for further assessment during the EES process as set out in Appendix 11.

These effects are primarily restricted to local areas and many are temporary, including:

- Impacts on amenity through noise and air emissions during construction
- Vibration impacts during construction and operation
- Impacts relating to hydrology, ground water and contamination
- Removal of street and/or park trees during construction.

13.2.4 Sustainability

Melbourne Metro will leave a lasting legacy of sustainable transport infrastructure for Melbourne and Victoria. It will be a key element of Melbourne's public transport network and drive the sustainable future development of both Central Melbourne and key growth areas. It will encourage more use of public transport and enable further expansion of the network.

The project is also an opportunity to create a positive legacy in the delivery of major projects. MMRA has committed to achieving excellent environmental, social and economic outcomes across all phases of the project and delivering an integrated outcome that connects the community in an environmentally sustainable manner.

MMRA has endorsed a Sustainability Policy setting out high-level project aspirations. Themes and targets are currently being developed to guide design and delivery of the project across a range of project elements. A summary of the themes and key outcomes being sought is detailed in Table 13-1.

Table 13-1: Sustainability Policy themes and target outcomes

| Theme | Key outcomes to be sought in targets |
|------------------------------|---|
| Excellence | <ul style="list-style-type: none"> Achieving excellent ratings against key sustainability rating tools Publicly reporting sustainability performance on an annual basis |
| Urban Ecology and Vegetation | <ul style="list-style-type: none"> Contributing to urban forest and biodiversity targets set out by other authorities |
| Climate Resilience | <ul style="list-style-type: none"> Undertaking climate change risk assessment and implementing adaptation measures |
| Supply Chain | <ul style="list-style-type: none"> Developing and implementing local content strategies in line with key state policies and ensuring local SMEs are suitably involved in the project supply chain |
| Communities | <ul style="list-style-type: none"> Ensuring project design leaves a positive legacy for Melbourne Ensuring heritage and identity are appropriately incorporated in project design Demonstrating how potential project impacts to the community have been considered, addressed and monitored |
| Workforce | <ul style="list-style-type: none"> Developing and implementing workforce strategies in line with key state policies to encourage skills transfer, employment of apprentices / trainees, training programs and indigenous employment |
| Energy | <ul style="list-style-type: none"> Reducing greenhouse gas emissions and energy consumption and encouraging renewable energy during project construction and operation |
| Materials and waste | <ul style="list-style-type: none"> Reducing materials use during project construction including cement, timber and steel Encouraging diversion of waste during project construction from landfill |
| Water | <ul style="list-style-type: none"> Reducing water use, reducing potable water use and minimising urban stormwater impacts during project construction |

These themes and targets are still subject to finalisation and approval prior to procurement.

To measure progress against the targets, MMRA will adopt the following sustainability ratings tools:

- Infrastructure Sustainability Council Australia’s (ISCA) Infrastructure Sustainability Rating tool - a comprehensive rating system to evaluate sustainability across design, construction and operation of infrastructure. This tool will apply to all project works, although the application to Wider Network Enhancements will be determined as delivery and scope of those works are finalised
- Green Building Council Australia’s (GBCA) Green Star Custom rating tool for below ground stations - a comprehensive, national voluntary environmental rating system to evaluate the environmental design and construction of buildings. MMRA is working with GBCA to develop a world-first tool for the assessment of underground railway stations, having recognised that existing tools for commercial buildings do not appropriately cover project scope. This tool will apply to the major works package.

“ To achieve excellent environmental, social and economic outcomes across all phases of the project in order to deliver an integrated project that connects the community in an environmentally sustainable manner.”

MMRA’s sustainability vision

MMRA is developing a detailed implementation plan to align project delivery with MMRA’s sustainability vision.

13.3 Social

13.3.1 Context

The project alignment provides much needed connections across the city between:

- Parkville health, research and education precinct
- CBD (including major civic facilities such as the City Square, Federation Square, St Paul's Cathedral, Melbourne Town Hall and the State Library of Victoria)
- St Kilda Road and the Domain Parklands.

The project will provide access to activities, services, facilities and employment opportunities concentrated in Central Melbourne.

As set out in Chapter 9 and Chapter 10, the broader effects of the Melbourne Metro Program and Extended Program are expected to:

- Reduce crowding on rail lines serving Melbourne's growth corridors
- Reduce crowding on trams and in existing CBD stations
- Reduce road congestion
- Improve access to jobs, health, education and a range of other opportunities at Arden, Parkville and Domain
- Increase agglomeration that will improve the productivity of businesses, particularly in Central Melbourne.

13.3.2 Potential benefits

The social benefits of Melbourne Metro are significant to the wider Melbourne region, including:

- Broadening accessibility to key services (including health and education services) by providing more frequent train services to existing railway stations and new services to areas currently not serviced by the heavy rail network
- Improving social and economic inclusion as more people will be able to access employment, education, sporting, entertainment and cultural opportunities in Central Melbourne via public transport. The project will especially benefit individuals from parts of Melbourne that are identified as experiencing disadvantage in the north, west and south east
- Facilitating increased dwelling development in Melbourne's established areas that will have better transport connections. This additional dwelling development will provide greater housing choice for existing and new residents as well as residential developments with access to a greater diversity of activities in their vicinity
- Facilitating stronger retail and commercial development from higher-density residential development in and around activity centres
- Reducing reliance on private motor vehicles and potentially lowering transport costs which makes up a significant proportion of the cost of living for many families
- Increasing the use of public and active transport
- Enhancing local amenity by reducing vehicle use at key locations along the alignment.

Transports Benefits associated with social and economic inclusion

Social and economic inclusion means that everyone is able to participate fully in society, having necessary opportunities, capability and resources to enable them both to contribute and to share in the benefits of Australia's success as a nation. Transport plays a critical role in developing social and economic inclusion by removing barriers to the use of the transport system, through how we plan and provide transport infrastructure and services. Transport also has a capacity – building role where opportunities for social and economic participation are maximised in partnership with communities.

Social and economic inclusion creates the capacity for both individuals and whole communities to be resilient in the face of adversity and change.

Source: Department of Transport, Transport and the triple bottom line, (2012), 7.

13.3.3 Identification of potential issues

Potential issues and effects were identified using the preliminary assessment set out in Appendix 11. These effects are primarily localised and many are temporary, including:

- Land acquisition for project infrastructure and to support construction, with associated impacts on residents and businesses
- Temporary loss of public open space during construction
- Impacts on businesses and residents, particularly in the CBD and nearby, by closing or restricting vehicular, bicycle and pedestrian access
- Impacts on broader surface transport networks, including the existing rail network
- Temporary displacement or altered access to community facilities during construction
- Changes in amenity around stations and other project infrastructure
- Temporary changes to public events or effects on places with particular cultural values
- Impacts on structures of European heritage or sites of Aboriginal heritage.

13.4 Standard mitigation strategies

If approved, the project will use well-proven techniques to mitigate any adverse impacts to acceptable levels.

The preliminary assessment identified that many of the project impacts are 'business as usual' for major infrastructure projects. However, the detailed impact assessment for the EES will identify appropriate mitigation measures for the project.

An Environmental Management Framework (EMF) will need to be prepared as part of the EES process. The EMF will be an integrated and accountable framework for managing environmental effects during project construction. It will set out roles and responsibilities to meet the relevant environmental legislation and other obligations. It will also set out requirements across areas such as:

- Air quality, noise and vibration, surface water, groundwater and contamination, including acid sulphate soils
- Occupation and reinstatement of public land affected by construction
- Avoiding and mitigating impacts on flora and fauna
- Maintaining access to and for business operations during construction
- Maintaining access to educational, social, community, religious and other facilities during construction.

The EMF will be implemented via contractual requirements with delivery contractors to develop detailed Construction Environmental Management Plans.

The Premier declared the project under Section 10 of the *Major Transport Projects Facilitation Act 2009 (MTPF Act)* for land acquisition and project delivery powers. This will allow land acquisition to be undertaken according to the principles, requirements and well-established processes under the *Land Acquisition and Compensation Act 1986 (LAC Act)* and the *MTPF Act*.

High quality urban design generates positive outcomes

Increasingly, large scale transport infrastructure projects are adopting urban design strategies to ensure infrastructure integrates with its surrounds and contributes positively to the urban form. Effective use of urban design strategies can result in, for example, new urban landmarks and gateways and improve the overall attractiveness of locations following project construction.

Contractors involved in the project delivery will be required to meet the urban design principles outlined in the Urban Design Strategy and specific requirements identified for specific precincts.

13.4.1 EES process and approach

The EES will rely on a concept design that demonstrates a feasible way for the project to achieve the Victorian Government's objectives and meet the environmental performance requirements. The concept design for the Melbourne Metro tunnel and stations:

- Provides a basis to assess the expected potential environmental risks and impacts and demonstrates that these risks and impacts can be managed to acceptable levels
- Recognises that the project can be configured differently, provided it meets the government's objectives and environmental performance requirements that are developed through the EES process.

A performance-based approach aims to achieve acceptable outcomes for the community and environment while allowing for a sufficiently flexible delivery model to encourage innovation by the private sector.

The environmental performance requirements:

- Define the outcomes that the project must achieve during its design, construction and operation. The contractor can then determine how they will innovatively and flexibly achieve these outcomes
- Will be developed by specialists during the EES assessment process. Management measures will be provided as examples of how the environmental performance requirements can be achieved.

Public input into the project impacts and mitigation measures will be gathered using:

- Public and stakeholder submissions during the EES preparation and exhibition
- Public hearings.

The Minister for Planning will then prepare and make public the assessment of the EES. Note that the assessment and approval of the Wider Network Enhancements will be pursued on a case-by-case basis as the design and location of those enhancements are developed. It is anticipated that the impacts of these enhancements will be localised, in some cases confined to within the rail corridor, and approved (where required) by way of planning permits.

13.4.2 Planning Scheme Amendment

If the Minister for Planning's assessment of the EES is favourable, a Planning Scheme Amendment (PSA) is proposed to regulate the development of the Melbourne Metro tunnel and stations in accordance with the environmental performance requirements. Similar to other major infrastructure projects, the PSA could require the following documents to be approved by the Minister:

- Development Plans
- Environment Management Framework
- Urban Design Strategy.

Drafts of these controls will be publicly exhibited and assessed as part of the EES.

The delivery contractors will develop detailed implementation plans (e.g. Construction Environmental Management Plans) to support and implement the higher-level documents.

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PART **D**
DELIVERY OF THE
MELBOURNE METRO

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CHAPTER 14

Packaging and procurement options analysis – Chapter Summary

- The evaluation methodology used to assess packaging and procurement options is consistent with relevant DTF and IA procurement guidelines, as well as approaches adopted on comparable projects.
- The recommended packaging and procurement strategy for Melbourne Metro is summarised below.

| Works Package | Procurement Model |
|--|---|
| Early Works Utility service relocations, tram infrastructure works, construction power, and works to prepare construction sites | Combination of managing contractor, Yarra Trams led and State led |
| Tunnel and Stations Main tunnelling works, five underground stations, station fit-out, mechanical and electrical systems, specific operation and maintenance services for the infrastructure delivered by the package and commercial opportunities at the new stations | Availability based Public Private Partnership |
| Rail Infrastructure Works at the eastern and western portals including cut and cover tunnelling, decline structures and local reconfiguration and realignment of existing lines | Competitive alliance |
| Rail Systems Rail systems design (including conventional signalling, HCS, train and power control systems and ICT), installation works, rail systems integration and commissioning | Competitive alliance |
| Wider Network Enhancements Proposed to include works which are required across the wider network including track modifications, station upgrades and signalling system upgrades | Case by case |

- The metropolitan rail franchisee will operate the services using the infrastructure delivered by the project as there are significant advantages to maintaining a single metropolitan operator across the metropolitan network.
- HCMTs that will operate on the Sunshine – Dandenong Line will be procured separately to the project. PTV is procuring HCMTs that will be deployed initially on the Dandenong Line to meet current short-term capacity requirements.
- The proposed delivery strategy was validated with the market as part of a market sounding process. This process confirmed there is broad private sector support for the delivery strategy, including contractor and financier appetite for the Tunnel and Stations PPP.



14 Packaging and procurement options analysis

14.1 Background

As set out in earlier Chapters, Melbourne Metro is planned as an integrated program of works to upgrade Melbourne's rail network. This program includes:

- The infrastructure delivered by the project
- Wider Network Enhancements and rolling stock procurement
- Operational changes required to leverage improved services from these works.

In framing the potential packaging and procurement options, the Department worked with PTV to identify and test some key boundary conditions, including:

- The operation of rail services on the Sunshine – Dandenong Line through the infrastructure delivered by the project will be provided by the metropolitan rail franchisee. This maintains the advantages of a single metropolitan operator across the metropolitan network, including economies of scale, customer service consistency and reduced interface risks, while also allowing the introduction of metro-style operations enabled by the project
- HCMTs that will operate on the Sunshine – Dandenong Line will be procured separately on a network wide basis to the project. This ensures that HCMTs are compatible with the broader network and are not unique to the Sunshine – Dandenong Line, and can still be optimised to deliver a quality outcome. PTV is currently procuring HCMTs that will be deployed on the Dandenong Line as soon as possible to meet short-term capacity requirements on this line.

Melbourne Metro is a major enhancement to the core rail network and is not a stand-alone facility. The procurement and delivery strategy was developed to respond to the unique challenges this poses.

14.2 Packaging and procurement options assessment methodology

As shown in Figure 14-1, a five-step process was followed according to DTF and Infrastructure Australia procurement guidelines to identify and assess likely packaging and procurement options.

Figure 14-1 – Process for developing packaging and procurement recommendation



The Department and PTV undertook a number of previous investigations to explore options to increase Melbourne's rail capacity and improve reliability. These previous investigations included considerable work on the deliverability and procurement of the project in various forms.

The Department validated the methodology and key conclusions reached in the most recent procurement investigations (the 2013 Procurement Strategy Update including the associated expert peer review undertaken in 2012) and satisfied itself that much of the analysis and key conclusions remain relevant.

In developing this Business Case, efforts have therefore focused on assessing the optimal packaging and procurement options and refining the procurement strategy to address further developments in the project’s design and the latest input from recent market sounding sessions.

This Chapter summarises the Department’s analysis and key conclusions under each of the five steps. Further detail is provided in Appendix 12.

14.3 Step 1: Data gathering

The Department gathered and considered key data about the project that is relevant to the packaging and procurement assessment, including:

- Project objectives
- Scope elements
- Costs and risks
- Base assumptions
- The findings of the 2013 Procurement Strategy Update.

14.4 Step 2: Packaging options assessment

14.4.1 Packaging assessment approach

To establish the most appropriate procurement strategy for Melbourne Metro it is necessary to determine if works should be delivered as a single, integrated package or split into a number of smaller packages.

After considering the project’s characteristics, inputs from technical advisers and analysis of approaches adopted or proposed to be adopted on comparable projects, the packaging drivers outlined in Table 14-1 were developed to support the assessment and comparison of packaging options. These drivers helped identify and inform the key differentiating factors between potential packaging options and are not intended to act as fixed evaluation criteria. Further detail is provided in Appendix 12.

Table 14-1 – Packaging value drivers

| Packaging value driver | Description |
|------------------------------|---|
| Technical requirements | Are the technical requirements / skills / capabilities required to deliver the elements of the package similar? |
| Interfaces and risk profile | Are there synergies from bundling project components? |
| | Does the package involve interaction with the existing network and are there any dependencies? |
| | Does the separation of the package create a natural and manageable point of interface with other packages, or does it create undesirable interface risks? |
| Innovation | Does the proposed packaging solution support appropriate risk transfer, such that value for money can be achieved by the State? |
| | Does the packaging approach create or reduce opportunities for innovation in design, construction and/or a whole of life focus? |
| Market appetite and capacity | Is there sufficient market interest in delivering the project package? |
| | Does packaging impact on market appetite? |
| | Is there market capacity to deliver the package such that a competitive outcome is likely to be achieved? |

Source: Department analysis.

The approach used to develop and evaluate packaging options comprised three key steps:

- Consideration of an extensive list of potential packaging options based on factors such as geography and technical discipline
- Identification of a shortlist of potential packaging options by undertaking a qualitative analysis to determine the most realistic, practical options. Factors considered during the shortlisting process included: the potential benefits of delivering elements with specific characteristics separately, the ability of the packaging option to assist in achieving project objectives and reduced interface risks
- Consideration of shortlisted packaging options against the packaging value drivers to determine the most suitable option.

