

APPENDIX 1

CAPITAL INVESTMENT OPTIONS

Appendix 1 - Capital Investment Options

1. Introduction

1.1. Purpose of this Appendix

This Appendix sets out a wide range of potential capital investments, assesses the relative merits of these and recommends a preferred capital investment option which should be progressed for further development.

The capital investment options and analysis undertaken within this Appendix builds upon the *East West Link Needs Assessment* (EWLNA) transport study prepared by Sir Rod Eddington. The EWLNA identified and assessed the following four infrastructure options:

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

Further analysis has resulted in the development of a total of 13 capital investment options (including those outlined above) which are identified and assessed in the following sections.

1.2. Scope of capital investment options analysis

This Appendix focuses on options that seek to address the Problems and achieve the Benefits through fundamentally different capital investments, for example, through deploying new technologies, by expanding or enhancing existing infrastructure or through new infrastructure options – many of which involve very different solutions.

More detailed assessment of the optimal scope for the recommended capital investment option is provided in Chapter 7 (Project Options Analysis) and Appendix 2.

2. Options assessment methodology

2.1. Approach to identifying capital investment options

A significant body of work has been undertaken over a number of years to consider potential options that could address Melbourne's current and future public transport capacity needs. In identifying and assessing the potential strategic capital investment options to be considered in this Business Case, the Department has reviewed earlier studies (including previous business cases and technical reports), undertaken further investigations (including to ensure ongoing currency of information) and liaised with key stakeholders. Through this process, 13 potential capital investment options have been identified as possible strategic responses to address the identified Problems and realise the identified Benefits.

2.2. Approach to assessing capital investment options

A structured approach has been adopted to assess the capital investment options based on key considerations identified by the Department, in conjunction with other relevant stakeholders and specialist advisors. This has involved a two stage process:

1. **Preliminary Assessment** – A preliminary assessment has been conducted on all thirteen capital investment options to determine a shortlist to progress for more detailed analysis. This preliminary assessment has been undertaken on a predominantly qualitative basis, with the thirteen options assessed against four evaluation criteria:
 - Increasing rail capacity and improving reliability
 - Improving access to jobs and stimulating urban renewal
 - Deliverability and minimising productivity impacts caused by disruptions
 - Cost, where considered a distinguishing factor.
2. **Detailed Assessment** – More detailed analysis has been undertaken in relation to the shortlisted options to determine a preferred capital investment option.

This Appendix provides an overview of the 13 capital investment options, summarises the key findings of the two stage options assessment process and recommends a preferred capital investment option to progress for further analysis in this Business Case.

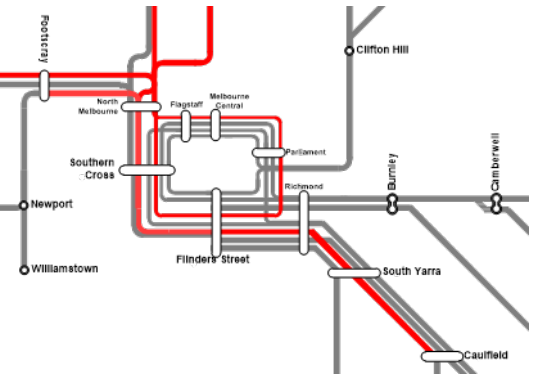
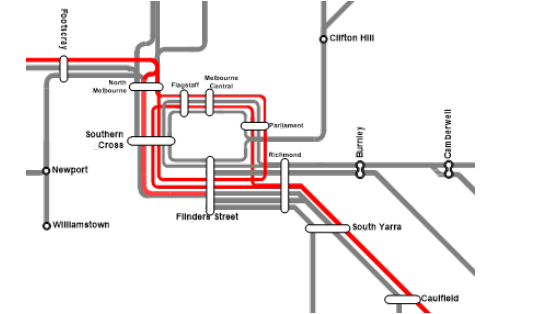
2.3. Overview of capital investment options

The capital investment options can broadly be categorised into options which:

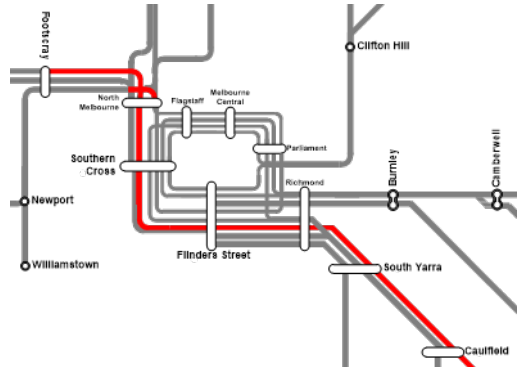
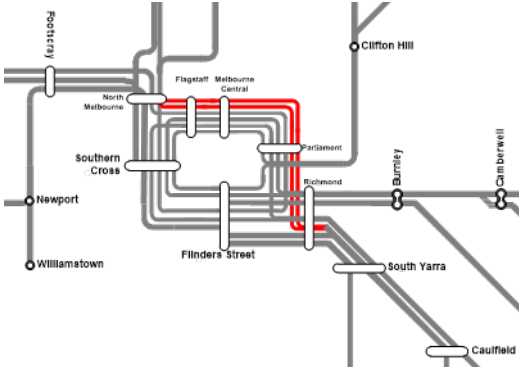
- Seek to improve network capacity through the deployment of new technology
- Predominantly involve the expansion or enhancement of existing infrastructure
- Involve the delivery of new rail infrastructure (in some instances in addition to deploying new technologies and/or modifying existing infrastructure).

These options are summarised in Table 1.

Table 1 - Summary identification of capital investment options

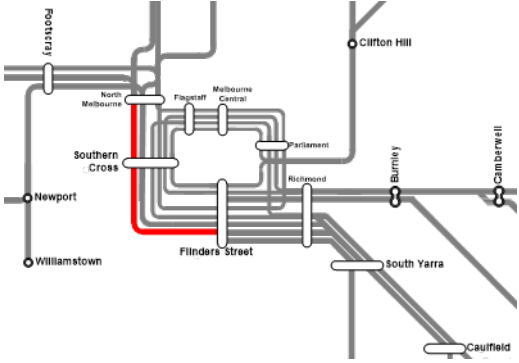
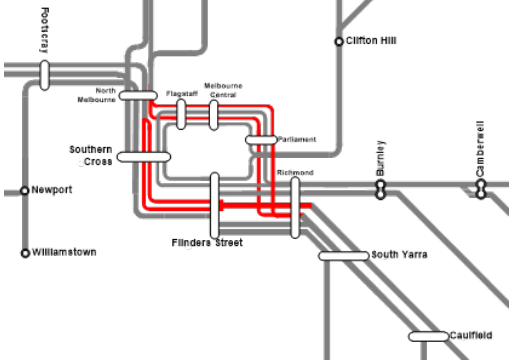
Option	Summary Description	
New technology options		
<p>High Capacity Signalling (HCS)</p>	<p>Existing signalling on some parts of Melbourne’s metropolitan rail network operates in a similar manner to signalling technologies from the early 20th century. Old signalling technology limits the number of trains per hour that are able to safely operate on the existing network infrastructure.</p> <p>This option would involve the replacement of existing signalling on the busiest parts of the network with state of the art HCS which would enable more train services to safely operate on the existing network. Instead of train drivers responding to trackside signals, a computer on the train that is in constant communication with central train control would control acceleration and braking, allowing the gaps between trains to be safely optimised. This would mean that trains could be scheduled more closely together, thereby enabling more trains to run and increasing capacity.</p> <p>To meet immediate demand pressures it is assumed that this option would initially involve signalling upgrades to introduce HCS on the suburban lines that operate through North Melbourne station and the Cross City Group (comprising the Werribee and Frankston lines, with some Craigieburn services also spilling over into this group). An examination of this option identified that it would increase capacity on the suburban lines that operate through North Melbourne station and on the Cross City Group from 20 tph to 26 tph.¹</p> <p>To maximise the benefits of HCS it would also be necessary to upgrade existing trains, procure new trains and/or redeploy trains across the network to ensure that trains operating on the upgraded lines are compatible with HCS.</p>	
<p>High Capacity Metro Trains (HCMTs)</p>	<p>This option would involve the progressive rollout of high capacity metro trains (HCMTs) across network. HCMTs are longer than existing trains (around 160m compared to approximately 143m for existing fleet types), but are constrained to this length as the maximum train length that could be accommodated within existing underground stations. These trains are more space-efficient and have significantly higher performance specifications than existing trains, providing a passenger load of 1,100 per train compared to 800-900 for existing suburban trains.</p> <p>This option involves continued deployment of these HCMT to replace existing rolling stock across the network, with services continuing to run on the same routes as today (although moderate works such as minor modification of station platforms, stabling facilities and changes to signal positions or power supplies will likely be required).</p> <p>The design for the HCMT allows for longer train configurations, however as they cannot be deployed in the existing MURL tunnels, this option is captured as a separate option (Extended High-Capacity Metro Trains).</p>	

¹ Public Transport Victoria *Metropolitan Rail Network Development* (PowerPoint presentation), (2015), slide 25.

Option	Summary Description	
<p>Extended High Capacity Metro Trains</p>	<p>This option would involve the progressive rollout of extended high capacity metro trains (HCMTs) across the surface network. Extended HCMTs are permitted by the HCMT design, with carriages added permanently within the train to increase capacity beyond that of a standard HCMT. Ten car extended HCMTs would require a platform of approximately 220m-225m in length and provide for a passenger load of 1,570 passengers per train (almost double the capacity of existing trains). Operation of these long trains requires substantial work such as lengthening station platforms across the network, including through the core of the rail network.</p> <p>This option involves deployment of extended ten car HCMTs on the Sunbury line and Cranbourne/Pakenham lines. To achieve this, the network would be reconfigured to establish a dedicated Sunshine – Dandenong Line on which the HCMTs would be deployed. This line would bypass the City Loop, because lengthening existing underground City Loop station platforms to cater for ten car HCMTs would require significant and extended City Loop disruptions and present material construction complexities given the stations’ underground locations, to the point that this would not be feasible. Instead these services would be routed through Flinders Street and Southern Cross stations.</p> <p>This would involve reassigning rail tracks within the City Loop and significant infrastructure works. These works would include the construction of a flyover in the north west of the CBD and significant works to lengthen existing station platforms at the inner core stations (North Melbourne, Southern Cross, Flinders Street, Richmond and South Yarra) as well as at surface stations along the Sunshine – Dandenong Line.</p> <p>Double-deck trains were also considered for inclusion within this option. However, while the configuration of these trains enables significantly more passengers per train, longer loading and unloading times associated with double-deck trains reduces the number of trains that can be run on the relevant lines at any one time, eroding the capacity uplift benefit. Double-deck trains would also be likely to attract additional costs associated with rebuilding bridges and flyovers, and other infrastructure to accommodate the difference in train dimension.²</p> <p>On this basis double-deck trains have not been put forward for consideration under this option.</p>	 <p>The diagram illustrates the Melbourne rail network with a new route highlighted in red. This route, the Sunshine-Dandenong Line, bypasses the central City Loop. It starts at Newport, goes through Southern Cross, Flinders Street, and Richmond, then heads south through Burnley, Clifton Hill, and Cheltenham to Caulfield. Other lines shown include the Frankston line (Frankston, North Melbourne, Flagstaff, Melbourne Central, Parliament, Richmond, South Yarra, Caulfield), the Sunbury line (Sunbury, Clifton Hill, Cheltenham, Caulfield), and the Cranbourne/Pakenham line (Cranbourne, Pakenham, Clifton Hill, Cheltenham, Caulfield).</p>
<p>New infrastructure – expanding or enhancing existing inner city routes</p>		
<p>City Loop Duplication</p>	<p>The City Loop currently comprises four single track tunnels servicing four of the five metropolitan rail groups (Northern, Dandenong, Burnley and Clifton Hill). The City Loop Duplication option proposes the construction of a new pair of tracks in new twin tunnels below the existing City Loop, thereby providing additional capacity within and through the CBD.³</p> <p>This would involve a third level of tunnelling and new platforms under the existing two levels at Flagstaff, Melbourne Central and Parliament stations (assumed of similar length to existing platforms), portals in the vicinity of North Melbourne and Richmond stations, and associated connections and changes to existing tracks.</p> <p>This option would enable services to operate via the new track pair from Richmond to North Melbourne, stopping at Flagstaff, Melbourne Central and Parliament. It would result in six independent train lines, potentially as follows:</p> <ul style="list-style-type: none"> • Craigieburn/Upfield – Frankston line: operating as a new cross-city service via the new pair of tracks • Werribee-Sandringham line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Sunbury line: operating as a dedicated service using the Northern city loop tracks • Dandenong Group: unchanged from base case operations • Burnley Group : unchanged from base case operations • Clifton Hill Group: unchanged from base case operations 	 <p>This diagram is similar to the one above but highlights the 'City Loop Duplication' option in red. It shows a new pair of tracks being added to the existing City Loop infrastructure, specifically between North Melbourne and Richmond, and connecting to Flagstaff, Melbourne Central, and Parliament stations. The rest of the network structure remains the same as in the previous diagram.</p>

² Additional costs would also likely be incurred if this option were paired with a new rail tunnel option, as the cross-sectional tunnel area and widths of station boxes requiring excavation would be significantly larger than the area required to construct a tunnel that provides for single-deck trains only. In comparison, single-deck HCMTs deliver project cost savings through a reduced tunnel diameter and station size.

