Western Distributor Technical Options Report

Department of Economic Development, Jobs, Transport and Resources

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1. Introduction

The purpose of this Technical Options Report is to present the options considered in developing a preliminary concept layout for the Western Distributor and, of those options, to select a preferred concept as an assumed scope upon which the Business Case can be developed. The corridor that has been assessed for the Western Distributor is between the M80 Ring Road and the eastern end of Footscray Road.

The scope of the concept design solution presented in this report should not be considered to be the finalised scope for the project. This scope was developed in order to have a reasonable basis on which to develop a range of assessments as part of the typical business case development process. This includes cost estimates, economic assessments and traffic impacts to name but a few.

Should this project proceed past the Business Case stage, the State will undertake a more exhaustive consultation and engagement process on all aspects of the project scope to ensure that all appropriate and relevant views have been considered before refining any scope through a detailed, inclusive and transparent planning approval phase.

The development of the State concept has been informed by the State's project objectives, traffic forecasts, consultation with the relevant State Government departments, previous work undertaken for WestLink, Truck Action Plan and the West Gate Distributor, listening to feedback from the community, engagement with key stakeholders (such as the Port of Melbourne and including attendance at stakeholder meetings facilitated by Transurban) and the project team's own risk workshops and design workshops.

The Project has developed four Project Objectives have been identified to assess alternate options:

1. ***Improve transport performance in the M1 Corridor:***
    - *to meet increased travel demand due to future population and economic growth trends*
    - *to enhance connectivity between economic clusters*
    - *to enhance safety along the M1 Corridor*
    - *to enhance access to jobs and services.*
2. ***Reduce reliance on the West Gate Bridge:***
    - *to improve network resilience and redundancy*
    - *to mitigate strategic risks to the State and national economy*
    - *to improve travel reliability.*
3. ***Improve freight access to the Port of Melbourne and greater Melbourne:***
    - *to improve reliability of access to the Port of Melbourne and on the freight network*
    - *to meet travel demand arising from the future freight task*
    - *to enhance state and national competitiveness through freight productivity improvements.*
4. ***Improve community amenity on local streets in the inner west:***
    - *to reduce freight on local streets*
    - *to improve safety on local streets.*

In addition to the Project Objectives, the following general principles have also been adopted in developing the State concept alignment:

- Avoid residential property acquisition;
- Minimise the impact on public open space;
- Minimise the impact to Port operational land;
- Minimise impact to businesses;
- Minimise impacts on both live road and live rail environments;

The State has developed a suite of preliminary Functional Requirements that set out the target functional outcomes for the Western Distributor. The Functional Requirements are provided at Appendix A.

2. Option Assessment

In developing the preferred concept design for the Western Distributor Project, many design options and alternatives were considered. Some of these options are explained in the following section with accompanying details supporting why they were or were not taken forward at this stage.

It should be noted that this option assessment has been undertaken for the purposes of identifying a possible alignment to inform the Business Case. It is acknowledged that some of these options, including those considered to be less preferred at this stage of investigation, may be considered further in later stages of the Project (i.e. during the consultation and planning approvals phases) as more in-depth investigations and consultation are undertaken.

2.1 West Gate Freeway

The complex nature of the West Gate Freeway between the M80 Ring Road and the West Gate Bridge requires a significant amount of analysis and option development to produce a preferred alignment that provides the required functionality for the corridor but also improves efficiency and safety through the removal of weaving and potential queuing along the mainline of the freeway.

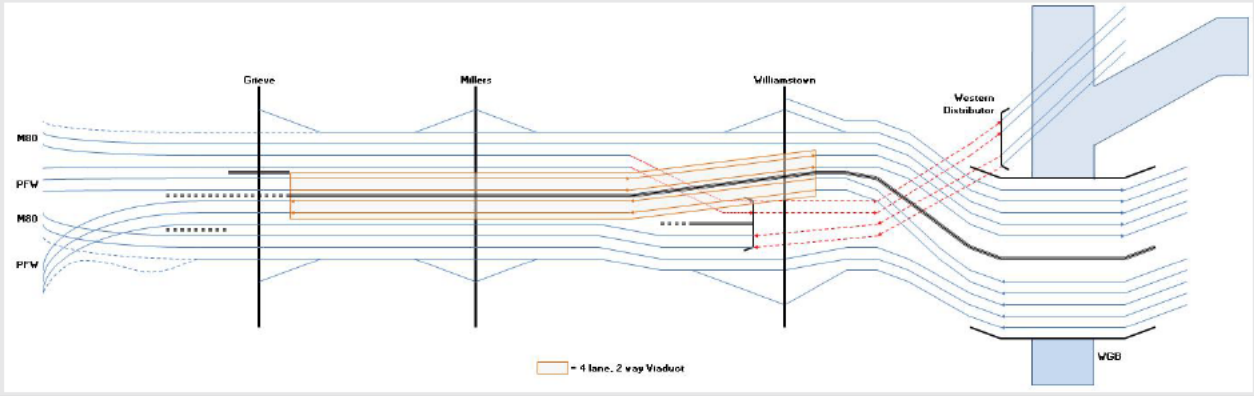
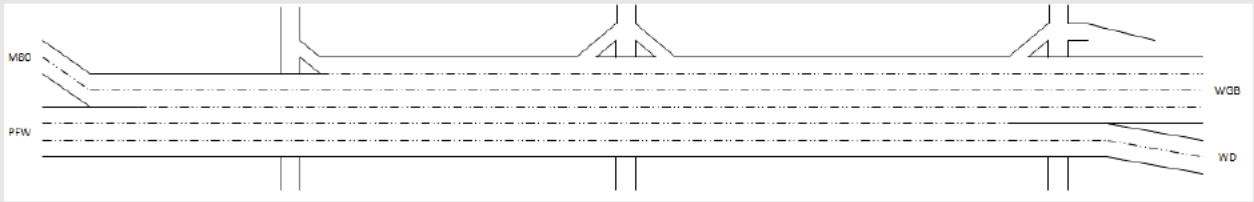
Based on the current phase of investigations, the preferred arrangement of the West Gate Freeway in the inbound direction separates traffic into two carriageways, providing access to the West Gate Bridge and the Western Distributor. Entries from and exits to the surrounding arterials are undertaken on the Western Distributor carriageway, maintaining priority and traffic flow on the West Gate Bridge carriageway. An overpass is provided for vehicles to travel from the entry ramps onto the West Gate Bridge. A direct connection to Hyde Street is provided to enable over-height vehicles and vehicles carrying dangerous goods to bypass the tunnel and avoid arterial roads with residential frontages.

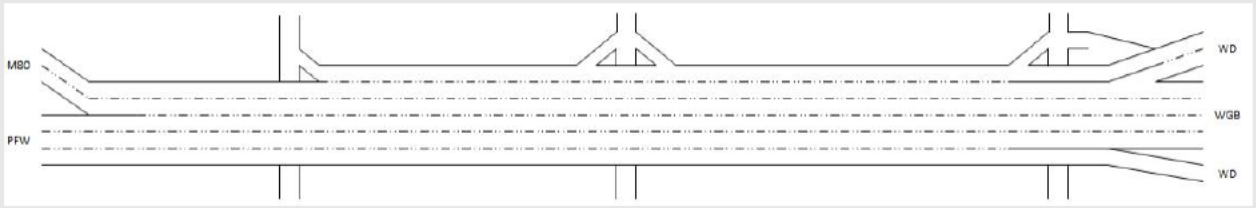
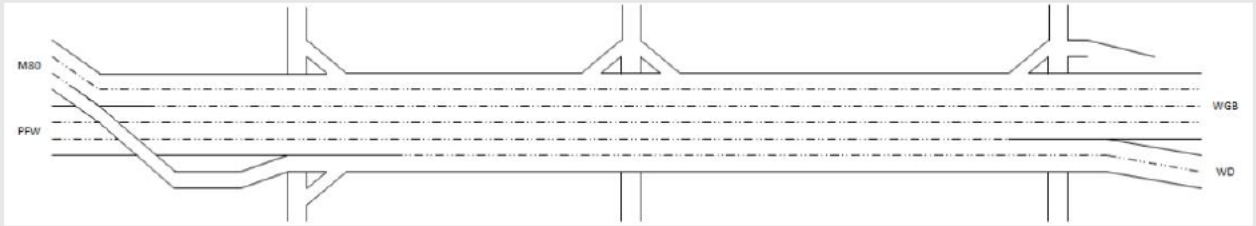
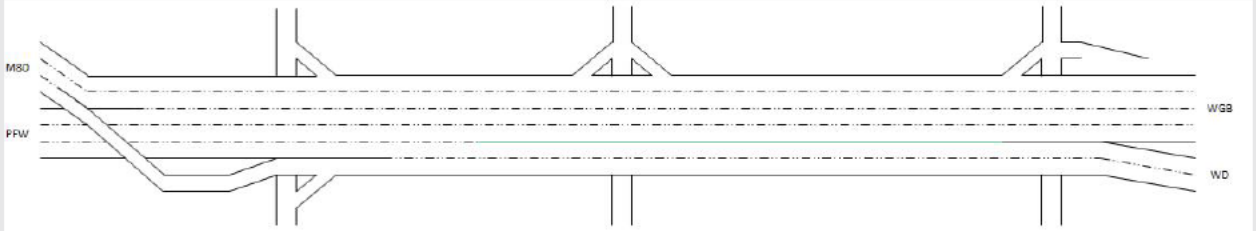
In the outbound direction, two carriageways are also provided, with traffic separated between those destined for the M80 Ring Road and the Princes Freeway West. The Western Distributor provides ramps to both carriageways. A direct connection from Hyde Street is also provided for vehicles that cannot use the tunnel. Access for Williamstown Road and Millers Road will be via the outer carriageway while Grieve Parade will be accessed via the inner carriageway.

This proposed lane arrangement reduces the amount of weaving that could occur on the West Gate Freeway, improving traffic flow and reducing congestion. It also provides balanced traffic volumes between each of the carriageways, further improving traffic flow.

Table 1 and Table 2 provides a summary of the options that were identified for the inbound and outbound directions of the West Gate Freeway but not taken forward as suitable options and the reasons why they were considered not suitable for further development. The preferred option is discussed further in Section 3.

Table 1 West Gate Freeway option assessment - Inbound

Layout	Description	Reason for no further development
	2 lane viaduct over WGF. 4 lanes on WGF.	• Vertical grade issues • Cost • Visual impact • Retains some significant weaving between WD and Millers Road
	6 lanes on WGF with no separation. WD access from centre of freeway.	• Significant weaving movements resulting in high levels of congestion, flow breakdown and safety issues

Layout	Description	Reason for no further development
	6 lanes on WGF with no separation. WD access from centre and left side of freeway.	• Multiple route choice from all entry ramps • Creates confusion for drivers • Safety concerns with unpredictability of routes • Differential speed issues with WD or WGB queuing
	M80 flyover plus additional ramp from Grieve Parade. 6 lanes on WGF.	• Requires Millers Road traffic to weave 4 lanes • Unsafe weave remains to access WD
	M80 flyover plus additional ramp from Grieve Parade. 6 lanes on WGF. Barrier extending from WD to beyond Millers Road.	• No access from Millers Road may result in less heavy vehicles using WD • Difficult to provide 3 lane tunnel in future

