



Appendix D

Options Assessment

February 2018

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Executive summary

North East Link – Objectives and Principles

In 2016, Infrastructure Victoria released its 30 Year Infrastructure Strategy, identifying North East Link as the highest priority infrastructure project in Victoria. Infrastructure Victoria noted that the link will enhance access to major suburban business and employment centres, improve orbital road connectivity across Melbourne and boost the capacity of the city’s freight network.

In October 2017, the Victorian Government’s five-year *Victorian Infrastructure Plan* confirmed North East Link as one of several ‘catalyst’, state-shaping infrastructure projects designed to stimulate economic growth, create jobs and deliver positive, long-term benefits for Victorians.

Investigations into potential corridors for North East Link began in early 2017.

North East Link Authority (NELA) sought early input from the community, local councils, non-government organisations and government agencies on key issues such as community values, current traffic issues and transport-related problems in the north east. In addition to the transport system objectives of the Transport Integration Act, these views have contributed to the setting of Project Objectives and Guiding Principles for North East Link, which are being used to focus the investigation of corridor options and guide the overall development of the project.

Reflecting the views and information provided during NELA’s community consultation, North East Link has a strong focus on supporting business and jobs growth in communities across Melbourne’s north, east and south east, while also improving cross-city connectivity and helping to address critical traffic, freight and amenity issues.

Project Objectives and Guiding Principles reflecting this focus were established and used to assess potential corridors for the new link.

Project Objectives			
<i>Objective 1</i> Improve business access and growth in Melbourne’s north, east and south east	<i>Objective 2</i> Improve household access to employment and education in Melbourne’s north, east and south east	<i>Objective 3</i> Improve freight and supply chain efficiency across the north, east and south east	<i>Objective 4</i> Improve access, amenity and safety for communities in the north east

Guiding Principles			
<i>Guiding Principle 1</i> Minimise impacts on communities	<i>Guiding Principle 2</i> Minimise impacts on environmental and cultural assets	<i>Guiding Principle 3</i> Minimise impacts during the construction phase	<i>Guiding Principle 4</i> Optimise the efficient use of resources

The project corridor

Following a detailed assessment of potential benefits and impacts, Corridor A - from the Eastern Freeway at Nunawading to the M80 at Greensborough –was selected as the North East Link corridor. The main reasons for this assessment include:

- This corridor best meets the Project Objectives and was assessed as performing very well against the Guiding Principles when compared to all other corridor options.
- This corridor provides the best opportunity for connections to the existing road network that respond to travel demand through, in and out of the north east of Melbourne. This means that Corridor A attracts the most through traffic to the new link out of all the options considered and therefore reduces demand on local arterial roads.
- It provides better connectivity for all freight journeys and serves a greater number of freight catchments for trucks travelling across the north, east and south east of Melbourne. This means that the corridor provides the best opportunity to remove trucks from local roads in the north east.
- It works together with the existing road network in the north east, resulting in the greatest ability of all the options considered to reduce traffic on existing arterial networks and providing opportunities to improve conditions for more local journeys and on-road public transport.
- By connecting close to areas of greater activity, the corridor provides better access for businesses and residents in the north, east and south east to workers, jobs and services. It provides the greatest improvement in business access to labour markets of all the corridor options considered, particularly the opportunity to stimulate jobs growth in the La Trobe National Employment and Innovation Cluster (NEIC) and between the Broadmeadows, Epping, Ringwood and Box Hill Metropolitan Activity Centres (MACs).
- In enhancing the Eastern Freeway, to cater for additional North East Link traffic, the project also addresses existing issues in the operation of the freeway, future proofing it for growth.
- It provides the best opportunity for improvements to public transport on the existing network and the opportunity to implement an integrated Doncaster Busway solution along the Eastern Freeway.
- It provides the best opportunity to connect and expand existing walking and cycling facilities in the north east.
- Corridor A offers the most cost-effective solution and the maximum benefits.

Identifying potential corridors

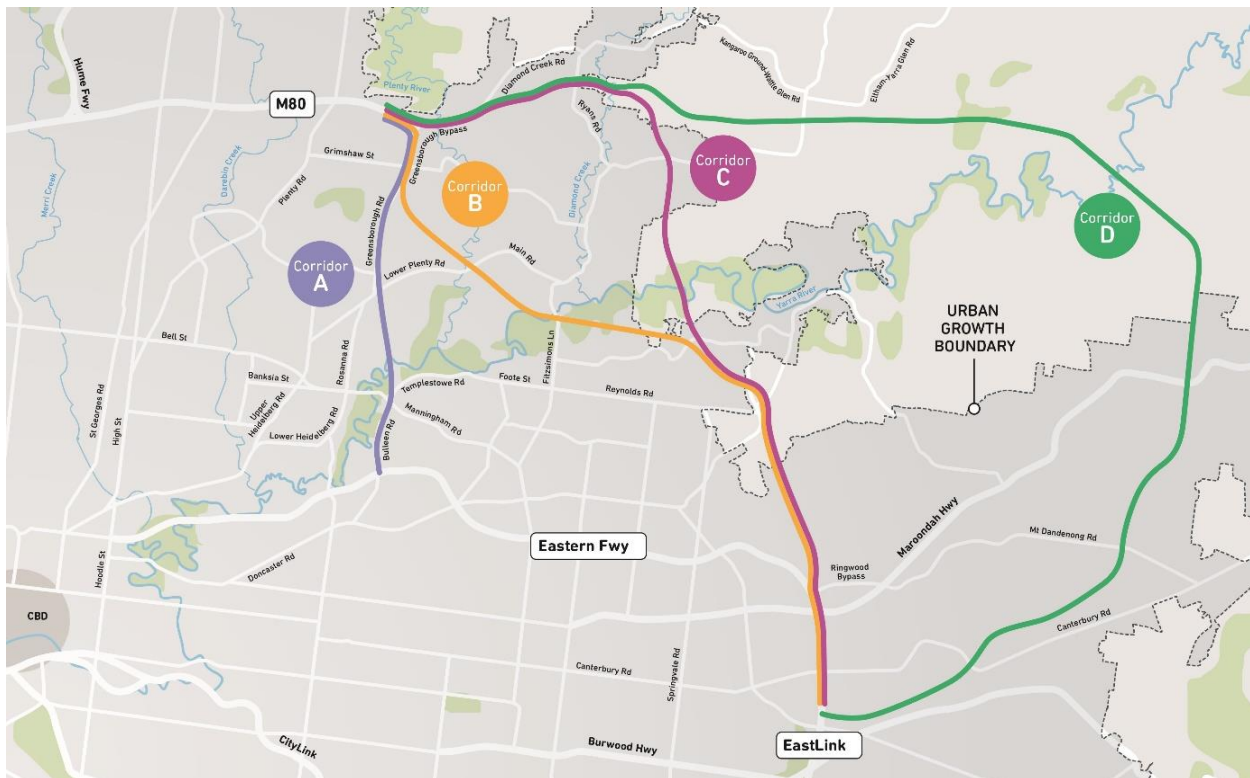
Potential corridors for North East Link were identified by:

- Assessing existing and future traffic conditions and transport movements
- Investigating existing road corridors and utilities easements that could be used for potential corridors
- Identifying potential corridors and constraints to these corridors (such as difficult terrain, sensitive environmental areas and important community assets)
- Considering treatments such as tunnels to avoid sensitive environmental and urban areas or to mitigate surface impacts
- Considering likely geology and geotechnical influences and areas suitable for tunnel construction
- Identifying opportunities for connectivity with the existing road network
- Considering current and future patterns of land use and development in the north east.

A surface road only option through any part of the north east was discounted due to potential impacts on areas of environmental sensitivity and existing development in all areas of the north east.

Four broad corridor options were identified initially, as shown in the figure below.

North East Link potential corridor options



Assessing corridor options

Guided by the Australian Transport Assessment and Planning Guidelines, a three-tiered approach was adopted to assess and narrow down these options to select a corridor for the project:

- Stage 1: Strategic merit test – a strategic assessment of a corridor’s alignment with the Project Objectives.
- Stage 2: Rapid appraisal – an initial indicative assessment of the scale of a corridor’s benefits and costs, as assessed against the Project Objectives and Guiding Principles
- Stage 3: Detailed appraisal – a more detailed assessment of a corridor’s benefits and costs, as assessed against Project Objectives and Guiding Principles.

As each stage progressed, the assessment of corridor options considered feedback, information provided and questions raised by the community and stakeholders, alongside evidence from technical investigations. Priority issues identified and considered included:

- Reducing congestion on key roads in Melbourne’s north-east
- Removing trucks that don’t need to be on roads in Melbourne’s north-east

- Providing better connections for people to access existing and new jobs and education opportunities
- Helping businesses better connect to each other and to workers across Melbourne
- Making freight journeys more efficient and reliable
- Improving public transport connections and travel times
- Improving connections for pedestrians and cyclists
- Protecting the environment, culture, heritage and open spaces
- Minimising the impacts from construction-related traffic as the project is being built.

The following sections discuss the corridor options in the order in which they were discounted as the options assessment progressed towards selection of the corridor for North East Link.

Corridor D

Corridor D was not selected as an appropriate corridor for North East Link. The main reasons for this assessment include:

- The corridor route is too long and circuitous. As a result, it would not address existing or future travel patterns, meaning that it would not attract enough traffic and not result in any reduction in traffic on the existing arterial network.
- The road network in this area is rural in nature and very steep, and does not provide for appropriate connections to a new freeway.
- The corridor's location outside the Urban Growth Boundary in areas of very low population density (now and in the future) limits the potential for the project to provide better access for businesses or workers. It also has the potential to generate development pressure in Green Wedge areas outside the boundary, which does not align with the objectives of Plan Melbourne.

Corridor B

Corridor B was not selected as an appropriate corridor for North East Link. The main reasons for this assessment include:

- The transport solution provided by this corridor is not satisfactory as it is likely to attract more east-west oriented trips and has limited ability to provide relief to the critically congested north-south arterial road network.
- Due to the unbalanced spacing location of the interchanges, feeder roads are likely to be affected to a greater extent as traffic would need to travel further distances to access the new link's alignment.
- There would be significant impacts on utility services, including high voltage power lines that cannot be moved underground without incurring substantial costs.
- Extensive tunnelling requirements would lead to a very high capital and operational cost solution.

Once these corridors were set aside, a detailed assessment was carried out on Corridor A and Corridor C. This assessment set aside Corridor C, and the results of this assessment are summarised below. Further information on the assessment is contained in Appendix D.