The recommended packaging approach is outlined in the following sub-sections, including the rationale for the proposed approach.

14.4.2 Early works

Early works comprise works that are needed to enable efficient and on-time delivery of the tunnel and stations works and to minimise disruption. This includes relocating and protecting utilities, tram diversions, construction power and works to prepare construction sites.

Site preparatory works are expected to include demolitions, removal or relocation of trees, relocation of monuments and any other activities required in order to facilitate early commencement of the main works, including for example, temporary works and other works that provide access for surface and underground construction.

Delivery of early works separately to the tunnel and station works ('Early Works' packages) is the optimal packaging approach for these works.

The key reasons for undertaking early works in advance of the tunnel and station works include:

- Preventing delays in the overarching construction program for the tunnel and stations works as scope definition and planning approval of certain early works are on the critical path. It is desirable to commence these activities as soon as possible and complete the works before the State contracts for the tunnel and stations works
- Enabling construction of the tunnel and stations to occur in a construction environment by reducing the constraints of existing utilities and transport infrastructure that conflicts with the project alignment, thereby reducing risk premiums (and by extension, costs) expected to be bid for the tunnel and stations works
- Easing the difficulty of packaging such works in the tunnel and stations works as specific parties (e.g. Yarra Trams and utilities service providers (USPs)) need to undertake and oversee certain early works. For example, certain utility relocations can only be undertaken by the asset owners and their pre-qualified sub-contractors
- Providing an opportunity to more effectively manage and mitigate any necessary community disruptions, including disruptions to commuters and businesses
- Enabling relevant USPs to manage their internal resources more effectively and ensure that resources are available when required (for example, because works can be staged, rather than undertaken all at once), thereby mitigating any program risks potentially arising from USP resource capacity constraints
- Providing an opportunity to reduce delivery costs. For example, the shorter construction program should result in reduced cost escalation and savings in project overheads. Similarly, de-risking the tunnel and station works should reduce the risk premium associated with these works.

Commencing early works in advance of core project works is a typical approach used on infrastructure projects that have in-ground civil works, particularly linear projects in urban environments such as railway lines.

14.4.3 Tunnel and stations

The tunnel and stations works comprise 9km twin tunnels, five stations (plus fit-out), mechanical and electrical systems and, subject to the procurement model(s) adopted for these works, may include substructure maintenance, stations operations and maintenance, and commercial opportunities at the new underground stations.

The key reasons for a single package approach include:

- Facilitating a single end-to-end solution that could lead to better service and customer experience outcomes by better integrating works (for example, consistency of station design)
- Avoiding the creation of additional interface risk for design, construction (particularly at the point at which the two packages would meet), program (for example, splitting packages is likely to result in an extended program to allow additional time to provide for an iterative design process and the more complex integration and commissioning processes) and commissioning (for example, to ensure that the tunnel ventilation and rail systems are integrated and commissioned across both packages)
- Providing more scope for innovation as the contractor has greater flexibility to adjust the design, develop alternative staging or program solutions or adopt different construction approaches, including approaches that would reduce disruption. For example, a single package provides increased flexibility for the contractor to develop alternative tunnelling solutions and construction methodologies
- Enabling more effective ground condition (geological and hydrogeological) risk management by the contractor as all high-risk locations (such as Arden and the Yarra River crossing) are included in one package, allowing risk to be mitigated. In addition, the design and construction interface risk between tunnels and stations is managed by the one contractor. This is particularly important given Melbourne's geological conditions, which make splitting these scope elements more technically challenging than certain other locations – for example, because the station box structures must be completed before the TBMs arrive at the stations
- Having one party responsible for managing site access, safety, industrial relations and disruption (for example, with a single party being responsible for all construction activities in the CBD), thereby further reducing interface risks between works and providing additional opportunities for economies of scale (for example, procurement of TBMs). In addition, key challenges for the delivery of the tunnel and station works include construction site access, lack of lay down areas and the requirement to use tunnels for delivery to site of key equipment. A single package approach facilitates better management of these risks, given that one party will have responsibility for managing construction and site access
- Having one party responsible for designing and delivering end-to-end mechanical and electrical systems. This is important because these systems are integral to the tunnels and stations being fit for purpose and facilitating the required operational outcomes. For example, the spacing of ventilation shafts and the effectiveness of the ventilation systems solution can restrict the number of trains per hour
- Having a single contractor responsible for facilitating the rail accreditation requirements for the tunnel and stations infrastructure and managing this metropolitan rail franchisee interface

A single package approach (the 'Tunnel and Stations' package) is the preferred packaging solution for the tunnel and stations works.

Although the interface between two geographically separated packages could be managed, there were no material benefits identified with pursuing a geographic split option for the tunnel and stations.

The mechanical and electrical systems were included as part of the Tunnel and Stations package due to the significant design, access and construction interface and because the mechanical and electrical systems are integral to the tunnel and stations being fit for purpose (for example, ventilation systems are essential for the tunnels to be operational).

As far as reasonably practicable, the scope of the Tunnel and Stations package will be defined to exclude works in the existing live rail environment, which involve additional brownfield risks and complexity.

14.4.4 Rail Infrastructure

Certain works will be required at the eastern and western portals which involve significant interface with the existing rail network, including cut and cover tunnelling works, decline structures and local reconfiguration and realignment of the existing Sunbury, Frankston and Cranbourne / Pakenham Lines (including modifying existing signalling, traction power and communications rail infrastructure).

The reasons for delivering these brownfield rail infrastructure works separately from the tunnel and stations include:

- Extensive works need to be undertaken in close proximity to the live rail network and in a complex, constrained operating environment (noting that, for example, the Sandringham, Frankston, Cranbourne and Pakenham Lines converge in the area where the eastern portal will be built and the Sunbury and Werribee lines operate where the western portal will be built). This will require multiple service disruptions and associated bus replacement services. Delivery of these works will involve complex, multi-staged construction processes (particularly at the eastern portal) requiring multiple weekend and other occupations over a significant time period. Given the technical nature and risk profile of undertaking these works in the live rail environment, it is imperative that these works are undertaken with significant involvement of rail franchisees and separate to the tunnel and stations works
- These works will affect the local road network (for example, with substantial works required to the William Street bridge structure at the Eastern Portal) and the local community. Procuring these works separately to the tunnel and stations package should ensure that the rail infrastructure contractor focuses on managing local disruption and stakeholder issues in these areas

A single package approach for the rail infrastructure works is considered optimal. Although separate Eastern and Western Portal packages could be managed, a single package is preferable on the basis that:

- The works are of a materially similar nature
- Track occupations can be coordinated more effectively and disruption can be minimised
- Separating the rail infrastructure works into two packages would create additional contractual interface, requiring the Tunnel and Stations contractor to engage with two contractors in relation to design, construction and commissioning
- Separate packages would require an additional procurement process and an additional contract, requiring additional resources from the Department, the market and the metropolitan rail franchisee
- Feedback from the most recent market soundings suggested that a single package will be attractive from the market's perspective.

This package will also include the western and eastern turnbacks. These works are similar in nature to the track works at the portals and packaging these works together should enable occupations to be coordinated and disruption minimised.

Delivering the brownfield rail infrastructure works separately to the tunnel and stations works (the 'Rail Infrastructure' package) is the optimal packaging approach for these works.

14.4.5 Rail systems

Rail systems works include conventional signalling, HCS, train and power control systems, ICT and rail system integration. This involves not only providing new rail systems in the tunnels and stations but also delivering new rail systems and systems upgrades on the existing Sunbury and Cranbourne / Pakenham Lines. The solution needs to be designed on a system-wide basis and integrated and commissioned across the newly-created Sunshine – Dandenong Line.

Delivering rail systems separately to the tunnel and stations (the ‘Rail Systems’ package) is the optimal packaging approach for these works.

The key drivers for delivering rail systems separately include:

- Rail systems are highly complex and will have significant interfaces with the new HCMT rolling stock, existing signalling infrastructure, rail operations and the broader network. Quarantining these works from the tunnel and stations works enable these works to be managed more effectively and allow the main works to be ‘de-risked’ and delivered at a lower cost
- Introducing HCS potentially compounds these issues given the specialist nature of HCS and noting that HCS has not yet been implemented anywhere on the Victorian rail network. This degree of technical specialism and uncertainty means that including a fixed scope for rail systems in the tunnel and stations works could lead to large risk premiums for the rail systems elements of the package
- Procuring the rail systems separately from the tunnel and stations enables the preferred rail systems provider to be selected on a stand-alone, value for money basis.

For completeness, it is noted that certain rail systems installation works in the tunnel and stations will be included in the Tunnel and Stations package. The key driver for this is to minimise program, access and delivery interface risks between the packages (noting that the proposed program to meet the required timelines involves installing rail systems throughout the tunnel and stations at the same time as installing mechanical and electrical systems, station fit-out and other activities that form part of the tunnel and stations works).

14.4.6 Wider Network Enhancements

Wider Network Enhancements involve works across the wider existing above ground rail network (outside of the tunnel and beyond the tunnel portals) including track modifications and signalling system upgrades.

Delivering wider network enhancements separately to the other packages (the ‘Wider Network Enhancements’ packages) is the optimal packaging approach for these works.

The key reasons for considering the Wider Network Enhancements as a separate package (or series of packages) include:

- The scope and location of these works means that they can potentially be undertaken independently of other scope elements
- They have very different technical characteristics to the tunnel and stations works, are geographically separate, are of a brownfield nature and will be undertaken in a live operating environment with significant interface and stakeholder management issues
- The required timeframe for procurement and delivery of these works differs to the rest of the project. These works need to be completed to coincide with completion of the tunnel and stations works, but have a much shorter construction duration.

Wider Network Enhancements will be packaged with other works where there are clearly demonstrable benefits such as procurement and/or delivery synergies. As noted above, the eastern turnback will form part of the Rail Infrastructure package and the signalling upgrades on the Sunshine – Dandenong Line will form part of the Rail Systems package. Other Wider Network Enhancements may ultimately form part of

these packages and, where appropriate, works will be incorporated in the Level Crossing Removal Project to reduce costs and minimise disruption. Further detailed assessment of any such opportunities will occur as part of the detailed pre-procurement planning activities.

14.4.7 Commercial opportunities and station airspace rights

Commercial opportunities associated with the project include general amenity retail offerings in stations, station airspace rights (over site development) and broader precinct development opportunities.

The preliminary packaging considerations in relation to these opportunities are:

- Commercial opportunities in stations – it is desirable to package these with the Tunnel and Stations package so that stations can be designed to best accommodate retail and other potential opportunities
- Station airspace rights – over site development opportunities exist at CBD North and CBD South stations. Given the significant interface between design and construction of the station boxes and any over site developments, it is desirable to package these development opportunities with the Tunnel and Stations package
- Commercial development on surplus land at Arden – the urban renewal opportunities at the Arden-Macaulay Precinct will have limited direct interface with the Arden station works. Significant additional work will be required by numerous government agencies to coordinate and deliver the desired urban renewal outcomes and the timing of any precinct-wide development activities will occur naturally over a significantly longer period than the tunnel and stations works. Accordingly, a separate government agency will be responsible for overseeing the urban renewal of this precinct and commercial developments at Arden will not be procured as part of Melbourne Metro.

14.4.8 Operation and maintenance of new infrastructure and systems

As noted in Section 14.1, the metropolitan rail franchisee will operate rail services on the Sunshine – Dandenong Line. The metropolitan rail franchisee is therefore the 'default' operations and maintenance service provider for the project.

Notwithstanding this, opportunities to package the operation and maintenance of relevant aspects of the new infrastructure and systems with delivery of the capital works were considered as part of this Business Case to identify opportunities to deliver whole-of-life benefits and improve value for money.

These opportunities, however, are driven largely by the procurement model rather than the packaging solution (for example, some procurement models include maintenance and other services during the operating term whereas others do not). As such, the proposed approach to operations and maintenance for each package is discussed in more detail in Section 14.5 Step 3: Procurement options assessment.

14.4.9 Recommended packaging solution

Using the packaging value drivers, the assessment of packaging options focused on bundling project components to better manage risk, minimise interfaces between project components and the network, provide opportunities for innovation and increase attractiveness and acceptance by the market.

Table 14-2 summarises the recommended packaging strategy.

Table 14-2 – Summary of recommended packaging solution

| Works package | Description | Estimated cost (P90, Nominal) |
|----------------------------|---|---|
| Early Works | Tram works | Tram divisions works |
| | Utilities relocations / protection and site preparation | Relocation / protection of utility services in conflict with the project alignment, plus other site preparatory works |
| | Construction power | Provision of power for construction activities |
| Tunnel and Stations | Main tunnelling works, construction of five underground stations, station fit-out and mechanical and electrical systems ¹ | \$ * bn |
| Rail Infrastructure | Works at the eastern and western portals including cut and cover tunnelling, decline structures and local reconfiguration and realignment of existing lines ² | \$ * m |
| Rail Systems | Rail systems design (including conventional signalling, HCS, train and power control systems and ICT), brownfield installation works, rail systems integration and commissioning ³ | \$ * m |
| Wider Network Enhancements | Works required across the wider existing above ground rail network (outside of the tunnel and beyond the tunnel portals) including track modifications and signalling system upgrades | \$ * m |

1 Estimated cost includes installation of rail systems in the tunnel

2 Estimated cost includes the western and eastern turnbacks

3 Estimated cost includes signalling upgrades on the Sunshine – Dandenong Line

14.5 Step 3: Procurement options assessment

14.5.1 Evaluation methodology

The evaluation methodology used by the Department to assess procurement options is consistent with relevant guidance from DTF (with specific reference to the High Value / High Risk Guidelines) and with the National PPP Policy and Guidelines issued by Infrastructure Australia (with specific reference to Volume 1: Procurement Options Analysis).

Table 14-3 summarises the evaluation criteria developed to support the value for money assessment of delivery models for the project packages.

Table 14-3 – Procurement options assessment evaluation criteria

| Evaluation criterion | Description | Relative priority |
|----------------------------|---|-------------------|
| Risk management | The extent to which the delivery model allocates risk to the party best placed to manage it | High |
| Time | The extent to which the delivery model is able to deliver the project within the State's time constraints and provides time certainty | High |
| Price and budget certainty | The extent to which the delivery model supports cost certainty and competitive pricing for capital and whole of life costs | High |

* Redacted - commercial-in-confidence

| Evaluation criterion | Description | Relative priority |
|------------------------------|---|-------------------|
| Innovation and incentive | The extent to which the delivery model provides incentives for the contractor to innovate to meet the required performance outputs and other requirements | Medium |
| Flexibility and control | The extent to which the delivery model enables the State to retain flexibility to change specifications and operations | Medium |
| Market interest and appetite | The extent to which the delivery model assists in maximising market interest amongst the appropriate market participants with the relevant skills, expertise and capacity | Medium |

Source: Department analysis.

Following DTF guidance, these criteria were not weighted numerically. However, some provide inherently greater differentiation between alternative procurement models than others and therefore an indicative 'priority' was attached to each criterion, as shown in the table above.

The ratings used to assess the suitability and value for money proposition of each shortlisted procurement model against the evaluation criteria (including the results of this assessment) are provided in Appendix 12.

Table 14-4 summarises the procurement models considered in the procurement options assessment as described in the National PPP Policy and Guidelines (Volume 1: Procurement Options Analysis).

Table 14-4 – Procurement models considered

| Model | Description |
|----------------------|---|
| Competitive alliance | Competitive alliancing is a form of relationship contracting in which the State collaborates with one or more non-owner parties to share risks and responsibilities in delivering the construction phase of a project. |
| Managing contractor | Under a managing contractor approach, the principal prepares a project brief, including a budget estimate and estimated completion time, and the managing contractor works collaboratively with the Principal to revise the project brief and refine the design, and engages subcontractors to deliver the works. Where possible, the managing contractor's subcontractors are procured on a fixed price, fixed time basis. |
| Franchisee delivery | The State has entered into Projects Agreements with the metropolitan rail franchisee (Metro Trains Melbourne) and trams franchisee (Yarra Trams), which allow these franchisees to deliver infrastructure works on behalf of the State. |
| D&C | The D&C arrangement consists of a fixed price contract for design and construction of the works by a specified completion date. |
| DCM | As for D&C, except that the DCM contractor must also maintain the works for a specified period – usually between 10 and 30 years. |
| DBOM | In a DBOM arrangement, the private sector party is responsible for designing, building, operating and maintaining the infrastructure. |
| PPP | A PPP is typically a long-term service contract between the public and private sectors where the State pays the private sector a service fee to deliver infrastructure and related services over an agreed project term (typically 15 to 30 years). The private sector party typically designs, builds and finances the facilities and operates and/or maintains them to specified standards. |

14.5.2 Procurement assessment – Early Works packages

Procurement assessment summary

Table 14-5 summarises the proposed approach to procurement of the Early Works packages.

