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Victorian Auditor-General's Office

Melbourne Metro Tunnel Project—Phase 1: Early Works

June 2019

Independent assurance report to Parliament
2018–19: 28

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Victorian Auditor-General's Office

The Hon Shaun Leane MLC
President
Legislative Council
Parliament House
Melbourne

The Hon Colin Brooks MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of section 16AB of the *Audit Act 1994*, I transmit my report *Melbourne Metro Tunnel Project—Phase 1: Early Works*.

Yours faithfully

Andrew Greaves
Auditor-General

6 June 2019

Contents

Acronyms

CBD	Central business district
ClicSim	City Loop and Inner Core Simulation
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water and Planning
DoT	Department of Transport
DPC	Department of Premier and Cabinet
DTF	Department of Treasury and Finance
EES	Environment Effects Statement
EMF	Environmental Management Framework
EMI	electromagnetic interference
EPR	Environmental Performance Requirement
EWLNA	*East West Link Needs Assessment*
EWMC	Early Works Managing Contractor
EWP	Early Works Plan
EWSA	Early Works Services Agreement
HCMT	High Capacity Metropolitan Train
IAC	Inquiry and Advisory Committee
MOTC	*Meeting Our Transport Challenges*
NEP	network enhancement project
PPP	Public Private Partnership
PTV	Public Transport Victoria
RPV	Rail Projects Victoria
VAGO	Victorian Auditor-General's Office
VITM	Victorian Integrated Transport Model
VTP	*Victorian Transport Plan*

Audit overview

The aim of the Melbourne Metro Tunnel Project is to free up Melbourne's central rail system by removing three of the city's busiest train lines—Pakenham, Cranbourne and Sunbury—from the City Loop.

City Loop refers to the two above ground and three underground stations that surround Melbourne's CBD—Flinders Street, Southern Cross, Flagstaff, Melbourne Central and Parliament.

The $11 billion transport infrastructure project will construct twin nine-kilometre rail tunnels through the central business district (CBD) from South Kensington to South Yarra and five new underground stations along this route. This is to create capacity to run more trains across the metropolitan rail network and increase service reliability.

This performance audit's objective was to determine whether the planning processes and early works of the Melbourne Metro Tunnel Project have adequately prepared the project for the main tunnel and stations works.

We audited the following agencies and one associated private sector entity:

- Department of Environment, Land, Water and Planning (DELWP)
- Department of Premier and Cabinet (DPC)
- Department of Transport (DoT)
- Department of Treasury and Finance (DTF)
- Public Transport Victoria (PTV)
- VicTrack
- Yarra Trams (associated entity of PTV).

Conclusion

The planning processes and early works have adequately prepared the Melbourne Metro Tunnel Project for its next phase, although at a greater cost and longer timeframe—mainly at the State Library station precinct—than originally approved and anticipated.

Notwithstanding this, the early works approach has effectively 'de-risked' some key elements of the overall project. In particular, DoT, Rail Projects Victoria (RPV) and contractors effectively delivered land acquisitions, site clearance and demolition, and utility relocations.

The **Public Private Partnership** is a consortium of corporate entities with responsibilities including design, construction, finance, commercial development, maintenance and overall project management.

The early works approach has also allowed the Public Private Partnership (PPP) consortium, which is contracted to deliver the tunnel and stations project component, to commit to deliver their works earlier than was expected in the 2016 business case. This has avoided some costs to the state and should bring forward expected economic and social benefits from the project.

The delays we observed in early works should not directly affect the contracted target dates for the next phase of the project, which focuses on the excavation and fit-out of the tunnel and stations.

Unexpected cost increases for the early works phase have put some pressure on internal budgets and wider project continency funds. The heavy use of project-wide contingency funds is an early warning flag for the project, particularly as there are at least five more years of complex and risky construction works ahead.

Due to the early stage and challenging risk profile of this large and complex transport infrastructure program, it is not yet possible for us to make conclusions about overall time and cost outcomes for the whole project.

Findings

The agencies we audited showed good practice in their early identification of project risks and made a focused effort to mitigate them. Examples of this include the early relocation of utilities and other services, as well as prompt land acquisitions and site clearances soon after the confirmation of the project's boundaries.

Another area of good practice we found was the effective coordination of the detailed design for the project to achieve environmental assessments and planning approvals before the state had signed contracts with the private sector for the main works.

Areas that could be improved relate to proponent agencies of major projects not showing comprehensive analysis of all realistic options in business cases, and central agencies not giving comparative advice on the costs and benefits of all realistic and sensible options.

Responding to wider rail network changes

Many recent rail project announcements, such as the Suburban Rail Loop, Melbourne Airport Rail Link, and Wyndham Vale and Melton electrification projects, have materially altered the original assumptions and analysis for the project. As a result, many assumptions around patronage demand projections, rail operating concepts, future rail network configurations, and wider project benefits, relate to a network strategy that is no longer correct.

DoT is the client for the project, but it has not yet adjusted its assumptions—considering these material changes to the project's context—about how the tunnels will operate and the benefits that will be delivered after completion.

DoT and the central agencies (DPC and DTF) need to review the underlying assumptions and expected project benefits given this changed rail project landscape. This could occur as part of the business case development for the newly announced rail projects so that DoT can develop a more comprehensive network-wide view, rather than only a project-specific view.

Forecasting and planning to meet demand

We are uncertain about the accuracy of some elements of the models PTV used to forecast passenger demand for the project. The 2016 business case was based on a specific demand forecast output from the Victorian Integrated Transport Model (VITM) and did not make it clear to decision-makers or the public that this figure could vary significantly because predictive models cannot be exact.

It was difficult for us to understand the rationale for many key assumptions used in the models as PTV and DoT did not document these decisions well.

RPV—the entity responsible for delivery of the Melbourne Metro Tunnel Project—and DoT have not explicitly defined potential triggers to bring forward unfunded projects that may be needed if the current patronage forecasts have underestimated demand. This includes the extension of platforms at some 35 stations to allow for an earlier than expected rollout of 10-car High Capacity Metropolitan Trains (HCMT) across the Sunbury/Melton and Pakenham/Cranbourne corridors.

Managing environmental risks

DELWP's identification and management of key environmental risks for this large and complex project, which affects many sensitive locations, has been diligent and effective.

In addition to this good work to date, all project parties will need to maintain high levels of focus to comply with the various environmental management controls now that construction is entering a more intense and complex phase.

Project management outcomes

The early works phase has cost more than the original total budget of $1.257 billion. The final forecast for all activities related to early works is now $1.353 billion, an increase of $95.8 million, or 7.6 per cent. In addition to this, RPV paid $68.3 million to a member of the PPP consortium for an Early Works Services Agreement (EWSA), which it funded from the main works phase budget.

RPV and DoT acquired the land needed for the project in an effective manner. RPV and DoT forecasts show that land acquisitions have been delivered at a cost of $728.1 million, which is $53.1 million, or 6.8 per cent, less than the total approved budget of $781.2 million.

Construction-focused activities in the early works phase have exceeded the original approved budget of $476.6 million, with a final forecast cost of $625.5 million. This 31.2 per cent increase is due to added scope and risks that have materialised for the state of Victoria, as the owner of the project.

Added scope for this project phase included network enhancement projects (NEP) to manage road closures and keep traffic flowing during construction, and an alternative modular strutting solution for the State Library station precinct access shafts. These scope additions should provide time savings for the main works contractor.

The state's desire to bring forward the overall project delivery date from 2026 to 2025—particularly by taking on the risk of constructing deep access shafts in the CBD—has come at an unanticipated extra cost, due to:

- initial underestimation by RPV of the likely costs and technical challenges of deep access shafts
- difficult and unforeseen geological conditions
- requirements by the PPP consortium for the redesign of the strutting system used in the State Library station access shafts after excavation works had already commenced
- lower productivity of the early works contractor due to:
    - delays triggered by redesigns
    - a more physically constrained construction environment within the State Library station precinct shafts due to the strutting design changes, which reduced the capacity and type of excavation equipment that could be used.

The early construction works had delays ranging from 35 days to 10.5 months across various precincts. RPV has a reasonable amount of time contingency in its overall construction program, and through a negotiated agreement, effectively transferred the risk of any early works construction delays to the PPP consortium. The early works delays have not impacted the main works' critical path, and if project activities are delivered as planned, this should not affect the 2025 completion date announced by the government.

RPV's decision to bring in a member of the PPP consortium as its 'delegate' to help resolve delay and design issues in the State Library station precinct access shafts, as well as other early works, resulted in an unanticipated cost of $68.3 million. This extra cost was due to the EWSA that RPV negotiated with a member of the PPP consortium.

Under this arrangement, the member of the PPP consortium raised an additional $172.8 million of variations, including the redesign of some elements of the deep access shafts. RPV paid for these variations, triggered by the PPP consortium while acting as the state's delegate, from wider project contingency funds.

RPV advises that it believes the state would have incurred these costs regardless of the delegate arrangement. It also asserts that the arrangement with a member of the PPP consortium has effectively mitigated the state's exposure to any more ongoing delay risks and potential future compensation claims by the PPP consortium due to late handover of the deep access shafts by the state. The wider public sector can learn from the interface risks that have realised in this project.

RPV had substantially consumed the project's overall cost contingency at the time of this audit. This raises an early concern about the sufficiency of contingency funds available for the next phase of the project, which includes five years of complex and risky tunnelling and construction.

Recommendations

We recommend that the Department of Premier and Cabinet, and the Department of Treasury and Finance:

1. ensure that project proponents have undertaken sufficient and comprehensive analysis of all sensible and realistic strategic interventions and project options in business cases (see Section 2.2).

We recommend that the Department of Premier and Cabinet, the Department of Treasury and Finance, and the Department of Transport:

2. review the remaining Melbourne Metro Tunnel Project contingency funds, taking into consideration the construction risks experienced to date and the likely time and complexity pressures expected for the remaining works, and advise government on the sufficiency of these funds (see Section 4.3)
3. review and revise the original assumptions contained in the Melbourne Metro Tunnel Project business case, considering the impacts of new rail system projects, and republish the refreshed assumptions in an updated project benefits management plan (see Section 2.4)
4. prior to commencing the next major transport infrastructure project with an early works stage, review the impact of technical interface risks between early and main works packages and, with the Office of Projects Victoria, share with the public sector any lessons learned from the interface issues and risks experienced in the Melbourne Metro Tunnel Project (see Section 4.3).

We recommend that the Department of Transport:

5. improve governance and visibility of the calibration and validation processes used for Victorian transport modelling and do more frequent and timely updates (see Section 2.3)
6. implement the recommended improvements from recently completed strategic modelling reviews for the various transport demand and simulation models used in the transport portfolio, and explore opportunities to better align and integrate transport service demand forecasting approaches with service demand modelling done in other public sector agencies (see Section 2.3)
7. further develop the various transport demand forecasting models so they can include a range of scenarios testing key areas of uncertainty, and provide a high/medium/low-growth range when supporting key investment decisions (see Section 2.3)
8. provide more disclosure and transparency around demand forecasting model assumptions and likely error and uncertainty bands when these modelling outputs are used as evidence by key decision-makers to support an investment decision or are included in public announcements or public communications about projects (see Section 2.3)
9. analyse and explicitly determine passenger load trigger points for the introduction of 10-car High Capacity Metropolitan Trains in the Melbourne Metro Tunnel and allow sufficient timeframes for consequential activities such as any necessary rail network upgrade projects and platform extensions (see Section 3.4)

10. transmit to the Minister for Planning and, if there are no specific legal impediments or restrictions, publish summaries of key findings and recommended actions from past and future Independent Environmental Auditor reports produced for the Melbourne Metro Tunnel Project on the project's official website (see Section 3.5).

We recommend that the Department of Environment, Land, Water and Planning:

11. require proponents of public infrastructure projects subject to an Environment Effects Statement process to publicly publish any environmental audit reports that an independent environmental auditor or equivalent undertakes and delivers as part of the environment management framework for the project (see Section 3.5).

Responses to recommendations

We have consulted with the following agencies, associated entities and departments:

- DELWP
- DPC
- DoT
- DTF
- PTV
- VicTrack
- Yarra Trams (associated entity of PTV).

We considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report to those agencies and asked for their submissions or comments.

DELWP, DPC, DoT and DTF all accepted the recommendations directed towards them, while PTV, VicTrack and Yarra Trams also welcomed the report's findings. The full responses are included in Appendix A.

1 Audit context

Melbourne's train patronage has been growing faster than the metropolitan system's ability to cope with demand.

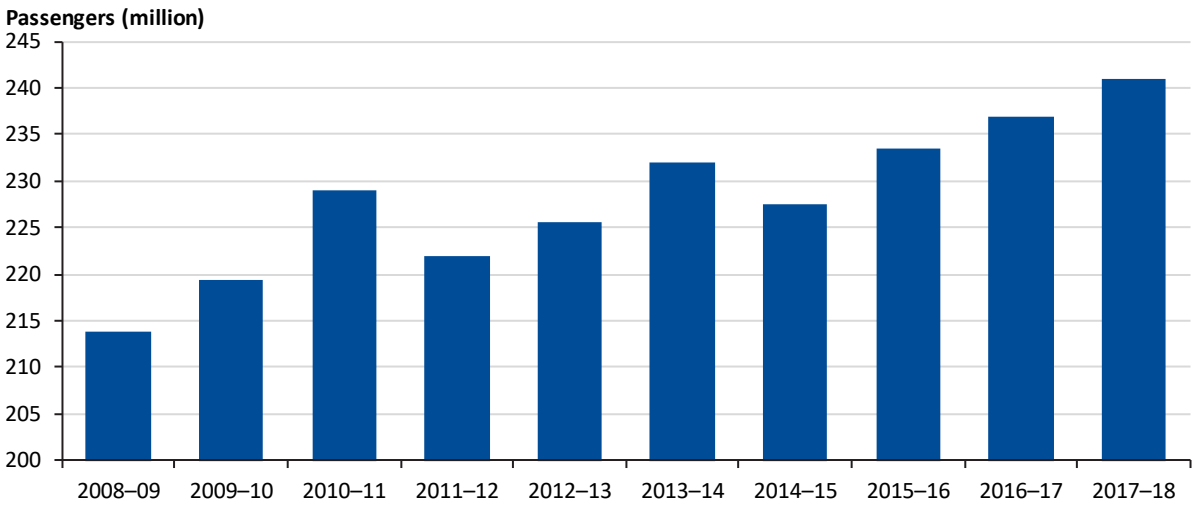
The aim of the Melbourne Metro Tunnel Project is to free up Melbourne's central rail system by removing three of the city's busiest train lines—Pakenham, Cranbourne and Sunbury—from the City Loop. This will create capacity to run more trains across the metropolitan rail network and increase service reliability.

This $11 billion transport infrastructure project will deliver twin nine-kilometre rail tunnels through the Melbourne CBD from South Kensington to South Yarra and construct five new underground stations.

1.1 Melbourne's rail transport problem

Metropolitan train patronage has increased by 13 per cent from 213.9 million passengers in 2008–09 to 240.9 million passengers in 2017–18 (Figure 1A). This high rate of growth is putting strain on the metropolitan rail network, triggering widespread crowding and reducing service reliability across the network.

Figure 1A
Annual metropolitan train patronage, 2008–09 to 2017–18



Source: VAGO analysis from PTV data.

For the 20 years from 2011 to 2031, PTV forecasts that patronage on metropolitan train lines will increase significantly (Figure 1B). PTV also forecasts that the average number of weekday passenger boardings will double from 750 000 to 1.5 million.

Figure 1B
Projected increase in patronage growth, 2011 to 2031

Source: Department of Economic Development, Jobs, Transport and Resources, *Melbourne Metro Business Case*, 2016.

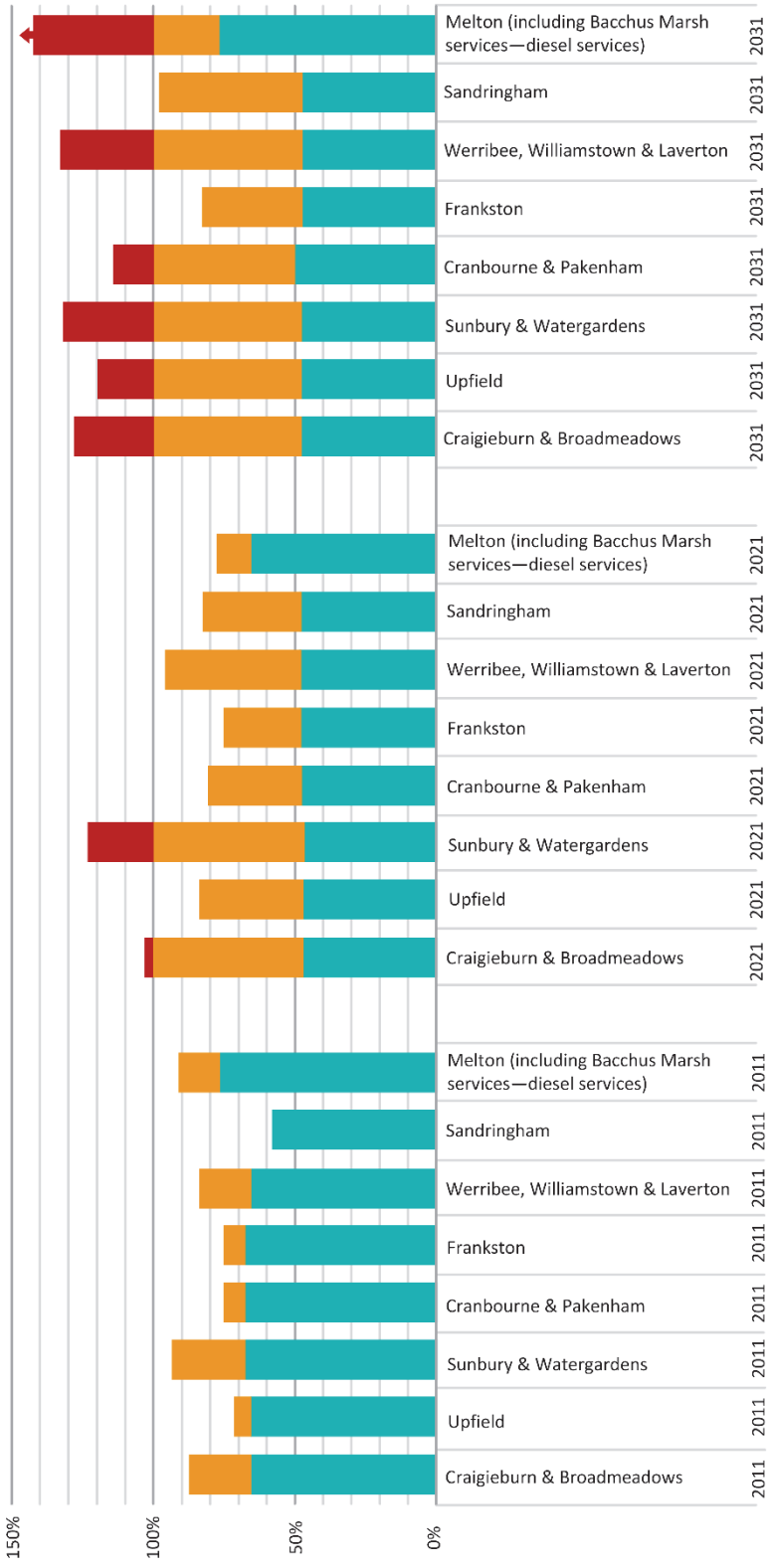
To meet a growing population and increasing centralisation of jobs, Melbourne's entire public and private transport network will need to provide 23 million trips per day by 2050—an extra 10.4 million trips per day compared to now.

All trains have a standard load capacity, which is the number of passengers who can fit comfortably in the carriages. For most metropolitan trains, this is 900 people per six-car train set. When there are more than 900 people, the train load is breached or 'crush' loaded.

Forecasting by PTV found that by 2031 all lines, except Frankston and Sandringham, are expected to breach load capacity during peak hours. As the number of load breaches increases, so too does passenger dissatisfaction with overcrowding and train dwell times—the time a train is stopped at a platform while passengers get on and off. Longer dwell times lead to delays, which impact reliability and time-keeping throughout the network.

Figure 1C shows the government's analysis of the excess demand on metropolitan lines if the Melbourne Metro Tunnel Project did not proceed.

Figure 1C
Future peak hour demand compared to available capacity if the Metro Tunnel was not built



Source: VAGO, based on Department of Economic Development, Jobs, Transport and Resources, *Melbourne Metro Business Case*, 2016.

1.2 Identifying the need for the Melbourne Metro Tunnel Project

Analysing Melbourne's rail transport problem

In response to the growing challenge of increased public transport patronage, various state governments commissioned investigations and reports to identify, analyse and solve the issues:

- *Meeting Our Transport Challenges* (MOTC), 2006
- *Investing in Transport: East West Link Needs Assessment* (EWLNA), 2008
- *The Victorian Transport Plan* (VTP), 2008.

Meeting Our Transport Challenges

The government described MOTC as a long-term transport plan for Victoria. It identified that Victoria's growing population and sustained economic growth would be the most significant influence on transport demand.

Stabling yards are locations where trains can be stored when not in use on the network.

Two relevant actions resulted from this plan—action 3 and action 4—which focused on improving existing rail infrastructure, as well as providing more stations and stabling yards. The MOTC strategy did not identify a metropolitan rail tunnel to complement the City Loop.

Investing in Transport: East West Link Needs Assessment

The March 2008 EWLNA report first proposed a tunnel linking Melbourne's western and south-eastern suburbs. The government commissioned the EWLNA as part of the MOTC plan, to investigate transport solutions to connect Melbourne's eastern and western suburbs.

The EWLNA recommended a 17-kilometre rail tunnel—'Melbourne's first "metro" style passenger line'—that should:

- be built in two stages:
  - **stage one**—a nine-kilometre tunnel running from Footscray to Domain, starting with West Footscray to Parkville and then south under Swanston Street and St Kilda Road to Domain
  - **stage two**—an eight-kilometre tunnel from Domain to Caulfield, following an alignment down St Kilda Road and Dandenong Road
- have a network of underground stations at Footscray, the Parkville precinct, in the central city and along St Kilda Road, with a station potentially at North Melbourne.

After this announcement, the project became a major focus of government transport plans, with several alternative alignment and station options.

The Victorian Transport Plan

In December 2008, in response to EWLNA recommendations, the government released the VTP, which replaced the MOTC strategy. The VTP consisted of a range of transport infrastructure projects, including the Melbourne Metro Tunnel Project—but only for stage one from Footscray to Domain.

The VTP stated that stage two, linking Domain to Caulfield, would be delivered after completion of stage one and would include more tracks from Caulfield to Westall.

1.3 Planning for the Melbourne Metro Tunnel Project

Submissions to Infrastructure Australia

In 2009 (after release of the VTP) and again in 2011, the state government submitted a project plan and the first business case for the Melbourne Metro Tunnel Project to Infrastructure Australia for assessment. Submitting a business case is a key step for state and territory governments to obtain Commonwealth funding for major projects.

The **Regional Rail Link** project constructed dedicated tracks for regional trains from West Werribee through Sunshine to Southern Cross stations. It opened in 2015.

Regional Rail Link and Melbourne Metro Rail Tunnel Stage 1

The 2009 project plan submission to Infrastructure Australia sought development funding for the Regional Rail Link and stage one of the Melbourne Metro Rail Tunnel. The state government identified these two projects as part of a seven-stage rail capacity upgrade program to double passenger capacity on the Victorian rail network over a decade.

