August 2021

Major transport program capital cost report

Development of capital costs to inform Infrastructure Victoria's Major transport program strategic assessment

INFRASTRUCTURE VICTORIA

About this paper

This report documents the assumptions behind Infrastructure Victoria's identification and adoption of capital cost figures for six major transport projects that have been analysed in Infrastructure Victoria's Major Transport Program Strategic Assessment.

Use of this paper

This document has been prepared by Infrastructure Victoria (IV) to support the strategic assessment of six major transport projects, which support several recommendations in *Victoria's infrastructure strategy 2021-2051*. The analysis contained within this report has been prepared by IV from material provided by and in discussions with:

- AECOM
- Arup
- Various transport sector stakeholders, including an independent expert panel of experienced transport network planners, managers and economists

IV has based this report on the information received or obtained, on the basis that such information is accurate, and where it is represented, complete. IV has used its reasonable endeavours to ensure that the data contained in the report reflects the most accurate and timely information available to it, and it is based on information current as of 1 July 2021.

No warranty or representation is made by IV that any of the projected values or results in the report will actually be achieved. Further project development is required to inform any cost estimation which could form the basis of a business case or funding submission to the Victorian and/or Australian Government for the delivery of these six projects. In no event, regardless of whether IV's consent has been provided, shall IV assume any liability or responsibility to any third party to whom this report is made available.

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Glossary

Term	Description
ABS	Australian Bureau of Statistics
AV	Automated vehicles
AZEVIA	Infrastructure Victoria's automated and zero emissions vehicle infrastructure advice
CCM	Cross city motorway project
CLR	City Loop reconfiguration
EAV	Electric and autonomous vehicles
LGA	Local Government Area
MM2G	Melbourne Metro Two and direct Geelong rail services project
NDS	Network development scenario
OMR	Outer metropolitan ring road project
PT	Public transport
PV	Private vehicle
RMS	Road management systems
TNP	Transport network pricing
VC	Volume capacity ratio
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VLUTI	Victorian Land Use and Transport Integration
WRU	Western rail upgrade project
ZEV	Zero emission vehicles

1. Executive Summary

1.1 Overview

This report documents the assumptions behind Infrastructure Victoria's development of capital cost estimates for six projects that have been assessed in Infrastructure Victoria's Major Transport Program Strategic Assessment report.[1] As the assessed projects are in very early stages of conceptual development, we identified that it was appropriate that a range of capital costs were considered for the strategic assessment.

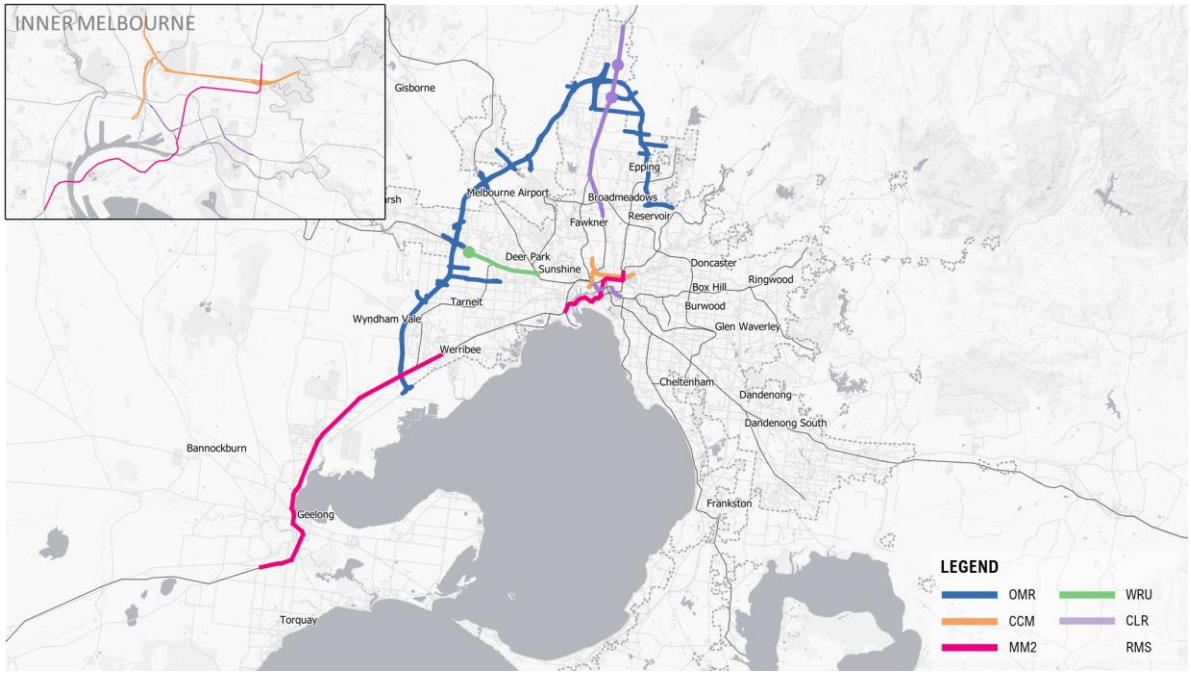
The six projects are:

- **City Loop Reconfiguration and Northern Rail Corridor Upgrade (CLR)** – the project consists of a broad group of interrelated changes to the heavy rail network facilitating increased service provision along the Craigieburn, Frankston and Glen Waverley rail corridors. The project also includes new stations and the extension of metropolitan rail services towards Wallan.
- **Cross City Motorway (CCM**) – the Cross City Motorway (CCM) would facilitate east-west vehicle travel for people and freight across the inner north of Melbourne by providing a connection between the West Gate Tunnel / CityLink and Eastern Freeway.
- **Melbourne Metro Two and Direct Geelong Rail Line (MM2G)** – the construction of a new rail tunnel connecting Newport to Clifton Hill, to support additional train services on the Hurstbridge, Mernda, and Werribee / Williamstown lines, and support direct, electrified train services to Geelong.
- **Outer Metropolitan Ring Road (OMR)** – a new tolled ring road across Melbourne's outer northern and western suburbs, facilitating motorway travel for private vehicles and freight. While the corridor will ultimately be used for rail freight also, the focus of the strategic assessment is on the road component of this corridor only and no rail freight has been considered as part of the project scope that has been costed and assessed by Infrastructure Victoria[2].
- **Road Management Systems (RMS)** – a combination of network-wide operational improvements, such as improved traffic signal timings, for arterial roads in metropolitan Melbourne, as well as lane configuration changes on select corridors to assist with traffic flows and public transport reliability and punctuality, assumed to drive an increase in efficiency across the network.
- **Western Rail Corridor Upgrade (WRU)** – upgrades to the Melton rail corridor to support extension of metropolitan rail services from Sunshine to a new station at Mount Atkinson. This would also enable increased capacity to the Pakenham/Cranbourne corridors in Melbourne's south-east.

[1] *Infrastructure Victoria, Major Transport Program Strategic Assessment, 2021*

[2] *The proposed rail freight improvements in this corridor are an integral part of the development of national rail freight network. They have strong inter-dependencies with the Inland Rail Project and associated projects to develop intermodal terminals in other states to realise network benefits that would accrue on a national scale. Assessing this rail freight component should involve adopting a national rather than state perspective and was therefore considered beyond the remit of this study.*