Table 14-5 – Early works procurement approach

| Early Works package | Procurement assessment |
|---|---|
| Utilities relocations / protection and site preparation | <p>Delivery of the majority of the utilities relocation and protection works is recommended to be via a managing contractor approach. This should ensure that the works are delivered quickly, that the State has sufficient flexibility to adjust scope if required as the project's design is further developed and that the benefits of coordinating and managing a diverse range of works and/or utility owner/operator interfaces are realised.</p> <p>It is recommended that any other early works to prepare construction sites, including works that provide access for surface and underground construction, are delivered as part of the managing contractor arrangement. However, the State will consider opportunities for including some elements of these works in the Tunnel and Stations package where there are clearly demonstrable benefits (for example, the State may wish to retain the ability to offer buildings provisionally nominated for demolition to the tunnel and stations contractor for use as a construction management base).</p> |
| Tram works | <p>The recommended option is franchisee delivery under the Projects Agreement between the State and Yarra Trams, as Yarra Trams is best placed to manage the significant interfaces with the existing tram network and to ensure that the works achieve the operational outcomes required.</p> |
| Construction power | <p>Provision of additional construction power at selected worksites is recommended to be delivered via a direct agreement with relevant power providers because delivery of these works does not have significant interfaces with other early works, this provides the State with more direct control over these works and because including these works within the scope of the managing contractor arrangement might result in additional costs (due to the managing contractor's margin, overheads, etc.) for potentially limited benefit. However, opportunities to include these works within the scope of the Managing Contractor arrangements will be considered if this can be achieved on a value for money basis.</p> |

Source: Department analysis.

Mitigation of key work package specific risks

Table 14-6 summarises the key risks¹ specific to the early works and how the recommended delivery model for each of the major Early Works packages would mitigate these risks.

Table 14-6 – Mitigation of key early works risks

| Key risks | Mitigation under delivery model |
|--|---|
| Utilities relocations and site preparation (Managing Contractor) | |
| <ul style="list-style-type: none"> • Risk of delay in approvals under telecommunications and/or pipeline legislation resulting in delayed commencement of the tunnel and stations works • Early works not adequately scoped and scheduled, resulting in additional works being added to the tunnel and stations works, causing delay • Early works not completed as required within the specified timeframe, causing delay. | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> • The managing contractor will be responsible for the procurement of applicable approvals / consents / authorisations required for the performance of the works. The managing contractor will also be responsible for verifying and completing all designs provided by, or on behalf, of the State • With respect to timely completion, the managing contractor agreement will include a target program setting out key milestone completion dates and an overall completion date. The target program will form the basis for measurement of the managing contractor's achievement of the time related KPIs. |

¹ Key risks specific to each works package were identified based on the value of the real risk adjustment attributable to the relevant risk, as documented in the risk register attached to Appendix 7.

| Key risks | Mitigation under delivery model |
|---|---|
| Tram infrastructure works (Yarra Trams delivery under the Projects Agreement) | |
| <ul style="list-style-type: none"> Interface issues arise with Yarra Trams resulting in scope changes and/or delay, e.g. acceptance of infrastructure into service Works are not completed as required within the specified timeframe, causing delay to Domain station construction commencement. | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> The State has entered into the Projects Agreement with Yarra Trams to facilitate the collaborative delivery of tram works on behalf of the State. The existing contractual framework provides an effective mechanism in which to manage interface issues, particularly given the nature, scale and cost of these works are consistent with the type of works typically managed by Yarra Trams under the Projects Agreement These works are required to be completed by early 2018 in order to facilitate construction of the Tunnel and Stations package. Given that Yarra Trams operates the existing tram infrastructure, Yarra Trams is arguably best placed to ensure the timely delivery of these works In addition, the existing performance incentives in the Projects Agreement would be reviewed to ensure appropriate incentives are offered for timely completion. |
| Provision of construction power (Direct agreements with USPs) | |
| <ul style="list-style-type: none"> Risk that HV power to TBM construction sites is inadequate, resulting in significant upgrades to local or remote substations Power utilities cannot meet anticipated future power consumption demand, leading to inability to achieve expected level of service Provision of construction power not completed as required within the specified timeframe causing delay. | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> Given the scale and importance of these works, it is desirable for MMRA to have a direct relationship with the USPs in order to oversee delivery of the works and ensure the HV power is adequate to enable effective TBM operation Direct agreements with USPs for delivering these works should accelerate the program because MMRA can progress the arrangements with the USPs prior to appointment of the Managing Contractor, ensuring power is available for all TBMs as early as possible. |

14.5.3 Procurement assessment – Tunnel and Stations package

Procurement assessment summary

The Tunnel and Stations package includes the main tunnelling works, construction of five underground stations, station fit-out and mechanical and electrical systems.

The key drivers for recommending an availability-based PPP model include:

- Risk management – PPPs achieve a significant and robust transfer of risk with the majority of design, construction, maintenance and relevant facilities management (FM) services risks transferred to the private sector on a whole-of-life basis (typically 15 to 30 years). Introducing private finance also provides additional discipline and scrutiny of risk (for example, financier due diligence and oversight)
- Time – using private finance results in very significant incentives for contractors to complete on time when compared to ‘traditional’ procurement methods, due to the financial incentive to achieve final completion. This is supported by independent research, which found that the average construction

The analysis undertaken, including qualitative VFM assessment, concludes that delivery under an availability-based PPP model is the optimal procurement approach for the Tunnel and Stations package.

phase delay for a sample of PPP projects was 1.4 per cent compared to 25.9 per cent for traditionally procured projects²

- Price and budget certainty – the effective risk transfer achieved under PPP contracts provides the State with a high degree of budget certainty. This is supported by the research cited above, which found that PPPs experienced average construction cost overruns of 4.3 per cent compared to 18 per cent for traditionally procured projects (only 43 per cent of which were completed within 5 per cent of the expected cost)
- Innovation and incentive – although a PPP model may not result in additional innovation in tunnel design or construction methodologies relative to other procurement approaches, it should provide additional incentive to focus on whole-of-life design innovation given the existence of a performance regime for the term of the PPP service contract, ongoing management of the stations and other facilities, and maximisation of commercial opportunities (e.g. retail outlets in stations)
- Flexibility and control – although PPP contracts are typically less flexible than D&C / DCM models, PPP contracts do include mechanisms to enable modifications. Importantly, it is noted that rail operational flexibility and control would be retained by the State to a large extent because rail services would continue to be delivered as part of the metropolitan franchise arrangements, with franchisee involvement in the design of rail systems (see Section 14.5.5) and the metropolitan rail franchisee operating and maintaining rail systems in the tunnels (e.g. signalling and train power)
- Market appetite and interest – market sounding participants stated that they would be interested in a PPP for the Tunnel and Stations package and market appetite is expected to be strong under this procurement approach. The market soundings also indicated that there should be strong appetite from equity investors and financiers.

As well as delivery of the main tunnelling works, construction of five underground stations, station fit-out and mechanical and electrical, the scope of the Tunnel and Stations PPP will also include:

- Delivery of certain rail systems works (e.g. installation of rail systems in the tunnels), as discussed in Section 14.4.5
- Maintaining relevant tunnel and stations infrastructure (including mechanical and electrical systems) and providing facilities management services in the stations to encourage a focus on whole of life benefits and improve value for money
- Commercial opportunities in the stations and above the station structures (over site developments at CBD South and CBD North) to improve value for money and ensure an integrated approach. For completeness, it is noted that delivery of over site development will not be included in the Tunnel and Stations PPP Project Agreement; it will be subject to separate contractual arrangements (e.g. a Development Agreement) procured as part of a single, integrated procurement process.

Certain works are recommended to be delivered by the PPP as ‘returned assets’ to be operated and maintained by the metropolitan rail franchisee. This is desirable to reduce operational interface risks and provide improved operational outcomes.

Mitigation of key work package specific risks

Table 14-7 summarises the key risks specific to the Tunnel and Stations package and how the recommended availability PPP model would mitigate these risks.

Table 14-7 – Mitigation of key Tunnel and Stations risks

| Key risks | Mitigation under delivery model |
|--|---|
| <ul style="list-style-type: none"> • Risk of delay in delivering the detailed design of the project, adversely impacting the overarching project timeline • Construction program is overly optimistic, leading to delay and additional costs | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> • PPP Co would bear the impact of delayed delivery of the tunnel and stations because the service payments would not commence until the works |

² Colin Duffield, Peter Raisbeck and Ming Xu, National PPP Forum – Benchmarking Study, Phase II – Report on the performance of PPP projects in Australia when compared with a representative sample of traditionally procured infrastructure projects, University of Melbourne.

| Key risks | Mitigation under delivery model |
|---|--|
| <ul style="list-style-type: none"> • Ground conditions encountered during TBM tunnelling / CBD cavern tunnelling activities are significantly worse than anticipated • TBMs do not perform as specified, leading to a slower production rate, delay, changes to construction methodology and/or redesign • Material defects in either the design or construction of the tunnel and stations become apparent during commissioning or operations phases • Inadequate consideration of O&M during detailed design results in additional costs during operations • Failure to design and construct in compliance with key standards. | <p>reach completion (except for very limited risks borne by the State)</p> <ul style="list-style-type: none"> • PPP Co would bear the risk of latent ground conditions such as geological conditions risk (with very limited exceptions) • PPP Co would remain responsible for availability of the assets over the life of the service contract. This would drive a whole of life focus in relation to design and construction of the works • Maintenance and relevant facilities management services costs are known and agreed upfront, thereby giving the State a high degree of budget certainty with respect to these costs • PPP Co would continue to be responsible for defect rectification after expiry of the defects liability period and would bear the risk of defects for the full term of the contract. |

Source: Department analysis.

14.5.4 Procurement assessment – Rail Infrastructure package

Procurement assessment summary

As noted above, the Rail Infrastructure package involves extensive works that need to be undertaken in close proximity to the live rail network (including the Sandringham, Frankston, Cranbourne and Pakenham Lines at the eastern portal and the Sunbury and Werribee Lines at the Western Portal) and involves interfacing with rail franchisees and freight services. These works require significant occupations and associated bus replacement services, as well as interfacing with the tunnel and stations works.

A competitive alliance model is recommended for this package. The alliance participants are likely to include the State, the metropolitan rail franchisee and the Rail Infrastructure package contractor(s) (including designers).

The key drivers for recommending a competitive alliance model as the preferred procurement approach for the Rail Infrastructure package include:

- Risk management – given the significant interface risks with the existing network and the rail franchisees, it will be difficult for the private sector to develop a fixed price, fixed time proposal on a value for money basis without the rail franchisees' input and cooperation. A competitive alliance model is expected to provide the best commercial framework through which these risks can be managed in a live rail environment
- Time – the complexity of the works (particularly at the Eastern Portal), including the need for rail occupations, creates significant program risk and any delay will potentially have adverse consequences for the delivery of the project. An alliance framework is best placed to mitigate this risk because the competitive alliance parties can commence design and construction planning early and, if an unforeseen event does occur, the parties are motivated to collectively resolve the situation in the timeliest manner
- Price and budget certainty – a competitive alliance that includes appropriate KPIs should deliver a level of certainty and provide value for money. In addition, it is proposed to procure the alliance as a competitive Target Outturn Cost (TOC) alliance, thereby creating significant competitive tension in the tender process
- Innovation and incentive – an alliance should drive / facilitate innovation by bringing all stakeholders together with aligned incentives and a focus on 'best for project' outcomes

The analysis undertaken concludes that delivery under a competitive alliance model is the optimal procurement approach for the Rail Infrastructure package.

- Flexibility and control – a competitive alliance delivery method provides significant flexibility to deal with any necessary changes in scope, design and/or construction methods during delivery
- Market interest and appetite – market sounding participants indicated a preference for a competitive alliance delivery method for packages involving significant interface with the ARTOs and therefore supported the proposed use of a competitive alliance model for the Rail Infrastructure package.

The metropolitan rail franchisee will operate and maintain the majority of the works delivered by the Rail Infrastructure alliance.

Mitigation of key work package specific risks

Table 14-8 summarises the key risks specific to the Rail Infrastructure package and how the recommended competitive alliance model would mitigate these risks.

Table 14-8 – Mitigation of key Rail Infrastructure risks

| Key risks | Mitigation under delivery model |
|--|---|
| <ul style="list-style-type: none"> • Stakeholder interface with ARTOs (MTM, V/Line, VicTrack, etc.) is less effective and efficient than expected, resulting in delay • There is insufficient ARTO capacity, or the franchisee is under-resourced, to deliver the works. | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> • The key risks in this package relate to the interface issues in relation to the live rail network. A competitive alliance model is expected to provide the best commercial framework through which these risks can be managed, with the State, the contractor(s) and the ARTOs commercially aligned and therefore all working together to identify, mitigate and manage these risks. This extends to understanding and mitigating risks around the franchisees' capacity to deliver the works • As the ARTOs would be involved directly in the planning and design of the works, this should align incentives and create an environment in which the ARTO interface can be appropriately managed and appropriate ARTO resources applied. |

Source: Department analysis.

14.5.5 Procurement assessment – Rail Systems package

Procurement assessment summary

As noted above, rail systems are highly complex and will have significant interfaces with the tunnel and stations works (including mechanical and electrical systems), new HCMT rolling stock that will operate on the new Sunshine – Dandenong Line, existing signalling infrastructure, rail operations and the broader network.

Rail systems are also fundamental to the successful commissioning of the tunnel and stations works and to successful integration of the new infrastructure into the existing network.

A competitive alliance model is recommended for this package. The alliance participants are likely to include the State, the metropolitan rail franchisee and the rail systems contractor(s) (including designers).

The key drivers for recommending a competitive alliance as the optimal procurement approach for the rail systems include:

- Risk management – given the significant interface risks with the existing network and the rail franchisees, it will be difficult for the private sector to develop a fixed price, fixed time proposal on a value for money basis without the rail franchisees' input and cooperation. A competitive alliance model including the rail systems contractor(s) and the rail franchisees enables the rail systems provider(s) to develop a rail systems solution in an environment that includes appropriate commercial

The analysis undertaken concludes that delivery under a competitive alliance is the optimal procurement approach for the Rail Systems package.

incentives for all parties (including the rail franchisees) to work together to achieve the requirements. This is particularly important for the rail systems package given that a large proportion of the works relate to upgrading existing infrastructure that will form part of the new Sunshine – Dandenong Line.

- Time – the ARTO stakeholders will be interested in the rail systems design and operations and can delay commissioning if rail systems do not meet their requirements. This requires an approach that coordinates these key stakeholders’ involvement in the rail systems design and installation. A competitive alliance model is the best forum to achieve this
- Price and budget certainty – a competitive alliance that includes appropriate KPIs should deliver a level of certainty and provide value for money by aligning the commercial interests of the alliance participants, reducing the likelihood of costly scope changes
- Innovation and incentive – an alliance should drive / facilitate innovation by bringing all stakeholders together with aligned incentives and a focus on ‘best for project’ outcomes
- Flexibility and control – a competitive alliance introduces flexibility in the design process and enables the State to access the expertise and innovative thinking of rail systems providers
- Market interest and appetite – Market sounding participants indicated a preference for a competitive alliance delivery method for packages involving significant ARTO interface and therefore support using a competitive alliance model for the rail systems.

It is noted that a competitive alliance model was used successfully for the design and delivery of the rail systems package for the RRL.

Consistent with the rest of the metropolitan rail network, the metropolitan rail franchisee will operate and maintain the rail systems.

Mitigation of key work package specific risks

Table 14-9 provides a summary of the key risks specific to the Rail Systems package and how the recommended competitive alliance model would mitigate these risks.