The submission focused on:

- the existing problems that the rail capacity upgrade program intended to address
- the preferred solutions for both projects
- a high-level summary of the expected outcomes and benefits from both projects.

In terms of the tunnel project, the submission focused on stage one (Footscray to Domain) and proposed a number of corridor, tunnel alignment and station options. The preferred alignment option was along Swanston Street, with four stations at Parkville, Melbourne Central, Flinders Street and Domain.

Ready to proceed means that the infrastructure proposal met all of Infrastructure Australia's criteria and is considered to deliver real economic benefits.

Real potential means that projects clearly address a nationally significant issue or problem and relevant options are being considered.

Infrastructure Australia supported the project and assessed stage one as 'ready to proceed' and stage two as 'real potential'. Victoria received $40 million from the Australian Government for the development of a business case for stage one.

Melbourne Metro Business Case

The 2011 business case proposed to deliver the project in a single stage and assessed several station and alignment options. An outcome of this process was confirmation of several key project attributes such as:

- new underground stations would be built at Arden, CBD North, CBD South and Domain
- the CBD alignment would be along Swanston Street

- the previous Melbourne Metro Tunnel Project stage two route would adopt an alignment along Toorak Road, joining the Dandenong rail corridor from the east of South Yarra Station (as opposed to a tunnel from Domain to Caulfield along Dandenong Road)
- no new stations would be built on the Toorak Road alignment.

Specifically, adopting the Toorak Road alignment meant a 'short' tunnel would connect Domain (now Anzac) to South Yarra and would be an extension to stage one—as opposed to a separate stage two involving a 'long' tunnel from Domain to Caulfield along Dandenong Road.

In 2012, Infrastructure Australia supported the project and assessed it as having 'real potential'.

Melbourne Rail Link

In May 2014, the government rebranded the project as the Melbourne Rail Link. It also announced a significant change in tunnel alignment, with a tunnel connecting Southern Cross Station and South Yarra Station via Fishermans Bend and two new underground stations at Domain and Montague.

This project did not proceed because of a change in government after the November 2014 election.

Impact of the 2014 election and 2015 announcements

The Melbourne Metro Tunnel Project was a feature of Victorian Labor Party (then in opposition) commitments at the 2014 election. According to *Victorian Labor Platform 2014*, the proposed alignment for the project was similar to previous announcements in November 2011.

In February 2015, the newly elected government announced the establishment of the Melbourne Metro Rail Authority (now RPV). It also announced its preferred alignment along Swanston Street, with no connection to South Yarra Station from Domain.

In April 2015, the government confirmed that the Melbourne Metro Tunnel Project would have an alignment route under Swanston Street. The government noted that it also considered alternative alignments along Russell and Elizabeth streets.

In October 2015, the government confirmed the construction method of a 'deep' tunnel through the CBD and a requirement to use a 'mined cavern' excavation technique for the tunnel and stations in the CBD, rather than a 'cut and cover' technique, which had been previously proposed.

Although the government expected the new construction technique to be costly and technically complex, it also expected this technique to cause less disruption to the city, particularly the extremely busy tram lines that run from St Kilda Road through Swanston Street to The University of Melbourne and beyond.

Mined cavern refers to a construction approach where the required space for an underground structure or tunnel is excavated or 'mined' underground from a smaller access shaft sunk from the surface.

Cut and cover construction involves digging or 'cutting' a deep trench from above, building a structure or tunnel in the trench, and then backfilling or 'covering' with the previously excavated earth and rock.

1.4 The 2016 Melbourne Metro Tunnel Project business case

Overview of the approved project

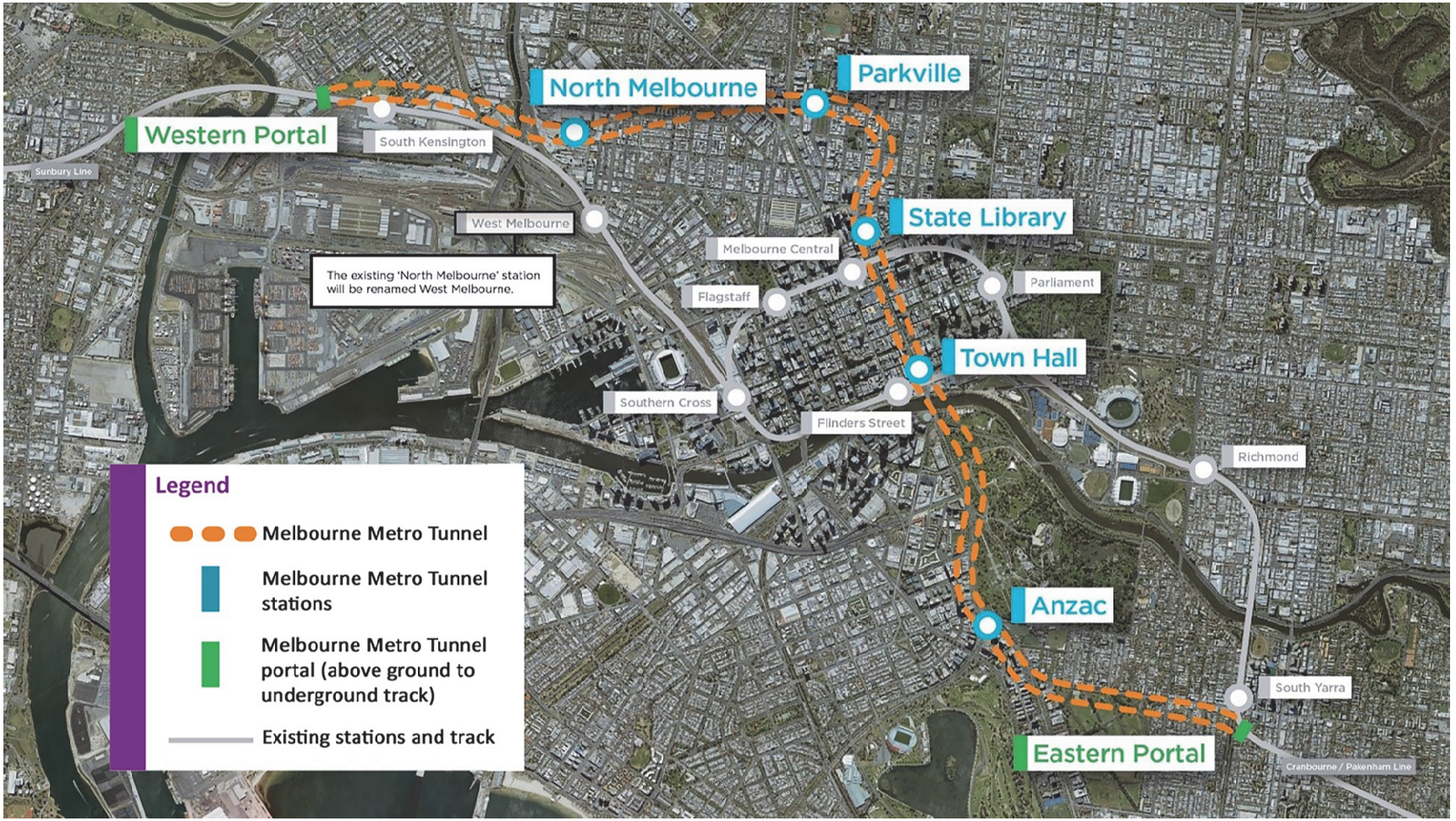
The Melbourne Metro Tunnel Project business case was prepared by the former Department of Economic Development, Jobs, Transport and Resources (DEDJTR) (now DoT) and approved by government in February 2016.

The Melbourne Metro Tunnel Project, when completed, plans to deliver:

- twin nine-kilometre rail tunnels from the west of the city to the south-east as part of a new Sunbury to Cranbourne/Pakenham line
- new underground stations (North Melbourne, Parkville and Anzac) and two new CBD stations directly connected to the City Loop at Flinders Street and Melbourne Central stations
- two portal entrances to the tunnel at South Kensington and South Yarra, where the existing above ground rail track enters the tunnel
- a train/tram interchange at Anzac
- high-capacity signalling to maximise the efficiency of the new fleet of HCMTs.

Figure 1D shows the tunnel alignment through the CBD and the location of the CBD stations in relation to the current CBD train lines and stations.

Figure 1D
The route of the Melbourne Metro Tunnel and the proposed stations

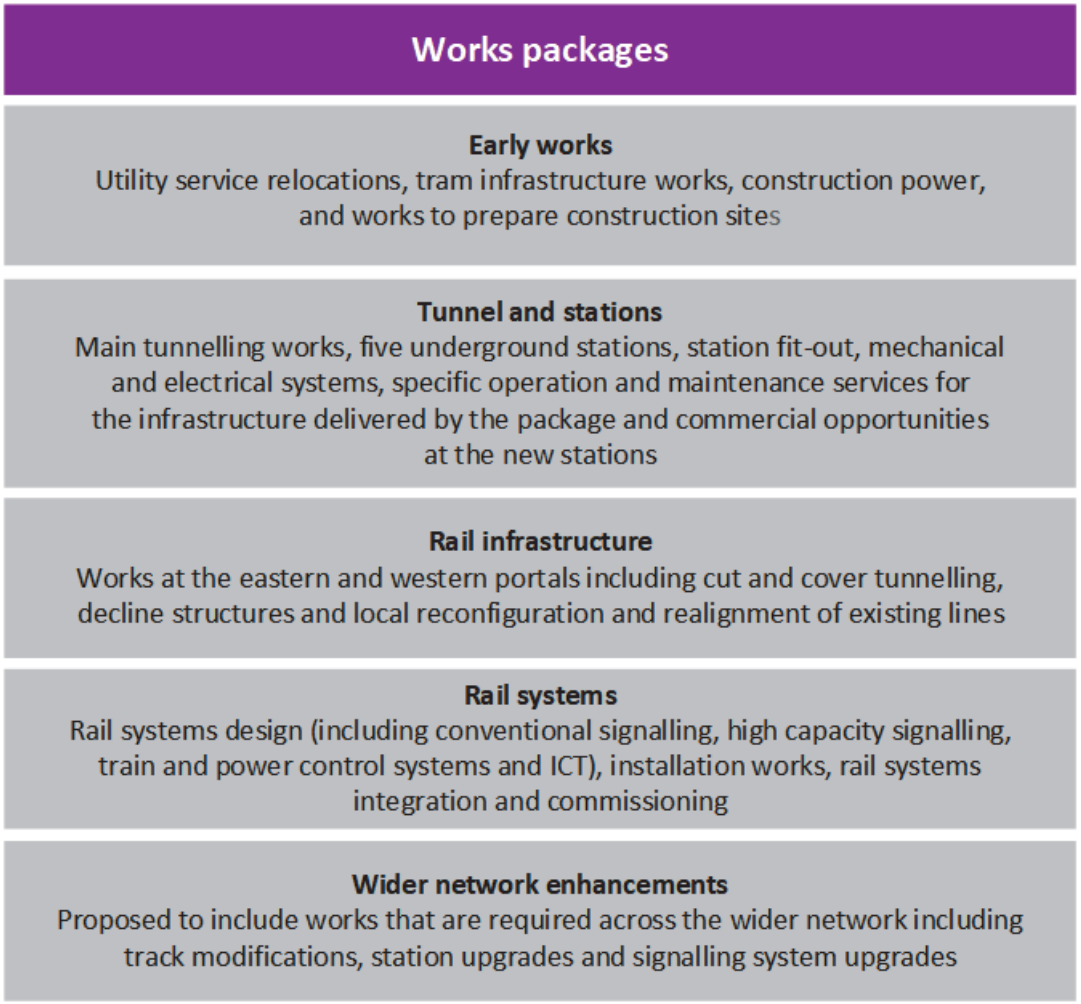


Key: Orange indicates the tunnel alignment. Blue indicates the new stations that are being constructed as part of the Melbourne Metro Tunnel Project. Green shows the locations of the two portals. Grey indicates the existing train lines and stations.
Source: VAGO, based on RPV, 2018.

Packaging of project works

In the 2016 business case, DEDJTR (now DoT) grouped works for the Melbourne Metro Tunnel Project into five key packages (Figure 1E).

Figure 1E
Works packages for the Melbourne Metro Tunnel Project

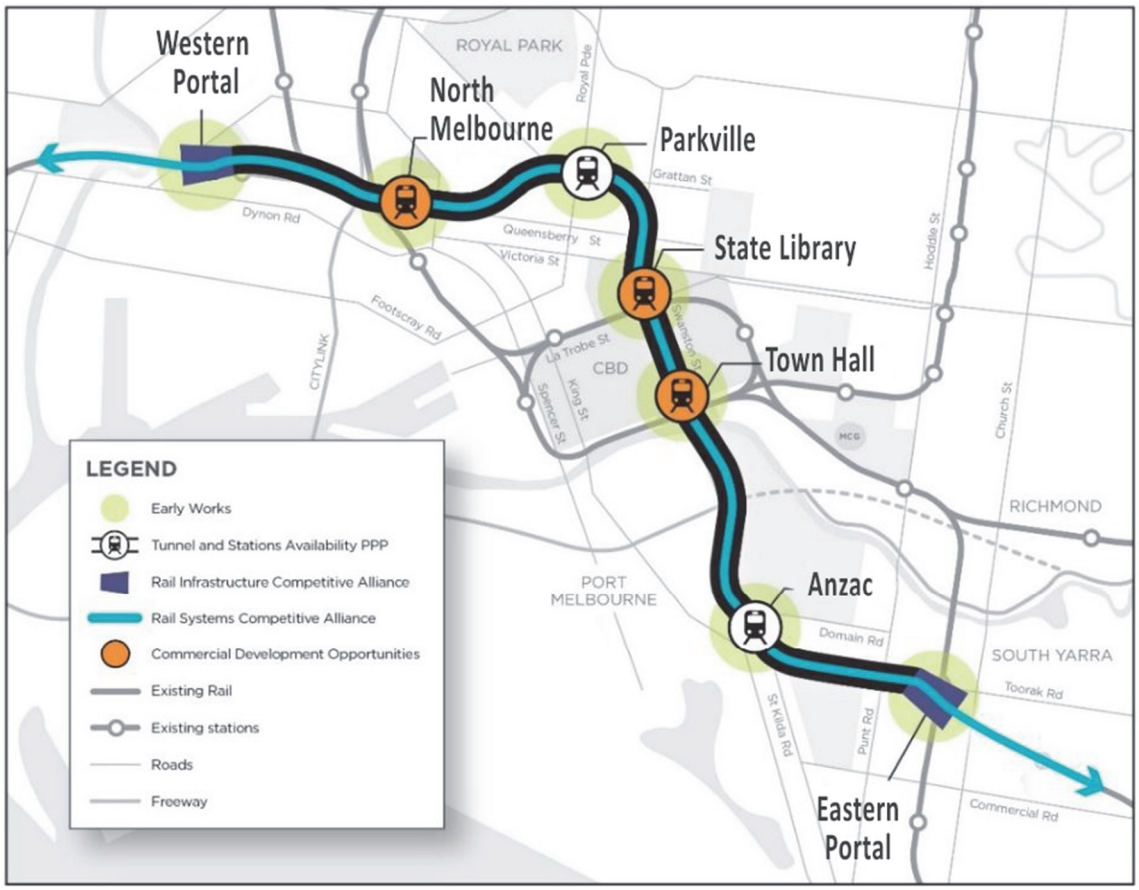


Source: VAGO, based on DEDJTR, *Melbourne Metro Business Case*, 2016.

In addition, a central property unit in DoT acquired, on behalf of the state, the land and properties needed for the project.

Figure 1F shows the interaction between each works package and the construction locations.

Figure 1F
Procurement strategy alignment map for the Melbourne Metro Tunnel Project



Source: DEDJTR, *Melbourne Metro Business Case*, 2016. Station names updated by VAGO.

Early works

In the business case, the concept of an early works phase was proposed to prepare the various project precincts for the main works.

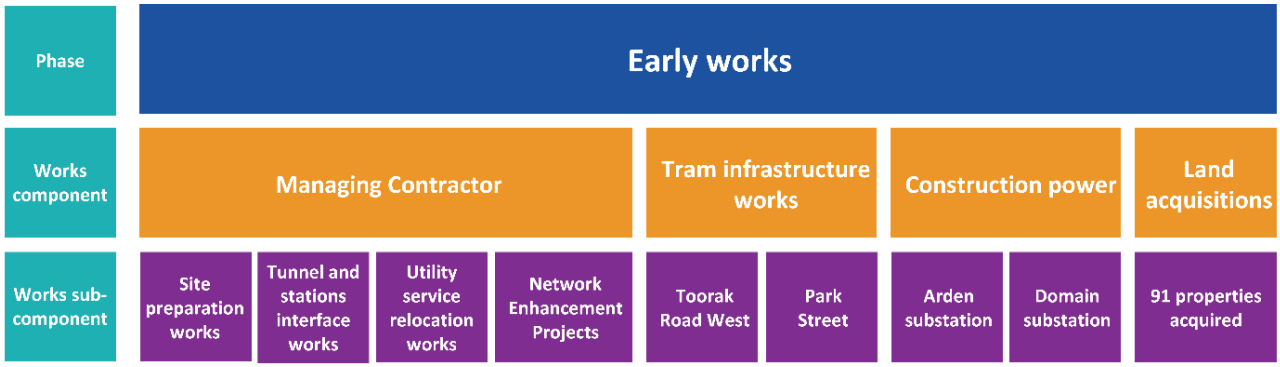
The business case analysed certain works that needed to be delivered before the core bundle of works (tunnel and stations, rail infrastructure and rail systems) and therefore should be procured as a separate package of works.

Early works included:

- tram diversions
- utility relocations and protections
- construction power
- demolitions and relocations.

After the business case was approved, the government expanded the scope of the early works package to include tunnel and stations interface works. Figure 1G shows the scope of early works.

Figure 1G
Scope of early works



Source: VAGO, based on RPV information.

Early works package

We examined four parts of the early works package:

- land acquisitions
- Early Works Managing Contractor (EWMC) activities, including:
  - site preparation works at:
    - North Melbourne
    - Parkville
    - State Library
    - Town Hall
    - Anzac
  - PPP interface works at the State Library and Town Hall station precincts
  - utility service relocations across all station and portal precincts
  - NEPs
- tram infrastructure works
- construction power works.

Land acquisitions

The government needed to acquire land and properties in the project boundaries that it did not own. Compulsory acquisition of land and property occurred through the *Land Acquisition and Compensation Act 1986*.

Early Works Managing Contractor

Site preparation works

Site preparation works included clearing and preparing future construction sites. This included property demolition works, the removal of trees, and relocation of artworks and monuments, as well as other minor road or transport network changes at the five station and two portal precincts.

Public Private Partnership interface works

RPV describes sites with an overlap of early works and main works as 'interface' works. The works that allow the PPP consortium to undertake future construction activities, and which have a direct interface with main works, include:

- design and construction of two deep access shafts—and associated acoustic sheds and gantry cranes—at Franklin Street and A'Beckett Street
- demolition of the former City Square and car park, underpinning and strengthening the foundations for the Westin Melbourne hotel and apartments, and partial excavation of the future station box.

Utility service relocations

RPV needed to protect or relocate utility services located on or near station and portal precincts so they would not be disrupted during main construction works.

The EWMC relocated gas, electricity, water, sewerage, and telecommunications services during early works.

Utilities have been protected or relocated during the early works phase of the Melbourne Metro Tunnel Project. Photograph courtesy of RPV.

Network enhancement projects

NEPs are road-based improvements, such as extra traffic lights, variable message signs, addition or removal of traffic or turning lanes, and traffic flow monitoring equipment (such as closed-circuit television cameras or Bluetooth traffic counters).

The aim of NEPs is to mitigate disruption impacts across the road network and provide suitable routes for vehicles around construction sites. NEPs were not originally part of the early works—RPV added them after public submissions raised traffic impact concerns during the Environment Effects Statement (EES) process.

Tram infrastructure works

Through the tram franchisee agreement with PTV, Yarra Trams was contracted to adjust the tram network for the Melbourne Metro Tunnel Project works. RPV directed Yarra Trams to reroute tram services that formerly ran along Domain Road to new tracks that were built on Toorak Road West to join St Kilda Road.

Yarra Trams also constructed a new platform stop on Park Street in South Melbourne to service trams that previously stopped at the Domain Interchange, which has now been demolished.

Construction power works

The main construction works, particularly the tunnel boring machines, need large amounts of high-voltage power.

This aspect of early works involved the design, engineering and construction of two substations to supply the necessary power for the main works. The substations are located at North Melbourne and Anzac.

Budgets for the Melbourne Metro Tunnel Project

The government announced the budget for the Melbourne Metro Tunnel Project as $11 billion. Figure 1H shows each works package and its budget at the contracted stage.

Figure 1H
Estimated cost of the Melbourne Metro Tunnel Project

Works package	Cost ($ million)
Land acquisition[(a)]	781.2
Early works[(b)]	365.3
Tunnel and stations[(c)]	5 319.7
Rail infrastructure	1 154.7
Rail systems (i.e. high-capacity signalling)	1 384.5
Other state costs[(d)]	2 023.5
Total cost:	**11 028.9**

(a) Land acquisitions were not a contracted package. This is the approved budgeted amount.
(b) Includes EWMC, tram infrastructure works and construction power.
(c) Includes the main works, minor contracted works, as well as the EWSA, which is related to the early works phase but was funded from tunnel and stations contingency funds.
(d) Includes wider network enhancements, design development, business case and procurement activities, contingency, project management and other direct costs.
Source: VAGO, based on RPV information.

Budgets for the early works

The government used different procurement approaches for the three early works contracts. Because the government has the right to compulsorily acquire property under the *Land Acquisition and Compensation Act 1986*, DEDJTR (now DoT) completed this component of the early works.

Figure 1I provides an overview of the early works contracts and budgets.

