

Metro Tunnel Project: Phase 3 – Systems Integration, Testing and Commissioning

June 2024

Independent assurance report to Parliament
2023–24:22



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Metro Tunnel Project: Phase 3 – Systems Integration, Testing and Commissioning

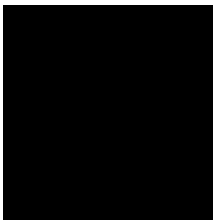
The Hon Shaun Leane MLC
President
Legislative Council
Parliament House
Melbourne

The Hon Maree Edwards MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of the *Audit Act 1994*, I transmit my report *Metro Tunnel Project: Phase 3 – Systems Integration, Testing and Commissioning*.

Yours faithfully



Andrew Greaves
Auditor-General
20 June 2024

The Victorian Auditor-General's Office (VAGO) acknowledges the Traditional Custodians of the lands and waters throughout Victoria. We pay our respects to Aboriginal and Torres Strait Islander communities, their continuing culture, and to Elders past and present.

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Audit snapshot

What we examined

We examined if the Metro Tunnel Project's systems integration, testing and commissioning activities are proceeding as planned.

We assessed the Department of Transport and Planning (the department), Rail Projects Victoria (RPV) as part of the Victorian Infrastructure Delivery Authority, VicTrack, Metro Trains Melbourne, Cross Yarra Partnership, the independent reviewer from AECOM Australia and a list of contractors working on the project detailed in Appendix C.

Why this is important

The Metro Tunnel is a large and complex transport infrastructure project. It aims to increase the metropolitan rail network's capacity to run more trains and make services more reliable.

This audit is an opportunity to assess if the project is progressing as planned during its most complex phase, which involves integrating different systems, such as signalling systems, testing trains in the tunnel and commissioning new assets, such as train tracks.

What we concluded

The department and RPV closely monitor the project. Despite this, the project is delayed.

It is meeting its design and safety requirements, but will not meet the contracted September 2024 completion date.

RPV's revised internal project schedule shows a new completion date in June 2025, which accords with the government's public commitments to open by the end of 2025.

The state will need to pay more to address remaining issues and finish the project. The project has insufficient contingency funds to cover these costs.

The government can apply lessons it has learnt from the Metro Tunnel to deliver other major projects.

What we recommended

We made 3 recommendations to the department and RPV, including:

- updating the project's revised completion date and reviewing how much more funding they need to address the remaining risks
- applying lessons learnt from the Metro Tunnel to other projects
- addressing the remaining impacts of electromagnetic interference.

→ [Full recommendations](#)

Key facts and findings

The government expects to open the Metro Tunnel by the end of 2025



Tests show that technology for the stations and signalling systems is so far working as intended



The government will need to pay more than the revised budget to finish the project

Source: VAGO.

Our recommendations

We made 3 recommendations to address 2 issues. The relevant agencies have accepted the recommendations in full.

Key issues and corresponding recommendations		Agency responses
Issue: The Metro Tunnel Project will not meet the September 2024 completion date in its contract and the state will need to spend more to finish it		
Department of Transport and Planning and the Victorian Infrastructure Delivery Authority	1 Update the government on the revised project schedule and review the Metro Tunnel Project's overall budget and contingency situation to determine what additional funds may be required to complete it (see Section 2).	Accepted
Department of Transport and Planning and the Victorian Infrastructure Delivery Authority	2 Review and apply lessons learnt from the Metro Tunnel Project to other Big Build projects, including but not limited to: <ul style="list-style-type: none">• planning workforce resources and contingencies• governing and assuring projects• building technical capability and capacity (see Section 3).	Accepted
Issue: Delivery agencies still need to mitigate the impact of electromagnetic interference		
Department of Transport and Planning and the Victorian Infrastructure Delivery Authority	3 Work with affected stakeholders to agree on and implement a solution for the remaining equipment affected by electromagnetic interference (see Section 2).	Accepted

What we found

This section summarises our key findings. The numbered sections detail our complete findings, including supporting evidence.

When reaching our conclusions, we consulted with the audited entities and considered their views. The entities' full responses are in Appendix A.

Why we did this audit The Metro Tunnel is central to the government's plan to upgrade Melbourne's rail infrastructure. We have previously done 2 performance audits on the project.

The first audit, which tabled in June 2019, examined the project's strategic planning and early works.

The second, which tabled in June 2022, focused on the main construction works for the tunnel and stations.

Many of the Metro Tunnel's technology systems are linked in terms of access, power and communication. Any installation delays or failed tests in one system could cause cascading delays through other systems, which could delay the Metro Tunnel's opening date.

This audit assesses if the various entities delivering the project:

- have appropriately addressed recommendations from our previous audits
- have comprehensive governance and assurance processes
- can show that testing and commissioning is progressing as planned.

Key project dates In 2017 the state signed contracts to complete the project by 17 September 2024.

The government then announced that it expects to open the Metro Tunnel by the end of 2025, in consideration of factors such as aligning the project with other network upgrades and service timetable changes.

The project's revised internal schedule shows the works will be completed in June 2025 for the Metro Tunnel to open by the end of the year.

In this audit, we use the 17 September 2024 contractual date as the baseline to assess the project's progress. This is because:

- this is the contracted date for the state to complete the project on time
- any delay beyond this date will have financial implications for either the state or the project's contractors.

Our key findings Our findings fall into 3 key areas:

1	The Department of Transport and Planning (the department) and Rail Projects Victoria (RPV) can show that the project is meeting its design and safety requirements.
2	The project will not meet its contracted September 2024 completion date.
3	The state will need to spend more to finish the project.

Key finding 1: The department and RPV can show that the project is meeting its design and safety requirements

Design and safety requirements

The government has set certain design and safety criteria for the Metro Tunnel.

The department and RPV have set up governance arrangements and review processes to assure themselves and the train operator Metro Trains Melbourne (Metro) that the project is meeting these requirements.

This means they can confirm the project is safe for contractors to conduct integration and testing activities including running trains in the tunnel.

RPV

In April 2024 the Major Transport Infrastructure Authority, which includes RPV, merged with the Victorian Health Building Authority to become the Victorian Infrastructure Delivery Authority. RPV was renamed to the Metro Tunnel Project Office.

In this report we refer to the agency delivering the Metro Tunnel as RPV.

Safety requirements

Metro set the safety criteria for the Metro Tunnel and accepts assets as they are completed.

For example, package contractors and independent safety assessors send reports to Metro to show that signalling systems meet safety requirements. Metro then gives contractors permission to test trains in the tunnel.

To date, Metro has been satisfied with the evidence from these reports that the project is meeting its safety requirements.

But Metro told us there have been delays getting some information from contractors. It said contractors need to provide the outstanding information in a timely way so it can accept the ownership transfer of these rail assets on time.

Work packages

The project has 4 key work packages:

- early works to relocate utility services, tram infrastructure works, construction power and prepare construction sites
- tunnel and stations works, including the main tunnelling works, building 5 underground stations, fitting out the stations and installing mechanical and electrical systems
- Rail Infrastructure Alliance-related works, including constructing rail track structures and cut and cover tunnels, reconfiguring and realigning existing tracks and modifying existing rail infrastructure
- Rail System Alliance-related works, including designing, supplying and installing power and operational control systems, signalling and platform screen doors at the 5 underground stations.

Design requirements

The department set the project's high-level design criteria on behalf of the state.

To make sure the project is meeting these criteria, RPV:

- sets the scope and technical requirements for each work package based on the department's criteria
- prepares assurance reports to show the department that the project meets the criteria. These reports include evidence from the independent reviewer, assessors and relevant contractors.

The department assesses RPV's assurance reports to confirm the project has met its design requirements.

RPV provided the department its latest assurance report in March 2023. The report concluded that the project has met its design requirements so far.

The department completed its review in early 2024. It progressively updates its findings as testing data becomes available. It then sends updates to the project's route to acceptance team to show that the project is meeting its requirements.

The department's next assurance review was due to start in March 2024. However, the project is delayed so the department is working with RPV to revise the review timeline based on the new project schedule.

Applying lessons learnt In delivering the Metro Tunnel RPV has applied lessons learnt from similar projects, such as the London Crossrail and the Sydney Metro Northwest projects.

For example, RPV learnt from London Crossrail that a project's structure needs to change when it moves from the construction phase to the testing phase.

As a result, RPV set up a route to acceptance team to:

- focus on integrating systems and testing
- coordinate package contractors.

This has helped the department and RPV foresee and mitigate common risks in major projects. RPV also learnt from the London Crossrail project that it should expect to repeat approximately half of its testing program due to the tests encountering unknown issues.

Completing Arden station earlier than the other stations is a good example of RPV applying lessons learnt from an international project.

To minimise the risk of project-wide delays, RPV accelerated construction and testing at Arden station. RPV can now use Arden station to test complex station systems and processes before rolling them out to the remaining 4 stations.

Key finding 2: The project will not meet its contracted September 2024 completion date

The project's timeline The department and RPV closely monitor the project, address risks and use acceleration measures to bring forward work packages. But the project is delayed.

The project will not meet its contracted September 2024 completion date.