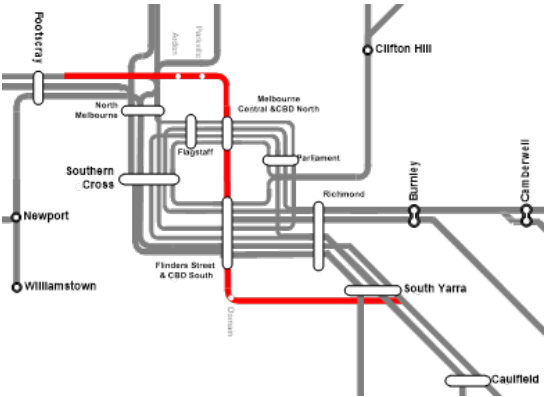
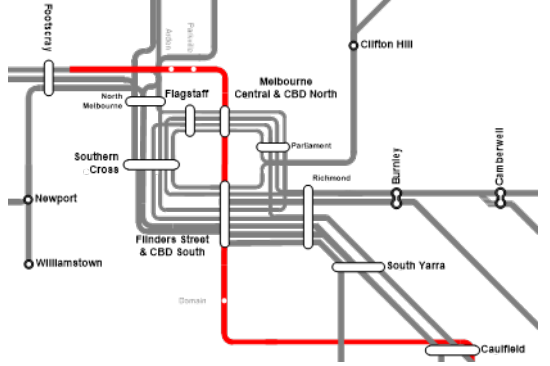
³ The variant considered through the EWLNA also widened the viaduct to enable a full new loop, via all five existing stations. Recognising the tunnel option delivers the core capacity uplift, the modified variant described has been considered as an improved candidate option for this analysis.

Option	Summary Description	
Viaduct Widening	<p>This option would involve:</p> <ul style="list-style-type: none"> • Electrification of approximately 2.5km of new Regional Rail Link (RRL) tracks between Spion Kop Junction (North Melbourne) and Southern Cross Station to enable metropolitan services to operate on these tracks • Widening the existing Flinders Street viaduct (Flinders Street Viaduct) between Southern Cross and Flinders Street stations to accommodate an additional pair of 1.3km tracks • Other modifications including construction of two new platforms (Platforms 7 and 8) at North Melbourne, track work alterations at Spion Kop Junction to enable the use of Southern Cross Platforms 15 and 16 for metropolitan services (instead of regional services⁴) and construction of a new rail-rail flyover at Sunshine to allow Melton / Bacchus Marsh trains to access Sunbury metropolitan tracks (instead of RRL tracks) • New viaduct at Franklin Street to enable existing platforms 15/16 RRL services to access platforms 1-8. <p>This would enable the Craigieburn and Sandringham lines to be connected via Southern Cross and Flinders Street stations, removing Craigieburn services from the City Loop and thereby increasing capacity for this line while making capacity available for Sunbury and Upfield services.</p>	
City Loop Split	<p>The City Loop Split would involve reconfiguring the City Loop by creating new tunnel connections to the tunnel portals at North Melbourne and Richmond to effectively create “new” capacity through the city using existing tracks. This would turn the existing loop tracks operating through platforms 2 and 3 in the City Loop into a track pair enabling services to operate between North Melbourne and Richmond via the City Loop (stopping at Flagstaff, Melbourne Central and Parliament) rather than looping around to Flinders Street via the Flinders Street Viaduct (as they do currently). In turn, two tracks over the Flinders Street Viaduct would become available as “new” capacity.</p> <p>This option would result in the following 6 independent train lines:</p> <ul style="list-style-type: none"> • Sunshine – Dandenong Line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Werribee-Sandringham line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Frankston-Craigieburn/Upfield line: operating as a new cross-city service via platforms 2 & 3 in the City Loop • Burnley Group : unchanged from base case operations • Clifton Hill Group: unchanged from base case operations 	

⁴ Regional services currently using Platform 15 & 16 at Southern Cross would be relocated to Platforms 1 – 8, merged with other regional services.

Option	Summary Description	
New infrastructure – providing new inner city routes		
<p>Standalone metro system</p>	<p>This option would initially involve the construction of a 12-13 kilometre standalone metro system between Maribyrnong and Domain, via Parkville and Swanston Street with options identified for in the order of 6 – 8 new stations.</p> <p>This would be the first stage of a new metro system that would have branch lines extending to inner/middle suburbs including Rowville and Melbourne Airport. The extension to Rowville would likely involve in the order of 20km of tunnelling from Domain, with the opportunity to link to Chadstone and Monash University.</p> <p>Because these lines would be entirely separate from the existing rail network, introduction of new technologies would be simpler, offering a “Greenfield” opportunity to deliver integrated metro-style rail systems (i.e. rolling stock, signalling and power would not need to interface with Melbourne’s legacy rail systems).</p>	
<p>Hoddle Street bypass</p>	<p>The Hoddle Street bypass would involve construction of a new pair of tracks in approximately 7 kilometre twin tunnels to connect services from the north-west (e.g. South Kensington) to South Yarra via Arden, Parkville, Fitzroy, Collingwood and Richmond – potentially with new stations at each of these locations. The tunnels would therefore bypass the city to the north before following Hoddle Street to the south.</p> <p>This would accommodate Sunbury to Dandenong services with these lines bypassing the City Loop, thereby releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield lines. It would result in six independent train lines.</p>	
<p>Fishermans Bend bypass</p>	<p>This option would involve the construction of a new pair of tracks in 6-7 kilometre twin tunnels linking the south-east (e.g. South Yarra) to the north-west (e.g. North Melbourne) via a new underground station at in the vicinity of Southern Cross and with opportunities for new underground stations at Fishermans Bend, Domain and South Yarra.</p> <p>This would accommodate Sunbury to Dandenong services with these lines bypassing the City Loop, thereby releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield lines. It would result in six independent train lines.</p>	

Option	Summary Description	
<p>North Melbourne to Richmond tunnel</p>	<p>This option would involve the construction of approximately 5 – 6 kilometre twin tunnels between North Melbourne and Richmond. Tunnels could be aligned with a number of east-west CBD streets, including Flinders, Collins, Bourke or Lonsdale Streets. A Flinders Street alignment would face particularly poor ground conditions, while Collins and Bourke are relatively busy in terms of trams and pedestrian movements, so Lonsdale Street has been focused on for the purpose of a high level assessment.</p> <p>New underground stations could be provided at between Spencer and King Streets and between Elizabeth and Swanston Streets, one city block from Southern Cross and Melbourne Central stations, respectively. Very extensive works would be required in the vicinity of North Melbourne and Richmond stations if the tunnel was to link to existing tracks on the city side of these stations and the feasibility of this cannot be confirmed without detailed investigation. Based on a high level assessment, this option may therefore involve linking to existing tracks on the other side of these stations and providing new underground platforms at each of these stations.</p> <p>The new tunnel would accommodate Sunbury to Dandenong services with these lines bypassing the City Loop, thereby releasing capacity for the Frankston, Sandringham, Craigieburn, Werribee and Upfield lines. It would result in six independent train lines.</p>	
<p>MRL (Fishermans Bend)</p>	<p>This option would involve the construction of a new pair of tracks in twin 6-7 kilometre tunnels linking the north-west corner of the City Loop (north of Southern Cross) to the existing tracks at South Yarra, with new underground stations at Southern Cross, Montague, Domain and South Yarra. A new portal would also be required at Jolimont to connect the Caulfield group City Loop tunnel to the Ringwood line. This option is effectively a hybrid of the Fishermans Bend bypass and Loop Split options discussed above.</p> <p>This would create a cross-city Frankston to Ringwood line (through the new tunnels and the City Loop tracks that pass through platforms 2 and 4 in the existing underground stations) that would remove Frankston and Ringwood services from the congested Flinders Street Viaduct. The capacity released on the viaduct could then be used to create a cross-city Sunshine to Dandenong line (on dedicated tracks between North Melbourne – Southern Cross – Flinders Street – Richmond along the viaduct), thereby removing Sunbury to CBD and Dandenong to CBD services from the City Loop. This would increase City Loop capacity for Craigieburn and Upfield services and provide a dedicated through-running service for Sunbury-Dandenong.</p> <p>The establishment of cross-city Frankston-Ringwood services would also enable the creation of a Werribee to Sandringham service (the existing network involves Werribee to Frankston services) which would increase capacity on the Werribee and Sandringham lines. This option would result in the following six independent train lines:</p> <ul style="list-style-type: none"> • Sunshine – Dandenong Line: via Southern Cross and Flinders Street using the Flinders Street Viaduct • Werribee-Sandringham Line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Frankston-Ringwood Line: operating as a new cross-city service via the new tunnel and the reconfigured Caulfield and Burnley loops • Craigieburn-Upfield Line: operating as a dedicated service via the Northern loop • Clifton Hill Line: unchanged from base case operations • Glen Waverley Line: Operating independently from the Ringwood line services 	

Option	Summary Description	
Melbourne Metro	<p>This option would involve the construction of 9 kilometre twin tunnels from South Kensington to South Yarra, with five new underground stations at Arden, Parkville, CBD North (Melbourne Central), CBD South (Flinders Street) and Domain.⁵ Services would operate on existing tracks from Sunbury to South Kensington before entering the new rail tunnel from South Kensington and then connecting to the existing Dandenong corridor at South Yarra.</p> <p>This would accommodate Sunbury to Dandenong services via the new tunnels, freeing up existing tracks to restructure the network. This option would result in the following six independent train lines:</p> <ul style="list-style-type: none"> • Craigieburn – Upfield Line: operating as a dedicated service via the Northern loop • Sunshine – Dandenong Line: Sunshine, Cranbourne and Pakenham services via the Melbourne Metro tunnels • Werribee – Sandringham Line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Frankston Loop Line: operating as a dedicated service via the Caulfield loop • Clifton Hill Line: unchanged from base case operations • Burnley line: unchanged from base case operations 	 <p>The diagram shows the Melbourne Metro rail network. A red line highlights the proposed 9 km twin tunnel route from South Kensington to South Yarra. Key stations along this route include Arden, Parkville, Melbourne Central & CBD North, Flinders Street & CBD South, and Domain. Other existing lines and stations shown include Footscray, North Melbourne, Southern Cross, Newport, Williamstown, Flagstaff, Parliament, Richmond, Burnley, Clifton Hill, and Caulfield.</p>
South Kensington to Caulfield tunnel	<p>New 15 km twin rail tunnels from South Kensington to Caulfield with seven new underground stations at Arden, Parkville, CBD North (Melbourne Central), CBD South (Flinders Street), Domain, in the vicinity of Alfred Hospital and in the vicinity of Windsor station.</p> <p>This options would operate services from Sunbury to Pakenham and Cranbourne via the tunnels so that the services could be 'through-routed' via the CBD. Dandenong corridor trains would operate into the new CBD tunnel at Caulfield.</p> <p>This options would result in the following six independent train lines:</p> <ul style="list-style-type: none"> • Craigieburn – Upfield Line: operating as a dedicated service via the Northern loop • Sunshine – Dandenong Line: Sunshine, Cranbourne and Pakenham services via the tunnels • Werribee – Sandringham Line: operating as a new cross-city service via Southern Cross and Flinders Street using the Flinders Street Viaduct • Frankston Loop Line: operating as a dedicated service via the Caulfield loop • Clifton Hill Line: unchanged from base case operations • Burnley Line: unchanged from base case operations 	 <p>The diagram shows the South Kensington to Caulfield tunnel rail network. A red line highlights the proposed 15 km twin tunnel route from South Kensington to Caulfield. Key stations along this route include Arden, Parkville, Melbourne Central & CBD North, Flinders Street & CBD South, Domain, and Caulfield. Other existing lines and stations shown include Footscray, North Melbourne, Southern Cross, Newport, Williamstown, Flagstaff, Parliament, Richmond, Burnley, Clifton Hill, and Caulfield.</p>

⁵ Additional/alternative station options have also been considered for this option. For the purposes of this appendix, the options analysis is based on the scope as documented in the previous Melbourne Metro business case in 2012. Further analysis of project options (including alignment and station options) is provided in Chapter 7 and Appendix 2.

3. Evaluation Framework

3.1. Evaluation criteria

Evaluation criteria have been developed to assess the capital investment options, as part of an overall project evaluation framework. These evaluation criteria have been developed to:

- Assess the ability of each option to address the Problems and realise the Benefits identified in the ILM
- Enable the key points of differentiation to be identified so that the capital investment options can be compared effectively.

Based on this approach, four evaluation criteria have been identified for the purposes of this options assessment.

Table 2 - Evaluation criteria

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

Where important issues have not been specifically captured in these criteria or the key considerations (for example, safety) it is because these issues, while important, are not considered to be key differentiating factors in the comparison between options (for example, because all options would need to be safe).

3.2. Approach to Preliminary and Detailed Assessments

The Preliminary Assessment has been undertaken by considering Evaluation Criteria 1, 2 and 3 outlined above, and Evaluation Criteria 4 only where required to distinguish options in order to identify a shortlist of capital investment options.

Further assessment of the shortlisted capital investment options, including an assessment against Evaluation Criterion 4 outlined above, has then been undertaken as part of the Detailed Assessment.

Finally, the analysis considered the extent to which each shortlisted capital investment option addresses the identified Problems and therefore is able to generate the Benefits set out in the ILM.

4. Preliminary Assessment

Outlined in the table below are the key preliminary assessment considerations for each capital investment option.

It should be noted that capital investment options were developed to a varying level of detail, particularly in relation to respective costs. Accordingly, the preliminary assessment does not consider cost unless it makes a significant difference to the consideration of that option.

4.1. Summary of preliminary options analysis

Table 3 - Summary of preliminary options analysis⁶

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
COMPLIMENTARY NEW TECHNOLOGY OPTIONS			
High Capacity Signalling (HCS)	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network by potentially providing up to three additional trains per hour on the Northern Loop. • (neutral): This option would delay (but not avoid) the need for significant new infrastructure investment (e.g. new tunnels) to expand network capacity. • (-ve): The lines to be upgraded are facing rapid growth in demand, and the capacity provided by this option to the suburban lines that operate through North Melbourne station would only support approximately 2-3 years of growth. • (-ve) The capacity uplift associated with this option is not sufficient to enable electrifications to Melton and Wallan or new lines to Melbourne Airport or Rowville. • (-ve): This option would not materially improve reliability because it would not deliver new infrastructure or lead to the operation of independent lines on the network. Additionally, the assumed capacity gain above stretches the HCS solution to the maximum throughput while maintaining current reliability and performance. • (-ve): This option would exacerbate crowding at busy CBD stations. 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. 	<ul style="list-style-type: none"> • (+ve): This option could be implemented somewhat faster than new tunnel options to help deliver capacity increases in the short term.⁷ • (+ve): This option would involve minimal / no road disruption or property acquisitions. • (-ve): Implementation of HCS would result in some disruption and reliability risks across the rail network.
High Capacity Metro Trains (HCMT)	<ul style="list-style-type: none"> • (+ve): This option would expand the passenger capacity of trains by approximately 22% on average. • (neutral): The option is consistent with the fleet renewal strategy set out in the Governments Victorian Rolling Stock Strategy. Deployment of High Capacity Metro Trains on the Sunbury Line is included in the Melbourne Metro option. • (-ve): As HCMT will be deployed on the Cranbourne and Pakenham lines prior by the CPLU 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. 	<ul style="list-style-type: none"> • (+ve): This option could be implemented somewhat faster than new tunnel options to help deliver capacity increases in the short term. • (-ve): New stabling and maintenance facilities would be required across the network to accommodate the HCMT.