Table 14-9 – Mitigation of key Rail Systems risks

| Key risks | Mitigation under delivery model |
|---|---|
| <ul style="list-style-type: none"> • Stakeholder interface with ARTOs (MTM, V/Line, VicTrack, PTV, etc.) is less effective and efficient than expected, resulting in delay • There is insufficient ARTO capacity, or the franchisees are under-resourced, to deliver the works. | <p>Key factors relevant to the proposed delivery model that mitigate these risks include:</p> <ul style="list-style-type: none"> • The key risk mitigating factors relating to ARTO involvement outlined for the Rail Infrastructure package also apply to the Rail Systems package. |

Source: Department analysis.

14.5.6 Procurement assessment – Wider Network Enhancements packages

A defining characteristic of the Wider Network Enhancements is that they will be undertaken in a brownfield, live rail environment. Works need to be conducted in a manner that enables the passenger rail and freight networks to continue to operate with minimal disruption during construction, requiring careful scheduling and staging, and management of access and occupations.

As the rail network is a complex operating environment with multiple interdependencies and interfaces, having the metropolitan rail franchisee, contractors and other stakeholders work closely together in this environment is critical to the project’s success.

As the scope of the Wider Network Enhancements is developed to a greater level of definition and design, optimum packaging will be assessed considering aspects such as coordinated construction staging to minimise network disruption.

Given the significant interface risks involved, the potential for unforeseen changes and the importance of stakeholder management, a competitive alliance or metropolitan rail franchisee delivery model may be suitable for aspects of these works to help manage these risks and ensure on budget and on time delivery (noting that the Department will also seek opportunities for fixed time, fixed cost models, where appropriate).

As previously noted, certain Wider Network Enhancements will be included in the Rail Infrastructure and Rail Systems packages. The remaining Wider Network Enhancements will be subject to a separate, more in-depth stand-alone packaging and procurement assessment (noting that the procurement processes for these works do not need to commence for several years), including consideration of opportunities for certain works to be incorporated with the Level Crossings Removal Project. Consistent with the rest of the metropolitan rail network, the metropolitan rail franchisee will operate and maintain these enhancements.

14.5.7 Preliminary packaging and procurement solution

Table 14-10 summarises the structure of the preliminary packaging and procurement solution as developed under Step 2 and Step 3.

Table 14-10 – Preliminary packaging and procurement solution

| Works package | Description | Procurement model |
|-----------------------------------|---|---|
| Early Works | Tram works | Tram diversion works |
| | | Yarra Trams led |
| Estimated cost of capital works: | Utilities relocations / protection and site preparation | Relocation / protection of utility services in conflict with the project alignment, plus other site preparatory works |
| | | Managing contractor |
| \$ * - \$ * m | Construction power | Provision of power for construction activities |
| | | Direct USP procurement |
| Tunnel and Stations | | Main tunnelling works, five underground stations, station fit-out, mechanical and electrical systems, specific operation and maintenance services for the infrastructure delivered by the package and commercial opportunities at the new stations ¹ |
| Estimated cost of capital works: | | Availability based PPP |
| \$ * bn | | |
| Rail Infrastructure | | Works at the eastern and western portals including cut and cover tunnelling, decline structures and local reconfiguration and realignment of existing lines ² |
| Estimated cost of capital works: | | Competitive alliance |
| \$ * n | | |
| Rail Systems | | Rail systems design (including conventional signalling, HCS, train and power control systems and ICT), brownfield installation works, rail systems integration and commissioning ³ |
| Estimated cost of capital works: | | Competitive alliance |
| \$ * n | | |
| Wider Network Enhancements | | Works required across the wider existing above ground rail network (outside of the tunnel and beyond the tunnel portals), including track modifications and signalling system upgrades |
| Estimated cost of capital works: | | Case by case |
| \$ * m | | |

¹ Estimated cost includes installation of rail systems in the tunnel

² Estimated cost includes the western and eastern turnbacks

³ Estimated cost includes signalling upgrades on the Sunshine – Dandenong Line

* Redacted - commercial-in-confidence

In addition, it is noted that:

- The metropolitan rail franchisee will operate the services using the infrastructure delivered by the project as there are significant advantages to maintaining a single metropolitan operator across the network
- The HCMTs that will operate on the Sunshine – Dandenong Line will be procured separately to the project on a network wide basis. PTV is procuring HCMTs that will be deployed on the Dandenong Line to meet short-term capacity requirements
- The structure of the preliminary packaging and procurement solution is materially consistent with the 2013 Procurement Strategy Update recommendation, including the associated expert peer review undertaken in 2012.

14.6 Step 4: Market validation

The preliminary packaging and procurement solution outlined above, along with a number of other procurement and packaging options that were considered as potential but less favoured options, were then taken forward to Step 4: Market validation to test the market's views on packaging, procurement models, risk allocation and service delivery.

Two stages of packaging and procurement market soundings were undertaken by the Department in conjunction with DTF and its external advisors. Stage 1 was undertaken in June 2015 and involved 16 domestic and international entities representing tunnelling and station contractors, financial sponsors, signalling systems providers and rail designers. Stage 2 was undertaken in December 2015 and aimed to build on the outcomes of Stage 1 and focus on more granular packaging and procurement issues relevant to establishing the project's 'go-to-market' procurement strategy. Stage 2 involved 26 participants from substantially the same sectors as Stage 1.

There is broad market support for the proposed packaging and procurement strategy, including contractor and financier appetite for a Tunnel and Stations PPP.

Key themes from the market sounding processes relevant to establishing the overarching procurement strategy outlined in this Chapter included:

- There is strong domestic and international market interest in the project and broad support for the packaging and procurement strategy. A clear majority of participants stated that the size of the Tunnel and Stations and the PPP delivery model is attractive and acceptable from a market capacity perspective. There was market interest in all works packages
- Participants indicated the market currently has a growing capacity for larger assets, with a large volume of competitive debt * and equity available. There was also support for State capital contributions for the Tunnel and Stations PPP (refer to Chapter 17)
- The key project risks were seen to be the rail franchisee / existing network interface risk (particularly during the commissioning stage), ground conditions risk, the need to manage the works in the CBD (including the interface with local businesses) and industrial relations risk. All of these risks were considered manageable provided appropriate commercial arrangements between the State, rail franchisee and the relevant contractors can be established (as applicable)
- All participants indicated a preference for the Tunnel and Stations PPP to be quarantined from the live rail environment at the portals, indicating clear market support for separate delivery of the portal works. Most civil contractors indicated that it would make sense for the eastern and western portal works to be packaged together given the works are of a similar nature
- The majority of participants supported delivering the rail systems separately to the Tunnel and Stations package, primarily due to the associated brownfield risks and the limited number of signalling providers with knowledge of Melbourne's rail network
- Most participants suggested that early establishment of the Rail Systems Alliance could assist in managing the interface between this package and the Tunnel and Stations PPP (refer to Chapter 17)

* Redacted - commercial-in-confidence

For completeness, it is noted that a structured process of further market testing of the recommended packaging and procurement strategy will be undertaken progressively as part of the detailed pre-procurement planning activities.

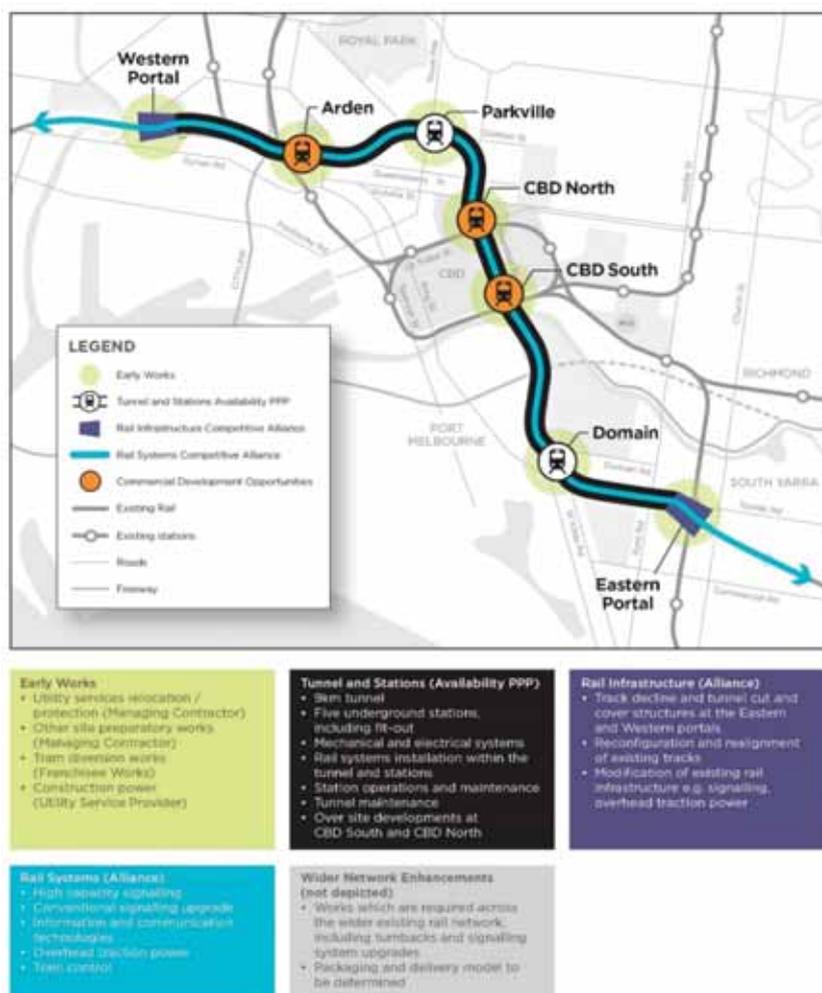
14.7 Step 5: Business Case recommendation

The analysis presented above indicates that:

- An availability PPP is the optimal procurement strategy for the Tunnel and Stations package and that there is market capacity and appetite for delivery of these works under this structure
- A range of project works should be packaged and procured separately to the Tunnel and Stations package.

Figure 14.2 shows a project procurement strategy alignment map outlining the relevant works packages and associated delivery models.

Figure 14-2 – Procurement strategy alignment map



Further work will be undertaken as part of detailed pre-procurement planning activities for the project to determine the precise scope delineation between works packages, including developing strategies to mitigate interface risks. This work will also consider the outcomes of the further market interactions noted above.

CHAPTER 15

Value capture – integrated development opportunities – Chapter Summary

- This Business Case focuses on identifying opportunities for Melbourne Metro to directly generate and capture value through integrated development and other commercial opportunities. It does not consider potential value capture mechanisms such as tax increment financing, new levies or new contributions.
- The Department has analysed the relevant opportunities associated with Melbourne Metro to identify, evaluate and, where appropriate, implement integrated development and other commercial opportunities.
- Quantified value capture opportunities include:
 - Over site developments at CBD North and CBD South
 - In-station retail and advertising.

It is estimated that approximately \$ * n of value could be realised through these opportunities in real terms over the assumed life of the project.

- Additional opportunities that are yet to be quantified include:
 - Use of new telecommunications infrastructure to drive revenue
 - Redevelopment of surplus land at Arden as part of the broader urban renewal of the Arden-Macaulay Precinct.
- As discussed in the previous Chapter, the Tunnel and Stations PPP package will be responsible for delivering over site developments at CBD North and CBD South as well as retail and other commercial opportunities within the new stations. The Department will therefore be seeking private sector innovation in relation to value capture opportunities as part of the competitive tender process for this package, with bidders encouraged to develop innovative value capture solutions to offset the cost of the project.
- Value capture opportunities will be monitored, assessed and managed over the life of the project.

* Redacted - commercial-in-confidence

WHAT MELBOURNE METRO DELIVERS



15 Value capture – integrated development opportunities

15.1 Value capture identification and assessment process

15.1.1 Overview of Business Case assessment

This Business Case focuses on identifying opportunities for Melbourne Metro to directly generate and capture value through integrated development and other commercial opportunities. It does not consider potential value capture mechanisms such as tax increment financing, new levies or new contributions.

The Department has analysed the relevant opportunities associated with Melbourne Metro to identify, evaluate and, where appropriate, implement integrated development and other commercial opportunities. In assessing these opportunities the Department has sought advice from technical, commercial / financial, property development and other specialist advisers to ensure that all options are considered and that the project is planned and delivered to capitalise on value capture opportunities where appropriate.

The assessment process for this Business Case has involved analysis of potential value capture opportunities along the Melbourne Metro alignment, undertaken on a precinct-by-precinct basis with a focus on the five new stations and the portals. Value capture opportunities considered as part of this assessment have included the potential to:

- Incorporate retail or other commercial opportunities within the new stations
- Expand station infrastructure to accommodate additional development
- Capture value from existing properties and/or planned developments in the vicinity of the new stations (such as by offering direct pedestrian access via underground pedestrian walkways)
- Develop 'air rights' above the new infrastructure (over site development)
- Develop surplus land (land required for construction purposes but not for ongoing use by the project)
- Stimulate urban renewal and capture value from the associated new development activities.

The process has involved a series of workshops with key project team members, stakeholders and advisers as well as detailed analyses of specific development and other opportunities.

15.1.2 Private sector innovation

As discussed in the previous Chapter, the tunnel and stations infrastructure will be delivered via a PPP. As has been demonstrated on numerous previous projects, PPPs provide an opportunity for governments to improve amenity and/or partially offset the cost of projects, by harnessing private sector innovation in relation to commercial opportunities. Examples range from large-scale private sector developments on projects such as Southern Cross Station, the Melbourne Convention Centre Development and the Sydney International Convention, Exhibition and Entertainment Precinct to smaller-scale opportunities which complement the public infrastructure and provide an additional offering to users and the community (such as early learning centres adjacent to new schools, short-stay accommodation at hospitals and food, retail and other amenity offerings within social infrastructure).

The Department will therefore seek to maximise value capture and encourage private sector innovation through the procurement process for the Tunnel and Stations PPP. As outlined in the previous Chapter, bidders for the Tunnel and Stations PPP will be required to include development expertise to plan and deliver the over site development opportunities at CBD North and CBD South. Bidders will also be encouraged to develop additional innovative solutions which enhance value capture and/or improve customer amenity.

Therefore, while the Department has considered a variety of opportunities, some of which have may been assessed as unviable at this stage, ideas in relation to integrated developments and other value capture opportunities will ultimately be sought from the private sector as part of the competitive tender process for the Tunnel and Stations PPP. These ideas will be considered as part of the tender evaluation process to assess whether they are consistent with Government objectives and provide value for money.

The assessment of value capture opportunities in this Business Case should therefore be considered preliminary in nature. The Department will continue to monitor, assess and manage value capture opportunities over the life of the project, including via the Tunnel and Stations PPP.

15.2 Development opportunities

15.2.1 Overview

The extent of potential development will be limited by the nature of the project. The vast majority of the infrastructure associated with the project involves tunnels and new stations that will be underground, located beneath existing roadways or land which has already been developed. Compulsory acquisitions of land will be undertaken in accordance with the requirements of the *Land Acquisition and Compensation Act 1986* and will be limited to sites required for construction of the project.

The types of development opportunities considered include:

- Developing land that is surplus to project requirements (for example, land required for construction purposes but not for ongoing use)
- Developing airspace over transport infrastructure (over site development)
- Expanding underground station infrastructure, for example to incorporate additional retail offerings.

As noted above, the identification of development opportunities has been undertaken on a precinct-by-precinct basis, focusing on the new stations and the portals.

15.2.2 Arden

As noted in Chapter 9, the Victorian and Local Governments have identified the Arden-Macaulay Precinct as a key urban renewal site that could catalyse a new CBD-fringe mixed-use office precinct with a potential to accommodate 25,000 residents and in excess of 43,000 jobs.

The Arden-Macaulay Precinct is an expanded central city urban renewal area and the southern part of the Arden-Macaulay Precinct (the Arden Precinct), which is largely government-owned land (the Arden Government Land), has been identified as suitable for more intensive redevelopment should a station be constructed at Arden.