Figure 1: Overview of Major Transport Projects



Source: Arup 20201 Strategic Modelling Outcomes Report

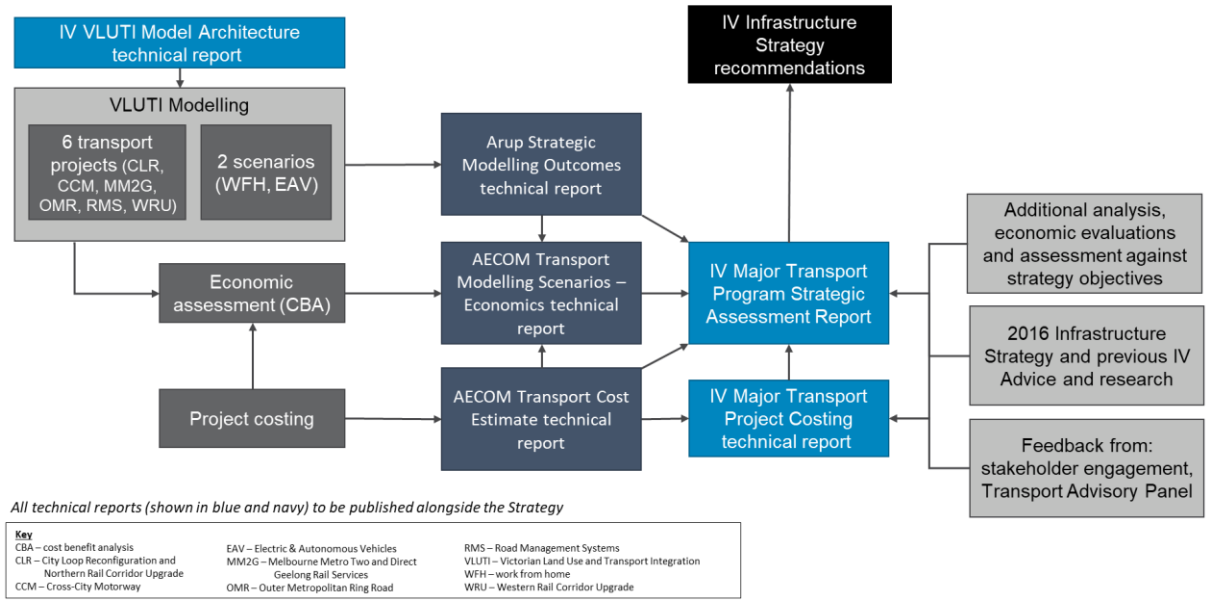
1.2 Identification of the cost range for each project

A cost range for each project was needed for the cost benefit analysis undertaken in the strategic assessment as the projects are in the very early stages of development.

AECOM and Arup supported Infrastructure Victoria by developing ***initial cost estimates***, undertaking demand modelling, and undertaking an initial economic analysis. These outputs were used to inform the development of ***refined cost estimates***, which were then used as inputs to the strategic assessment.

The strategic assessment in turn has then informed recommendations in *Victoria's Infrastructure Strategy 2021–2051 (Victoria's Infrastructure Strategy)*, as shown in the following figure:

Figure 2: Major Transport Program Strategic Assessment – Study Overview



1.2.1 Initial Cost Estimate

Order of Magnitude initial cost estimates were developed by AECOM based on an initial scope provided by Infrastructure Victoria to support the cost benefit analysis that contributed to assessment of the major transport projects. Cost estimates are inclusive of infrastructure works, on-costs, government costs, land acquisition costs, contingencies, rolling stock, 50-year renewal costs and operations, and maintenance costs.

Order of Magnitude costs are considered within an accuracy range of -40% and +60%[3]. The initial cost estimates were compiled, where possible, by measuring approximate high-level quantities and pricing at current day rates, plus adding allowances where insufficient information exists for basic elements that are necessary to deliver each project.

1.2.2 Refined Cost Estimate

The Order of Magnitude Cost accuracy range of -40% to +60% developed by AECOM for the initial cost estimate results in a very wide cost range. Applying this wide range would have resulted in a similarly broad range of economic assessment outcomes. Such a broad range of assessment outcomes would have made the strategic assessment challenging and potentially meaningless to inform recommendations about the projects.

Infrastructure Victoria therefore developed a narrower cost range that could be used as part of the economic assessment to further inform our strategic assessment of the six projects. The focus was on developing a range of capital costs, with operating, maintenance and asset renewal costs assumed to be the same for both cost estimates.

The cost range adopted for the strategic assessment's cost benefit analysis was therefore defined as being the ***initial cost estimate*** and the ***refined cost estimate.***

A range of inputs were used to develop the refined high-level scope and capital cost estimates. These included using demand modelling outputs and initial economic assessment outputs prepared by Arup and AECOM[4] to reconsider the assumed timing and staging of the projects. It also included drawing upon independent expert advice, beyond our consultant team, regarding the initial cost estimate and economic analysis, transport network requirements and the scope of interdependent projects. This was obtained through discussions with stakeholders in the transport sector and included consultation with an independent expert panel of experienced transport network planners, managers and economists. Work undertaken for the 2016 Infrastructure Strategy, including economic analysis and capital cost estimation was also considered.

Using these inputs, Infrastructure Victoria developed a refined project scope for each project, with an associated refined capital cost estimate for analysis to inform the strategic assessment. The refined cost estimate provides a higher cost estimate than the initial cost estimate for two projects (RMS and WRU), and lower cost estimates than the initial cost estimate for four projects (CLR, CCM, MM2G and OMR).

For all six projects, Infrastructure Victoria's refined cost estimate sits within the -40% to +60% order of magnitude cost accuracy range associated with AECOM's initial cost estimate.

[3] *Department of Treasury and Finance, Victorian Government Investment Lifecycle and High Value High Risk Guidelines Overview and glossary, 2019 p16*

[4] *AECOM's economic evaluation report presents economic evaluation results based on the Initial Cost Estimate only. Infrastructure Victoria's MTP Strategic Assessment Report presents economic evaluation results using both Initial and Refined Cost Estimates*

1.3 Nominated Capital Cost Range

The following capital costs are nominated for analysis in Infrastructure Victoria's Major Transport Program Strategic Assessment. Further details on what informed this process to determine this cost range for each project is provided in this report.

Table 1: Nominated Lower and Upper Capital Costs by Project (2020 dollars)

Transport Project	Lower ($billion 2020)	Upper ($billion 2020)
CLR	*6.1*	**6.9**
CCM	*9.1*	**13.0**
MM2G	*27.4*	**36.7**
OMR	*17.2*	**34.7**
RMS	**4.5**	*5.3*
WRU	**1.9**	*2.8*

Note: The cost in **Bold and Underlined** is the initial cost estimate. The *italicised* cost is the refined cost estimate. These are the lower and upper costs used in IV's economic and strategic assessment of the projects, rather than the –40% to +60% wide order of magnitude range identified by AECOM.

2. City Loop Reconfiguration and Northern Rail Corridor Upgrade

2.1 Overview

This project transforms more rail lines into providing metro style services by altering the existing City Loop, providing more reliable services and additional capacity for new services on the Craigieburn, Frankston, and Upfield lines, as well as on services that travel to the eastern suburbs through Burnley. In addition, the introduction of new metro style services will mitigate network disruption impacts and improve reliability of the metropolitan rail network for all users. It will also provide crowding relief for northern regional V/Line services to Seymour and Shepparton and provide those on the Glen Waverley line with more central city stations to stop at in peak periods.

The City Loop Reconfiguration and northern rail corridor upgrade (CLR) project includes the following scope items:

- City Loop Reconfiguration
- Upfield rail corridor upgrade: Upfield to North Melbourne
- Upfield to Craigieburn rail corridor improvements:
- Craigieburn to Wallan rail corridor improvements
- Craigieburn rail corridor upgrade: Craigieburn to North Melbourne (via Broadmeadows and Essendon)
- Glen Waverley rail corridor upgrade: Glen Waverley to Richmond

No works have been included on the Frankston line as upgrades are assumed to be undertaken separately. Level crossing removals are not considered as part of the scope as they are assumed to continue to be separately assessed and funded through the State Government's Level Crossing Removal Program

The lower and upper capital costs nominated for the strategic assessment are provided in the table below.

Table 2: CLR Lower and Upper Capital Costs (2020 dollars)

Project scope	Lower Cost ($ million)	Upper Cost ($ million)
City Loop Reconfiguration	1,686	1,686
Craigieburn to Wallan rail corridor • including electrification from Beveridge to Wallan • excluding electrification from Beveridge to Wallan	 1,542 1,025	 1,542 1,025
Upfield to Craigieburn rail corridor	1,000	1,409
Upfield rail corridor: Upfield to North Melbourne	929	929
Craigieburn rail corridor: Craigieburn to North Melbourne (via Broadmeadows and Essendon)	386	773
Glen Waverley rail corridor: Glen Waverley to Richmond	595	595
Total Project (including electrification from Beveridge to Wallan)	**6,138**	**6,935**

Total Project (excluding electrification from Beveridge to Wallan)	**5,621**	**6,418**

2.2 Initial project scope

The following scope description reflects the project scope on which the initial cost identified by AECOM was based,[5] with the same project scope in the AECOM report titled the '*City Loop Reconfiguration (CLR) and Wallan Corridor Upgrade'*.

2.2.1 City Loop Reconfiguration (CLR)

The CLR would involve reconfiguring the City Loop by constructing new single tunnel links between Flagstaff (Caulfield Loop) and North Melbourne station, which is approximately 1km in length, and Parliament (Northern Loop) to Richmond station, which is approximately 1.3km in length (Figure 3). The rail tunnel scope includes the construction and formation of the tunnel and associated works such as cross-tunnels, ventilation shafts, access shaft, portal works, walkways, tunnel drainage system, cable ducts, embedded pipework and civil supports for high capacity signalling equipment and construction of the concrete lining, as well as allowance for commissioning and de-commissioning of tunnel boring machines.