⁶ Analysis is presented as positive (+ve), neutral or negative (-ve) in comparison to the Base Case.

⁷ Prior to implementation a HCS trial would be conducted on the Sandringham Line. It is anticipated this option could be operational by the early-mid 2020s.

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	<p>project, this option would not provide any new capacity to these growth areas.</p> <ul style="list-style-type: none"> • (-ve): Reliability improvements would be limited to improvements associated with the new train, there improvements relating to simplifying and separating complex interactions between lines would not occur. • (-ve): This option would exacerbate crowding at busy CBD stations. • (-ve) The capacity uplift associated with this option is not sufficient to enable electrifications to Melton and Wallan or new lines to Melbourne Airport or Rowville. • (-ve): This option would bring forward rolling stock elements of Melbourne Metro, but otherwise only marginally delay (rather than avoid) the need for significant new infrastructure investment (e.g. new tunnels) to expand network capacity. 		
Extended High Capacity Metro Trains (HCMTs)	<ul style="list-style-type: none"> • (+ve): This option would further expand the passenger capacity of trains. This would enable medium term demand to be addressed on the Sunshine – Dandenong Rail Line (where the new trains would be deployed). • (-ve): This option would not materially improve reliability because it would not result in the operation of independent lines on the network. • (-ve): This option would exacerbate crowding at busy CBD stations. • (-ve): The capacity uplift associated with this option is not sufficient to enable electrifications to Melton and Wallan or new lines to Melbourne Airport or Rowville. • (-ve): This option would merely delay (rather than avoid) the need for significant new infrastructure investment (e.g. new tunnels) to expand network capacity. 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. • (-ve): New stabling and maintenance facilities would be required across the network to accommodate the HCMT. 	<ul style="list-style-type: none"> • (-ve): This option would require extensive track reconfiguration between North Melbourne and Richmond to connect the Sunbury and Cranbourne / Pakenham lines, involving major disruption to the network, including platform extensions, power upgrades, stabling upgrades, and construction of flyovers between Caulfield – Richmond and North Melbourne – Footscray. • (-ve): In order to accommodate longer trains, the platforms of inner core stations and the stations servicing the Sunbury – Dandenong Lines would require lengthening. This would involve major works at inner core stations, particularly Richmond and Flinders Street which are constrained by narrow platforms and limited accessibility to/from platforms. • (-ve): If a new rail tunnel is subsequently constructed, the above works to the core of the rail network may become redundant.
EXPANSION/ENHANCEMENT OF EXISTING INFRASTRUCTURE			
City Loop Duplication	<ul style="list-style-type: none"> • (+ve): This option would materially expand the capacity and throughput of the core of the rail network. • (+ve): The capacity uplift associated with this option is sufficient to enable electrification on Melton and Wallan. 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). 	<ul style="list-style-type: none"> • (-ve): Construction would be highly complex and expensive as it involves the construction of two new tracks below the City Loop, new platforms 5 and 6 at Flagstaff, Melbourne Central and Parliament, and associated track connections. The constructability of this option has not been tested

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	<ul style="list-style-type: none"> • (-ve): The capacity uplift associated with this option is not sufficient to enable new lines to Melbourne Airport, Rowville or Melton. • (-ve): Based on the patronage forecasts presented in Chapter 3, this expanded capacity would start to be exhausted by around 2030, at which point the Problems defined in this Business Case would reoccur. • (+ve): Results in improved reliability benefits as result of the independent operation of the following lines: Sunbury, Dandenong, Werribee-Sandringham, Frankston and Craigieburn - Upfield Lines. • (-ve): This option would exacerbate crowding particularly at Flagstaff, Melbourne Central and Parliament stations, but also at North Melbourne and Richmond. • (-ve): This option would not result in extended HCMTs operating on the Sunshine – Dandenong Rail Line (which remain split in this option). 	<ul style="list-style-type: none"> • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. 	<p>to any level of detail⁸ but it is likely that it would involve significant disruption to rail services including potential closures of City Loop stations and major construction sites in the CBD.</p> <ul style="list-style-type: none"> • (-ve): Road and other disruption would be required at major construction sites to launch the tunnelling works.
Viaduct Widening	<ul style="list-style-type: none"> • (+ve): This option would materially expand the capacity and throughput of the core of the rail network. • (+ve): This option would provide a new route through to the CBD from the north, thereby increasing the capacity of the rail network. • (-ve): The capacity uplift associated with this option is not sufficient to enable electrifications to Wallan or new lines to Melbourne Airport or Rowville. • (-ve): This option would exacerbate crowding at busy CBD stations, North Melbourne and Richmond. • (-ve): This option would require more capacity to be provided on the Sunshine to Dandenong corridor in the early 2030s which would be challenging to deliver 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would adversely impact the amenity of Northbank precinct along the Yarra River. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. 	<ul style="list-style-type: none"> • (+ve): Track alternation works at Spion Kop Junction, the electrification of the relevant RRL tracks and construction of platforms 7 and 8 on the RRL tracks at North Melbourne could be undertaken (although this would require some occupations mainly on weekends) and a new flyover to mitigate impacts on regional network). • (-ve): Widening of the viaduct would lead to service disruptions primarily to the cross-city services operating between Werribee/Williamstown and Frankston. (However, the operation of all other lines, including the Cranbourne and Pakenham lines, which would continue to utilise the Caulfield Loop, should be unaffected during construction works on the viaduct.) • (-ve): The construction of a new flyover at Sunshine would require short periods of disruption (mainly on weekends) to Sunbury and Bendigo line services. • (-ve): Other construction period disruptions include potential partial closure of Melbourne Aquarium and King and Market Streets, impacts on the

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

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
City Loop Split	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network. • (+ve): This would enable more services to operate cross-city on dedicated tracks thereby enhancing the reliability as well as frequency of services. • (+ve): The capacity uplift associated with this option is sufficient to enable electrifications to Melton for the medium term • (-ve): This would result in greater interchanges at Richmond and North Melbourne stations, leading to more congestion and unreliability at these locations. • (-ve): This option would exacerbate crowding at underground platforms. • (-ve): Operation of extended HCMT would be limited to surface routes and only if substantial upgrades to inner city stations (as per the extended HCMT option) were completed, and without this the option would not provide sufficient capacity on the to enable new lines to Melbourne Airport, Rowville or electrification to Wallan • (-ve): This option would require more capacity to be provided on the Sunshine – Dandenong Rail Corridor in the early 2030s which would be challenging to deliver. 	<ul style="list-style-type: none"> • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (-ve): This option would not provide any new stations to service new catchment areas. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. Parkville) or stimulate urban renewal in key precincts. • (-ve): This option would result in Frankston, Craigieburn and Upfield lines no longer serving Flinders Street and Southern Cross stations 	<p>World Trade Centre and disruptions to the 55 tram service as construction works would occur in the vicinity of these businesses and areas.</p> <ul style="list-style-type: none"> • (-ve): This option would involve portal and track works which would significantly disrupt City Loop services over several months during delivery. • (-ve): The capacity of unaffected underground loop lines would be grossly insufficient to distribute passengers across the city during construction works and therefore this option would be difficult/impractical to build as it would leave very limited rail alternatives to cross the city. • (-ve): Some road and other disruption would be required at major construction sites to enable construction of the expanded tunnel portals and connections in North Melbourne and Richmond / Jolimont.
NEW INFRASTRUCTURE			
Standalone metro system⁹	<ul style="list-style-type: none"> • (+ve): Subsequent stages of the project could deliver some crowding relief on the Dandenong corridor as the new metro system could divert passengers from the middle suburbs away from the existing line. (NB: no benefit from the initial project). • (-ve): The option would not connect to existing suburban lines, and therefore would not provide capacity, deliver more services or improve reliability on rail services for the growth areas to the west, north and south-east of Melbourne where demand is increasing. 	<ul style="list-style-type: none"> • (+ve): Provides opportunities for in the order of six to eight new stations, although the catchment along the line with direct access to these stations (i.e. without interchange) would be limited until the network was further expanded so use of these stations would depend on interchange from the existing rail network • (+ve): This option would alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville). • (+ve): Possible urban development opportunity within the Arden Renewal Area on existing state government land. 	<ul style="list-style-type: none"> • (+ve): This option would likely involve only minor disruption to the existing metropolitan rail network, where it physically crosses rail corridors. • (+ve): This option avoids the need to interface new technologies with a legacy brownfield rail network, making it possible to incorporate new technologies efficiently / more cheaply. • (-ve): Construction would cause significant road and other disruption (including property acquisitions), along the length of the standalone link alignment.

⁹ This option has been evaluated on the basis of the first stage of the metro system (Maribyrnong to Domain), a major project in its own right, recognising it is conceived of as a program of work to build a standalone series of lines.

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	<ul style="list-style-type: none"> • (-ve): To meet medium term network requirements it would be necessary to undertake another significant capital investment project to increase capacity on the existing rail network within the CBD. • (-ve): The capacity uplift associated with this option is not sufficient to enable electrifications to Melton and Wallan. • (-ve) While this option could enable new lines to Melbourne Airport and Rowville, these projects would be considerably more expensive, as they would require long tunnels back to central Melbourne, rather than making use of existing tracks. • (-ve): This option would not alleviate crowding at busy CBD stations. • (-ve): The new line would be only lightly patronised compared to central area sections of the existing railway until subsequent network expansion was completed. 	<ul style="list-style-type: none"> • (+ve): May provide opportunities for further urban development due to creation of a new rail corridor. However, this would be limited until further line expansions occurred beyond the initial project (i.e. subsequent capital investment). • (-ve): Initial concept terminates at Domain, which will result in significant metro-tram interchanges. • (-ve): Limited catchment until further line expansions occurred beyond the initial project. 	<ul style="list-style-type: none"> • (-ve): Complex ground conditions could be expected, particularly in the vicinity of the Maribyrnong River and Yarra River. • (-ve): The benefits of the project depend heavily on subsequent expansion of the standalone network, requiring Government to commit to a high cost program of works over several decades to make use of the infrastructure delivered by the initial project.
Hoddle Street – City bypass	<ul style="list-style-type: none"> • (+ve): Allows Sunbury to Dandenong services to bypass the City Loop, releasing capacity for other lines within the existing network. • (neutral): This option would expand the capacity of the network. However, given its nature as a CBD bypass, this capacity would be grossly underutilised in the core underground section of the lines that operate through the new tunnel as it is not taking most customers to where they want to go in Central Melbourne. • (-ve): To meet medium term network requirements it would be necessary to undertake another significant capital investment project to increase capacity within the CBD. • (-ve): Major flows of interchanging passengers would occur at Richmond and Footscray for CBD access, leading to significant crowding issues at these stations and on trains between these stations and the CBD. • (-ve): Major flows of interchanging passengers would occur at the new stations in the inner north for CBD access, likely leading to significant crowding issues on trams. • (-ve): Due to crowding issues this option creates in the core of the rail network, it would not enable 	<ul style="list-style-type: none"> • (+ve): Provides opportunities for new stations at Arden, Parkville, Fitzroy, Collingwood and Richmond. • (+ve): The new station at Parkville would facilitate access to a key employment cluster outside the CBD. • (+ve): The new station at Arden (a key urban renewal precinct) provides an opportunity to stimulate development and urban renewal. • (-ve): Rather than improving access to Melbourne’s most important employment precinct, this option would result in Sunbury-Dandenong services bypassing the CBD. • (-ve): This option would not alleviate congestion on busy tram routes (e.g. St Kilda Road or Parkville) and in many cases would exacerbate it. • (-ve): This option does not increase capacity where it is most needed (i.e. for CBD access). • (-ve): Does not provide connectivity to the CBD or interchanges to the centre of Melbourne’s existing public transport network. • (-ve): This option removes direct access to all existing inner core stations for all passengers on the Sunbury and Cranbourne / Pakenham Lines. 	<ul style="list-style-type: none"> • (-ve): This option would involve disruption to rail services for construction of portals and potentially for interchange stations. • (-ve): Construction would cause significant road and other disruption (including property acquisitions), particularly due to station construction at South Kensington, Parkville, Fitzroy, Collingwood and Richmond. Along the Hoddle Street corridor there would either be major property acquisitions or major disruption to this key arterial road.