A range of interventions would be required to facilitate urban renewal in this area. The Arden Government Land site, and the precinct more broadly, is subject to some significant inundation and a range of poor soil conditions, including contamination and large deposits of Coode Island silt. Existing planning controls also limit the extent of potential development. Accordingly, a co-ordinated approach is required to facilitate precinct-wide urban renewal and allow the Arden Government Land site to be brought to market, including:

- Preparation of a structure plan and subsequent planning scheme amendment that would contemplate a more intensive scale of development than previously considered (currently being prepared by MPA)
- Development of an integrated flooding and development scheme for the precinct (potentially incorporating dredging of the Moonee Ponds Creek, removal of levee banks and construction of major pipelines with outfalls to the Moonee Ponds Creek). This would allow a balanced consideration of flooding and open space needs along the creek corridor to respond to the growing population needs for the broader renewal precinct

- Finalising the Arden-Macaulay Partnership Blueprint. This is a government initiative led by DPC in consultation with the City of Melbourne, the Department of Education and Training, Office of Housing, VicTrack and other major land owners and stakeholders in the precinct, with a view to coordinating the renewal and redevelopment of publicly owned land and alignment of investment
- Potential acquisition of a number of properties immediately adjacent to the Arden Government Land to facilitate raising of the ground level plane to address localised soil conditions and inundation of the Arden Government Land.

Investment is also required from prospective developers to make the Arden Government Land available for redevelopment, which could potentially include decking over flood levels.

Further assessment of the most appropriate implementation strategy is required.

A concept masterplan has been prepared by MPA informed by a central city forecast land use assessment (identifying significant demand for commercial, retail, residential and institutional land use). This assessment demonstrates likely market interest in the precinct starting in the mid-2020s (coinciding with the proposed completion of the project) with the development absorption of the remainder of the site anticipated to occur throughout the subsequent 30 year period to approximately 2056.

The City of Melbourne has identified this area as suitable for more intensive redevelopment should a railway station be provided.

While a preliminary assessment of the feasibility of Arden has been undertaken in conjunction with MPA, the interventions above will be subject to a separate investment submission.

This investment will require preparation of a further detailed business case and a co-ordinated approach between relevant Local and Victorian Government departments and agencies, including the Department, the City of Melbourne, Melbourne Water, MPA, the Department of Environment, Land, Water and Planning, DPC and DTF.

The value of the integrated development opportunity at Arden has therefore not been quantified as part of this Business Case.

15.2.3 Parkville

The Department has assessed the potential for over site or air rights developments at Parkville station. However, this station is proposed to be located within existing road reserves and as such is not considered to provide a footprint suitable for a significant over site development. There may be some limited opportunities for in station value capture (retail and small scale commercial ventures, for example), but these opportunities are not expected to be significant and have not been considered in detail in this Business Case.

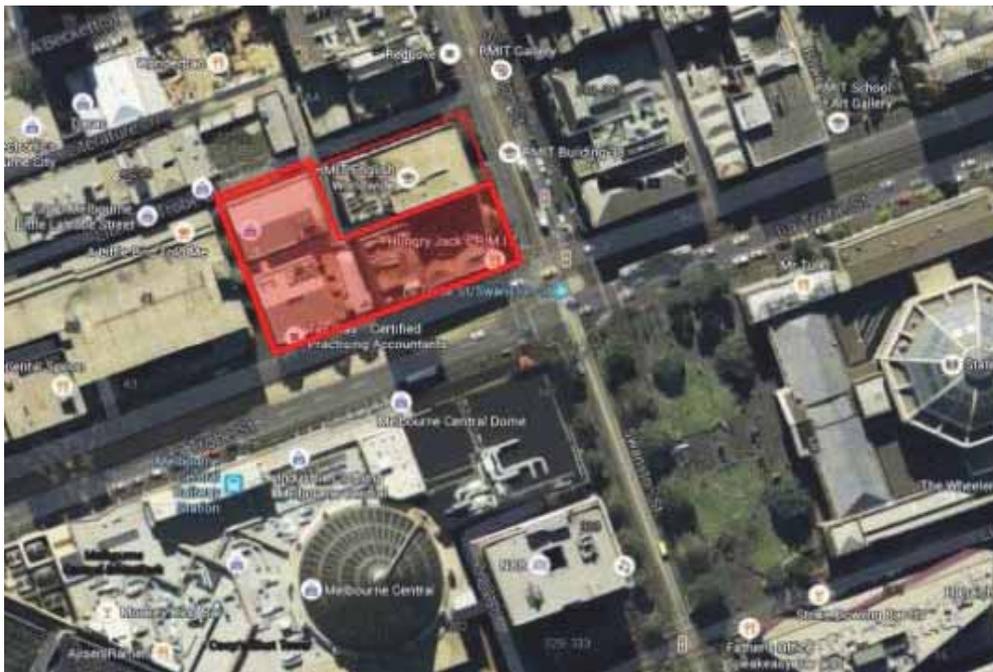
The Department has also considered value capture options relating to properties adjacent to Parkville station, including underground retail, commercial and educational redevelopment opportunities. Following consultation with the relevant stakeholders and high level financial assessment, it has been concluded that these opportunities are not likely to be feasible, due to negative value and technical constraints.

The Department will continue to consider other value capture opportunities, including developments seeking to increase accessibility to educational and research institutions in the vicinity of the station. As noted above, the private sector will also be encouraged to consider potential value capture opportunities at the new stations as part of the Tunnel and Stations PPP.

15.2.4 CBD North

Construction of the CBD North station and associated station entrances require acquisition of properties near the corner of Swanston Street and La Trobe Street, opposite RMIT University, Melbourne Central and the State Library. Figure 15-1 depicts the land to be potentially acquired to facilitate the construction of the station and associated entrances.

Figure 15-1 – Potential development site at CBD North



The site is located within the City of Melbourne Local Government Area and is designated Capital City Zone 1 (CCZ1). The CCZ1 covers sites outside of the retail core and is intended to provide for a range of financial, legal, administrative, cultural, recreational, tourist, entertainment and other uses that complement the capital city function of the locality. CCZ1 includes requirements in relation to shadowing which have implications for the maximum achievable building height on this site.

The site is subject to the Melbourne Planning Scheme (MPS) Amendment C262, which was approved by the Victorian Minister for Planning on 4 September 2015. The Amendment has introduced discretionary plot ratios, mandatory podium height, mandatory setback requirements and mandatory height controls with the aim of providing better amenity outcomes for new development. MPS Amendment CMP C262 will apply as an interim planning control until 4 September 2016.

The site is also subject to design and development and parking overlays, including ensuring an attractive pedestrian oriented street frontage.

A preliminary assessment of the CBD North development opportunities has been undertaken to assess the value capture potential at this site. This has involved:

- The development of indicative massing studies based on existing planning controls and highest and best use assumptions (predominantly residential development with retail at ground level)
- Informed by these massing studies, feasibility analysis based on current market-based assumptions to determine an indicative residual land valuation.

Based on this preliminary assessment, it is considered that this is a significant integrated development opportunity, with a potential value capture from the sale of surplus land and air rights at CBD North estimated to be between \$ * m in today's dollars.

The Department, in conjunction with DTF, is also investigating integrated development opportunities relating to properties adjacent to CBD North station, including:

* Redacted - commercial-in-confidence

- Increased commercial opportunities for land owners within the alignment catchment (e.g. student accommodation, etc.)
- Increased accessibility making RMIT a more viable option for local and international students
- Creation of wider connections with existing retail at Melbourne Central
- Developing an underground retail scheme adjacent to the station.

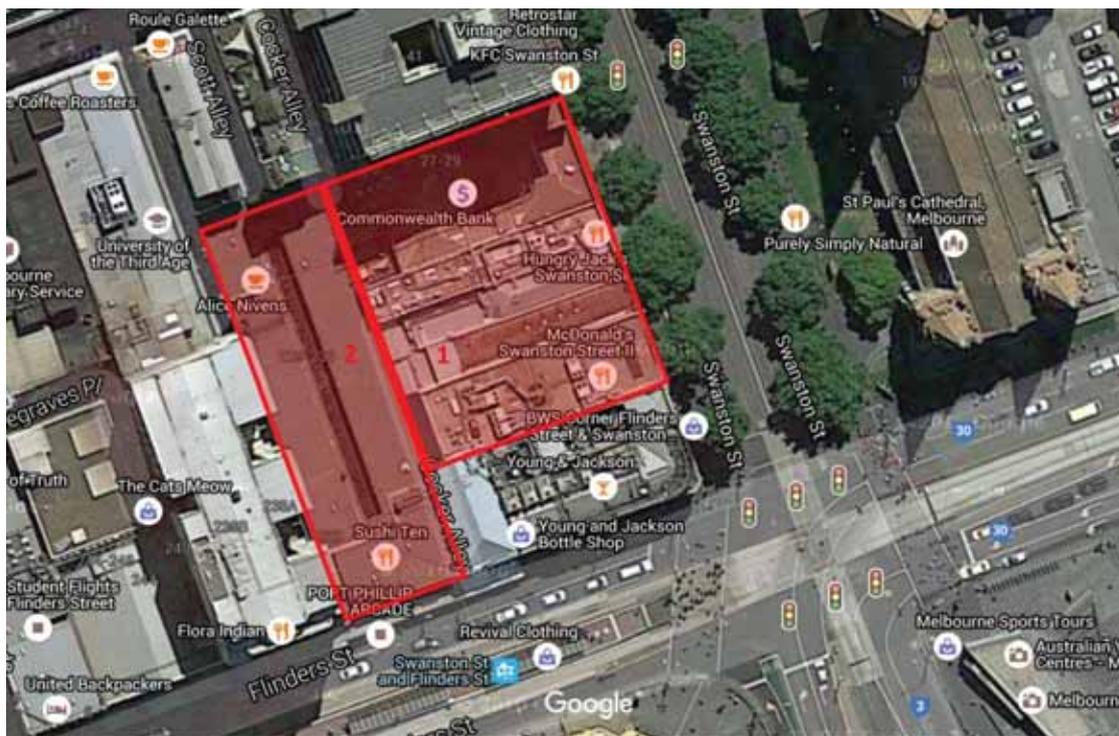
It was determined that the development of an underground retail scheme would not be feasible within the current design, however analysis is being undertaken to examine the revenue potential associated with the remaining opportunities.

Further work will be undertaken as the project progresses to assess and optimise the key development opportunities at CBD North, including via the Tunnel and Stations PPP procurement process.

15.2.5 CBD South

The CBD South station and associated station entrances require acquisition of properties surrounding the Young and Jackson Hotel on the corner of Swanston Street and Flinders Street, opposite St Paul's Cathedral, Federation Square and Flinders Street Station. Figure 15-2 depicts the land to be acquired to facilitate the construction of the station and associated entrances.

Figure 15-2 – Potential development site at CBD South



The site is located within the City of Melbourne Local Government Area and is designated Capital City Zone 2 (CCZ2). The CCZ2 is intended to develop retail core of the City of Melbourne and provide for the intensification of retail and other complementary commercial, community and entertainment uses within this established retail core.

The site is subject to the MPS Amendment C262, as discussed above.

The site is also subject to design and development, heritage and parking overlays, including imposition of a 40 metre mandatory height control.

A preliminary assessment of the CBD South development opportunities has been undertaken to assess the value capture potential at this site. This has involved:

- The development of indicative massing studies based on existing planning controls and highest and best use assumptions (predominantly residential development with retail at ground level)
- Informed by these massing studies, feasibility analysis based on current market-based assumptions to determine an indicative residual land valuation.

Based on this preliminary assessment, it is considered that this is a significant development opportunity with a potential value capture from the sale of surplus land and air rights at CBD South estimated to be between \$ * m in today's dollars.

The Department has also identified a number of retail options in relation to properties adjoining the CBD South station (in the vicinity of Federation and City Squares), and is examining opportunities to further maximise potential retail revenues in this area through developments that connect with existing Flinders Street Station retail and activate laneways beyond the station precinct.

Further work will be undertaken as the project progresses to assess and optimise the key development opportunities at CBD South, including via the Tunnel and Stations PPP procurement process.

15.2.6 Domain

The Department has assessed the potential for over site or air rights developments at the Domain station. However, this station is proposed to be located within existing road reserves and as such is not considered to provide a footprint suitable for a significant over site development. Although there may be limited small-scale opportunities at the station entrances or over the station box, any value capture is not expected to be significant and these opportunities have not been considered in detail for the purposes of this Business Case.

Analysis indicates some limited opportunity for value capture associated with the properties surrounding Domain station. A number of other options are being considered, including the development of a new retail scheme at surface on one of the sites not immediately adjacent to the station (it is anticipated that this would be delivered by the private sector). Investigations in relation to this opportunity are ongoing.

The private sector will also be encouraged to consider potential value capture opportunities at the new stations as part of the Tunnel and Stations PPP.

15.2.7 Portals

It is possible that land required for construction activities at the portals might not be required for ongoing use and that some of this land could be available for redevelopment.

The Department has estimated that the residual land value capture opportunities at these sites amount to approximately \$ * m in real terms.

Detailed opportunities are being assessed.

* Redacted - commercial-in-confidence

15.3 Other commercial opportunities

15.3.1 Overview

The Department has explored a wide variety of potential commercial opportunities, including through consultation with PTV and VicTrack and by reference to comparable projects in other jurisdictions. Identified commercial opportunities include station convenience and general amenity retail offerings, advertising and telecommunications.

Each of the five stations constructed as part of the project provides an opportunity to derive revenue streams from convenience and general amenity. These opportunities include:

- Small-scale internal station retail ventures, retail spaces, parcel lockers, vending machines, ATMs and retail offerings within the planned station pedestrian entrances (i.e. located within the underground station structure)
- Retail within above ground station structures
- Revenue derived from station advertising, billboards and other advertising
- Revenue associated with new telecommunications infrastructure.

These opportunities are set out in further detail below.

The Department has also considered the potential to connect existing buildings directly to the new stations via new underground pedestrian tunnels, thereby enhancing the value of these buildings and providing an opportunity to capture value. However, it has been concluded that, given the significant development costs associated with construction, it is unlikely that funding underground passenger links will be deemed a commercially viable option by the private sector.

The private sector will also be encouraged to consider potential value capture opportunities at the new stations as part of the Tunnel and Stations PPP.

15.3.2 Station retail

The Department has performed preliminary analyses to identify value capture opportunities from small-scale internal station retail ventures, retail spaces, parcel lockers, vending machines, ATMs and other retail offerings within the planned station pedestrian entrances.

Based on PTV's experience at other stations, these opportunities are currently estimated to total \$110m in real terms over 30 years across all five stations.

15.3.3 Advertising

All new stations will provide opportunities to generate additional revenues from advertising rentals within the station box. Based on PTV's experience at other stations, these opportunities are estimated at some \$ * m in real terms over 30 years.

There are also a range of opportunities at Arden station and in the vicinity of the western and eastern portals to generate additional revenue from billboard and other advertising opportunities along the new line. This is a relatively low value opportunity, and currently the subject of further consideration by the Department and other key stakeholders.

15.3.4 Telecommunications

The project will provide an opportunity to improve the telecommunications network by including new telecommunications infrastructure through the tunnel and in underground stations. These opportunities are yet to be quantified but analysis remains ongoing.

* Redacted - commercial-in-confidence

15.4 Preliminary value capture analysis

The Arden-Macaulay precinct presents a significant urban renewal opportunity. However, this investment will require preparation of a further detailed business case and the potential for value capture at Arden has therefore not been quantified as part of this Business Case.

The identified integrated development opportunities that have been quantified in this Business Case are summarised in Table 15-1.

Table 15-1 – Value capture total

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Additional details in relation to implementation of proposed value capture and integrated opportunities are provided in Chapter 18.

¹ Excluding telecommunications revenues which are yet to be quantified.

CHAPTER 16

Budget impacts – Chapter Summary

- Government provided \$1.56bn in the 2015/16 budget to fund planning, design and early works.
- As shown in Chapter 12, the project's total estimated investment (TEI) is \$10.9bn.

*Redacted
commercial-in-confidence and subject to appropriate
contributions by the Commonwealth Government*

- The Tunnel and Stations package has estimated annual capital service payments of \$* m commencing in 2023/24 and an average of \$* m per annum (in 2015/16 dollars) for facilities management, maintenance and lifecycle costs. The operating costs are expected to be partially offset by revenues from commercial opportunities (in station retail, advertising, etc.) of approximately \$* n per annum (in 2015/16 dollars).
- The maintenance and lifecycle costs associated with the non-PPP works are estimated at an average of \$* m per annum (in 2015/16 dollars).
- As discussed in Chapter 15, opportunities exist to partially defray the cost of the project through value associated with air rights development at CBD North and CBD South, and through the sale of surplus land. The value of these opportunities is estimated to be between \$* m to \$* m in real terms. Additional opportunities also exist at Arden. Further work is required, however, to refine the value of all these opportunities and this potential value has not been factored into the funding sought by this Business Case.
- This Business Case does not seek funding for rolling stock, operations of rolling stock (e.g. drivers, traction energy etc.) or for Enabled Investments enabled by Melbourne Metro.
- This Chapter summarises the project's accounting treatment, with more detailed advice provided in Appendix 13.