Corridor C

Following a detailed assessment of potential benefits and impacts, Corridor C was set aside. The main reasons for this assessment include:

- The available connections to the existing road network from this corridor are not well suited to the levels of traffic likely to be using them, resulting in lower use of a route through this corridor and less trips being attracted from the existing network (compared to Corridor A).
- While the corridor supports long-distance trips between the north and south east of Melbourne, it provides limited support for the key origins and destinations of the wide range of trips travelling into and out of the north east, both now and into the future, (compared to Corridor A).
- The corridor provides little support for or integration with the strategic arterial road network through the north east, resulting in lower levels of traffic on the new link and providing less truck traffic relief on roads in the north east (compared to Corridor A).
- The location of the corridor weaves across the Urban Growth Boundary through Green Wedge areas of low population density and has the potential to generate development pressure in these areas, contrary to the objectives of Plan Melbourne.
- Extensive tunnelling requirements would lead to a significantly higher cost solution.

North East Link corridor implementation

During community consultation conducted by NELA in August and early September 2017, the community sought further detail about several issues relating to a potential Corridor A:

- Performance of the Eastern Freeway
- Management of environmental impacts
- Maintaining and improving connectivity for communities along the corridor
- Supporting public transport in the north east.

Further information on these issues is provided below.

Improving the performance of the Eastern Freeway

Daily weekday traffic volumes along the Eastern Freeway range from 128,000 to 178,000 vehicles per day, with the busiest section between Middleborough Road and Tram Road.

Congestion occurs at a number of locations along the freeway, which result in traffic breakdown and can be attributed largely to merging and weaving at the freeway interchanges, the capacity of the freeway ramps and some mid-block areas where capacity is constrained.

In addition to the freeway on-ramps operating at capacity, the short distances between each of the interchanges affect the performance of the Eastern Freeway. Freeways operate efficiently when lane changing is minimised – the short distances between many of the Eastern Freeway interchanges result in a greater amount of lane changing within a relatively short section of road.

There are five interchanges on the Eastern Freeway within a 5.5 kilometre length of road between Elgar Road and Springvale Road. As a result, a high degree of pressure is placed on the left-most lanes of the freeway, as vehicles position themselves to exit the freeway in advance of their exits while, at the same time, traffic is merging onto the freeway. The combination of excessive lane changing and merging and weaving of traffic reduces the performance of the freeway, leading to reduced vehicle speeds and congestion during peak periods of demand.

Traffic flow in the vicinity of the EastLink tunnels also often breaks down in the peak periods, affecting the freeway's performance and creating queues. However, the flow breakdown that occurs in the tunnels is not due to a lack of capacity in the tunnel, but rather upstream and downstream bottlenecks at Springvale Road and Ringwood Bypass.

As the Eastern Freeway and EastLink are not Managed Motorways, there is no ramp metering to control merging and weaving movements. Ramp metering regulates the rate and spacing of traffic entering onto the freeway with traffic lights and is proven to improve the overall performance (vehicle speeds and capacity) of a freeway network¹.

Capacity east of Bulleen Road

As North East Link connects into the existing Eastern Freeway at Bulleen Road, demand for travel along the Eastern Freeway east of Bulleen Road is expected to increase significantly: around 75% of southbound traffic on North East Link will head east when joining the Eastern Freeway and around 30% of this traffic will continue on through the EastLink tunnels. The figure on the next page shows the expected distribution of this southbound traffic from North East Link to the Eastern Freeway.

To cater for this increased demand, the project will upgrade and modernise the Eastern Freeway to significantly increase traffic carrying capacity and improve traffic flow.

The project will use intelligent transport systems, including Managed Motorway systems, to manage traffic flow and provide express lanes to improve unimpeded travel. Between Station Street and Burke Road, traffic will be split into main 'expressway' lanes in the centre of the freeway, physically separated from 'collector-distributor' lanes on the outside. The collector-distributor lanes will provide for the separation of traffic flows: access to the various interchanges along the corridor will be provided by the collector-distributor carriageways, while longer trips will be able to use the express lanes. This will reduce traffic turbulence at on- and off-ramps and optimise traffic performance. This combination of intelligent transport systems and state-of-the-art design will provide a significant uplift in carrying capacity for the Eastern Freeway, bringing it up to modern standards.

Implementation of Managed Motorway systems and the upgrade of the Springvale Road inbound on-ramp will improve traffic flow in the EastLink tunnels. Tunnel traffic will no longer need to slow down significantly to allow vehicles from Springvale Road to enter the Eastern Freeway, reducing the likelihood of a 'shockwave' of congestion travelling back into the EastLink tunnels and providing a significant capacity uplift for future traffic.

Capacity west of Bulleen Road

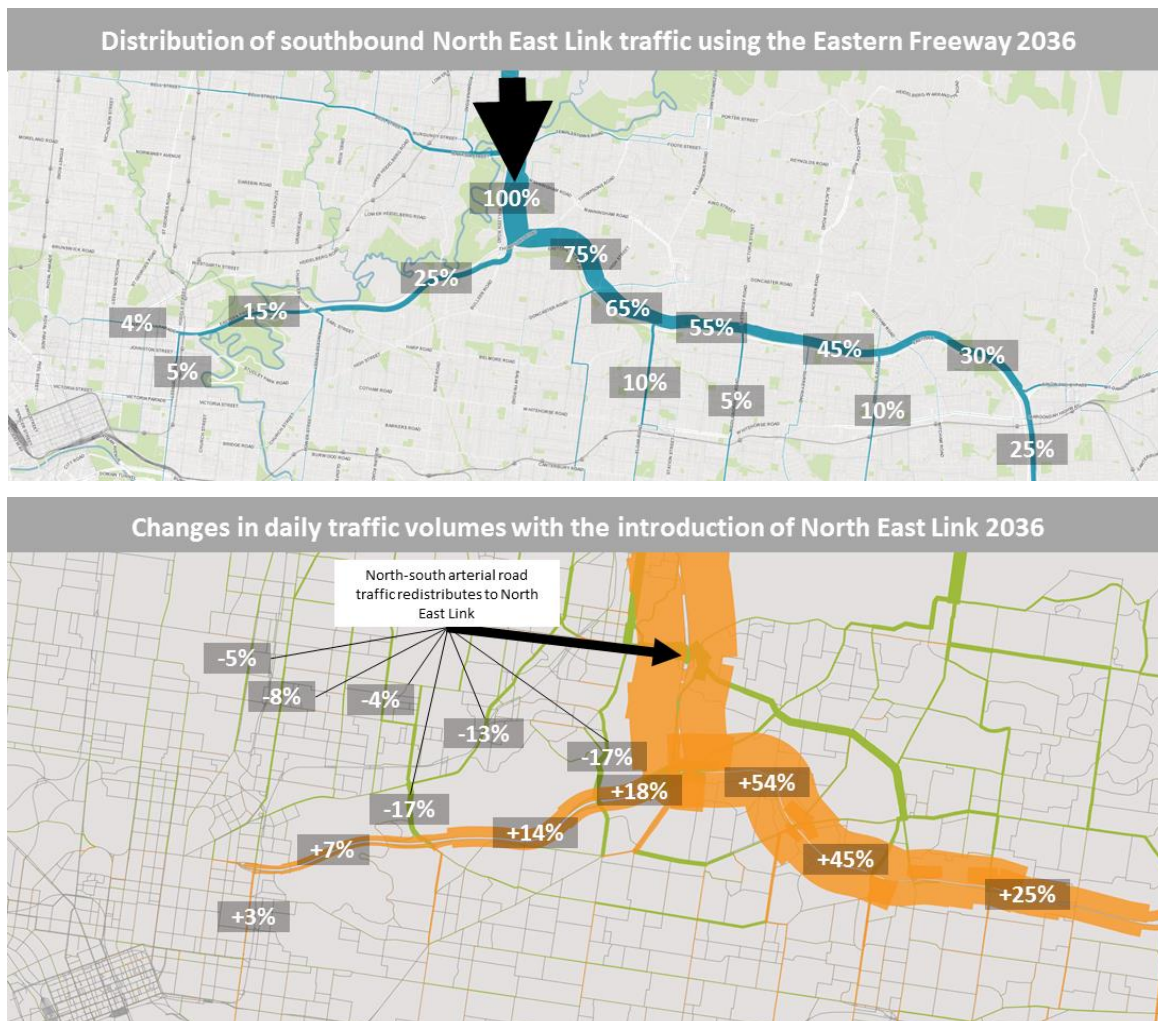
Demand for travel along the Eastern Freeway west of Bulleen Road is expected to increase moderately, with approximately 25% of southbound traffic on North East Link heading west. As shown in the figure on the next page, 5% of this southbound traffic on North East Link is destined for Hoddle Street and 4% for Alexandra Parade.

To cater for this traffic, additional lanes on the Eastern Freeway west of Bulleen Road will be provided to enable smooth entry and exit movements. Implementing Managed Motorway technology and operations for the full length of the Eastern Freeway will also improve traffic flow and performance.

In total, factoring in growth over time, there is expected to be no net increase in traffic to the CBD, with an increase of around 3% in traffic at the western end of the Eastern Freeway.

¹ VicRoads Managed Freeways – Freeway Ramp Signals Handbook, July 2013

Distribution and traffic volume changes of North East Link traffic, 2036



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

Doncaster Busway

Buses are an important component of the Eastern Freeway corridor, and the modernisation of the freeway will also improve bus travel times and reliability. The reconfiguration includes the full separation of Doncaster Busway services from Hoddle Street to Doncaster Road by building a separated bus-only carriageway in the central median from east of Hoddle Street to east of Burke Road and then on the north side of the freeway to Doncaster Road. These dedicated bus lanes will connect to Victoria Park and significantly improve travel time reliability for bus services along the Eastern Freeway into the future.

Managing environmental and social impacts

Protecting the Yarra River, its tributaries, floodplains and surrounding environment – along with culturally significant sites such as Bolin Bolin Billabong – is a core requirement for North East Link and has been a key consideration in developing the project.

NELA has identified environmentally and culturally sensitive areas that are highly valued by the both the Traditional owners of the land, the Wurundjeri people, and the local community in the corridor. These areas include:

- The Yarra River and its floodplain, incorporating Banyule Flats and Bolin Bolin Billabong, have high cultural significance to the Wurundjeri people. These are also areas of high ecological value and which have retained important patches of remnant native vegetation and areas of high value habitat
- The Yarra River and its tributaries, featuring public parks and recreational areas of high value to the broader community
- Habitat for identified threatened species in the vicinity of Bolin Bolin Billabong, the Simpson Barracks and the Western Ring Road road reserve
- Waterways including the Yarra River, Plenty River, Koonung Creek, Banyule Creek and Merri Creek.