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
Fishermans Bend bypass	<p>electrifications to Melton and Wallan or new lines to Melbourne Airport or Rowville.</p> <ul style="list-style-type: none"> • (+ve): Allows Sunbury to Dandenong services to bypass the City Loop, releasing capacity for other lines within the existing network. • (+ve / Neutral): This option would expand the capacity and throughput of the core of the rail network. However, given it only services one CBD station, this capacity would be underutilised in the core underground section of the lines that operate through the new tunnel. • (-ve): To meet medium term network requirements it would be necessary to undertake another significant capital investment project to increase capacity within the CBD. • (-ve): This bypass would result in only one CBD stop (Southern Cross) for two of the busiest lines in the network (Sunbury and Cranbourne-Pakenham). This would result in increased interchange and crowding at fringe CBD stations (for example, North Melbourne and South Yarra), and on rail services between these stations and the CBD. • (-ve): This option would result in increased rail-rail interchange at Southern Cross station to access the City Loop, leading to overloading of Clifton Hill Loop services. • (-ve): Due to crowding issues this option creates in the core of the rail network, it would not enable electrifications to Melton and Wallan or new lines to Melbourne Airport or Rowville. • (-ve): May be detrimental to existing tram network capacity along St Kilda Road, Bourke, Collins and La Trobe Streets due to increased interchanges at Domain and Southern Cross. 	<ul style="list-style-type: none"> • (+ve): Provides opportunities for new stations at Southern Cross, Fishermans Bend, Domain and South Yarra. • (+ve): The new station at Fishermans Bend (a key urban renewal precinct) provides an opportunity to support development and urban renewal. • (+ve): The new station at Domain would improve access to employment located along St Kilda Road. • (+ve): Supports south westerly expansion of CBD. • (-ve): This option does not improve rail access to the central CBD as it only stops at one station. • (-ve): This option would also result in a severe increase in rail-to-tram interchange at Southern Cross for access to the centre of the CBD, leading to additional crowding on tram services. It may also increase pressure on St Kilda Road trams because passengers from the south-east travelling to the central or north-eastern end of the CBD (currently the major activity centre) may change from train to tram at Domain or South Yarra. • (+ve): This option would offer some level of relief to the St Kilda Road tram corridor. However, the network configuration resulting from this option would make Domain Station relatively less attractive than the Melbourne Metro option described below, with passengers from the eastern and north-eastern suburbs required to travel via Southern Cross for access to Domain Station making the tram from Flinders Street relatively more attractive and resulting in less crowding relief on trams. 	<ul style="list-style-type: none"> • (-ve): This option would involve significant disruption to rail services due to construction of tunnel portals, connections and new stations at Southern Cross and South Yarra. • (-ve): Tunnelling works would require significant road and other disruption (including property acquisitions), for example at Charles Grimes Bridge (Wurundjeri Way) and/or in the South Wharf precinct. • (-ve): Construction would cause significant road and other disruption (including property acquisitions), particularly due to station construction at Southern Cross, Fishermans Bend, Domain and South Yarra.
North Melbourne to Richmond tunnel	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network. • (+ve): Enables more services to operate cross-city on dedicated tracks thereby enhancing the reliability as well as frequency of services. • (+ve): This option would alleviate crowding at busy CBD stations. • (+ve): Would provide capacity increase along existing Bourke, Collins and La Trobe Street tram routes (but not on St Kilda Road). 	<ul style="list-style-type: none"> • (+ve): Provides two new CBD stations (one city block from Southern Cross and Melbourne Central stations). • (+ve): This option would enable more people to travel by train to jobs in the CBD. • (+ve): Option would relieve Collins and Bourke St routes which are currently heavily loaded. • (-ve): This option would not improve access to key employment clusters outside the CBD (e.g. 	<ul style="list-style-type: none"> • (-ve): If it were determined that connecting the tunnel on the city side of North Melbourne and Richmond Stations were feasible, this option would involve very significant disruption to rail services for these connections, affecting the majority of the rail network. • (-ve): Construction would cause significant road and other disruption (including property acquisitions), particularly due to station construction works for the two CBD stations in

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	<ul style="list-style-type: none"> • (+ve): The capacity uplift associated with this option is sufficient to enable electrifications to Melton and Wallan and new lines to Melbourne Airport or Rowville. • (-ve): Would exacerbate station overcrowding at Richmond and North Melbourne, which are already under considerable pressure, as these would be the primary interchange points to access Flinders Street or Parliament stations. 	<p>Parkville) or stimulate urban renewal in key precincts.</p> <ul style="list-style-type: none"> • (-ve): This option would not alleviate congestion on busy north-south tram routes (e.g. St Kilda Road or Parkville). 	<p>Lonsdale Street and potentially also at Richmond and/or North Melbourne.</p> <ul style="list-style-type: none"> • (-ve): This option requires construction in complex underground conditions, particularly in the vicinity of North Melbourne and Southern Cross Stations, and the likelihood that a very deep alignment would be required to pass underneath Parliament Station, making the two CBD stations relatively deep.
MRL (Fishermans Bend)	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network. • (+ve): Results in improved network reliability through the operation of the following independent lines: Frankston-Ringwood, Sunbury – Dandenong, Werribee-Sandringham and Craigieburn-Upfield lines. This delivers a similar service uplift to Melbourne Metro on opening. • (+ve): Frees up tracks between South Yarra and Flinders Street for freight and regional rail services to the south east. (Noting that the timing and need for this is still under review). • (+ve): Provides additional platform capacity in the CBD through expansion of Southern Cross station. • (+ve): The capacity uplift associated with this option is sufficient to enable electrifications to Melton and Wallan. • (-ve): Loop splitting is an integral part of the capacity uplift associated with this option. As a result, it is not possible to undertake works of a similar nature in the future to provide further capacity uplift. • (-ve): Poor quality interchange between existing and new CBD stations. • (-ve): This option would result in increased interchange and crowding at fringe CBD stations (for example, Caulfield and Richmond), and crowding hot spots on some services between these stations and the CBD. • (-ve): The option would require additional investment to extend surface stations through the inner core (Richmond, Flinders Street, Southern Cross, and North Melbourne) to enable deployment of Extended HCMT to the Sunshine Dandenong line. Without this complex addition, the uplift associated with this option is not 	<ul style="list-style-type: none"> • (+ve): Provides opportunities for new stations at Southern Cross, Montague, Domain and South Yarra. • (+ve): The new station at Montague (a key urban renewal precinct) provides an opportunity to support development and urban renewal. • (+ve): The new station at Domain would improve access to employment located along St Kilda Road. • (+ve): This option supports the westerly expansion of CBD. • (+ve): This option would offer some level of relief to the St Kilda Road tram corridor. However, the network configuration resulting from this option would make Domain Station relatively less attractive than the Melbourne Metro option described below, with passengers from the eastern and north-eastern suburbs required to travel via Southern Cross for access to Domain Station – making the tram from Flinders Street relatively more attractive and resulting in less crowding relief on trams. • (-ve): This option removes direct access to Flinders Street station from the Frankston, Alamein, Belgrave and Lilydale lines. 	<ul style="list-style-type: none"> • (neutral): It is noted that development of the alignment and its constructability was at an early stage when work concluded on this option, with many different alignment options under consideration, each with different deliverability and disruption characteristics. • (-ve): This option would involve significant disruption to rail services due to construction of tunnel portals at South Yarra and near Richmond, and particularly due to the cross connections and reconfiguration to the existing City Loop tunnels near Southern Cross (similar to the Loop Split option). • (-ve): This option involves high risk commissioning and staging disruptions affecting the core of the rail network, including the City Loop. • (-ve): Construction would cause significant road and other disruption (including property acquisitions), particularly at major construction sites to launch tunnelling works, at tunnel portals (Southern Cross, South Yarra and near Richmond) and at new station locations (Southern Cross, Montague, Domain and South Yarra). • (-ve): Complex construction work through the inner core, affecting the Sunshine – Dandenong Line would need to be undertaken to enable Extended HCMT, extending disruptions to these lines.

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	sufficient to enable new lines to Melbourne Airport or Rowville. ¹⁰		
Melbourne Metro	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network. • (+ve): Provides additional platform capacity in the CBD, relieving congestion on existing stations. • (+ve): Results in improved network reliability through the operation of the following independent lines: Sunbury-Dandenong, Werribee-Sandringham, Frankston and Craigieburn-Upfield lines. • (+ve): Enables the operation of longer trains on the Sunshine – Dandenong Line though the core of the network. • (+ve): This option provides two new CBD stations, improving rail access to the central CBD, better distributing passengers and providing higher aggregate station capacity within the CBD compared to single station options. • (+ve): This option allows for “through-routing” of the City Loop to occur in the future thereby providing a long term opportunity to further increase capacity. • (+ve): This option relieves interchange and congestion at North Melbourne and Richmond stations. • (+ve): The capacity uplift associated with this option is sufficient to enable electrifications to Melton and Wallan and new lines to Melbourne Airport and Rowville. • (-ve): This option would increase interchange and passenger movements at Caulfield and Footscray stations, although to a lesser extent than MRL. 	<ul style="list-style-type: none"> • (+ve): Provides new underground stations at Arden, Parkville, CBD North (pedestrian connection to Melbourne Central), CBD South (pedestrian connection to Flinders St) and Domain. • (+ve): This option distributes interchange movements evenly around the CBD. • (+ve): The new station at Arden (a key urban renewal precinct) provides an opportunity to both stimulate and support development and urban renewal. • (+ve): The new station at Parkville would facilitate access to a key employment cluster outside the CBD. • (+ve): The new station at Domain would improve access to employment located along St Kilda Road. • (+ve): This option would alleviate congestion on busy St Kilda Road and Parkville tram routes due to new stations at Domain and Parkville and Domain will have a direct interchange with a new tram super stop. • (-ve): This option removes direct access to Southern Cross, Flagstaff and Parliament from the Sunbury and Dandenong corridors. 	<ul style="list-style-type: none"> • (+ve): With the exception of the tunnel portals and connections, construction occurs largely separate from the existing rail network with relatively limited disruption of existing train services when compared to other options. • (-ve): Construction of tunnel portal and direct connection at South Yarra would result in significant rail disruption (with more minor disruption at South Kensington) and increased property acquisition requirements. • (-ve): Road network and other disruption would be caused, particularly at major construction sites to launch tunnelling works (Arden, Domain and/or Fawkner Park), at new station locations (Arden, Parkville, CBD North, CBD South and Domain) and at tunnel portals (South Kensington and South Yarra).
Kensington to Caulfield tunnel	<ul style="list-style-type: none"> • (+ve): This option would expand the capacity and throughput of the core of the rail network. • (+ve): Provides additional platform capacity in the CBD, relieving congestion on existing stations. • (+ve): Results in improved network reliability through the operation of the following independent 	<ul style="list-style-type: none"> • (+ve): Provides new underground stations at Arden, Parkville, CBD North (Melbourne Central), CBD South (Flinders St), Domain, in the vicinity of Alfred Hospital and in the vicinity of Windsor station. 	<ul style="list-style-type: none"> • (+ve): Construction from a tunnelling and engineering perspective would be relatively straightforward with the relatively wide road reservations of St Kilda Road and Dandenong Road.

¹⁰ It is noted that this former project was structured as an integrated proposal with both the tunnel section and the Melbourne Airport Link. This approach is feasible. However, for consistency with the way other options have been assessed here, the MRL (Fishermans Bend) project has been assessed on the basis of an assumption that a Melton Electrification project would occur ahead of a new link to Melbourne Airport, in line with PTV demand modelling.

OPTION	1. CAPACITY & RELIABILITY	2. ACCESS & URBAN RENEWAL	3. DELIVERABILITY & DISRUPTION
	<p>lines: Sunshine-Dandenong, Werribee-Sandringham, Frankston and Craigieburn-Upfield lines.</p> <ul style="list-style-type: none"> • (+ve): This option connects to the DRC and enables extended HCMTs to operate through the central area. • (+ve): This alignment is likely to result in an uplift in new public transport trips at Parkville and Domain. However, there would only be a modest uplift in trips between Caulfield and Domain as the areas is well serviced by train and tram. • (+ve/neutral): This provides relief to tram congestion along the St Kilda – Swanston Street corridor, particularly north of Domain. However, trams are able to meet forecast demand south of Domain.¹¹ • (+ve/neutral): Duplicates DRC tracks to Caulfield, however the need and timing for additional tracks is uncertain and likely to be a longer term proposition (i.e. this option over-provides infrastructure in the medium term). • (-ve): This option delivers expensive infrastructure well in advance of when it is required. • (-ve): This option would increase interchange and congestion at Melbourne Central and Flinders Street stations. 	<ul style="list-style-type: none"> • (+ve): This option distributes interchange movement evenly around the CBD. • (+ve): This option would alleviate congestion on busy St Kilda Road and Parkville tram routes due to new stations at Parkville and Domain. • (+ve): The new station at Domain would improve access to employment located along St Kilda Road. • (+ve): A new station in the vicinity of Alfred Hospital would improve accessibility and provide higher quality public transport links to major research institutes at Clayton (Monash Medical Centre), Parkville and the Alfred precinct (comprising Alfred Hospital and research institutes including Baker TDI). This would result in improved knowledge sharing opportunities and productivity. • (+ve): The new station at Parkville would facilitate access to a key employment cluster outside the CBD. • (+ve/neutral): A new Windsor station would provide moderate interchange benefits with the existing station and enhance connectivity to Melbourne Polytechnic (Prahran Campus), secondary schools and to the Chapel Street retail and entertainment precinct. • (-ve/neutral): Limited urban renewal potential around stations south of Domain given the level of existing and dense residential development, parklands and heritage areas. This option also does not provide any new stations at key urban renewal precincts. • (-ve): Potential station usage at Alfred, Windsor along with other potential stations to Caulfield is limited by the extensive amount of parkland, heritage areas and characteristics of the existing residential area, as well as the tram network continuing to provide an attractive travel option for these areas. • (-ve): This option removes direct access to Southern Cross, Flagstaff and Parliament from the Sunbury and Dandenong corridors. 	<ul style="list-style-type: none"> • (+ve): This options would result in relatively minor land acquisition, most limited to the station sites. • (-ve): Construction would cause manageable road and other disruptions, particularly at major construction sites to launch tunnelling works, at tunnel portals (South Kensington and Caulfield) and at new station locations (Arden, Parkville, CBD North (Melbourne Central), CBD South, Domain, in the vicinity of Alfred Hospital and in the vicinity of Windsor station. • (-ve): Involves challenges associated with the lack of worksite areas on the surface. • (-ve): Scale of project would become such that an additional staging point would likely need to be introduced, potentially in the CBD or at Domain.

¹¹ Department of Transport, *MM2 Alignment Options Assessment*, (2011).