RPV's revised internal project schedule shows a new completion date in June 2025, but notes there is limited contingency for unforeseeable delays.

There are remaining risks, such as electromagnetic interference, that RPV still needs to manage to deliver the project.

Contracted completion date In 2016 the government said in its business case it could deliver the Metro Tunnel by 2026.

Since its *Budget Paper No. 4: State Capital Program 2018–19*, the government has publicly said it will complete the project by the end of 2025.

RPV's contracts with its delivery partners aim to start running passenger services in the tunnel by 17 September 2024.

Delays to the project's September 2024 milestone will add more costs, such as labour expenses.

Delays In March 2024 RPV told us it will not meet its September 2024 completion date.

Its revised internal project schedule says the new date for completing the tunnel is June 2025. This is a 9-month delay.

The schedule also notes that the new date allows for limited contingency. Any delays to critical activities will affect the project's final completion date.

Reasons for delays

There are 3 key issues delaying the project's current phase:

RPV told us that ...	Are ...
resourcing issues, such as not enough construction workers	delaying Cross Yarra Partnership (CYP) from completing the CBD stations, which is having a cascading effect on the rest of the project.
supply chain hold-ups, such as disruptions caused by COVID-19	affecting construction schedules at certain sites.
issues identified during systems testing and integration, such as software errors	requiring contractors to do more testing before continuing further integration activities.

RPV is discussing solutions to these issues with the contractors.

Acceleration measures

CYP is the contractor building the project's tunnel and stations. To reduce delays, RPV has used acceleration measures to incentivise CYP to bring forward selected work packages. For example, by adding workforce resources and increasing shifts.

Some acceleration measures have been effective. For example, early access to Arden station has allowed RPV to complete the station and use it as a 'super lab' for testing.

But CYP could not complete all acceleration measures by the target dates. Issues such as waterproofing in one of the stations caused delays.

This meant RPV could not completely reduce the project's delays.

RPV told us:

- the acceleration measures helped contractors to identify and address issues earlier
- but the measures' scope did not include the construction of the 2 CBD stations, which is the main cause of the delays.

In December 2023 RPV proposed more acceleration measures to reduce further delays. These measures do not require additional funding because they are minor changes to the project's requirements.

CYP is implementing these measures.

Managing remaining electromagnetic interference

Trains moving through the Metro Tunnel will generate electromagnetic interference, which could adversely affect certain medical and scientific equipment in nearby hospitals and research facilities. For example, MRI machines in the Melbourne Biomedical Precinct.

The project's environmental management framework requires RPV and CYP to work with the affected institutions to mitigate the potential impact of electromagnetic interference.

RPV and CYP implemented measures so contractors could start testing trains in the tunnel in July 2023.

But to fully comply with the environmental management framework, RPV and CYP need to address the remaining risks before completing the project. This involves:

- testing how effective their solutions have been so far
- working with the remaining affected hospitals and research facilities to agree on and implement solutions for the remaining impacted equipment.

Any delays to this work will further affect the project's budget and timeline.

Key finding 3: The state will need to spend more to finish the project

Additional costs The state expected RPV to deliver the project on budget, but RPV will not meet its contracted September 2024 completion date.

There is insufficient contingency funding left, which means it will cost the state more to finish the project.

RPV has advised the government of the additional contingency funds it will likely need to complete the project. But as of April 2024 it has not sought more funding to cover the costs.

Cost forecast against the approved budget When the government announced the project in 2016, its total estimated investment (TEI) was \$10.9 billion.

The project's current TEI is \$12.8 billion.

The \$1.9 billion, or 17 per cent, increase is due to an extra:

- \$1.37 billion for a commercial settlement for the tunnel and stations in 2020
- \$166 million to increase the scope of the high-capacity signalling trial
- \$388 million to settle with CYP over COVID-19 delays in 2023.

The project's tunnel and stations works are forecast to cost \$430 million more than its budget.

The government has offset this overrun using savings from the project's rail infrastructure budget and its decision to not do \$236 million of wider network enhancements.

RPV's February 2024 forecast still shows the project's total cost will be \$12.8 billion, which matches the current TEI.

But in March 2024 RPV confirmed the project will not meet its contracted completion date, which will add costs.

RPV told us it will update its forecast after negotiating additional costs with the contractors based on its revised internal project schedule.

Contingency fund In February 2024 RPV confirmed:

- there is insufficient contingency funding left in the project's budget
- the project's current approved TEI (\$12.8 billion) does not include any further funding to address risks.

In its December 2023 major project performance report to the state, RPV advised the government of the additional contingency funds it will likely need to complete the project.

RPV's estimate is mainly driven by the additional costs to finish the project because the project will not meet the September 2024 completion date.

As of April 2024 RPV has not sought more funding to cover these costs.

1.

Audit context

The Metro Tunnel is central to the Victorian Government's plans to upgrade Melbourne's rail infrastructure.

The new tunnel crosses the CBD and bypasses the City Loop to create a continuous line from Sunbury in the north-west to Cranbourne and Pakenham in the south-east.

The project is now in its most complex phase, which involves integrating, testing and commissioning technology systems such as train signals, platform screen doors and CCTV.

The Metro Tunnel Project

Purpose

The Metro Tunnel aims to increase the metropolitan rail network's capacity to run more services by:

- removing 2 busy lines from the City Loop
- introducing high-capacity signalling.

The project includes 5 new underground stations at Anzac, Town Hall, State Library, Parkville and Arden. It aims to improve the community's access to key economic, educational, medical and development precincts.

High-capacity signalling

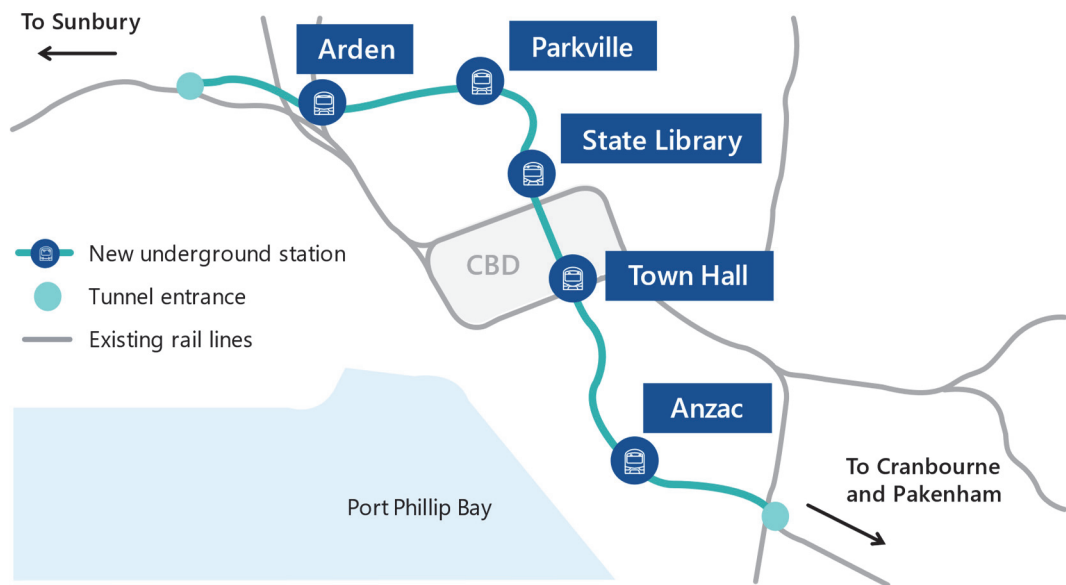
Compared with conventional signalling, which uses track-side posts and lights, high-capacity signalling allows trains to safely travel closer together. Trains running through the Metro Tunnel will be fitted with high-capacity signalling technology, which will allow Metro to run more frequent services.

Tunnel route

Figure 1 shows the Metro Tunnel's route.

Twin 9-kilometre tracks run underground from west of Arden to east of Anzac. They were completed on time in May 2021.

Figure 1: The Metro Tunnel's route



Note: The above drawing is not to scale and is for illustrative purposes only.
Source: VAGO, based on information from RPV.

Current phase

The project entered its most complex phase on 24 July 2023 when the first train entered the tunnel.

Since March 2024, the project has run 12 test trains between West Footscray and Hawksburn, with up to 18 services per hour through the tunnel. This simulates an ordinary service timetable.

The current phase is complex because multiple contractors need to install and test different technology systems at the same time. This includes systems that require access to the same spaces, power sources and communications infrastructure. So a delay to one system could cause cascading delays across the project.

This phase of the project includes:

- installing rail systems (including tracks, traction power and overhead equipment)
- testing moving trains in the tunnel and stations
- commissioning and integrating train and station systems, including platform screen doors
- trialling staff-related operations, such as running a realistic timetable with trained staff and various scenarios.

Platform screen doors

Platform screen doors are gates that separate passengers from trains. They are automated to open and close at the same time as train carriage doors. The Metro Tunnel stations are the first in Victoria to use this technology.

Project roles and responsibilities

Key entities

A combination of public and private entities are delivering the Metro Tunnel.