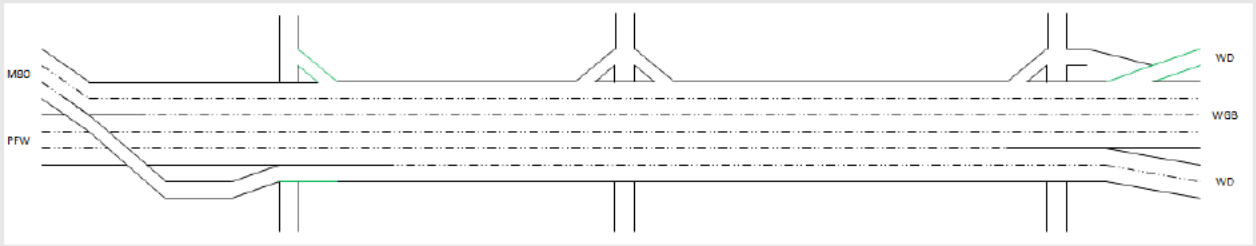
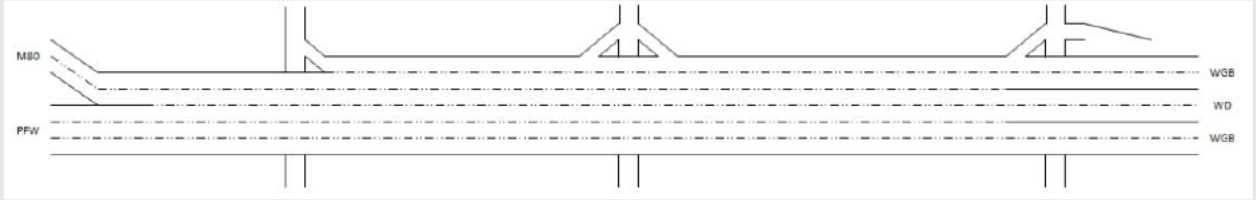
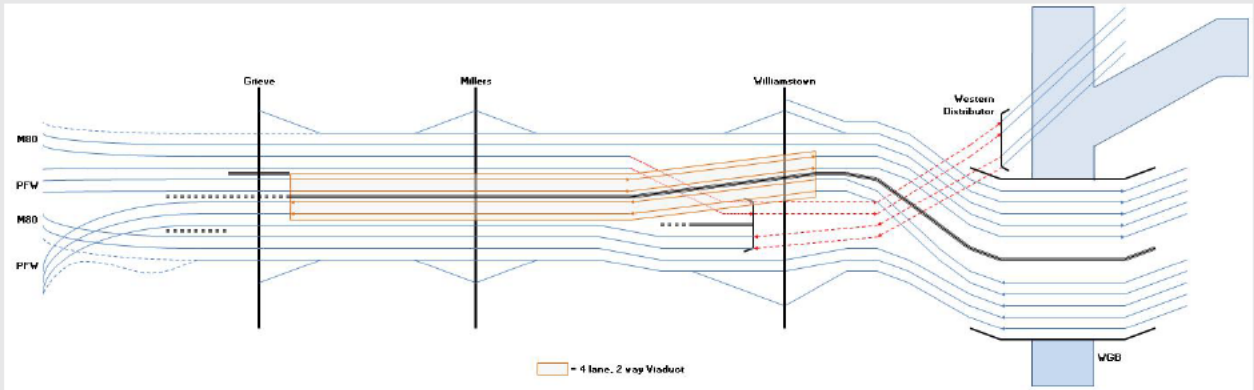
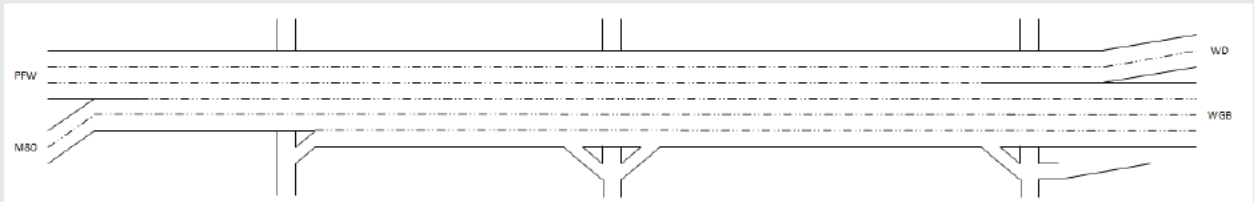
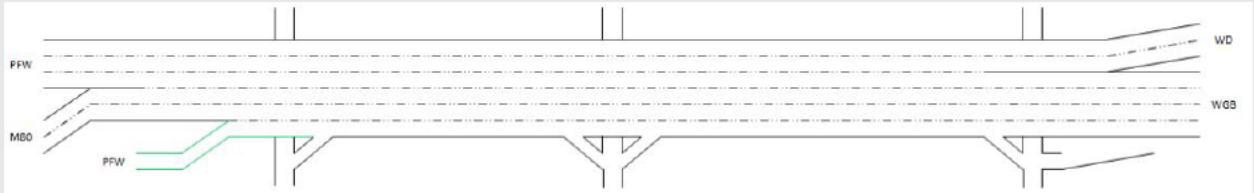
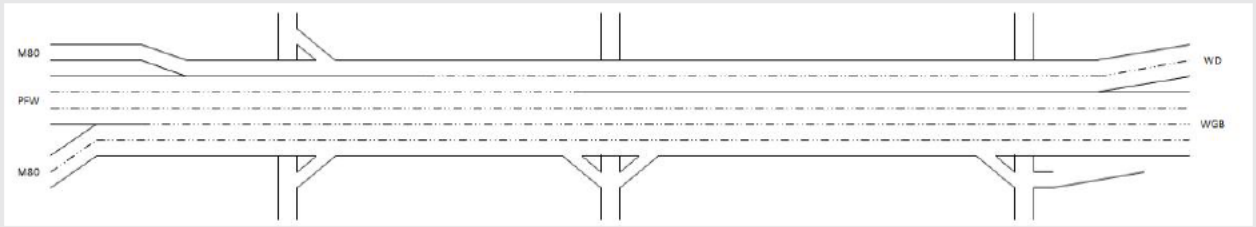
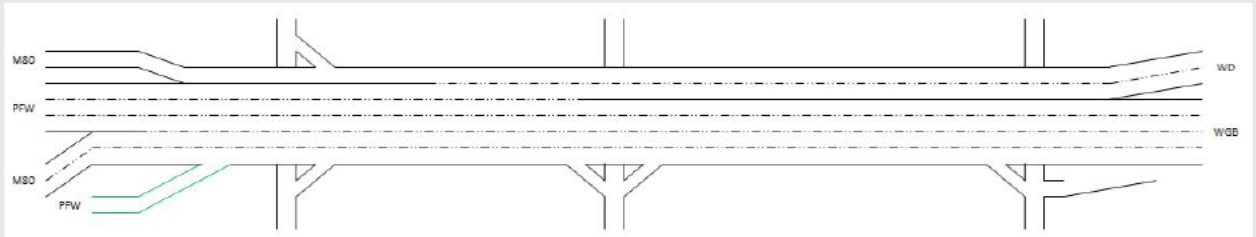
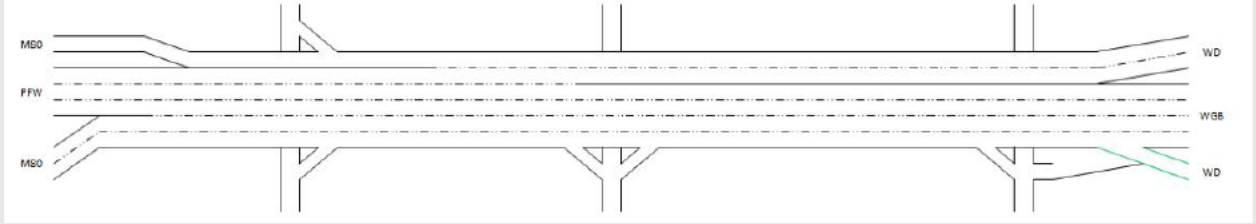
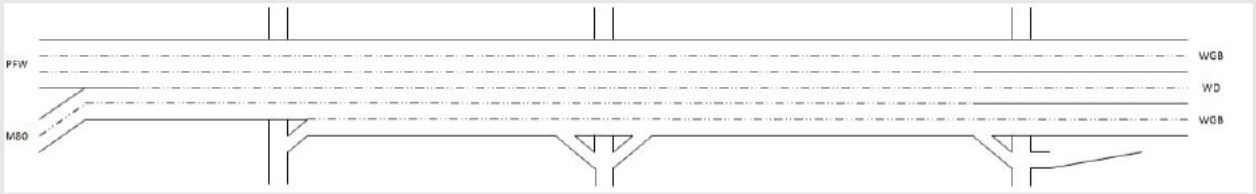
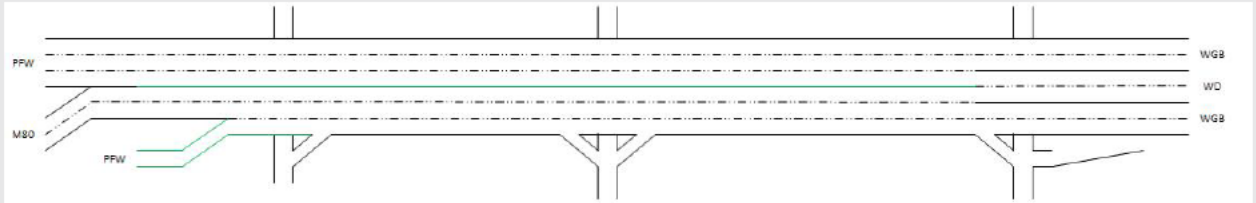
Layout	Description	Reason for no further development
	M80 flyover plus additional ramp from Grieve Parade. 6 lanes on WGF No additional ramp from Grieve Parade and additional left side exit to WD.	• Multiple route choice from all entry ramps • Creates confusion for drivers • Safety concerns with unpredictability of routes • Differential speed issues with WD or WGB queuing • Balanced utilisation of exits to WD cannot be controlled
	6 lanes on WGF with WD access in the middle of the carriageway.	• Lack of central separation • Overloading of left lanes forces traffic across tunnel-bound lanes

Table 2 West Gate Freeway option assessment – Outbound

Layout	Description	Reason for no further development
	2 lane viaduct over WGF. 4 lanes on WGF.	• Vertical grade issues • Cost • Visual impact • Retains some significant weaving between WD and Millers Road
	6 lanes on WGF with no separation.	• Significant weaving movementse resulting in high levels of congestion and safety issues
	6 lanes on WGF with no separation. Additional ramp connection to Princes Freeway West near Grieve Parade.	• Multiple Routes to PFW along Mainline may create confusion • Weave from WD to Miller and Grieve exit ramps

Layout	Description	Reason for no further development
	6 lanes on WGF with concrete barrier from WD to Millers Road. New ramp connection from WD to M80.	• Concerns with impact of right side M80 connection • Potential conflict with future layouts proposed for M80 • No access from WD to Millers Road
	6 lanes on WGF with concrete barrier from WD to Millers Road. New ramp connection from WD to M80. Additional ramp connection to Princes Freeway West near Grieve Parade.	• Concerns with impact of right side M80 connection • Potential conflict with future layouts proposed for M80 • No access from WD to Millers Road • Weave from WD to Grieve Parade
	6 lanes on WGF with concrete barrier from WD to Millers Road. New ramp connection from WD to M80. Additional ramp connection from WD to WGF.	• Concerns with impact of right side M80 connection • Potential conflict with future layouts proposed for M80

Layout	Description	Reason for no further development
	6 lanes on WGF with WD access in the middle of the carriageway.	• Lane changing required across tunnel lanes to balance flows
	6 lanes on WGF with WD access in the middle of the carriageway. Barrier from WD to M80.	• Demand imbalance in outer carriageway, overloading and causing congestion.

2.2 Tunnel cross-section

Two scenarios were considered for the tunnel cross section, a two lane tunnel or a three lane tunnel.

A two lane tunnel has been tested in the strategic traffic modelling for the Project. The modelling shows that in the peak periods, the tunnel will be operating close to its capacity in 2031. If a two lane tunnel was constructed, flow breakdown could occur as the tunnel approaches its capacity. An incident in the tunnel during the peak period, such as a broken down vehicle, would also have a significant impact on the operation of the tunnel as there would be insufficient space to provide a shoulder for a broken down vehicle, reducing the operation of the tunnel down to a single lane or potentially a full closure.

A three lane tunnel could be constructed, operating with two lanes and a wide shoulder. This will still operate close to its capacity in the peak periods, however it will provide an opportunity for a broken down vehicle to pull over into the shoulder so that it will not impact traffic flow, and potentially for emergency vehicle access to the broken down vehicle. The wide shoulder also allows for an additional traffic lane in the future or the provision of a dedicated truck lane to assist access of trucks to and from the Port of Melbourne.