4.2. Outcome of preliminary options assessment

4.2.1. Technology options

While the HCS and HCMT options provide an uplift in capacity that is being pursued as part of business-as-usual development, they would be unable to meet medium term demand requirements without significant further investment in infrastructure. For example, HCS would only provide three additional trains per hour on the Northern Loop, which carries the Craigieburn, Upfield and Sunbury lines, less than half the additional capacity provided at day one to address demand on these lines through provision of Melbourne Metro.

Introduction of Extended HCMTs would require reconfiguring the network to establish a dedicated line (such as the Sunshine – Dandenong Line) bypassing the City Loop, as these long trains could not be supported at existing underground stations. Substantial works would also be required to extend surface station platforms, with the option not delivering any service uplifts and only providing capacity uplift to the dedicated route where these longer trains operate. In addition, these options in isolation would not improve reliability to any significant extent (as they do not deliver new infrastructure or facilitate the independent operation of lines¹²) or materially alleviate tram congestion. Both options would exacerbate crowding at busy CBD stations (unless scope were further extended to provide major station augmentations such as new concourse and entrance facilities. As they do not provide new stations, these options also do not improve access to key employment centres outside the CBD or stimulate urban renewal.

Accordingly, these options should be considered in conjunction with (and in addition to) enhanced or new infrastructure options.

4.2.2. Expansion / enhancement of existing infrastructure

All of these options have the potential to provide additional rail capacity through the CBD. However, they do not provide any new stations to service new catchment areas, meaning they do not improve access to jobs outside the CBD or stimulate urban renewal. These options would not alleviate congestion on busy tram routes and would exacerbate overcrowding at CBD, North Melbourne and Richmond stations.

The City Loop Split option provides a comparatively low cost opportunity to immediately increase rail capacity in comparison to the suite of new infrastructure options. However, this option would be impractical to build at this stage of the rail network's life as it would shut-down city loop access during the construction phase. This option is best suited as a subsequent investment following a project that created a rail corridor and additional station capacity through the city which would serve to assist in mitigating the construction impacts and disruptions. The operation of extended HCMTs on the Sunshine – Dandenong Rail Line would require further investment at a later stage to extend platforms at existing stations between Richmond and North Melbourne. The option does not provide for new stations at locations to facilitate urban renewal.

The Viaduct Widening option and City Loop Split have the potential to provide a material capacity uplift in terms of the number of trains that could operate, but there is significant disruption. These options would be less expensive to deliver than the new infrastructure options (see below) and the two options are likely to be a similar order of cost. The City Loop Split option provides a better network outcome, consistent with future network development and expansion options, whereas the Viaduct Widening option would degrade some of the benefits of the RRL project in terms of both capacity and reliability (requiring a new flyover and all regional services to use terminal platforms 1-8 at Southern Cross Station).

The Viaduct Widening option would also have an adverse impact on the North Bank precinct of the Yarra River, which is important to the design of the urban environment along the Yarra River.

¹² Except to the extent that the reliability derives from new assets (e.g. HCS technology may be more reliable than existing way-side signalling and provide functionality that facilitates reliability improvements such as intelligent schedule modification).

Duplicating the City Loop would cause severe disruption and compound rail crowding in existing stations. This option would be particularly expensive and complex to deliver. It would also be difficult/impractical to build as it would leave no rail alternatives across the city and fewer central city stations.

All of these options involve construction impacts in the CBD at locations and junctions that are critical to the operation of the rail network.

4.2.3. New infrastructure

The options requiring the construction of new tunnels will involve varying degrees of disruption (and cost) depending on a range of factors, including horizontal and vertical alignment, station locations, ground conditions and constructability.

The Stand-alone metro option would not provide capacity where needed most within Melbourne: in the growth areas to the west, north and south-east. This means that capacity pressures would be exacerbated even further in the future. While this option could enable new lines to Melbourne Airport and Rowville, these projects would be considerably more expensive, as they would require long tunnels back to Central Melbourne rather than making use of existing tracks. This option would not provide any reliability improvement to the existing heavy rail network or relieve crowding at existing CBD stations, but could alleviate congestion on some busy tram routes.

The Hoddle Street and Fishermans Bend bypasses would not improve rail capacity for access to and within the CBD, Melbourne's most important employment precinct. While both options would facilitate access to jobs outside the CBD and open up opportunities for urban renewal through new stations, they are likely to lead to significant crowding issues at inner city stations and on some train and tram services due to the high number of passengers who would need to interchange for CBD access. Neither option would alleviate congestion on busy tram routes.

The North Melbourne to Richmond tunnel would enable more people to travel by train to jobs in the CBD, but would not improve access to key employment nodes outside the central city. This option would also exacerbate overcrowding at Richmond and North Melbourne stations, and do little to alleviate tram congestion. The new tunnel would not provide new stations to serve an expanding Central Melbourne.

The Kensington to Caulfield tunnel enables the Northern lines to operate independently to deliver a range of reliability benefits and effectively creates a new track pair between Caulfield and the CBD – effectively this option offers the Melbourne Metro scheme, but includes an extension to Caulfield. As such, it includes the benefits of Melbourne Metro along with some minor additional benefits in the form of additional trunk capacity to Caulfield and some degree of additional tram relief. However these benefits are relatively minor and this option would be considerably more expensive (in the order of \$2b) than the next most expensive infrastructure option. As a result, the additional cost is not warranted and the extension is not required now, but provision should be made to consider this option into the future.

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

- **MRL (Fishermans Bend)** – This option will improve network reliability by delivering six dedicated lines, creating four new stations, supporting connectivity to key activity precincts (CBD and South Yarra) and employment hubs (CBD and Domain), and supporting urban redevelopment at Montague.¹³

¹³ Note that this does not include the Airport Rail Link, which is considered a separate project.

- Melbourne Metro** – This option provides network reliability benefits by delivering six dedicated lines (Ringwood loop and Glen Waverley operate as one group), creating five new stations, improving connectivity to key activity precincts (CBD and Parkville) and employment hubs (CBD, Parkville and Domain), providing significant relief for tram congestion along the Swanston Street / St Kilda road corridor, stimulating urban redevelopment at Arden and delivering the greatest capacity uplift in the long term (ultimate infrastructure capacity).

5. Detailed assessment of shortlisted capital investment options

5.1. Evaluation of shortlisted capital investment options

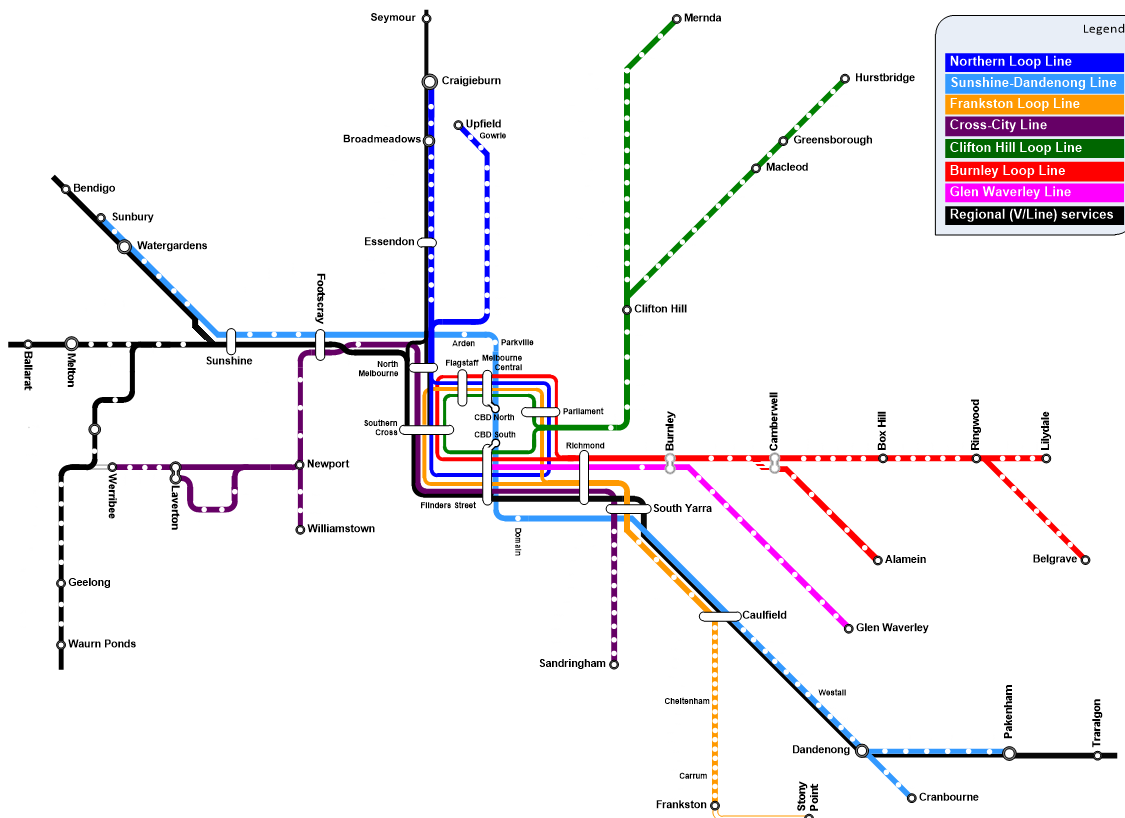
The evaluation framework for assessing capital investment options is outlined in Section 1.3. This section outlines the outcomes of the detailed assessment of the shortlisted capital investment options, including an assessment against Criterion 4 (Cost) and how the options address the Problems identified in Chapter 3.

The key findings of the detailed assessment in relation to each shortlisted capital investment option are set out below.

5.2. Background – network structure under each option

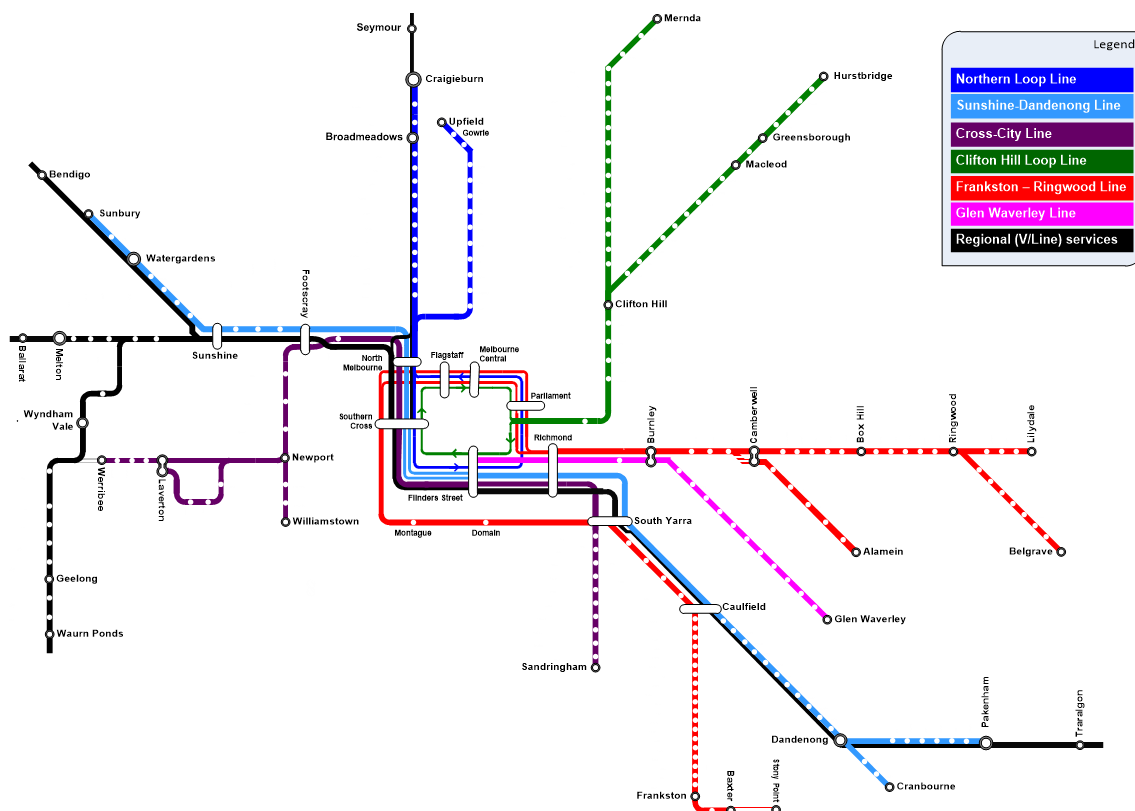
The rail network configuration on completion of each shortlisted capital investment option is shown in the figures below. The MRL (Fishermans Bend) options involve reconfiguring the City Loop to release capacity, whereas the Melbourne Metro project creates a new corridor through the CBD, freeing up the City Loop for additional services.

Figure 1 – Proposed network structure at the completion of Melbourne Metro



Source: PTV.

Figure 2 – Proposed network structure at the completion of MRL (Fishermans Bend)



Source: PTV.

5.3. Increasing rail capacity

Assessment and analysis has been undertaken to compare each shortlisted capital investment option to determine which operational approach (how the system and rail lines are structured and operated post investment) would deliver the greatest capacity uplift initially and in the longer term.

5.3.1. Increasing suburban rail capacity at opening

The initial capacity uplift focuses on the likely service plan that would be implemented on opening to meet demand in the mid-2020s (including uplifts in capacity across lines to the north, west and south east).

Analysis undertaken demonstrated that both shortlisted options would provide similarly significant additional capacity to the rail network initially and would meet projected demand on lines to the north, west and south east in the mid-2020s. The key conclusions therefore was that both options provided similar performance in terms of contribution to suburban rail capacity at opening.

5.3.2. Project contribution to longer term capacity needs of inner core

The longer term capacity is a measure of what new central area capacity is provided by the project at opening, noting that this will not be fully exploited initially.¹⁴

¹⁴ While concept timetables have been developed to test the capacity provided by Melbourne Metro, the capacity provided by the MRL (Fishermans Bend) may be overstated, as it assumes for example that 24 trains per hour can be reliably operated on the busy Sunbury – Cranbourne/Pakenham line via the existing Flinders Street Station, where the level of crowding on these relatively narrow platforms may constrain the capacity of this line.