The scope also includes provision of traction power infrastructure, mechanical and electrical systems including the tunnel ventilation systems, vertical transport and lighting. Cost provision is required for improving station transfers for gateway stations which has been notionally based on three new pedestrian bridges located at Burnley and South Yarra stations.[6]

Figure 3: City Loop Reconfiguration

2.2.2 Craigieburn to Wallan rail corridor

The scope costed for the rail corridor upgrade is to enable electrified services beyond Craigieburn. This upgrade was split into two sections, Craigieburn to Beveridge and Beveridge to Wallan. The scope encompasses the following:

Craigieburn to Beveridge:

- Electrifying 15km of existing twin tracks

[5] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[6] *Given the complex layout at Richmond Station, it has been assumed that passenger flow improvements would occur at Richmond Station up to the cost of two new pedestrian bridges at South Yarra and one at Burnley Station. Should it be found that these pedestrian flow improvements at Richmond Station cost more, then it is assumed that the option to undertake these improvements at South Yarra and Burnley would become more attractive or the preferred option.*

- Building two new stations at Beveridge and Lockerbie. These new stations would include facilities such as car parking, access and forecourts
- Expansion of existing stabling yard at Craigieburn
- Upgrades to power, conventional signalling and communications

Beveridge to Wallan:

- Electrifying 6km of existing twin tracks from Beveridge to Wallan
- Building a new platform at Wallan
- Construction of new stabling yard at Wallan
- Upgrades to power, conventional signalling and communications

Following a review of the initial modelling and economic analysis results, it was determined that the project be staged to open in two parts, with most scope to open in 2036, and construction of the Beveridge to Wallan section of the rail corridor upgrade delayed to open in 2051.

2.2.3 Upfield to Craigieburn rail corridor

The scope costed for the rail corridor upgrade includes the following works:

- Removal of existing dilapidated track and reinstatement of a 7.7km twin electrified track between Upfield and Craigieburn stations with the alignment going via Roxburgh Park Station
- Power upgrades including new substations and overhead infrastructure
- Conventional signalling and communication upgrades
- U-trough rail bridge structures over Merlynston Creek and Somerton Junction

2.2.4 Upfield rail corridor: Upfield to North Melbourne

The scope costed for the rail corridor upgrade includes the following works:

- Duplication of around 4.1km of track between Gowrie and Upfield stations
- Power upgrades including new substations and overhead infrastructure
- Conventional signalling and communication upgrades
- Constructing Upfield station into a two-platform station

2.2.5 Craigieburn rail corridor: Craigieburn to North Melbourne (via Broadmeadows and Essendon)

The scope costed for the rail corridor upgrade between Craigieburn and North Melbourne (via Broadmeadows and Essendon) is an incremental upgrade to power and traction on an existing corridor to cater for additional train services. The proposed scope includes new substations and rail power upgrades, overhead infrastructures, communications and conventional signalling upgrades

2.2.6 Glen Waverley rail corridor: Glen Waverley to Richmond

The scope costed for the Glen Waverley line upgrade between Glen Waverley and Richmond is an incremental upgrade to power and traction on an existing corridor. The project includes new substations and rail power upgrades, overhead infrastructures, communications and conventional signalling upgrades.

2.3 Refined project scope

The upper cost proposed for the strategic assessment is the initial cost estimate prepared by AECOM,[7] with the project scope in the AECOM report '*City Loop Reconfiguration (CLR) and Wallan Corridor Upgrade'*. The lower cost reflects the refined cost estimate developed by Infrastructure Victoria, as described in section 1.2.

The refined cost developed by Infrastructure Victoria did not alter the initial cost for the following scope elements:

- City Loop Reconfiguration
- Upfield rail corridor: Upfield to North Melbourne
- Craigieburn to Wallan rail corridor upgrade
- Glen Waverley rail corridor upgrade – Glen Waverley to Richmond.,

The approach to develop refined costs for the other scope elements of CLR is presented in the following sections.

2.3.1 Upfield to Craigieburn rail corridor

Infrastructure Victoria reviewed the project scope of the Upfield to Craigieburn rail corridor and identified that as an initial stage that it would be possible to truncate the current Craigieburn line operations via Broadmeadows at Roxburgh Park and run services from Craigieburn to the city via Upfield. Passengers could interchange at Roxburgh Station to board services to either Upfield or Broadmeadows.

This revised scope would still contain the U-trough rail bridge structures over Merlynston Creek and Somerton Junction, estimated by AECOM to cost $448 million.[8]

In the revised scope a new track pair would only be required from Upfield to just beyond Roxburgh Park Station, a distance of approximately 4.5 km, as opposed to the 7.7km scope assumed for the initial cost.

The revised scope of new track capital works from 7.7km to 4.5km would reduce the cost of the remaining scope from $960 million (estimated by AECOM) to be $560 million based on a pro rata approach which is a saving of $400 million. A refined cost of $1,000 million was therefore adopted for the refined cost estimate compared to $1,409m for the initial cost estimate. The revised cost includes all the bridge scope and the pro-rated equivalent cost of 4.5km of new track, but also incorporated rounding to reflect the approximate nature of the refined cost estimate.

2.3.2 Craigieburn rail corridor: Craigieburn to North Melbourne (via Broadmeadows and Essendon)

Infrastructure Victoria reviewed the scope of the Craigieburn rail corridor from Craigieburn to North Melbourne (via Broadmeadows and Essendon). The review identified that it is possible that a significant component of the signalling and power upgrade scope included in the initial cost estimate, estimated by AECOM to cost $773 million, could be undertaken prior to this project being commenced, either as part of Melbourne Metro Tunnel corridor upgrades, level crossing removal program or as part of a general maintenance and asset renewal program.

The timing of these works could see the Melbourne Metro Tunnel Project corridor works delivered prior to construction commencing on the CLR works and as such signalling and power infrastructure upgrades may have been completed to support the additional services on the Craigieburn line.[9] As such, a refined cost of $386 million was therefore adopted for this project scope element, based on the l assumption that up to 50% of capital works identified under the AECOM scope and cost estimate could be possibly delivered prior to the commencement of the CLR project construction works.

[7] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[8] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis, Table 10-3 (pro rata government allowance, land acquisition and contingencies)*

[9] *Victorian Government, Melbourne Metro Business Case Appendix 3: Melbourne Metro scope of works*

3. Cross City Motorway

3.1 Overview

The Cross-City Motorway (CCM) would facilitate east-west vehicle travel for people and freight across the inner north of Melbourne by providing a connection between the West Gate Tunnel / CityLink and the Eastern Freeway. This project includes the assumption of widening the Eastern Freeway from Chandler Highway to Hoddle Street, after which the CCM transitions into a three-lane tunnel that emerges past Royal Park. Traffic at this point can then access CityLink or continue towards a two-lane connection to Footscray Road and the West Gate Tunnel.

Table 3: CCM Upper and Lower Capital Cost (2020 dollars)

Project	Lower Capital Cost ($million)	Upper Capital Cost ($million)
CCM	9,100	13,027

3.2 Initial project scope

The following describes the project scope on which the initial cost estimate, identified by AECOM,[10] was based. This scope included connection of the existing Eastern Freeway to the West Gate Tunnel, as shown in Figure 4.