If additional capacity within the two lane tunnel was required in the future, it is not possible to widen it to three lanes. As the existing tunnel could not be widened, a separate tunnel would require construction at significant cost. The cost of constructing a new tunnel would be significantly higher than the difference in cost between the construction of a three lane tunnel compared to a two lane tunnel.

The provision of a three lane tunnel initially provides the flexibility to operate the tunnel with three lanes in the future if required without additional construction costs or impacts. The three lane tunnel provides additional redundancy into the road network, with the opportunity to open the third lane to general traffic if there was an incident on the West Gate Bridge.

For these reasons, the State concept adopts a three lane tunnel which would be operated with two lanes and a wide shoulder.

2.3 Southern tunnel portal

Two main options were considered for the location of the southern portal:

1. Within the central median of the West Gate Freeway, west of Williamstown Road; and
2. North of the West Gate Freeway near Hyde Street.

For each of these options, an important consideration is the identification of an alternate at-grade route for vehicles that are either unable to or not permitted to use tunnels, such as over-height vehicles or vehicles carrying dangerous goods (i.e. placarded loads). For the inner west such a route should avoid roads with residential frontages. Without a Hyde Street connection there would be no way of redirecting over-height vehicles or vehicles carrying dangerous goods away from the tunnel, and would result in such vehicles exiting the Freeway at Williamstown Road and travelling via Francis Street to head towards Footscray Road and the Port.

Option 1 is for a tunnel portal within the centre of the West Gate Freeway road reserve, west of Williamstown Road. At the tunnel portal location, it would see the cross-section of the existing West Gate Freeway widened to accommodate the existing 10 freeway lanes (5 inbound and 5 outbound plus shoulders) plus the 4 lanes to and from the tunnel (2 inbound lanes and 2 outbound lanes plus shoulders) and associated retaining walls, batter slopes and barriers.

The placement of the tunnel portals in the centre of the freeway will mean that vehicles that are not permitted to enter the tunnel (i.e. over-height or placarded loads) will be trapped with nowhere to turn around once they enter the Western Distributor carriageway. This will require the vehicle to stop on the side of the freeway and wait for recovery which would have a significant impact on the operation of the freeway and access to the tunnel.

Ramps that provide a direct connection to Hyde Street could be provided for over-height or placarded loads, however these would most likely be located on the side of the freeway, and therefore would not assist trapped vehicles in the Western Distributor carriageway (which would presumably be within the central median). Furthermore, the provision of these ramps would require additional widening of the freeway under this option which may result in the acquisition of residential properties.

Without the Hyde Street ramps, any tunnel closure for maintenance or other purposes would force traffic and trucks back onto the Inner West Road network.

Emergency access into the tunnel under this option would most likely need to travel down the freeway mainline. Depending on the length of the separator barrier between the carriageways, emergency vehicles may need to access the freeway from as far as the M80 interchange. Barrier gates could be provided to allow access between the two carriageways, however these could still be a hindrance for emergency access. Providing the tunnel portal within the centre of the West Gate Freeway will have a significant impact on over 200,000 vehicles that use the West Gate Bridge every day (i.e. 59 to 63 percent of all trips to/from the west that currently cross the Maribyrnong River) for the full duration of construction activities, which could last between two to three years for the portal construction.

It is possible that a number of traffic lanes in each direction will require closure during construction, reducing the capacity of this major freeway connection from the west and impacting over 200,000 vehicles a day. In addition to the closure of traffic lanes, the posted speed limit will likely be reduced to between 40km/h and 60km/h all day for the full construction period, which may last between two and three years. These two significant construction impacts are likely to increase congestion along the freeway which may lead to rat-running as traffic will seek to use other routes to reach their destinations, such as via the Inner West, increasing congestion off the freeway network.

The location of the construction site in the middle of a live freeway creates significant constructability issues which may have an impact on the duration of works and access to the site. These issues may prolong the amount of time required for construction activities, further impacting vehicles on the West Gate Freeway and surrounding residents.

The Tunnel Boring Machine (TBM) could potentially be in the order of 200m in total length, which includes cutting head and shield, plus the train which removes the muck/tunnel spoil and installs the tunnel lining segments. For this Option 1, it is assumed that two TBMs would be required to bore the two tunnels. Assuming that the TBMs are launched from the northern tunnel portal, when they emerge at the southern portal they must be dismantled and removed from the site. While the TBM train would be removed in sections (i.e. progressively pushed out of the portal and dismantled) this is a major operation involving heavy handling and moving equipment. This task may take several months in duration and during this period there would need to be clear and unimpeded access to the machine. It would not be feasible to open and shut traffic lanes for peak hour traffic within the overall required works area. Access and egress of heavy equipment to and from the works area would also be required. Accordingly, the construction of tunnel portals within the West Gate Freeway road reserve would have a substantial and prolonged impact on one of Melbourne's most critical road links.

Further, should the tunnel portals not be constructed in the centre of the West Gate Freeway but rather constructed at the outer extents of the road reserve this may assist with the ability to divert over-height and placarded vehicles, however this would require two construction sites, with potentially longer and more complex construction and disruption to traffic. Residential acquisition would be likely.

The section of the tunnel that passes under Williamstown Road may be constructed using a cut-and-cover technique. This would require the closure of Williamstown Road for lengthy periods. Williamstown Road is a critical link for private and commercial vehicles and on-road public transport (including bus route 472) into and out of suburbs such as Yarraville, Spotswood, Williamstown and Newport. These works will have a significant impact on private vehicles and commercial vehicles accessing these precincts. During the closure of Williamstown Road, vehicles will need to divert to Millers Road to access their destination. However, Millers Road currently operates with high levels of congestion in the peak periods and is unlikely to be able to accommodate any additional traffic.

A tunnel portal in this location would be within proximity of approximately 530 residential properties within a 500m radius from the tunnel portal. It would also avoid any at-surface impacts to the Stony Creek and Stony Creek Reserve.

In summary, Option 1 is not considered suitable due to the following key issues:

- Significant impacts during construction affecting one of Melbourne's key freight and commuter corridors;
- Significant constructability issues, working in the centre of a live freeway which carries over 200,000 vehicles a day;
- Poor operational outcomes for the diversion of over-height and placarded vehicles, potentially resulting in trapped vehicles in the Western Distributor carriageway impacting the operation of the tunnel;
- Inefficient access for emergency services into the tunnel;
- No credible diversion route for heavy vehicles during closures of the tunnel for maintenance;

- Williamstown Road closure impacting access to a number of suburbs requiring the diversion of vehicles to Millers Road which is already congested in peak periods; and
- Potential residential property acquisition for the construction of the Hyde Street connection.

Option 2 is for a tunnel portal north of the West Gate Freeway, south of Francis Street and west of Hyde Street. A tunnel portal in this location could surface in the vicinity of the existing vacant site adjoining an existing electricity terminal, with ramps ascending to the existing surface level, a bridge crossing the Stony Creek and then elevated ramps over the metropolitan rail line and above the West Gate Freeway with ramps descending to the existing surface level of the West Gate Freeway west of Williamstown Road. It is assumed that a single TBM could be utilised, being launched from the north and then turned around to head back north for the other tunnel, or dismantled and transported back to the northern portal.

A direct connection to Hyde Street can be incorporated under this option similar to that proposed under the West Gate Distributor proposal by connecting to the Western Distributor ramps between the West Gate Freeway and the tunnel portal and, accordingly, it avoids the requirement for any residential land acquisition. These ramps will be connected to the freeway in such a way that will allow the diversion of vehicles that are not permitted into the tunnel. This will prevent any vehicles needing to stop on the side of the freeway, removing any impacts to operation and access to the tunnel.

The Hyde Street ramps also provide an opportunity for more efficient access for emergency services, compared to travelling along the freeway mainline with Option 1.

Localised widening of the West Gate Freeway would be required to accommodate the 4 lanes (2 inbound and 2 outbound plus shoulders) to/from the Western Distributor ramps. However, compared to Option 1 the construction footprint will be much narrower and less complex. Whilst there is a high likelihood that traffic conditions on the West Gate Freeway and surrounding road network may experience heavy congestion for the duration of the construction period under this option, it is anticipated that the construction duration on the West Gate Freeway will be significantly shorter compared to Option 1. The works required may also be able to be performed outside of peak hours, further reducing their impact on the operation of the freeway.

The impact to Williamstown Road will be limited to the construction of the elevated ramps over the Freeway. Short-term closures of Williamstown Road may be limited to off peak hours, weekends or other low impact periods.

A tunnel portal in this location would be within proximity of approximately 380 residential properties within a 500m radius from the tunnel portal, approximately 150 residential properties fewer than Option 1.

Option 2 will require a footprint across part of the Stony Creek Reserve. Whilst this will result in the loss of some existing parkland, it creates the opportunity to transfer existing vacant and unused land to create new and expanded public open space. There is further opportunity to integrate improvements to the open space and urban amenity of the Stony Creek Reserve and surrounds, through shared path connections (including the Federation Trail completion), linking major cycling routes in the west. The ultimate layout and uses of the expanded park would be subject to extensive stakeholder and community consultation to enable the development of appropriate masterplans for the reserve.

In summary, Option 2 is the preferred location of the tunnel portal for the following reasons:

- Hyde Street ramps can be provided without any residential acquisition. These ramps will increase the reduction of trucks on roads in the Inner West;
- The Hyde Street connection provides an opportunity for prohibited vehicles to divert from the entry tunnel and avoid stopping on the freeway mainline. It also provides a suitable bypass of the tunnel during planned closures such as maintenance;
- Significantly reduced impact to the West Gate Freeway during construction;
- Significantly reduced constructability issues with the majority of the construction activities occurring outside of a live freeway environment;
- Significantly reduced impact to Williamstown Road, with construction activities likely to occur outside peak periods; and
- No residential property acquisition.

For these reasons, the Southern Tunnel portal north of the West Gate Freeway near Hyde Street was taken forward.

2.4 Northern tunnel portal

The preferred location for the northern tunnel portal is generally considered to be west of Whitehall Street and north of Somerville Road. If it was located further north or east, it would be difficult to achieve suitable clearance over the Maribyrnong River without a steep grade into and out of the tunnel which would have adverse impacts, particularly to heavy vehicles and the emissions that they generate.

It is assumed that construction of the tunnels will be launched from this location requiring a large temporary construction footprint (potentially in the order of 36,000m^2) and, accordingly, there is flexibility within this site for the exact siting of the tunnel portal. However, key considerations will include maximising the offset to the Yarraville Gardens, clearances over the Maribyrnong River and the alignment through the Port of Melbourne to minimise the impacts to key port operational land.

A tunnel portal east of the Maribyrnong River has not been considered largely due to the poor ground conditions (e.g. Coode Island silt) and potential disruption to port and freight operations.

2.5 Maribyrnong River crossing

The road crossing of the Maribyrnong River can potentially be achieved through the provision of a bridge structure with a single span over the river or a bridge structure with piers into the waterway.

A clear span bridge over the Maribyrnong River is the preferred option as it minimises environmental impacts on the Maribyrnong River and potentially provides for a better urban design outcome. It is acknowledged that a clear span bridge may be more expensive than an option with bridge piers in the Maribyrnong River, although further structural and design investigations are required to prove feasibility of this clear span option.

A design with piers within the waterway, or close to the bank, may require further work or consideration of river aflux levels during a storm event. While a reasonable solution may be achieved to address these issues, the State concept design has adopted a solution that avoids piers within the waterway or close to the river banks. A single span structure is also likely to have better urban design outcomes.

The alignment of the proposed bridge will be dictated by the ultimate location of the northern tunnel portal (i.e. west side of river) and the desired intent to minimise the impacts to operational Port land as it approaches the proposed viaduct along Footscray Road.

2.6 Port access

Currently, the key locations for access to the Port of Melbourne from Footscray Road are via Mackenzie Road, Dock Link Road and Appleton Dock Road. The Port of Melbourne have indicated that it is their plan to sever Coode Road within the Port area, thereby downgrading the access provided by Dock Link Road on the southern side of Footscray Road in the future. Even without this closure, it is expected that with a forecast increase in rail movements, Dock Link Road would be impacted by long periods of closure due to train shunting and rail operations.