One of the key strengths of Melbourne Metro is that it provides the necessary central city capacity to operate extended HCMTs on the Sunshine corridor. Only with subsequent or concurrent upgrades to station lengths at Richmond, Flinders Street, Southern Cross and North Melbourne is the MRL (Fishermans Bend) option able to provide similar capabilities.

Analysis undertaken therefore concluded that Melbourne Metro would provide greater support for longer term capacity needs within the inner core, as it delivers longer platforms through the central area, enabling extended HCMTs to operate, carrying more passengers per hour than the MRL (Fishermans Bend) option.¹⁵

While the sections above focused on the capacity enabled by each shortlisted capital investment option on opening and in the long term, it is noted that utilisation of the long term capacity depends on further growth and expansion of the rail network, which is subject to future decisions of Government. A number of future projects to further expand network capacity at the core of the rail network have been identified in the Department's Reference Case transport network.

The extent to which each shortlisted capital investment option provides the capacity for future network expansion was further evaluated, as shown in the following table.

¹⁵ MRL (Fishermans Bend) would require additional infrastructure works to be funded at Richmond, Flinders Street, Southern Cross and North Melbourne Stations to enable HCMTs through the central area.

Table 4 – Extent to which shortlisted options provide the necessary central city capacity to enable network expansion

NDP-MR scope element	Melbourne Metro	MRL (Fishermans Bend)	Key comparison considerations
Melton Electrification	✓	~	Melbourne Metro is able to provide the necessary central city capacity for longer HCMTs on the Sunshine corridor, and therefore supports the Airport Rail Link and Melton Electrification. MRL (Fishermans Bend) does not have capacity to support both the Airport Rail Link and Melton Electrification projects without subsequent or concurrent upgrade to station lengths at Richmond, Flinders Street, Southern Cross and North Melbourne.
Airport Rail Link	✓	~	To operate both Airport Rail Link and Melton Electrification, both the following network upgrades are required: <ul style="list-style-type: none"> • Higher frequency services on the Sunshine corridor • Extended HCMTs on the Sunshine corridor.
Rowville Rail Link	✓	~	Due to patronage demand, the Rowville Rail Link requires: <ul style="list-style-type: none"> • Higher frequency services on the Dandenong corridor (enabled by Cranbourne Pakenham Line Upgrade) and • Extended HCMTs on the Dandenong Corridor. Melbourne Metro provides central Melbourne capacity for extended HCMTs, whereas MRL (Fishermans Bend) requires subsequent works.
Wallan electrification	~	✘	Both options provide capacity relief to the Craigieburn and Upfield lines, needed to support Wallan electrification. However it is expected that the City Loop Split would be required in the medium term to accommodate the forecast patronage generated from the growth area which is not supported as a subsequent investment under MRL (Fishermans Bend).
Baxter electrification	✓	✓	Can be implemented independent of the capital investment. However, it is required the first day of MRL (Fishermans Bend) operations.

- Key:**
- ✓ Project provides sufficient central area capacity relevant to the needs of this expansion/electrification
 - ~ Project provides central area capacity relevant to the needs of this expansion/electrification – with conditions
 - ✘ Project provides the central area capacity relevant to the expansion/electrification – but insufficient to enable the expansion
 - n/a Project works do not affect central area routes relevant to enable this expansion/electrification

5.3.3. Comparison of future core-network upgrade pathway to meet growth demands

In addition to the project (irrespective of shortlisted capital investment option), a number of network changes will be needed to expand the core capacity of the network to meet forecast growth of the city. This section presents the differing investment pathways (post Project) associated with each shortlisted capital investment option should government elect to invest in longer term capacity expansion beyond the project.

Methodology overview

In line with current assumptions and planning to support growth and/or enable network expansion to meet forecast future demands, these network changes are assumed to be sequenced (and broadly defined) as follows:

- Stage A – The project (the two shortlisted capital investment options)
- Stage B – Introduction of Extended HCMT on the Sunshine – Dandenong line, to support continued growth in demand on Day-1 lines (Sunbury – Cranbourne/Pakenham) and enable network expansion to alleviate growth pressures in adjacent catchments (Melton/Airport/Rowville lines)
- Stage C – Additional capacity to north/west (new pair of central city tracks), to support continued growth in demand on other parts of the affected network
- Stage D – Additional capacity to north/west (further new pair of tracks), to support continued growth in demand.

Each of the shortlisted capital investment options present different staging sequences. Table 5 summarises the further core capacity upgrades needed on the lines affected by this investment and the options available to Government to meet this need under each development pathway.

To the extent possible, alternatives for subsequent major upgrades are held constant between the two options, with differences in interfacing/supporting works noted.

Subsequent investments assessed and indicative timings relate to the need for the capacity based on demand projections and do not necessarily represent Government policy or investment priorities.

Assessment outcomes

The Melbourne Metro and MRL (Fishermans Bend) capital investment options deliver different long term network configurations. Upgrade pathways, including indicative timings that investments at each stage would be required, are set out in Table 5 below for both the Melbourne Metro and MRL (Fishermans Bend) options.

Key differences between the options are summarised as follows:

- **Melbourne Metro** – provides purpose built stations through the central part of the network, designed to accommodate longer 10 car trains. The addition of a new heavy rail route through the centre of the CBD then provides the foundation to split the City Loop to meet future patronage demands; with the Melbourne Metro tunnel then providing the ability to better manage rail services and customer flows during construction. Subsequent investment decisions for the Newport – Clifton Hill tunnel (and Viaduct Widening) are decoupled from growth pressures on other lines, and may be completed when justified by patronage on those lines.
- **MRL (Fishermans Bend)** – defers investment associated with accommodation of longer 10-car trains on the Sunshine-Dandenong line, but immediately exploits the opportunity to split the City Loop (in this case, the Caulfield and Burnley loops) to achieve similar day one outcomes. The design of the MRL (Fishermans Bend) solution identified a series of future upgrades to surface stations within the inner core to accommodate extended HCMTs, noting these works are

considered more complex, higher-risk and likely to involve further commuter disruption due to the constrained environment for the required works. Without the subsequent option to implement the City Loop Split option, the network expansion options available to Government are likely to require bringing forward the timing of the need for the next major new rail link from the west (Newport – Clifton Hill tunnel) by approximately a decade (vis-à-vis the Melbourne Metro option), with additional works required to enable this project to provide interim capacity relief to the Northern Loop. Ultimately, construction of the Viaduct Widening from Flinders Street to Southern Cross station, an option which has previously been discounted based on a variety of issues including impact on amenities, cost and disruption, would also be necessary to provide equivalent capacity and segregation as the Melbourne Metro option.

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

Table 5 – Stages of expanding capacity in the core of the rail network and different pathways for shortlisted capital investment options

Stage	Approximate Timing	Network Change	Shortlisted capital investment options – subsequent investment pathway	
			Melbourne Metro	MRL (Fishermans Bend)
A	Early-Mid 2020s	This Project (the 2 shortlisted capital investment options)	-	-
B	Early 2030s	Introduce extended HCMTs on Sunbury – Cranbourne/Pakenham (Melton/Airport) lines	Extend surface stations either side of tunnel <i>(no further investment in core)</i>	Extend surface station either side of this core section AND Extend North Melbourne, Southern Cross, Flinders Street, Richmond & South Yarra stations and associated works ¹⁶
C	Mid-2030s	Additional capacity to north/west (new pair of central city tracks)	City Loop Split	Newport – Clifton Hill link AND Construction of flyover works near North Melbourne ¹⁷
D	Mid-2040s	Additional capacity to north/west (further new pair of tracks)	Newport – Clifton Hill link	Construct new Viaduct Flinders Street to Southern Cross & associated junction modifications ¹⁸

¹⁶ Note associated works include the provision of two platform faces per direction at Southern Cross Station to cater for passenger interchange demands on Sunshine –Dandenong (as 10-car) and a flyover at North Melbourne to enable Cross City line operation via 15 & 16 at Southern Cross station.

¹⁷ The flyover works would be required to enable Upfield (Wallan) services to merge with Cross City line operations (inc. junction and retained connection to existing for Seymour VLine via Upfield).

¹⁸ Note that this would also require the construction of platforms 17 & 18 at Southern Cross Station (re-align freight/bypass) and re-activation of platform 11 at Flinders Street station.

5.3.4. Expanding the freight rail network

The primary freight rail consideration relevant to this investment is the need to support additional freight movements between the south-east and the Dynon precinct. Growth in freight demand in this corridor would be primarily driven by the future port strategy and secondarily by the potential for coal exports from Gippsland.

A major step up in freight rail operations between the south east and the Dynon precinct would likely require additional rail track(s), as a substantial increase in freight operations could not be accommodated alongside growing metropolitan passenger rail operations on existing tracks. The provision of additional tracks would also provide an opportunity to separate Gippsland's express and regional services from slower (all stations, or most stations) metropolitan services from the Cranbourne and Pakenham lines, which would likely offer some reliability and travel time benefits.

Methodology overview

With the future port strategy under development, this assessment focuses on protecting options and assumes that the appropriate manner for providing for additional freight rail track(s) would be largely via the existing Dandenong rail corridor (in line with earlier assessments prepared for the South East Rail Link project). As for the suburban capacity assessment, both initial (Day 1) benefits and longer term implications are considered.

Assessment outcomes

Both Melbourne Metro and MRL (Fishermans Bend):

- Actively provide for a pair of tracks between South Yarra and Flinders Street to be available for dedicated freight and regional operations by diverting an existing line (Dandenong or Frankston, respectively) into a new rail tunnel at South Yarra to free existing tracks to the city
- Require other substantial investments west of Flinders Street and south of South Yarra to provide dedicated track(s) for freight throughout the corridor
- Have the ability to protect for freight rail options where there is a physical interface with those options.

Therefore, overall, the extent to which the options provide or protect for future freight requirements is not a major point of distinction, particularly given the likely long time frames involved and current uncertainty regarding need.

5.3.5. Summary finding

Assessment Outcome: Increasing rail capacity

Based on the analysis outlined above:

- Both shortlisted capital investment options are capable of delivering a similar initial capacity uplift to meet forecast demand in the mid-2020s.
- Melbourne Metro delivers a higher long term infrastructure capacity uplift than MRL (Fishermans Bend) as it provides longer platforms through the central city area to enabling extended HCMTs to operate on the Sunshine to Dandenong Line (which is needed in the early 2030s). MRL (Fishermans Bend) relies on an additional investment in upgrades to the surface stations through Richmond, Flinders Street, Southern Cross and North Melbourne to enable an equivalent capability.
- Both shortlisted capital investment options are compatible with future expansion of the rail network for freight.
- The MRL (Fishermans Bend) option leads to a long-term network configuration that would be significantly less cost effective to implement than the investment pathway offered by Melbourne Metro to expand the capacity of the network in the future.
- Melbourne Metro is able to provide the necessary central city capacity for extended HCMTs on the Sunshine corridor, and therefore supports the Airport Rail Link and Melton Electrification (without the need for additional investment to support longer trains through the CBD, as under the MRL (Fishermans Bend) option).

5.4. Improving rail service reliability and punctuality

The capital investment options on the rail network facilitate improvements in reliability and punctuality of the service through removal of conflict points and unnecessary interactions between services (reducing the likelihood of incidents and service disruptions cascading across lines), provision of additional capacity and technologies to reduce congestion impacts, and through provision of new, more reliable assets.

5.4.1. Asset reliability improvements

The potential to include technology and asset improvements is largely equivalent for each of the shortlisted capital investment options.

5.4.2. Operational complexity of network operations

The operation of independent lines is highly desirable as it provides an operational state whereby trains operate on dedicated tracks independently of each other. It enables the delivery of a consistent, high frequency, punctual (i.e. on time) service which enhances the customer experience by removing the uncertainty and stress associated with variable or unreliable transport.

Whilst both options provide a similar level of line independence, the configuration of those lines is significantly different with MRL (Fishermans Bend) requiring the connection of the Frankston and Ringwood corridors. This new line would require a highly complex operational plan and present a number of scheduling and operational challenges to schedule and operate for the following reasons:

- This line would be extremely long – 90km running from Belgrave to Frankston via the CBD, which would result in a journey time over more than 2 hours for a train with little opportunity for recovery from delay
- The line would include a long trunk section from Caulfield to Burnley via the City Loop with no opportunity to terminate, reverse or stable trains on that section
- Timetabling a corridor with sections of express (overtake) track sections at both ends of the line and single line sections on the Alamein, Belgrave and Lilydale lines would be extremely complicated
- Lack of an appropriate maintenance facility on that line would result in the need to construct a new facility on the Frankston or Lilydale ends of the line
- Insufficient stabling facilities at the Frankston end of the line would result in the need to invest in, and build, more at that location, or ‘empty run’ trains from the Ringwood line / another group.
- The service requirements at both ends of the line would be unbalanced, resulting in the need to construct a new turn-back between South Yarra and Caulfield.

5.4.3. Station crowding and dwell time risk

Reliability of the rail network is also influenced by the way customers move through the network, particularly the variability in how long trains need to spend at stations to allow for boarding and alighting (dwell time variability).

- **Melbourne Metro** – Provides two new CBD stations for this busy line and relieves crowding at other CBD stations. It also distributes more interchanging movements to Footscray and Caulfield rather than North Melbourne and Richmond, taking pressure off these stations
- **MRL (Fishermans Bend)** – Results in significantly more interchanges at the already crowded Richmond Station. This option would see the busy Sunshine – Dandenong Line operating via Southern Cross and Flinders Street, and the narrow platforms at Flinders Street would result in reliability issues in particular for this line.

As the MRL (Fishermans Bend) option relies on accommodating increased and substantially changed passenger flows at existing stations (without, or with limited modifications) it is expected to have higher risk of dwell variability or congestion within stations than the Melbourne Metro option, which provides new station and platforms facilities where critical changes in movements are expected.