To protect areas of environmental and cultural significance that are also highly valued by the community along Corridor A, no-go zones were designated for the Banyule Flats, Bolin Bolin Billabong and Heide Museum of Modern Art. This meant that, in developing concepts for the project, modification of the existing surface in these zones was not considered acceptable, either permanently or during construction. As a result, North East Link will feature a tunnel beneath the Yarra River with a northern portal (tunnel entrance) north of Lower Plenty Road and a southern portal south of the Veneto Club, instead of an above ground or surface road design. This will avoid impacts on the environmentally and culturally sensitive Yarra River valley, Banyule Flats and Bolin Bolin Billabong.

The Victorian Government is committed to the protection of the Yarra River, as demonstrated by the Yarra River Protection Act (*Wilip-gin Birrarun murrn*) that comes into effect on 1st December 2017. The Yarra River Action Plan, developed in partnership with the Wurundjeri Tribe Land and Compensation and Cultural Heritage Council (Wurundjeri Council), sets out the actions that will be taken to achieve the objectives of the Yarra River Protection Act and meet the Government's commitment to protecting the river.

Maintaining and improving connectivity for communities along the corridor

North East Link will maintain existing bicycle and pedestrian connectivity across the corridor. In a number of places, connectivity will be improved. Where the removal of an existing bicycle or pedestrian connection is unavoidable, an alternative connection will be provided.

North East Link enables the completion of a key missing link in the Strategic Cycling Corridor network: the completion of the Greensborough Road path between Yallambie Road and Grimshaw Street/Greensborough Road Bypass shared use paths. This will enable cycling entirely off-road between the M80 and the wider walking and cycling network via the Eastern Freeway. This path will form part of a continuous ring road trail around Melbourne – over 100 kilometres of off-road cycling following the orbital freeway network via Altona, Tullamarine, Greensborough, Ringwood, Dandenong, Carrum and Mt Martha.

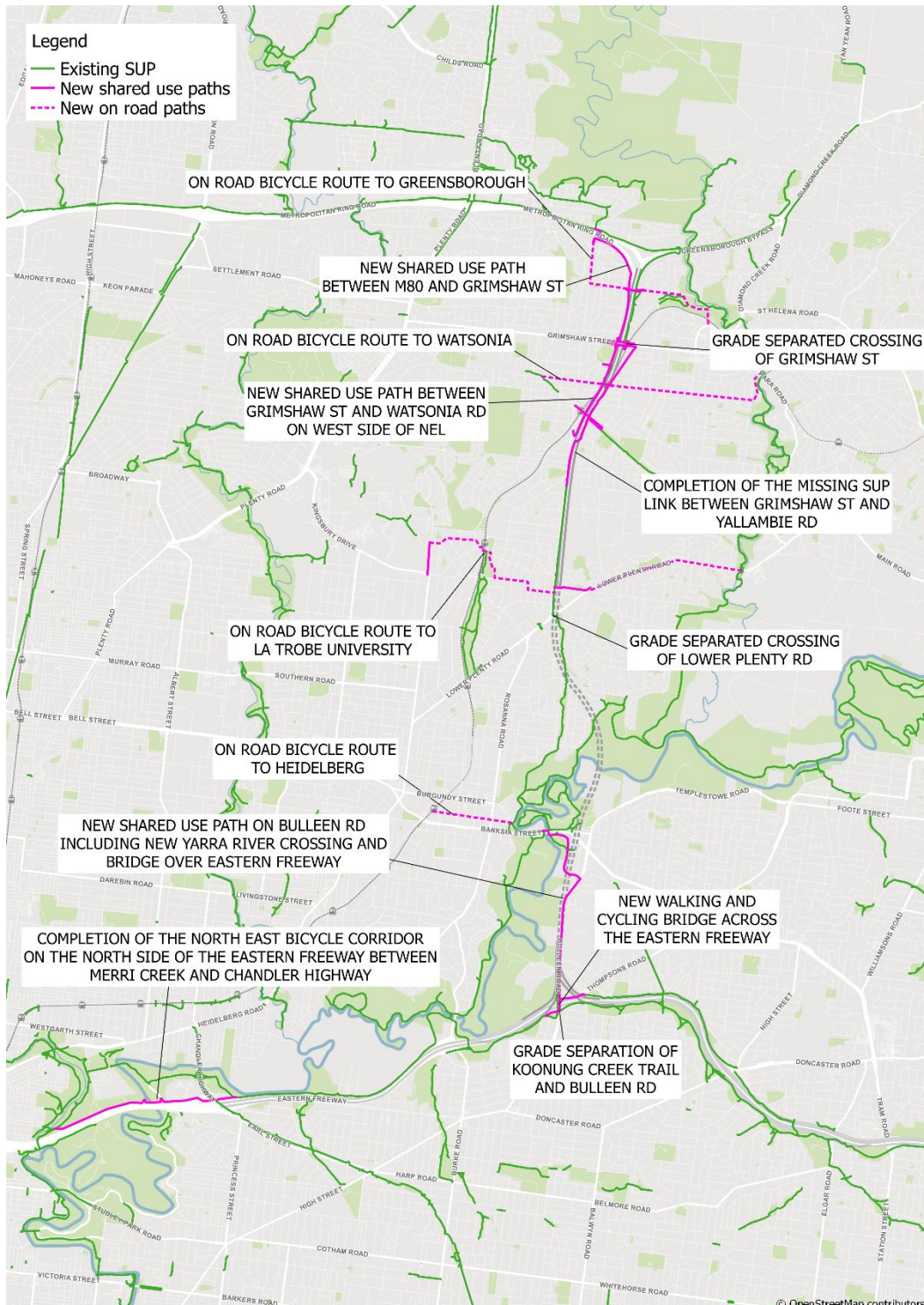
Additionally, a shared use path connection starting from Banksia Street (including a new crossing of the Yarra River near Heidelberg) running parallel to Bulleen Road to the Eastern Freeway will provide new connectivity to the schools and sporting fields on Bulleen Road. A new shared use path structure on the eastern side of the Bulleen Road interchange over the Eastern Freeway will enable safer and easier crossing of the freeway, linking the new Bulleen Road path with residential areas south of the freeway. This will be a significant upgrade from the current narrow and sub-standard footpath at the Bulleen Road bridge over the freeway.

In locations where North East Link is planned to be lower than the existing ground level, walking and cycling connections are expected to be provided at the existing surface. There are also opportunities to provide connections via land bridges over the freeway where it is in cutting, improving community integration and accessibility along and across the new link.

Other opportunities to provide connected walking and cycling infrastructure include:

- Completion of the North East Bicycle Corridor – a new walking and cycling link between Merri Creek and Chandler Highway on the north side of the Eastern Freeway to improve access between the eastern suburbs and the inner city
- A new shared use path on the southern side of the M80 and western side of North East Link to improve walking and cycling accessibility to and from Watsonia
- On road cycling routes to improve accessibility to Heidelberg, Watsonia, Greensborough and La Trobe University
- Grade-separated crossings of the Greensborough Road path at Grimshaw Street and Lower Plenty Road
- Grade separation of the Koonung Creek Trail at the Bulleen Road intersection near the Eastern Freeway.

Walking and cycling connections facilitated through North East Link



Supporting public transport in the north east

Public transport connections in the north east experience delays due to congestion, particularly at bottlenecks at existing crossings of the Yarra River for services between the northern and eastern suburbs. Bus services that run through the area are inefficient, and growth in residential areas to the north and expansions of commercial and educational precincts in the east and south east will continue to increase demand for these movements.

In addition to implementing Doncaster Busway, North East Link presents opportunities to improve bus services throughout the north east. Further planning will be undertaken to identify how and where these improvements can be made, including:

- Bus priority measures at interchanges with the new freeway
- Performance improvement measures at key intersections to increase the reliability of bus services
- Bus priority measures along key routes and at key intersections
- Interchanges between buses and trains including at Watsonia Station.

North East Link also provides opportunities to build a more efficient and better connected city-wide bus network including providing opportunities for commercially operated bus services to access Melbourne Airport from eastern and south-eastern parts of the state.

Next steps

NELA will work with local councils, VicRoads, PTV, Transport for Victoria, Melbourne Water and other agencies to develop the reference design for the project and identify opportunities to provide additional benefits to the community. An important next step is for NELA to work with Melbourne Water and the Wurundjeri Council to ensure development, design and delivery of North East Link respects and protects the Yarra River.

The reference design will be subject to an independent planning and environmental approvals process. This process, which will commence in 2018, will include extensive technical investigations and assessments, and provide multiple opportunities for community comment and input.

1 Overview

1.1 Background

North East Link is Victoria's highest priority road project as identified in Infrastructure Victoria's 30-year strategy, released in 2016. North East Link will complete the 'missing link' in Melbourne's freeway network between the M80 Ring Road (M80) and the Eastern Freeway/EastLink, providing an essential north-south freeway-standard connection through the city's north east. The new link will cater for forecast strong population growth in the north and south east, improve access to major employment, industrial and activity centres in the north, north east and south east, and increase the capacity and connectivity of the metropolitan freight network. It will provide accessibility through some of the most congested parts of the city's arterial road network, reducing congestion in Melbourne's northern suburbs and helping to take trucks off local streets.

For the first time, Melbourne will have a fully connected suburban freeway network, providing continuous traffic flow conditions and allowing timely and efficient travel across, through and around Melbourne.

In October 2017, the Victorian Government confirmed its commitment to North East Link, identifying the new link in the *Victorian Infrastructure Plan* as one of several 'catalyst', state-shaping infrastructure projects designed to stimulate economic growth, create jobs and deliver positive, long-term benefits for Victorians.

1.2 Community consultation

1.2.1 The approach

In preparing the business case for the North East Link, the North East Link Authority (NELA) adopted an approach that sought early input from the community, local councils and non-government organisations. Before starting to investigate the four potential project corridors NELA sought input on issues such as individual and community values and the principles and objectives of the project.

In May 2017, NELA canvassed community opinion via a widely advertised opt-in survey. The aim was to understand different views, including about what people valued in the north east, their thoughts on current traffic issues and problems, and how North East Link should be developed. NELA also asked how people would like to be involved in the project's development. This survey was conducted before the four potential corridors were announced and the results were published in October².

In August 2017, the four potential corridors were announced, along with the North East Link Project Objectives and Guiding Principles and a snapshot of work undertaken to that date. Through extensive face-to-face and online consultation, NELA asked people to comment on whether they felt the objectives and principles would deliver the North East Link they wanted in the way they wanted.

The four corridors showed minimum tunnel sections, mainly determined according to early assessments of potential social and environmental impacts. An important part of NELA's consultation was understanding community views about whether these minimum lengths of tunnel were appropriate. The corridor maps also showed indicative interchange locations to enable discussion about how these might affect communities and road users.