The department is the client on behalf of the government. And RPV is the government body responsible for delivering the project overall.

Other key entities are ...	Which is responsible for...
CYP	constructing the tunnel and stations.
Rail Network Alliance	constructing infrastructure outside the tunnel as well as rail and signalling systems at stations and along the line.
the independent reviewer	independently certifying completion of design, testing and construction work.
Metro	testing and operating trains in the tunnel and stations.

Appendix C includes more details on each entity's roles and responsibilities.

Project delivery dates

Likely opening date

In 2017 the state entered contracts with key delivery agencies to complete the project by September 2024.

The government announced in its *Budget Paper No. 4: State Capital Program 2018–19* that it expects to open the Metro Tunnel by the end of 2025.

As of April 2024 the project's revised internal schedule shows it will be completed by June 2025.

Key milestone dates

RPV's plan to deliver the project includes 10 key target dates. The last date is the first day of passenger services.

It has achieved 5 targets so far. Targets 1 and 2 were completed on time.

Figure 2 shows the status of the project's key target dates.

Figure 2: The project's key target dates

1	16 March 2022	Final design assurance case	
2	06 October 2022	To commence dynamic tests in tunnels	
3	24 July 2023	Works complete for dynamic tests	
4	02 November 2023	Systems integration testing commences	
5	30 January 2024	Trial operations procedures commence	
6	5 October 2024	Trial operations, reliability growth trips and driver training commence	
7	30 November 2024	Blockades complete	
8	30 March 2025	Last station complete for trial operations	
9	30 March 2025	Dynamic testing complete	
10	29 June 2025	Day 1 train operations	

Note: The dates for targets 1–5 are actual completion dates. The rest are planned dates.
 Source: VAGO, based on RPV's revised internal project schedule as of 12 April 2024.

Our previous reports on the project

2019 audit: early works Our 2019 report, *Melbourne Metro Tunnel Project – Phase 1: Early Works*, looked at aspects of the project's planning and early works.

We found that unexpected cost increases had put pressure on the project's budget and contingency fund.

We recommended that the Department of Premier and Cabinet, the Department of Treasury and Finance and the then Department of Transport review the remaining risk contingency fund.

We also identified some of the project's impacts on external stakeholders, including the risk of electromagnetic interference.

2022 audit: main works

Our 2022 report, *Melbourne Metro Tunnel Phase 2: Main Works*, looked at progress on the tunnel and stations against the project's contracted scope, time, cost and quality targets.

We found the project had experienced cost overruns and time delays. We also noted that further cost and time pressures could arise as the project moved into the systems integration, testing and commissioning phase.

In our 2022 report, we noted electromagnetic interference as a major risk. We found that RPV and CYP had plans to mitigate the impact of electromagnetic interference. But they would not know how effective these solutions were until they tested moving trains in the tunnel.

We made 3 recommendations to RPV, the Department of Treasury and Finance and the then Department of Transport about:

- assessing if the contingency fund was still sufficient
 - addressing known delays to the project's schedule
 - formalising RPV and CYP's proposed solutions to mitigate the impact of electromagnetic interference with the relevant stakeholders.
-

2.

Project timeline and budget

The project will not meet its contracted completion date of 17 September 2024 and the state will need to spend more than the revised budget to complete it.

It may still be on track to open to take passengers by the end of 2025, which accords with the government's public commitment.

RPV has advised the government of the additional contingency funds it will likely need to address risks related to delays and electromagnetic interference.

The project will not meet its contracted September 2024 completion date

The project's timeline

RPV has an integrated program to monitor the project and identify and address risks. But the project is delayed.

The project will not meet its contracted September 2024 completion date.

RPV has revised its internal project schedule with a new June 2025 completion date. The schedule notes there is limited contingency for unforeseeable delays.

There are remaining risks, such as electromagnetic interference, that RPV needs to carefully manage to deliver the project.

Contracted completion date

In 2016 the government said in its business case it could deliver the Metro Tunnel by 2026.

Since its *Budget Paper No. 4: State Capital Program 2018–19*, the government has said it will complete the project by the end of 2025.

RPV's contracts with its delivery partners aim to start running passenger services by 17 September 2024.

Delays to the project's September 2024 date will increase costs, such as labour expenses. But the project is not going to meet this date.

It may still be on track to meet the government's commitment to open to the public by the end of 2025. To achieve this, RPV needs to address any remaining risks that could cause further delays.

The integrated program

Before December 2020 the contractor for each package developed its own construction program.

In December 2020 RPV amended its contract with CYP and introduced an integrated construction program for all work packages.

The integrated program outlines the relevant contractors' roles and responsibilities to meet 6 key milestones to complete the project.

In August 2023 RPV revised these milestones to 10 to make the integrated program more detailed (see Figure 2).

December 2020 contract amendments

During the first years of building and tunnelling, RPV and CYP identified commercial and delivery issues. On 23 December 2020, the state signed settlement and amending deeds with CYP to address them.

CYP and the state agreed to share the extra construction costs.

The state agreed to pay up to a further \$1.37 billion towards the extra construction costs on the condition that CYP meet its contracted milestones. CYP needs to cover its share plus any additional costs from its own financial resources. Our 2022 audit discusses this in detail.

Delays

The independent reviewer assesses CYP's works and certifies if they meet the project's requirements. The reviewer gives a monthly report to RPV and CYP about the results.

The reviewer uses its own site data, CYP's monthly updates to the construction program including progress to date, and other information such as progress trackers provided by CYP and contractors for its review.

As early as September 2019 the reviewer raised concerns that CYP was not completing the works in a timely way. In its recent reports, the reviewer continues to tell RPV that tunnel and stations work packages were getting delayed. It said CYP:

- did not consistently complete its works on time
- based its production rate on optimistic assumptions, which had led to unrealistic program scheduling.

In April 2024 the reviewer noted that the revised internal project schedule largely rectified the unrealistic scheduling, which resulted in a 9-month delay to the final completion date.

RPV is monitoring CYP's progress and is transparent about delays in a dashboard, which it updates monthly for the department. But RPV has not been able to fully address the independent reviewer's concerns about CYP's delays and their effect on the project.

The project's overall delays are due to 3 key issues:

RPV told us that ...	Such as ...	Are ...
resourcing issues	insufficient number of workers to keep up with CYP's planned production rates	delaying CYP from completing the CBD stations, which is having a cascading effect on the rest of the program.
supply chain hold-ups	disruptions caused by COVID-19 and key construction material stuck at the Port of Melbourne	affecting installation schedules at certain sites.
issues identified during systems testing and integration, such as software errors	a faulty supervisory control and data acquisition (SCADA) system affecting the energisation of traction substations	requiring contractors to do more testing before rolling it out to all stations.

SCADA systems

SCADA systems are used in rail operations to monitor and control various processes including train speed, track switch positions, signal statuses and traction power.

RPV told us it is discussing solutions to address these issues with its contractors.

Revising the internal project schedule

In April 2024 RPV and its delivery partners revised the project's internal schedule to reflect its progress to date.

They significantly changed the completion dates for the 2 CBD stations from 30 June 2024 to 31 March 2025.

The revised internal project schedule says the new date for day 1 train operations:

- is June 2025, which is a 9-month delay to the September 2024 date
- allows for limited contingency, which means any delays to critical activities will affect the final completion date.

RPV has taken steps to reduce delays, such as introducing acceleration measures for CYP.

Some of these steps have been successful. But RPV has not been able to completely reduce the delay to the project's completion date.

Acceleration measures helped RPV identify issues but CYP completed some late

Acceleration measures

RPV introduced acceleration measures to incentivise CYP to bring forward selected work packages. For example, by adding workforce resources and increasing shifts.

These measures aimed to reduce the risk of delaying the day 1 train operations milestone.

There were 4 sets of acceleration measures:

- a COVID-19-related arrangement
 - early access to Arden station
 - early track and tunnel system installations
 - providing permanent power at Domain station.
-

COVID-19 acceleration measure

Industry-wide and site-specific COVID-19 shutdowns in late 2021 delayed CYP's construction schedule.

In January 2022 CYP estimated that COVID-19 had caused a 52-day delay.

In February 2022 it gave RPV a new construction schedule with its proposed measures to reduce the delay. The measures included:

- changing CYP's building methods
- increasing CYP's workforce resources
- adding extra shifts
- improving logistics coordination.

CYP also gave RPV an estimated cost of the delays that CYP could claim from RPV because of the shutdowns.

Our 2022 audit recommended that RPV 'finalise its analysis of the COVID-19 impact and time delay mitigations and acceleration proposal delivered by CYP in February 2022 and brief the government on any cost or other implications and, if approved, implement it'.

RPV accepted this recommendation and engaged 3 consultants to assess:

- the pandemic's impact on CYP's construction program between September 2021 and January 2022
- CYP's potential legal entitlement to extend its construction schedule under the contract
- CYP's potential additional construction and financing costs under the extended schedule.

The consultants' reviews show that CYP's estimated costs represented value for money for the state.

RPV has since settled with CYP on all its COVID-19-related delay claims to 30 June 2022. The settlement has let RPV minimise its costs associated with the pandemic.