* Redacted - commercial-in-confidence



16 Budget impacts

16.1 Introduction

The preceding Chapters of this Business Case present the anticipated risks, costs and revenue opportunities and the recommended packaging and procurement strategy for the project.

This Chapter outlines the expected budget impacts.

16.2 Government capital contributions to the PPP

Consistent with many recent Australian PPP projects and DTF policy requirements¹, the PPP for the Tunnels and Stations package will involve capital contributions from government to address potential finance market capacity constraints and reduce the costs associated with private finance, while still achieving the risk transfer and other benefits associated with the PPP delivery model.

Further detailed work on the appropriate form, size and timing of the capital contributions will be undertaken as part of the next stage of the project and prior to the release of detailed tender documentation for the Tunnel and Stations package.

The following assumptions have been adopted for the purposes of the budget impacts analysis in this Business Case:

- The government capital contributions will be in the form of a grant (that is, the contributions will not attract any return)
- Government will make capital contributions totalling \$* bn towards the end of the design and construction phase
- Government will provide a further \$* bn capital contribution upon completion of the Tunnel and Stations works.

Analysis to support this proposed approach is provided in Appendix 10.

This analysis assumes that any government funding is provided by the Victorian Government. The impact of any Commonwealth Government funding that may be allocated in the future is not considered.

Government approval will be sought if any material changes are proposed in relation to the capital contributions approach outlined in this Business Case.

¹ As documented in the Partnerships Victoria Requirements dated May 2013.

* *Redacted - commercial-in-confidence*

16.3 Accounting treatment

As set out in Appendix 13, this Business Case assumes that existing State accounting policies will apply to the project. Based on this assumption, the accounting treatment for the Tunnel and Stations package can be summarised as follows:

- The PPP works will be recognised on the State's balance sheet as a leased asset and liability, first recognised when the Tunnel and Stations works reach final completion. The relevant amount will be disclosed as a contingent liability in a note to the accounts during the design and construction period
- The lease asset and liability are assumed to be of an equal value when initially recognised, based on the fair value of the leased asset measured by reference to the relevant design and construction costs plus capitalised interest and certain other costs incurred by the PPP concessionaire during the design and construction phase. While these amounts will ultimately be determined from the successful bidder's financial model, for the purposes of this Business Case they have been estimated based on assumed finance and other PPP cost assumptions agreed with DTF
- In each year of the operating term, the State's payment of the availability service payments is recognised as a cash outflow, apportioned between: payments for operating expenses, such as the provision of facilities management and maintenance services; interest expense, calculated based on the implicit internal rate of return in the lease and the outstanding lease liability; and a reduction in the lease liability, being the balance of the service payment in each year and fully amortising the lease over the operating term of the concession.

For the purposes of this analysis, no assumptions have been made about additional State borrowing required to fund either the government capital contributions or the costs associated with the non-PPP aspects of the project.

16.4 Key timing assumptions

For the Tunnel and Stations package it is assumed that design and construction will commence in late 2017, the main construction works will be completed in late 2023 (at which point commercial acceptance will occur) and additional integration and commissioning works will occur in the period from late 2023 to late 2024. The 25 year PPP operating phase including FM, maintenance and lifecycle works is assumed to commence in late 2023 and end in late 2048.

Design and construction of the remaining capital works is expected to be completed by the end of 2025.

16.5 Net funding request to government

Table 16-1 outlines the components of the project's total budget impact. It:

- Identifies the capital costs for each non-PPP package
- Details the estimated finance lease liability and State capital contributions for the Tunnel and Stations PPP
- Identifies State costs
- Separately details the government funding provided in the 2014-15 budget.

Table 16-1 – Budget impact (delivery phase)

*Redacted
commercial-in-confidence and subject to appropriate
contributions by the Commonwealth Government*

Service payments for the Tunnel and Stations package will commence following completion of the PPP works. These are not shown in the table above and are discussed in Section 16.6. The project will also require funding for the ongoing maintenance and asset renewal of the non-PPP works. Table 16-3 shows these expected costs.

As discussed in Chapter 15, opportunities exist to partially defray the cost of the project through value associated with air rights development at CBD North and CBD South, and through the sale of surplus land. The value of these opportunities is estimated to be between \$* million in real terms. Additional opportunities also exist at Arden. Further work is required, however, to refine the value of all these opportunities and this potential value has not been factored into the funding sought by this Business Case.

This Business Case does not seek funding for rolling stock or for Enabled Investments.

16.6 Estimated operating phase costs

The estimated ongoing funding requirement for the first 10 years following completion of the Tunnel and Stations PPP works are summarised in the table below.

Table 16-3 – Estimated ongoing funding requirement

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commercial-in-confidence

* Redacted - commercial in confidence

Stakeholder engagement – Summary

- The Melbourne Metro concept has a strong history of constructive stakeholder engagement between 2008 and 2013. Stakeholder engagement recommenced in February 2015 following the Victorian Government's commitment to Melbourne Metro. A significant amount of stakeholder consultation undertaken to date relates to the tunnel and stations. Broad consultation across all aspects of Melbourne Metro will continue as the project develops.
- A wide variety of stakeholders are engaged in this project including local residents, businesses, utility providers, community and interest groups, and government departments and agencies.
- Disruption to residents and businesses during construction, operational changes to train and tram services, and land and property impacts are key stakeholder issues that will be considered and managed appropriately.
- An approach to communicating and engaging with stakeholders has been developed which proactively identifies and manages issues and risks, and supports the planning, development and delivery of Melbourne Metro.
- To enable public participation at key points in the planning, development and delivery of the project, a phased communications and stakeholder engagement approach will be used. This includes, for example:
 - Phase 1 (February to September 2015): Raising awareness and early engagement (complete)
 - Phase 2 (October to December 2015): Supporting development of planning and reference design (complete)
 - Phase 3 (Early 2016 to early 2017): Statutory planning process (underway)
 - Phase 4 (2016 to 2018): Procurement and early works
 - Phase 5 (2017 – 2026): Major works delivery.
- The results of the stakeholder engagement process are key inputs to project design development and planning and developing the EES.



17 Stakeholder engagement

17.1 Background

Melbourne Metro was first proposed in March 2008 as part of the Investing in Transport report completed by the East West Link Needs Assessment Study team led by Sir Rod Eddington. The study consulted significantly on strategic transport issues.

A broader formal submission process was undertaken as part of the Victorian Government's response to the East West Link Needs Assessment Study (the Victorian Transport Plan).

During the project's options evaluation and refinement phases in 2009-2010, a two-stage engagement process was undertaken to seek external views and feedback:

- Stage 1 (October 2009 to June 2010): Focused on seeking feedback to the question: "Given the alignment and station locations set out in the Victorian Transport Plan, what are your views on this?" Feedback was gathered primarily through direct meetings with key stakeholders and land users in the vicinity of the proposed stations
- Stage 2 (July to September 2010): Provided the public and stakeholders with the opportunity to learn more about the preferred alignment and station locations and provide comment. The project website made high-level project materials available for viewing and download.¹ A 10 part questionnaire was provided online for the community to provide direct feedback. This resulted in more than 340 responses with more than 93 per cent supporting the project overall. A series of stakeholder briefings with peak bodies and community groups were also held to outline the proposed options and gather direct feedback to assist in design development.

Informal engagement continued with key stakeholders until late 2013 to further develop project concept designs.

Stakeholder engagement recommenced following the Victorian Government's commitment to Melbourne Metro in February 2015. MMRA is largely responsible for stakeholder engagement and a dedicated Communications and Stakeholder Relations team was established for this purpose.

A significant amount of stakeholder consultation undertaken to date relates to the tunnel and stations. Broad consultation across all aspects of Melbourne Metro will continue as the project develops.

For clarity, it is noted that the stakeholder engagement process outlined in this Chapter is distinct from the procurement-related market engagement process outlined in Chapter 14, which focused on private sector constructors, financiers, operators and maintainers who may be interested in contracting with the government for the project's financing, delivery and operation.

17.2 Stakeholder engagement objectives and principles

A targeted, strategic approach is being applied to communications and stakeholder engagement to meaningfully engage the public at key points during the planning, development and delivery of the project.

The objectives of stakeholder engagement are to:

- Build MMRA's understanding of stakeholder interests, concerns and preferred outcomes

The project concept has broad community backing. Formal and informal feedback indicate strong support for investment in a large rail tunnel project to address the capacity constraints of the metropolitan network.

¹ The project overview document was downloaded more than 3,500 times, the overview animation was viewed more than 4,500 times and the train-into-station animation was viewed more than 2,300 times.

- Generate stakeholder involvement, understanding and support for the project by raising awareness of its direct and indirect benefits across the rail network, listening to feedback and by actively addressing any issues or concerns
- Elicit important information from stakeholders about technical, social and community requirements to inform the planning, design and delivery of the project and develop appropriate mitigation strategies. This includes closing the loop with stakeholders to demonstrate how feedback was considered and incorporated where appropriate.

Guiding principles that will underpin the approach to communications and stakeholder relations activities for the project include:

- Involve a broad spectrum of the community in the planning, development and delivery of the project using an open, transparent and inclusive communications approach
- Promote understanding and trust with external and internal audiences using accessible, accurate and consistent communication materials and delivering well-planned, coordinated and timely engagement activities
- Inform and engage affected stakeholders early in the planning processes using proactive communication and maintaining this contact throughout
- Use direct communication (i.e. letters, direct email) to communicate major decisions and issues to relevant community members and stakeholder groups
- Tailor messages and delivery channels to the communications / information needs of their intended audiences
- Identify and involve stakeholders using stakeholder mapping and monitor the consultation process to ensure we (and our stakeholders) deliver on our commitments
- Validate the effectiveness and relevance of communication by continuously evaluating and improving communication strategies and activities.

17.3 Stakeholder identification and engagement

As a complex and large project, there are a number of stakeholders who will be involved in, impacted by, or interested in Melbourne Metro. The stakeholder engagement approach will target the breadth of stakeholders listed in Appendix 14.

Figure 17-1 outlines the phased approach to implement activities to support project milestones and deliverables.

Figure 17-1 – Stakeholder engagement – Overview of key phases



17.3.1 Phase 1 – Raising awareness and early engagement (February to September 2015)

Phase 1 focused on early stakeholder engagement and communications activities to:

- Raise awareness and understanding of the project
- Gather inputs from key stakeholders to inform initial project designs
- Support site investigations and early planning process steps.

Activities included stakeholder workshops and meetings, social research, letter drops, a newsletter to 100,000 households and businesses, establishing a website and social media channels, eNews, collateral, information sessions, pop-up displays, and presentations.

Nearly 3,000 people took part in the social research which demonstrated that 84 per cent of the Victorian population are aware of Melbourne Metro and the majority of Victorians are supportive of the project.

17.3.2 Phase 2 – Supporting the planning process and reference design development (October to December 2015)

Phase 2 focused on public consultation and communication activities to support the statutory planning approvals process and release of project designs.

The objectives of this phase were to:

- Commence engagement with potentially affected landowners and tenants
- Gather stakeholder and community feedback and input related to the project designs and to inform the planning process
- Continue raising public awareness and understanding about the project benefits and outcomes.

Activities for this phase included direct engagement with potentially affected landowners and tenants, meetings and forums with key stakeholders, traders and community, public information sessions and displays, online engagement and the distribution of project information. A snapshot of the engagement activities for Phases 1 and 2 is provided in Table 17-1.

Table 17-1 – Engagement activities for Phases 1 and 2

| Information | Interactions | Online and social engagement |
|--|--|--|
| Over 13,500 information postcards distributed at 19 pop-up sessions at train stations, community events and locations across Melbourne. | Over 180 presentations and briefings to conferences and major stakeholder groups. | Melbourne Metro videos on YouTube have been viewed over 29,000 times. Over 1,400 people following on Twitter. |
| More than 200,000 newsletters distributed to residents and businesses along the proposed Melbourne Metro alignment. | More than 1,000 community attendees at 15 drop-in information sessions across Melbourne. | Almost 75,000 visits to the project website – www.mmrailproject.vic.gov.au with e-News updates distributed regularly to approximately 1,900 email subscribers. |
| Over 30 advertisements in metro and local newspapers, in-train advertising on eight trains across the network, and a total of two months of online advertising. | Answered over 400 calls to the project’s community information line (1800 551 927) and received more than 800 enquiries via the ‘contact us’ online feedback form. | Over 8,100 visits to the Your Say online engagement portal. Over 3,300 downloads of brochures and information. |
| Displayed information about the project on 480 station posters across the rail network. | More than 120 phone and face-to-face conversations with property owners potentially impacted by land acquisition and over 50 follow-up meetings with affected parties. | Over 5,500 visits to the interactive online map with more than 200 individual posts. 81 contributions across 9 discussion forums hosted on the Your Say site. |
| More than 40 letterbox drops to over 12,000 homes and businesses to communicate geotechnical and site investigation activities for the project’s early planning works. | 2,979 people participated in an initial project survey between July and August. ² 232 detailed surveys were submitted between October and November via community drop-in sessions and the Your Say site, generating more than 7,600 pieces of feedback. | |

17.3.3 Phase 3 – Statutory planning process (early 2016 to early 2017)

Phase 3 is focusing on stakeholder engagement to support the statutory planning approvals process.

The objectives of this phase are to:

- Support the statutory planning process including providing information about formal avenues to provide feedback and make submissions
- Continue raising public awareness and understanding about the project benefits and outcomes
- Proactively manage stakeholder and community relationships to keep them informed of any major developments in the process and report back to key stakeholders on planning outcomes
- Continue to capture stakeholder feedback to inform ongoing design work.

Key activities include ongoing engagement with key stakeholders, potentially affected landowners, tenants and traders, and developing communications materials to support the planning process and other project milestones.

² Social survey undertaken by Ipsos Australia for Melbourne Metro (2,979 people participated in the survey between 28 July and 25 August 2015).

17.3.4 Phase 4 – Procurement and early works (2016 to 2018)

Phase 4 will focus on stakeholder engagement to support procurement, the formal land acquisition process and commencement of early works.

The objectives of this phase are to:

- Support landowners and tenants through the land acquisition process
- Engage with and provide advanced notice to local businesses, residents, road and public transport users about early works
- Proactively manage stakeholder and community relationships to keep them informed of any major developments in the process
- Continue raising public awareness and understanding about the project benefits and outcomes
- Provide advance notice, and direct contact where required, of the commencement of major works to key stakeholders, local businesses and residents.

Key activities will include engagement with local councils and transport operators, and notifying local residents, traders, and public transport and road users ahead of works commencing. Other communications activities will inform relevant stakeholders about the procurement process and key milestones.

17.3.5 Phase 5 – Major works delivery (2017 to 2026)

Phase 5 will focus on stakeholder engagement to support major works delivery.

The objectives of this phase are to:

- Support the detailed design work undertaken by the appointed construction contractors including providing opportunities for stakeholder and community input and feedback
- Engage with and provide advance notice, including direct contact where required, to local businesses, residents, road and public transport users about major works construction activities and traffic timetable changes as appropriate
- Continue raising public awareness and understanding about the project benefits and outcomes
- Support the transition from major works delivery to operation of the tunnels and stations.

MMRA will work with the appointed contractors to develop and implement a comprehensive communications and stakeholder relations strategy for major works delivery. Contractors will take a lead role in stakeholder and community engagement for their work areas, with MMRA performing an oversight and coordination role across the project.

17.3.6 Stakeholder management initiatives

A number of initiatives were developed to promote coordination with stakeholders to complement the stakeholder engagement process. Approaches for managing stakeholder engagement include:

- Direct stakeholder meetings
- Technical working groups
- Stakeholder reference groups.

A broader public awareness strategy supports these approaches and is aimed at building understanding, support and feedback for the project through initiatives such as:

- Media events and briefings
- Industry briefings (in addition to those proposed for potential private sector financiers, constructors, operators and maintainers)
- Presentations to community, business and other interest groups

- A project website, online engagement tool, social media channels and an online enquiry form
- A project information line.

17.4 Key stakeholder issues

Understanding the interests, concerns, requirements and preferred outcomes of key stakeholders enables the project team to find solutions to the issues and challenges that will be faced in delivering the project.