² http://northeastlink.vic.gov.au/__data/assets/pdf_file/0009/137565/North-East-Link-Community-Survey-Report-May-July-2017.pdf

1.2.2 How community consultation informed the options assessment

The options assessment for North East Link considered feedback and information provided by the community and stakeholders alongside evidence from technical investigations conducted for the business case. The assessment also considered questions raised by community members and stakeholders. In many respects, these questions were the most helpful input at the conceptual stage of the project: they pointed to areas where further research was required, showed where information was lacking or an issue or concept not explained clearly, clarified what is and isn't acceptable to sections of the community, and helped in identifying and understanding likely issues, opportunities and 'hot spots' that could arise regardless of which corridor was chosen.

The consultation report released by NELA in early November³ shows how community input informed the corridor assessment. This report indicates where further work was done following the release of the Technical Summary in August and where assessment against the Project Objectives and Guiding Principles changed as a result.

This options assessment is a technical study. It incorporates assessments of corridor options against the Project Objectives and Guiding Principles and includes an evaluation of potential environmental and social impacts, including visual, noise, air quality and health impacts.

1.3 Project Objectives and Guiding Principles

The North East Link has a strong focus on supporting business and jobs growth in communities across Melbourne's north, east and south east, while also improving cross-city connectivity and helping to address critical traffic, freight and amenity issues. Project Objectives and Guiding Principles reflecting this focus were established for the North East Link Project (as shown in the table below), informed by the transport system objectives and principles set out in the Victorian Transport Integration Act 2010 (TI Act) and the goals of Plan Melbourne.

These objectives and principles informed the development of options for the project and formed the basis of the assessment criteria in the options assessment process. The Project Objectives provided the basis for assessing the performance of corridors during the assessment process.

Table 1 North East Link Project Objectives and Guiding Principles

Project Objectives			
<i>Objective 1</i> Improve business access and growth in Melbourne's north, east and south east	<i>Objective 2</i> Improve household access to employment and education in Melbourne's north, east and south east	<i>Objective 3</i> Improve freight and supply chain efficiency across the north, east and south east	<i>Objective 4</i> Improve access, amenity and safety for communities in the north east
Guiding Principles			
<i>Guiding Principle 1</i> Minimise impacts on communities	<i>Guiding Principle 2</i> Minimise impacts on environmental and cultural assets	<i>Guiding Principle 3</i> Minimise impacts during the construction phase	<i>Guiding Principle 4</i> Optimise the efficient use of resources

³ http://northeastlink.vic.gov.au/__data/assets/pdf_file/0019/140149/NorthEastLink-CommunityEngagementReport-Aug-Oct-2017.pdf

1.4 Policy context

A range of policies, strategies, plans and legislative frameworks have been considered in developing the project options and assessing the corridor concepts. These are listed in the table below.

Table 2 Relevant legislation, policies and strategies

Level of government	
Australian Government	Smart Cities Plan (Department of the Prime Minister and Cabinet) National Freight and Supply Chain Strategy Australian Infrastructure Plan (Infrastructure Australia) Heavy vehicle road reform
Victorian Government	<i>Transport Integration Act 2010</i> Plan Melbourne 2017-2050 State Planning Policy Framework Victoria's 30-year infrastructure strategy (Infrastructure Victoria) Victoria's Value Creation and Capture Framework La Trobe NEIC Draft Framework Plan (Victorian Planning Authority) Northern Growth Corridor Plan 2012 (Victorian Planning Authority) Yarra River Protection Bill 2017 (DELWP) Towards Zero 2016-2020 Road Safety Strategy and Plan Movement and Place (VicRoads) Operational Controls of the Motorway Network Victorian Bicycle Strategy Victoria's freight strategy
Local government	Strategies and plans developed by local governments: Banyule City Council Nillumbik Shire Council Manningham City Council Yarra Ranges Council Hume City Council Boroondara City Council Maroondah City Council Knox City Council Whitehorse City Council

The *Transport Integration Act 2010* and Plan Melbourne 2017-2050 have been important strategic influences in the development of the project, as described below.

1.4.1 *Transport Integration Act 2010*

The *Transport Integration Act 2010* (the TIA) is Victoria's principal transport statute. It brings together the transport portfolio, including ports and marine, under one framework with the aim of developing 'an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State'.

The TIA aims to achieve ensure that Victoria’s transport system delivers balanced economic, environmental and social outcomes, and requires all transport agencies to work together toward the common goal of an integrated, sustainable transport system. Agencies responsible for urban and regional planning are required to take account of the TIA when making land use decisions that impact on the transport system.

Assessment of each of the corridor options for North East Link was guided by (among other things) the Project Objectives and Guiding Principles developed for the project. These objectives and principles were developed having regard to the transport system objectives and decision-making principles set out in the TIA. Appendix A provides further details about how the North East Link Project Objectives and Guiding Principles and corridor assessment aligns with the TIA.

1.4.2 Plan Melbourne 2017-2050

Plan Melbourne provides important transport and land use planning context for the assessment of project options for North East Link. As the primary planning strategy for the city, Plan Melbourne sets out a framework over the next 35 years for the future development of transport and other infrastructure to service a growing population.

Melbourne’s population is growing rapidly and is projected to increase from 4.5 million to almost eight million by 2051. Over this period, the economy will need to create another 1.5 million jobs across a diverse range of industries and build another 1.6 million homes in places where people want to live. This strong growth presents transport, infrastructure, land use planning and environmental challenges that will need to be addressed for Melbourne to continue to develop as a successful, sustainable and highly liveable city.

Plan Melbourne provides for population and housing growth to be kept within the existing Urban Growth Boundary by the careful development of growth areas and the selective redevelopment of underutilised areas within existing communities. It also seeks to facilitate a higher percentage of new housing in established areas to create a city of ‘20-minute neighbourhoods’ close to existing services, jobs and public transport. These approaches will minimise further urban sprawl and create a more consolidated, sustainable city.

The need to continue to invest in the Melbourne transport network is another key plank of Plan Melbourne. This investment will include building the Metro Tunnel and major road projects across the city and suburbs, informed by Infrastructure Victoria’s independent assessment of transport priorities.

Melbourne’s Urban Growth Boundary

The Urban Growth Boundary (UGB) is a critical feature in planning for Melbourne’s future as a liveable, sustainable and accessible city. The UGB applies around the urban areas of metropolitan Melbourne and is designed to direct urban growth to areas with appropriate infrastructure and services and to protect valuable agricultural land, rural landscapes, important habitats and environmental features.

The UGB was legislated in 2002 to contain the city’s sprawl and encourage more sustainable, higher density development within existing centres. In subsequent years, the high demand for housing from a rapidly growing population has led to the boundary being expanded several times. The current UGB was reaffirmed as the outer limit for Melbourne’s growth in Plan Melbourne 2017-2050.

Plan Melbourne confirmed the UGB’s importance in:

- Reducing urban sprawl and creating a more consolidated city
- Increasing metropolitan housing densities in the right places
- Protecting the values of non-urban land, opportunities for productive agricultural land and significant natural landscapes.

While the UGB can only be changed by majority vote in both houses of the Victorian Parliament, planning for new infrastructure should not strain the boundary or encourage its expansion. In Melbourne’s north east, placing the UGB under pressure has the potential not only to push the city’s growth out into rural areas and natural landscapes, but also to jeopardise the attributes valued by residents and communities.

Melbourne's transport system must be able to respond to the needs of a changing and growing city. It must give residents good access to jobs and services, deliver fast and reliable connections between businesses and their workers, customers and suppliers, and offer efficient ways to move ever increasing volumes of freight around the city. An integrated transport system that provides a range of travel choices will be essential to meeting these needs. This includes additional and improved public transport services, upgrades to the arterial road and freeway network, enhancements to the efficiency of Melbourne's freight network and more opportunities for walking and cycling.

Strong transport accessibility is a core feature of liveable cities. Cities with good transport connectivity give a large proportion of residents access to social and economic opportunities within a reasonable travel time and at a reasonable cost. Connectivity is also vital for business productivity and competitiveness by reducing travel time and vehicle operating costs and improving travel time reliability. These are key drivers for the introduction of North East Link.

1.5 Strategic drivers in the north east

The North-East Link Project Objectives are structured primarily around improving access for businesses, households and freight operators in Melbourne's north, east and south east, as well the improving access, amenity and safety for communities in the north east. To achieve these Project Objectives, the North-East Link will need to be designed to service existing and future land uses, providing a solution that will improve access for users of the new link, being those businesses, households and freight operators with origins and destinations associated with these land uses.

Strategic drivers for land use and transport planning have been key considerations in assessing options for North East Link. Project options have been evaluated for their potential contribution to supporting these drivers and resolving the problems and challenges associated with them – thereby achieving the Project Objectives.

1.5.1 Strategic land use planning drivers

1.5.1.1 Land use plans

The primary land use consideration for the project relates to the potential users of the North-East Link – where are they located, now and into the future, and where do they need to travel (the origins and destinations of their trips). This section outlines the key land use planning considerations for the options assessment.

Plan Melbourne 2017-2050 sets out economic development and employment goals designed to guide the city's growth over the next 35 years, building on Melbourne's distinctiveness, liveability and sustainability. To achieve these goals, a series of interconnected learning, working and living precincts across Melbourne are identified for targeted investment and growth. The ability to service these places is an important consideration for North East Link.

Future land use is also a key consideration for the project, especially in relation to the city's urban growth corridors:

- The Northern Growth Corridor straddles the Hume Highway and extends to the Whittlesea, Hume and Mitchell Local Government Areas (LGAs). These northern growth fronts include future major employment precincts, as well as large tracts of industrial land.
- The South Eastern Growth Corridor includes land within the Casey and Cardinia LGAs for future commercial, business and industrial uses.