Figure 1I
Contracts and values for early works

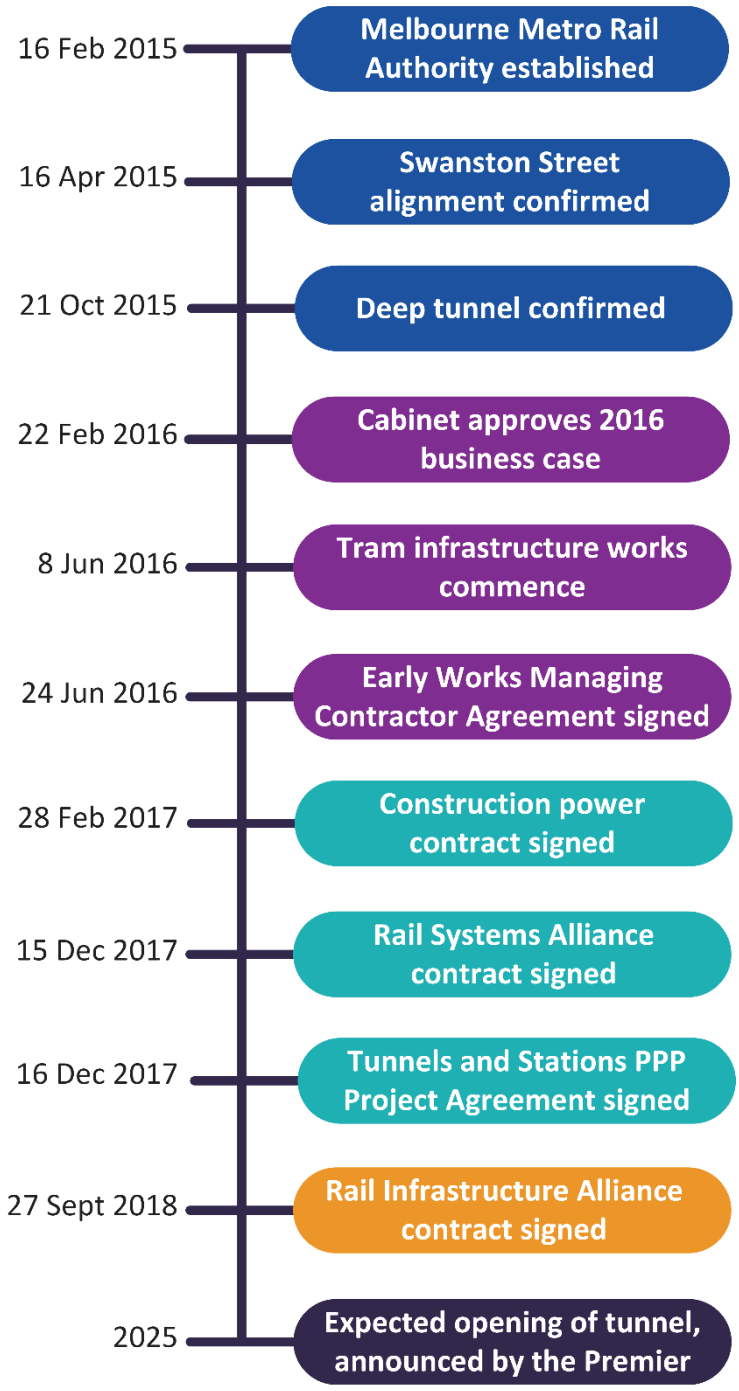
Works component	Contractual agreement	Procurement process	Contract/ budgeted value ($ million)	Start date
Managing Contractor Agreement	Managing Contractor Agreement	Public tender	324.1	24 June 2016
Construction Power	Engineer, Procure, Construct and Maintain Agreement	Select tender	10.3	28 February 2017
Tram Infrastructure Works	Franchisee Agreement	Existing contract	27.6 [(a)]	8 June 2016
Other RPV costs	N/A	N/A	3.3	N/A
Total cost			**365.3**	

Key: N/A = not applicable.
(a) Tram infrastructure works were not contracted—this is the budgeted amount.
Note: Figures do not include RPV risk and contingency amounts.
Source: VAGO, based on RPV information.

Time line for the project

Development of the current alignment began in 2015, when the Melbourne Metro Rail Authority (now RPV) was established. The government expects the tunnels to open in 2025 (Figure 1J).

Figure 1J
Time line of major Melbourne Metro Tunnel Project events



Source: VAGO, based on RPV and publicly available information.

Integration with other rail network initiatives

The Melbourne Metro Tunnel Project is not a standalone project. Once complete, this project and supporting projects are expected to provide the basis for future rail network improvements.

Figure 1K shows current and future projects that intersect with or complement the Melbourne Metro Tunnel Project and contribute to increasing Melbourne's metropolitan rail capacity.

Figure 1K
Current and future projects that contribute to growing Melbourne's metropolitan rail capacity

Project	Status[(a)]	Budget
Cranbourne line upgrade and duplication	Underway	$750 million (announced)
Electrification of the metropolitan rail network to growth areas including Melton and Wyndham	Planned	Not yet announced
Electrification to Baxter	Planned	$225 million (estimated)
Fast Rail to Geelong	Planned	Not yet announced
HCMTs and high-capacity signalling	Underway	$3.3 billion (announced)
Level Crossing Removal Program (original 50 crossings)	Underway	$7.6 billion (announced)[(b)]
Level Crossing Removal Program (additional 25 crossings)	Planned	$6.6 billion (announced)
Melbourne Airport Rail Link	Planned	$8–13 billion (estimated)
Rail infrastructure upgrades between Upfield and Somerton on the Craigieburn line	Planned	Not yet announced
Regional Rail Revival	Underway	$1.75 billion (announced)
Suburban Rail Loop	Planned	$50 billion (announced)

(a) Planned: announced projects. Underway: projects that are fully funded and/or have commenced.
(b) VAGO's *Managing the Level Crossing Removal Program* audit found that the estimated cost, as of July 2017, was $8.3 billion.
Source: VAGO, based on Transport for Victoria, *Growing Our Rail Network 2018–2025*, 2018, and ministerial press releases.

1.5 Environment Effects Statement and statutory planning processes

Environment Effects Statement process

The EES process under the *Environment Effects Act 1978* allows statutory decision-makers to decide whether a project with potentially significant environmental effects should go ahead. This requires the project proponent to prepare and release an EES for public comment. The EES process ends when the Minister for Planning releases an assessment of the project's environmental effects. This is known as the Minister's Assessment.

The Minister for Planning decides whether a project needs to undergo the EES process. On 3 September 2015, the Minister for Planning declared the Melbourne Metro Tunnel Project as 'public works' under the Act. This declaration meant that RPV had to undertake the EES process to identify the project's environmental effects and any necessary mitigation measures.

The EES was available for public review between May and July 2016, and RPV received 379 submissions. DELWP established a joint Inquiry and Advisory Committee (IAC) to consider the EES, public submissions and draft planning controls for the project. In November 2016, the IAC provided its report to the Minister for Planning supporting the Melbourne Metro Tunnel Project.

The EES process concluded in December 2016, when the Minister for Planning released the Minister's Assessment, which found that the environmental effects of the project were acceptable, subject to recommended actions.

After the EES process finished, the Minister for Planning approved a suite of environmental management and planning controls for the project.

Statutory planning approvals

The planning process for the project under the *Planning and Environment Act 1987* ran concurrently with the EES process. The Minister's Assessment and subsequent statutory approvals allowed the Melbourne Metro Tunnel Project to begin major construction.

The planning schemes for the cities of Maribyrnong, Melbourne, Port Phillip and Stonnington govern the land required for the project. The Minister for Planning approved *Planning Scheme Amendment GC45* in December 2016, which introduced an Incorporated Document to exempt the project from the four local planning schemes. This planning scheme amendment also made the Minister for Planning the responsible authority for planning provisions applicable to the project, which means that local government is not involved in approving any planning matters related to the project.

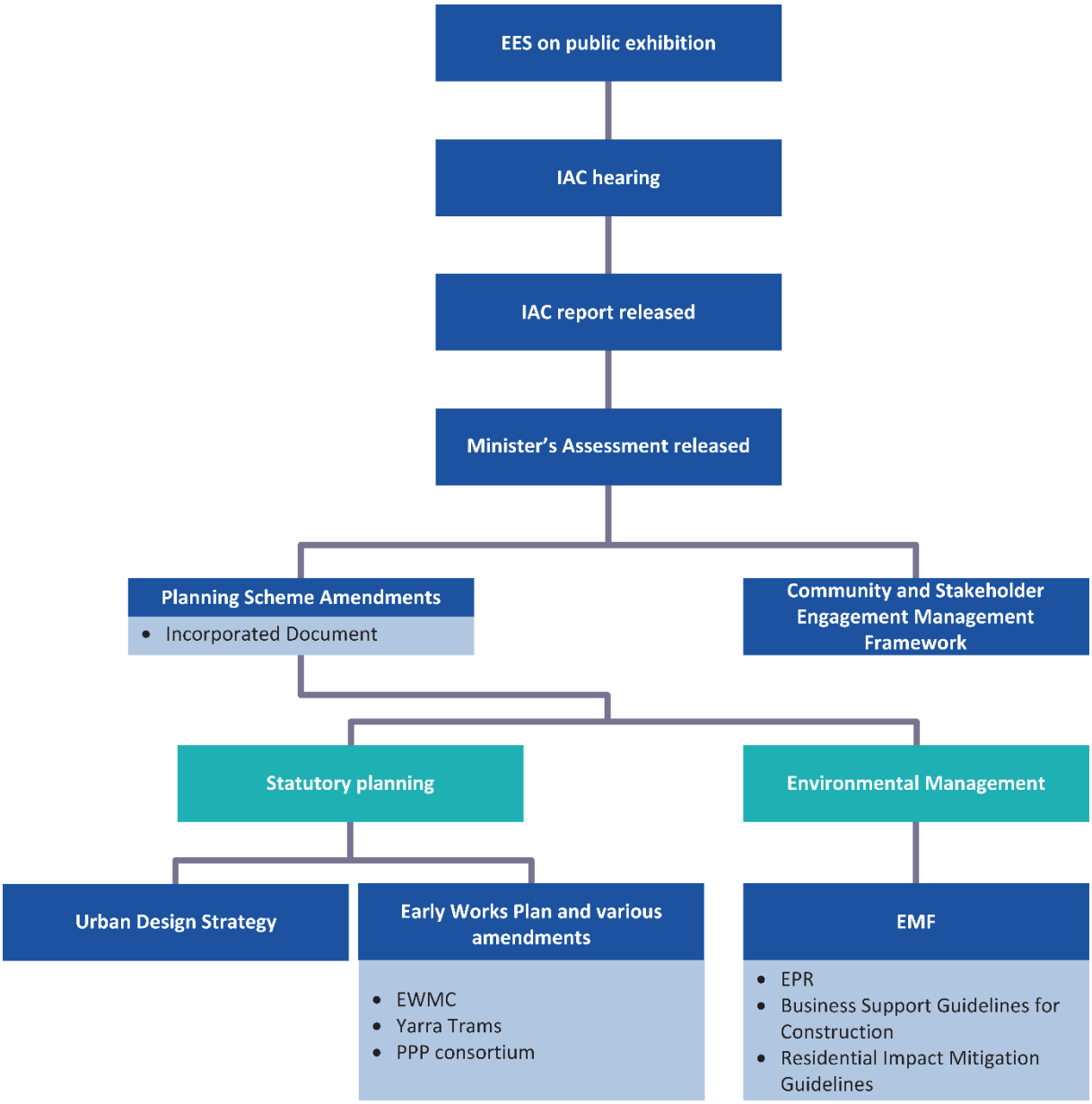
The Incorporated Document sets out the project land, the permitted project activities and the conditions that RPV and its contractors must follow. It also sets out requirements for, and gives statutory weight to, the following overarching environmental and planning management strategies or frameworks:

- an Environmental Management Framework (EMF), which includes 125 Environmental Performance Requirements (EPR), Business Support Guidelines for Construction and Residential Impact Mitigation Guidelines
- an Urban Design Strategy
- a Community and Stakeholder Engagement Management Framework.

The EMF provides a governance framework to manage the environmental effects of the project. The EPRs detailed in the EMF are environmental outcomes that must be achieved by RPV and its contractors during design, construction and operation of the Melbourne Metro Tunnel.

Figure 1L shows the EES processes and planning approvals relevant to this audit.

Figure 1L
Relevant EES processes and planning approvals



Source: VAGO.

Part 3 of this report further examines the EES and statutory planning processes for the Melbourne Metro Tunnel Project. Part 4 discusses compliance with the EPRs during the early works phase.

1.6 Agency roles

The following departments are responsible for facilitating the early works of the Melbourne Metro Tunnel Project or have some involvement with the early works.

Department of Environment, Land, Water and Planning

DELWP brings together Victoria's planning, local government, environment, energy, forests, emergency management, climate change and water functions into a single department.

DELWP's Impact Assessment Unit administers the EES process and provides advice to the Minister for Planning, including drafting content for the Minister's Assessment.

The Impact Assessment Unit also advises the Minister for Planning on statutory planning matters for this project.

Department of Premier and Cabinet

DPC leads whole-of-government policy and performance and helps the government achieve its strategic objectives by assisting the Premier and members of the Cabinet.

DPC is also the secretariat of a key interdepartmental committee relevant to the project and leads the whole-of-government policy agenda for major transport projects.

Department of Transport

DoT is responsible for policy and planning for all transport matters. DoT works closely with the Major Transport Infrastructure Authority to coordinate major transport construction activities and network disruptions. DoT is the client for the Melbourne Metro Tunnel Project and is responsible for setting the scope and intended network benefits for the project.

DoT also acts as the state's lead transport agency and aims to bring together the planning and coordination of Victoria's transport system and agencies, including VicRoads and PTV, and to integrate Victoria's transport system to connect people, places and opportunities.

The **Gateway Review** process examines nominated projects at key decision points during a project life cycle.

The **High Value High Risk Framework** is a series of checks and processes to assess whether an infrastructure project of high value and/or high risk will achieve its stated benefits on time and within budget.

Department of Treasury and Finance

DTF provides economic, financial and resource management advice to help the Victorian Government deliver its policies.

DTF is the owner of the State Budget process, which is key to funding approval for major infrastructure projects such as the Melbourne Metro Tunnel Project. DTF also runs the Gateway Review and High Value High Risk project assurance processes, which both apply to the project.

Rail Projects Victoria

Previously known as the Melbourne Metro Rail Authority, RPV has responsibility for all delivery aspects of the Melbourne Metro Tunnel Project, including procurement, construction and project commissioning.

In January 2019, RPV became a project team under the Major Transport Infrastructure Authority, which is an administrative office under DoT.

Public Transport Victoria

PTV is a statutory authority that acts as a system coordinator for all public transport in Victoria. It aims to promote public transport and improve it by ensuring better coordination between modes, facilitating expansion of the network, and auditing public transport assets.

PTV oversees public transport operators that act under franchise and services agreements.

VicTrack

VicTrack is a state-owned organisation operating under the *Transport Integration Act 2010*. It owns Victoria's rail transport assets—such as railway land, signalling and tracks—and leases them to rail and tram operators through PTV. VicTrack commercialises unused transport assets for re-investment purposes, such as through leasing land.

VicTrack made parcels of land it manages available for the Melbourne Metro Tunnel Project.

Yarra Trams

Yarra Trams is operated by Keolis Downer, which is a private sector transport company that has managed Victoria's tram network since 2009. Some Melbourne Metro Tunnel Project construction sites have impacted the tram network.

Working under its franchise agreement with PTV, Yarra Trams has carried out tram infrastructure works to reroute affected tram services.

1.7 Relevant legislation

Major Transport Projects Facilitation Act 2009

The *Major Transport Projects Facilitation Act 2009* provides a 'one-stop shop' to assess, approve and deliver major transport projects in Victoria. The declaration of a project means that the Premier can determine which aspects of the *Major Transport Projects Facilitation Act 2009* apply.

On 4 September 2015, the government appointed the Minister for Public Transport as Project Minister and the Secretary of DEDJTR (now DoT) as project proponent.

Environment Effects Act 1978

The *Environment Effects Act 1978* can require an assessment of the potential environmental impacts or effects of a proposed development through preparation of an EES.

This is not an approval process but supports statutory decision-makers, such as government ministers, to make decisions about whether a development should go ahead. The Minister for Planning determines whether a project needs to undergo the EES process under the *Environment Effects Act 1978*.

Section 1.5 of this audit details the EES process for the Melbourne Metro Tunnel Project.

Planning and Environment Act 1987

The *Planning and Environment Act 1987* sets out the administrative processes that regulate the planning, use and development of Victorian land.

This law empowers the Minister for Planning to exempt the Melbourne Metro Tunnel Project from the four municipal councils' planning schemes, and also allows the Minister for Planning to act as the responsible authority for planning decisions related to the project.

Land Acquisition and Compensation Act 1986

The *Land Acquisition and Compensation Act 1986* provides the legal power and sets out the process for state authorities to compulsorily acquire land for a public purpose.

It also sets out the process for paying compensation for compulsorily acquired properties.

1.8 Auditing the Melbourne Metro Tunnel Project

This performance audit is the first in a series of audits examining the Melbourne Metro Tunnel Project.

The rationale for this staged approach is to examine a major transport infrastructure project at key life cycle stages so that audit observations and findings can maximise our impact to improve the next stage of the project. It also provides timely learnings for other similar projects.

This first audit focused on project planning and early works for the Melbourne Metro Tunnel Project.

The second audit will focus on the main tunnel and stations works, as well as other critical enabling projects such as a new high-capacity signalling system, rail infrastructure connection works for the tunnel—combined with wider rail network improvements—and the introduction of HCMTs.

We expect the third audit to focus on the commissioning of the tunnel and stations, as well as an assessment of the likely realisation of benefits across the rail network that were identified in the 2016 business case.

1.9 Why this audit is important

When completed and commissioned, the Melbourne Metro Tunnel will be a major public transport infrastructure asset that will impact most rail users across Melbourne.

This project is meant to be the start of an interconnected metro-style public transport system like those seen in other major international cities. The improvement in public transport into the CBD, if achieved, will support increased business, leisure and educational activity.

Large transport infrastructure projects are complex, expensive and risky. Historically, they have not always delivered benefits within time, cost and quality targets.

Independent audit scrutiny gives assurance to Parliament, the government and taxpayers that public resources are used well and that the Melbourne Metro Tunnel Project is performing as expected.

1.10 What this audit examined and how

The objective of this audit was to determine whether the Melbourne Metro Tunnel Project planning processes and early works have adequately prepared the project for the main tunnel and stations works.

Specifically, we examined whether:

- the transport problem that the Melbourne Metro Tunnel Project is expected to solve was adequately understood in the 2016 business case
- the reference design of the Melbourne Metro Tunnel Project was informed by robust modelling that was supported by realistic and validated data for demography, land use and travel patterns
- the project's reference design demonstrates a flexible future-proofed solution
- the EES and statutory planning processes adequately considered environmental risks and site-specific issues, and recommended effective mitigations and/or controls
- the various early works packages proceeded to plan and have been delivered within expected time, cost, scope, quality and environmental parameters.

We conducted our audit in accordance with section 15 of the *Audit Act 1994* and ASAE 3500 Performance Engagements. We complied with the independence and other relevant ethical requirements related to assurance engagements. The cost of this audit was $920 000.

1.11 Report structure

The remainder of this report is structured as follows:

- Part 2 examines the project's strategic planning and options analysis.
- Part 3 examines the project's detailed design, environmental assessment and planning approvals processes.
- Part 4 examines the project's progress to date, focusing on the scope, cost, time, quality and environmental outcomes.

2 Strategic planning for the Melbourne Metro Tunnel

Before the Victorian Government funds a public sector project, agencies must show that they have examined the need for the investment, understood the underlying context of the need, and can propose strategic interventions and project options to solve the problem and deliver benefits to the community and the economy.

This strategic conceptualising and planning process helps agencies to develop a detailed business case, which is the typical vehicle used to seek government approval and funding of a project.

This part examines the strategic planning, option identification and business case development used for the Melbourne Metro Tunnel Project.

For this component of the audit, we examined whether the transport problem that the Melbourne Metro Tunnel Project is expected to solve was adequately understood in the 2016 business case.

To achieve this, we focused on the following agencies:

- DPC
- DoT
- DTF
- PTV.

2.1 Conclusion

The agencies involved in the strategic planning for the Melbourne Metro Tunnel Project demonstrated a good understanding of Melbourne's future rail transport needs, as expressed in the business case.

Although these agencies understood the problem and therefore the need for the project, their response to the need only considered a tunnel as an option for detailed analysis. Other potentially viable non-tunnel options to solve the identified transport problem were not analysed in a meaningful and comparative manner.

Options analysis

DoT did not undertake a comprehensive, comparative analysis of any option other than a new asset option—that is, a city bypass rail tunnel. This meant government was not fully informed as to whether a non-tunnel option could have provided similar benefits to the overall rail network at an equivalent or potentially lower cost than the current Melbourne Metro Tunnel Project.

A potential 'existing network improvement' option could have involved heavy investment in the existing overland rail network, using HCMTs and high-capacity signalling.

We consider that DoT could have provided a clearer picture for decision-makers by presenting separate analyses of the costs and benefits of a tunnel project compared to investing in the existing overland rail network, and a combination of these options.

Modelling of passenger demand

The business case used two strategic passenger demand models—VITM and a Strategic Check Model—a commercially available strategic transport forecasting model.

The sensitivity of these models to changes in the supply of public transport services or fares, which could affect passenger behaviour, is low when compared to the typical ranges that international guidelines expect from strategic transport models.

This means that there is a risk that both models could have inaccurately forecast the timing, location, quantity and rate of growth of future patronage for the new tunnel and stations. This could also affect the accuracy of the proposed economic benefits of the project, which heavily relied on forecast patronage data from VITM.

Benefits framework

The 2016 business case captured the expected network-wide benefits from the Melbourne Metro Tunnel Project well and showed that a rigorous analysis was conducted to identify and attribute project benefits.

However, the benefits plan in the business case has some weaknesses. It does not describe a risk management strategy, nor does it allocate responsibility for ongoing benefits management. This could make it challenging in the future to measure whether the project has delivered its expected benefits, and thus define the level of value for money achieved.

2.2 Melbourne Metro Tunnel Project business case

Aim of the project

The 2016 business case's key objectives were to:

- ease pressure on a strained public transport system
- meet public transport patronage growth due to the city's growing population
- provide the 'backbone' to establish a future metro-style rail network.

The project aims to achieve these by connecting the Cranbourne/Pakenham and Sunbury lines—the metropolitan rail lines that service two of Melbourne's largest growth corridors to the south-east and north-west—to create a Sunshine–Dandenong line. This is meant to increase the number of services on the new dedicated corridor and enable future expansion of the metropolitan network by removing these services from the City Loop and other central area tracks.

The project also aims to create capacity through the inner core of the network for five other metropolitan lines—Werribee, Frankston, Craigieburn, Upfield and Sandringham—and enable an increase in services to better meet demand across the metropolitan rail network.

Analysing the transport problem

The business case details the anticipated population growth of Melbourne and the trend towards increased demand for public transport on trains.

The high-level problems identified were:

- chronic overcrowding and unreliable rail services, which reduce Melbourne's liveability and access to jobs and key activity precincts
- physical transport network constraints, which reduce Melbourne's economic prosperity and productivity
- insufficient public transport services, which impact access into and around central Melbourne and limit the potential for urban renewal.

The business case sufficiently describes and analyses these problems.

Strategic options to address the problem

When addressing potential solutions to the three identified high-level problems, the business case makes a distinction between high-level strategic options and lower-level options to implement a solution based on the preferred strategic option. This two-step approach is consistent with DTF guidance.

The business case considered three strategic options to address the identified problems:

- Strategic option 1—current state: current operations with productivity improvements, without significant investment beyond currently planned expenditure.
- Strategic option 2—demand and productivity management: conduct demand management and productivity improvements on existing assets or systems without significant investment.
- Strategic option 3—increase supply: increase capacity for access to the CBD through significant capital investment in public transport assets or road alternatives.

The business case assessed the strategic option to increase supply as the most favourable strategic response.

Options assessments of various capital projects were used to develop detailed solutions that could respond to the chosen strategic option, with the Melbourne Metro Tunnel Project listed as one of the detailed solutions.

The business case identified that this strategic option provided the most comprehensive medium to long-term solution to meet increasing patronage demand and capacity constraints on the rail network and increasing supply would provide better public transport for priority CBD development precincts.

Incomplete analysis of capital options

Only strategic option 3 considers significant investment as a possibility—and this option does not consider significant new investment to better use or augment the existing overland rail network.

Therefore, transport agencies did not adequately analyse whether a similar (i.e. $11 billion) or lesser amount of money could have delivered similar or greater benefits than the Melbourne Metro Tunnel Project if directly invested across the existing rail infrastructure network.

An appendix to the business case, which subjected 13 capital investment options to a high-level qualitative ranking analysis, included separate elements of an overland rail network option (HCMTs, high-capacity signalling, and an overland route improvement described as ‘viaduct widening’).

