Infrastructure Australia

Project Business Case Evaluation

Project name	Melbourne Metro
Rating	High Priority Project
Date of IA Board rating	9 December 2016

Location	Central Melbourne, Victoria
Proponent	Victorian Government
Project timeframe	- Enabling and early work – mid/late 2016 to late 2017 / early 2018 - Major works – mid 2017 / 2018 to 2025-2026 - Wider network enhancements – to be completed prior to 2026

Evaluation Summary

Rail services into central Melbourne are becoming capacity constrained, particularly during peak periods. Melbourne's future population growth will expand the city's urban footprint into greenfield areas in the north, west and south-east, while employment will grow most strongly in central Melbourne. Major rail corridors, including the Craigieburn, Sunbury, Werribee and Cranbourne/Pakenham lines, are projected to reach or exceed crush capacity[1] by 2031. Without investment to improve the capacity of the rail network, growing demand for rail services into and around central Melbourne will exacerbate capacity constraints, leading to passenger crowding and network reliability issues.

The Melbourne Metro project would connect the Sunbury line with the Cranbourne/Pakenham line through twin 9km rail tunnels running from South Kensington to South Yarra under the CBD. This would form a new line which would operate independent of the rest of the network, and release capacity for more services into the CBD on other lines through the city loop. The overall capacity of the network would increase by over 39,000 passengers for each two hour peak period. The project includes five new underground stations – Arden, Parkville, Domain, and two new stations in the CBD with interconnections to the broader rail network. The project is expected to catalyse urban renewal in the Arden-Macaulay Precinct (north-west of the CBD) in particular. This precinct has the potential to accommodate 25,000 residents and 43,000 jobs.

The capital cost of the project is estimated at $10.2 billion (P50 costs, nominal, undiscounted). The project is expected to generate economic benefits such as travel time savings, reduced train crowding and improved customer experience. The proponent's stated benefit-cost ratio (BCR) for the project is 1.1, with a net present value (NPV) of $0.6 billion (P50 costs, 7% real discount rate). The proponent has estimated that the project will generate $3.1 billion in wider economic benefits (WEBs), resulting in a NPV of $3.7 billion and a BCR of 1.5 when WEBs are included.

Notwithstanding some limitations in the economic appraisal which, if addressed, would better demonstrate the economic value of the project, Infrastructure Australia is confident that the project's benefits would exceed its costs, and that it would generate net benefits to the Australian economy.

[1] The maximum level of capacity for a vehicle. In practice, crush loads involve standing passengers being "crushed" against each other.

1. Strategic Context

Melbourne's population is projected to almost double to around 8 million people by 2051. Much of this growth is planned to occur outside central Melbourne. By 2031, over 40% of Melbourne's population growth is expected to occur in greenfield residential developments in Melbourne's north, west and south-eastern growth corridors. Employment in central Melbourne is forecast to grow from 435,000 in 2011 to almost 900,000 in 2051.

As a consequence, rail patronage is also expected to continue to grow, particularly during peak periods. The Australian Infrastructure Audit (2015) projected that demand for rail services to central Melbourne would more than double from 119,700 passenger hours travelled per day in 2011 to 263,600 passenger hours travelled in 2031. Passenger loadings are projected to reach or exceed crush capacity on the Craigieburn, Sunbury, Werribee and Cranbourne/Pakenham lines by 2031. If the rail capacity constraint is not addressed, more people are likely to seek to travel by car, and contribute further to growing congestion on Melbourne's road network.[2]

The number of people travelling by rail into the city in the morning peak is forecast to grow by 65% between 2015 and 2031, with lines servicing growth corridors in Melbourne's north, west and south east growing most quickly. The 2008 *East West Link Needs Assessment*[3] recognised the need for a metro rail tunnel to facilitate Melbourne's future growth.

Melbourne Metro is expected to improve accessibility to jobs located in central Melbourne, an area which accounts for 6 per cent of Australian Gross Domestic Product (GDP).[4] It is also intended to improve public transport access to urban renewal areas that are not well serviced by public transport, such as the Arden-Macaulay Precinct.

Melbourne Metro has previously been listed on the Infrastructure Priority List as a High Priority Initiative.

2. Problem Description

The problems identified by the proponent include:

- Overcrowding for passengers and unreliable rail services which are reducing Melbourne's liveability and access to jobs and key activity precincts. The number of customers using the existing CBD stations is projected to almost double by 2031, exacerbating overcrowding issues and eroding customer experience;
- Physical transport network constraints which are reducing Melbourne's economic prosperity and productivity. Passenger loadings on Melbourne's major rail corridors are projected to reach or exceed crush capacity within 15 years; and
- Insufficient public transport services are impeding access into and around central Melbourne, and limiting the potential for urban renewal. Plan Melbourne sets out an expanded CBD, including the Arden-Macaulay Precinct.[5] Melbourne's CBD is now expanding into areas that currently have a much lower level of public transport accessibility. Insufficient public transport services cause additional travel time and prevent high-density clustering, which limits Melbourne's productivity growth.