These corridors include some of the fastest growing suburbs in Australia and they will continue to experience significant growth prior to and after the opening of North-East Link:

Consideration has also been given to supporting National Employment and Innovation Clusters (NEICs) and Metropolitan Activity Centres (MACs) within the vicinity of North East Link:

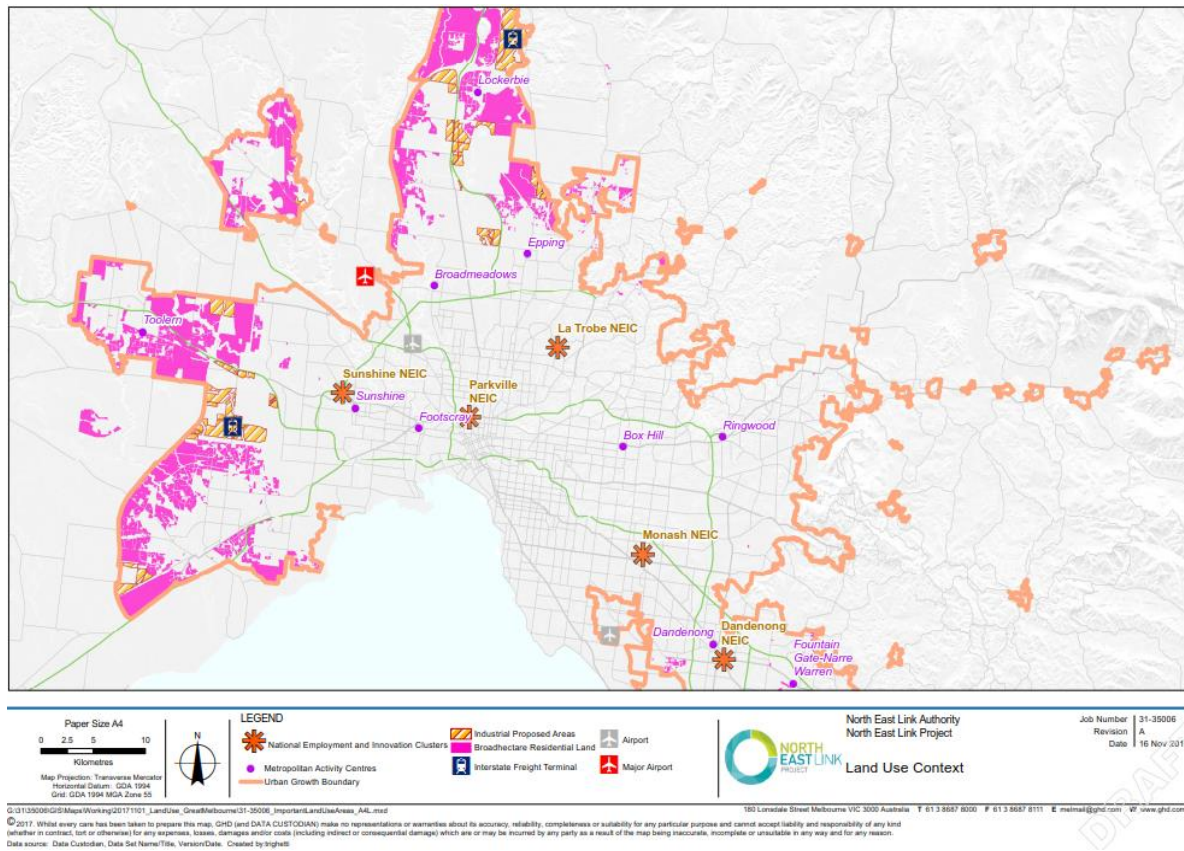
- La Trobe NEIC, located in the east of the North East Link study area⁴ near La Trobe University and Austin Health
- Monash and Dandenong NEICs, located outside and to the south east of the study area
- Ringwood MAC in the south east of the study area
- Several MACs that are outside of, but close to, the study area, including Box Hill, Epping and Broadmeadows.

A significant portion of the study area lies outside of the current Urban Growth Boundary and in land designated as a 'Green Wedge' zone (areas that contain a mix of agriculture and low density activities). Potential outward development pressure due to the project would be inconsistent with policies aimed at containing urban sprawl and protecting non-urban land uses.

Figure 1 illustrates the land use context of the study area, including the urban growth corridors, NEICs, MACs and the Urban Growth Boundary.

⁴ The NEL study area extends from Coburg in the east to Lilydale in the west, and from Diamond Creek north of the M80 to Balwyn and Forest Hill in the south (parallel with the Eastern Freeway and Maroondah Highway). Corridor selection and options and impact assessments for North East Link are focused within this geographic area.

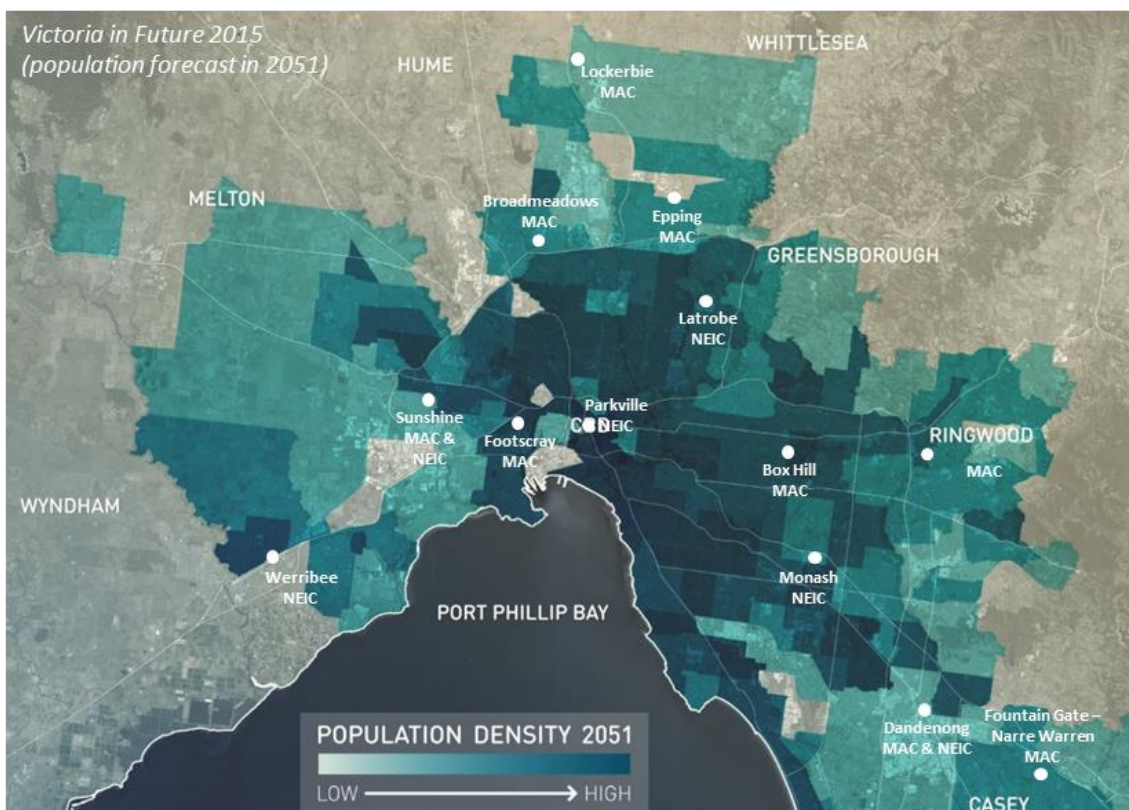
Figure 1 Land use context of the North East Link study area



1.5.1.2 Population growth

The north east is a mix of established and growing urban environments. Figure 2 shows the population density forecast in 2051. Strong growth is expected to the north of the M80 in the northern growth corridor, while limited growth is expected east of Greensborough and Watsonia, where growth is constrained by the existing low density environment and the Urban Growth Boundary. Further south, some of Australia's fastest growing suburbs are located in the city's south east growth corridor. A significant portion of travel between these two areas passes through the north east.

Figure 2 Forecast population density 2051

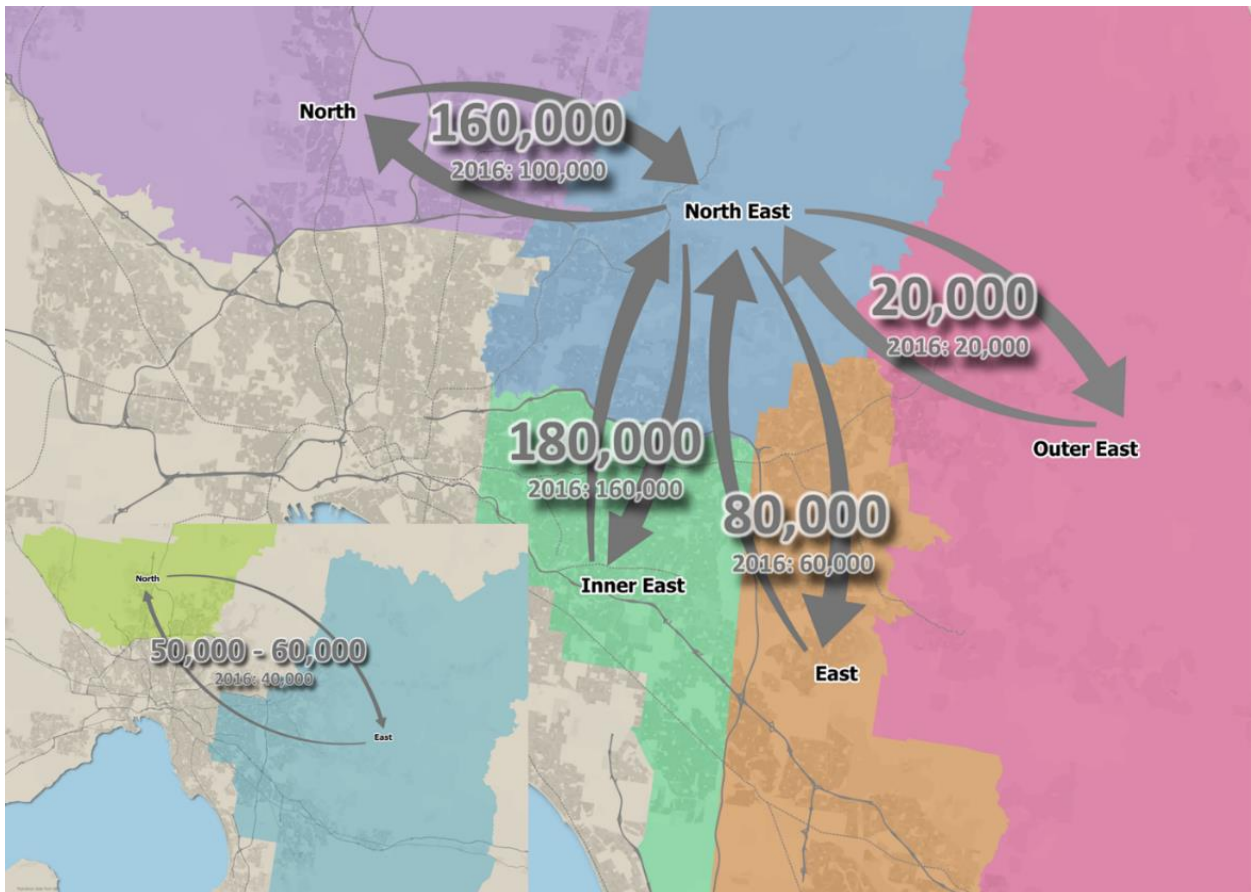


Source: Victoria in Future 2015 (population forecast in 2051)

1.5.2 Strategic transport planning drivers in the north east

Transport modelling used to support the North-East Link options assessment process has identified the major movements to and from the north-east both now (2017) and 20 years into the future (2036), as shown in Figure 3.