Although the qualitative shortlisting process used did not result in a detailed analysis in the business case of this combination of potential capital projects, HCMTs and improvements to track and power supply along the Pakenham/Cranbourne corridor are now being delivered by other projects.

Longer, higher-capacity trains will increase the productivity of each train trip. The new seven-car HCMTs will carry 1 100 passengers per train, which is 20 per cent more than older trains. This means that some capacity benefits for the Dandenong–Sunshine corridor will be available early, by using HCMTs on the existing overland rail route before the tunnels open in 2025.

These capital projects are funded under the HCMT PPP and the Cranbourne–Pakenham Line Upgrade Project and are key enablers for many of the wider network benefits that the Melbourne Metro Tunnel Project expects to deliver.

This will deliver important enabling infrastructure and rolling stock, which will support the Melbourne Metro Tunnel to achieve expected operational benefits across the wider rail network.

These current investments are similar to what would have been required for heavy investment in the overland rail network—and therefore imply that this option was not only feasible, but required.

We consider that DoT should have given more objective comparative analysis of heavy investment in the overland rail network as part of the detailed capital options development process.

This would have given decision-makers a better understanding of the relative costs and benefits of an overland rail network investment approach versus the current tunnel project.

2.3 Concept design and modelling of passenger demand

After the government approved the Melbourne Metro Tunnel Project business case in February 2016, RPV commissioned the development of a concept reference design by a private sector joint venture, which RPV appointed as their technical adviser.

Purpose of the concept design

The main purpose of the concept design was to demonstrate a technically feasible way for the Melbourne Metro Tunnel Project to be constructed.

A secondary purpose was for the concept design to be used for any required environmental assessments and planning approvals. The design included maps of the proposed tunnel alignment and architectural drawings of the stations.

Part 3 of this report discusses the reference design and EES process in detail.

Patronage demand modelling

The purpose of transport modelling is to evaluate the performance of complex transport systems and to identify an expected capacity range for patronage demand.

Models used in Victorian transport planning

Transport agencies in the Victorian public sector use transport simulation models to test and identify the benefits or drawbacks of changes to the transport network. These models are not limited to rail infrastructure and simulations can be performed for any transport mode.

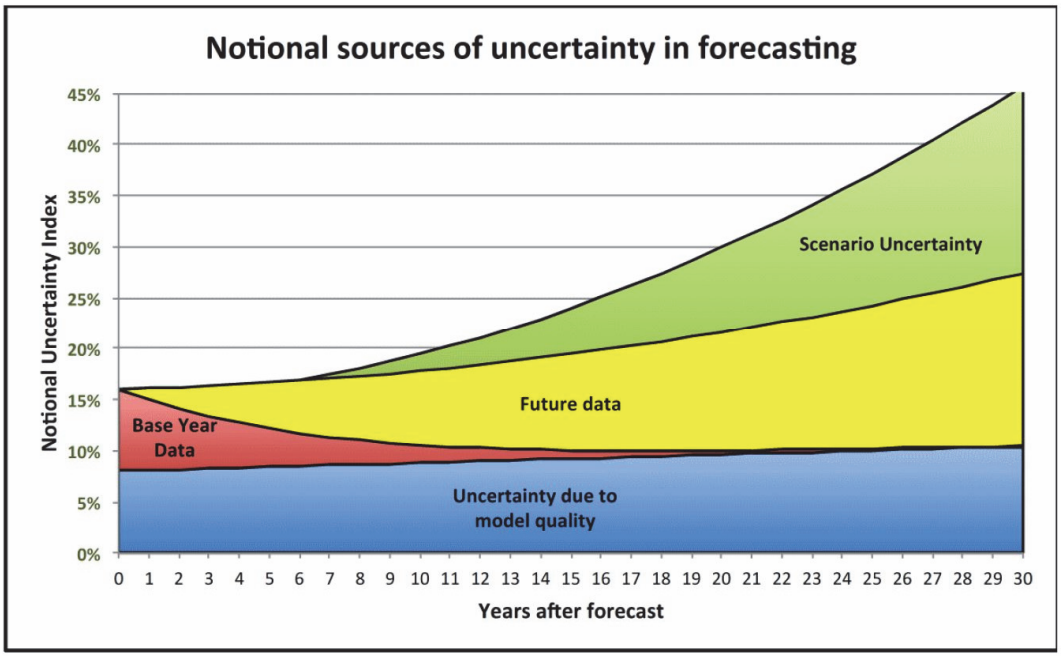
Strategic simulations used for transport modelling are commonly known as four-step models and are an accepted international approach for this type of predictive modelling.

The four steps refer to the following:

- Determine the total number of trips to be made in the simulation.
- For each of these trips, determine a trip start point and a trip end point.
- Distribute the trips between the start points and the end points to either a public transport mode of travel or a 'highway' mode of travel (i.e. to a private vehicle).
- Assign the trips to a particular path through either the public transport system or the 'highway' system, as applicable.

These types of models attempt to simulate the future but, as Figure 2A shows, many sources of uncertainty can have a material impact on their accuracy.

Figure 2A
Notional sources of uncertainty in predictive forecasting models



Source: Willumsen, Luis G. (2015). 'Dealing with Uncertainty in Demand Modelling and Forecasting', presented at the New Zealand Modelling User Group Conference, Auckland, 10 September 2015.

The uncertainty associated with a model's output is driven by four factors:

- The base year data used in the model may become out of date over time.
- The future data that could replace the base year data is itself uncertain.
- The imperfect quality of the model may introduce a level of uncertainty.
- The scenarios explored by the models introduce a level of uncertainty as time passes and the model's scenarios become increasingly out of date.

These four factors of uncertainty increase exponentially with time, meaning that forecasts more than a few years into the future become increasingly uncertain and therefore cannot, in general, be relied on.

Models used to support Melbourne Metro Tunnel Project strategic planning

To support analysis in the 2016 business case, PTV and its contractors simulated the predicted future operations of the Melbourne Metro Tunnel on two strategic computer-based modelling tools, VITM and a Strategic Check Model.

This modelling effort sought to calculate passenger demand for proposed and existing stations after the Melbourne Metro Tunnel Project is operating.

Victorian Integrated Transport Model

VITM was the primary strategic demand modelling tool used for the Melbourne Metro Tunnel Project analysis.

VITM is a four-step strategic transport simulation tool that transport agencies use to model the overall transport system in Victoria. VITM calculates the total number of trips between different points in Victoria. This can be used to determine increased demand for transport due to population growth or an increase of jobs in a particular location.

A private company developed VITM in 2011 for DoT, which owns the model and supports it with a mix of departmental staff and contractors.

Strategic Check Model

The Strategic Check Model is another four-step strategic simulation tool.

Although the modelling for the Melbourne Metro Tunnel Project primarily used VITM outputs, PTV used the output from the Strategic Check Model to assess the accuracy of outputs from VITM.

Finer-grain models

RPV used VITM-generated passenger demand forecasts to inform two station-level passenger modelling tools called ClicSim (City Loop and Inner Core Simulation) and STEPS. RPV used these simulations to support the detailed design process and refine the concept designs for the stations.

We discuss these finer-grain simulations in Part 3 of this report.

Analysis of the strategic forecasting models

Our analysis of the models found that key decisions about the construction of demand forecasting models are not well documented.

Similarly, calibration and validation processes are not transparent or timely and the rationale for many data assumptions included in VITM and used for the 2016 business case is not clear, because DoT did not document these in detail.

The accuracy of a predictive model's sensitivity to change can be checked by testing a feature in the model and then seeing how the model predicts any subsequent demand changes. This is known as 'output elasticity' and can show how well the model performs when predicting change.

Our commissioned expert research found that elements of the modelling—such as the sensitivity of the model to the provision of extra services or an increase in fares—may cause an under-forecast of the rate of expected demand growth. We judged this in comparison to the expected values from other comparable international guidelines, which are based on observed international experience.

We also found that the Strategic Check Model, which PTV used to check VITM outputs, has more acute sensitivity issues than VITM. The sensitivity of VITM is just within, and the Strategic Check Model is well outside, the range of international guidelines, when judged against both models' observed output elasticities.

There is a risk, therefore, that neither model is adequately sensitive to impacts of public transport system changes, and therefore could under-forecast the future rate of patronage demand growth. This could mean that more passengers use the public transport system more often or earlier than the model predicts.

Lack of disclosure of uncertainty in forecasting models

DoT does not adequately disclose the inherent bands of uncertainty in the various strategic transport models used in Victoria in briefings to key decision-makers, public documents, or government announcements or websites when referencing modelling outputs. Although an appendix in the 2016 business case considered different modelling scenarios, the modellers did not vary the inputs of each scenario to arrive at a band of uncertainty for each scenario.

Models can generate a precise level of detail, but because of uncertainty, there is a risk that they are not accurate in representing current or future situations.

Relevant recent examples of how data from models is used without a discussion of the inherent uncertainty include:

- modelling for the Melbourne Metro Tunnel Project business case, which was presented as a sole modelling output rather than offering a range of potential modelling scenarios such as low/medium/high or conservative/median/aggressive
- passenger-per-day public announcements for new rail projects, which often use a single expected patronage figure, with no discussion of any possible plus or minus percentage variance.

Recent reviews of the models

The models used for demand forecasting for the Melbourne Metro Tunnel Project were peer reviewed, as required by DTF's High Value High Risk process. We found, however, that the peer review reports were high level and did not critique the basis or rationale for some of the fundamental assumptions that drive each model's outputs.

DoT advises that assumptions were queried by the peer reviewers, but we saw limited documentary evidence of this.

A review by an international engineering and consultancy firm, commissioned by Infrastructure Victoria in 2016, found that the models used by DoT, including VITM, were satisfactory in the way they performed their calculations.

However, the technical review also found that the current set of forecasting tools needed sustained investment, as well as enhancements in construction and usage, to improve decision-making and investment choices.

DoT has not yet implemented this report's suggested further enhancements, but advised that it is undertaking work to improve specific elements of the VITM model, and will do a major model recalibration over the next two years.

The 2016 review provides a useful road map for the wider transport portfolio to improve rigour and cohesion in the way it uses demand forecasting models. We are also aware of two other external reviews of transport modelling commissioned by DoT in 2014 and 2016 that make a range of useful recommendations about VITM's construction and operation, as well as broader governance and resourcing improvements.

DoT should implement the enhancements recommended in these three strategic and technical reviews and apply them to the various transport demand and simulation models used across the wider transport portfolio, as applicable.

Other implications from our review

Due to many machinery-of-government changes in the transport portfolio in recent years, we observed that corporate memory is sometimes patchy and human capital is stretched in the transport modelling area. This leads to fragmented technical knowledge about the models and limited documentation on past key decisions.

The governance processes for the calibration and validation of the VITM model are not transparent and some assumptions used in the models are not clearly documented or, when documented, are complex and difficult to understand.

Our previous audits have found that population growth forecasts in general—including the *Victoria in Future* population forecasts from DELWP, which have been used as inputs to the modelling for the Melbourne Metro Tunnel Project—have been historically inaccurate and tend to underestimate growth.

However, these forecasts are still used as key data input into long-run patronage demand models, so any previous error in population forecasting can carry forward as a trend error for future patronage demand assumptions and forecasts.

2.4 Expected benefits from the proposed solution

The business case outlined a number of benefits that the Melbourne Metro Tunnel Project is expected to deliver.

Economic benefits

The Melbourne Metro Tunnel Project is expected to enable rail users to commute more easily to and from the CBD, thereby increasing the accessibility of economic opportunities and high-quality jobs and services. It should also enable businesses in the CBD to access a broader range and wider pool of workers.

During construction, the Melbourne Metro Tunnel Project is expected to create an extra 3 900 jobs across Victoria, and approximately 4 700 jobs across Australia. The 2016 business case analysis argued that the overall economic benefits outweigh the costs of the project.

The business case identified these financial benefits in the form of net present values and benefit–cost ratios, which rely on outputs from VITM. If this modelling is incorrect, the benefit–cost ratio for the project may be incorrect.

Substantial benefits could also have been achieved through better use of existing assets. However, only cursory discussion or analysis of this option is made in the business case.

It is therefore unclear whether the benefit–cost ratio of the Melbourne Metro Tunnel Project outweighs the benefit–cost ratio that better use of existing assets—through targeted improvement investments such as investing in the existing overland route assets and using high-capacity signalling and HCMTs—could have delivered.

Passenger benefits

Modelling for the business case estimated that the Melbourne Metro Tunnel Project could increase the peak capacity of the network by 39 000 passengers in each morning and afternoon peak period.

Modelling for the project has also estimated substantial travel time savings for both metropolitan and regional commuters travelling to St Kilda Road and Parkville, with a maximum saving of up to 25 minutes for commuters on the Cranbourne/Pakenham line and up to 15 minutes on the Gippsland line.

Figure 2B shows the projected increase in peak capacity and time savings for all metropolitan train lines as a result of the Melbourne Metro Tunnel Project.

Figure 2B
Expected increase in peak capacity and time savings

Metropolitan train line	Increase in peak capacity (%)	Increase in passengers (per week)	Time saving to St Kilda Road (minutes)	Time saving to Parkville (minutes)
Alamein	Not reported	Not reported	10	10
Belgrave/Lilydale	Not reported	Not reported	10	10
Craigieburn	27	54 000	8	8
Cranbourne/ Pakenham	45	121 000	25	15
Frankston	15	36 000	15	15
Glen Waverley	Not reported	Not reported	5	10
Hurstbridge	Not reported	Not reported	5	10
Sandringham	48	72 000	5	10
Mernda	Not reported	Not reported	5	10
Sunbury	60	113 000	20	20
Upfield	17	45 000	8	8
Werribee/ Williamstown	24	63 000	5	10

Source: RPV (Metro Tunnel website).

Service benefits

The business case details a range of benefits that improve service reliability and capacity of the metropolitan rail network, including:

- easing congestion and facilitating future growth
- freeing up the City Loop and capacity in the inner core of the metropolitan rail system
- minimising the overall impact of incidents and improving the resilience, punctuality and reliability of services.

The 2016 business case also identified some benefits for trams on the busy St Kilda Road/Swanston Street corridor, with the new rail line expected to take up some of the heavy north–south passenger tram loads.

This would allow for future redistribution of some tram routes off the corridor to better serve growth in the western area of the CBD, via a new 200-metre connecting tram track known as the Park Street Link.

Benefits framework for the project

A benefits management process is expected to identify, track and measure 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 required for all major infrastructure projects in Victoria.

The 2016 business case clearly specifies two major benefits, namely:

- greater productivity and economic growth for Melbourne
- a more liveable Melbourne.

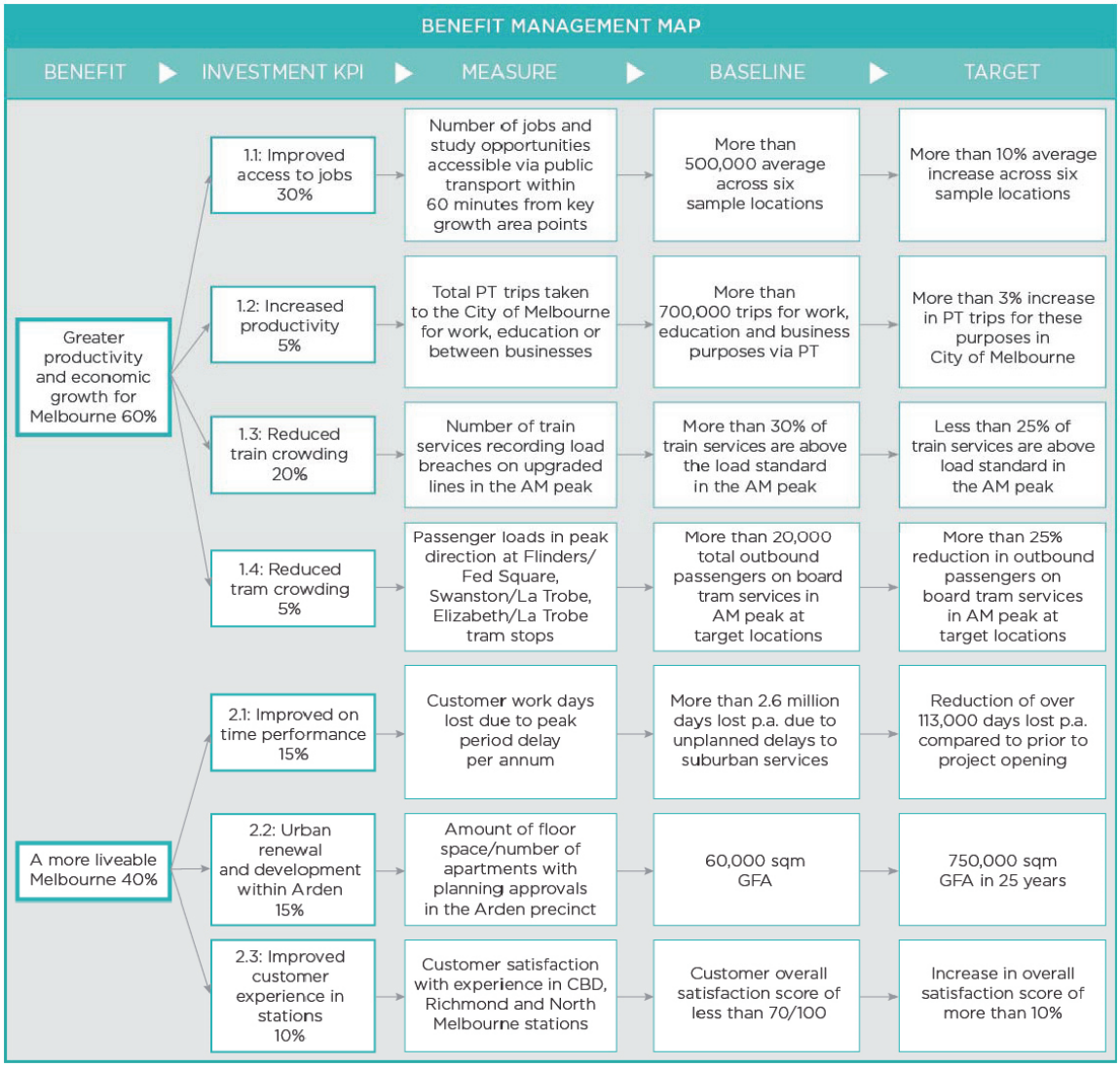
Both benefits are linked to a specific project outcome—the completion of the Melbourne Metro Tunnel Project. Public transport users and non-users will benefit from increased productivity and economic growth, and improved liveability.

However, the business case does not explain the weighting of these benefits (or the process used to choose them):

- greater productivity and economic growth for Melbourne—60 per cent
- a more liveable Melbourne—40 per cent.

Figure 2C shows the Benefit Management Map.

Figure 2C
Melbourne Metro Tunnel Project Benefit Management Map



Note: PT = public transport. GFA = gross floor area.
Source: DEDJTR, *Melbourne Metro Business Case*, 2016.

Analysis of the benefits framework

Overall, the benefit management framework is well designed and:

- identifies benefits that logically flow from the proposed outcomes of the Melbourne Metro Tunnel Project
- defines a target group for the benefits
- shows the outlined benefits as clearly attributable to the project
- has benefits that are discernible and have measurable key performance indicators.

The 2016 business case followed the applicable DTF guidance and captured the expected benefits well. The business case also shows that DoT performed a rigorous analysis to correctly identify and attribute the expected project benefits.

We found, however, some deficiencies in the benefit management process. The business case does not describe a risk-management strategy, nor does it allocate responsibility for benefit management.

We have found in recent transport-related audits that it is important to assign ongoing evaluation responsibilities for projects to entities that will exist well beyond the project's completion.

Allocating clear benefit management responsibility, with adequate resources, mitigates the risk that agencies focused on delivery will neglect or avoid the final stages of benefit management and post-completion evaluations for major investments.

Many benefits assumptions relate to unfunded projects

Many benefits from the Melbourne Metro Tunnel Project are expected to accrue to the wider metropolitan rail network rather than just the Sunbury to Pakenham/Cranbourne corridor, which the business case shows will only get a modest frequency increase of four trains per peak hour when the tunnels open.

Many assumptions in the wider benefits framework are also based on projects that the government has not yet approved or funded.

During this audit, DoT told us that the business case's economic analysis was based on a distinct modelling approach used in Victoria, where assumptions about the future development of the network are built into any underpinning analysis. DoT says that this is done to give a more realistic comparison of the transport network and economy, both with and without the project, and to moderate an overly optimistic view of a project's potential benefits.

We understand DoT's rationale for this modelling and analysis approach, but consider that relying on unfunded projects to define a future network state is a key risk to defining and thus realising the overall benefits.

Including unfunded projects in modelling assumptions potentially reduces the extent and attribution of benefits arising from the project under analysis. This is because the model assumes that other notional unfunded projects will provide some other benefits and absorb some demand growth. However, this assumption is only valid if the assumed projects proceed within the model's assumed time frame.

Infrastructure Australia's December 2016 review of the business case concluded that it was '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'.

However, Infrastructure Australia also raised some concerns with DoT's modelling approach and noted that although the 'approach is useful for the purpose of integrated long-term transport planning, it is unconventional for economic evaluations, and could understate the [benefit–cost ratio] if the unfunded substitute projects assumed in the base case do not proceed'.

DoT and the central agencies—DTF and DPC—will need to carefully manage this issue around unfunded assumed projects to ensure the significant investment in the Melbourne Metro Tunnel Project delivers the expected benefits to society and the economy, as described in the business case.

Recent rail project announcements

Many recent rail project announcements, such as the Suburban Rail Loop, Melbourne Airport Rail Link, and the Wyndham Vale and Melton electrification projects, have materially altered the 2016 business case assumptions and analysis for the tunnel project.

Due to these announcements, many assumptions around patronage demand projections, rail operating concepts, future rail network configurations and wider project benefits relate to a future network strategy that is no longer correct.

DoT is the client for the project, but despite the many material changes to the Melbourne Metro Tunnel Project's wider context, it has not yet adjusted its assumptions about how the tunnels will operate and the benefits that will be delivered after completion.

DoT will need to review and refresh the original assumptions. This could occur as part of the modelling and business case development processes for any new projects so that agencies can better understand network-wide effects and their interaction with the tunnels.

Once assumptions are refreshed, this should inform an updated benefits management plan which DoT, as project client, should actively manage and oversee.

3 Detailed design and environmental approvals

Major transport projects have the potential for wide-scale impacts on the community and the natural environment. They should be carefully planned and well designed, should undergo scrutiny of proposed construction techniques and designs, and should be diligently assessed for environmental impacts before construction starts.

This part of the report assesses whether the reference design for the Melbourne Metro Tunnel Project:

- was informed by reliable modelling and supported by realistic and validated data on demography, land use and travel patterns
- demonstrates a flexible future-proofed solution.

It also examines whether the EES and statutory planning processes:

- adequately considered environmental risks and site-specific issues
- recommended effective mitigations and controls.

3.1 Conclusion

The reference design developed by RPV and its advisers used a range of modelling and simulation tools, but the uncertainty of the outputs from the strategic model means that the data used to develop the station-level models is also uncertain. Potential underlying demand forecast errors from the strategic model about patronage growth could mean that the new stations reach full capacity sooner than the business case expects.

RPV has not explicitly assessed a scenario where the scale and timing of passenger demand exceeds the passenger forecasts and future scenarios described in the business case. Although RPV took a 'conservative' approach during the design process, there is a risk that the new stations may not have enough entrance and exit capacity to meet future demand or enough elevators or escalators in the stations, if the underlying forecasts are unreliable.