3. Project Overview

The core elements of the project are new twin 9km rail tunnels from South Kensington to South Yarra connecting the Sunbury and Cranbourne/Pakenham lines, and five new underground stations at Arden, Parkville, CBD North, CBD South, and Domain. Both CBD stations would interconnect with the rest of the Melbourne rail network. The project also comprises a range of wider network enhancements, including infrastructure to increase the capacity of the network. Overall, these developments are expected to provide rail capacity to accommodate an additional 39,000 passengers in the two-hour peak period.

The Victorian Government is currently procuring 65 high capacity metro trains, which will operate on the Cranbourne/Pakenham lines, and through to the Sunbury line when the Melbourne Metro tunnel is operating. This will deliver the metro style system at the commencement of operations in 2026.The cost of procuring 25 of these high

[2] Infrastructure Australia (2015), *Australian Infrastructure Audit – Our Infrastructure Challenges*, Volume 1, April 2015, p.83.

[3] Victorian Government (2008), *Investing in Transport – East West Link Needs Assessment*, April.

[4] City of Melbourne, *City of Melbourne Economic Profile*, available at: http://melbourne.geografia.com.au/.

[5] Victorian Department of Transport, Planning and Local Infrastructure (2014), *Plan Melbourne*, May 2014, p.30.

capacity metro trains, and associated stabling works, platform extensions, maintenance and power upgrades, has been included in the proponent's economic analysis.

4. Options Identification and Assessment

The proponent considered three analyses as part of its assessment.

- Strategic analysis – three packages of strategic options were assessed: (1) current state; (2) demand and productivity management; and (3) increase supply. The strategic option to 'increase supply' was recommended for further assessment as it provided a medium- to long-term solution to meet increasing demand and capacity constraints on the rail network, whereas other strategic options were considered insufficient to meet future rail demand.
- Capital investment options analysis – 13 capital investment options were assessed. Melbourne Metro and Melbourne Rail Link, an alternative proposal for additional rail capacity, were shortlisted as they provided the most significant capacity uplift for access to the CBD. The two options represented comparable capital investment but the Melbourne Rail Link was expected to cause greater disruption during construction. The option analysis concluded that Melbourne Metro was the recommended capital investment option because it is expected to better address the problem and achieve a better transport outcome.
- Project options analysis – detailed assessment of scope and alignment options for Melbourne Metro was undertaken for five study areas, comprising South Kensington and the Arden-Macaulay Precinct, Parkville, CBD, Domain and South Melbourne, and South Yarra. The project option analysis suggested that a new South Yarra Station not be included in the project because of its significant cost and limited transport benefits. The business case does not include an option for a new station at South Yarra.

Infrastructure Australia notes that the avoidance of disruption to CBD businesses and traffic during the construction stage was a key consideration in the shortlisting of options during the options assessment process.

5. Economic Evaluation

The capital cost estimate for the project is $10.2 billion (P50, nominal, undiscounted). The proponent's stated BCR for the project is 1.1, with a NPV of $0.6 billion using a real discount rate of 7% and P50 capital costs. The present value of the project costs is estimated to be $7.3 billion, while the present value of benefits, excluding WEBs, is estimated to be $7.9 billion. Transport benefits account for 89% of these benefits. Of the public transport benefits, which make up about 59% of the user benefits and external benefits, approximately 23% of the project benefits are derived from reduced crowding on trains, and 13% from public transport users' travel time savings.

The economic appraisal adopts the Victorian Government Reference Case as the basis for both the base case and the project case in its strategic transport demand modelling and economic appraisals. The Reference Case includes several future road and public transport projects which are yet to be funded. While the Reference Case approach is useful for the purpose of integrated long-term transport planning, it is unconventional for economic evaluations, and could understate the BCR if the unfunded substitute projects assumed in the base case do not proceed.

The economic appraisal does not allow for the 'ramp up' of benefits in the early years of operation. As the benefits are driven by employment and land use changes, it is standard practice to assume a 'ramp up' in the demand profile and hence benefits in the early years of operation. This approach would likely result in a small reduction in the stated BCR.

The proponent has estimated that Melbourne Metro would generate $3.1 billion in WEBs, resulting in a NPV of $3.7 billion and a BCR of 1.5 when WEBs are included. The project would provide workers with faster and more direct access to the CBD, resulting in increased productivity for businesses in Melbourne and the creation of more high-value jobs. While Infrastructure Australia recognises the strategic merit of the project and its potential to generate significant WEBs, the methodology underpinning the quantification of WEBs in Australia is still under development.