A number of options have been considered for connection from the Western Distributor to the Port of Melbourne. They are:

- Connection to Footscray Road in the vicinity of Dock Link Road
- Connection to Mackenzie Road
- Connection to Appleton Dock Road
- Connection from Enterprize Road to CityLink ramp (northbound)

The connection to Footscray Road in the vicinity of Dock Link Road would provide access to Port facilities on both sides of Footscray Road, until the access point on the southern side is closed. The ramps would require a large amount of u-turning movements to occur on Footscray Road which will have an impact on the capacity of the road, particularly as heavy vehicle movements to/from the Port increase in the future. This connection also creates a weave between vehicles from the ramps and those travelling along Footscray Road. Due to these two major issues, the Footscray Road connection was not considered feasible.

The connection to Mackenzie Road provides direct access from the Western Distributor into the Port of Melbourne, removing heavy vehicles from the inner west and Footscray Road improving the amenity and operation of roads within these areas. It also improves safety along Footscray Road by avoiding heavy vehicle u-turning movements.

Connection to Appleton Dock Road is required for vehicles accessing the eastern side of the Port. The connection proposed is for vehicles travelling to/from the west. This connection removes heavy vehicles from Footscray Road and the inner west.

A connection from Enterprize Road to the CityLink northbound ramp was investigated. This connection would remove northbound vehicles from Footscray Road, potentially improving its performance between Appleton Dock Road and CityLink. However, this connection may create a hazard along the on-ramp with slow moving Port vehicles mixing with faster vehicles on the ramp. As such, this connection has not been included into the preferred alignment.

2.7 CityLink connection

North facing ramps will be provided from the Western Distributor to CityLink. Given the close spacing of entry and exit ramps north of Footscray Road, consideration had to be given to the alignment and connection of these ramps to the existing viaduct.

Two key options were considered for the connection from the Western Distributor to CityLink. These were:

1. Connection with the existing Footscray Road ramps
2. Connection with the existing Dynon Road ramps

The connection with the Footscray Road ramps would result in a shorter elevated road between the Western Distributor and CityLink, therefore reducing the cost of the connection. However, the forecast traffic demand on these ramps was higher than could be accommodated in a single added lane arrangement onto CityLink that is proposed. The alignment of the ramp would also require significant modification and an extension of the northbound ramp. This results in insufficient separation between the revised ramp and the Dynon Road entry ramp which is likely to cause flow breakdown and congestion. Therefore, this option was not considered suitable.

The forecast traffic volumes on the Dynon Road ramp and the Western Distributor ramp would be suitable for an added lane arrangement onto the CityLink viaduct. There is also sufficient spacing between the Footscray Road entry ramp and the proposed combined Western Distributor and Dynon Road entry ramp.

2.8 Inner urban access

A number of inner urban access connections were investigated as part of the option development process. These connections were:

1. Footscray Road only connection
2. Footscray Road and Dynon Road connections
3. Footscray Road, Dynon Road and Wurundjeri Way extension (CBD bypass)

The Footscray Road only connection placed a significant amount of pressure on Footscray Road, particularly in the AM peak period. Currently, Footscray Road experiences highly variable travel times and large amounts of congestion in the AM peak period. As Footscray Road approaches the CBD, a number of signalised intersections create delays and congestion. This congestion is highest at the eastern end of Footscray Road as it approaches Dudley Street and Harbour Esplanade. Typically, queuing along Footscray Road in the AM peak can extend to Waterfront Way and on occasion back to the CityLink off-ramp.

Attracting additional traffic along Footscray Road does not align with the future development plan for E-Gate and Docklands. These two precincts are intended to interact with each other, with high levels of pedestrian movements forecast between both sites. However, increased traffic volumes and traffic lanes will create a physical barrier to pedestrians, impacting the amenity of the area and the viability of the developments.

The Footscray Road connection places additional pressure on Dudley Street as vehicles will use this road to access north of the city as well as the CBD. These issues indicate that the Footscray Road only connection has an adverse impact on Footscray Road and should be avoided.

The Footscray Road and Dynon Road connection assists in reducing traffic demands along Footscray Road. However, it increases traffic demand along Dynon Road to a level that creates significant congestion along Dynon Road. This level of congestion has resulted in this connection option being removed from further consideration.

Strategic traffic modelling has shown that a large proportion of traffic from Dynon Road is destined for locations south of the Yarra River and this traffic travels through the CBD to access these locations. This through traffic places pressure on CBD roads and signalised intersections. An extension of Wurundjeri Way which essentially extends the city bypass function of this important road could assist in relieving the pressure on Dynon Road.

The option investigated extends Wurundjeri Way to Dynon Road via a grade-separated connection over Dudley Street and provides three points of access from the Western Distributor, to Footscray Road, to Dynon Road and to the Wurundjeri Way extension.

It is believed that this arrangement will remove through traffic from critical roads and intersections, improving their operation compared to the other options investigated. The Wurundjeri Way extension provides the ability to redistribute traffic from Dynon Road and also traffic from the Western Distributor which would otherwise have been required to use Footscray Road and Dudley Street to access Wurundjeri Way.

Traffic accessing the inner north can do this directly from the Dynon Road connections without the need to travel through the congested Dudley Street corridor.

Based on this assessment, the Footscray Road, Dynon Road and Wurundjeri Way extension option has been selected as the assumed scope for the purpose of the business case.

2.9 Webb Dock Access Improvements

A number of options for improving access between Webb Dock and CityLink were considered. All options included widening of Cook Street west to two lanes eastbound from Todd Road to the West Gate Freeway Ramps Terminal Intersection (in addition to the Port funded widening to two lanes westbound). Variations included:

1. Collector distributor connection with alignment along the north side of the existing freeway service centre
2. Collector distributor connection with alignment along the south side of the existing freeway service centre
3. Collector distributor connection via a new flyover over the eastbound carriageway of the West Gate Freeway

The preferred option is option 1 which includes a separated carriageway on the north side of the West Gate Freeway providing direct access from Cook Street to the CityLink Western Link ramp without interacting with West Gate Freeway mainline traffic via signalisation of the Cook Street/Salmon Street intersection. It includes widening, realignment and regrading of the ramp to improve heavy vehicle performance and safety (based on the history of truck rollovers)

This option was selected as the most direct and efficient access from Webb Dock to WesternLink for heavy vehicles. By separating West Gate Freeway bound traffic from WesternLink traffic, ramp controls can be applied more efficiently.

The tight curve radius and grade of the Ramp currently makes it difficult for trucks to negotiate safely. To improve safety, the ramp will be regraded and realigned along with the installation of ramp metering with adequate storage provisions.

All options include one additional eastbound lane on Cook Street to assist egress from Webb Dock.

The flyover option for the CityLink connection was not considered appropriate because of the complexity it added to exiting the service centre.

The alignment option on the south side of the freeway service centre was eliminated due to its operational impacts, environmental and compensation risks with leasing arrangements to the freeway service centre. This alignment was also less amenable for large numbers of large vehicles and introduced potential operational issues with the Cook Street entry ramp meter.

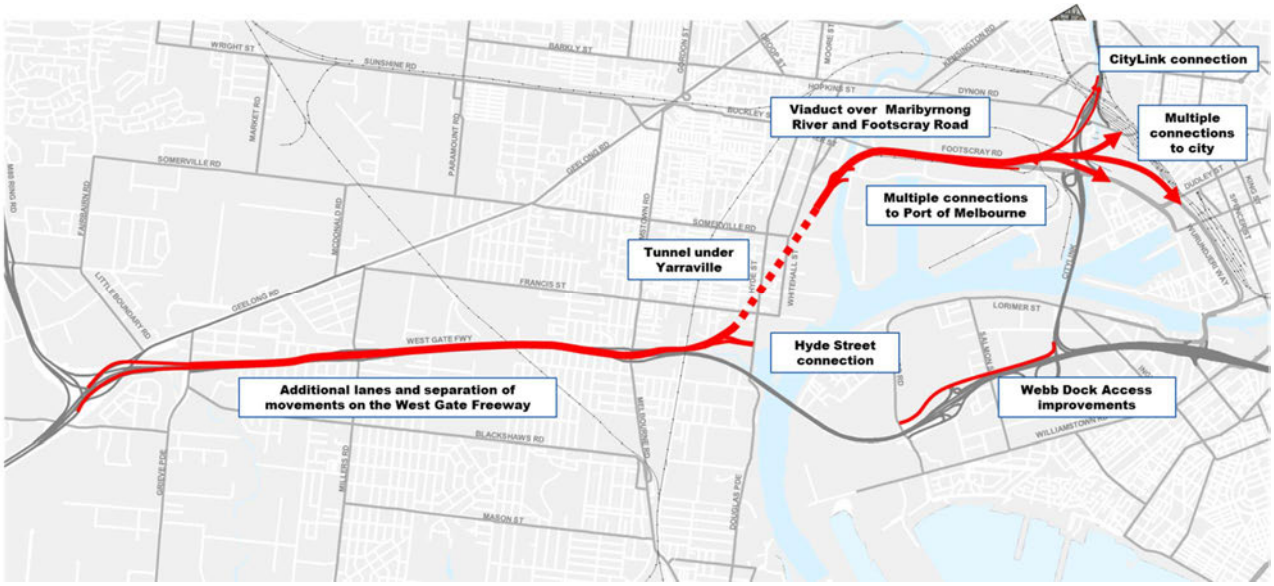
3. Business Case Concept Design

This section identifies the preferred elements of the State concept for each interface. It is broken up into the key corridor elements, namely:

- West Gate Freeway (between M80 and Williamstown Road)
- Yarraville alignment
- Southern tunnel portal
- Northern tunnel portal
- Maribyrnong River crossing
- Port access
- City Link connection
- Inner urban access

The preferred alignment of the State Concept design is shown in Figure 1.

Figure 1: Preferred State Concept Design



3.1 West Gate Freeway

The preferred option to expand the capacity of the West Gate Freeway (WGF) in both inbound and outbound directions is to provide a collector-distributor arrangement with a total of 6 lanes in each direction. This includes three lanes providing an uninterrupted link between the West Gate Bridge (WGB) and M80/Princes Freeway separated from 3 lanes in the same direction that allows for entry and exits to Williamstown Road, Millers Road and Grieve Parade.

This has been selected as the preferred option because additional lanes support continued growth in the west and a braided collector-distributor configuration will minimise merging and weaving of traffic, and maximise throughput. The inclusion of separated main and collector-distributor carriageways provides additional network redundancy meaning the disruption caused by a substantial incident on the WGF between Williamstown Road and the M80 interchange will be predominately contained to the carriageway it occurred in, reducing the overall disruption to the network.

The preferred layout of the West Gate Freeway is provided in Figure 2 and Figure 3.