The project has been divided into two sectors as follows:

- Sector A: Eastern Freeway to CityLink Flemington (4.6 km twin tunnels)
- Sector B: CityLink Flemington to West Gate Tunnel (3.2km viaduct)

Sector A works are based on the Linking Melbourne Authority reference design (dated 27/09/2013), excluding provision for a dedicated bus lane on Alexander Parade and comprise:

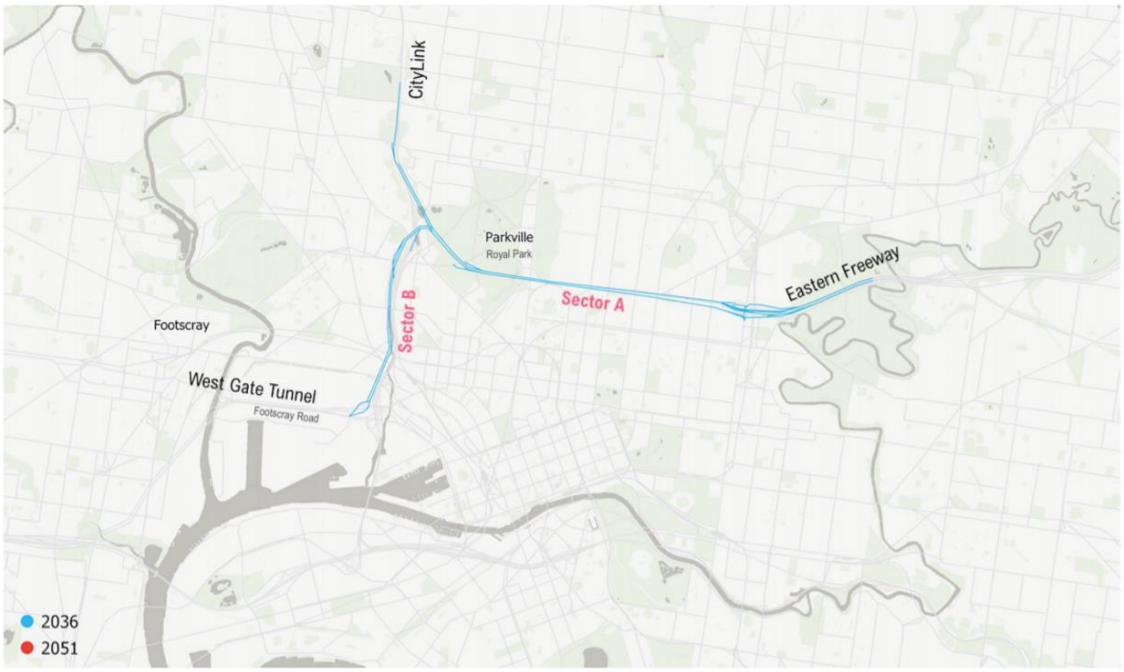
- Widening of the existing Eastern Freeway from Chandler Highway to Hoddle Street by one lane in each direction (approx. 3km)
- Significantly upgrading the existing Hoddle Street interchange to enable the freeway west of Hoddle Street to transition into two tunnels
- Construction of two three-lane tunnels taking traffic in two directions from the Eastern Freeway, west of Hoddle Street to Royal Park, exiting just west of the Upfield trainline
- Two viaducts (27m wide) connecting the Royal Park tunnel exits to CityLink, with the viaduct connecting to southbound CityLink lanes adjacent to the existing Sound Tube and the viaduct connecting to northbound CityLink lanes

Sector B works are based on the Linking Melbourne Authority reference design (dated 27/09/2013) and comprise:

- A new CCM viaduct corridor running adjacent to CityLink with two traffic lanes plus one shoulder in each direction (27m wide). The viaduct commences at the tunnel exit point at Royal Park, crosses over CityLink and heads south on the western side of CityLink to connect to Footscray Road and the West Gate Tunnel
- A new northbound slip lane connecting the new CCM viaduct to CityLink before Racecourse Road

[10] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

Figure 4: CCM assumed alignment for initial cost estimate



Source: Arup 20201 Strategic Modelling Outcomes Report

3.3 Refined project scope

The upper cost proposed for the strategic assessment is the initial cost estimate prepared by AECOM.[11] The lower cost estimate reflects the refined cost prepared by Infrastructure Victoria, as described in section 1.2.

The initial cost estimate has been classified by AECOM as an Order of Magnitude estimate with an accuracy range of -40% to +60, based on the project scope and referencing the Victorian Government Department of Treasury and Finance Investment Lifecycle and High Value/High Risk Guidelines.[12]

Due to the advanced level of documentation available for this project, Infrastructure Victoria assessed the project scope as being at least at a Concept Estimate level, rather than an Order of Magnitude estimate level, which would suggest using a lower accuracy range of -30% instead of the -40% adopted for an Order of Magnitude estimate.

In addition, a review of the demand modelling outputs indicated that the CCM, with 3 lanes in each direction in Sector A, provided greater capacity than may be required, and that an infrastructure solution with 2 lanes in each direction was likely to provide sufficient capacity to support the travel demand on the network. This would reduce the cost and scope of the project.

On this basis, a lower refined cost figure of -30% of the initial cost estimate prepared by AECOM was adopted as the refined cost, representing the lowest cost that is likely to be achieved for the project, which equates to $9,100 million ($2020).

[11] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*
[12] *Department of Treasury and Finance, Victorian Government Investment Lifecycle and High Value High Risk Guidelines Overview and glossary, 2019 p16*

4. Melbourne Metro Two and direct Geelong rail services

4.1 Overview

The Melbourne Metro Two and direct Geelong rail services project (MM2G) involves the construction of a new rail tunnel connecting Newport to Clifton Hill, accompanied by electrification to Geelong. It would allow for a significant reconfiguration of the network's service patterns to expand the network to create more lines, allowing for an additional metro-style cross-city service that connects the Werribee line in the west with the Mernda line in the north. This significantly increases accessibility to major destinations that would be served along these two metropolitan corridors.

It has been assumed that MM2G be delivered in two stages:

Stage 1

- Melbourne Metro Two Tunnel (MM2) – from Newport to Southern Cross with a turnback box at Southern Cross Station
- Werribee to Newport rail corridor upgrade
- Manor to Werribee rail corridor upgrade
- Stabling and maintenance facilities at Manor to hold 47 high-capacity metro trains (HCMT)

Stage 2

- Melbourne Metro Two Tunnel (MM2) – Southern Cross to Clifton Hill
- Altona Loop partial duplication (including second platform at Williamstown)
- Mernda rail corridor upgrade
- Geelong (Waurn Ponds) to Werribee rail corridor upgrade
- Hurstbridge rail corridor upgrade

Level crossing removals are not considered as part of the scope as they are assumed to continue to be separately assessed and funded through the State Government's Level Crossing Removal Program

The lower and upper capital costs nominated for the strategic assessment are provided in the table below.

Table 4: MM2G Upper and Lower Capital Cost (2020 dollars)

Project scope	Lower Cost ($ million)		Upper Cost ($ million)	
	Stage 1	Stage 2	Stage 1	Stage 2
Melbourne Metro Two	11,118	10,484	14,771	13,929
Altona / Williamstown partial duplication		470		937
Werribee rail corridor upgrade	2,827	1,673	3,387	2,004
Mernda rail corridor upgrade		547		1,093
Hurstbridge rail corridor upgrade		280		561
Total cost	**13,945**	**13,454**	**18,158**	**18,524**

4.2 Initial project scope

The following scope describes the project scope on which the initial cost estimate identified by AECOM was based,[13] with the same project scope in the AECOM report, '*Melbourne Metro Two (MM2) Program*. Figure 5 shows the initial project scope's new tunnel alignment through the CBD and location of the stations.

Figure 5: MM2G assumed route alignment

4.2.1 Stage 1: Melbourne Metro Two Tunnel (MM2) – Newport to Southern Cross

Stage 1 includes the construction of twin tunnels connecting Newport to a new MM2 underground station at Southern Cross station, with a turn back box to be provided to the north of Southern Cross station[14]. New underground stations future proofed to accommodate 230 metre trains have been adopted at Newport, two Fishermans Bend stations (Employment Precinct and Sandridge) and Southern Cross. The rail tunnel scope includes the construction and formation of the tunnel and associated works such as cross-tunnels, ventilation shafts, access shaft, portal works, walkways, tunnel drainage system, cable ducts, embedded pipework and civil supports for high capacity signalling equipment and construction of the concrete lining as well as allowance for commissioning and de-commissioning of tunnel boring machines.

In addition to this the initial project scope includes:

- Rail systems to support one rail line per tunnel, high capacity signalling, communications, combined utility ducts / channels and trackwork
- Construction of underground stations and their associated fit out including at-grade station entrances and public realm works around the stations. Passenger connections to existing stations will also be required at Newport and Southern Cross stations
- Structures to support the tunnel portals and reconfiguration and realignment of existing lines
- Provision of power and traction power infrastructure, mechanical and electrical systems including the tunnel ventilation systems, vertical transport and lighting
- Increase the station box to allow for both tunnels to extend approximately beyond the platform at Southern Cross Station to provide a turn back facility

[13] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[14] *Southern Cross was assumed to be the staging point for this assessment. However, further detailed work would need to be undertaken to determine the preferred staging point taking into consideration aspects such as constructability and impacts on other services.*

Geelong and Werribee Rail Corridor Upgrade

The scope costed for the rail corridor upgrade is to enable the deployment of electrified HCMTs at higher frequencies and operating speeds. The upgrade is proposed along the Newport to Werribee section of the corridor. The initial cost does not include provision of new track between Werribee and Laverton, as this is assumed to be provided under the Geelong Fast Rail Project.