Other acceleration measures

Besides the COVID-19-related measures, RPV introduced 3 sets of acceleration measures.

Figure 3 summarises:

- their purpose
- the dates in the contract and the accelerated dates
- the days RPV planned to save between the original delivery date and accelerated completion date
- the actual number of days it saved
- payment arrangements.

The acceleration measures helped RPV identify issues, such as:

- a faulty manufacturing part that the contractors needed to replace
- a waterproofing issue, which led to disconnecting and removing a switchgear
- a design compliance issue, which caused confusion about who owned and was responsible for the handling protocol for a rail cable asset.

CYP completed only some acceleration measures by the target dates. This led to the measures saving less time than RPV originally planned.

As a result, RPV could not completely reduce the project's delays. RPV said this is because the acceleration measures' scope did not include the construction of the 2 CBD stations, which is the main cause of delays.

Figure 3: RPV's acceleration measures for CYP

	Acceleration measures		
	Track and tunnel system installation works	Permanent power at Domain station	Early access to Arden station
Purpose	To resolve potential coordination issues and give contractors more time for critical testing activities	To provide a stable supply of electricity to critical equipment to reduce risks during testing	To make Arden station accessible earlier for testing
Original delivery date	30 May 2023	17 July 2023	30 April 2024
Planned accelerated completion date	Track installation: 28 February 2023 Tunnel system installation: 11 March 2023	Preparation works: 30 April 2023 Permanent power: 15 June 2023	1 November 2023
Actual completion date	Track installation: 22 April 2023 Tunnel system installation: 4 May 2023	Preparation works: 31 August 2023 Permanent power: 16 September 2023	22 December 2023
Days planned to save (natural days)	91	32	181
Actual days saved (natural days)	38	-45 [^]	130
Base payment (\$ million)	20.0	6.3	31.1
Time-based payment* (\$ million)	5.0	0.8	3.7

Note: [^]The delay took CYP an additional 45 days to complete the work compared to its original delivery date.

*Time-based payment is an incentive payment if CYP delivered the required work by the accelerated completion date.

Source: VAGO, based on information from RPV.

Additional acceleration measures

In December 2023 RPV and CYP agreed to introduce more acceleration measures.

These are minor changes to the project's requirements that will not add any more costs. The measures:

- streamline review processes for certifying construction works
- revise the handover schedule for completed assets so other contractors can integrate some systems faster.

For example, one measure requires CYP to include the independent reviewer in its program review meetings with the state. This allows the reviewer to have better visibility over the works' progress and any measures that CYP needs to introduce to reduce delays.

Another measure requires CYP to report to RPV and other contractors on the re-sequenced activities in the program schedule. This allows CYP to hand over some assets to the Rail Network Alliance earlier.

CYP is currently implementing these measures.

The state will need to spend more to finish the project

The project's budget and contingency fund

The state expected RPV to deliver the project on budget.

But if RPV does not meet its contracted September 2024 completion date to complete the tunnel, the government will need to spend more to finish it.

This is because delays will add more costs, such as labour expenses. And there is insufficient contingency funding left in the budget.

RPV has advised the government of the additional contingency funds it will likely need to complete the project. But as of April 2024, it has not sought more funding to cover the costs.

Approved budget

When the government announced the project in 2016, its TEI was \$10.9 billion.

The project's current TEI is \$12.8 billion.

The \$1.9 billion, or 17 per cent, increase is due to the state adding:

- \$1.37 billion for a commercial settlement with CYP for the tunnel and stations in 2020
 - \$166 million to increase the scope of the high-capacity signalling trial
 - \$388 million to settle with CYP on the COVID-19 related delays in 2023.
-

Project cost to date and forecast

Our 2019 and 2022 audits examined the project’s overall performance against its budget by project component.

Figure 4 shows RPV's forecast final costs as of February 2024.

Figure 4: The project's 2022 approved budget compared to RPV's February 2024 forecast by project component (\$ million)

Project component	2022 approved budget	2024 forecast final cost	Forecast variance
Early works	652.9	634.7	-18.3 (-2.8%)
Land acquisitions	715.5	658.2	-57.3 (-8.0%)
Rail Systems Alliance	1,594.6	1,580.3	-14.3 (-0.9%)
Rail Infrastructure Alliance	1,180.0	1,003.0	-177.0 (-15.0%)
Wider network enhancements	189.5	96.2	-93.3 (-49.3%)
Tunnel and stations	7,491.6	7,921.6	430.0 (5.7%)
Project management	1,001.2	931.3	-69.8 (-7.0%)
Total	12,825.3	12,825.3	0

Note: Project management includes the 'program-wide common costs' and 'program management/Office of the Coordinator-General' budget components. Rail Systems Alliance includes the 'system integration and testing' budget component. Some numbers and percentages may not add up due to rounding. Source: VAGO, based on RPV's data from February 2024.

Figure 5 shows key changes in the project's overall budget and forecast since 2016.

The tunnel and stations component is forecast to cost \$430 million more than its June 2022 budget.

RPV has offset this:

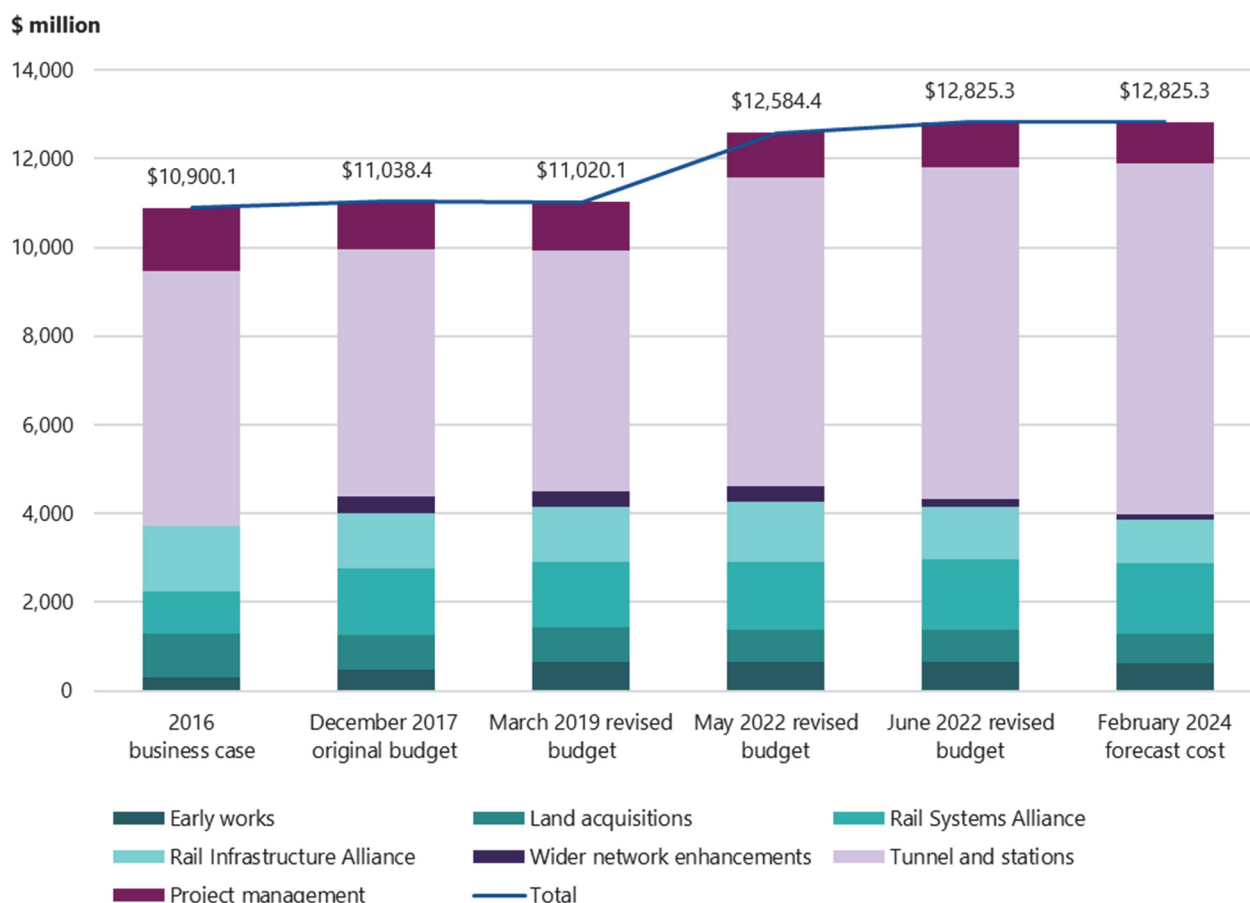
- with \$177 million of savings within the rail infrastructure budget component
- by moving \$236 million of network enhancements to sit under other related projects (which we identified in our 2022 audit).

But RPV's final cost forecast is out of date because it has confirmed the project will not meet the contracted September 2024 completion date.

This means the total cost of the project will be more than \$12.8 billion.

In March 2024 RPV told us it is negotiating additional costs with contractors based on its revised internal project schedule. It said it will update its forecast when it has finalised these agreements.