Figure 2: West Gate Freeway Separation of Movement – Inbound

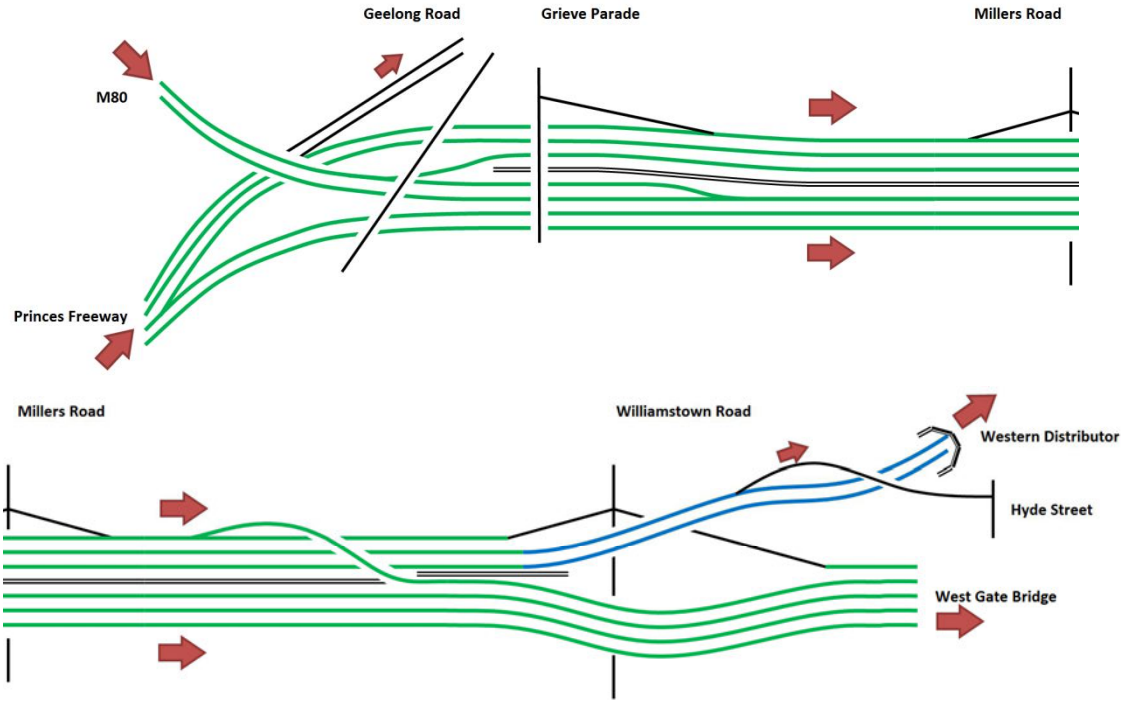
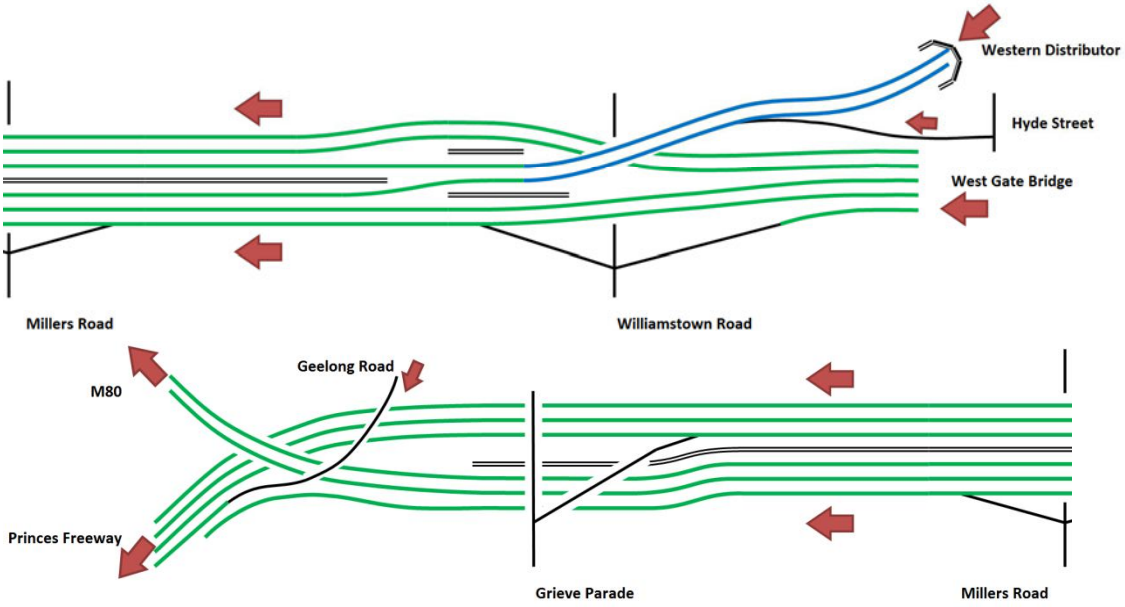


Figure 3: West Gate Freeway Separation of Movement - Outbound

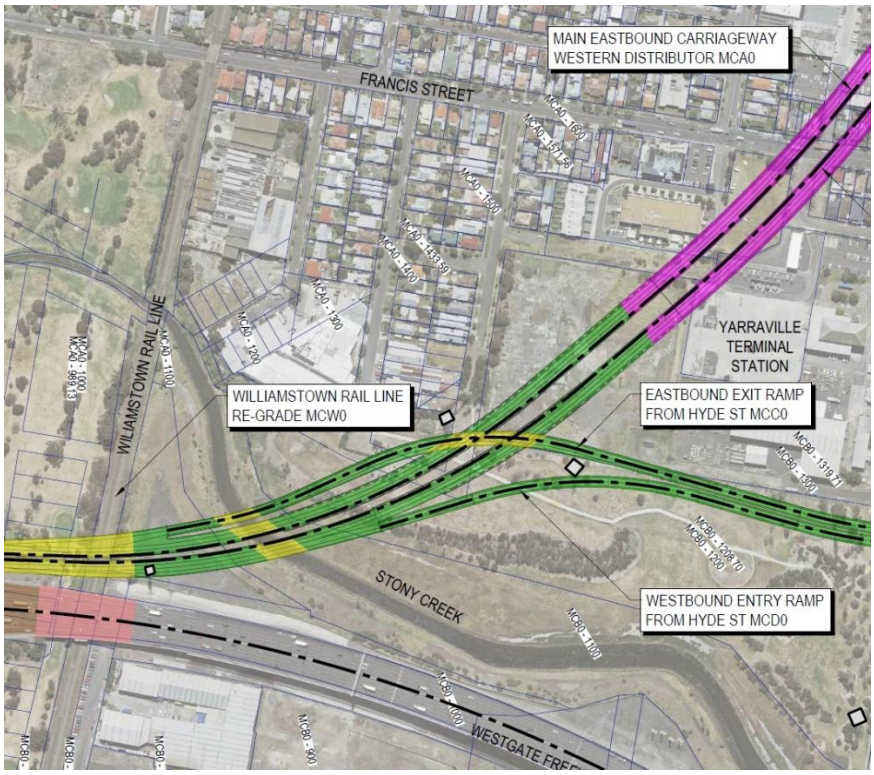


3.2 Southern tunnel portal

The preferred design concept for the Southern Tunnel Portal is a short tunnel with a portal located north of the West Gate Freeway, west of Hyde Street and south of Francis Street and includes connectivity to Hyde Street.

The Hyde Street ramps allow for the removal of vehicles carrying dangerous goods and trucks with a destination in Yarraville from roads such as Francis Street and Whitehall Street. It also provides a new connection to the Port of Melbourne for over-height vehicles, again to remove them from residential streets in the inner west. The Hyde Street ramps will provide an alternative route to the tunnel during planned closures such as tunnel maintenance, keeping trucks off the local road network in Yarraville.

Figure 4 Southern portal location

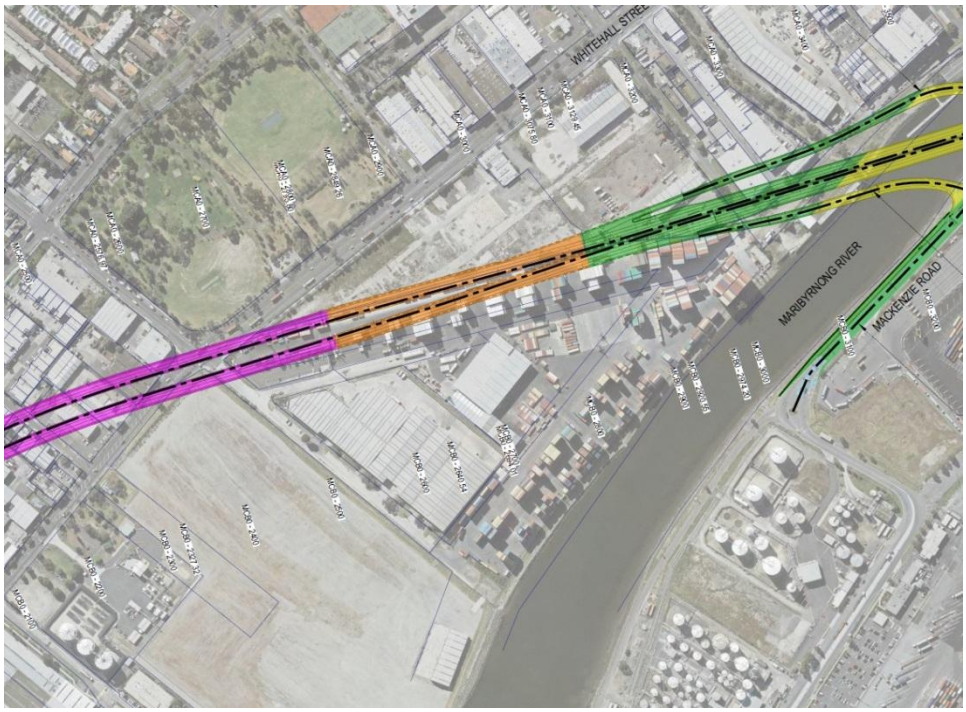


3.3 Northern tunnel portal

The State concept adopts a location for the northern tunnel portal that is east of Whitehall Road and north of Somerville Road.

This location of the northern tunnel portal seeks to minimise the impact on existing property and business, minimise impacts to the Maribyrnong River, and maximise the opportunity for efficient construction.

Figure 5 Northern portal location



3.4 Maribyrnong River crossing

The preferred concept option for the Maribyrnong River crossing is to provide a single span bridge. This option, whilst it is likely to be the most expensive of the options to construct and possibly have the greatest impact on visual amenity, is considered to be superior because it does not place bridge piers within the Maribyrnong River.

It is likely to be possible to span the Maribyrnong River with the use of a cable-stay bridge, however to enable direct connection to the Port via Mackenzie Road bridge piers may ultimately be required within the underlying waterway. This will require further focused investigations at future stages of development.

3.5 Port access and Footscray Road

The preferred concept option to connect the Western Distributor to the Port of Melbourne is via direct connections to Mackenzie Road and to Appleton Dock Road. This seeks to provide efficient and equitable access to both East and West Swanson Dock precincts as well as optimise the efficiency of access to the Port and Dynon precinct.

A freeway standard road link providing two lanes in each direction, with wide shoulders enabling provision for future widening to three lanes, is provided as a viaduct above Footscray Road.