Upgrade works on the following sections include:

- Newport to Laverton
  - High capacity signalling, communication, combined services routes and cabling to be installed between Newport and Laverton on the two existing electrified tracks that suburban services currently operate on
- Laverton to Werribee
  - High capacity signalling, communication, combined services routes and cabling to be installed between Laverton and Werribee on the two existing electrified tracks that suburban services currently operate on
  - Overhead electrification works including new substations and overhead infrastructure to be installed between Laverton and Werribee on track work that is assumed to be provided under the Geelong Fast Rail Project (track work, signalling and communications excluded from this costing scope)
- Werribee to Geelong
  The scope of works for this component of the rail corridor upgrade is to enable the deployment of electrified HCMTs used for MM2G Stage 1 to access the new stabling site which is assumed to be located at Manor. Upgrade works will include:
  - Overhead electrification works including new substations and overhead infrastructure on the two broad gauge passenger tracks between Werribee and the site of the maintenance and stabling facility at Manor (assumed to be just south of the rail junction with recently built Regional Rail Link to Wyndham Vale and Sunshine)
  - Introduction of high capacity signalling, communication, combined services routes and cabling along the corridor from Werribee to Manor
  - Maintenance workshop facility at the new stabling site, with provision for wheel lathe, bio wash, train wash, fuel point, a depot administration building, staff amenities and car parking. The scope also includes a rail connection to the main rail line
  - New stabling yard at the maintenance facility to accommodate some of the 47 trains needed to be stabled for the full scheme

4.2.2 Stage 2: Melbourne Metro Two Tunnel (MM2) –Southern Cross to Clifton Hill

Stage 2 includes the construction of twin tunnels connecting the new turn back north of Southern Cross Station constructed in Stage 1 to Clifton Hill on a new alignment, with the tunnel transitioning into the existing Mernda line between Clifton Hill station and Merri station. Four new underground stations future proofed to accommodate 230 metre trains have been adopted at Flagstaff, Parkville, Fitzroy and Clifton Hill.

The rail tunnel scope includes the construction and formation of the tunnel and associated works such as cross-tunnels, ventilation shafts, access shaft, portal works, walkways, tunnel drainage system, cable ducts, embedded pipework and civil supports for high capacity signalling equipment and construction of the concrete lining as well as allowance for commissioning and de-commissioning of tunnel boring machines.

In addition to this the scope costed includes:

- Rail systems to support one rail line per tunnel, high capacity signalling, communications, combined utility ducts / channels and trackwork
- Construction of underground stations and their associated fit out including at-grade station entrances and public realm works around the stations
- Structures to support the tunnel portals and reconfiguration and realignment of existing lines
- Provision of power and traction power infrastructure, mechanical and electrical systems including the tunnel ventilation systems, vertical transport and lighting

Geelong and Werribee Rail Corridor Upgrade

The scope costed for the rail corridor upgrade is to enable the deployment of electrified HCMTs from Manor to Waurn Ponds sections of the corridor so that HCMTs can operate to Waurn Ponds.

Upgrade works will include:

- Werribee to Geelong
  - High capacity signalling, communication, combined services routes and cabling to be installed between Manor and Geelong on the two broad gauge tracks that VLine services currently operate on
  - Overhead electrification works including new substations and overhead infrastructure to be installed between Manor and Geelong on the two broad gauge tracks that VLIne services currently operate on
- Geelong to Waurn Ponds
  - Overhead electrification works including new substations and overhead infrastructure to be installed on the existing tracks between Geelong and Waurn Ponds, expanding the existing Geelong tunnel
  - High capacity signalling, communication, combined services routes and cabling to be installed on the existing single track

The cost does not include provision of new track between Werribee and Laverton, as this is assumed to be provided under the Geelong Fast Rail Project.

Altona Loop Partial Duplication and Williamstown Line Second Platform

The Altona Loop partial duplication scope costed is an incremental upgrade to power and traction on the existing corridor and includes the construction of the following:

- Duplication of around 2.5km of track (increasing from one track to two tracks in the corridor), laid at grade from Kororoit Creek Road leading into Seaholme station. Railway works and associated infrastructure, including (but not limited to) utility services relocation, overhead infrastructure, existing communications and conventional signalling infrastructure upgrades, rail bridges and earthworks required to enable the development.
- Building of a new Seaholme station assumed to include a 2,500m2 building with 160m platform. This new station would be provided with facilities such as car parking, access and a forecourt
- Quadruplication of around 2.9km of twin track (adding an additional two tracks), between Altona Junction and Newport. Associated works such as services relocation, earthworks, retaining walls, drainage, rail systems including overhead wiring, conventional signalling upgrades, communications, combined services route and trackwork are included in the cost estimate.
- Providing an additional platform at Williamstown and additional 400m of single track including associated works such as signalling and shared user path

Mernda Rail Corridor Upgrade

The scope costed for the Mernda rail corridor upgrade is to enable the deployment of HCMTs. The upgrade will happen on the section from the transition out of the tunnel south of Merri Station to Mernda Station. Upgrades to the rail network will include:

- Power upgrades including new substations and overhead infrastructure
- Introduction of high capacity signalling, communication, combined services routes and cabling

Hurstbridge Rail Corridor Upgrade

The scope costed for the Hurstbridge rail corridor upgrade is between Macleod and Clifton Hill and involves an incremental upgrade to power and traction on the existing corridor. The project includes new substations and rail power upgrades, overhead infrastructure and existing communications and conventional signalling upgrades.

4.3 Refined project scope

The upper cost proposed for the strategic assessment is the initial cost estimate prepared by AECOM.[15] The lower cost estimate reflects the refined cost developed by Infrastructure Victoria, as described in section 1.2.

Infrastructure Victoria reviewed the scope of several components of the project and identified that a significant component of the scope to improve corridor capacity included in the initial cost estimate could be undertaken on the rail network prior to the MM2G project commencing, such as upgrades to the Sandringham and Werribee lines as part of Melbourne Metro Tunnel broader network corridor upgrades[16] and the Geelong Fast Rail Project, .These projects are likely to deliver express tracks, signalling upgrades, bridges and station works which will also provide improvements for Werribee and Williamstown services. It is possible that these works will reduce the scope of capital works for the Werribee rail corridor upgrade as part of MM2G.

The approach to develop refined costs for scope elements of MM2G is presented in the following sections.

4.3.1 Melbourne Metro Two Tunnel (Stages 1 and 2)

Infrastructure Victoria reviewed the scope of the MM2 tunnel works and sought to identify alternative scope options that could provide better value for money. Several studies have previously been undertaken considering a range of alternative alignments for the project. In Infrastructure Victoria's 2016 infrastructure strategy, a similar strategic assessment was undertaken for major transport projects.[17] As part of this analysis, a cost estimate for the MM2 tunnel was developed and options investigated that considered alternative alignments, construction methodology and staging.[18]

One option proposed was to adopt an alignment along the old inner metropolitan ring rail corridor and Royal Parade, enabling a lower cost construction approach from the Mernda line to Princes Park before entering a tunnel into the CBD.[19] This option, however, was not costed, and a similar tunnelled approach to the scope described in section 4.2 along a different alignment was costed and estimated to be within a range of $13.9 billion to $20.8 billion in 2016 real dollars.[20]

The Metro Tunnel Project, a 9km rail tunnel estimated to cost $10.5 billion in 2016 real dollars, was used as a benchmark to estimate the cost of the new 15km rail tunnel, and escalated in accordance with ABS escalation rates.[21] This estimate, $21.6 billion in 2020 real dollars, was adopted as the refined capital cost.

4.3.2 Altona Loop Partial Duplication and Williamstown Line Second Platform

Infrastructure Victoria refined the project scope of the Altona / Williamstown corridor and identified that it is possible that the construction of a new station at Seaholme and the duplication of 2.5km of track from Kororoit Creek Road to Seaholme may not be essential to the MM2G operations.