Figure 3 Daily trip movements across the north east (2031 and 2036)



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

The north east is a mix of established and growing urban environments. As discussed above, strong growth is expected to the north of the M80, while limited growth is expected east of Greensborough and Watsonia.

While Melbourne has strong radial connections that support access to the central city, other trips are not as well-served by the transport network. The north east's location between two urban growth corridors and between the major cross-city connections of the M80 and the Eastern Freeway – along with the lack of a freeway-standard orbital connection in this part of the city – means that the region's arterial road network is used for freight and commuter trips across Melbourne.

North East Link will need to attract trips currently using this network, as well as those identified for the future. This means the link has to service existing and future trips through, to and from the north east with multiple origins and destinations across Melbourne. These trips include:

- Long trips – orbital trips with both origin and destination outside the north east (for example a trip between Dandenong and Tullamarine)
- Medium trips – cross-city trips that have one end of the trip within the north east (for example, a trip between Watsonia and Box Hill).

Melbourne's north east relies on a handful of key arterial roads for traffic movement, lacking the grid-based network found in the south eastern suburbs. Rather than having multiple routes, trips are heavily reliant on a handful of arterial roads, including Bell Street for east-west movements and Plenty Road, Rosanna Road and Bulleen Road for north-south movements.

The Yarra River forms a natural barrier to traffic movements, with five river crossings providing access to the Eastern Freeway within the north east. Traffic is funnelled through the road network to these crossing points, creating congestion.

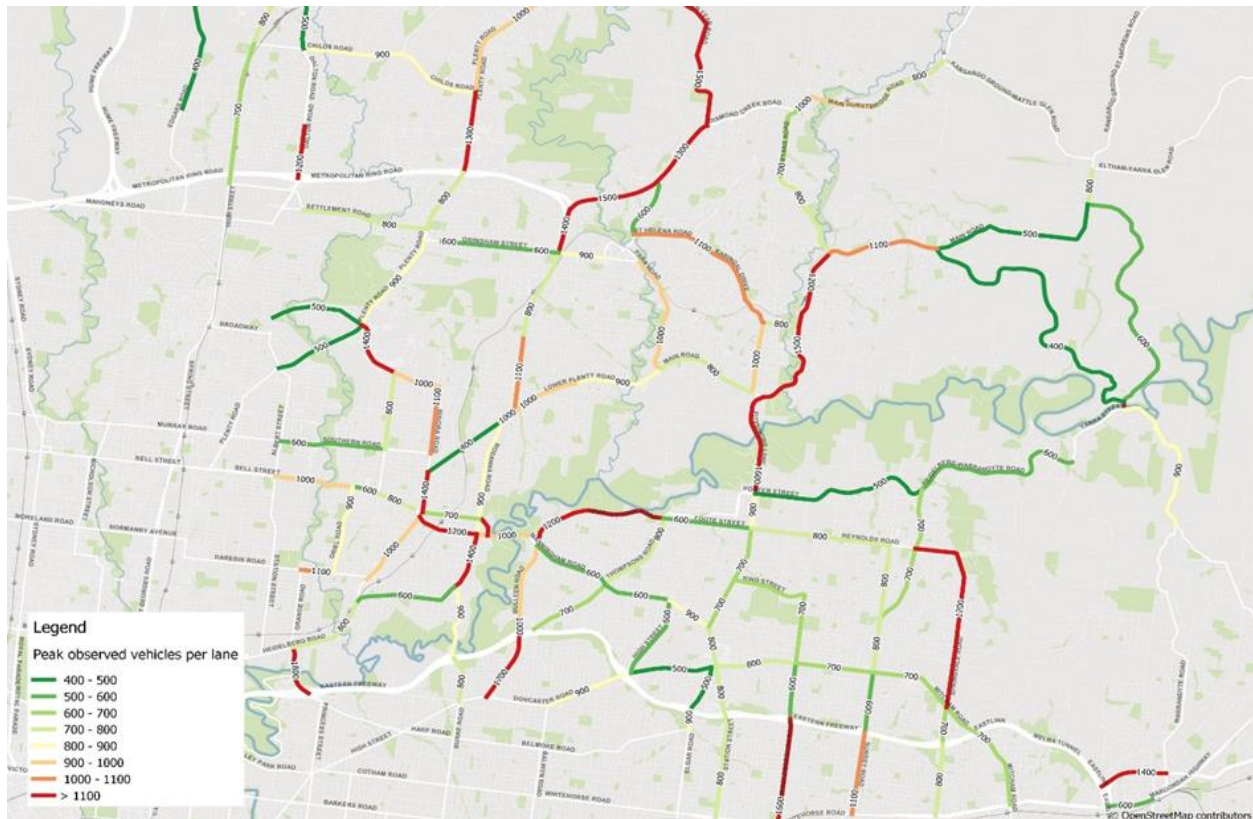
There are very few traffic routes or preferred traffic routes within the north east, with no single road for north-south and east-west movements. The key traffic route between the Eastern Freeway and the M80 involves travelling along five separate roads – Bulleen Road, Banksia Street, Rosanna Road, Lower Plenty Road and Greensborough Road. However, these key traffic routes are also shared with bus and bicycle priority routes, highlighting the lack of suitable routes that allow the separation of priority for different modes of transport.

This lack of suitable corridors for vehicles to travel through the north east means there are multiple locations where flow breakdown occurs during the peak periods or throughout the day. The north-south corridor of Bulleen Road, Banksia Street, Rosanna Road, Lower Plenty Road and Greensborough Road has high levels of congestion throughout the day, with key pinch-points at the Eastern Freeway entry ramps and the intersections of Bulleen Road/Manningham Road and Banksia Street/Rosanna Road.

Congestion also occurs along the M80 as it approaches Greensborough Highway and the Eastern Freeway within the vicinity of Doncaster Road and Bulleen Road.

A summary of the locations of congestion within the north east is presented in Figure 4 below.

Figure 4 Existing locations of congestion



Demand for travel on the road network in the north east fluctuates across the day, with periods of high demand during the morning and evening peak periods affecting network speeds, travel times and journey reliability. This variability is seen on key arterial routes such as Bulleen Road, where large reductions in speeds around 8am and 3pm coincide with periods of increased demand for travel. During these peak periods, the average speed can reduce to nearly half the posted speed limit due to congestion.

Even within the peak periods, investigations have determined that there is a high level of variability in travel times. For example, on Bulleen Road, Rosanna Road and Greensborough Road, the slowest trip recorded was over twice the length of the fastest trip, with minimum and maximum travel times varying by approximately 30 to 35% from the median.

Achieving the North-East Project Objectives of improving business, household and freight efficiency, as well as improving access, amenity and safety for communities in the north east, is dependent upon delivering an efficient transport solution that responds adequately to the trips and the transport issues identified above.

The options assessment process investigated which North-East Link corridor option best satisfies the Project Objectives and Guiding Principles by delivering a solution that caters for existing and future business, household and freight trips.

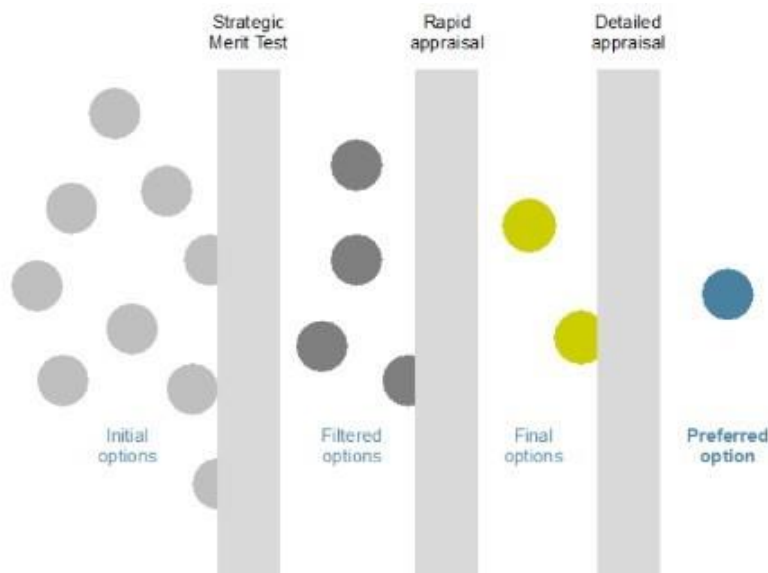
1.6 Options assessment framework

This document outlines the approach to options assessment and the key findings from the assessment that have been used to identify the corridor for North East Link.

The Options Assessment Framework for the project has been guided by *the Australian Transport Assessment and Planning (ATAP) Guidelines*, which recommend a three-tiered assessment process to narrow down a long list of possible options to a preferred option.

As shown in Figure 5, the Strategic Merit Test (SMT) is the first stage of the assessment process, followed by a rapid appraisal and a detailed appraisal. The process can be viewed as a series of ‘filters’, with options being subjected to greater scrutiny and more intensive examination as they pass through each filter. The best performing or preferred option is the one that passes through all the filters. The stages of assessment are described further in Section 1.6.1.

Figure 5 Options assessment process



Source: ATAP Guidelines

1.6.1 The stages of assessment

Each stage of the assessment framework aims to filter some options based on the information and level of options development available at each phase. As the process progresses, an increasing number of options are rejected. The preferred option is the one that passes through all the filters. The purpose of each stage is outlined below:

- The **Strategic Merit Test (SMT)** is an assessment of how well the identified corridor options for the North East Link align with the higher level economic, environmental and social goals and the transport system objectives for the project.
- The **rapid appraisal** involves an indicative assessment of the scale of a corridor option’s benefits and costs.
- The **detailed appraisal** undertakes a detailed assessment of the likely benefits, costs and other impacts of the remaining options.

A **final appraisal** is undertaken through the business case, justifying investment in the corridor. This analysis includes a detailed risk assessment outlining key risks and strategies to manage these risks, detailed costings and a comprehensive economic evaluation for the corridor.

1.6.2 Criteria for options assessment

A set of criteria and measures for the options assessment has been developed for the North East Link Project. These criteria and measures, which were used for the detailed appraisal, are provided in Appendix B. In developing the criteria and measures, the Options Assessment Framework developed for the project considered the triple bottom line objectives of the *Transport Integration Act 2010*, Plan Melbourne 2017-2050, the Project Objectives and Guiding Principles, the problems that the project seeks to address and the key benefits that would be realised from tackling these problems successfully.