Figure 6 Mackenzie Road connection

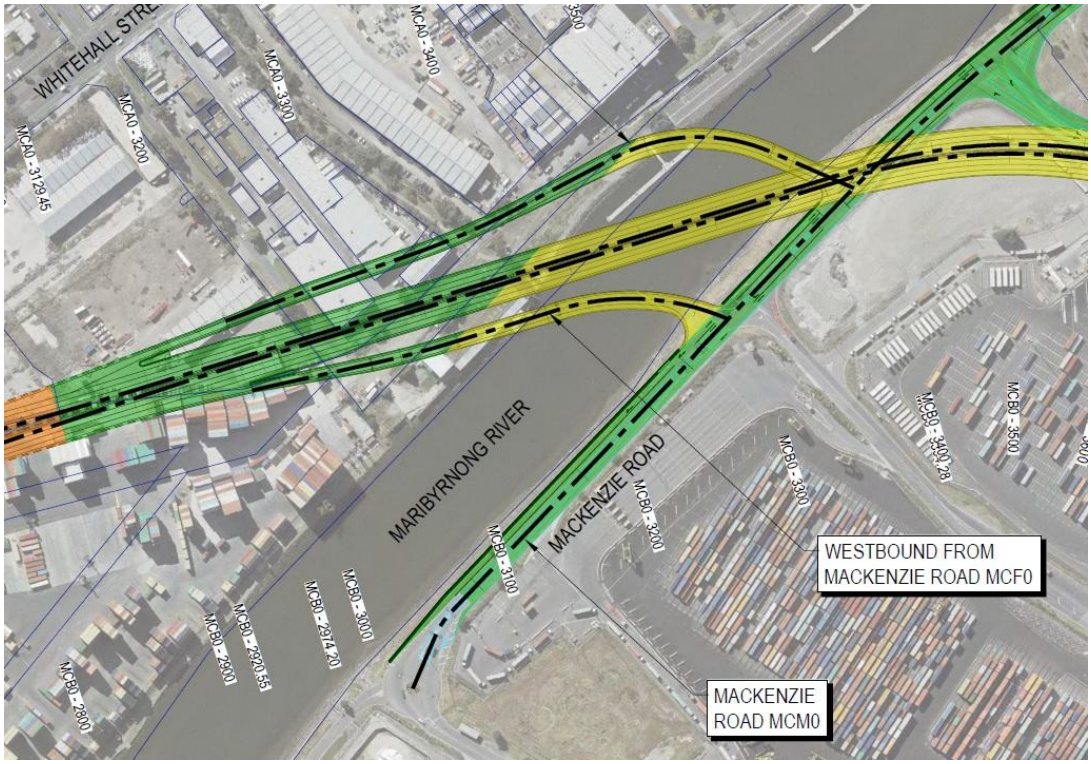
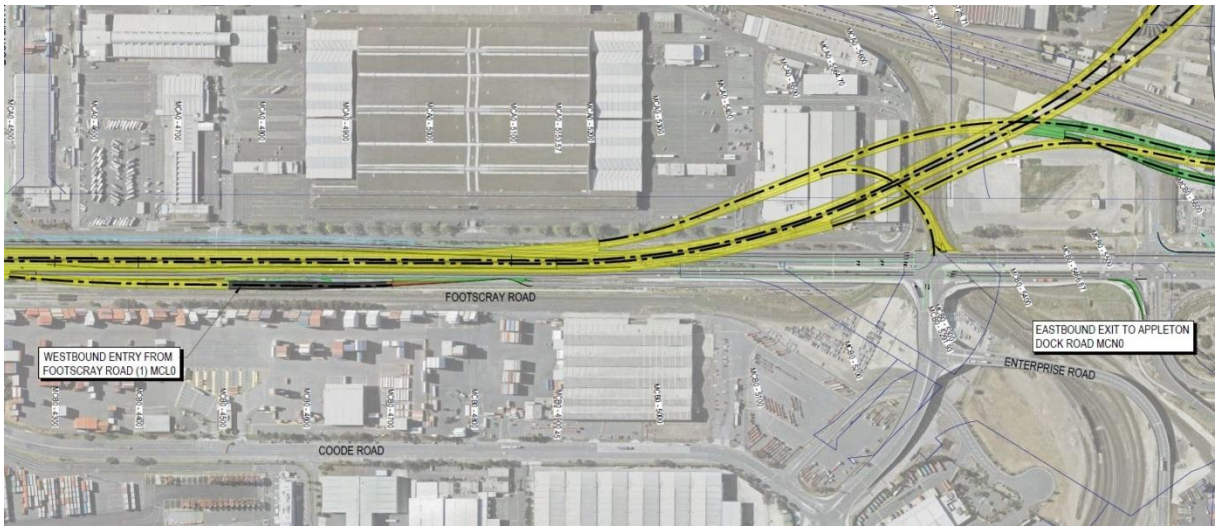


Figure 7 Footscray Road viaduct

Figure 8 Appleton Road connection



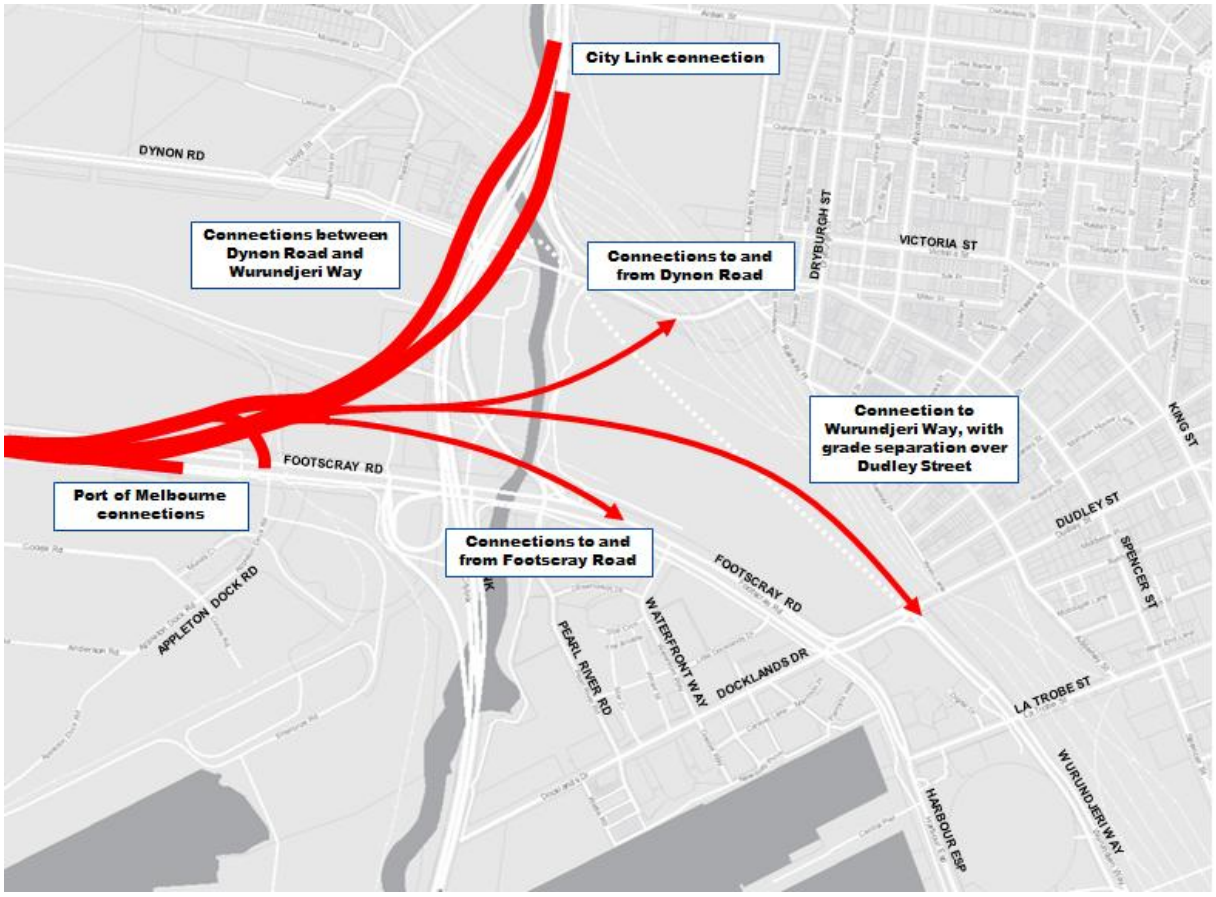
3.6 CityLink connection

The preferred concept for the Western Distributor connection with the existing CityLink network is through two new ramps in the vicinity of Dynon Road. A new structure over the rail yard joining the viaduct to the existing Dynon Road entry ramp is required to connect the eastbound/northbound traffic, and a new structure from the existing Dynon Road exit ramp over CityLink to the viaduct west of Appleton Dock Road is required to provide connectivity between the southbound/westbound traffic.

3.7 Inner urban access

To disperse and redistribute traffic across multiple locations to assist in minimising congestion, the State concept assumes that ramps will be provided to Footscray Road and Dynon Road. The State concept also assumes that a CBD bypass will be created by connecting Wurundjeri Way to Dynon Road with a new road that will be grade separated over Dudley Street. The final scope including the number and design of connections will need to be resolved in consultation with the City of Melbourne and other stakeholders as part of the statutory planning approvals process.

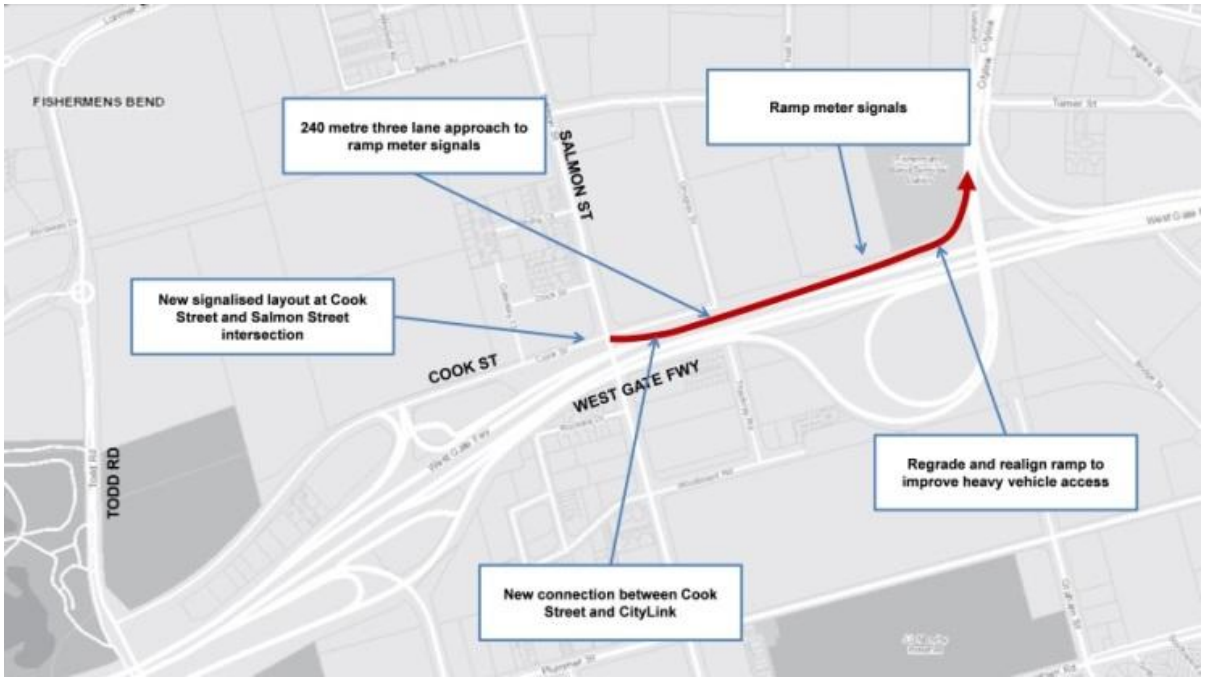
Figure 9 Inner urban access connections



3.8 Webb Dock Access Improvements

The preferred option includes a separated carriageway on the north side of the West Gate Freeway providing direct access from Cook Street to the CityLink Western Link ramp without interacting with West Gate Freeway mainline traffic via signalisation of the Cook Street/Salmon Street intersection. It includes widening, realignment and regrading of the ramp to improve heavy vehicle performance and safety (based on the history of truck rollovers)

Figure 10 Webb Dock Access Improvement



APPENDIX A:

FUNCTIONAL REQUIREMENTS

This document identifies the functional requirements for the Western Distributor Project. It is acknowledged that for some specific elements all of the functional requirements may not be able to be fully met. In these circumstances an appropriate and acceptable balance between functional requirements is to be achieved.

Whole of Project

Gradients

Grades shall be minimised to optimise the traffic throughput of the Freeway.

- The upgrade in the tunnels shall not exceed 4.0%.
- The maximum continuous length of carriageway within the tunnels with an upgrade greater than 3.0%, shall be less than 600m.
- Grades outside of the tunnel shall meet the VicRoads and Austroads guidelines and shall be no greater than 5%.
- Where high truck volumes are expected in the vicinity of port access, truck performance modelling shall be carried out to ensure that the geometry proposed will adequately facilitate efficient port access.

Design vehicles

The Project must be designed to cater for the design vehicles identified in **Table 3-1**

Table 3-1 Design vehicles

Element	Design Vehicles	
	Single Lane Turns	Multiple Lane Turns
Basic Intersection Layout	AUSTROADS 25m B-Double (1)	Two AUSTROADS 25m B-Double turning side by side
Right turn access to port precinct	AUSTROADS B-Triple (34.5m) (1)	B-Triple (34.5m) and B-Double turning side by side including the combinations of the B-Triple on the inside and outside lane
Swept path clearance to obstructions around intersections	AUSTROADS 25m semi-trailer (1)	AUSTROADS 25m semi-trailer (1)
Lane widening on curves	AUSTROADS 25.0m semi-trailer	
Table Notes: (1) intersection turning speed 5km/h to 15km/h		

Roadside furniture shall be located 500mm clear of the swept path of the design vehicles and shall not be within 500mm behind the face of kerb and channel.