A number of economic benefits have not been quantified by the proponent, including:

- Urban renewal benefits – Melbourne Metro has the potential to unlock urban renewal opportunities which could generate significant urban renewal benefits attributable to the transport intervention, such as improved land use (through increases in the capacity and value of the land), infrastructure cost savings (resulting from the lower cost of servicing infill developments, compared to greenfield areas) and sustainability benefits (such as more efficient use of energy and water in high-density apartments);

- Potential tram cost savings – Melbourne Metro would provide relief to some tram routes in central Melbourne, potentially allowing trams to be redeployed to other parts of the network. Improved operational efficiency and tram network optimisation could reduce future tram capital and operating costs; and
- Producer surplus of retailers in the new Metro stations – it is expected that retail facilities at the new stations will have higher design specifications and more attractive layouts, which could attract higher value customers, resulting in higher margins or increased sales and, in turn, higher economic returns to the station retailers.

Overall, Infrastructure Australia is confident that the benefits of the project will exceed its costs and that the proposed solution will provide a net benefit to the Australian economy.

Capital cost and funding

Total capital cost (nominal, undiscounted)	$10.2 billion (P50) $10.9 billion (P90)
Proponent's proposed Australian Government funding contribution	The Victorian Government has committed to funding the project independent of any Australian Government funding contribution
Other funding (source / amount / cash flow) (nominal, undiscounted)	Some opportunities for value capture are being considered by the Victorian Government.

Major sources of benefit

The major sources of benefit identified by the proponent include:

- **Public transport user benefits:** travel time savings, reduced crowding on trains and trams, improved service punctuality, improved network resilience, improved customer amenity, reduced crowding in stations and farebox resource cost correction;
- **Road user benefits:** travel time savings, vehicle operating cost savings, improved journey time reliability, reduced travel time in congested conditions, toll and parking cost savings;
- **Other societal impacts:** crash cost savings, reduced environmental externalities and health benefits due to increased walking and cycling;
- **Residual values** of new capital assets; and
- **Wider economic benefits:** agglomeration, labour market deepening and increased outputs under imperfectly competitive markets.

Proponent's Stated Benefits and Costs	Present Value ($m, 2015) @ 7% real discount rate		% of total
Benefits			
Public transport user benefits	$4,700		59%
Road user benefits	$2,300		29%
Other societal impacts	$800		10%
Residual value of assets	$200		3%
Total Benefits[5]	**$7,900**	(A)	**100%**
Costs			
Capital costs (P50)	$6,700		92%
Operating and maintenance costs	$600		8%
Total Costs[5]	**$7,300**	(B)	**100%**
Net Benefits - Net Present Value (NPV)[1] without WEBs[5]	**$600**	(C)	n/a
Benefit-Cost Ratio (BCR)[2] without WEBs	**1.1**	(D)	n/a
Wider Economic Benefits (WEBs)	$3,100	(E)	n/a
Net Benefits - Net Present Value (NPV)[3] with WEBs[5]	**$3,700**	(F)	n/a
Benefit-Cost Ratio (BCR)[4] with WEBs	**1.5**	(G)	n/a

Source: Melbourne Metro Business Case (2016)

Notes:
(1) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A − B).
(2) The benefit-cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).
(3) The net present value with WEBs (F) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) – B)
(4) The benefit-cost ratio with WEBs (G) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) ÷ B)
(5) Totals may not sum due to rounding.

6. Deliverability

The proponent undertook a risk assessment and developed strategies to mitigate the risks identified for the project. Infrastructure Australia was provided with a risk register that identifies and quantifies risk. The impact of these risks (e.g. potential scope creep, signalling design delays and ground condition issues) on the cost of the project was incorporated into the proponent's probabilistic cost estimate and contingency.

Some of the deliverability risks associated with a large urban tunnelling project include the disruption to the CBD during construction. The proponent has sought to minimise these risks through the option assessment process, in particular through the selection of a deep tunnel through the CBD, underneath the existing city loop tunnels.

The Victorian Government has committed to funding the project independent of any Australian Government funding contribution. The proponent has identified a limited number of value capture opportunities, including development proposals at the CBD North and CBD South station sites.

As part of best practice project development, Infrastructure Australia recommends that a post-completion review of the project be conducted to gauge accurately whether works have delivered high levels of service, and identify any lessons learnt that could be used to inform future projects. In particular, this project may provide an opportunity for a longitudinal case study to monitor and understand changes in travel behaviour and agglomeration benefits in a major Australian capital city.