As such, The AECOM cost estimate for this scope ($937 million) was amended on this basis to reflect the possible removal of the scope related to the new station at Seaholme and the duplication of track as well as other opportunities, resulting in the refined cost estimate of $470 million.[22]

4.3.3 Geelong and Werribee Rail Corridor Upgrade

As stated above, it is likely that Melbourne Metro Tunnel broader network corridor Upgrades and the Geelong Fast Rail project will deliver key components of the scope included in the Geelong and Werribee Corridor Upgrade, particularly in relation to signalling works. As such, a refined cost estimate has been adopted of $4.5 billion, to approximate the savings due to some works being completed under other programs.

4.3.4 Hurstbridge and Mernda Rail Corridor Upgrades

Significant upgrades were being undertaken on the Hurstbridge and Mernda corridors as part of the Level Crossing Removals Program and other corridor improvement projects, along with a High Capacity Signalling trial that is currently underway between Epping and South Morang[23]. Given forecast population growth on these corridors, it is considered

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[15] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[16] *Victorian Government, Melbourne Metro Business Case Appendix 3: Melbourne Metro scope of works*

[17] *KPMG/Arup/Jacobs – Preliminary demand modelling and economic appraisal – 27 September 2016*

[18] *AECOM/PwC Options Assessment 3 Technical Report – Supplement C – 23 September 2016, page 32 to 40, 2016*

[19] *AECOM/PwC Options Assessment 3 Technical Report – Supplement C – 23 September 2016, page 32 & 33, 2016*

[20] *AECOM/PwC Options Assessment 3 Technical Report – Supplement C – 23 September 2016, page 36, 2016*

[21] *ABS Data Index Number; 31 Heavy & civil engineering Victoria; A852199099L: 2016 to 2020*

[22] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[23] *Metro Tunnel 2021 High Capacity Signalling Upgrade https://metrotunnel.vic.gov.au/about-the-project/project-overview/high-capacity-signalling (Accessed 9th July 2021)*

likely that this trend of improving the corridor would continue, with further works related to power upgrades and signalling upgrades delivered in this corridor prior to the construction of the MM2G project.

As such, the refined cost estimate was developed based on the possibility that the 50% of the corridor upgrades identified in the AECOM Cost Report would be delivered along these corridors, resulting in a refined cost estimate of $547 million for the Mernda corridor and $280 million for the Hurstbridge corridor.

5. Outer Metropolitan Ring Road

5.1 Overview

The Outer Metropolitan Ring Road and E6 transport corridor (OMR) is a major orbital high-speed transport link connecting people and freight, travelling through Melbourne's outer north and west. The project is proposed to link the existing M80 Ring Road to the north with the Hume Freeway and continue with an outer ring down to the Princes Freeway in Melbourne's west. Planning for the OMR includes both road and rail links, connecting growth areas and major employment corridors, major freight terminals and transport hubs, and enhancing connectivity to interstate and major regional destinations.

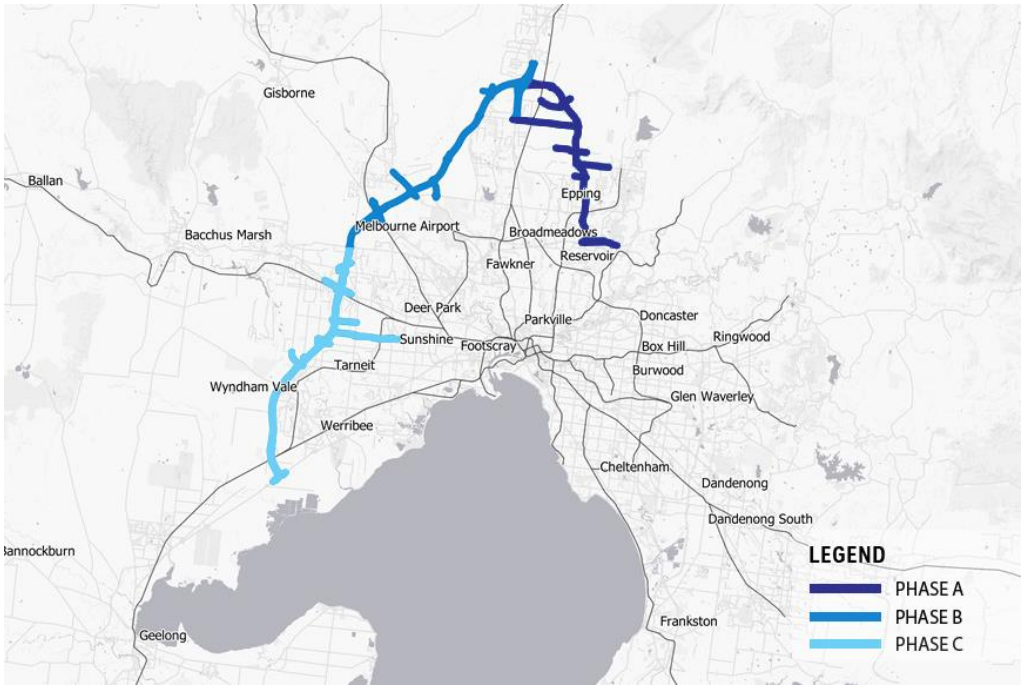
This includes new links connecting international transport hubs including Melbourne Airport, the Port of Melbourne, and the proposed Bay West Port with intermodal freight terminals like the proposed Beveridge Intermodal Freight Terminal (BIFT) and Western Intermodal Freight Terminal (WIFT). The project also provides new interchange opportunities for users on the Princes, Western, Calder and Hume Freeways, better serving major regional destinations such as Bendigo and Ballarat. Private vehicle-based access is also improved in growth areas like Wyndham Vale and Donnybrook and employment corridors such as Werribee, Truganina, and Melbourne Airport.

Infrastructure Victoria's major transport project strategic assessment considers the Outer Metropolitan Corridor as a road project only and the analysis does not capture any of the benefits associated with the rail component of the project. It is therefore important that the cost estimate adopted for the strategic assessment does not include additional costs that will be incurred by the road project as a result of being combined with the rail, when the benefits are not also being recognised. Because of this approach the cost estimate development needed to separate costs attributable to the road and rail components. As the rail and road projects share the same corridor but will be developed under different timing and funding sources, separating the costs adds complexity to developing the cost estimate. This is discussed further in section 5.3.

The proposed rail freight improvements in this corridor are an integral part of the development of national rail freight network, and have strong inter-dependencies with the Inland Rail Project and associated projects to develop intermodal terminals in other states to realise network benefits that would accrue on a national scale. Assessing this rail freight component should involve adopting a national rather than state perspective and was therefore considered beyond the remit of the strategic assessment.

The road project is split into three phases as shown in Figure 6.

Figure 6: OMR Phases



Source: Arup 2021, annotated by Infrastructure Victoria

The lower and upper capital costs nominated for the strategic assessment are provided in the table below.

Table 5: OMR Upper and Lower Capital Cost (2020 dollars)

Project scope	Lower Cost ($ million)	Upper Cost ($ million)
OMR Phase A	4,695	8,556
OMR Phase B	5,591	13,496
OMR Phase C	6,921	12,656
OMR (Total)	**17,207**	**34,708**

5.2 Initial project scope

The program is split into three phases as shown in Table 6 below.

Table 6: OMR Scope by Phase

	Sector	Length	Additional Scope
Phase A – E6	Hume Freeway to M80 Ring Road	27.2km	Widening and extension of the roads below: • M80 Ring Road widening from E6 to Greensborough Bypass • Bridge Inn Road widening from Epping Road to Cravens Road • Donnybrook Road widening from Hume Freeway to E6 • Extend Gunns Gully Road (2 lanes) from E6 to Railway line
Phase B - OMR	Melton Highway to Hume Freeway	32.3km	• 1.6km Tullamarine Freeway Extension from Somerton Road to OMR • Sunbury Road widening from Lancefield Road to OMR
Phase C - OMR	Princess Freeway to Melton Highway	40.1km	• 7.7km DPBC connecting OMR to Western Freeway

Phase A: E6 Corridor

For the E6 corridor, the cost assumes that land acquisition and civil works are undertaken to accommodate an ultimate four-lane each way roadway in a 70m wide corridor and the roadway will be initially constructed as two lanes in each direction.

Phases B and C: Outer Metropolitan Road

As this cost estimate is being prepared for an economic analysis of the road corridor only, costs attributed to the rail component of the works have been excluded.

The cost of the road component of the works has been calculated by adopting a nominally 120m wide corridor on one side of the total rail and road corridor (nominally 240m wide), which allows the roadway to ultimately accommodate four lanes of road traffic in each direction. Whilst allowance has been made in the road corridor for four lanes each way, it has been assumed that the freeway will be constructed as two lanes in each direction at project opening for this assessment.