Emergency Stopping Lanes

Emergency lanes shall be provided along the full length of the Project and meet the requirements of VicRoads Supplement to Austroads Guide to Road Design - Part 4c.

Where full width emergency stopping lanes cannot be provided for significant lengths, emergency breakdown bays shall be provided at regular intervals.

If an undivided mainline is proposed on the West Gate Freeway, a full 3.0m width emergency lane shall be provided on the outside of the carriageway with a reduced width emergency lane provided on the inside of the carriageway.

The Project shall also provide movable barriers, appropriate breaks in the barrier system (or similar) to allow emergency access / egress.

Freeway Management System

The Project shall incorporate sufficient Intelligent Transport Systems (ITS) to ensure it can operate as a Managed Motorway (MM) in accordance with VicRoads policy and guidelines, including but not limited to:

- Co-ordinated ramp metering;
- Lane use management (LUMS);
- Variable speed and message signs;
- Exit ramp management;
- Integration or effective interfacing with VicRoads MM and connecting major road network;
- Well-developed incident detection and response mechanisms (e.g. AID).

Ramp metering

Ramp metering shall be provided at each entry ramp and connecting ramps from the surrounding arterial road network and connected freeways. The layout of the ramp metering shall meet the requirements set out in the VicRoads Managed Freeway Guidelines. Ramp metering installation and modification shall be provided on adjacent freeway corridors (upstream and downstream) in order to provide a coordinated management system, balancing the ramp storage needs of the network.

Lane use management signs

Lane use management signs shall be provided along the full length of the Project at nominal intervals of 500m with adjustments to spacing to be in accordance with the requirements of the VicRoads Managed Freeway Guidelines.

Lane Use Management Signs are to be designed for an operating speed of 100km/h.

Weave/merge performance

All weave and merge locations along the Project (for freeway and non-freeway road sections) shall have an operating performance of at least Level of Service D utilising the design traffic volumes (Level of Service as defined by the Highway Capacity Manual – analysis to determine relevant measures to be an output from microsimulation models).

Operating Speed

The operating speed for the Project shall be in accordance with the Austroads Guide to Road Design - Part 3 and the relevant VicRoads Supplement(s).

- The West Gate Freeway shall be designed to operate at 100km/h (V110)
- The tunnel and viaduct shall be designed to operate at 80km/h (V90)
- Freeway to freeway ramps shall be designed to operate at 80km/h (V90)
- Freeway to arterial ramps shall be designed in accordance with the Austroads Guides to Road Design and relevant VicRoads Supplement(s)
- Arterial roads shall be designed to maintain their existing operating speed

Lane Widths

Lane widths throughout the Project shall be in accordance with VicRoads and Austroads guidelines and shall match into the existing lane widths on the West Gate Freeway and Western Link.

Constructability

All options must be able to be constructed under a live traffic operation, and maintain, in the first instance, sufficient lanes to cater for the traffic demands present at the start of the Project works, relevant to the time of day

Access to the existing freeways at existing interchanges, as a minimum, shall be maintained throughout the AM and PM peaks and the daytime interpeak period.

Public Transport

All existing public transport (both on and off road) routes shall be maintained during construction and operation of the Project.

Barriers on structures

Medium containment barriers are required on structures unless risk assessment highlights that high containment barriers shall be provided.

Separation Barrier

The Project shall include an F shape reinforced concrete median barrier designed to TL5 containment level and anchored to meet the requirement of AS5100.

Public Safety Barriers

In the case that an elevated bridge structure is provided over any significant water course or body, public safety barriers shall be provided.

Anti-throw screens

Anti-throw screens are to be incorporated into shared user path structures crossing a freeway alignment and in accordance with VicRoads Policy.

Noise

Requirements for noise walls are to be in accordance with VicRoads Noise Policy.

Lighting

Continuous street lighting shall be provided along the full length of the Project.

Shared path

Pedestrian / shared paths, including on structures, provided or modified as part of the Project shall have a minimum unobstructed width of 3m, or no less than existing where greater than 3m. Ramps and paths grades shall be DDA compliant.

Continuity of Federation Trail

The connectivity of existing sections of Federation Trail shall be maintained as part of the Project. Usable access to the path, or a reasonable, safe alternative shall be available to path users for the period of the Project works.

Realignment / relocation / extension of the Federation Trail route will be subject to VicRoads approval and must consider the needs of the relevant stakeholders.

Safety In Design

Safety in design provisions shall be in accordance with VicRoads requirements.

Pier Protection Barriers

Pier protection shall be provided in accordance with AS5100. In addition to the requirements of AS5100, any piers within the clear zone must be designed and / or protected to prevent collapse of the bridge from a maximum permissible loaded heavy vehicle travelling at the road operating speed which collides with the pier or pier protection system at any and all possible angles.

Western Distributor

The Western Distributor (including the Yarraville section, Maribyrnong River crossing and Footscray Road sections) shall operate, and be designed to freeway standards.

Tunnel

The Western Distributor tunnels shall provide for the safe and efficient movement of the design traffic volumes (excluding placarded vehicles) during normal operation.

Emergency lane provision

Emergency lanes shall be provided along the length of the Western Distributor. A 1.0m emergency lane width shall be provided adjacent to the outside lane while a 0.5m emergency lane shall be provided adjacent to the median lane.

Gradients in tunnel

The upgrade in the tunnels must not exceed 4.0%. The maximum continuous length of carriageway within the tunnels with an upgrade greater than 3.0%, must be less than 600m.

Vent station location

The vent station/s shall be placed in a location/s that will not negatively impact existing surrounding properties, taking into consideration both visual impacts and emissions. The vent station/s shall be located away from residential areas and schools as far as is practicable.

Port of Melbourne access

The Project shall provide safe, efficient and reliable access to Victoria, Appleton, East Swanson and West Swanson Dock precincts for heavy commercial vehicles (HCVs) and high productivity freight vehicles (HPFV's) on a 24/7 basis. The Project shall be designed so that trucks shall not be required to undertake 180 degree turns at any point within the public road network.

The Project shall provide safe, efficient and reliable access for existing and likely proposed facilities in the Dynon precinct fronting the north side of Footscray Road or accessed via Dock Link Road.

The Project shall not preclude the movement of 36.5m long/120t GVM (Super A-double) vehicles between Swanson Dock precinct and the Dynon rail precinct.

The Project shall not constrain existing rail access to the dock precincts or preclude future rail operations, including involving double stacked containers.

The Project shall:

- Support future growth of the Port
- Support Port operations and maritime security
- Not inhibit the ability for a Port operator to provide access to/from the Port (including truck marshalling)
- Not generate truck queues or parking within the public road network.

The Project shall be designed in such a way that it:

- Avoids encroachment of the Port's operational areas that would impact port capacity e.g. storage yard, gate, landside transport corridor.
- Maintains multiple access points into and out of the Port for traffic from the west, north and east directions, taking into consideration that Coode Road may be closed in the future.
- Allows for over-height and over-width cargo movements into and out of the Port.
- Does not preclude the future use of the Market site for Port related activities.

Clearance heights

The following clearance heights shall be provided along Western Distributor:

- 5.9m over Footscray Road

- 5.4m between Western Link and Western Distributor
- 4.88m over the Maribyrnong River

Over-height vehicle system

An automatic over-height vehicle system must be provided. The over-height vehicle system must:

- detect over-height vehicles:
- classify over-height vehicles into two categories being:
    - class 1 over-height, for vehicles from 4.6m to 4.9m in height (inclusive); and
    - class 2 over-height, for vehicles greater than 4.9m in height
- warn drivers of over-height vehicles with sufficient time to avoid entering the tunnel
- activate the associated portal barriers if class 2 over-height vehicles are detected
- provide areas for over-height vehicles to park safely prior to portal barriers or alternatively provide an opportunity to divert or reroute these vehicles.

If over-height vehicles are provided with an area to park prior to the portal barriers, a traffic management plan shall be provided identifying how these vehicles will be recovered.

Freeway connections

The junction of the Western Distributor and the West Gate Freeway shall be designed to maximise the safe movement of diverging and converging traffic streams including the separation of traffic streams in a staged manner to eliminate or minimise multi-lane weaving where possible

Property access

All existing property access shall be maintained.

Bicycle paths

All existing bicycle connections shall be maintained. There shall be no deterioration in efficiency, connectivity or safety for existing designated cycle routes where practicable.

Monash Freeway Upgrade

Project Options Report

Department of Economic Development, Jobs, Transport and Resources

November 2015

State Government Victoria

Document summary information

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Document history

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[redacted]	[redacted]	[redacted]	[redacted]

Table of contents

1 Introduction

This report provides an assessment of the project options considered for the Monash Freeway Upgrade Project. The content of this report has been developed to inform the development of the business case for this project. This report should be read in the context of the Western Distributor business case, which includes consideration of investment in the Monash Freeway Upgrade Project, including details in relation to the problems to be addressed by this project scope.

The Project has developed four Project Objectives to assess alternate options. It is noted that some of the Project Objectives relate more specifically to the Monash Freeway Upgrade component, namely Project Objective #1.

1. **Improve transport performance in the M1 Corridor:**
   - to meet increased travel demand due to future population and economic growth trends
   - to enhance connectivity between economic clusters
   - to enhance safety along the M1 Corridor
   - to enhance access to jobs and services.
2. **Reduce reliance on the West Gate Bridge:**
   - to improve network resilience and redundancy
   - to mitigate strategic risks to the State and national economies
   - to improve travel reliability.
3. **Improve freight access to the Port of Melbourne and greater Melbourne:**
   - to improve reliability of access to the Port of Melbourne and on the freight network
   - to meet travel demand arising from the future freight task
   - to enhance state and national competitiveness through freight productivity
   - improvements.
4. **Improve community amenity on local streets in the inner west:**
   - to reduce freight on local streets
   - to improve safety on local streets.

1.1 The project options

The project options represent different ways in which the preferred Strategic Response could be achieved. Four specific project options have been identified for assessment. These are presented in Table 1.

Table 1: Project options summary

Reference	Option description
Option 1 – Additional freeway lane only	• One additional lane in each direction from EastLink to Clyde Road, widening to the median with structural upgrades as required
Option 2 – Hard Shoulder Running	• One additional lane in each direction using existing pavement with no widening or structural upgrades and dynamic lane control for part-time operation.
Option 3 – Additional Freeway Ramp Meters	• Ramp Metering at EastLink, four inbound east of Clyde Road, two outbound west of Clyde Road and arterial network management of South Gippsland Freeway.
Option 4 – Additional Freeway Lane and Ramp Metering Improvements	• One additional lane in each direction from EastLink to Clyde Road, widening to the median with structural upgrades as required • Ramp Metering at EastLink, four inbound east of Clyde Road, two outbound west of Clyde Road and arterial network management of South Gippsland Freeway.

2 Rationale for project options

This chapter outlines the rationale for the scope of the project options.

2.1 Option 1 – Additional freeway lane only

To address network imbalances suffered by Melbourne's outer east additional traffic lanes along the Monash Freeway were investigated as a broad stroke solution.

The initial key investigation area was the saturated section of the Monash Freeway from South Gippsland Freeway to Clyde Road in both directions. While this provided significant benefits in a strategic model, further analysis of the South Gippsland Freeway / Monash Freeway interchange revealed critical failures. Particularly on the inbound, three lanes from the Monash and two lanes from the South Gippsland Freeway would provide an unmanageable merge into four lanes that would result in a network worse than existing conditions. Even a strong increase in utilisation of managed motorway techniques was found to be not able to control this lane drop.

To alleviate this merge it was determined that a fifth lane would be required with the investigation turning to the best location to drop the fifth lane. Heatherton Road and Stud Road exits did not have sufficient current or predicted exit demand to be feasible locations. The first location that would provide sufficient exit ramp demand now and in the 2031 modelling was EastLink freeway, with the five lanes matching into the existing approach five lanes. Provision of the fifth lane through to Eastlink also connects at the major intersection of two strategic freeway routes in the southeast.