5.4.4. Summary finding

Assessment Outcome: Improving rail reliability

Based on the analysis outlined above:

- Asset improvement potential of both options is similar.
- Melbourne Metro would provide for less complex independent line operation than MRL (Fishermans Bend).
- The connection of the Frankston and Ringwood corridors under MRL (Fishermans Bend) would present a number of challenges to schedule and operate due to the length of the line and journey time from end to end, the limited terminating facilities on the trunk section, multiple single line and overtake sections and insufficient maintenance and stabling facilities.
- Melbourne Metro has less risk associated with dwell variability or station congestion, as it is providing new infrastructure at key risk locations (designed to manage these risks), where MRL is reliant on operational management changes to manage risk using existing infrastructure.

5.5. Improving access to jobs and stimulating urban renewal

5.5.1. Access to jobs

This section assesses and compares each shortlisted capital investment option's proposed connection to new stations, access to key jobs and activity precincts and relief of the tram and bus network for access to central Melbourne jobs.

Table 6 provides a summary comparison of the various connective and intermodal aspects of the shortlisted capital investment options.

Table 6 - Connectivity - Summary comparison of shortlisted capital investment options

Option	New stations in areas not currently serviced by heavy rail	Direct access to jobs	Other changes in access to jobs outside CBD	Impact on tram/bus congestion
MRL (Fishermans Bend)	<ul style="list-style-type: none"> Montague, to support urban renewal (discussed later). Domain, improving access to employment on St Kilda Road. 	<ul style="list-style-type: none"> (+ve): More services to CBD and emphasises the growing west of the CBD. (+ve): Potential to relieve Southern Cross Station, depending on extent of works. (neutral): Some lines that previously had direct access to five CBD stations will have access to fewer, but can interchange to access others (however interchange locations are already crowded). (+ve): Network emphasises the growing western part of CBD, with more lines channelled through Southern Cross Station (Docklands), but Frankston, Belgrave, Lilydale and Alamein lines losing direct access to Flinders Street Station. (-ve): Exacerbates crowding in CBD stations, with an increase in movements per weekday forecast to occur in the existing CBD stations in 2031 (NB: does overall reduce passenger numbers at Flinders Street Station as it would be serviced by fewer lines, but increases crowding hotspots at other stations). 	<ul style="list-style-type: none"> (+ve): Creates new cross-town linkage between Sunbury and Cranbourne-Pakenham lines. (+ve): Creates new cross-town linkage between Werribee and Sandringham lines.¹⁹ (-ve): Frankston line access to Richmond requires interchange, or a long journey around the CBD. 	<ul style="list-style-type: none"> (+ve/neutral): Some relief to St Kilda Rd congestion (not as great as Melbourne Metro, as network configuration makes it less attractive to interchange from other lines to new MRL tunnel for access to Domain). (neutral): No material change to Parkville. (neutral): No material change in need for Fishermans Bend tram capacity, as most Fishermans Bend development west of new station.
Melbourne Metro	<ul style="list-style-type: none"> Arden, to support urban renewal (discussed later). Parkville, improving access to education and biomedical precinct. 	<ul style="list-style-type: none"> (+ve): More services to CBD and the west (where growth is projected to be the strongest). (neutral): Some lines that previously had direct access to five CBD stations will have 	<ul style="list-style-type: none"> (+ve): Creates new cross-town linkage between Sunbury and Cranbourne-Pakenham lines. (+ve): Creates new cross-town linkage between Werribee and Sandringham lines. 	<ul style="list-style-type: none"> (+ve): Alleviates tram congestion on St Kilda Road, Swanston Street and Elizabeth St leading to improving operational performance.

¹⁹ In considering cross-town linkages, the link between the Frankston and Belgrave/Lilydale/Alamein lines created by MRL (Fishermans Bend) has not been included, as in most instances there would be quicker ways of undertaking trips between these lines by public transport than travelling via Southern Cross.

Option	New stations in areas not currently serviced by heavy rail	Direct access to jobs	Other changes in access to jobs outside CBD	Impact on tram/bus congestion
	<ul style="list-style-type: none"> Domain, improving access to employment on St Kilda Road. 	<p>access to fewer, but can interchange to access others (e.g. at Footscray, Caulfield or Melbourne Central).</p> <ul style="list-style-type: none"> (+ve): Network emphasises access to central civic spine of CBD, including growing central Collins Street employment, but Sunbury, Cranbourne & Pakenham lines lose direct access to Southern Cross Station (Docklands). (+ve): Relieves crowding in CBD stations, due to provision of CBD North and CBD South stations. 	<ul style="list-style-type: none"> (+ve): Cranbourne & Pakenham line access to South Yarra and Richmond requires interchange. (+ve): Sunbury line access to North Melbourne requires interchange or walk from Arden. 	<ul style="list-style-type: none"> (+ve): Will enable reconfiguration of the tram and bus network that facilitates trams running at higher frequency with less interference between routes and facilitates interconnectivity across the public transport network. (+ve): Alleviates Parkville tram and tram and bus network, particularly the 401 bus route which provides a vital intermodal link between North Melbourne station and the Parkville education and biomedical precinct. (neutral): No material change in need for Fishermans Bend tram capacity.

The key conclusions with respect to the comparisons of access to jobs and connectivity benefits of the options are:

- All options would increase rail services to access CBD jobs
- MRL (Fishermans Bend) emphasises the growing west of the CBD (e.g. Southern Cross and Docklands)
- Melbourne Metro emphasises the central civic spine of the CBD (e.g. Swanston Street and central Collins Street employment).

Both options would drive the need for some customers to start interchanging where before they had access to all five existing CBD stations without interchange; however Melbourne Metro provides the most balanced distribution of these interchange movements (partly due to two CBD stations). Due to MRL (Fishermans Bend) and Melbourne Metro both requiring tunnel portals outside of the CBD and providing stations in new areas currently not serviced by heavy rail, both options would lead to some lines bypassing existing inner area stations, requiring passengers destined for those stations to interchange. In general, these stations are much less significant destinations than the CBD; however it does inconvenience some passengers.

- Both options would increase cross-city connectivity, better linking people with jobs from the north and west to the south east. Public transport plays a relatively smaller role than travel by car for these trips at this point in time but will continue to grow. MRL (Fishermans Bend) and Melbourne Metro each provide moderate cross-city connectivity, with two lines between the north and west and the south east
- Melbourne Metro would relieve station crowding in existing CBD stations, whereas the MRL (Fishermans Bend) would exacerbate it
- Melbourne Metro supports the reconfiguration of the tram network that enables better tram route distribution (particularly to the west of the CBD) and high capacity trams on Swanston Street, ultimately improving operational performance of the tram network and facilitate new connections across and within the CBD
- Melbourne Metro would provide three new stations in areas currently not serviced by rail, whereas MRL (Fishermans Bend) would provide two
- Melbourne Metro and MRL (Fishermans Bend) each provide the opportunity for a station that would support urban renewal (Arden and Montague, respectively), discussed in more detail in the next section
- Melbourne Metro and MRL (Fishermans Bend) each provide a station at Domain, improving access to employment on St Kilda Road and relieving trams; however the MRL (Fishermans Bend) network configuration (which does not include two CBD stations) makes it less attractive to interchange from other lines to the new tunnel for access to Domain than it would be for Melbourne Metro
- Only Melbourne Metro provides a new station at Parkville, improving access to this education and biomedical precinct and relieving trams and buses. Parkville is an established precinct of national significance as discussed further in Chapter 7 and also has significant future growth potential with the rise of knowledge-based jobs; however its transport constraints are evident today. It is noted that under any of the capital investment options a subsequent rail link from Clifton Hill to Newport could provide a station at Parkville; however this is subject to a future investment decision of Government.

5.5.2. Urban Renewal Potential

Table 7 below assesses and compares each shortlisted capital investment option regarding its potential to revitalise and transform key urban renewal precincts around Central Melbourne. The focus of this section is the opportunity for a station at Montague under the MRL (Fishermans Bend) option or at Arden under the Melbourne Metro option.

In general, the provision of a new train station as an integrated part of an inner area urban renewal precinct is most efficient where there is potential for significant employment-oriented development. Stations provide a high capacity link between jobs and the wider metropolitan labour market, and utilise counter-peak capacity for customers interchanging in the CBD to access the precinct for work. In practice, Central Melbourne is expanding with mixed use urban development, however, and an individual balance needs to be struck in terms of the transport network for each precinct.

Table 7 - Urban renewal potential

Option	Urban renewal potential
MRL (Fishermans Bend)	<ul style="list-style-type: none"> • This option could support a market-led urban renewal in the Montague precinct of Fishermans Bend, supported by significant renewal already occurring in Melbourne’s inner south and the area’s proximity to existing central city employment / market trends in Southbank and St Kilda Road • Even with a new station, the Montague precinct is expected to consist of mostly residential development rather than act as a significant employment hub. At the present time, many sites have developments approved, and the vast majority are residential. Addition of a station could promote some greater employment-oriented development on remaining sites, assisting in the supply of competitively priced, large floor plate office space in Central Melbourne. • Given existing approved developments, the extent of development that could be considered to have been stimulated by a station at Montague is limited; however the station could play a role in supporting and servicing this development, in addition to existing light rail • It is worth noting that the majority of the Fishermans Bend urban renewal area lies well beyond the proposed Montague Station location(s), and the proposed station would have limited affect beyond its local precinct. Under any of the capital investment options a subsequent rail link from Clifton Hill to Newport could provide stations in the broader Fishermans Bend urban renewal area; however this is subject to a future investment decision of Government • Expansion of the tram network could present a more cost effective means of stimulating growth until demand in this area is proven (which is not canvassed under this option) • Overall, the two stations delivered by MRL (Fishermans Bend) in areas not already serviced by rail (Montague & Domain) are projected to have a combined catchment of less than 100,000 inclusive jobs, education enrolments and residents.²⁰
Melbourne Metro	<ul style="list-style-type: none"> • This option could support urban renewal in the Arden – Macaulay Precinct, currently an industrial area with large tracts of government-owned land • Given its proximity to Melbourne’s CBD and, with Melbourne Metro, its high accessibility to the Parkville education and biomedical precinct, it presents a significant opportunity for redevelopment to support growing knowledge sector employment. This could support increased agglomeration in central Melbourne, while maintaining competitively priced large floor plate office space. • Were this land rezoned without addition of a station, it is likely that the primary use would be medium density residential development, and with addition of a station a significant degree of residential development would be expected to complement a more commercially-oriented core. • Overall, the three stations delivered by the Melbourne Metro in areas not already served by heavy rail (Arden, Parkville and Domain) are expected to have a combined catchment of over 200,000 jobs, student enrolments and residents in 2031 – compared to the combined catchments of under 100,000 jobs, education enrolments and residents for the MRL (Fishermans Bend) (Montague and Domain).

²⁰ PTV.

Assessment Outcome: Improving access to jobs and stimulating urban renewal

Based on the analysis outlined above:

- Melbourne Metro provides improved access to CBD jobs while maintaining the most balanced distribution of passenger movements and relieving existing CBD stations. Most notably, this option will be able to cater for the strong employment and passenger growth to the west of the CBD.
- Melbourne Metro provides the greatest number of new stations in areas not currently serviced by heavy rail and the greatest relief to St Kilda Road – Swanston Street tram corridor and Parkville tram and bus networks. MRL (Fishermans Bend) would offer less relief to St Kilda Road trams and no station at Parkville to support this established precinct with increasing public transport and growing education and biomedical precinct.
- Both Melbourne Metro and MRL (Fishermans Bend) offer the ability to provide a new station as part of major urban renewal; however the Arden Station as part of Melbourne Metro would have a more transformative role in terms of stimulating a major employment-oriented development. A Montague Station as part of MRL (Fishermans Bend) could, however, play a key role in supporting the extensive residential development already approved in this precinct.

5.6. Deliverability and minimising productivity impacts caused by disruptions

Construction of rail infrastructure can be expected to involve significant construction complexities and disruptions to the existing metropolitan rail network and along the alignment route, and this is influenced by the construction approach. This section assesses and compares the length of time and level of disruption that is expected during the construction works associated with each shortlisted capital investment option. The major disruptions relevant to each option are considered in Table 8.

Table 8 – Works and major disruptions assessment

Option	Summary of works	Major disruption
MRL (Fishermans Bend)	<ul style="list-style-type: none"> Bored tunnel construction (using a Tunnel Boring Machine (TBM)) of twin tunnels between South Yarra and Southern Cross. Cut and cover works to extend the existing City Loop tunnel entrance adjacent to Brunton Avenue and associated track works to connect to the Ringwood line. Tunnelling works¹ to construct the new underground station at Southern Cross and to connect the new tunnel to the existing City Loop tunnel. Cut and cover works to construct new stations at Montague and Domain. Cut and cover works to construct the new station, decline structure and tunnel portal at South Yarra, including significant track reconfiguration works. A range of staged portal configuration works between Richmond and Flinders Street to enable trains to exit from the Caulfield Loop tunnel onto the Ringwood Line. 	<p>Rail network</p> <ul style="list-style-type: none"> Closures of two out of four City Loop tunnels – the Caulfield Loop (Cranbourne and Pakenham lines) and Burnley Loop (Belgrave, Lilydale and Alamein lines) – with flow-on effects to other lines depending on re-routing or early termination options, indicatively expected to extend for 3 – 5 months.²¹ Due to the implications of the reconfiguration works associated with the Burnley and Caulfield MURL tunnels, passengers on the Ringwood and Dandenong lines are severely impacted by the disruption works associated with MRL (Fishermans Bend). Over an extended period of disruption, construction works would require these services to operate directly between Richmond and Flinders Street stations; operating with significantly reduced service levels and not servicing the underground stations. Construction works in the rail reserve north of Southern Cross Station. Impact would depend on construction method. If TBM construction feasible this would be limited to a significant impact on V/Line operations, but if cut-and-cover works necessary this would involve a number of occupations, progressively affecting the majority of the metropolitan network. Cut-and-cover works at Brunton Avenue likely to require 10 to 20 weekend occupations with reduced weekend access to City Loop for all Burnley services. The works at South Yarra to construct the portal, station and reconfiguration of the tracks is likely to require a significant number of weekend occupations and several extended occupations affecting the Sandringham, Frankston, Cranbourne and Pakenham lines. Staged portal configuration works between Richmond and Flinders Street requiring varying degrees of disruption to Ringwood services for a number of years. <p>Other</p> <ul style="list-style-type: none"> Prolonged significant disruption of road traffic conditions and property acquisitions at Wurundjeri Way, Montague, Domain and South Yarra due to the cut and cover construction works for new stations. Several station and tunnel alignment options identified in the Montague – Yarra River precinct and impacts would depend on selected alignment. However, may require partial demolition (and rebuild) of Charles Grimes Bridge (Wurundjeri Way) and/or significant and complex commercial interfaces (potentially involving property acquisitions) including the South Wharf precinct and Melbourne Exhibition and Convention Centre expansion, other significant developments (e.g. Batman Hill) and the Southern Cross Station Public Private Partnership. Temporary use of park land for construction, including possibly Fawkner Park if used as a TBM launch site.