Figure 5: Changes in the project's overall budget and forecast cost since 2016



Note: Project management includes the 'program-wide common costs' and 'program management/Office of the Coordinator-General' budget components. Rail Systems Alliance includes the 'system integration and testing' budget component. Source: VAGO, based on RPV data.

Contingency fund

Our 2022 audit recommended that RPV 'conduct a comprehensive, bottom-up review of the overall project budget and contingency situation to determine what additional funds might be required'.

RPV accepted this recommendation in June 2022. It reviewed the project's overall budget and contingency fund in June 2023.

In March 2024 RPV told us that there is insufficient contingency funding left in the project's budget to manage known risks and issues, such as costs associated with project delays and the impact of electromagnetic interference.

This means RPV will need to seek more funding from the government to cover the additional costs, such as labour expenses, to finish the project.

It has advised the government of the additional contingency funds it will likely need to complete the project. But as of April 2024 it has not sought more funding to cover the costs.

Further work is needed to address the impact of electromagnetic interference

Electromagnetic interference Trains travelling through the Metro Tunnel will generate electromagnetic interference, which could adversely affect medical and scientific equipment in nearby hospitals and research facilities.

The project's environmental management framework requires RPV and CYP to work with affected institutions to address the potential impact of electromagnetic interference. This work is ongoing.

As shown in Figure 6, the affected institutions are near to the Parkville and State Library stations. They are:

- Royal Melbourne Hospital
- Royal Women’s Hospital
- Peter MacCallum Cancer Centre (Peter Mac)
- University of Melbourne
- Peter Doherty Institute
- RMIT University (RMIT).

Figure 6: Institutions affected by electromagnetic interference



Note: The above drawing is not to scale and is for illustrative purposes only. Source: VAGO, based on information from RPV.

RPV, CYP and the affected institutions do not have agreed solutions for several pieces of equipment. And they need further evidence to confirm if their other solutions are effective.

Solutions to mitigate electromagnetic interference

Our 2022 audit recommended that RPV 'formalise the implementation of proposed electromagnetic interference mitigations with relevant external parties to allow for installation and commencement of technical solutions before train testing commences in the tunnel in June 2023'. RPV accepted this recommendation.

During the tunnel's construction, integration and testing, RPV has managed electromagnetic interference by coordinating project activities with the affected institutions' treatment requirements.

But when passenger trains start running, RPV will need a more permanent solution.

A major part of RPV's solution involves relocating MRI services at the Royal Women's Hospital, Royal Melbourne Hospital and Peter Mac.

RPV has relocated the Royal Women's Hospital's MRI service to a different floor.

The Royal Melbourne Hospital is relocating its MRI services to a new MRI department. The hospital is currently building a lift to give ICU patients access to the department. In the meantime, it is providing MRI services to these patients at Melbourne Private Hospital.

Peter Mac has temporarily moved its MRI services from its Parkville centre to its East Melbourne centre and the Royal Melbourne Hospital's new MRI department.

RPV is working with Peter Mac and the Royal Melbourne Hospital to find permanent solutions.

This includes a trial with Peter Mac to test if magnetic active cancellation systems (MACS) could permanently address the remaining risks to Peter Mac's MRI machines and the Royal Melbourne Hospital's intraoperative MRI machine. Figure 7 explains this in detail.

RPV and RMIT have agreed on solutions for 16 items of sensitive equipment. But they still need to progress the work for RMIT's transmission electron microscopes.

As of February 2024, the cost to address electromagnetic interference issues is \$179 million. This includes total committed costs to date and RPV's current estimate for future works.

Appendix D shows the status of electromagnetic interference mitigations for the affected institutions, including their completion status.

Figure 7: Case study: trialling MACS for MRI machines

MACS have previously been used to protect sensitive medical and scientific equipment from electromagnetic interference, including from Melbourne's trams.

But there are limited examples where MACS have effectively shielded MRI machines from the level of electromagnetic interference expected from trains travelling in the Metro Tunnel.

To assess if MACS can effectively reduce the impact of the tunnel's electromagnetic interference, RPV has provided funding to:

- install a MACS at Peter Mac's original MRI facility in Parkville
- engage independent specialists to monitor the equipment during stress testing, where RPV increases the tunnel's power to produce more electromagnetic interference than it expects from passenger services.

The specialists are providing Peter Mac and the Royal Melbourne Hospital with the data from these tests and consulting with the manufacturer of their MRI machines.

To date, Peter Mac and the Royal Melbourne Hospital have not accepted MACS as a permanent solution for their MRI machines. The April 2024 testing also shows inconclusive results on the effectiveness of MACS.

RPV is working with stakeholders to explore more options and has planned further testing for June 2024.

Source: VAGO, based on information from RPV and the relevant stakeholders.

Remaining electromagnetic interference risks

There are several remaining electromagnetic interference risks that could affect the project's budget and timeline.

If ...	Then RPV may need to ...
the agreed solution for RMIT's transmission electron microscopes is not effective or RMIT does not accept it as effective	provide funding to relocate the equipment.
RPV's modelling has underestimated the impact of electromagnetic interference so its solutions for the University of Melbourne's and RMIT's equipment are not fully effective	look into new solutions, which could cost more and delay the project.
the MACS trial at Peter Mac's original MRI facility does not effectively reduce the tunnel's electromagnetic interference	permanently relocate Peter Mac's MRI machines to another facility.
RPV needs to do more work to finish relocating MRI machines	spend more than it planned to.

RPV and CYP are monitoring these risks and working with the relevant stakeholders.

But they will need to explore more options if the Royal Melbourne Hospital finds that installing MACS will not effectively shield its intraoperative MRI machine from electromagnetic interference.

Funding for remaining electromagnetic interference risks

RPV estimates that the likelihood of the remaining risks happening varies from 10 to 50 per cent.

It has advised the government on the additional funds it will need to mitigate them.

To avoid requesting this funding through the state's Budget process, RPV has proposed the government transfers this work from the project's scope to the Sunbury Line Upgrade. This is because:

- electromagnetic interference is a network-wide issue that goes beyond the Metro Tunnel
- the Sunbury Line upgrade has unspent contingency funding to absorb some unfunded electromagnetic interference costs.

In June 2023 the state approved RPV's proposal.

But regardless of which project the funding comes from, the government will need to spend more money to address these unanticipated electromagnetic interference issues.

3.

Project governance, assurance and lessons learnt

The department and RPV have governance structures to oversee the project, monitor its progress and address risks.

They have also set up assurance processes and can demonstrate that the project is meeting its design and safety requirements.

RPV has applied lessons learnt from other rail projects to reduce some foreseeable risks.

The department and RPV have governance structures to monitor progress and address risks

Governance structures

The project is currently at its most complex phase, which requires RPV to have visibility of the entire project.

The department and RPV have set up a governance framework that helps them:

- oversee the project's progress
- coordinate work packages
- verify the works meet the government's design and safety requirements
- intervene to address emerging risks.

The project's contractors can also raise issues to a joint committee that governs the interfacing works. The committee meets weekly and includes representatives from each work package contractor.

The department is accountable for Victoria's transport network. It works collaboratively with RPV and other transport operators to make sure major transport projects, including the Metro Tunnel, meet its requirements.

Monitoring progress and addressing risks

RPV monitors the project's progress and identifies and addresses risks by:

- providing weekly progress reports to the department, CYP, Rail Network Alliance, Metro and other stakeholders
- using its weekly reports to outline major risks and proposed solutions
- tracking the progress of proposed solutions against identified risks
- updating a monthly project dashboard that:
 - assesses risks to the project's cost, time, scope and approvals for the department
 - informs RPV's major project performance reporting, which RPV provides to the department and Cabinet every quarter.

RPV's reporting highlights issues that could affect the project's progress to contractors, stakeholders and the government.

The department and RPV can demonstrate that the project is meeting its design and safety requirements

Design and safety requirements

To make sure it is safe to test and open to passengers, the Metro Tunnel must meet design and safety requirements.

The department set the project's high-level requirements, including its objectives and the specifications for its systems.

Based on these requirements, RPV set the scope and technical requirements for each work package.

Metro set the project's safety criteria, including requirements for:

- testing trains and running services
 - signalling systems
 - station and platform structures
 - emergency protocols.
-

Making sure the project meets requirements

The department and RPV have processes to check the project meets its design and safety requirements.

These processes include design and safety reviews at each key stage of the project.

The department and RPV get:

- the route to acceptance team to review design requirements
- Metro to review safety requirements.

The reviewers consider evidence from ...	To ...
the work package contractors	identify issues: <ul style="list-style-type: none">• with individual work packages• between multiple work packages.
the independent reviewer	get an objective opinion on a package contractor's evidence and the project's compliance with the requirements.

These processes mean:

- the reviewers can conduct balanced and objective reviews
 - the department and RPV can have confidence in their design and safety assurance processes.
-

Meeting safety requirements

Metro requires work package contractors to submit evidence at each key stage of the project.

It uses this evidence to assess if completed works meet its safety requirements.

There are 6 key stages in the works program. Each stage has its own criteria.