While an additional lane in each direction from EastLink to Clyde Road would provide significant network benefits, full realisation of these benefits would not be met. Uncontrolled flows such as EastLink freeway to freeway interchange, South Gippsland Freeway and other ramps would continue to impact the ability of the existing ramp metering system to maintain flows throughout the day.

2.2 Option 2 – Hard Shoulder Running

This option focuses on maximising use of the existing pavement by reducing shoulders and lane widths. This option was considered as a lower cost alternative to building an additional lane.

This option has been extensively investigated, particularly along the Monash Freeway (Hallam Bypass section) from South Gippsland Freeway to Clyde Road. Analysis indicated that the existing pavement is not wide enough to support an additional lane and maintain current levels of safety or operational speeds, even with the support of current and under proposed future managed motorway technology.

Forecasts also showed it would need to operate, at a reduced speed, for up to 16 hours a day. Overseas studies of part time lanes, particularly in the UK and western European countries, showed a decline in part time lane usage with them generally being transformed into full time lanes. Reasons cited included extended operational periods, unrealised benefits and higher than expected operational and maintenance costs.

Based on these factors, this option is not considered feasible.

2.3 Option 3 – Additional Freeway Ramp Meters

Detailed investigation of the corridor in 2013 showed uncontrolled traffic flows on the corridor have significant impacts throughout the day, particularly around the EastLink interchange, along the Hallam Bypass and at the intersection with South Gippsland Freeway. Extending the ramp metering network to all uncontrolled inputs creating an effectively 'closed network' would contribute strongly to managing these issues and provide more reliable journeys, particularly during shoulder peak periods.

A closed system approach enables the community to make best use of the investment along the Monash corridor. It features close monitoring of the mainline to enable the maximum capacity to be sustained throughout the day combined with controlling access to the freeway. Any uncontrolled access or compromise in prioritising freeway movements over arterial movements would compromise the closed system approach. Extending the ramp metering control on the M1 corridor along the Pakenham Bypass and at other existing unmetered locations would create the desired closed control system, effectively managing the inflows to the Monash Freeway.

The benefit realisation of this option is impacted by substandard existing ramp storage and network demand imbalances, particularly along the Hallam Bypass (i.e. the ramp inflows would need to be more severely restricted without ramp or mainline capacity upgrades). Therefore, this option would be most effective supporting the additional lanes option.

2.4 Option 4 – Additional Freeway Lane and Ramp Metering Improvements

This option combines the scope of Options 1 and 3 to provide a holistic solution that addresses the demand imbalances and capacity issues through an additional lane, as well as creating a closed network approach to better manage traffic flows and contribute to more reliable journeys.

3 Assessment of the project options

A rapid appraisal of the options is outlined below in Table 2. This was undertaken utilising a Multi-Criteria Assessment (MCA) framework, based on the first project objective (which is most relevant to the Monash Freeway section).

Table 2. Project Options Assessment

Objective	**Option 1 –** Additional freeway lane only	**Option 2 -** Hard Shoulder Running	**Option 3 -** Additional Freeway Ramp Meters	**Option 4** Additional Freeway Lane and Ramp Metering Improvements
Improve transport performance in the M1 Corridor:				
• to meet increased travel demand due to future population and economic growth trends	Well	Poor	Poor	Very Well
• to enhance connectivity between economic clusters	Well	Neutral	Neutral	Very Well
• to enhance safety along the M1 Corridor	Poor	Poor	Neutral	Well
• to enhance access to jobs and services.	Well	Poor	Neutral	Well

The results from the Multi-Criteria analysis indicate that Option 4 is best able to meet the project objectives.

Hard Shoulder Running, Option 2, has been investigated and evaluated by VicRoads for both its traffic performance and physical feasibility. This option was considered infeasible as additional capacity created east of the South Gippsland Highway cannot be fully utilised due to a lack of capacity west of the South Gippsland Freeway. In addition, to fit three lanes on the existing pavement would require the use of extended design domain and/or non-standard approaches including reduced lane widths and the substantial reduction or removal of Emergency Stopping Lanes. This treatment will also create operational and safety issues.

Option 1 provides extra capacity to this corridor, but it does not maximise the existing or upgraded asset utilisation with the absence of additional ramp metering control. The additional freeway ramp meters will manage the ongoing operation, reduce impacts of disruptions caused by incidents and assist recovery from flow breakdown when it does occur, whether from an incident or operational bottlenecks.

Although additional freeway ramp meters would create significant benefits, Option 3, which implements ramp metering upgrades only, has difficulty in managing inherent network demand imbalances. Without an additional lane, the lack of capacity could create major bottlenecks during peak periods, causing significant congestion and poor travel time reliability, both on the freeway corridor and adjacent arterial roads.

To deliver a sustainable solution, there is a benefit of providing a holistic approach by combining both the additional lane and the ramp metering, as in Option 4. This will ensure this important road asset can deliver the highest value economic return to the community, business and freight.

4 Preferred project option

The preferred project option is Option 4 – Additional Freeway Lane and Ramp Metering Improvements. The option will provide an additional lane in each direction along the Monash Freeway from EastLink to Clyde Road. It will also provide additional and expanded freeway ramp metering with supporting systems at specified locations from Warrigal Road to Clyde Road.

The specific scope is outlined in the following sections and demonstrated visually in visually in Figure 1.

4.1 Lane Widening

Clyde Road to South Gippsland Freeway

The scope includes:

- Additional lane resulting in 3 x 3.5m lanes, 3.0m outside shoulder and 1.0-3.0m inside shoulder;
- Widening to the median with construction of new barriers;
- Structural widening, protection and approach barrier modifications;
- Pavement to be replaced with new to meet requirements and new overlay; and
- Noise wall, drainage, lighting and other freeway asset improvements to meet VicRoads requirements, standards and guidelines.

South Gippsland Freeway to EastLink

The scope includes:

- Additional lane resulting in 5 x 3.5m lanes, 3.0m outside shoulder and 1.0-3.0m inside shoulder;
- Infill to the median with construction of new concrete barriers;
- Reconstruction of the outside shoulder as required;
- Structural widening, protection and approach barrier modifications as required;
- Pavement to be replaced with new to meet requirements and new overlay; and
- Noise wall, drainage, lighting and other freeway asset improvements to meet VicRoads requirements, standards and guidelines.

4.2 Ramp metering

The ramp metering sites to be added or modified are shown in Table 3. Upgrades generally include an increase in ramp storage.

The scope also includes the following elements:

- All electronic systems, adjacent arterial road and signal modifications, civil infrastructure widening in accordance with VicRoads requirements, standards and guidelines;
- Signalisation of Ferntree Gully Road outbound exit ramp;
- Replace and upgrade existing freeway data stations from Warrigal Road to Clyde Road at approximately 500m spacings;
- Exit ramp detection; and
- Integration of expanded network and devices with VicRoads systems.

Table 3: Ramp metering sites being added or modified

Intersection	Direction	Site status	Storage Reqt (m)
Warrigal Road	Inbound	Upgrade	950
Warrigal Road	Outbound	Upgrade	1150
Wellington Road	Inbound	Upgrade	1150
Jacksons Road	Inbound	Upgrade	1000
EastLink / Monash	Inbound	New	1300
EastLink / Monash	Outbound	New	1250
Stud Road	Inbound	Upgrade	650
Stud Road	Outbound	Upgrade	800
Heatherton Road	Inbound	Upgrade	850
Heatherton Road	Outbound	Upgrade	600
Ernst Wanke Road	Inbound	Upgrade	600
Narre Warren North Road	Outbound	New	400
Princes Highway East	Outbound	New	800
Clyde Road	Inbound	Upgrade	1100
Princes Highway Old	Inbound	New	600
Cardinia Road IB	Inbound	New	600
McGregor Road IB	Inbound	New	600
Koo Wee Rup Road IB	Inbound	New	600

Figure 1: Preferred project option – Warrigal Road to EastLink

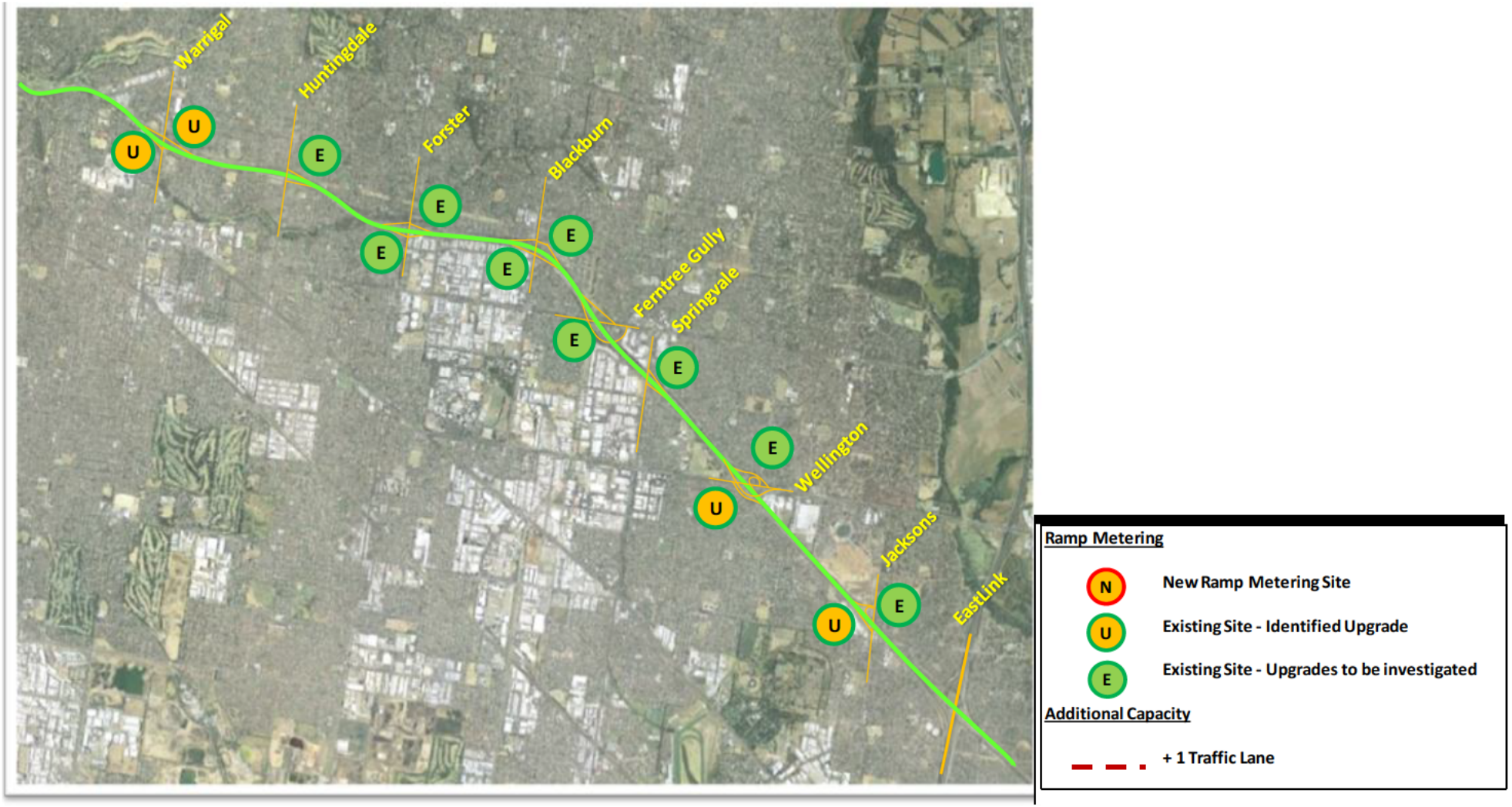

Figure 2: Preferred project option –EastLink to Clyde Road

Figure 3: Preferred project option – M1 - Princes Freeway (Pakenham Bypass) - Clyde Road to Koo Wee Rup Road