Key issues raised during Phases 1 and 2 of the stakeholder engagement process included:

- Construction impacts (e.g. access in the CBD, noise and vibration, traffic, service disruptions, night works, construction sites, amenity, local access)
- Business disruption (e.g. access to buildings, loss of trade)
- Operational changes to the transport network (e.g. new services on completion, changes to the network configuration)
- Urban design features (e.g. landscaping, new station designs)
- Environment and heritage (e.g. indigenous / non-indigenous cultural heritage, tree / species protection, impact on open space)
- Land impacts (e.g. land acquisition).

A range of issues, including localised concerns, may emerge over the life of the project in addition to those outlined above. Identifying key issues and risks as well as developing mitigation strategies to manage them is a critical part of the communications planning process and the effective delivery of the project.

A proactive approach will be taken to identifying and managing issues and risk, including:

- Use of issues and risk registers
- Building and maintaining constructive relationships with key stakeholders
- Seeking stakeholder and community input at appropriate times throughout the planning, development and delivery of the project.

The issues identified to date will be considered in the ongoing planning and development of the project.

Contractor performance requirements, to be established as part of the planning process, will be informed by feedback received through stakeholder engagement activities in Phases 1-3.

CHAPTER 18

Implementation – Chapter Summary

- As shown in the diagram below, progressing from this Business Case to the commencement of major works involves a range of implementation activities including the key time-sensitive activities of planning assessment and process approvals, acquiring required property and preparing site.



- The Minister for Planning determined that the project should be assessed through an EES under the *Environment Effects Act 1978*. The Minister’s assessment will inform key approvals for the project, including a Planning Scheme Amendment under the *Planning and Environment Act 1987*, approvals under the *Aboriginal Heritage Act 2006*, *Heritage Act 1995* and other legislation. Delivery powers will be available under the *Major Transport Projects Facilitation Act 2009*.
- In undertaking land acquisition for the project, the principles, requirements and well-established processes under the *Land Acquisition and Compensation Act 1986* will be followed.
- Developing tender documentation and awarding key contracts in a timely manner, including implementing the Tunnel and Stations package according to the Partnerships Victoria framework, will require careful management.
- MMRA is responsible for delivery of the project. MMRA developed a Project Management Framework to provide guiding policies, procedures and plans that explain how the project will be managed to achieve the project objectives.



18 Implementation

18.1 Target forward program

18.1.1 Project development and early works phase

The primary critical path for this phase of the project is:

- Planning and environmental assessment and statutory approvals
- Land acquisition (access is on the critical path for major works)
- Site preparation
- Commencement of major works under the Tunnel and Stations PPP contract
- Design, installation and commissioning of rail systems.

There are a number of other activity sequences that are close to the critical path and require careful management, including:

- Enabling and early works
 - Completion of design sufficient to undertake enabling and early works
 - Completion of enabling and early works in advance of major works
- Procurement
 - Completion of reference design and major works tender documentation
 - Approvals to release request for tender, tender period, evaluation period
 - Award of the major works contracts.

Further information on the key steps and timing for the statutory approvals process and property acquisition process is included in Appendix 15.

Further information on the procurement process is included in Appendix 12.

Table 18-1 summarises the proposed key milestones for the project's key decision / approval points.

Table 18-1 – Key milestones

| Key decision / approval points | Timing |
|---|------------------------|
| Business Case consideration assumed to occur | May 2016 |
| Release request for Expressions of Interest for Tunnel and Stations PPP and Rail Systems Alliance | Q2 2016 |
| Appoint Early Works Managing Contractor | Mid 2016 |
| EES public exhibition and hearings | Q2/Q3 2016 |
| Final EES assessment by the Minister for Planning | Q1 2017 |
| Planning Scheme Amendment approved and Project Area designated under MTPF Act | Q1 2017 |
| Release Request for Proposals for Rail Systems Alliance | Late 2016 |
| Release Request for Proposals for Tunnel and Stations PPP | Late 2016 |
| Award Rail Systems Alliance contract | Mid 2017 |
| Release request for Expressions of Interest for Rail Infrastructure Alliance | Mid / late 2017 |
| Award Tunnel and Stations PPP contract | Late 2017 / early 2018 |
| Award Rail Infrastructure Alliance contract | Mid / late 2018 |

18.1.2 Major works phase timing

The program for delivery is broadly structured around the following categories of works:

- Enabling and early works (tram works, utilities relocations / protection and site preparation, construction power) – mid / late 2016 to late 2017 / early 2018
- Major works (Tunnel and Stations, Rail Infrastructure, Rail Systems) – late 2017 / early 2018 to 2025 / 2026
- Wider Network Enhancements – to be completed prior to 2026.

18.1.3 Program risk

Risks to the above program for both project development and delivery phases were fully incorporated in the risk assessment set out in Chapter 11.

A risk adjusted program was developed that verified that the project (plus Rolling Stock) can be completed and in operational service by 2026.

18.1.4 Interfacing programs

The project is fully integrated with the Wider Network Enhancements and Rolling Stock (managed by PTV) required to deliver the proposed 2026 service plan. Early planning for the Arden–Macaulay Precinct is also linked to the overall project.

18.2 Statutory approvals and property acquisition

18.2.1 Statutory approvals strategy

The Minister for Planning determined that the Melbourne Metro tunnel and stations need to be assessed through an EES under the *Environment Effects Act 1978*.

Figure 18-1 depicts the EES process.

Figure 18-1 – EES Process



The Minister for Planning’s final EES assessment will inform key approvals for the program including:

- A Planning Scheme Amendment under the *Planning and Environment Act 1987*
- A Cultural Heritage Management Plan under the *Aboriginal Heritage Act 2006*
- Permits and consents under the *Heritage Act 1995*
- Potential approvals under the *Crown Land (Reserves) Act 1978*, *Environment Protection Act 1970*, *Flora and Fauna Guarantee Act 1988*, *Road Management Act 2004*, *Water Act 1989* and *Wildlife Act 1985*.

In addition, after submitting a referral to the Commonwealth Minister for Environment under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, it was determined that the project will not have a significant impact on Matters of National Environmental Significance.

In September 2015, the Premier declared the project under the *Major Transport Projects Facilitation Act 2009 (MTPF Act)* to enable use of land acquisition and delivery powers under that Act. These powers will be available after the Planning Scheme Amendment is approved and the Minister for Planning designates a Project Area.

Further information on Victorian and Commonwealth approvals processes is provided in Appendix 15.

18.2.2 Process for securing project land

The principles, requirements and well-established processes under the *Land Acquisition and Compensation Act 1986 (LAC Act)* and the *MTPF Act* will be followed to acquire land for the project.

Assembling privately owned land will predominantly be by compulsory acquisition using powers available under the *LAC Act* and the *MTPF Act*. These powers will be available after the Planning Scheme Amendment is approved and a Project Area under the *MTPF Act* is designated.

Assembling public land (either controlled by Victorian Government departments and agencies or by Local Government) will be by surrender or acquisition. Typically this involves using provisions of the *MTPF Act* and other relevant legislation.

A summary of the process is provided in Appendix 15.

18.3 Implementation of integrated development opportunities

Further work will be undertaken as the project progresses to assess and optimise the key development opportunities at CBD North, CBD South and Arden, as well as to explore other integrated development opportunities to generate and capture value (for example, by generating additional revenue through leasing or licencing arrangements with telecommunications providers).

The tender process for the project will be structured to encourage private sector innovation in relation to commercial opportunities and to make clear that integrated development outcomes will be an important part of the evaluation process.

18.4 Tender strategy

In line with procurement strategy set out in Chapter 14, multiple competitive tender processes will be used to identify private sector parties that will collaboratively work with project stakeholders to deliver the project.

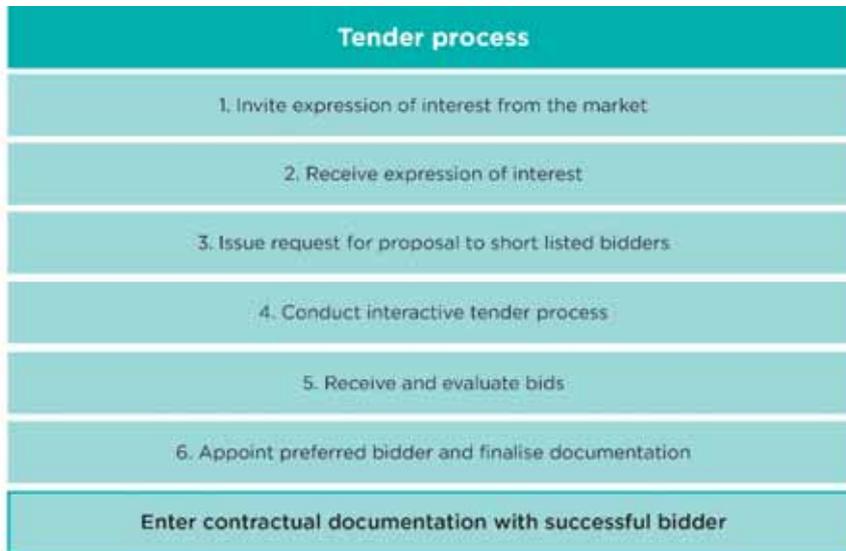
The tender process for the Tunnel and Stations PPP will be implemented according to the Partnerships Victoria framework.

The tender processes for the Rail Infrastructure and Rail Systems competitive alliances will be implemented according to the Commonwealth Department of Infrastructure and Regional Development's National Alliance Contracting Guidelines.

The potential impact of other Australian projects on the market capacity for the project is an important consideration when formulating the tender strategy for the project. As noted in Chapter 14, although there are a number of issues that will need to be monitored leading into taking the project to market, including around competing projects and the availability of select specialist resources, the market sounding process indicated strong interest in, and capacity for, the project.

Figure 18-2 outlines the standard tender process that will be adopted during the tendering of the project. To ensure that the government receives the best value for money outcome and meets its overarching project timelines, ongoing consideration will be given to how the process can be streamlined and improved, including drawing on feedback obtained through market sounding.

Figure 18-2 – Tender process



18.5 Governance

18.5.1 Principles

The governance arrangements for the project were established using the foundation principles for public sector governance¹ and for project governance as they relate to:

- Developing and delivering the project using best practices across relevant disciplines
- Clearly separating infrastructure planning and project approval from project delivery
- Making project delivery clearly accountable to government
- Providing robust oversight and stewardship of the project.

18.5.2 Governance framework

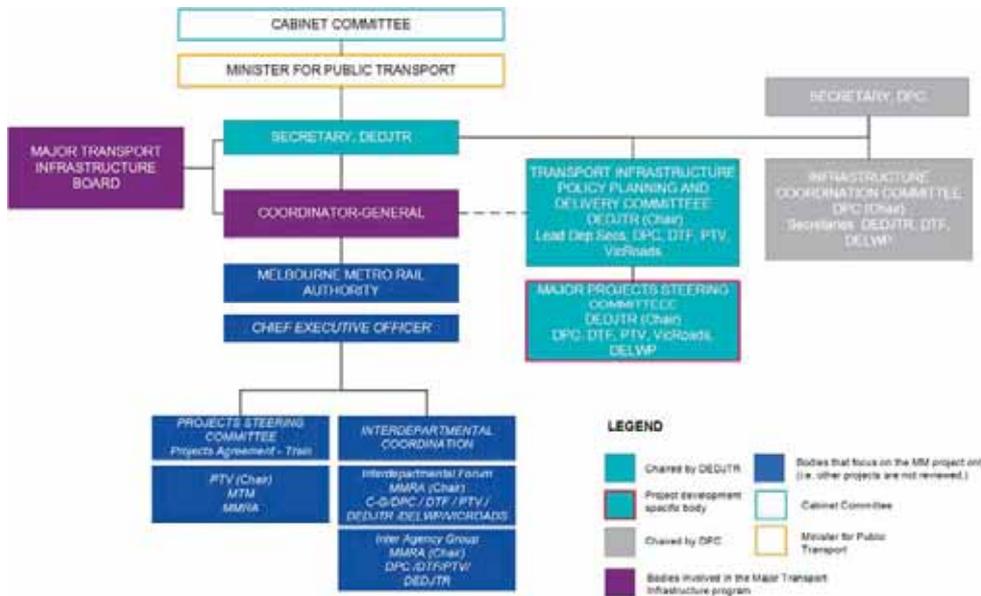
The Major Transport Infrastructure Program Governance Framework provides a framework for the stewardship of the project together with the Level Crossing Removal Project. The Governance Framework establishes the terms of reference and guiding principles for the governance structure for all phases of project implementation.

The Department working with PTV will finalise the project development stage and the resulting documentation, including the principle project requirements.

The project development stage has its own governance structure as depicted in Figure 18-3.

¹ Building Better Governance, APSC 2007.

Figure 18-3 – Governance Structure – Project Development



The Lead Deputy Secretary – Transport is the Chair of the Major Projects Steering Committee (MPSC) which is the key forum for project decisions during project development. The purpose of MPSC is to ensure that projects are developed according to strategic directions defined by the Transport and Infrastructure Policy, Planning and Delivery Committee (TIPDDC).

The MPSC includes representation from Department portfolio agencies including PTV, VicRoads, DPC and DTF. MPSC provides a forum for all relevant government agencies to provide oversight of project development work and documentation (including the procurement strategy) prior to the project being recommended to the government for funding and delivery.

Additional forums were established to inform DTF, DPC, PTV, DELWP and VicRoads of progress of the Business Case and to resolve issues that may arise.

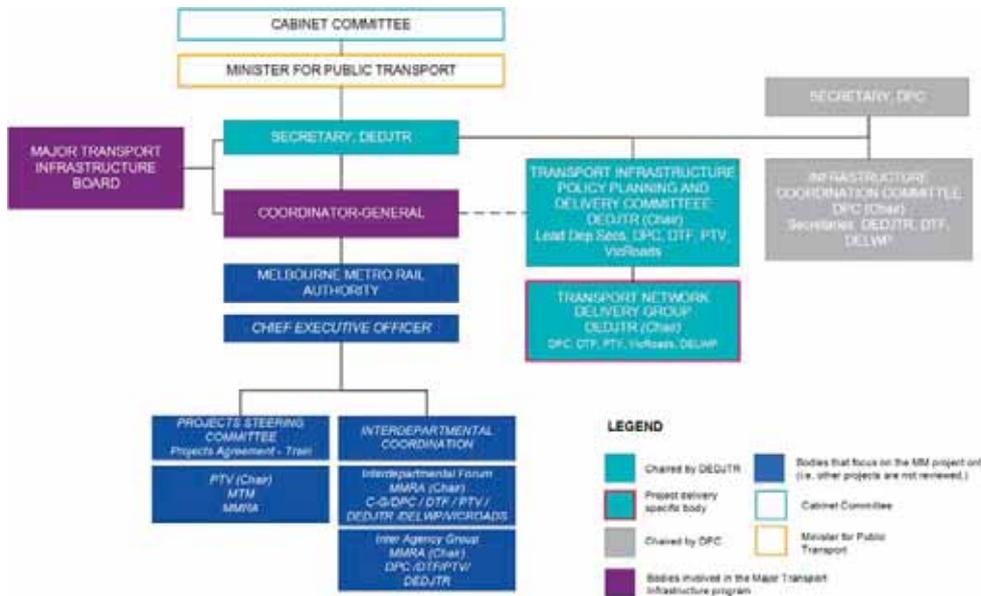
Pursuant to the Franchise Agreement for metropolitan rail (Projects Agreement – Train), a Projects Steering Committee was established and includes representatives from Level Crossing Removal Authority, PTV and Metro Trains Melbourne. This committee continues throughout both development and delivery provides a forum to discuss and resolve relevant matters relating to the project.

The Infrastructure Coordination Committee (ICC), chaired by the Secretary to DPC, provides an opportunity to discuss and inform Heads of Departments of project-related matters to be considered by the government for decision.

Ultimately, the government is then required to approve the Business Case and funding to deliver the project.

During the project delivery phase, governance focuses on driving performance against key delivery metrics, including safety, program and cost to deliver the scope approved in the Business Case. Figure 18-4 depicts the governance structure for delivery.

Figure 18-4 – Governance Structure – Project Delivery



The key governance group during delivery is the Major Transport Infrastructure Board (MTIB) which was established to ensure that project delivery:

- Is in line with the approved Business Case and Scope and Technical Requirements
- Is cost effective
- Promotes sustainability
- Enhances community amenity
- Is consistent with broader transport policy objectives.