There are practical construction and engineering limitations on how many entries and exits can be built for deep stations in the CBD. However, the reference designs—and the detailed tendered designs from the PPP consortium for the stations, which are now under construction—have limited provisions to increase the number of street entries at some of the stations in the future.

Building the five new underground stations with platforms long enough to allow for 10-car HCMTs—compared to the seven-car HCMTs that will use the tunnels on 'Day 1'—is an effective future-proofing element of the design to meet unexpected demand increases. However, DoT and RPV have inadequately defined patronage trigger points to bring forward unfunded projects—such as the early introduction of 10-car HCMTs or the extension of 35 station platforms needed on the Sunbury/Melton and Pakenham/Cranbourne corridors to allow the longer trains to run on the network.

The EES and statutory planning processes for the Melbourne Metro Tunnel Project were comprehensive. They effectively considered stakeholder perspectives, key environmental risks and planning issues relevant to the project.

The EES process informed the development of a comprehensive suite of EPRs and other mitigations and controls that are appropriate for the identified project risks.

The statutory planning process has been effective in recommending strategic environmental management strategies and performance outcomes. However, statutory planning does not have a role in recommending detailed responses to environmental risks. DELWP relies on RPV and the Independent Environmental Auditor to make sure these measures will be in place but has limited visibility of this assurance work.

3.2 Developing a concept design and assessing impact on the environment

Concept design process and its purpose

The state invested significant funds to develop a detailed concept design for the Melbourne Metro Tunnel Project, for which the three main purposes were to:

- demonstrate a technically feasible reference design prior to engaging with the market
- allow the EES process to commence before final designs had been developed
- undertake the procurement processes for the PPP at the same time as the EES to allow the winning consortia to be aware of any environmental risks and controls.

Environmental assessment and planning approvals

The EES process used the outputs from the detailed design work to understand the impact of the proposed project on the environment, and to identify any risks that required mitigation or control.

These processes involved an in-depth examination by an independent expert panel, public submissions and hearings, and an assessment by the Minister for Planning.

As a result, RPV and DELWP developed a suite of monitoring requirements, as well as statutory planning mechanisms and approvals.

3.3 Modelling inputs for the detailed design

Modelling of passenger demand at the station level

Modelling for the Melbourne Metro Tunnel Project produced long-run forecasts to 2046. For design purposes, the reference year for station capacity was set at 2056, or 30 years after the tunnels' planned opening. RPV and PTV applied a straight line 25 per cent uplift to the 2046 VITM forecasts to produce a notional design scenario for 2056.

DoT advised us that the rationale for the straight line 25 per cent uplift was that it:

- extrapolated the VITM-generated growth trend in train boardings from 2031 to 2046 (2.2 per cent compounding per annum, or 24 per cent over 10 years)
- extrapolated the forecast growth in jobs from 2031 to 2046 in the City of Melbourne (2 per cent per year, which is 22 per cent over 10 years).

The base data for the other two finer grain station-level models (ClicSim and STEPS) was also a VITM output. This means that any uncertainty or error arising from the VITM forecasts cascades down to the other station-level models.

ClicSim

ClicSim is a simulation tool used to model the movement of trains through the metropolitan rail network. ClicSim models the location of trains and passengers on a second-by-second basis for the entire Melbourne metropolitan rail network.

A private company developed ClicSim for DEDJTR (now DoT) in 2007 to assess the capacity of the City Loop and inner core stations. The simulation can inform understanding of how the rail system will cope with future demand. The future demand figures input into ClicSim were derived from VITM.

The station-level models refined the VITM outputs to give a more accurate picture than VITM can provide of how demand will be distributed across the network.

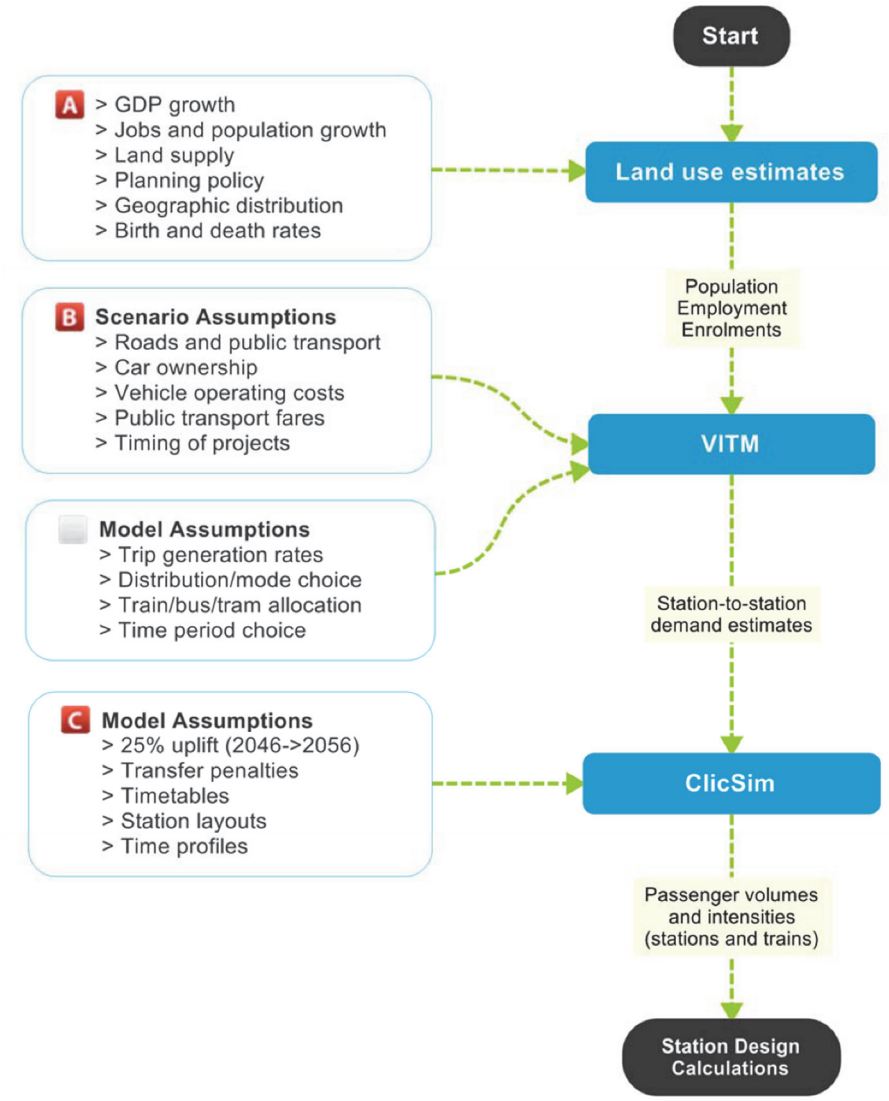
STEPS

STEPS is a detailed simulation tool used for modelling the movement of passengers through a train station. The simulation can be used to identify the areas of a station that may become crowded due to passenger movements.

It can also be used to test proposed design solutions for areas showing overcrowding.

Figure 3A shows how a range of assumptions indicating an area of uncertainty interact through the various models at different stages of demand forecasting.

Figure 3A
Sources of modelling uncertainty



Note: GDP = gross domestic product.
Source: Aurecon, Jacobs and Mott McDonald Joint Venture, *Stage B Demand Modelling report*, October 2016.

3.4 Detailed design of the stations

Station design process

RPV used expert advisers to help design fit-for-purpose stations that would meet the 'Day 1' demands of the railway in 2026 (the business case opening date) and also have enough capacity and design flexibility to meet forecast demand out to 2056, including notional additional passenger demand from the running of future Airport Rail, Melton and Rowville lines through the tunnel.

DoT's strategic network development plans designate Parkville Station as a future underground interchange for a potential Melbourne Metro 2 line from Clifton Hill to Newport, so the impact of this future scenario was also modelled to inform the station design process.

The design and modelling work involved a complex and interrelated process of scenario testing for each new station. This iterative process was meant to unify the specific outputs from demand forecasting, station design and operational planning teams.

RPV's advisers ran detailed modelling simulations to identify passenger flows through the metro stations during different situations, such as normal operations, 'degraded' mode (such as when there are a number of train cancellations or other disruptions on the rail network), or during an emergency when passengers need to rapidly exit stations.

This modelling informed the design width of the platforms, since wider platforms can accommodate more passengers, and the number of escalators needed to meet forecast demand.

The design width of the future station platforms was compared to the notional platform width derived from the raw passenger demand modelling. Adjustments were then made within engineering and design limitations to provide optimal space allocation for waiting passengers.

To calculate the number of escalators needed, the forecast patronage was tested against an engineering design rule-of-thumb of 100 people per minute, per escalator. To better understand station design resilience in the face of abnormal operations or demand, the modelling also tested scenarios where an escalator was out of service and where train delays led to increased crowding.

Analysis of the design and model outputs

The patronage data assumptions used for station design purposes, as well as the iterative design process, led to the 2056 forecast demand equalling the maximum designed throughput capacity of the tunnels—or 24 fully loaded 10-car HCMTs per hour in each tunnel.

The implication of this outcome is that the stations could reach full capacity sooner than the business case expectations if the underlying demand forecast from the models underestimated growth in patronage. Once this limit is reached, no opportunity for substantial expansion or design change is available.

In light of this, we consider that DoT and RPV have not explicitly defined the potential passenger load trigger points to bring forward other currently unfunded projects on the rail network that may be needed if the strategic patronage forecasts have underestimated demand.

In particular, DoT has not explicitly defined the time frames required to extend platforms at more than 35 stations to allow for an earlier rollout of 10-car HCMTs across the Sunbury/Melton and Pakenham/Cranbourne corridors. This decision would require commercial negotiations with the PPP building the HCMTs and adequate time frames for the extra carriages to be constructed and commissioned in time to meet passenger demand.

Future-proofing of station designs

DoT developed reference designs for the new stations to achieve the modelled passenger demand and operating profile for the rail tunnels. Due to the presence of pre-existing adjoining structures, as well as heritage considerations, there are pragmatic limits to the number of entry and exit points that can be realistically provided.

RPV considered several future-proofing options for the stations in the reference design and these options have also been included in the designs tendered by the PPP consortium:

- North Melbourne—the 'Day 1' station entry is sized to meet planned patronage. An additional western entrance is future-proofed into the design and could be provided as part of a development in the precinct by property developers once the precinct starts to be built out.
- Parkville—the street entrances and concourse have been designed to accommodate future patronage for a four-platform station (incorporating a future Melbourne Metro 2 connection). In addition, the platform has been 'space-proofed' to allow for future interchange escalators between the Metro Tunnel and future Melbourne Metro 2 platforms. Also, an option for a Barry Street entrance is future-proofed on the south side of Grattan Street.
- State Library—RPV advises that conservative assumptions (the maximum possible number of people using the escalators per minute) have been made about the number of passengers using the State Library and Melbourne Central stations, by basing the patronage through the new entry portal and escalators that will be built at the north-west corner of La Trobe and Swanston streets on the six platforms that will be able to access the entry.
- Town Hall—the tendered design allows for a potential future 'pop-up' entry near the Town Hall on Collins Street, extending from the new station box. A 'knock-out' panel has been allowed for at the northern end of the station (on the west side of Swanston Street) that could incorporate a possible future basement entry to the station from the western vicinity of Collins Street. These potential entrances are not in the current scope of the project and would need additional funding and construction.

- Anzac—this station has no future-proofing options due to its constrained footprint in a busy road junction. However, a need for a southern street entry was identified during concept design and has been incorporated into the tendered design. This design outcome allows for a pedestrian underpass through to the northern side of St Kilda Road, as well as a direct connection to trams.

The Anzac Station design features entrances on either side of St Kilda Road, an underground pedestrian walkway and direct passenger access to trams. Image courtesy of RPV (Metro Tunnel website).

Vertical transport in the new stations

Apart from these examples of future-proofing in the reference designs and the designs that the PPP consortium tendered to the state, the stations do not include additional shell space or shafts for escalators and elevators if needed in the future.

The station-level modelling focused on the use of escalators as well as expected elevator usage, based on analysis of existing patterns of elevator usage observed at Melbourne Central station. We did not, however, see evidence that the designed provision of vertical transport has explicitly considered emerging future demographic profiles of public transport users, such as frail but active elderly passengers using walking aids and mobility buggies, and more parents with young children in pushers/prams.

Without design flexibility or reserved space, the installation of future vertical transport, particularly elevators, will be extremely costly and unlikely to proceed, even if it is clearly required. The implication for passengers with mobility challenges is that long queues could form at elevators due to their relatively small size and number, and an inability of the station design to meet future growth in demand from this type of passenger.

Notwithstanding our findings about station design and crowding implications, RPV advised that it included a key mitigation for station overcrowding in the reference design parameters. Each station has a safety requirement to have capacity for a worst-case fire evacuation scenario of two crush-loaded 10-car HCMTs arriving at the same time on a crowded island platform. RPV advised us that this safety requirement was included in the PPP consortium's tendered designs.

A crush-loaded 10-car HCMT would carry about 2 000 people. In an emergency, two fully loaded trains, plus a busy platform full of passengers waiting for trains in both directions, would require the swift evacuation of 6 000 to 8 000 passengers using all available vertical transport in the station.

In emergency situations, it is likely that the stations would be closed at their surface entries and all escalators would need to operate to focus on evacuating passengers to the surface. This procedure would add one or more escalators to the number typically available at peak times.

3.5 Environmental assessment and planning approval

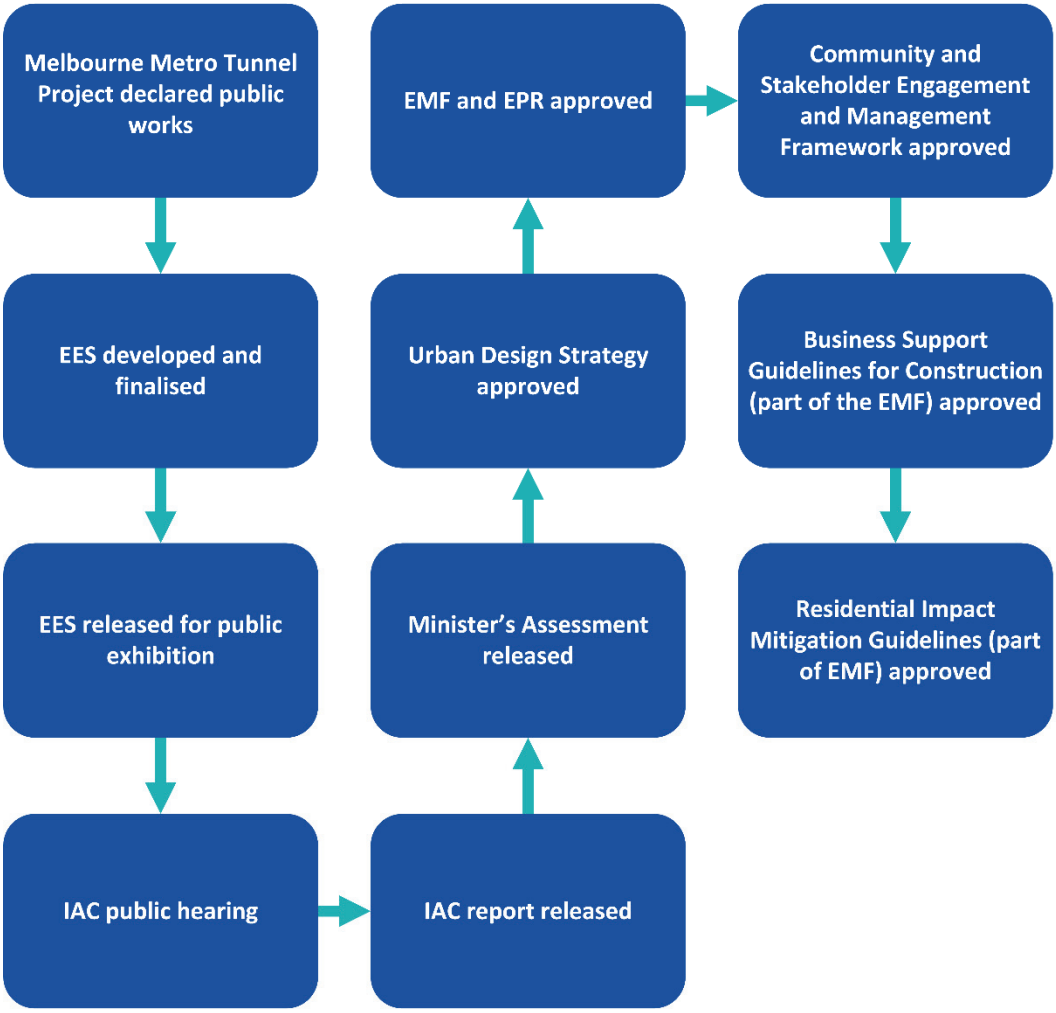
Environment Effects Statement and environmental strategies

In September 2015, the Minister for Planning declared that the Melbourne Metro Tunnel Project needed to undergo an EES process to assess its environmental effects.

RPV, in consultation with DELWP, developed the EES documentation that identifies the project's potential environmental effects and any necessary mitigation measures, including a draft EMF and EPRs. The Minister for Planning released the EES for public review between 25 May and 6 July 2016, and it attracted 379 submissions.

Figure 3B shows the EES process and post-EES approvals of environmental strategies for the Melbourne Metro Tunnel Project.

Figure 3B
EES process and post-EES approval of environmental strategies for the Melbourne Metro Tunnel Project



Source: VAGO, based on DELWP information.

DELWP established a joint IAC to consider the EES, public submissions and draft planning controls for the project. The IAC conducted public hearings over 33 days. In November 2016, the IAC provided a report to the Minister for Planning.

The report concludes that the project can achieve acceptable environmental outcomes and impacts can be adequately managed. It also recommended changes to the EPRs. One example of an impact mitigation measure that arose from public consultation and the IAC hearing process was that RPV develop and implement NEPs. Figure 3C discusses this in detail.

Figure 3C
NEPs

A key issue identified throughout the EES process was the impact of the Melbourne Metro Tunnel Project on traffic and transport during and after construction.

NEPs were one of the proposed ways to manage construction impacts on roads. One EPR requires contractors to have a transport management plan that includes the implementation of NEPs in areas near the Parkville and Anzac precincts.

NEPs are road network upgrades that help traffic flow during road closures and lane reductions. NEPs, such as those involving closed-circuit television and Bluetooth receivers, can provide up-to-date information on traffic conditions to monitor travel behaviour and identify road incidents.

DoT and RPV did not initially include NEPs as part of the EWMC scope because RPV procured the EWMC before the EES process concluded. In response to the final EPRs, RPV directed the EWMC to undertake NEPs specified in the EPRs. RPV also expanded the scope of NEPs to other early works construction precincts.

Part 4 of this report discusses NEPs in detail.

Source: VAGO, based on DELWP and RPV information.

In December 2016, the Minister for Planning released the Minister's Assessment, which concluded the EES process for the Melbourne Metro Tunnel Project. The Minister's Assessment found that the environmental effects of the project were acceptable, subject to recommended actions such as changes to selected EPRs, the EMF and the Urban Design Strategy.

Minister's Assessment

The *Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978* state that the Minister's Assessment will consider, among other things, the EES, IAC report and public submissions.

DELWP's advice to the Minister for Planning on the Minister's Assessment was forthright and covered the key material related to the project's potential environmental risks. DELWP drafted the Minister's Assessment, considering the EES and covering key matters raised by the IAC report and public submissions.

The Minister's Assessment addresses 16 environmental effect areas. DELWP discussed the IAC report and/or public submissions in the Minister's Assessment for 10 of the 16 environmental effect areas.

For these 10 areas, the Minister's Assessment accurately reflects the perspectives of the IAC report and submitters. Our analysis showed that the Minister's Assessment either gives a summary or includes direct quotes from the IAC report, which also included public submissions.

For the remaining six environmental effect areas, there is little documentation showing how DELWP considered the IAC report and public submissions. The Minister's Assessment did not reference—and DELWP did not separately document—its consideration of both information sources.

DELWP advises that it took a risk-based approach when drafting the Minister's Assessment and do not consider that there is a requirement to acquit every IAC mention and public submission. This approach allowed DELWP to dedicate more extensive discussions to the issues that DELWP assessed as having a greater environmental risk or impact, such as noise, vibration, transport and traffic.

DELWP faced considerable time pressure to publish the Minister's Assessment to meet the time frames set out in DELWP's internal Quality Management System. According to the Quality Management System, the Minister for Planning must release the Minister's Assessment within 25 business days of receiving the IAC report. To meet this requirement—and to allow enough time for DELWP internal reviews and consideration by the Minister for Planning—DELWP had to complete a first draft of the Minister's Assessment about 10 working days after receiving the IAC report.

While a risk-based approach is pragmatic when there are time constraints, DELWP does not have clear risk-assessment criteria to guide which IAC or stakeholder issues the Minister's Assessment should address. DELWP advised that this decision is usually based on the technical knowledge and expertise of the staff drafting the Minister's Assessment.

Despite the lack of documentation for these six environmental effect areas, DELWP's assessment that these areas are low-risk is consistent with the IAC report's conclusion. An example is the issue of surface water, which DELWP assessed as low risk and therefore not warranting further discussion in the Minister's Assessment. This assessment is consistent with the IAC report, which assessed surface water-related risks as low to very low.

Another environmental risk that DELWP did not discuss in detail in the Minister's Assessment, but which was mentioned in the IAC report, was the issue of electromagnetic interference (EMI). Figure 3D discusses this in detail.

Figure 3D
EMI identified through the public submission process

EMI can occur when an electronic device's electromagnetic field disrupts the operation of another device. RPV did not identify EMI impacts when DELWP determined the EES scope.

EMI became one of the key issues considered by the IAC after it received submissions and evidence from The University of Melbourne. It was concerned about the potential EMI impact on its sensitive facilities and equipment near the Parkville Station precinct.

During the public hearing process, RPV responded to the University of Melbourne's concerns by proposing two new EPRs—EMI1 and EMI2—that aim to ensure that RPV and contractors understand and manage EMI impacts from the Melbourne Metro Tunnel Project.

The IAC acknowledges in its report the potential EMI impact on the operation of sensitive equipment. The IAC was satisfied that the new EPRs are appropriate in identifying and managing EMI impacts.

The Minister's Assessment determined the proposed EMI EPRs, as recommended by the IAC, are appropriate and that they should be adopted.

Source: VAGO, based on DELWP information.

Environmental strategies

After the Minister's Assessment, DELWP recommended—and the Minister for Planning approved—the following suite of frameworks and guidelines to manage and mitigate identified risks and impacts:

- an EMF, which includes the EPRs, Business Support Guidelines for Construction and Residential Impact Mitigation Guidelines
- an Urban Design Strategy
- a Community and Stakeholder Engagement and Management Framework.

DELWP's advice to the Minister for Planning to approve these documents was sound. DELWP assessed whether these documents aligned with the IAC and Minister's Assessment recommendations, EPRs or other relevant sources. For example, when recommending approval of the Urban Design Strategy, DELWP assessed the proposed strategy against the IAC report and Minister's Assessment recommendations, as well as those from an expert panel that the IAC convened during the hearing process.

Statutory planning outputs

An Incorporated Document is the applicable planning tool that regulates the use and development of land for the Melbourne Metro Tunnel Project. This was an outcome of the combined EES and planning process to streamline statutory planning approvals for the project.