The cost therefore assumes that land acquisition and civil works are undertaken to accommodate a four-lane each way roadway in a 120m wide corridor (half of the full 240m wide road and rail corridor), however the roadway construction has been costed as two lanes in each direction.

Details are summarised in Table 7.

Table 7: OMR Road Scope – Corridors and Lanes

	Corridor	Corridor Width & Future Proofed Lane Allowance (Assumed for Land Acquisition and Civil Works)	Constructed lanes each way
Phase A – E6	E6 M80 Ring Road widening	70m – 4 lanes each way	2 lanes each way M80 i. E6 to Plenty Road Eastbound: Widen existing 4 lanes + shoulder ii. E6 to Plenty Road Eastbound: Widen existing 4 lanes + shoulder to 5 lanes + shoulder iii. Plenty Road overpass both directions: Provide extra outbound and inbound lanes iv. Plenty Road to E6 Westbound: Widen existing 4 lanes + shoulder to 5 lanes + shoulder
Phase B - OMR	OMR Tullamarine Freeway	120m – 4 lanes each way 120m – 4 lanes each way	2 lanes each way 2 lanes each way
Phase C - OMR	OMR DPBC	120m – 4 lanes each way 110m – 2 lanes each way	2 lanes each way 2 lanes each way

Road works required at the interfaces between the proposed corridor and existing roads include new interchanges, bridges, and road upgrades as specified in the initial AECOM cost report. It assumes road bridge over rail solutions where the OMR/E6 corridor interfaces with existing rail corridors (i.e. Geelong-Melbourne railway line, Melbourne-Bendigo railway line, Melbourne-Ballarat railway line, Mernda line, Albury line).

Six-metre high gantries along the OMR and E6 corridor have been allowed every 833m along corridors, with intelligent transport systems (ITS) and lane use management system (LUMS) gantries in accordance with the VicRoads Managed Freeway Handbook based on a design speed of 100km/h.

5.3 Refined project scope

The upper cost proposed for the strategic assessment is the initial cost prepared by AECOM.[24] The lower cost estimate reflects the refined scope and cost developed by Infrastructure Victoria, as described in section 1.2. The basis for the refined cost and scope are as follows.

[24] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

5.3.1 Opportunities to Refine the Scope

There are also opportunities to refine the scope and value-engineer the scheme given the modelling results. This includes considering whether future proofing four lanes in each direction is needed for the entire length of the road and the merits of including all of the interchanges and ramps.

Upon reviewing the modelling of the OMR in 2051, it was found that some sections of the OMR with two lanes in each direction had low utilisation, and it is therefore questionable whether future proofing for an ultimate four lanes in each direction should be provided for in these section. Reducing the future proofing requirement would reduce the costs of property acquisition and civil works. This may involve considering whether future proofing for three lanes could be suffice, or whether future proofing for any additional lanes is needed at all.

A section that had lower utilisation includes a 12 kilometre segment of OMR Phase C, between Ballan Road and the Princes Freeway. Despite strong population levels expected west of Wyndham Vale by 2051, demand along the OMR alignment running between these major radial corridors remains relatively low, utilising under 50% of available capacity. This provides an opportunity to refine future proofing for this section of OMR corridor. Modelled at two lanes in each direction in 2051, future proofing for an ultimate three lanes in each direction may be an alternative to the original four lanes in each direction. This section of the OMR alignment between Ballan Road and Princes Freeway also caters for a more specific range of movements than the OMR corridor just north of it. Given the close proximity of the Deer Park Bypass extension and Western Freeway, freight and commuter traffic from Melbourne's middle and outer west will likely use these connections to access the OMR, rather than travelling the further down the Princes Freeway past Werribee and then turning onto the OMR at its most south-westerly interchange. This leaves the OMR between the Princes Freeway and Ballan Road primarily catering for connecting routes through to Avalon Airport, Geelong and collecting some localised trips within the immediate growth area.

Another section of the OMR with lower levels of utilisation include a 5.5 kilometre segment between the Deer Park Bypass extension and Western Freeway. Similar to the previous case, these two intersecting roadways collect a large volume of traffic from the OMR corridor, meaning that future proofing this section to four lanes in each direction may also be unnecessary.

Additional opportunities to refine the scope include re-assessing the number and complexity of interchanges along the OMR corridor. The modelled initial project scope involved the construction of 30 interchanges, including half and full diamond interchanges, and various system interchanges with multiple ramps to facilitate all possible movements between intersecting motorways. With one interchange at about every 3 kilometres and a significant proportion of the road being constructed outside or on the edge of the Urban Growth Boundary, there are opportunities to consider the need and functionality of a number of interchanges and ramps.

Removal or consolidation of proposed interchanges along the OMR corridor would reduce the construction costs of the project. The modelling results indicated that there were also a number of ramps and interchanges with low utilisation, which potentially could be removed from the scope, which included a diamond interchange located on the extension of Aitken Boulevard in the outer north and Bulban Road in the outer west. Both interchanges recorded volumes of under 10% of total ramp capacity, suggesting general low utilisation in the area, or more suitable nearby interchange alternatives for motorists. In the early stages of constructing the full OMR corridor, given some sections of the corridor run through less populated areas outside of the urban growth boundary, at-grade interchanges may also be suitable for intersecting low-volume roads (if and where speed limits permit), reducing the initial costs of the project.

In addition, there are some interchanges that are close together and could potentially be consolidated into a single interchange. Having motorway interchanges in close proximity to each other not only increase the complexity and cost of the road, often requiring auxiliary lanes or braided ramps, but also potentially compromise safety of the roadway with more cars and trucks merging. An example where multiple interchanges can be consolidated is along the proposed E6 corridor, currently with interchanges at Bridge Inn Road and Masons Road, both full diamond interchanges. While both interchange sections may serve different local areas, they are within only 1.7 kilometres of each other, and may benefit the wider network if consolidated into a single connection with the E6 corridor. On a similar theme, there may also be locations along the alignment where only some movements will need to be accommodated. For example, motorists travelling west on the proposed Deer Park Bypass extension only have the option to head southbound once reaching the OMR. This is due to the close proximity of the Western Freeway, accommodating for motorists that need to travel northbound along the OMR. Through reducing possible vehicle movements, this reduces the complexity of the Deer Park Bypass interchange of OMR.

5.3.2 Design Synergies Across Road and Rail Scope

The OMR project is unusual as it involves the co-location of a road and a railway in one corridor, with each transport mode having different design criteria. For example, the OMR rail corridor is required to accommodate double stacked containers on the rail network, requiring greater clearances under intersecting transport corridors. In turn, having a greater clearance between the OMR roadway and intersecting roadways will require longer connecting ramp structures

to link the OMR into the existing road network. In addition to this, a rail corridor is typically designed to operate at lower gradients than a road corridor, requiring greater civil works to cut excavations and import fill to create a flatter corridor.

These combined factors make it more expensive to construct the OMR roadway in a shared road rail corridor, compared to a dedicated road corridor. There is the opportunity however to offset this additional cost by creating additional benefits and making cost savings in other areas. An example of a cost saving is sharing the requirement to separate the construction and operations of transport corridors from other land uses by acquiring additional land or providing sound walls.

AECOM's initial cost estimate has been developed based on a design that accommodates rail and road in the corridor, as outlined in section 5.2, with the total cost adjusted to remove costs associated with rail. This cost distribution exercise is difficult to precisely estimate and has currently been done based on the width of the corridor occupied by road compared to rail.

Infrastructure Victoria's major transport project strategic assessment considers the Outer Metropolitan Corridor as a road project only and the analysis does not capture any of the benefits associated with the rail component of the project. It is therefore important that the cost estimate adopted for the strategic assessment does not include additional costs that will be incurred by the road project as a result of being combined with the rail, when the benefits are not also being recognised.

5.3.3 Approach to Refined Cost

Based on the examples presented above, there are a number of opportunities to reduce the overall cost of the project through better scope definition. As such, it is likely that a lower cost could be achieved, as part of project development activities. In lieu of further design work and cost estimation, the cost estimates prepared for Infrastructure Victoria's 2016 30-Year Strategy were utilised to create a lower cost range.[25] While the scope of the 2016 work does not directly reflect the opportunities described in section 5.3.1 and 5.3.2 of this report, it does provide a valid lower cost value for the purpose of comparison and assessment of this project. This lower cost estimate is still within the -40% lower range of cost accuracy identified in the initial cost estimate prepared by AECOM.