During delivery, if required, consideration of major change events in relation to the project scope required to deliver the project benefits and/or additional budget requirement will be escalated through MPSC. Both MPSC and TIPPDC will receive high-level progress briefings and reporting throughout delivery of the project.

Additionally the Department established a Transport Network Delivery Group that will maximise efficiencies across the suite of transport infrastructure projects in delivery by sharing information across agencies, including MMRA, PTV and VicRoads.

Table 18-2 summarise the roles and responsibilities of the governance framework.

Table 18-2 – Governance framework roles and responsibilities

| Role | Responsibilities |
|---------------------|---|
| MMRA | An administrative office in relation to Department has been established to deliver the project. The CEO of MMRA reports to the Coordinator-General. |
| PTV | PTV demonstrates fulfilment of its legislative obligations to plan, coordinate, provide, operate and maintain a safe, punctual, reliable and clean public transport system consistent with the vision statement and the transport system objectives of the Transport Integration Act. |
| Coordinator-General | The Premier has appointed the Coordinator-General as Head the Melbourne Metro Rail Authority pursuant to the <i>Public Administration Act 2004</i> . The Coordinator-General, Major Transport Infrastructure Program oversees the delivery of the project as part of a program of significant transport infrastructure projects. The Coordinator-General works collaboratively with members of the Department’s Executive Board and other senior staff and undertake the role of Coordinator-General in accordance with the public sector values and code of conduct. |

| Role | Responsibilities |
|--|---|
| Major Transport Infrastructure Board (MTIB) | The Victorian Government has established the MTIB to ensure effective governance in the delivery of the project. The purpose of the MTIB is to ensure that project delivery accords with the approved Business Case and Scope and Technical Requirements, is cost effective, promotes sustainability, enhances community amenity and is consistent with broader transport policy objectives. |
| Transport and Infrastructure Policy, Planning and Delivery Committee (TIPPDC) | The Secretary, the Department has established TIPPDC which is responsible for overseeing the effective governance of the transport portfolio and key infrastructure investment, through clearly defining the strategic directions that will enable economic development and jobs creation, ensuring integrated network planning and close coordination across the transport system areas serviced by DEDJTR, and overseeing the delivery of major transport and infrastructure policies and projects. |
| Major Projects Steering Committee (During Development) | The Lead Deputy Secretary – Transport is the Chair of the Major Projects Steering Committee (MPSC). The purpose of MPSC is to ensure that projects are developed in accordance with strategic directions defined by the Transport and Infrastructure Policy, Planning and Delivery Committee. This Committee has oversight of MMRP during development in particular the Business Case development and finalisation. |
| Transport Network Development Group (During Delivery) | The Lead Deputy-Secretary – Transport has established the Transport Network Development Group (TNDG) to provide a forum to consider and respond to whole of network risks, issues and interdependencies during project delivery. |
| Infrastructure Coordination Committee | The Secretary to DPC has established the Infrastructure Coordination Committee (ICC) which provides whole-of-government oversight of major project development and delivery. |

18.6 Project Management

18.6.1 Melbourne Metro Rail Authority (MMRA)

MMRA was established as an administrative office in relation to the Department to deliver the project and oversee its day-to-day implementation. MMRA is a sophisticated delivery organisation that reflects the scale, complexity and duration of the project.

During 2016, MMRA has approximately 400 people, including staff, contractors and advisers working on Melbourne Metro.

Resources will be adjusted as required to:

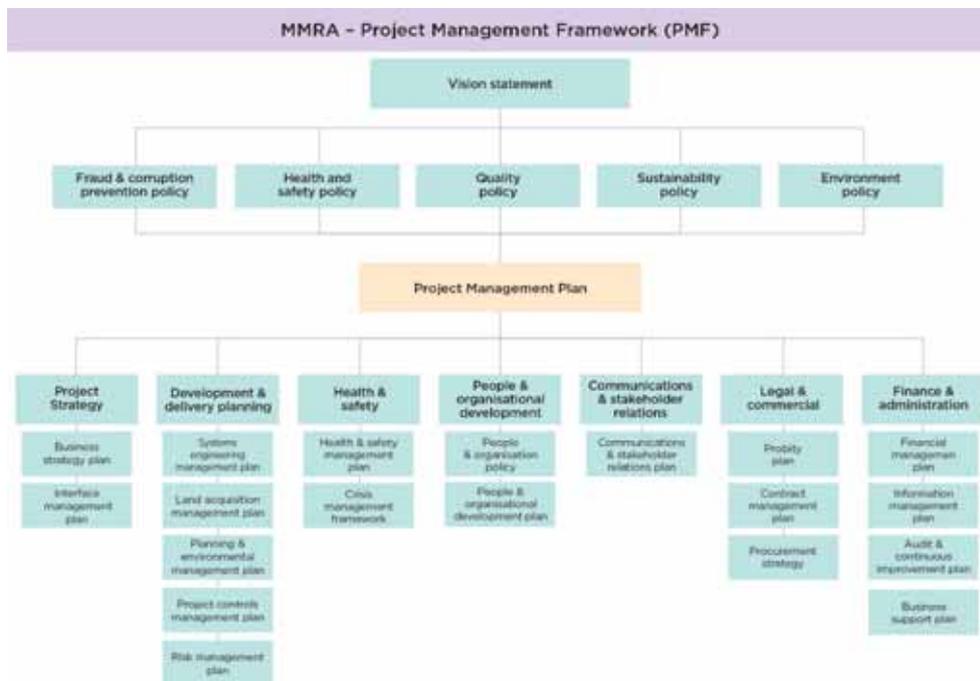
- Support the various phases of the project, particularly when there is a need for specialist project design, construction and project management skills
- Reflect the appropriate level of management to align with the packaging and delivery models set out in the procurement strategy.

18.6.2 Project Management Framework

A Project Management Framework was developed to provide guiding policies, procedures and plans that outline how the project will be managed to achieve the project objectives.

Figure 18-5 outlines the framework of management plans and supporting policies. These plans and policies are all currently in use and will continue to be updated as the project progresses.

Figure 18-5 – Project Management Framework



18.7 Performance measures for the project

As noted in Chapter 4, a preliminary BMP has been developed for this Business Case. The BMP encompasses benefits that will result from the Melbourne Metro Program (i.e. the project, Wider Network Enhancements and rolling stock).

The preliminary Key Performance Indicators (KPIs) and measures, as defined in the BMP, will be used to assess if the benefits of these investments were delivered.

The detailed operational outcomes will be continuously developed concurrent with the finalisation of the detailed project technical solution.

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GLOSSARY

Glossary

| Term | Definition |
|-------------------------|--|
| ABS | Australian Bureau of Statistics |
| Agglomeration | Agglomeration externalities relate to the benefits which flow to firms and households from locating in areas which have a high density of economic activity (measured by employment) |
| AM Peak | The AM Peak is a two-hour period between 7:00 am – 9:00 am |
| Arden Government Land | As defined in Chapter 7 |
| Arden Precinct | As defined in Chapter 7 |
| Arden-Macaulay Precinct | Arden-Macaulay is a 147 hectare precinct taking in parts of Kensington and North Melbourne and located between Melbourne's central city and the inner west suburb of Footscray |
| Asset Renewal Costs | Asset renewals are the costs associated with capital maintenance (major maintenance, refurbishment or replacement) of the project infrastructure over the operating period |
| Benefits | The benefits outlined in Chapter 4 |
| BCR | Benefit Cost Ratio |
| BITRE | Bureau of Infrastructure, Transport and Regional Economics |
| BMP | Benefits Management Plan |
| BRIP | Bayside Rail Improvement Project |
| Burnley Group | The Belgrave, Lilydale and Alamein Lines, operating via the Burnley Loop |
| Burnley Loop | Single loop track via Platform 4 in the City Loop and through Southern Cross and Flinders Street Stations |
| CAGR | Compound Annual Growth Rate. The average year-on-year growth rate over a specified period |
| Caulfield Group | The Cranbourne and Pakenham Lines and (dependent on constitution of Cross-City Group), Frankston and Sandringham Lines |
| Caulfield Loop | Single loop track via Platform 2 in the City Loop and through Southern Cross and Flinders Street Stations |
| CBA | Cost benefit analysis |
| CBD | The Central Business District of Melbourne which is bordered by Spencer Street to the west, La Trobe Street to the north, Spring Street to the east and Flinders Street to the south |
| CCZ1 | Capital City Zone 1 |
| Central Melbourne | The area which includes the CBD, Fishermans Bend, Docklands, Southbank, St Kilda Road, Parkville and the Arden urban renewal precinct |
| CGE | Computable general equilibrium |
| City Cordon | The stations immediately prior to the City Loop on the existing network, that is, Richmond, North Melbourne and Jolimont. Once the project is complete, the Cranbourne / Pakenham Line cordon would be measured at Domain station and the Sunbury line cordon at Parkville station |

| Term | Definition |
|---------------------|---|
| City Loop | Also known as the Melbourne Underground Rail Loop (MURL). Comprises four single track tunnels for each of the four metropolitan rail groups (Caulfield, Northern, Burnley and Clifton Hill). Trains operate in either direction through three underground stations – Parliament, Melbourne Central and Flagstaff. The tunnels connect to Flinders Street and Southern Cross Stations over the Flinders Street Viaduct to form the ‘loops’ |
| Clifton Hill Group | The South Morang (future Mernda) and Hurstbridge lines, operating via the Clifton Hill Loop |
| Clifton Hill Loop | Single loop track via Platform 1 in the City Loop and through Southern Cross and Flinders Street Stations |
| COAG | Council of Australian Governments |
| CPLU | Cranbourne Pakenham Line Upgrade |
| Cross-City Group | Under the Base Case, this consists of the Werribee, Williamstown and Frankston Lines. Once Melbourne Metro has been implemented, this group will comprise the Werribee, Williamstown and Sandringham Lines. This group operates via Flinders Street and Southern Cross Stations |
| Dandenong Group | The Pakenham and Cranbourne Lines, operating via the City Loop |
| Day one | The proposed service plan on project opening in 2026. Also referred to as the “initial service plan”, which delivers the “initial capacity uplift” |
| DELWP | Department of Environment, Land, Water and Planning |
| Department | The Department of Economic Development, Jobs, Transport and Resources |
| DPC | Department of Premier and Cabinet |
| DRC | Dandenong Rail Corridor. This comprises the Cranbourne / Pakenham Lines (longer term, potentially includes the Rowville line) |
| DTF | The Department of Treasury and Finance |
| Dwell time | The length of time the train is stopped at the platform with doors open |
| Early Works | Works that are needed to enable delivery of the tunnel and stations works, including relocating and protecting utilities, tram diversions, construction power and works to prepare construction sites |
| EES | Environmental Effects Statement |
| EMF | Environmental Management Framework |
| Enabled Investments | A range of subsequent investments that are included in the Extended Program (specifically, to achieve the proposed 2031 service plan as set out in the COO), but for which funding is not sought as part of this Business Case. This includes additional HCMTs (10 cars), longer platforms, Melton quad track between Sunshine and Deer park, Melton electrification, and power and signalling upgrades |
| Extended HCMT | Extended HCMT means an HCMT of an extended length (10 cars) which carries 1,570 passengers per train |
| Extended Program | The Melbourne Metro Program and delivery of the Enabled Investments |
| EPBC Act | Environment Protection and Biodiversity Conservation Act 1999 |
| GBCA | Green Building Council Australia |
| GFA | Gross floor area |

| Term | Definition |
|---|---|
| GDP | Gross Domestic Product. The market value of all final goods and services produced nationally in Australia in a given period |
| GLP | Gross Local Product |
| GSP | Gross State Product. The market value of all final goods and services produced within a state or territory in a given period |
| HCMT | High Capacity Metro Train |
| HCS | High Capacity Signalling. In-cab signalling with automatic train protection and warning systems enabling high frequency operations |
| HVHR | High Value High Risk |
| IA | Infrastructure Australia |
| IPL | Infrastructure Priority List |
| ICC | Infrastructure Coordination Committee |
| ICT | Information and Communications Technology |
| ILM | Investment Logic Map |
| ISCA | Infrastructure Sustainability Council Australia |
| KPI | Key Performance Indicator |
| LAC Act | Land Acquisition and Compensation Act 1986 |
| LGA | Local Government Area |
| Load | The number of passengers travelling on a tram or train, often measured over a rolling hour or over the AM peak |
| Load breach | Where there is more than a rolling average of 798 people on board for existing rolling stock, however is being increased to an average of 900 people per train prior to 2021 by a project to reconfigure the interior of existing trains. A load breach for the new HCMTs will be considered to occur when the rolling average exceeds 1,100 passengers train |
| Melbourne Metro Program | The project and associated program of works (Wider Network Enhancements and Rolling Stock) required to achieve the Melbourne Metro service plan proposed for 2026 |
| Melbourne Metro Program Case / Program Case | As defined in Chapter 10 |
| MMRA | Melbourne Metro Rail Authority |
| MPA | Metropolitan Planning Authority |
| MPS | Melbourne Planning Scheme |
| MPSC | Major Projects Steering Committee |
| MTM | Metro Trains Melbourne |
| MTPF Act | Major Transport Projects Facilitation Act 2009 |
| NGTSM | National Guidelines for Transport System Management |
| NOA | Notice of Acquisition |
| Northern Group | The Craigieburn, Upfield and Sunbury Lines, operating via the City Loop |

| Term | Definition |
|----------------------|--|
| Northern Loop | Single loop track via Platform 3 in the City Loop and through Southern Cross and Flinders Street Stations |
| NPV | Net Present Value |
| O&M | Operations and maintenance |
| Peak hour | The busiest hour on a given line at the cordon station |
| Plan Melbourne | The Victorian Government's metropolitan planning strategy for the city's growth to 2050. A revised version is proposed for release in the first half of 2016 |
| Planning load | A rolling average of 900 people on board for existing rolling stock or 1100 for HCMTs |
| PM Peak | For the majority of lines, PM Peak is experienced between 3:00 to 7:00pm. |
| PPP | Public Private Partnership |
| Problems | The problems outlined in Chapter 3 of this Business Case |
| PSA | Planning Scheme Amendment |
| PTV | Public Transport Victoria |
| PV | Present Value, a current day value of costs or benefits, calculated by discounting future costs or benefits by a discount rate |
| Punctuality | Train services which arrive on time to 4 minutes 59 seconds of their scheduled time |
| Quad track | Quad track is used to describe a section of the railway where four trains can operate independently (e.g. in different directions, side-by-side or overtaking each-other) – the railway equivalent of a four-lane road |
| Rail Infrastructure | As defined in Chapter 14 |
| Rail Systems | As defined in Chapter 14 |
| Recommended Solution | The recommended project option as defined in Chapter 7 |
| Reference Case | The Department reference case as defined in Chapter 10 |
| Reliability | Reliability is measured as the percentage of the timetable that is delivered. Non-delivery of services includes cancellations, trains that run short and trains that bypass the City or Altona Loops |
| RMP | Risk Management Plan |
| RRL | Regional Rail Link |
| SEIFA | Socio-Economic Indexes for Areas |
| STP | Social time preference |
| SOC | Social opportunity cost of capital |
| TBM | Tunnel Boring Machine |
| TEI | Total Estimated Investment |
| TIPPDC | Transport and Infrastructure Policy, Planning and Delivery Committee |
| TNDG | Transport Network Delivery Group |
| TRG | Technical Reference Group |

| Term | Definition |
|---------------------------------|---|
| Tunnel and Stations Civil Works | As defined in Chapter 2 |
| Tunnel and Stations PPP | As defined in Chapter 14 |
| UCB | Urban Consolidation Benefits |
| USP | Utility Service Providers |
| Viaduct | Generally refers to the six tracks on viaduct between Flinders Street and Southern Cross Stations |
| VU-COPS | Victoria University Centre of Policy Studies |
| VU-TERM | 'The Enormous Regional Model' of Victoria University |
| VITM | Victorian Integrated Transport Model |
| WEB | Wider Economic Benefits |
| Wider Network Enhancements | Small – medium scale works across the rail network to support the initial service plan on project completion. These works include Signalling and other works on Sunbury, Dandenong, Craigieburn, Upfield, Newport Corridor, Sandringham and Frankston Lines, and tram network changes |

Images: Courtesy of Crossrail London, Melbourne Metro Rail Authority and Public Transport Victoria.