Planning Scheme Amendment GC45 inserted an Incorporated Document into the four planning schemes relevant to the Melbourne Metro Tunnel Project—Melbourne, Port Phillip, Stonnington and Maribyrnong. This made the Incorporated Document the planning tool for the project, 'switching off' all other planning provisions in these four planning schemes. *Planning Scheme Amendment GC45* also made the Minister for Planning the responsible authority for planning provisions applicable to the project, which means that local government is not involved in approving any planning matters relating to the project.

The Incorporated Document gives statutory weight to the planning and environmental management strategies—specifically the EMF (EPRs) and Urban Design Strategy—because it requires RPV and its contractors to carry out the Melbourne Metro Tunnel Project according to these strategies.

Under the Incorporated Document, the Minister for Planning must approve an Early Works Plan (EWP) for early works to begin. Contractors are responsible for drafting the EWPs and demonstrating how they will conduct early works according to the EPRs and the Urban Design Strategy. The Incorporated Document requires contractors to develop the relevant project land according the EWPs.

The Minister for Planning approved three EWPs relevant for this audit—specifically, the plans relating to the EWMC, Yarra Trams and the PPP consortium.

We looked at the adequacy of DELWP's advice to the Minister for Planning to approve the EWPs and, more broadly, the role of planning to ensure environmental mitigation measures will be in place.

Early Works Plans

Compliance with the Incorporated Document

DELWP has ensured that EWPs comply with the Incorporated Document. Section 4.10 of the Incorporated Document establishes a range of requirements in relation to EWPs, such as the stakeholder consultation process (sections 4.10.4–4.10.6), and that they demonstrate compliance with the EPRs and Urban Design Strategy (section 4.10.3).

When recommending that the Minister for Planning approve the EWPs, DELWP attached a standard assessment template that clearly showed how proposed EWPs comply with relevant sections of the Incorporated Document.

Stakeholder consultation

Section 4.10.6 of the Incorporated Document requires the Minister for Planning to consider all written submissions and responses to issues raised when deciding whether to approve EWPs.

DELWP considered stakeholder perspectives and contractor responses when recommending approval of the EWPs, though it was not consistently clear to us how DELWP assessed them as it has not always documented this assessment.

For all three EWP briefings, DELWP received EWP stakeholder consultation reports and attached them to its briefings to the Minister for Planning. These extensive reports detail the entire EWP consultation process, including all submissions and corresponding contractor responses.

DELWP advised the Minister for Planning that the consultation process was adequate in identifying potential stakeholder issues and contractors had adequately responded to these submissions.

We asked DELWP about the basis of its assessment of the stakeholder consultation report because this was not clear in its briefing. DELWP advised that most contractor responses said that environmental sub-plans would be in place to address concerns noted in a submission. DELWP also advised that most submissions were concerned with the impact rather than the nature of the works and, on that basis, preparation of environmental sub-plans was an appropriate response.

DELWP took a reasonable risk-based approach to assessing compliance with the consultation requirements of the Incorporated Document, focusing its documentation efforts on main works—the next and more intensive construction phase of the project—that will have a greater impact on stakeholders.

DELWP has developed a template so that it can document a more comprehensive assessment of consultation summary reports when reviewing development plans for the Minister for Planning's approval. The PPP consortium received 1 507 submissions relating to its five Station Precinct Development Plans—in comparison, the EWMC's EWP received 77 submissions.

DELWP is taking a methodical and transparent approach for this higher-risk phase of the project.

Statutory planning role in environmental risk mitigation

The Minister for Planning approved the EMF and EPRs. The EMF sets out the governance structure for environmental management for the Melbourne Metro Tunnel Project. According to the EMF, RPV is responsible for environmental oversight, with an Independent Environmental Auditor—appointed by the contractors—responsible for conducting and providing regular audit reports to RPV and the contractors. The EPRs set out the environmental outcomes that RPV and contractors must achieve.

EPRs do not prescribe the mitigation measures necessary to achieve the intended environmental outcomes. Instead, contractors detail their mitigation measures in sub-environmental plans. Under the EMF, RPV—not the Minister for Planning—is responsible for approving these sub-environmental plans. DELWP advised that this is because RPV has the capacity to do so. It would be challenging for the Minister for Planning to assess and review all sub-environmental plans for the life of the project. For early works alone and across three contractors, there are at least 21 sub-plans.

DELWP's primary role is setting the strategic environmental framework and performance outcomes. Although the EWP approval process provides DELWP with some assurance on how contractors will comply with the EPRs, DELWP relies on RPV and the Independent Environmental Auditor to ensure this occurs in practice and to provide assurance to the Minister for Planning that contractors have indeed established and implemented sub-environmental plans as set out in EWPs.

Given that RPV is the project owner, a role conflict might emerge in ensuring timely progress of the project, versus overseeing management of environmental impacts. DELWP acknowledged this potential role conflict, but advised us that:

- it is common statutory planning practice for project proponents to also be responsible for environmental management
- RPV is part of the state and must follow all applicable state laws and requirements, and therefore has an enduring interest in appropriately managing and mitigating any environmental impacts from the Melbourne Metro Tunnel Project
- the governance structure set out in the EMF was subject to EES public consultation and there were no adverse comments.

We also note that the IAC report did not raise any issues regarding RPV's role in environmental management.

Beyond the legal requirements between RPV and its contractors and the governance structure in the EMF, the Minister for Planning and the Environment Protection Authority have enforcement powers for breaches related to the Incorporated Document and specific EPRs, although they would need to know when there is non-compliance in order to take action.

Increasing public transparency around compliance and performance is one way to make sure the Minister for Planning and the wider public understand how well the environmental protections are working.

The West Gate Tunnel Project, which is another large and complex transport infrastructure project under construction, has an EPR in place that requires the Independent Reviewer and Environmental Auditor (equivalent to the Independent Environmental Auditor for the Melbourne Metro Tunnel Project) to publish all its reports in the public domain.

Publishing environmental audit reports can help drive contractors' compliance with EPRs and environmental management plans, as their performance is subject to public scrutiny.

We consider that this requirement should be applied not only to the Melbourne Metro Tunnel Project, but other major public infrastructure projects that are going through the EES process and will have an EPR framework in place.

4 Progress of the early works phase

The Melbourne Metro Tunnel Project is a large, expensive, risky and complex transport infrastructure program.

The state decided to accelerate the overall program schedule by starting some components of the project early. These activities are known as early works and are designed to prepare the Melbourne Metro Tunnel Project for the main tunnel and stations works.

For this component of the audit we assessed whether the four early works packages have been delivered within expected scope, cost, time, quality and environmental performance parameters.

4.1 Conclusion

Overall, the early works phase of the project has successfully completed nearly all expected activities and has allowed the main works phase to get underway.

However, the state's desire to accelerate the overall project's delivery date has come at an unanticipated extra cost. The final forecast cost of the early works phase, in its entirety, is now $1.353 billion, an increase of $95.8 million over the budgeted amount, or 7.62 per cent. In addition, RPV paid $68.3 million to a member of the PPP consortium for an EWSA, which it funded from the main works budget.

The construction activities in the early works phase have exceeded the original budget of $476.6 million and, as of March 2019, have a final forecast cost of $625.5 million. This is a $148.9 million, or 31.2 per cent, increase.

Contingency is the extra money or time incorporated into project plans in case the project is more expensive or takes longer than expected.

RPV used project-wide contingency funds to meet this extra cost. Overall, due to unexpected expenditures from the early works phase, as well as other unexpected program expenditures outside the early works, there has been a substantial decrease in the amount of project-wide contingency available until project completion.

With at least five years of complex and risky construction to go, this raises some risk that the project may exceed the publicly announced $11 billion budget. The wider public sector can learn from the interface risks that have realised in this project.

The early works were delayed in some precincts, but RPV effectively mitigated the risk of overall project delay through a member of the PPP consortium agreeing to accept the risk of early works delays on their works.

Based on our analysis of the recent construction schedules provided by RPV, we consider that these delays have not impacted the critical path for main works.

The early works approach has also effectively 'de-risked' some key elements of the overall project. In particular, DoT, RPV and contractors effectively delivered land acquisitions, site clearance and demolition, and utility relocations.

RPV and the early works contractors set up effective quality control processes, and we have found no concerns about the quality of works. RPV has also been effective in monitoring contractor compliance with environmental requirements.

4.2 Background on early works

Acceleration of early works

The 2016 *Melbourne Metro Business Case* identified that the tunnels would be completed by 2026.

In late 2015, RPV proposed to bring forward the completion date for the Melbourne Metro Tunnel Project. It projected that up to 29 months in time savings could be gained through a range of initiatives. RPV proposed to achieve this through accelerating some design work, planning approvals, and components of early and main works. RPV estimated the potential cost savings associated with the time savings to be approximately $770 million.

RPV did not implement all these measures. However, the proposed PPP interface works and accelerated design works did proceed as part of the early works phase. The PPP interface works were included in the state's early works scope, and the PPP consortium started the accelerated design works.

Consultancy advice commissioned by RPV in August 2018 showed that using an early works package has helped reduce the overall project schedule by 11 to 17 months, compared to a scenario where RPV did not undertake early works ahead of the main works packages.

The advice also calculated potential savings ranging from $1.2 billion to $1.9 billion from an 11 to 17 month reduction of the overall project schedule, mainly due to:

- savings—estimated at between $187 million and $289 million—associated with the early delivery of benefits by alleviating congestion sooner and providing economic benefits for Victoria
- prolongation and finance cost savings—estimated to be worth between $660 million and $1.2 billion—by reducing the duration of the PPP consortium's construction time and therefore financing needs
- other potential cost savings— estimated to be worth approximately $401 million—including reduced risk and overheads in delivery.

Prolongation costs are the additional costs that a contractor has incurred because the completion of the works has been delayed.

The state's decision to have an early works package, and include the PPP interface works in them, gave the PPP bidders an opportunity to offer an earlier completion date than a date arising from a more linear approach to a construction schedule.

In February 2018, based on the contracted delivery dates agreed by the PPP consortium, the government announced that it expects the Melbourne Metro Tunnel Project to be complete and open by the end of 2025, which is one year earlier than the 2026 date in the business case.

4.3 Results of our review of progress

The early works approach has effectively 'de-risked' some key elements of the overall construction program. In particular, DoT, RPV and contractors effectively delivered land acquisitions, site clearance and demolition, and utility relocations.

Taking on the early risk of utility relocations helped to manage a major cost and schedule risk to the overall project by avoiding the potential that a PPP would overprice this risk.

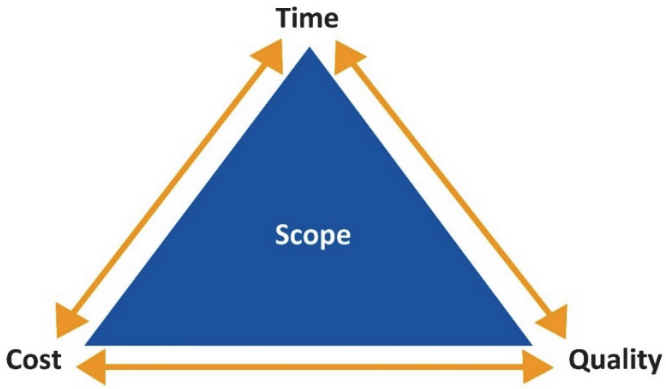
Notwithstanding these positive results, the early works phase has taken longer than originally planned and has cost more than originally budgeted.

The 'iron triangle' of project management

Good project management practices focus on delivering a project within intended scope, time, cost and quality parameters. These success factors are all related to each other and a project manager may need to prioritise one over another to deliver the best possible outcome.

The 'iron triangle' shown in Figure 4A is a conceptual tool for project managers to consider how changes in one project domain can lead to changes in another.

Figure 4A
The 'iron triangle' of project management



Source: VAGO, derived from the Project Management Institute's Project Management Body of Knowledge.

Based on this conceptual diagram, if a project must be delivered at a low cost in a short time frame, then quality might be compromised. If quality must be maintained, then the project would either need to increase time or cost, or both.

Any change to scope can also affect time, cost or quality because their relationships are linked and dynamic.

Scope assessment

Land acquisitions

Planning for land acquisitions began in December 2015. Figure 4B shows the estimated number of properties that RPV expected to acquire for the Melbourne Metro Tunnel Project. RPV refined this number as it confirmed and approved the land needed at each station and the station designs.

Figure 4B
Number of properties to be acquired

Date	Estimated number of properties
December 2015	114
January 2017	131
September 2018	91

Source: VAGO, based on DoT information.

DEDJTR (now DoT), assisted by RPV, negotiated and managed the land acquisitions on behalf of the state.

DEDJTR and RPV's negotiations in the Town Hall precinct, specifically regarding The Westin Melbourne hotel and City Square, resulted in a mutually agreed outcome for all parties, and effectively managed a potential delay risk to the state.

Early Works Managing Contractor

The EWMC has had the most changes out of all the early works packages. There have been 24 scope variations, which, as of December 2018, have resulted in 102 target budget adjustments valued at $267.1 million. The largest variations, based on increased cost, related to the State Library access shafts, utility relocations and NEPs. In addition to this, on 16 December 2017, RPV signed the EWSA, valued at $68.3 million, which is described in Figure 4C.

Figure 4C
Early Works Services Agreement

The EWMC experienced delays, which were most acute at the two deep access shafts at the State Library station precinct. These delays stemmed from planning approval times, adverse ground conditions, slower than anticipated production rates, and the PPP shortlisted bidders requesting design changes to the access shafts and acoustic shed size.

The state was aware of these delays and knew the EWMC was going to be late in finishing the contracted early works. Finishing early works late would expose the state to a risk that the PPP consortium may claim damages for affecting its ability to start and finish main works on time. To avoid this risk, the state negotiated with the PPP consortium to accept the risks that early works would run late.

The state and a member of the PPP consortium negotiated an EWSA, which included the Delegation Agreement. The Minister for Public Transport and members of the PPP consortium signed these agreements on 16 December 2017.

The key terms of the EWSA are that the PPP consortium:

- accepts any costs or delay risks to the main works caused by late completion of any of the early works
- can appoint a delegate to actively control and manage the EWMC and its works, including the ability to direct variations agreed to by the state
- receives $68.3 million (early services fee of $10 million and early works risk fee of $58.3 million)
- has an extra 48 days to complete the main works, which were factored into the contracted date.

The delegate's role is to minimise and avoid any further delays to the EWMC works and the main works by directing the EWMC works. The delegate can also direct the EWMC to undertake works that were originally PPP consortium works.

Under the EWSA, the state pays for the extra costs of early works, and the PPP consortium must reimburse the state for any PPP main works done by the EWMC.

The delegate has issued a number of unexpected variations/instructions, which are mainly design changes to the State Library access shafts, and have increased EWMC costs for the state.

Of the $267.1 million in adjustments to the EWMC, the delegate-directed $191.9 million (71.8 per cent) and the state-directed $75.2 million (28.2 per cent). A number of the delegate-directed variations relate to works that are at the PPP consortium's cost. RPV expects to recoup costs for works identified as related to the PPP consortium's contracted responsibilities.

Source: VAGO, based on RPV information.

The state may choose to **retain risk** by managing and mitigating the risk itself.

The state can also choose to **transfer risk**, where a third party accepts it, usually at a cost.

RPV believes that the EWSA has allowed it to transfer the state's risk of delays to the PPP consortium and mitigate the state's exposure to delay risks and potential compensation claims from the PPP consortium. We agree with RPV's view.

Although it is too early to definitively know whether the $68.3 million is value for money, the delays experienced in early works since the EWSA was signed are a strong indication that the PPP consortium may have been eligible to claim delay payments without this arrangement.

RPV also advised us that the 48-day extension the government gave the PPP consortium will not impact the announced opening date of 2025.

State Library shafts

Strutting provides temporary structural support to retaining walls to keep them stable and to resist movement around a large open space.

The State Library precinct has experienced the most scope changes in all the precincts and packages. The design, type of strutting supports and depth of the shafts have all changed since contracts were signed.

RPV originally budgeted the State Library PPP interface works at $75.7 million. As at March 2019, the final forecast cost was $201 million. This is an increase of $125.3 million, or 165.5 per cent.

The access shafts at the State Library precinct originally used concrete and tubular struts (seen at the top of the photo) but this was later replaced with the orange modular steel struts requested by the PPP consortium. Photograph courtesy of RPV.

Figure 4D outlines the scope changes to the State Library access shafts.

Figure 4D
State Library strutting redesign

In 2015, RPV explored opportunities to bring forward the final completion date for the Melbourne Metro Tunnel Project. One option was to have the EWMC design and build two access shafts for the State Library Station under Swanston Street. The PPP consortium is using the access shafts to transport machinery, equipment and workers underground, and remove spoil and excavation materials.

RPV found that this option would create an additional interface with the PPP works and there was a risk that the EWMC's shaft design would not be suitable for the PPP consortium. However, RPV decided to include the access shafts as part of the EWMC scope (described as PPP interface works) given the time savings that RPV projected it would deliver.

The EWMC had to design and build the access shafts at State Library to the following depths by December 2017:

- A'Beckett Street to the depth of 31.35 metres
- Franklin Street to the depth of 33.0 metres.

To build the access shafts, the EWMC dug out two large shafts, one on A'Beckett Street and another on Franklin Street. To support the shafts while they were being dug, the EWMC installed a concrete beam along the edge, and tubular steel struts across the shafts. The struts stop the shaft walls from collapsing in on the shaft while it is being used. The PPP consortium will remove the strutting as it builds out the permanent structures that will fill the shafts when the station opens.

The PPP consortium later advised RPV that it wanted to use modular steel strutting because it would be faster to install and remove. In August 2017, RPV agreed to install modular steel, rather than concrete beams and steel tubular strutting, for the remaining six levels of the shaft.

The PPP consortium's design changes, which started in October 2017, increased the cost of building the access shafts. This means that the PPP interface risk that RPV had previously identified has now realised.

Delays at the access shafts were a key driver for the state to enter into the EWSA (see Figure 4C). However, even after the EWSA was in place, delays have still arisen.

Due to these ongoing delays, the PPP consortium and the state agreed to hand over the shafts at a shallower depth than originally planned. The State Library access shafts were handed over at the following dates and depths:

- A'Beckett Street on 24 October 2018 at a depth of 24.2 metres (decrease of 7.15 metres)
- Franklin Street on 10 December 2018 at a depth of 26.6 metres (decrease of 6.4 metres).

The PPP consortium is responsible for completing both shafts to the required depths needed for their design.

Source: VAGO, based on RPV information.

Utility service relocations

Utility service relocations were originally included in the EWMC for all station and portal precincts and included:

- water pipes
- sewerage system
- stormwater drains
- telecommunications conduits and cables
- electricity cables, including high-voltage cables and associated supervisory cables
- gas pipes.

RPV originally budgeted utility service relocations at $182.5 million. This includes the cost associated with preparing the sites, moving monuments and public artworks, as well as other related costs. As of March 2019, utility relocations showed a final forecast cost of $189.5 million, an increase of $60.1 million, or 43 per cent. Initially, RPV identified 86 utilities for relocation. However, at the end of early works, it had relocated 93 utility services.

Due to changing station box designs, the exact number of utility services that RPV needed to relocate changed as the designs were refined and approved.

Unknown or undocumented utility services can be a large risk to projects. This risk has eventuated for the Sydney Light Rail project. In February 2019, the New South Wales Government and the contractor were negotiating to settle their legal dispute over undeclared and undocumented utility services, with some media reports citing a compensation claim of up to $1.5 billion.

The inclusion of utility service relocations at the station precincts has helped to manage a major risk to the overall project, which has avoided the potential for overpricing of this risk by a PPP.

Network enhancement projects

RPV added the NEPs to the EWMC after the EES process (see Figure 3D). The EMF specifies the requirement for NEPs at the Parkville and Anzac station precincts, and in Kensington.

At first, RPV included NEPs in the main works phase, but moved it to the early works phase after the project started. At this time, RPV approved budget transfers worth $39 million to cover this scope; however, initially only a budget of $8.7 million was reported in internal budget reports. RPV advised us that these reports did not reflect the full budget transfer due to an administrative oversight. As of March 2019, NEPs have a final forecast cost of $34.9 million.

NEPs include various changes to road infrastructure, such as road augmentation, changes to signal timing or parking rules, and the installation of clearways. RPV proposed 578 NEPs across 251 locations.

NEPs are not critical to the delivery of main works. However, they help reduce disruption and assist transport routes to flow better during the project's long construction period.

In October 2018, RPV published an infographic of the locations and types of NEPs (Figure 4E).

Figure 4E
Location and type of NEPs

Source: RPV (Metro Tunnel website). Station names edited by VAGO.

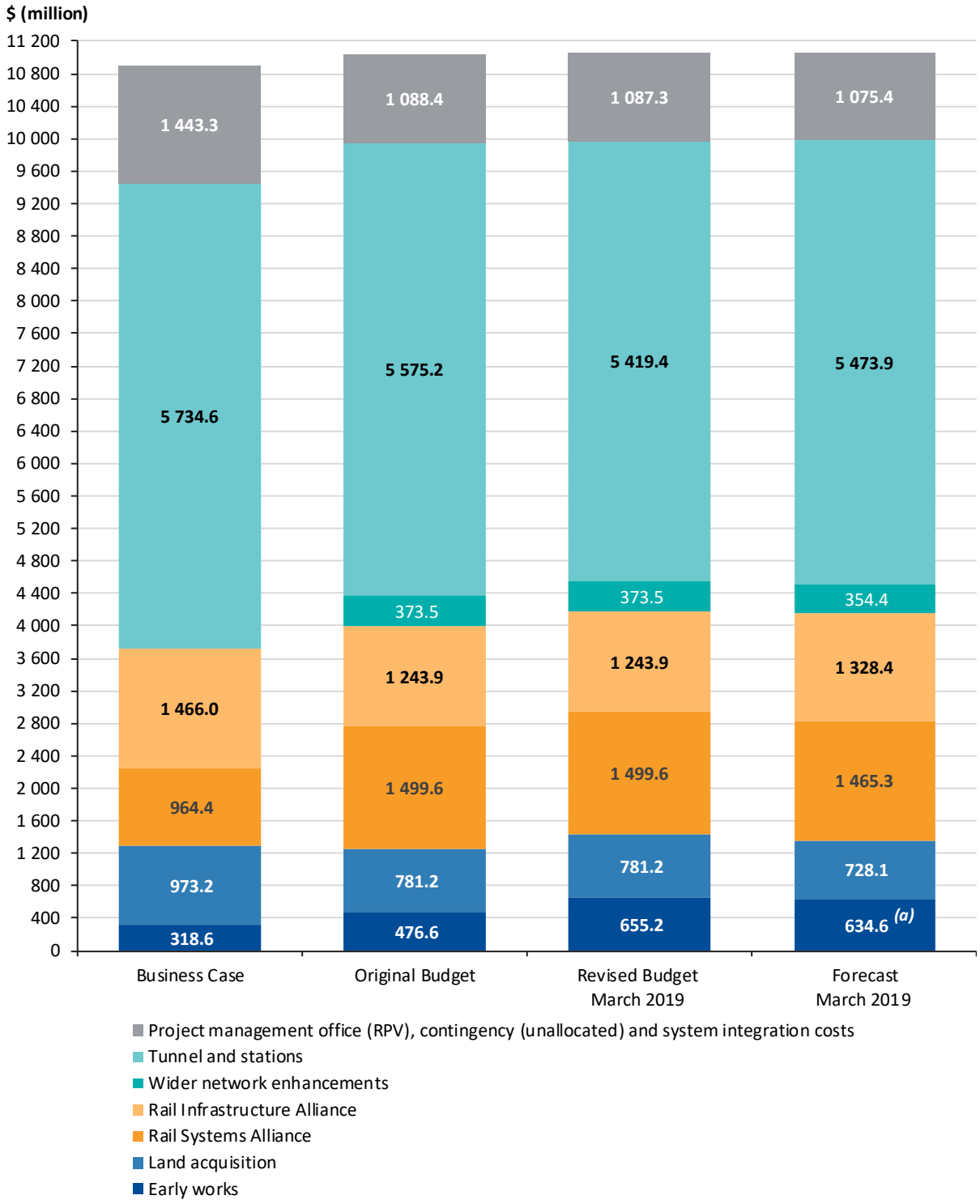
By December 2018, RPV completed 336 NEPs. RPV also descoped 198 proposed NEPs and transferred 44 to VicRoads to complete.