Metro will only approve a work package to progress to the next stage when the contractors' evidence satisfies these criteria.

Metro requires the following evidence:

- assurance and safety reports from each work package contractor and the route to acceptance team
- reports from each contractor that summarise the work package's emerging business impact, commercial readiness and residual risks
- certificates from the independent reviewer and letters of support from other independent assessors.

In March 2024 Metro told us it is satisfied that the built assets are safe to run. This is based on the evidence it has received from contractors to date, which includes testing results.

But Metro told us there have been delays getting some evidence from contractors, including testing results. It said contractors need to provide the outstanding information in a timely way so it can accept ownership transfer of the rail assets on time.

This is consistent with the independent reviewer's reports, which say that contractors need to provide documents on time so it can certify they have completed work packages.

Meeting design requirements

To show the project meets its scope and technical requirements, RPV produces an assurance report for the department at each project stage.

RPV uses evidence to support these reports from:

- assurance reports from work package contractors and the independent reviewer
- additional reports at the end of each key project stage from the relevant contractors and RPV's route to acceptance team.

In March 2023 RPV gave the department its project assurance report on meeting critical design requirements. The report describes the processes RPV and its contractors have set up to make sure the project is meeting the requirements. It concluded that so far, the project is meeting its design requirements for operations and maintenance.

The department assesses each of RPV's assurance reports to confirm:

- the project is meeting its scope and technical requirements
- the completed assets are meeting the government's requirements.

The department completed its review in early 2024. It progressively updates its findings as testing data becomes available. It then sends updates to the project's route to acceptance team to show that the project is meeting its requirements.

The department's next assurance review was due to start in March 2024. However, the project is delayed so the department is working with RPV to align the timing of the review with the revised project schedule.

Managing noncompliance

RPV has procedures for monitoring and managing work packages that do not meet the project's requirements.

Work package contractors are responsible for reporting noncompliance to RPV and proposing solutions.

RPV then:

- monitors noncompliance using a live reporting system
- reviews the contractor's proposed solutions, which can involve making minor changes to the project's requirements if necessary
- reports aggregated data on noncompliance to the department on a quarterly basis.

This allows RPV to oversee noncompliance issues across the project to help resolve them and reduce their effect on the project's cost and timeline.

RPV has applied lessons learnt from similar projects to address foreseeable risks

Lessons learnt RPV considered lessons learnt from similar projects to plan the Metro Tunnel project. In particular, it looked at the London Crossrail and the Sydney Metro Northwest projects.

RPV applied these lessons by:

- using a single delivery program to better coordinate work packages
- setting up a route to acceptance team to focus on integrating systems early
- unifying the Rail System Alliance and Rail Infrastructure Alliance to reduce the risk of issues where their work packages overlap.

This has helped RPV reduce some foreseeable risks.

For example, it completed Arden station earlier than the other stations to use it as a 'super lab' for testing. It based this on a lesson learnt from London's Crossrail project. As Figure 8 shows, this helped RPV identify issues and apply lessons to the remaining stations.

Figure 8: Case study: using Arden station as a 'super lab' for early testing

RPV learnt from London's Crossrail project that it should expect to repeat approximately half of its testing program due to the tests encountering unknown issues.

To minimise the risk of project-wide delays, RPV accelerated construction and testing at Arden station.

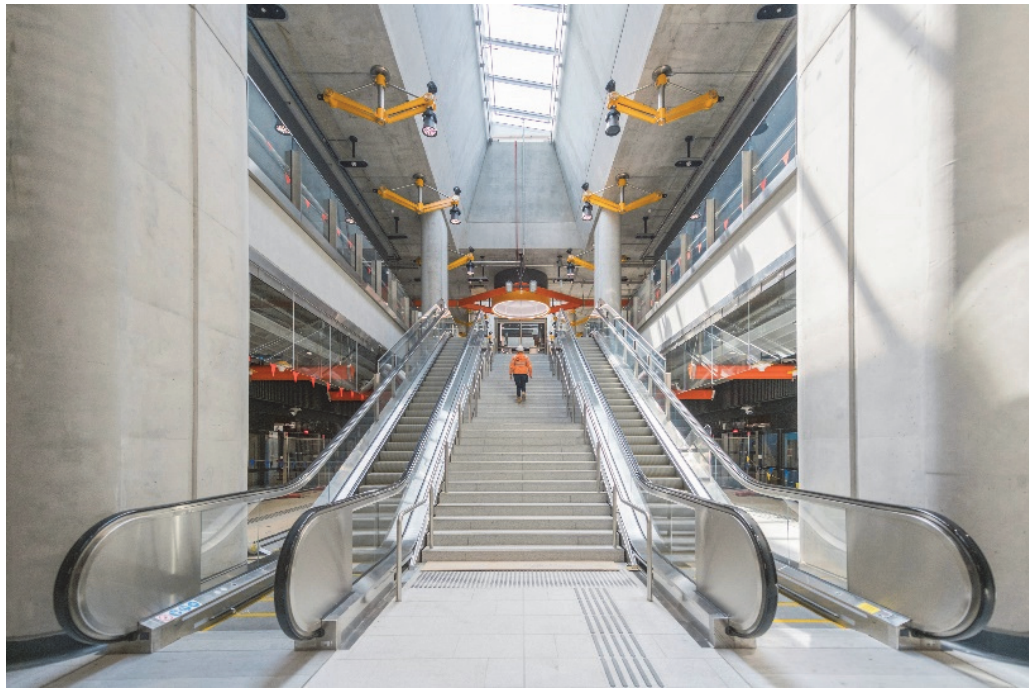
RPV has used Arden station to test complex systems and processes before rolling them out to the remaining 4 stations.

Testing at Arden station has helped RPV to identify issues early. For example, it has needed to:

- redesign the security interface between station room doors
- recruit more technical experts to run certain tests
- redevelop fire testing systems, which involved rewriting the software for running lifts and escalators in fire mode.

Using Arden station as a 'super lab' for early testing has allowed RPV to apply its own lessons to deliver the remaining 4 stations.

RPV plans to have a lessons learnt session with the project's delivery partners to consolidate its learnings from Arden station.



Source: VAGO, based on information from RPV. Image of Arden station from RPV.

Appendices

Appendix A: Submissions and comments

Appendix B: Abbreviations, acronyms and glossary

Appendix C: Audit scope and method

Appendix D: Equipment impacted by electromagnetic interference

Appendix A:

Submissions and comments

We have consulted with the Department of Transport and Planning, Victorian Infrastructure Delivery Authority (including RPV), CYP, the independent reviewer, AECOM Australia, Alstom, CPB Contractors, John Holland Group, Metro Trains Melbourne and VicTrack, and we considered their views when reaching our audit conclusions. As required by the *Audit Act 1994*, we gave a draft copy of this report, or relevant extracts, to those entities and asked for their submissions and comments.

Responsibility for the accuracy, fairness and balance of those comments rests solely with the entity's accountable officer.

Responses received

Agency	Page
Department of Transport and Planning and Victorian Infrastructure Delivery Authority	A-2
Metro Trains Melbourne	A-5

Response provided by the Secretary, Department of Transport and Planning on behalf of the department and the Victorian Infrastructure Delivery Authority



Department of Transport and Planning

GPO Box 2392
Melbourne, Victoria 3001 Australia

Ref: BSEC-1-24-2029

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

Dear Mr Greaves

Victorian Auditor-General's Office - Metro Tunnel Project: Phase 3 – systems integration, testing and commissioning - Proposed report

Thank you for your letter dated 8 May 2024 enclosing the proposed report (**Report**) relating to the above performance engagement.

The Metro Tunnel Project (**Project**) will create a new end-to-end rail line from Sunbury to Cranbourne / Pakenham, with bigger and more modern trains and five new underground stations. Next-generation signalling technology will be used to run the trains, allowing for turn-up-and-go services during peak times. It will give people better access to jobs, education and healthcare and direct access to new destinations, including Anzac Station on St Kilda Road, Melbourne's major health and education precinct at Parkville Station and the Arden renewal precinct in North Melbourne.

Work on the Project is well advanced. Excavation of the twin nine-kilometre tunnels was finished in May 2021 after 20 months of tunnelling. This phase of the Project was completed safely and on program, a remarkable engineering feat especially considering the significant impacts of the COVID-19 pandemic on the construction industry during this time.

The twin tunnels have since been fitted out with systems and equipment, including 15.5 kilometres of elevated steel walkway for safety and maintenance access, more than 474 kilometres of electrical and fibre cables and more than 19.5 kilometres of overhead lines to power the trains. Major construction has been completed at two of the five underground stations – Arden and Parkville – with the remaining three stations – Anzac, Town Hall and State Library – due for completion later this year.

The Project is now in its most complex stage, with meticulous testing and commissioning of the complex tunnel and stations systems underway. Test trains have been running through the tunnels since July 2023 with more than 18,000km of testing in the tunnels completed to date, and high capacity signalling is already in use for passenger services on parts of the Cranbourne and Pakenham line.