The measures used to evaluate options were rated in accordance with the guidance presented in Table 3.

Table 3 Performance ratings: Project Objectives and Guiding Principles

Rating	Descriptor – Project Objectives
	Extreme positive impact - impacts widespread across the project area and beyond, of vast magnitude, long-term in nature and of a scale significant at a State level
	Major positive impact - impacts affecting a significant portion of the project area, generally large in magnitude and long-term in nature and of a scale significant at regional level
	Moderate positive impact - impacts affecting a number of locations within the project area, potentially small in magnitude and long-term or large in magnitude and short-term and of a scale significant at municipality level
	Minimal positive impact - impacts confined to a small number of locations, generally small in magnitude and short-term and of a scale significant at local level
	No positive impact discernible or predicted

Rating	Descriptor – Guiding Principles
	No negative impact discernible or predicted
	Minimal negative impact – impacts confined to a small number of locations, generally small in magnitude and short-term and of a scale significant at local level
	Moderate negative impact – impacts affecting a number of locations within the project area, potentially small in magnitude and long-term or large in magnitude and short-term and of a scale significant at municipality level
	Major negative impact - impacts affecting a significant portion of the project area, generally large in magnitude and long-term in nature and of a scale significant at regional level
	Extreme negative impact – impacts widespread across the project area and beyond, of vast magnitude, long-term in nature and of a scale significant at a State level

1.6.3 Inputs for assessment framework

As a major project develops, additional and/or new information becomes available, informing and influencing the assessment and filtering of options. The following approach was adopted for the three-stage options assessment process for North East Link:

- The Strategic Merit Test was largely qualitative, based on key inputs taken from the initial modelling of traffic conditions and an assessment of how well each option aligned with the Project Objectives and the potential of each option to deliver anticipated benefits. At this stage, the options were assessed against the Project Objectives
- The rapid appraisal was mostly qualitative, with quantitative inputs from the modelled traffic conditions, order of magnitude cost estimates and desktop studies of environmental and heritage conditions. At this stage, the options were assessed against measures corresponding to both the Project Objectives and the Guiding Principles
- The detailed appraisal was predominantly quantitative, with some qualitative impacts assessed based on the findings of technical and other investigations. At this stage, the options were assessed against the full range of measures corresponding to the Project Objectives and the Guiding Principles, as outlined in Appendix B.

1.6.4 Geography of analysis

Options have been assessed in relation to four levels of geography:

- **Metropolitan Melbourne** – the broader metropolitan area within the Urban Growth Boundary set by Plan Melbourne 2017-2050
- **North East Link project catchment** – a catchment that covers areas where the project is expected to deliver benefits, determined with reference to statistical areas as defined by the Australian Bureau of Statistics⁵. The project catchment is shown in Figure 6.
- **NEICs and MACs in the project catchment** – as noted in section 1.5, there are three NEICs in the project catchment: La Trobe, Monash and Dandenong. Five MACs located in the catchment were considered in the options assessment: Broadmeadows, Epping, Box Hill, Ringwood and Narre Warren. These NEICs and MACs are identified on Figure 6.
- **Key residential locations** – locations in areas where accessibility is significantly impacted by conflicting local and strategic orbital movements between the M80 Freeway and Eastern Freeway/Eastlink. These locations are mapped broadly in Figure 7 and include suburbs such as Rosanna, Eltham, Heidelberg, Bundoora, Greensborough and Bulleen.

⁵ Statistical Area 3 (SA3) was the level used to define the project catchment. This geography represents areas serviced by the same major transport or commercial hubs the ABS (2016), Australian Statistical Geography Standard (ASGS): Volume 1 - Main Structure and Greater Capital City Statistical Areas, ABS Cat no. 1270.0.55.001 - July 2016

Figure 6 North East Link project catchment

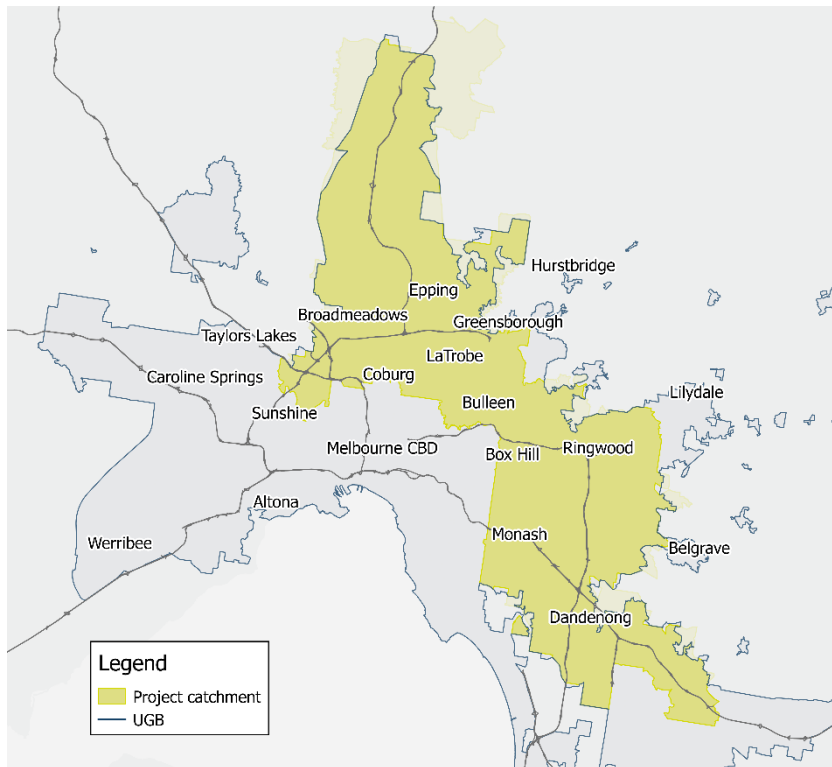
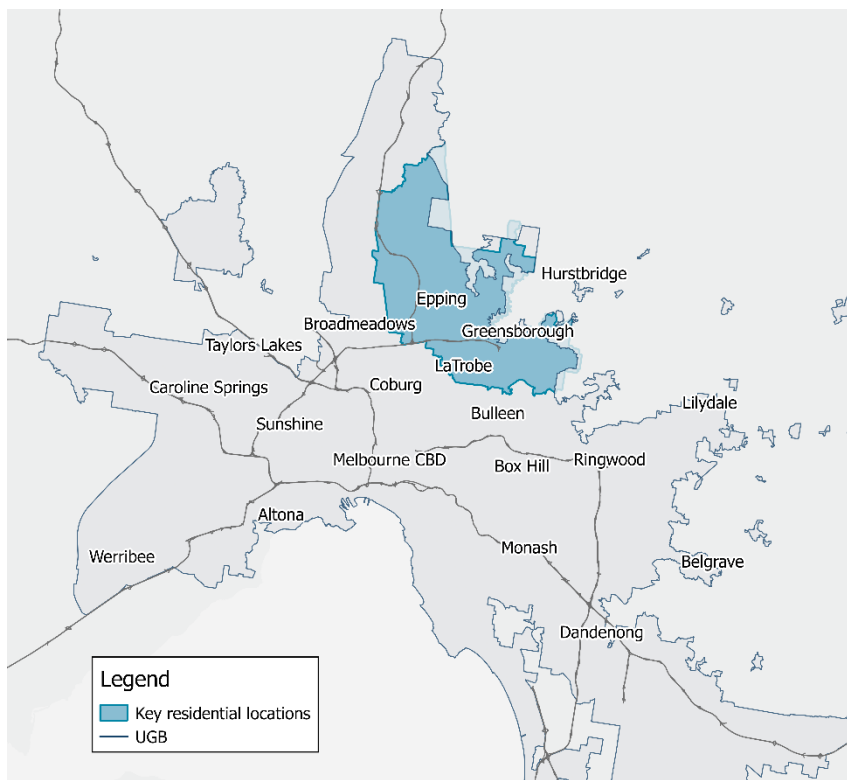


Figure 7 Key residential locations



1.6.5 Identifying corridor options

Numerous studies extending back to 1929 have recognised the need for a link between the M80 and the M3 Eastern Freeway/EastLink. However, a preferred route has never been identified and no established road reservation exists for such a link. Therefore, the North East Link Project Team initially identified a broad set of potential alignment options, including those considered in previous studies and others not previously considered.

Information from the following sources was referenced in identifying potential alignments and generate broad corridor options:

- Victorian Government (1969), Melbourne Transportation Plan
- Victorian Government (1974), F35 Study: Eastern Freeway - Ringwood to Greensborough
- Victorian Government (1979), Outer ring study, Diamond Creek to Ringwood: Technical Report: Transport and Economic Evaluation
- Victorian Government (2008), Victorian Transport Plan
- Infrastructure Victoria (2016), 30 Year Infrastructure Strategy

While there are numerous ways to provide such a connection, the North East Link Project Team identified four of the most practical potential corridor options for North East Link, as shown in Figure 8. Potential options further to the west were identified at this stage, but set aside early due to their potential to attract trips with a CBD focus that are better served by public transport and existing freeways in the north of Melbourne.

The four potential corridors were identified by:

- Assessing existing traffic conditions and transport movements
- Investigating existing road corridors and utilities easements that could be used for freeway corridors
- Identifying potential surface road corridors and constraints to these corridors (such as difficult terrain, sensitive environmental areas and important community assets)
- Considering treatments such as tunnels to avoid sensitive environmental and urban areas or to mitigate substantive surface impacts.

The following issues are common to all corridors and are reflected in each of the corridor options:

- A continuous road reservation does not exist between the M80 and Eastern Freeway and EastLink.
- Steep natural grades are encountered throughout Melbourne's north east and are reflected in elements of the concepts for each corridor.
- Acquisition of some property is anticipated, which may affect commercial, industrial and residential properties. Government-owned land may also be affected by some corridors.
- North East Link will require integration with the M80 and Eastern Freeway or EastLink. These roads are anticipated to be Managed Motorways, with Intelligent Transport Systems used to manage traffic flow, improve safety and provide travel information to drivers.
- Arterial roads adjacent to North East Link will require upgrades to support interchanges. This typically involves additional through lanes, turning lanes and corridor improvements to allow traffic to move safely and efficiently between the wider road network and North East Link.
- North East Link is required to integrate with various modes of public transport.