²¹ MRL (Fishermans Bend) requires the reconfiguration of the Caulfield and Burnley Loops at the portal entrances at Richmond and Southern Cross as well as a new portal at South Yarra. Works includes new tracks adjacent to Southern Cross Platforms 15/16 to join the Caulfield & Burnley tunnels underground to the north of Southern Cross Station by new underground connections. At the east end of the tunnel, a new connection from the Caulfield tunnel back to surface in the vicinity of the existing Burnley tunnel portal would also be required. These connections would cause considerable disruption, with the closure of the Caulfield and Burnley tunnels requiring Burnley and Caulfield trains to run direct to Flinders St with significantly reduced service levels for an extended period of time. Concept timetable designs for the final infrastructure likely to include service level uplift on the Frankston corridor, resulting in disruptive alterations at Burnley, Moorabbin, Mordialloc and Frankston.

Option	Summary of works	Major disruption
		<ul style="list-style-type: none"> • Very high risk sequencing works related to portal and City Loop match in works at Southern Cross, South Yarra and Jolimont, involving interfaces between new and legacy rail systems, requiring time critical execution in the context of a major rail network occupation. • Land acquisition surrounding the Montague station box site to initially be used as a TBM launch site and then subsequently as the location for the station.
Melbourne Metro	<ul style="list-style-type: none"> • Bored tunnel construction (using a TBM) of twin tunnels between South Kensington and the CBD and between South Yarra and the CBD. • Mined tunnel construction between CBD North and CBD South. • TBM tunnelling at the Yarra River crossing. • Cut and cover works and construction of decline structure at South Kensington tunnel portal, including embankment widening and some relatively minor track reconfiguration works. • Cut and cover works and construction of decline structure at South Yarra tunnel portal, including significant track reconfiguration and widening of the rail cutting. • Cut and cover works to construct new stations at Arden, Parkville, and Domain. Cavern construction for new stations at CBD North and CBD South. 	<p>Rail network</p> <ul style="list-style-type: none"> • Comparatively limited rail service disruptions over the life of the construction program compared to other options as the new tunnel would be constructed largely separate to the existing rail network. • The works at South Yarra to construct the portal and reconfiguration of the tracks is likely to require a significant number of weekend occupations and several extended occupations affecting the Sandringham, Frankston, Cranbourne and Pakenham lines. • There would be minor disruption to Sunbury Line services with occupations required as a result of the works at the South Kensington portal. • Other comparatively limited disruption would be required in relation to signalling upgrades and civil works on the existing network, although it is expected that disruption would be managed by coordinating these with other works affecting the network (for example, level crossing removals). <p>Other</p> <ul style="list-style-type: none"> • Prolonged disruption of road traffic conditions to varying degrees at South Kensington, Arden, Parkville, CBD, Domain and South Yarra. However, CBD disruption is comparatively limited as a result of the cavern construction methodology, meaning that the stations will be constructed almost entirely underground (rather than cut and cover from the surface). • Land acquisition, predominantly within the CBD but also at portals. • Construction in proximity to sensitive research and biomedical facilities in the Parkville precinct. • Temporary use of park land for construction, including possibly Fawkner Park if used as a TBM launch site. • Possible use of Edmund Herring Oval on Domain Road (next to the Shrine) as a construction site and TBM support site.

Note: Construction methods for each option would be further developed over time if the option is pursued. Initiatives to reduce disruption would be closely examined in project planning and would be an integral aspect of arrangements ultimately entered into with contractors. In the case of the MRL (Fishermans Bend) option, the design and construction methods are at a particularly early phase compared to Melbourne Metro and uncertainties are indicated where relevant to support a balanced comparison.

The shortlisted capital investment options all result in varying forms of disruption to the rail network and along the alignment route that may impact productivity:

- Construction of Melbourne Metro would involve significantly less impact to train services, with most construction occurring separate to the existing rail network.
- MRL (Fishermans Bend)²² options would involve:
 - Major closures in the core of the rail network, involving disruption to many lines, with the most significant closures extending over periods of months.
 - A significant logistical effort to transport the scale of movements ordinarily carried by heavy rail to destinations around the CBD.
- Many customers would need to use the surface transport network to get to their destinations during construction of the MRL (Fishermans Bend) option. This would be a major logistical exercise, given a high performing tram corridor can already be required to carry up to 10,000 customers in the busiest two hours (peak direction), and given crowding on the existing tram network.
- For all options, mitigation measures would be developed to maximise business continuity and continued operation of surface transport networks throughout construction.

Assessment Outcome: Deliverability and minimising productivity impacts caused by disruptions

Based on the analysis outlined above:

- MRL (Fishermans Bend) would involve major disruption to the core of the rail network, including shutting two out of four City Loop tunnels for a period of months to support the reconfiguration of the City Loop.
- For the reasons noted above and in particular the implications of the reconfiguration works associated with the Burnley and Caulfield tunnels, passengers on the Ringwood and Dandenong Lines are severely impacted by the disruption works associated with MRL (Fishermans Bend). Over an extended period of disruption, construction works would require these services to operate directly between Richmond and Flinders Street stations; operating with significantly reduced service levels and not servicing the underground stations.
- Both MRL (Fishermans Bend) and Melbourne Metro would involve the construction of new stations and would necessitate, to varying degrees, manageable surface disruptions which would impact retailers, residents and road users.
- As well as MRL (Fishermans Bend), construction works to enable extended trains for the Sunshine to Dandenong Line would then have to take place. This project has delivery challenges through the Central City, including at Southern Cross, Flinders Street and Richmond.

²² As discussed earlier, projected demand growth indicates that should Melbourne Metro be selected, the City Loop Split would also be required over the longer term, subject to a later investment decision of Government. It should be noted that if Melbourne Metro were constructed, this would create significantly greater flexibility in the rail network to manage the disruption associated with subsequent construction of the City Loop Split.

5.7. Cost

This section assesses the financial impact of delivering each shortlisted capital investment option.

5.7.1. Capital costs

Preliminary capital cost estimates for each capital investment option are provided in the table below. Each option would also require a significant investment in rolling stock and associated stabling, maintenance and power infrastructure, which would be of a similar order for each option.²³

Rail network expansion costs are comparable between the two options, as shown in Table 9 (based on the longer term pathways set out in Table 4 above).

Table 9 – Costs associated with stages of expanding capacity in the core of the rail network for the different shortlisted capital investment options

Stage	Network Change	Indicative timing	Shortlisted capital investment options – investment pathway (2015\$, p90 real)	
			Melbourne Metro	MRL (Fishermans Bend)
A	This Project	Early-Mid 2020s	~\$9.5b	~\$8.9b
B	Introduce extended HCMTs on Sunshine Dandenong line to accommodate extension and growth area demand	Early 2030s	~\$0.8b	~\$2.4b
C	Additional capacity to north/west (new pair of central city tracks)	Mid-2030s	~\$2.7b	~\$12.2b
D	Additional capacity to north/west (further new pair of tracks)	Mid-2040s	~\$11.8b	~\$1.0b

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

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

²³ These costs would be highest for the MRL (Fishermans Bend) option, as it disconnects the Frankston Line from the Newport maintenance facility, driving a need to electrify to Baxter to construct a stabling and maintenance facility. Under all options, this would be needed in the longer term either way.

5.7.2. Operations and maintenance costs

Operations and maintenance costs for all options are significantly smaller than the capital investment. MRL (Fishermans Bend) is likely to have higher operations and maintenance costs associated with train operations, as this option would have a greater degree of operational ‘imbalances’ (i.e. mismatch between services and demand across various lines) as a result of connecting the Craigieburn and Upfield lines to the less busy Frankston Line, resulting in somewhat less efficient operations.

5.8. Addressing identified Problems

Table 10 provides a summary of the extent to which each option addresses the identified Problems and therefore is able to generate the Benefits set out in the ILM.

Table 10 – Extent to which Problems are addressed

Option	Problem 1: Chronic overcrowding and unreliability of rail services are reducing Melbourne’s liveability and access to jobs and key activity precincts	Problem 2: Physical transport network constraints are reducing Melbourne’s economic prosperity	Problem 3: Insufficient public transport services are impacting access into and around Central Melbourne, and limiting the potential for urban renewal
Melbourne Metro	✓✓✓✓	✓✓✓✓	✓✓✓✓
MRL (Fishermans Bend)	✓✓✓	✓✓✓	✓✓✓

- ✓✓✓✓ Shortlisted capital investment option fully addresses the Problems as set out in the ILM
- ✓✓✓ Shortlisted capital investment option makes a substantial contribution to addressing the Problems as set out in the ILM
- ✓✓ Shortlisted capital investment option partially addresses the Problems as set out in the ILM
- x Shortlisted capital investment option insufficiently addresses Problems as set out in the ILM

Assessment Outcome: Assessing identified Problems

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

- Melbourne Metro provides an ultimate capacity uplift of 150,000, whereas MRL (Fishermans Bend) would not (without augmentation) provide sufficient capacity uplift to fully support network expansion options that Government may seek to subsequently invest in
- Melbourne Metro provides two new CBD stations, taking pressure off other stations and improving access to the civic spine of the city
- MRL (Fishermans Bend) would involve major disruption to the core of the rail network, including shutting two out of four City Loop tunnels for a period of months to support the reconfiguration of the City Loop. Melbourne Metro does not result in the same level of disruption to the core of the existing network, although Melbourne Metro would require significant surface level disruption particularly at the sites of the new stations
- Due to the implications of the reconfiguration works associated with the Burnley and Caulfield tunnels, passengers on the Ringwood and Dandenong Lines are severely impacted by the disruption works associated with MRL (Fishermans Bend). Over an extended period of disruption, construction works would require these services to operate directly between Richmond and Flinders Street stations; operating with significantly reduced service levels and not servicing the underground stations.
- Melbourne Metro provides the greatest number of new stations in areas not currently serviced by heavy rail and the greatest relief to St Kilda Road and Swanston Street tram corridor and Parkville tram and bus networks. MRL (Fishermans Bend) would offer less relief to St Kilda Road trams and no station at Parkville to support this growing education and biomedical precinct
- Both Melbourne Metro and MRL (Fishermans Bend) offer the ability to provide a new station as part of major urban renewal, however the Arden Station as part of Melbourne Metro would have a more transformative role in terms of stimulating a major employment-oriented development
- Rail network expansion costs are comparable between the two options. However, the Melbourne Metro investment pathway has a less adverse effect on rail operations and passenger journeys
- Melbourne Metro is able to provide the necessary central city capacity for extended HCMTs on the Sunshine corridor, whereas MRL (Fishermans Bend) does not make provision for this capacity. Additional investment in construction works would be required to enable extended trains for the Sunshine – Dandenong Rail Line, which would be challenging to deliver through Central Melbourne, including at Southern Cross, Flinders Street and Richmond.
- Melbourne Metro would provide for less complex independent line operation than MRL (Fishermans Bend); the connection of the Frankston and Ringwood corridors under MRL (Fishermans Bend) would present a number of challenges to schedule and operate due to the length of the line and journey time from end to end, the limited

terminating facilities on the trunk section, multiple single line and overtake sections and insufficient maintenance and stabling facilities.

The MRL (Fishermans Bend) and Melbourne Metro options have a number of similarities in the way that they each address Problem 3. Both involve new stations in Central Melbourne to improve accessibility and reduce crowding on trams. On balance, the Melbourne Metro option is rated higher, due to the larger catchment served by the new stations, greater relief to trams, and stronger role in stimulating urban redevelopment.

6. Recommended capital investment option

Melbourne Metro is the option that best addresses the Problems and achieves the Benefits identified in Chapter 3 and Chapter 4.

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

- Providing new services and capacity to accommodate over 39,000 passengers in the two-hour peak period from the first day of operation (and potential to provide capacity for 150,000 additional passengers over the long term) and two new CBD stations to more evenly distribute passenger flow and interchange movements in the inner core of the network
- Providing purpose-built stations that are designed to accommodate longer 10-car trains through the central part of the network, which delivers the highest long-term infrastructure capacity
- Providing the foundation to split the City Loop in the future by reducing the impact of necessary rail operation disruptions associated with this future investment to meet patronage demands
- Creating a new inner city line, which will remove the need for planned interactions to work around congestion on other routes, and improve the resilience, punctuality and overall reliability of the network through six dedicated lines
- Providing effective and direct congestion relief to trams running to and through the CBD along the Swanston Street tram corridor
- Providing the greatest number of new stations in areas not currently serviced by heavy rail (such as Arden, Parkville and Domain), with a combined catchment of over 200,000 jobs, enrolments and residents, more than double the next best option
- Providing the greatest potential for stimulating urban renewal and redevelopment, focused mainly around a new Arden station
- Providing for independent line operation and good distribution of passenger interchange across the network, supporting better reliability on the metropolitan rail network
- Providing the least disruptive (in terms of passenger journeys and rail operation) investment pathway for expanding the core of the rail network to meet growth in demand to the north, west and south-east in the long term.

For these reasons, Melbourne Metro is ranked first and is the recommended capital investment option.