The 2016 cost estimate has been escalated in accordance with the ABS index for construction costs[26] and Core Logic RP data[27] for house sales for land values, as Core Logic RP data was the cost source for land data utilised in 2016.

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[25] *AECOM/PwC, Options Assessment 3 Technical Report – Supplement C, Sept 2016, Page 50 to 56.*

[26] *ABS Data Index Number; 3101 Road and bridge construction Victoria;A2333706A: 2016 to 2020*

[27] *Website, https://www.corelogic.com.au/products/rp-data-professional (accessed 25 May 2021)*

6. Road Management Systems

6.1 Overview

The Road Management Systems (RMS) project aims to transform operational performance to improve the use of the road network for all modes. This project involves improving the management of the road network using a combination of up to date technology, modifications to the layout of roads and the development and application of innovative and improved operational practices. The project has been broken down into the following scope:

- Arterial Operations Improvement
- Clearway Implementation
- Road layout improvements, including for public transport

The cost estimates are based on the same scope, with the variance between the lower and upper cost ranges identified for the strategic assessment relating to the road layout improvements component of the project, as identified in the table below.

Table 8: RMS Upper and Lower Capital Cost (2020 dollars)

Project	Lower Cost ($ million)	Upper Cost ($ million)
Road Operations Management Systems Improvement	745	745
Clearway implementation	10	10
Road layout improvements (including for public transport)	3,800	4,500
Total RMS	**4,555**	**5,255**

6.2 Initial project scope

A more detailed description is provided for each component of the project.

6.2.1 Arterial Operations Improvement

The estimate includes:

- Operational staff and capability – more response crews and traffic engineers to tackle congestion hotspots, incidents and blockages on the network
- Data collection (with the intention of eventually being able to operate the network in real time)
- Additional crews to improve incident response
- Adjusting and reviewing the timings of several traffic lights to optimise traffic flows
- Updated and modern information technology systems

6.2.2 Clearway Implementation

The clearway implementation involves replacement of existing parking signage with new clearway signs on both directions along selected roads, including along the Grange Road, Chandler Highway to Power Street corridor.

6.2.3 Road layout improvements (including public transport)

The road layout improvements (referred to as ‘On-Road Public Transport and Arterial Road Improvements’ in the AECOM initial cost estimate) comprises:

- Implementation of continuous bus lanes and shared user path on Wellington Road between Princes Highway and Stud Road in each direction, including widening of the Wellington Road M1 bridge from 2 lanes each direction to 3 lanes plus shared user path in each direction and intersection upgrades.
- Extension of existing dedicated bus lanes (both directions) on Johnston Street (Abbotsford) from Smith Street to Nicholson Street using an overhead lane use management system, plus new dedicated bus lanes (both directions) on Elgin Street (Carlton) from Nicholson Street to Swanston Street , both making use of existing traffic lanes
- Arterial road improvements to employment precincts project as per the 2016 IV Strategy[28]. This scope involved targeted upgrades to road networks surrounding major employment centres to support their development by improving roads to access and by-pass centres and alleviating bottlenecks. It also includes prioritisation to public transport. The notional scope used for this project assessment involved upgrades to networks surrounding 30 activity centres.

6.3 Refined project scope

The lower cost proposed for the strategic assessment is the initial cost prepared by AECOM.[29] The upper cost estimate reflects the refined cost developed by Infrastructure Victoria, developed as described in section 1.2.

The modelling results indicated significant operational performance improvements due to this project. Given the significance of the operational improvements and resultant benefits from the modelling, it was deemed to be more likely that there may need to be further road layout improvements in more locations. Scope in the refined cost estimate was made for improvements to surrounding networks for an additional 20 activity centres, adopting a refined cost estimate of $4,500 million for this scope element of improving networks surrounding 50 activity centres.

[28] *Infrastructure Victoria (2016) Options Book – Refer to Arterial Road Network Employment Centre Enhancements – Project ARN (pp121)*

[29] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

7. Western Rail Corridor Upgrade

7.1 Overview

The Western Rail Corridor Upgrade project (WRU) seeks to provide a metro-style train line for growing communities in the western growth corridor, including Melton LGA, as well as providing similar services in the south-eastern growth corridor, including Casey and Cardinia LGAs.

The scope costed for the rail corridor is broken into two segments:

- Sunshine to Mt Atkinson (as identified in the Mt Atkinson and Tarneit Plains Precinct Structure Plan[30])
- Pakenham line upgrades (referred to 'Westall to South Yarra" in some documents)

Level crossing removals are not considered as part of the scope as they are assumed to continue to be separately assessed and funded through the State Government's Level Crossing Removal Program

The lower and upper capital costs nominated for the strategic assessment are provided in the table below:

Table 9: WRU Upper and Lower Capital Cost (2020 dollars)

Project	Lower Capital Cost ($million)	Upper Capital Cost ($million)
Sunshine to Mt Atkinson	1,570	2,512
Pakenham line upgrades (Westall to South Yarra)	317	317
Total	**1,887**	**2,829**

Figure 7: WRU Project Alignment

[30] *Mt Atkinson and Tarneit Plains Precinct Structure Plan*

Source: Arup 2021, annotated by Infrastructure Victoria

7.2 Initial project scope

The following scope describes the project scope on which the initial cost identified by AECOM[31] was based.

7.2.1 Sunshine to Mt Atkinson

The project scope is a significant uplift to the existing corridor and comprises of the construction of 13km of electrified twin tracks from Sunshine station to a newly constructed station at Mt Atkinson. The additional twin tracks will run parallel to the existing track on the Sunshine to Melton rail corridor.

The work also encompasses electrification of approximately 2.5km of the existing twin line, reconstruction of the Hampshire road flyover, relocation and upgrading of the existing stations at Deer Park and Ardeer, bridge structure under Bendigo/Sunbury and airport line tracks and a bridge over Kororoit Creek for new tracks.

The new station would be provided with facilities such as car parking, access, four platforms, forecourts, a bus interchange and stabling facilities for up to six trains.

7.2.2 Pakenham line upgrade (also referred to as 'Westall to South Yarra')

The project scope involves an incremental upgrade to power and traction on an existing corridor and includes new substations and rail power upgrades and overhead infrastructures upgrades. It is assumed that other parts of the South Eastern Rail Corridor can already accommodate service uplifts, as there are a number of projects improving this corridor.

7.3 Refined project scope

The lower cost proposed for the strategic assessment is the initial cost prepared by AECOM,[32]. The upper cost estimate reflects the refined cost developed by Infrastructure Victoria, developed as described in section 1.2.

The refined cost developed by Infrastructure Victoria did not alter the initial cost for the Westall to South Yarra segment, as no refinement opportunities were identified. Infrastructure Victoria reviewed the project scope of the Sunshine to Mt Atkinson segment and identified that it is possible the scope of work may increase, due to the scope interfacing with other projects at Sunshine Station and rail junction.

Sunshine Station will provide an interchange function for Melbourne Airport Rail Link, the Metro Tunnel Project, V/Line services from Ballarat and Wyndham Vale, and support rail freight. The station is likely to require significant works to reconfigure track alignments and support the connection of the Mt Atkinson services into the Metro Tunnel tracks. It is possible that this project will need to make a contribution to these improvements in addition to the scope that has been assumed in the initial cost estimate.

As such, a refined cost of $2,512 million was therefore adopted for this project scope element, representing the +60% upper range of cost accuracy identified in the initial cost estimate prepared by AECOM for the Sunshine to Mt Atkinson corridor.[33]

[31] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[32] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

[33] *AECOM 2021, IV 118 Transport Cost estimate to support Cost Benefit Analysis*

About us

Infrastructure Victoria is an independent advisory body, which began operating on 1 October 2015 under the *Infrastructure Victoria Act 2015*.

Infrastructure Victoria has three main functions:

- preparing a 30-year infrastructure strategy for Victoria, which is refreshed every three to five years
- providing written advice to government on specific infrastructure matters
- publishing original research on infrastructure-related issues

Infrastructure Victoria also supports the development of sectoral infrastructure plans by government departments and agencies.

The aim of Infrastructure Victoria is to take a long-term, evidence-based view of infrastructure planning and raise the level of community debate about infrastructure provision.

Infrastructure Victoria does not directly oversee or fund infrastructure projects.

Aboriginal acknowledgment

Infrastructure Victoria acknowledges the traditional owners of country in Victoria and pays respect to their elders past and present, as well as elders of other Aboriginal communities. We recognise that the state's infrastructure is built on land that has been managed by Aboriginal people for millennia.

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