Cost assessment

Overall project

Figure 4F shows how the budget for the whole project has changed to the March 2019 final forecast cost since the business case. The business case budget was $10.9 billion, and the current approved budget is $11.06 billion.

Figure 4F
Change in Melbourne Metro Tunnel Project budget



(a) The discrepancy between the early works amount in this chart and reported elsewhere in this report is due to $9 million of forecast income from other entities.
Note: The other works packages (for example, Rail Systems Alliance) are explained in Figure 1E in Part 1.
Source: VAGO, based on RPV data.

As of March 2019, RPV spent $511.1 million in project management costs. These costs are not directly allocated to any of the works packages, but are related to resources that work across all aspects of the Melbourne Metro Tunnel Project. A small portion of this amount funds general oversight of RPV projects.

As Figure 4F shows, some package budgets are forecast to be different from their original budgets. RPV funded these unanticipated increases from risk and contingency funds.

We found a significant decrease between the overall project contingency funds allocated when the government approved the business case, compared to when we conducted this audit. As of March 2019, RPV forecasts a relatively small amount of contingency will be available at the project's announced completion date of 2025.

Early works phase budget outcomes

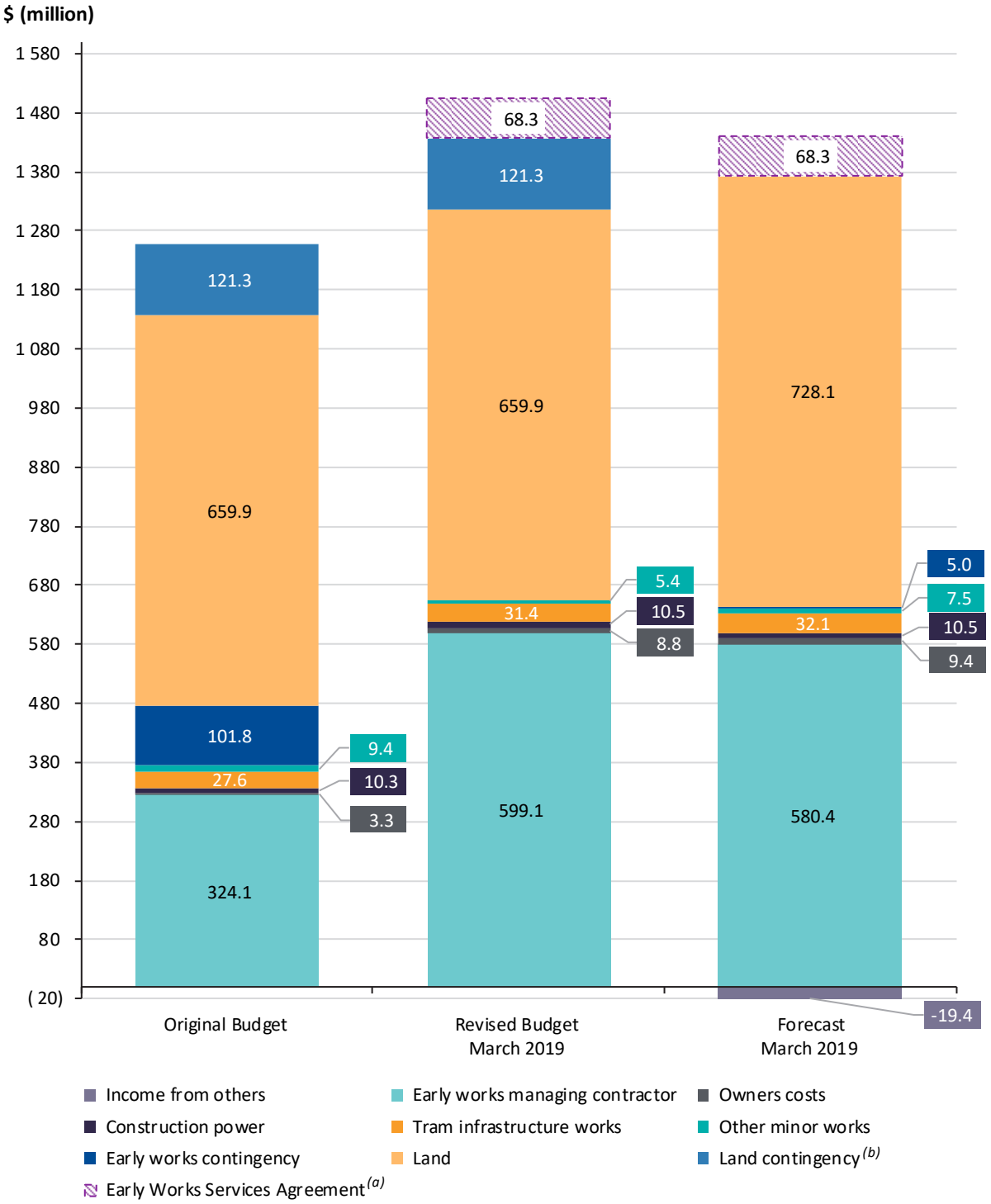
The cost for the early works phase of the Melbourne Metro Tunnel Project has increased from the original budget of $1.257 billion ($781.2 million of land acquisition costs and $476.6 million of early construction works costs) to a March 2019 forecast final cost of $1.353 billion ($728.1 million of land acquisition costs and $625.5 million of early construction costs).

The savings from land acquisition costs ($53.1 million, or 6.8 per cent decrease) have been offset against the increase in the other early works packages ($148.9 million, or a 31.2 per cent increase). Overall, there has been a cost increase of $95.8 million or 7.6 per cent.

In addition, RPV paid $68.3 million to the PPP consortium for the EWSA, which was funded from the main works budget. Under the EWSA, $172.8 million of the total $267.1 million in EWMC variations were raised. RPV paid for these variations, triggered by a member of the PPP consortium while acting as the state's delegate, from wider project contingency funds.

Figure 4G shows the overall budget changes for the early works phase of the Melbourne Metro Tunnel Project.

Figure 4G
Original and revised budget and forecast final cost of the total early works phase



(a) RPV funded the EWSA ($68.3 million) in the main works budget. However, we believe it is a cost associated with early works, so we have shown it here.
(b) $53.1 million in unspent land contingency has been reallocated across the Melbourne Metro Tunnel Project.
Note: Income is shown as a negative.
Source: VAGO, based on RPV data.

RPV's commissioned consultancy advice from August 2018 estimated the savings from undertaking early works at between $660 million and $1.275 billion. We note, however, that these are not actual bankable savings, but avoided costs related to a hypothetical course of action that did not proceed (the PPP to do all works, including early works). These savings were also contingent on achieving a time saving of 11 to 17 months.

From RPV's perspective, enabling the early completion of the whole project makes the early works phase cost increases reasonable if considered against the overall project outcomes. If the Melbourne Metro Tunnel opens in 2025 and without further cost increases, the time delays and increased expenditure that RPV incurred in the early works phase will be offset.

Land acquisitions

Land acquisitions have been effective and delivered within expected budget parameters. Originally budgeted at $781.2 million, as of March 2019 RPV forecasts that land acquisitions will cost $728.3 million. This is a decrease of $53.1 million, or 6.8 per cent.

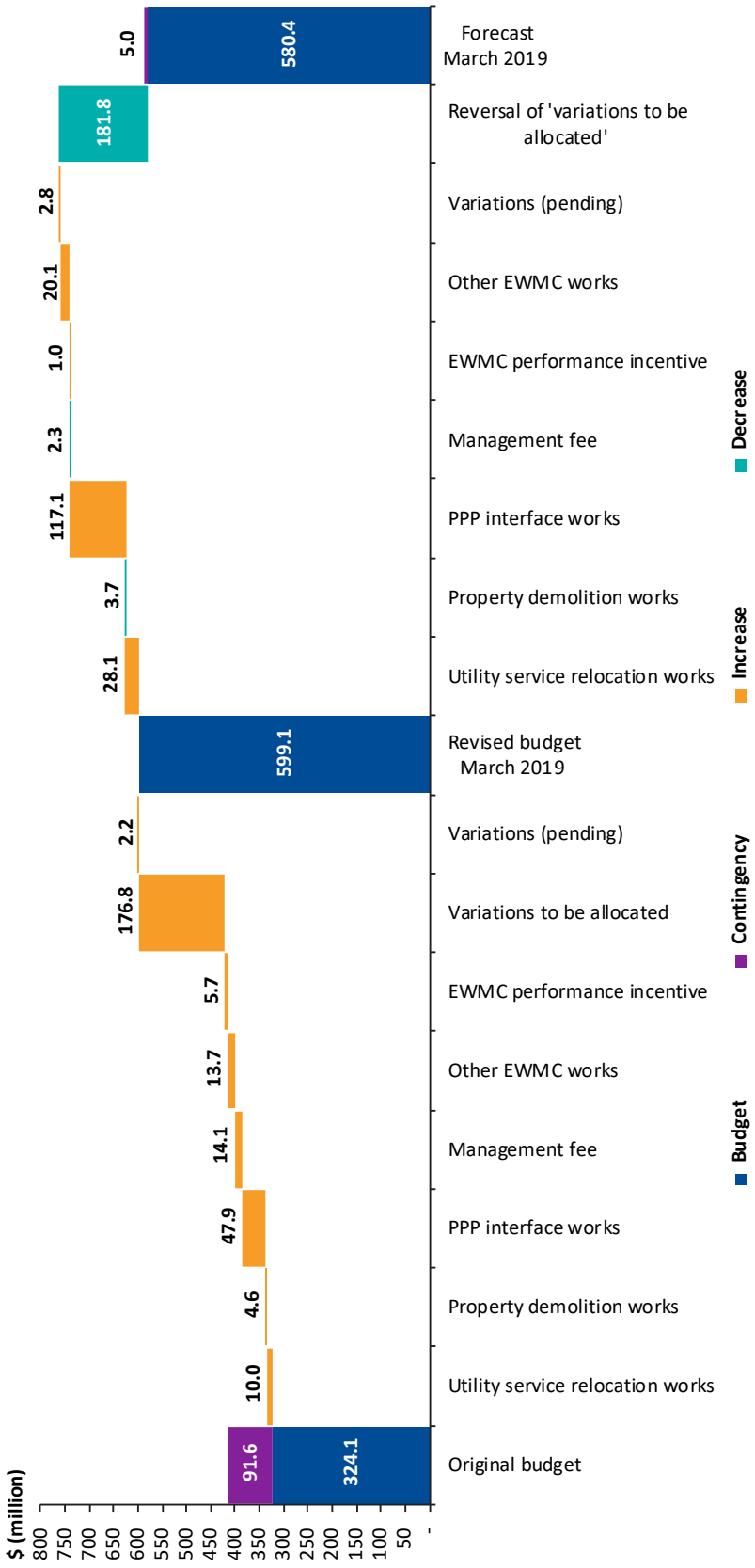
The unspent contingency funds that were budgeted for land acquisition have been reallocated to wider program contingency funds.

Early Works Managing Contractor

DEDJTR (now DoT) contracted the EWMC for $324.1 million. RPV is now responsible for managing the contract. As of December 2018, RPV made 102 target budget adjustments to the EWMC valued at $267.1 million, of which $91.6 million was funded from the original allocated contingency. The final forecast cost of the EWMC, as at March 2019, is $580.4 million.

Figure 4H shows the EWMC budget changes. The largest increases have been for the PPP interface works ($157 million increase), utility service relocations ($45.1 million increase) and NEPs ($34.9 million increase). Combined, these three components cost $237 million more than anticipated, which is 88.7 per cent of the adjustments.

Figure 4H
Budget changes to EWMC agreement



Note: The NEPs are currently included in 'contract variation to be allocated'.
Note: 'variations to be allocated' will be reversed when variations are allocated to their respective categories.
Source: VAGO, based on RPV data.

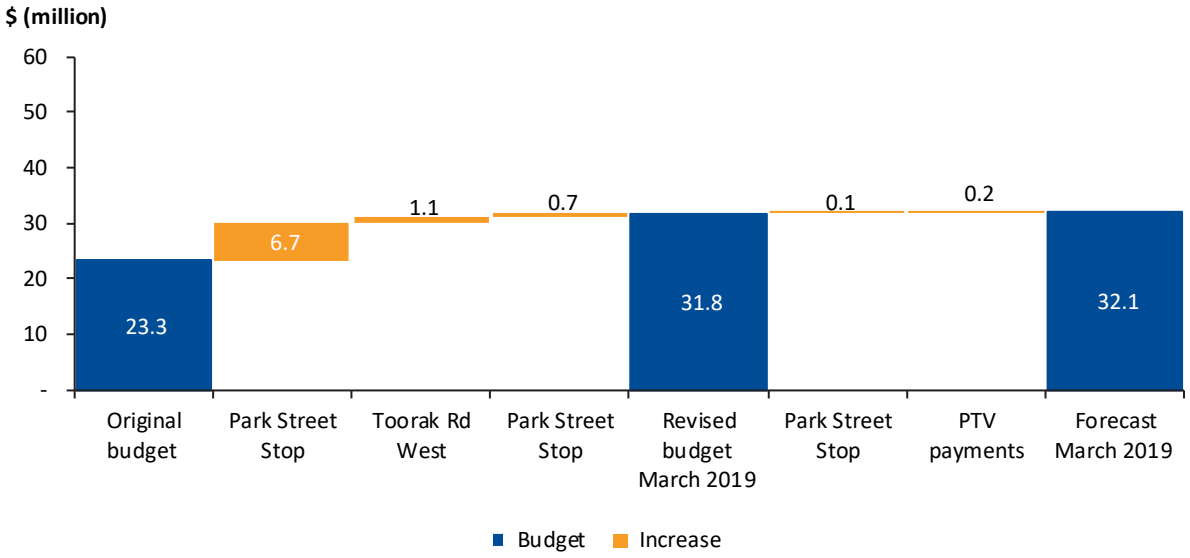
Tram infrastructure works

Yarra Trams delivered tram infrastructure works within budget. The original budget was $23.3 million (Figure 4I) for the Toorak Road West works.

One variation of $8.6 million added the Park Street platform stop to early works ($6.7 million) and provided additional funding for the Toorak Road West works ($1.1 million). The remainder of this variation ($0.8 million) was contingency, which was used for the Park Street stop. An unexpected cost of $200 000 was paid to PTV for services associated with these works.

Figure 4I shows the budget changes to the tram infrastructure works package, and the final forecast cost of $32.1 million.

Figure 4I
Budget changes to the tram infrastructure works



Source: VAGO, based on RPV data.

Construction power

The contractor delivered construction power works within the contracted budget of $10.3 million.

One variation, valued at around $190 000, was added for the installation of protective firewalls at the Anzac precinct and some extra substation design costs.

Time assessment

The **critical path** is the longest sequence of tasks that must be finished for a project to be completed on time.

Nearly all the early works packages have experienced some time delays. RPV reports we reviewed showed, however, that these delays have not affected the critical path for the main tunnel and stations works.

Early works time achievement

Almost all the elements of the early works packages are now complete.

As Figure 4J shows, when compared to the original contracted completion date, some early works experienced delays that ranged from 35 days to 10.5 months.

RPV extended the EWMC completion date, originally set for 25 January 2018, by 11 months to 22 December 2018. RPV advise that the time extensions were due to alterations to the scope of works, and/or a change in delivery method.

The State Library station precinct experienced the greatest delay, at 10.5 months. The delays primarily related to the redesign of the access shafts (see the State Library case study in Figure 4D). Under the EWSA, RPV effectively transferred the risks associated with the delay of the EWMC works to the PPP consortium.

Figure 4J
Completion dates of early works construction packages

Package	Original contracted completion date	Revised contracted completion date	Practical completion date[(a)]	Approximate time from original contract date to practical completion
EWMC				
• North Melbourne	25/1/2018	22/12/2018	1/3/2018[(c)]	35 days
• Parkville	25/1/2018	22/12/2018	19/1/2018[(c)]	–7 days
• State Library	25/1/2018	22/12/2018	10/12/2018	10.5 months
• Town Hall	25/1/2018	22/12/2018	18/6/2018[(c)]	5 months
• Anzac	25/1/2018	22/12/2018	5/4/2018[(c)]	2 months
• NEPs	N/A[(b)]	22/12/2018	27/8/2018[(c)]	7 months
Tram infrastructure works				
• Toorak Road West	30/4/2017	N/A	17/9/2017	4 months
• Park Street	17/2/2018	N/A	16/2/2018	–1 day
Construction power	31/3/2018	N/A	29/5/2018	2 months

(a) Practical completion means when the work is sufficiently complete to hand over but may not be complete in all respects. A small number of items may still need to be rectified.

(b) NEPs were not originally contracted in early works—instead, they were identified during the EES process (see Section 3.5). The variations that added NEPs to the EWMC did not provide a schedule (time) extension, therefore making the completion date the same as the contract—25 January 2018.

(c) This date is from the practical completion certificate that is still in draft.

Note: Land acquisitions had varying dates depending on the precinct. All properties were acquired and available when needed. Utility service relocations were linked to the station precinct and have the same start and completion dates as the precinct.

Note: N/A = not applicable.

Source: VAGO, based on RPV data.

Quality assessment

We have identified no concerns about the quality of works. We found the approach taken by RPV to assess quality to be sound; however, due to the system's focus on self-assessment, this ultimately relies on the contractor's own quality systems.

Quality processes

Quality processes are in place at RPV and the early works contractors. We found that RPV's quality processes, documentation and approach to managing quality are effective.

RPV's quality assurance mechanisms include obtaining and reviewing all relevant documentation and attending site inspections and pre-handover inspections with the contractor's staff.

RPV also maintains an audit and inspection tracking register for all EWMC and construction power works. The register details the contract, type and date of attendance (audit or inspection), focus of the audit/inspection, status (open or closed), a link to the relevant report or documentation and a list of attendees. Our review of this tracking register found that it was simple but effective for keeping track of the inspections and audits attended by RPV and the outstanding items for each of these works.

In each agreement for the EWMC, tram infrastructure works and construction power, RPV included the requirement that the contractor draft and submit a Quality Management Plan to RPV for approval. This is the key document that facilitates management of the quality of works and describes how the contractor will ensure that performed works conform to contractual obligations. The Quality Management Plan also outlines the processes that contractors must have, such as planning, inspections and reporting of non-conformances. When the early works contractors or RPV identify a non-conformance, the Quality Management Plan outlines the procedure the contractor must follow, such as notifying RPV within 24 hours. RPV and contractors also use a defect register to list any outstanding items at practical completion.

RPV's quality team has been involved in reviewing and accepting quality-related documentation and processes for all the contractors' work. RPV ensures that its quality team has the proper knowledge and expertise through recruitment processes and appointing individuals with the requisite competencies. We found this approach to be reasonable.

Land acquisitions

Under the *Victorian Government Land Transactions Policy and Guidelines*, the Valuer-General Victoria and the Victorian Government Land Monitor have mandated roles in the compulsory land acquisition process to ensure a fair price is reached during negotiations.

Our review of a sample of land acquisitions found that RPV obtained all required valuations and approvals. During our review, we also found that other requirements of the *Land Acquisition and Compensation Act 1986*, such as the publication of mandatory notices, and correspondence with affected parties taking the correct form, were correct and well documented.

Completion certificates

Practical completion certificates certify that RPV is satisfied that relevant works are complete.

Early Works Managing Contractor

As Figure 4K shows, completion certificates have been issued for some of the EWMC stages.

Figure 4K
Completion certificates for EWMC stages

Stage	Summary of scope of works	Date RPV issued completion certificate
Stage 1	Utility service relocations at station and portal precincts and some demolitions	Not yet issued
Stage 2	State Library and Town Hall property demolitions and some NEPs	Not yet issued
Stage 3	Remaining NEPs and additional works at North Melbourne and Anzac	Not yet issued
Stage 4A	PPP interface works at A'Beckett Street shaft	25 October 2018
Stage 4B	PPP interface works at Franklin Street shaft	11 December 2018
Stage 4C	State Library recharge system	Not yet issued
Stage 4D	Town Hall Property Demolition	Not yet issued

Source: VAGO, based on RPV information.

The PPP consortium's acceptance of a site is an informal indicator that early works have been completed to standard. As of January 2019, the PPP consortium has accepted handover of the sites and is proceeding with main works.

Tram infrastructure works

Yarra Trams is responsible for the quality of the tram infrastructure works. It achieved practical completion for the Toorak Road West works on 17 September 2017 and issued the completion certificate on 22 September 2017.

Yarra Trams completed the Park Street works on 16 February 2018 and issued the certificate on 25 October 2018.

Construction power

The contractor achieved practical completion of construction power works on 29 May 2018, and RPV issued the completion certificate on 9 August 2018.

Environmental performance assessment

For environmental outcomes, we found that RPV and early works contractors met applicable EPRs and environmental monitoring processes. RPV has identified instances where there is a potential non-conformance or exceedance of guideline targets based on the data provided by contractors.

RPV actively monitors this and has responded to opportunities to reduce the occurrences, which is a positive action. We found RPV's approach to monitoring and managing EPR compliance to be sound.

Environmental Performance Requirements

We examined contractors' monitoring of and adherence to the EPRs set under the EES process (described in Section 3.5).

The EMF, developed by RPV as part of the EES process, specifies the EPRs for the project.

The EPRs cover 19 areas, such as air quality, noise and vibration, and groundwater. Across these areas, there are 125 EPRs. The EPRs cover the whole Melbourne Metro Tunnel Project, not just the early works. Additionally, not all EPRs apply to each contractor or every site. As an example, the EPRs related to EMI were not identified as relevant to any of the early works. An RPV-commissioned report found that EMI is more likely to have an impact during operations, rather than early works.

Some EPRs outline a specific administrative process that contractors must follow to comply with the EPR. Other EPRs draw on established guidelines and targets, such as those set by the Environment Protection Authority, as the reference level for the EPR. For example, there is a noise and vibration EPR (NV1) that requires construction noise to be managed in accordance with the Environment Protection Authority's *Noise Control Guidelines* (Publication 1254). These EPRs provide guidance on what the acceptable levels are for certain environmental factors.

Figure 4L shows the number of EPRs applicable to each early works contract.

Figure 4L
Number of Environmental Performance Requirements applicable to each early works contract

Category	Number of EPRs in category	Number of EPRs applicable to each contract		
		EWMC Agreement	Tram infrastructure works	Construction power
Environmental Management Framework	4	4	4	4
Aquatic Ecology and River Health	7	7	2	5
Aboriginal Cultural Heritage	1	1	1	1
Air Quality	3	3	3	3
Arboriculture	5	5	5	2
Business	6	6	3	2
Contaminated Land and Soil Management	4	4	2	4
Cultural Heritage—Historical	24	24	12	7
Electromagnetic interference	2	0	0	0
Flora and Fauna—Terrestrial	3	3	3	1
Greenhouse Gas	2	2	1	2
Ground Movement and Land Stability	6	6	2	0
Groundwater	5	5	0	5
Land Use Planning	4	4	3	3
Landscape and Visual	4	4	3	3
Noise and Vibration	21	21	12	13
Social and Community	12	12	8	6
Surface Water	2	2	1	2
Transport	10	10	8	6
Total	**125**	**123**	**73**	**69**

Note: EPRs are not applicable to land acquisitions.
Source: VAGO, based on RPV information.