The Department of Transport and Planning (DTP) and the Victorian Infrastructure Delivery Authority (VIDA) welcome your conclusion that the Project is being delivered in accordance with its design and safety requirements, as a result of the robust assurance framework which is in place for the Project. DTP and VIDA also welcome the finding that the Metro Tunnel Project Office (MTPO) has been applying lessons learned from other major projects



Response provided by the Secretary, Department of Transport and Planning on behalf of the department and the Victorian Infrastructure Delivery Authority – continued

including Crossrail and Sydney Metro, to ensure the Project is being delivered as efficiently as possible.

DTP and VIDA accept the three recommendations outlined in the Report and have provided proposed action plans for implementing the recommendations which are enclosed with this letter. While DTP and VIDA accept the Report's recommendations, it is appropriate to take this opportunity to provide some additional comments on some of the Report's findings:

- DTP and VIDA do not agree with the Report's findings that the Project is delayed. In 2018, the Government approved a completion date for the Project of end 2025, which was a year ahead of the original 2026 completion date envisaged by the Metro Tunnel Project Business Case. On any project of this scale and complexity, with complex commercial and contractual arrangements and associated delivery milestones, along with complex package interfaces to manage, the delivery program will require flexibility throughout the course of the project. While delivery program and milestones have shifted throughout the course of the Project, the Project is on track to being operational by the end of 2025, in line with the Government's commitment.
- Following the COVID-19 pandemic, MTPO implemented a number of program accelerations designed to avoid delays and ensure the Project continued to be delivered in accordance with its budget and program. These accelerations provided significant benefit to the State in avoiding potential lengthy delay claims by contractors and in supporting early identification and resolution of issues. The impact of the measures on keeping the Project on track has been significant.
- The Project is currently in its most complex phase of delivery, with many risks and issues that need to be managed through to project completion. MTPO is working closely with its contractors and with Government to monitor these risks, understand their impact, and ensure they are appropriately managed.
- Lessons Learned from the Project are being documented, shared and applied across the VIDA program, through formal governance processes as well as multiple communities of practice in key project discipline areas. This process will continue, ensuring that projects currently in delivery and those in the future including the Suburban Rail Loop can be delivered as effectively and efficiently as possible.

DTP and VIDA remain focussed on the success of this critical city-shaping project, and to delivering it in line with the Government's commitment by the end of 2025. DTP and VIDA thank you for the opportunity to engage with VAGO throughout all three performance engagements VAGO has conducted on the Metro Tunnel Project.

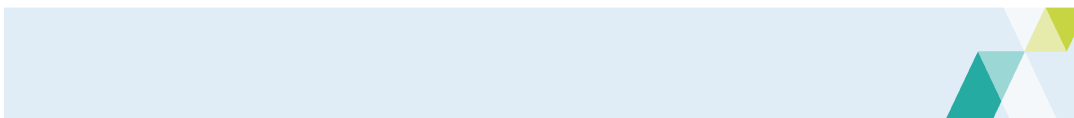
Yours sincerely



Secretary
Department of Transport and Planning

22 May 2024





Metro Tunnel Project: Phase 3 – systems integration, testing and commissioning

Department of Transport and Planning & Victorian Infrastructure Delivery Authority – Joint action plan

No.	VAGO Recommendation	DTP/VIDA Action	Due date
1	Update the government on the revised project schedule and review the Metro Tunnel Project’s overall budget and contingency situation to determine what additional funds may be required to complete it.	Accepted MTPO and DTP will continue to forecast and report to Government on a contingency position and collaborate with Government and central agencies regularly to ensure an aligned understanding of the project schedule and the range of any additional risk contingency funds which may be required to complete the project.	31 December 2024
2	Review and apply lessons learnt from the Metro Tunnel Project to other Big Build projects, including but not limited to: <ul style="list-style-type: none"> • Planning workforce resources and contingencies • Governing and assuring projects • Building technical capability and capacity 	Accepted Lessons learned from MTP are documented, shared and applied across VIDA and DTP, through formal governance processes as well as multiple communities of practice in key project discipline areas. Lessons learned from MTP are particularly relevant for major transport and tunnelling projects, including the Suburban Rail Loop. MTPO has and will continue to actively and closely engage with the Suburban Rail Loop Authority to share lessons learned as the project progresses.	31 December 2025
3	Work with affected stakeholders to agree on and implement a solution for the remaining equipment affected by electromagnetic interference.	Accepted MTPO and DTP will continue to work with contractors and stakeholders to agree and implement any remaining EMI mitigations required prior to completion of MTP.	31 December 2025



Ref: MTM-702

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

BY EMAIL: [REDACTED]

14/05/2024

Dear Mr Greaves,

METRO TUNNEL PROJECT (MTP)
Proposed Report MTP: Phase 3– systems integration, testing and commissioning

We refer to the document titled 'Metro Tunnel Project: Phase 3 – systems integration, testing and commissioning – Independent assurance report to Parliament' issued by the Victorian Auditor-General's Office (VAGO) to Metro Trains Melbourne (MTM) on 8 May 2024 (Proposed Report).

We have reviewed the Proposed Report and confirm that we have no additional matters that we wish to raise with VAGO for inclusion in the report.

Thank you for the opportunity to review and comment on the Proposed Report and we look forward to receiving a copy of VAGO's final report.

Yours sincerely,

[REDACTED]

Raymond O'Flaherty
Chief Executive Officer, Metro Trains Melbourne

c.c. Mike Moyes, Director – Metro Tunnel Transition

[REDACTED]

Pallavi Khanna, Head of Internal Audit & Enterprise Risk – Finance & Commercial

[REDACTED]

Incoming Ref: 34827 24

METRO TRAINS MELBOURNE
GPO BOX 1880
Melbourne VIC Australia 3001

Office of the CEO
Phone: +61 3 9610 3644
ABN 43 136 429 948

Appendix B:

Abbreviations, acronyms and glossary

Abbreviations We use the following abbreviations in this report:

Abbreviation

the department	Department of Transport and Planning
Metro	Metro Trains Melbourne
Peter Mac	Peter MacCallum Cancer Centre
the project	Metro Tunnel Project
RMIT	RMIT University

Acronyms We use the following acronyms in this report:

Acronym

CYP	Cross Yarra Partnership
MACS	magnetic active cancellation system
RPV	Rail Projects Victoria
SCADA	supervisory control and data acquisition
TEI	total estimated investment
VAGO	Victorian Auditor-General's Office

Glossary This glossary includes an explanation of the types of engagements we perform:

Term

Reasonable assurance	We achieve reasonable assurance by obtaining and verifying direct evidence from a variety of internal and external sources about an agency's performance. This enables us to express an opinion or draw a conclusion against an audit objective with a high level of assurance. We call these audit engagements. See our assurance services fact sheet for more information.
Limited assurance	We obtain less assurance when we rely primarily on an agency's representations and other evidence generated by that agency. However, we aim to have enough confidence in our conclusion for it to be meaningful. We call these types of engagements assurance reviews and typically express our opinions in negative terms. For example, that nothing has come to our attention to indicate there is a problem. See our assurance services fact sheet for more information.

Appendix C:

Audit scope and method

Scope of this audit

Who we examined We examined the following agencies:

Agency	Their key responsibilities
Public sector agencies	
The department	The department is the 'client' for the project and sets the project scope and intended network benefits on behalf of the government.
Victorian Infrastructure Delivery Authority, formerly the Major Transport Infrastructure Authority (including RPV)	<p>The Major Transport Infrastructure Authority is responsible for facilitating the development and delivery of the Big Build program.</p> <p>RPV is part of the project and is responsible for all delivery aspects of the project, including procurement, construction and the project commissioning phase.</p> <p>RPV is also a participant in the Rail Network Alliance.</p> <p>RPV was renamed to the Metro Tunnel Project Office in April 2024.</p>
VicTrack	<p>VicTrack is the residual owner of all transport assets in Victoria.</p> <p>VicTrack also provides telecommunication services for the rail network.</p> <p>In the project, VicTrack is responsible for the design, review, inspection and acceptance of telecommunications infrastructure assets.</p>
Associated entities	
CYP	<p>CYP is delivering the tunnel and stations work package through a private–public partnership contract with the state.</p> <p>The main works contract is an 'availability' private–public partnership, which requires CYP to:</p> <ul style="list-style-type: none"> • finance, design and build the new tunnel and stations • maintain the infrastructure to applicable standards for 25 years after the project's practical completion. <p>CYP is responsible for delivering tunnelling works, 5 underground stations, station fit-out, mechanical and electrical systems, and maintenance services specified in the contract.</p>
John Holland Group	<p>John Holland Group is involved in various areas of the project.</p> <p>It is:</p> <ul style="list-style-type: none"> • a partner in CYP and a member of the joint venture of the Design and Construction Subcontractor to design and construct the tunnel and stations private–public partnership works • the maintenance subcontractor for the 25-year maintenance phase of the tunnel and stations private–public partnership works • a contractor in the Rail Network Alliance, as the specialist installer of the project's rail systems.
AECOM Australia	<p>AECOM Australia provides design services as the lead designer for the Rail Network Alliance surface works in respect to the Rail Infrastructure Alliance.</p> <p>This includes tunnel entrances, brownfield rail network enhancements and station improvements.</p>
Alstom	Alstom provides the technology systems that run communications-based train control, which is the backbone of the new high-capacity signalling system implemented as part of the project.