Compliance with, and monitoring of, the Environmental Performance Requirements

Early works contractors are responsible for compliance with, and monitoring of, EPRs. RPV is involved in monitoring the compliance of EPRs.

Each early works contractor must implement an Environmental Management System that is certified to *AS/NZ ISO 14001:2015—Environmental Management Systems* to ensure consistency with relevant legislation, policy and guidelines, and RPV's environmental policy.

Contractors must also:

- develop an EWP that demonstrates how works will be carried out in accordance with the EPRs
- develop a Construction Environmental Management Plan that details how it will manage environmental impacts
- comply with the EMF, legislative and approval requirements
- undertake environmental audits to confirm compliance with the EMF and EPRs
- appoint an Independent Environmental Auditor, who must verify compliance with EPRs, conduct audits to assess compliance with the Construction Environmental Management Plan, and prepare audit reports on findings against the EPRs and Construction Environmental Management Plan.

Our review of the contractors' environmental audit reports and Independent Environmental Auditor reports found that EPRs are being adhered to. There have been five EPR non-conformances by the EWMC. This is when the EWMC has not followed a process outlined by an EPR, rather than when it has exceeded a guideline target. One non-conformance was when the EWMC did not obtain an out-of-hours work permit prior to the commencement of 24-hours-a-day, seven-days-a-week works. Once the EWMC was aware of this, it obtained the correct permit.

The other four non-conformances related to modelling and project documentation to manage groundwater movements. RPV advised us that these non-conformances have had no material impact on the delivery of the project.

RPV receives a weekly summary report of the contractor's environmental monitoring (type of monitoring and location) and measured outcomes (such as noise levels). These reports include instances of when contractors exceed standards or targets in EPRs—for example, when the measured noise level exceeds the target.

Our review of these reports found instances when contractors had exceeded targets. However, it was often for a short time period and was not a recurring issue at the same location.

Figure 4M
Response to noise guidelines exceeded by contractors

Contractors must manage the noise from their works as it impacts nearby residents and businesses. The EPRs for the Melbourne Metro Tunnel Project provide recommended and target noise levels for contractors to consider and follow. For example, at night, residents should not hear any construction noise.

Acoustic sheds, such as those used at the State Library station precinct, are one way to contain construction noise. Noise monitors are located around and next to construction sites to measure and track whether noise levels are within the acceptable range. One challenge for both contractors and RPV is that it is difficult to separate the noise from construction activities from background noises, such as traffic and residential activity.

Acoustic sheds have been built on Franklin Street and A'Beckett Street to minimise construction noise impacts. Photo courtesy of RPV.

The EWMC measures and reports noise levels to RPV every week. In May 2018, the EWMC reported excessive noise at the State Library station precinct. In response, RPV asked the EWMC to demonstrate how it complied with the noise EPRs.

The EWMC advised RPV that it had adopted measures to address the issue, including automating the closure of acoustic shed doors during the day and planning work around mandatory door closure hours of 6 pm to 7 am each night. The EWMC also reported to RPV that noise-monitoring results during the day and evening were generally within the EPR guideline noise targets.

Source: VAGO, based on RPV information.

RPV's role in monitoring the compliance of EPRs includes reviewing and approving environmental management and monitoring plans and attending project meetings with contractors to understand the environmental issues for each site. Where an issue is identified, RPV works with the contractor to ensure that appropriate actions are taken to address it.

In the example in Figure 4M, RPV's review of target exceedances led to a practice improvement that reduced the noise impact on residents near the station precincts where overnight works take place.

Appendix A *Audit Act 1994* section 16—submissions and comments

We have consulted with DELWP, DPC, DoT, DTF, PTV, VicTrack and Yarra Trams, and we considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report, or relevant extracts, to those agencies and asked for their submissions and comments.

Responsibility for the accuracy, fairness and balance of those comments rests solely with the agency head.

Responses were received as follows:

RESPONSE provided by the Secretary, DELWP

Department of Environment, Land, Water and Planning

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delwp.vic.gov.au

Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Ref: SEC014164

Dear ~~Mr Greaves~~ Andrew,

PERFORMANCE AUDIT - PROPOSED REPORT ON MELBOURNE METRO TUNNEL PROJECT – PHASE 1: EARLY WORKS

Thank you for your letter of 13 May 2019, providing the Department of Environment, Land, Water and Planning (DELWP) with an opportunity to comment on the proposed report for the performance audit Melbourne Metro Tunnel Project – Phase 1: Early Works. The proposed report is a fair and accurate reflection of DELWP's diligent and effective identification and management of key environmental risks for large and complex projects.

I note the proposed report's observations on the use of the environmental performance requirements (EPRs) to manage the project's environmental effects and confirm that DELWP is committed to implementing innovative environmental management tools. The use of the EPRs for major public infrastructure projects is a relatively new environmental management tool that had been used only once before the Metro Tunnel Project. DELWP actively reviews its practice, particularly relating to the form and content of EPRs, and seeks to apply lessons learnt to new projects to enhance their environmental performance.

DELWP accepts Recommendation 11, and agrees that increasing transparency in compliance and performance improves the visibility of how well a project's environmental protection strategies are working for both the Minister for Planning and the community. In response to the recommendation, DELWP will continue to recommend the Minister for Planning approve EPRs that include a requirement for the proponents of public infrastructure projects, subject to an Environment Effects Statement, to publicly publish environmental audit reports undertaken by an independent environmental auditor.

I note that since the approval of the Metro Tunnel Project an improved process on the reporting of EPR compliance by an independent environmental auditor was instituted for the West Gate Tunnel Project. For that project, an EPR requires the state proponent (and its contractor) to publish its six-monthly audit report on the project's website.

I thank you for the collaborative process in the drafting of the proposed report.

Yours sincerely

John Bradley
Secretary
23/5/19

VICTORIA State Government

RESPONSE provided by the Secretary, DELWP—continued

Department of Environment, Land, Water and Planning action plan to address recommendations from the performance audit of Melbourne Metro Tunnel Project: Phase 1 – Early Works

No	VAGO recommendation	Action	Completion date
11	We recommend that the Department of Environment, Land, Water and Planning (DELWP): require proponents of public infrastructure projects subject to an Environment Effects Statement process to publicly publish any environmental audit reports that an Independent Environmental Auditor or equivalent undertakes and delivers as part of the environment management framework for the project (see Section 3.8).	Since the Minister's Assessment of the environmental effects on the Metro Tunnel Project, DELWP now recommends environmental performance requirements (EPRs) that require proponents of public infrastructure projects, subject to an Environment Effects Statement, to publicly publish environmental audit reports that an independent environmental auditor has undertaken. Typically, this EPR will form part of the environment management framework (EMF) for a project. For the West Gate Tunnel Project, DELWP recommended an environmental performance requirement (EMP3 Environmental Compliance) that required (among other things) the project's independent environmental auditor to produce six-monthly audit reports during construction. Western Distributor Authority is further required to forward the reports to the Minister for Planning and make them publicly available (which it does through publication on its website). DELWP will continue to implement the effective environmental management mechanisms available to improve the proponent's accountability.	Completed

RESPONSE provided by the Secretary, DPC

Department of
Premier and Cabinet

27 MAY 2019

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D19/187447

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Dear Auditor-General ~~General~~ Andrew

Thank you for your letter dated 13 May 2019 providing me with a copy of the proposed report *Melbourne Metro Tunnel Project – Phase 1: Early Works.*

DPC agrees with the four relevant recommendations.

Enclosed with this letter are DPC's responses to each of the recommendations, outlining the actions we will take and projected completion dates.

I recognise the important role my department holds in guiding and supporting government investment in the Victorian transport network.

Thank you for the opportunity to consider the proposed report.

Yours sincerely

Chris Eccles AO
Secretary

Enclosed: DPC's position on the audit recommendations

VICTORIA State Government

RESPONSE provided by the Secretary, DPC—continued

Department of Premier and Cabinet action plan to address recommendations from the performance audit of Melbourne Metro Tunnel Project: Phase 1 – Early Works

No	VAGO recommendation	Action	Completion date
1	We recommend that the Department of Premier and Cabinet (DPC) and Department of Treasury and Finance (DTF): ensure that project proponents have undertaken sufficient and comprehensive analysis of all sensible and realistic strategic interventions and project options in business cases (see Section 2.5).	**Agreed** DPC will continue to support DTF's effort to promote Investment Lifecycle Guidelines and the Gateway Review Process to encourage departmental business cases to include clear project options and a reasonable spread of project options. DPC will continue to analyse project options in capital asset business cases.	Ongoing
2	We recommend that DPC and DTF: review the remaining Melbourne Metro Tunnel Project contingency funds, taking into consideration the construction risks experienced to date and the likely time and complexity pressures expected for the remaining works, and advise government on the sufficiency of these funds (see Section 4.6)	**Agreed** DPC notes government will continue to be kept informed of the Project's contingency funding through the quarterly Major Projects Performance Report. DPC will work with DTF, DoT and the Office of Projects Victoria to ensure the terms of reference for a Project Assurance Review include a review of Metro Tunnel Project contingency funding.	May 2020
3	We recommend that DPC and DTF: review and revise the original assumptions contained in the Melbourne Metro Tunnel Project business case, considering the impacts of new rail system projects, and republish the refreshed assumptions in an updated project benefits management plan (see Section 2.6)	**Agreed** DPC and DTF will work with DoT on an updated benefits management plan that outlines the impact of new rail system projects on the original assumed benefits.	May 2020
4	We recommend that DPC and DTF: prior to commencing the next major transport infrastructure project with an early works stage, review the impact of technical interface risks between early and main works packages and, with the Office of Projects Victoria, share with the public sector any lessons learned from the interface issues and risks experienced in the Melbourne Metro Tunnel project (see Section 4.6).	**Agreed** DPC will work with DTF, DoT and Office of Projects Victoria to share lessons learned from an early works review.	December 2019

VICTORIA State Government

RESPONSE provided by the Secretary, DoT

Department of Transport

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Dear Mr Greaves

PROPOSED PERFORMANCE AUDIT REPORT *MELBOURNE METRO TUNNEL PROJECT – PHASE 1: EARLY WORKS*

Thank you for your letter dated 13 May 2019 enclosing your proposed report relating to the Melbourne Metro Tunnel Project – Phase 1: Early Works audit, and for the opportunity to provide comment on the proposed report.

The Melbourne Metro Tunnel Project, Melbourne's largest rail project since the City Loop was built in the 1970s, commenced in 2016 and is planned to be completed in 2025. The project will deliver significant benefits to Melbourne by reducing congestion in the City Loop, enabling trains to run more frequently and increasing capacity across the network.

We welcome your conclusion that the planning processes and early works have adequately prepared the Melbourne Metro Tunnel Project for its next phase.

The Department accepts the recommendations outlined in the proposed report, and has provided comments on the recommendations for your office's consideration and for inclusion in the final report.

The Department is committed to the success of the Melbourne Metro Tunnel Project and all future projects within the Transport Infrastructure portfolio. As such, we welcome opportunities to further strengthen the approach undertaken in delivery of these projects.

If you have any queries please do not hesitate to contact either Evan Tattersall, Chief Executive Officer, Rail Projects Victoria or Sara McIvor, Director Audit, Risk and Integrity, Department of Transport.

Yours sincerely

Paul Younis
Secretary

Date: 24 / 5 / 19

VICTORIA State Government

RESPONSE provided by the Secretary, DoT—continued

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Department of Transport action plan to address recommendations from the performance audit of Melbourne Metro Tunnel Project: Phase 1 – Early Works

No	VAGO recommendation	Action	Completion date
2	We recommend that DPC, DTF and Department of Transport (DoT): review the remaining Melbourne Metro Tunnel Project contingency funds, taking into consideration the construction risks experienced to date and the likely time and complexity pressures expected for the remaining works, and advise government on the sufficiency of these funds (see Section 4.6)	Agreed. DoT notes Government will continue to receive project status reports through the Major Project Performance Report. DoT will work with DTF, DPC and the Office of Projects Victoria to ensure the terms of reference for a Project Assurance Review include a review of Metro Tunnel Project contingency funding.	May 2020
3	We recommend that DPC, DTF and DoT: review and revise the original assumptions contained in the Melbourne Metro Tunnel Project business case, considering the impacts of new rail system projects, and republish the refreshed assumptions in an updated project benefits management plan (see Section 2.6)	Agreed. DoT will work with DTF and DPC on an updated benefits management plan that outlines the impact of subsequent investments on the original assumed benefits.	May 2020
4	We recommend that DPC, DTF and DoT: prior to commencing the next major transport infrastructure project with an early works stage, review the impact of technical interface risks between early and main works packages and, with the Office of Projects Victoria, share with the public sector any lessons learned from the interface issues and risks experienced in the Melbourne Metro Tunnel project (see Section 4.6).	Agreed. DoT will work with DTF, DPC and the Office of Projects Victoria to share lessons learned from an early works review.	December 2019
5	We recommend that DoT: improve governance and visibility of the calibration and validation processes used for Victorian transport modelling and do more frequent and timely updates (see Section 2.6)	Agreed. DoT will continue to prepare and peer review validation and forecasting for modelling undertaken for specific projects. DoT will establish an ongoing program of model updates, including annual assumptions reviews and 5-yearly model recalibration exercises. DoT is reviewing governance arrangements for transport modelling and economic appraisal in Victoria to strengthen these arrangements.	Mid 2021 End 2019
6	We recommend that DoT: implement the recommended improvements from recently completed strategic modelling reviews for the various transport demand and simulation models used in the transport portfolio, and explore opportunities to better align and integrate transport service demand forecasting approaches with service demand modelling done in other public sector agencies (see Section 2.6)	Agreed. DoT is preparing a multi-year forward program of improvements, guided by the findings of recent modelling reviews. DoT will explore opportunities for closer connections to other government service demand modelling, where it is relevant (as, for instance, already occurs with the VITM's population and employment assumptions).	Mid 2020 Mid 2021

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RESPONSE provided by the Secretary, DoT—continued

No	VAGO recommendation	Action	Completion date
7	We recommend that DoT: further develop the various transport demand forecasting models so they can include a range of scenarios testing key areas of uncertainty, and provide a high/medium/low growth range when supporting key investment decisions (see Section 2.6)	Agreed. DoT is currently developing a range of scenarios to test key areas of uncertainty in strategic and project-related demand forecasts.	Early 2020
8	We recommend that DoT: provide more disclosure and transparency around demand forecasting model assumptions and likely error and uncertainty bands when these modelling outputs are used as evidence by key decision-makers to support an investment decision or are included in public announcements or public communications about projects (see Section 2.6)	Agreed. DoT proposes to improve the clarity of its documentation of assumptions, including publishing a data-book of key modelling and economic appraisal inputs in its modelling and economic guidelines. DoT is also reviewing how it can present decision-makers with a range of estimates for a project's impacts, rather than a single summary figure.	Early 2020 Early 2020
9	We recommend that DoT: analyse and explicitly determine passenger load trigger points for the introduction of 10-car High Capacity Metropolitan Trains in the Melbourne Metro Tunnel and allow sufficient timeframes for consequential activities such as any necessary rail network upgrade projects and platform extensions (see Section 3.7)	Agreed. DoT will undertake analysis to explicitly determine the trigger points for the introduction of 10-car High Capacity Metropolitan Trains.	End 2019
10	We recommend that DoT: transmit to the Minister for Planning and, if there are no specific legal impediments or restrictions, publish summaries of key findings and recommended actions from past and future Independent Environmental Auditor reports produced for the Melbourne Metro Tunnel Project on the project's official website (see Section 3.8).	Agreed. DoT will review the legal implications of publishing the proposed information and. subject to those implications, will publish appropriate summaries of previously received audit reports for the Metro Tunnel Project. Summaries of future audit report will be published on a periodic basis.	December 2019 and ongoing

RESPONSE provided by the Secretary, DTF

Department of Treasury and Finance

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Mr Andrew Greaves
Auditor-General
Level 31
35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

PROPOSED PERFORMANCE AUDIT REPORT: MELBOURNE METRO TUNNEL PROJECT – PHASE 1: EARLY WORKS

Thank you for your letter of 13 May 2019 inviting a response to the proposed performance audit report: *Melbourne Metro Tunnel Project – Phase 1: Early works.*

The Department of Treasury and Finance (DTF) notes the findings of the report and supports the recommendations as they relate to DTF.

I note the proposed report collectively directs four recommendations to a combination of DTF, Department of Premier and Cabinet (DPC) and Department of Transport (DoT). My department has worked with DPC and DoT to provide an aligned response to the report's joint recommendations.

A proposed action plan for implementing the recommendations directed at DTF is attached to this letter.

Thank you for the opportunity to consider the proposed draft report.

Yours sincerely

David Martine
Secretary

21 / 5 / 2019

RESPONSE provided by the Secretary, DTF—continued

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Department of Treasury and Finance action plan to address recommendations from the performance audit of Melbourne Metro Tunnel Project: Phase 1 – Early Works

No	VAGO recommendation	Action	Completion date
1	We recommend that the Department of Premier and Cabinet (DPC) and Department of Treasury and Finance (DTF): ensure that project proponents have undertaken sufficient and comprehensive analysis of all sensible and realistic strategic interventions and project options in business cases (see Section 2.5).	Agreed. DTF will continue to promote Investment Lifecycle Guidelines and the Gateway Review Process to encourage departmental business cases to include clear project options and a reasonable spread of project options. DTF will continue to analyse project options in capital asset business cases.	Ongoing
2	We recommend that DPC, DTF and Department of Transport (DoT): review the remaining Melbourne Metro Tunnel Project contingency funds, taking into consideration the construction risks experienced to date and the likely time and complexity pressures expected for the remaining works, and advise government on the sufficiency of these funds (see Section 4.6)	Agreed. DTF notes Government will continue to receive project status reports through the Major Project Performance Report. DTF will work with DoT, DPC and the Office of Projects Victoria to ensure the terms of reference for a Project Assurance Review include a review of Metro Tunnel Project contingency funding.	May 2020
3	We recommend that DPC, DTF and DoT: review and revise the original assumptions contained in the Melbourne Metro Tunnel Project business case, considering the impacts of new rail system projects, and republish the refreshed assumptions in an updated project benefits management plan (see Section 2.6)	Agreed. DTF will work with DoT and DPC on an updated benefits management plan that outlines the impact of subsequent investments on the original assumed benefits.	May 2020
4	We recommend that DPC, DTF and DoT: prior to commencing the next major transport infrastructure project with an early works stage, review the impact of technical interface risks between early and main works packages and, with the Office of Projects Victoria, share with the public sector any lessons learned from the interface issues and risks experienced in the Melbourne Metro Tunnel project (see Section 4.6).	Agreed. DTF will work with DoT, DPC and the Office of Projects Victoria to share lessons learned from an early works review.	December 2019

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RESPONSE provided by the Chief Executive Officer, PTV

PUBLIC TRANSPORT VICTORIA

Ref: DOC/19/219906

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Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VICTORIA 3000

Dear Mr Greaves

Proposed Performance Audit Report – Melbourne Metro Tunnel Project – Phase 1: Early Works

Thank you for your letter of 13 May 2019 inviting a response to the proposed performance audit report *Melbourne Metro Tunnel Project – Phase 1: Early Works.*

Public Transport Victoria (PTV) acknowledges the value of this performance audit, the importance of the Melbourne Metro Tunnel Project and the significant future benefits to the State.

PTV has reviewed the proposed performance audit report and notes the findings and recommendations raised. We note that no specific recommendations are addressed directly to PTV for action. PTV will continue to support the Department of Transport and relevant Agencies to achieve the report recommendations as required.

Thank you for the opportunity to comment on the report.

Yours sincerely

Jeroen Weimar
Chief Executive Officer
Public Transport Victoria

17 / 5 / 19

RESPONSE provided by the Chief Executive, VicTrack

Our Ref: D/19/28311

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves Andrew

PROPOSED PERFORMANCE AUDIT REPORT – MELBOURNE METRO TUNNEL – PHASE 1 – EARLY WORKS

Thank you for your letter of 13 May 2019, and for the opportunity to comment on the proposed report.

We note that there are no specific recommendations for VicTrack. We do not have any comment on the report.

Yours sincerely

Campbell A. Rose AM
Chief Executive
23 /05/2019

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VicTrack

RESPONSE provided by the Chief Executive Officer, Yarra Trams

Keolis Downer | PROUD OPERATOR OF yarra trams

Ref: YTE19H-149
24 May 2019

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street,
Melbourne VIC 3000

Dear Mr Greaves,

Re: Proposed Performance Audit Report for Melbourne Metro Tunnel Project Phase 1: Early Works

Thank you for providing a copy of the above report for Yarra Trams' review.

We note that all previous comments have been addressed and we have no further comments.

We thank you for the opportunity to participate in this process and commend your staff for the professional manner in which they undertook the investigation.

Yours sincerely

Nicolas Gindt
CEO, Yarra Trams

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Auditor-General's reports tabled during 2018–19

Report title	Date tabled
Local Government Insurance Risks (2018–19:1)	July 2018
Managing the Municipal and Industrial Landfill Levy (2018–19:2)	July 2018
School Councils in Government Schools (2018–19:3)	July 2018
Managing Rehabilitation Services in Youth Detention (2018–19:4)	August 2018
Police Management of Property and Exhibits (2018–19:5)	September 2018
Crime Data (2018–19:6)	September 2018
Follow up of Oversight and Accountability of Committees of Management (2018–19:7)	September 2018
Delivering Local Government Services (2018–19:8)	September 2018
Security and Privacy of Surveillance Technologies in Public Places (2018–19:9)	September 2018
Managing the Environmental Impacts of Domestic Wastewater (2018–19:10)	September 2018
Contract Management Capability in DHHS: Service Agreements (2018–19:11)	September 2018
State Purchase Contracts (2018–19:12)	September 2018
Auditor-General's Report on the Annual Financial Report of the State of Victoria: 2017–18 (2018–19:13)	October 2018
Results of 2017–18 Audits: Local Government (2018–19:14)	December 2018
Professional Learning for School Teachers (2018–19:15)	February 2019
Access to Mental Health Services (2018–19:16)	March 2019
Outcomes of Investing in Regional Victoria (2018–19:17)	May 2019
Reporting on Local Government Performance (2018–19:18)	May 2019
Local Government Assets: Asset Management and Compliance (2018–19:19)	May 2019
Compliance with the Asset Management Accountability Framework (2018–19:20)	May 2019
Security of Government Buildings (2018–19:21)	May 2019
Security of Water Infrastructure Control Systems (2018–19:22)	May 2019

Security of Patients' Hospital Data (2018–19:23)	May 2019
Results of 2018 Audits: Universities (2018–19:24)	May 2019
Results of 2018 Audits: Technical and Further Education Institutes (2018–19:25)	May 2019
Child and Youth Mental Health (2018–19:26)	June 2019
Recovering and Reprocessing Resources from Waste (2018–19:27)	June 2019

VAGO
Victorian Auditor-General's Office

All reports are available for download in PDF and HTML format on our website www.audit.vic.gov.au

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