Agency

Their key responsibilities

CPB Contractors	CPB Contractors is a contractor and delivers all site construction services, including civil works. It also leads the design, supply, installation, testing, integration and commissioning activities for train and power control systems, operational control systems, and high capacity and conventional signalling on the new Sunbury to Cranbourne/Pakenham line.
Metro	Metro is Melbourne's metropolitan train franchisee. It will test and then operate trains in the Metro Tunnel. Metro is an accredited rail transport operator and confirms that any metropolitan rail network changes comply with its Office of the National Rail Safety Regulator accreditation.
Independent reviewer (AECOM Australia)	The independent reviewer is a team of senior and experienced engineers, planners and architects led by AECOM Australia. Its role is jointly appointed by CYP and RPV to verify and validate works and interfaces on the project. The reviewer is responsible for certifying CYP works, including design, installation, testing and construction. It also reviews the construction program and certifies any works done by CYP on behalf of the Rail Network Alliance.

Our audit objective

To determine whether the Metro Tunnel Project's systems integration, testing and commissioning activities are proceeding as planned.

What we examined

We examined if the various entities involved in delivering the project:

- have appropriately addressed our previous audit recommendations for the project
 - have comprehensive governance and assurance processes
 - can show that testing and commissioning is progressing as planned.
-

Conducting this audit

Assessing performance

To form our conclusion against our objective we used the following lines of inquiry and associated evaluation criteria:

Line of inquiry	Criteria
1. Have the department and RPV within the Major Transport Infrastructure Authority actioned the recommendations in our 2022 audit?	1.1 RPV's current Metro Tunnel Project budget and forecast covers actual expenses and any future cost exposures.
	1.2 RPV monitors post-COVID-19 acceleration measures and can confirm that the lost time has been recovered.
	1.3 The department and RPV have agreed with impacted stakeholders on the mitigations for potential electromagnetic interference impacts and are implementing the agreed actions.
2. Are the systems integration testing and commissioning activities progressing according to their timeline, budget and scope?	2.1 RPV can demonstrate that the following systems integration testing and commissioning activities are progressing as per the project's timeline and budget: <ul style="list-style-type: none">tunnel and stations testing and commissioningrail systems integrationdynamic train testing.
	2.2 RPV applies lessons learnt, monitors and oversees contractors' systems integration testing and commissioning activities to identify and address any emerging risks.
	2.3 The department and RPV can demonstrate that the project's built assets and systems comply with the project scope and technical requirements.
	2.4 The department and RPV can demonstrate that the built assets and systems progressively meet the franchisee's acceptance requirements.

Our methods

As part of the audit we:

- reviewed and analysed documentation, including data from RPV
- reviewed and analysed RPV's risk contingency, budget and forecast reporting
- consulted with affected external stakeholders
- met with relevant key staff at each department and associated entity.

Compliance

We conducted our audit in accordance with the *Audit Act 1994* and ASAE 3500 *Performance Engagements* to obtain reasonable assurance to provide a basis for our conclusion.

We complied with the independence and other relevant ethical requirements related to assurance engagements.

We also provided a copy of the report to the Department of Premier and Cabinet and the Department of Treasury and Finance.

Cost and time

The full cost of the audit and preparation of this report was \$540,000.

The duration of the audit was 10 months from initiation to tabling.

Appendix D: Equipment impacted by electromagnetic interference

Status of electromagnetic interference mitigations

Institution	Impacted equipment	Proposed mitigation measures	Completion status	Note
Peter Mac	6 linear accelerators	Reduce railway current	Complete	Railway current has been reduced with the option to reduce further
		Additional testing and monitoring	Complete	Testing so far confirms that reducing the railway current can mitigate the impact of electromagnetic interference
	3 MRI machines	Fit MACS in one original MRI room at Peter Mac Parkville for testing	In progress	MACS MRI tests have drawn inconclusive results. RPV has planned further testing
		Temporarily relocate 2 outpatient MRI services from Peter Mac Parkville to Peter Mac East Melbourne	Complete	None
		Temporarily relocate one inpatient MRI service from Peter Mac Parkville to the Royal Melbourne Hospital's new MRI department	Complete	
	Royal Melbourne Hospital	2 MRI machines	Extend the hospital's North Wing to accommodate a new MRI department	Complete
Construct a new lift to allow ICU patients access to MRI department			In progress	MRI services for ICU patients are temporarily being delivered at Melbourne Private Hospital
Permanently relocate 2 MRI services to the new MRI department			Complete	None
Install one additional MRI machine			Complete	None
One intraoperative MRI machine		<ul style="list-style-type: none"> Agreed procedure to stop Metro Tunnel testing when intraoperative MRI machine needs to be used Option to install MACS for permanent mitigation 	No agreed mitigation	MACS MRI tests have drawn inconclusive results. RPV has paused further MACS installation
Royal Women's Hospital	One MRI machine	Permanently relocate one MRI service within the Royal Women's Hospital	Complete	None
University of Melbourne/ Peter Doherty Institute	One transmission electron microscope	Upgrade existing MACS	Complete	None
		Option to install passive shielding to enable transmission electron	No agreed mitigation	The suitability of passive shielding is subject to ongoing discussion

Institution	Impacted equipment	Proposed mitigation measures	Completion status	Note
		microscope to operate at full capability		
	Other equipment	Not defined	In progress	Tests are ongoing to ascertain electromagnetic interference impact
RMIT	3 transmission electron microscopes	Install shielding and MACS	Not started	None
	Other equipment	Install or upgrade MACS (15 items)	In progress	Mitigations are complete for all 15 items, pending dynamic testing results
		Relocate (one item)	Complete	None

Note: RPV has not agreed on a contingency plan in the event that:

- MRI services cannot safely return to Peter Mac Parkville
- MACS cannot mitigate the electromagnetic interference impact on Royal Melbourne Hospital's intraoperative MRI (noting that relocating this service is not currently an option) or the MRIs currently servicing ICU patients at Melbourne Private Hospital.

RPV continues to work with RMIT and CYP to progress mitigation measures for RMIT's transmission electron microscopes.

Source: VAGO, based on information from RPV and other relevant stakeholders as of 19 April 2024.

Auditor-General's reports tabled during 2023–24

Report title	Tabled
<i>Cybersecurity: Cloud Computing Products</i> (2023–24: 1)	August 2023
<i>Responses to Performance Engagement Recommendations: Annual Status Update 2023</i> (2023–24: 2)	August 2023
<i>Eloque: the Joint Venture Between DoT and Xerox</i> (2023–24: 3)	October 2023
<i>Domestic Building Oversight Part 1: Regulation</i> (2023–24: 4)	November 2023
<i>Employee Health and Wellbeing in Victorian Public Hospitals</i> (2023–24: 5)	November 2023
<i>Reducing the Illegal Disposal of Asbestos</i> (2023–24: 6)	November 2023
<i>Auditor-General's Report on the Annual Financial Report of the State of Victoria: 2022–23</i> (2023–24: 7)	November 2023
<i>Contractors and Consultants in the Victorian Public Service: Spending</i> (2023–24: 8)	November 2023
<i>Major Projects Performance Reporting 2023</i> (2023–24: 9)	November 2023
<i>Fair Presentation of Service Delivery Performance 2023</i> (2023–24: 10)	November 2023
<i>Reducing the Harm Caused by Drugs on Victorian Roads</i> (2023–24: 11)	December 2023
<i>Results of 2022–23 Audits: Local Government</i> (2023–24: 12)	March 2024
<i>Withdrawal from 2026 Commonwealth Games</i> (2023–24: 13)	March 2024
<i>Follow-up of Management of the Student Resource Package</i> (2023–24: 14)	May 2024
<i>Literacy and Numeracy Achievement Outcomes for Victorian Students</i> (2023–24: 15)	May 2024
<i>Guardianship and Decision-making for Vulnerable Adults</i> (2023–24: 16)	May 2024
<i>Domestic Building Oversight Part 2: Dispute Resolution</i> (2023–24: 17)	June 2024
<i>Planning Social Housing</i> (2023–24: 18)	June 2024
<i>Effectiveness of the Tutor Learning Initiative</i> (2023–24: 19)	June 2024
<i>Assuring the Integrity of the Victorian Government's Procurement Activities</i> (2023–24: 20)	June 2024
<i>Effectiveness of Arterial Road Congestion Initiatives</i> (2023–24: 21)	June 2024
<i>Metro Tunnel Project: Phase 3 – Systems Integration, Testing and Commissioning</i> (2023–24: 22)	June 2024

All reports are available for download in PDF and HTML format on our website at <https://www.audit.vic.gov.au>

Our role and contact details

The Auditor-General's role

For information about the Auditor-General's role and VAGO's work, please see our online fact sheet [About VAGO](#).

Our assurance services

Our online fact sheet [Our assurance services](#) details the nature and levels of assurance that we provide to Parliament and public sector agencies through our work program.

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