- Enhancement of walking and cycling routes will form part of the project. This may include routes adjacent to the North East Link corridor or routes that cross the corridor. There are also opportunities for pedestrian and cycling traffic to use areas that are subject to lower traffic volumes due to the project.
- The use of tunnelling will be critical to protect environmentally sensitive areas that may be affected by the proposed corridors.
- All options cross the Yarra River valley by either tunnel or bridge structures.
- Major utilities easements are affected by the proposed works and will require protection or relocation.

Figure 8 North East Link potential corridor options



2 Assessing corridor options

2.1 Strategic merit test

The results of the strategic merit test assessment showed that Corridor D was the least aligned with the Project Objectives, performing poorly across all four objectives. The corridor is the longest and most circuitous, with limited opportunity to connect to the strategic arterial network.

As a result, early strategic transport modelling indicated that its potential to attract traffic to the corridor would be limited. The corridor also provides the lowest potential travel time savings.

Project Objectives

1 Improve business access and growth in Melbourne's north, east and south east

Corridor D provides no appreciable savings in travel time for businesses and delivers limited potential improvement for business to access additional workers.

2 Improve household access to employment and education in Melbourne's north, east and south east

Corridor D has limited potential to increase accessibility to employment for people living in key residential locations.

3 Improve freight and supply chain efficiency and industrial growth across the north, east and south east

Corridor D provides no appreciable savings in travel time; as a result, it is least likely to be an attractive choice for trucks travelling through, to and from the north east.

4 Improve access, amenity and safety for communities in the north east

There are limited opportunities for connection to the arterial road network for Corridor D; as such, it offers little potential to remove vehicles from key roads in the north east and relieve existing amenity issues.

In delivering a potentially significant accessibility uplift to the outer north east of Melbourne, this corridor would also place significant development pressure on Green Wedge areas outside the Urban Growth Boundary by increasing the attractiveness of these areas for locating businesses and residences.

Based on the Strategic Merit Test assessment, Corridor D was not selected as an appropriate corridor for North East Link and Corridors A, B and C were taken forward for further development and assessment.

2.2 Rapid appraisal

For the rapid appraisal stage, potential engineering concepts assessed as feasible from a technical perspective were developed within each of the corridor options carried forward from the Strategic Merit Test. These concepts were assessed for how well they would perform against the evaluation criteria for the Project Objectives and Guiding Principles. Appendix C provides further detail of this assessment.

Corridors A, B and C concepts were assessed using:

- Modelled traffic conditions using updated traffic data
- Preliminary land use modelling
- Available geotechnical information
- GIS data
- Potential impacts on utilities based on existing data and reports
- Potential social and environmental impacts based on existing available planning and environmental information.

The results of the Rapid Appraisal identified that Corridor B had adequate to poor performance against the Project Objectives compared to the other corridors and has as many, if not more impacts when assessed against the Guiding Principles. Early estimates identified Corridor B as the highest cost solution, with technical issues that were likely to increase design complexity as further development of the concept progressed.

Project Objectives

1 Improve business access and growth in Melbourne's north, east and south east

Corridor B has potential to deliver some improvement in labour market accessibility to businesses in Metropolitan Activity Centres such as Ringwood and Box Hill; however, it has the potential to result in a reduction in accessibility for businesses in key employment clusters such as La Trobe, Monash, Epping and Dandenong.

2 Improve household access to employment and education in Melbourne's north, east and south east

Corridor B has the least potential to deliver better accessibility and opportunity for households for key residential locations.

3 Improve freight and supply chain efficiency and industrial growth across the north, east and south east

Corridor B has potential to improve freight and supply chain efficiency; however, due to extended sections of steep tunnel grades resulting in reduced speeds for trucks and increased operating costs, there is limited attractiveness for trucks.

4 Improve access, amenity and safety for communities in the north east

Corridor B provides a mixed response to improving local access, amenity and safety. The route has potential to remove traffic from existing roads, however some local roads carrying public transport have potential increases in traffic as a result of the connections to the link. Truck traffic may not be reduced as much as possible on the existing network.

Guiding Principles

1 Minimise impacts on communities

All corridors have potential impacts on residential and business properties, which may require acquisition. Corridor B also has the potential to result in severance affecting a significant portion of residential or cohesive areas.

2 Minimise impacts on environmental and cultural assets

All corridors affect areas of environmental and cultural sensitivity. Corridor B affects a significant area of high value flora and fauna and potential heritage areas.

3 Minimise impacts during the construction phase

Corridor B would have severe impacts over a long period during construction. A significant volume of construction trucks would be generated due to the length of tunnels; this is compounded by the minimal number of roads available to divert traffic or use for haulage.

4 Optimise the efficient use of resources

Due to the significant length of tunnel and impacts on utilities, Corridor B requires a significant construction period and use of resources to construct – leading to a very high cost solution.

Corridor A and Corridor C proceeded to the detailed appraisal stage of the options assessment process.

2.3 Detailed appraisal

The detailed appraisal involved a largely quantitative assessment of the shortlisted options' ability to provide net benefits. It focused on a series of quantitative and some qualitative measures to inform a more detailed understanding of the performance of the options against the Project Objectives and Guiding Principles using the identified criteria adopted.

The key inputs used to assess the options at detailed appraisal include:

- Modelled traffic conditions using updated traffic and origin-destination data
- Microsimulation modelling
- Updated land use modelling
- GIS data
- Potential impacts on utilities based on existing data and reports
- Updated geotechnical information
- Constructability assessment
- Existing available planning and environmental information further informed by field studies
- Risk adjusted cost estimates.

2.3.1 Further development of corridor options

In preparation for detailed appraisal, further development of feasible engineering concepts was undertaken to address areas where each corridor had performed poorly against the assessment criteria during the rapid appraisal stage.

For **Corridor A**, four potential alignment concepts were taken forward into the detailed appraisal phase. These four concepts consisted of the same elements north of Manningham Road, with potentially different arrangements south of Manningham Road to connect to the Eastern Freeway.

Further development and refinement was undertaken on the concepts to:

- Improve connections to the Eastern Freeway and the performance of the Eastern Freeway to enhance the corridor's ability to provide greater accessibility more broadly across Melbourne
- Identify opportunities to reduce impacts on residential and business properties
- Identify opportunities to reduce impacts on areas of environmental and community sensitivity
- Improve constructability to reduce capital and operational expenditure.

For **Corridor C**, four potential alignment concepts were taken forward into the detailed appraisal phase. These four concepts followed the same horizontal alignment, with differences in arrangements at the Yarra River crossing and in the connection between North East Link and EastLink in the vicinity of Ringwood Bypass interchange.

Further development and refinement were undertaken on the concepts to:

- Improve connections to the arterial network and to EastLink to provide greater accessibility in the north and east
- Improve grades in the tunnels, which were impacting the ability of the option to provide benefits for freight vehicles
- Identify opportunities to reduce impacts on residential properties
- Identify opportunities to reduce impacts on areas of environmental and community sensitivity

- Improve constructability to reduce capital and operational expenditure.

Figure 9 Corridor A concept

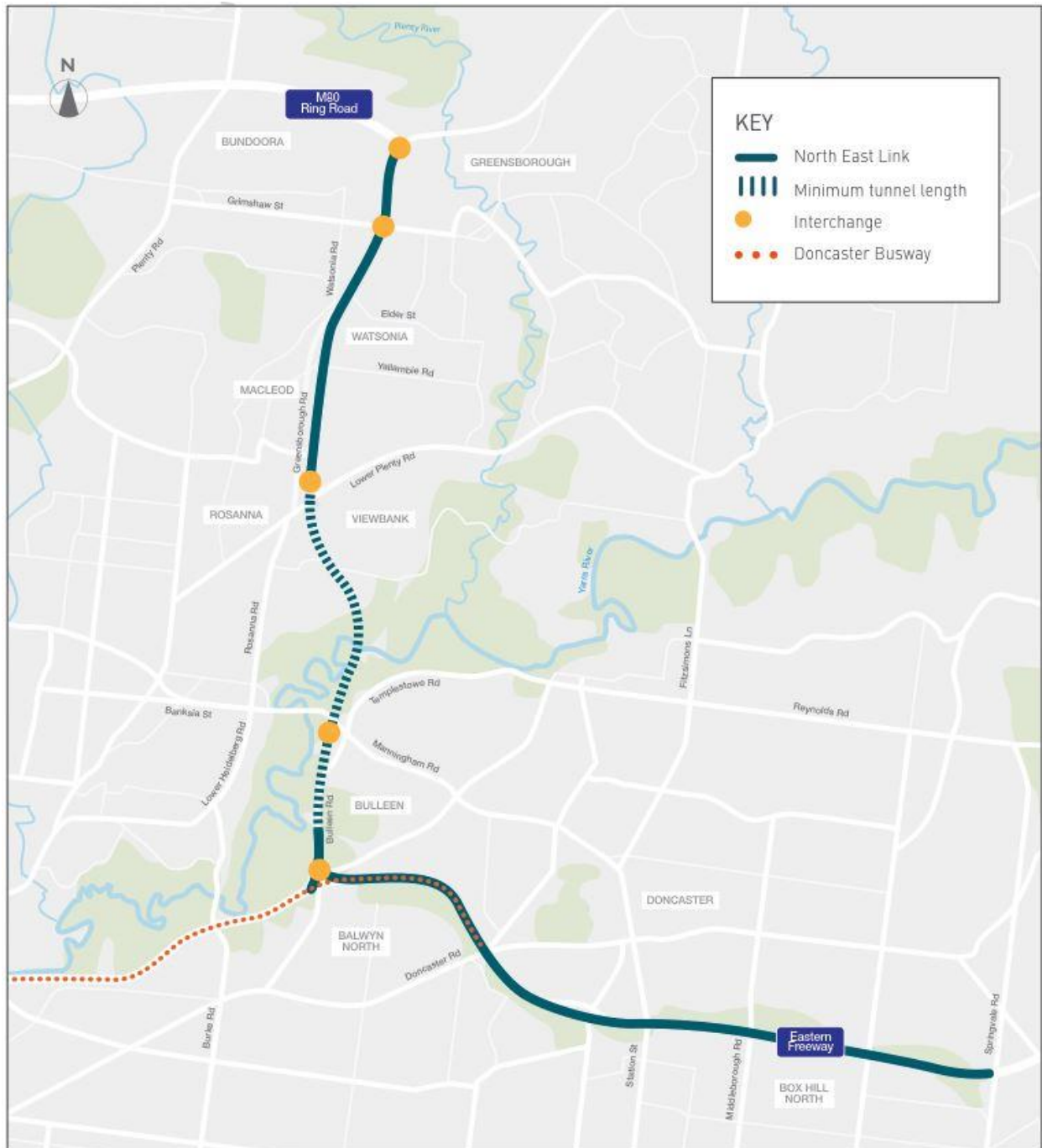
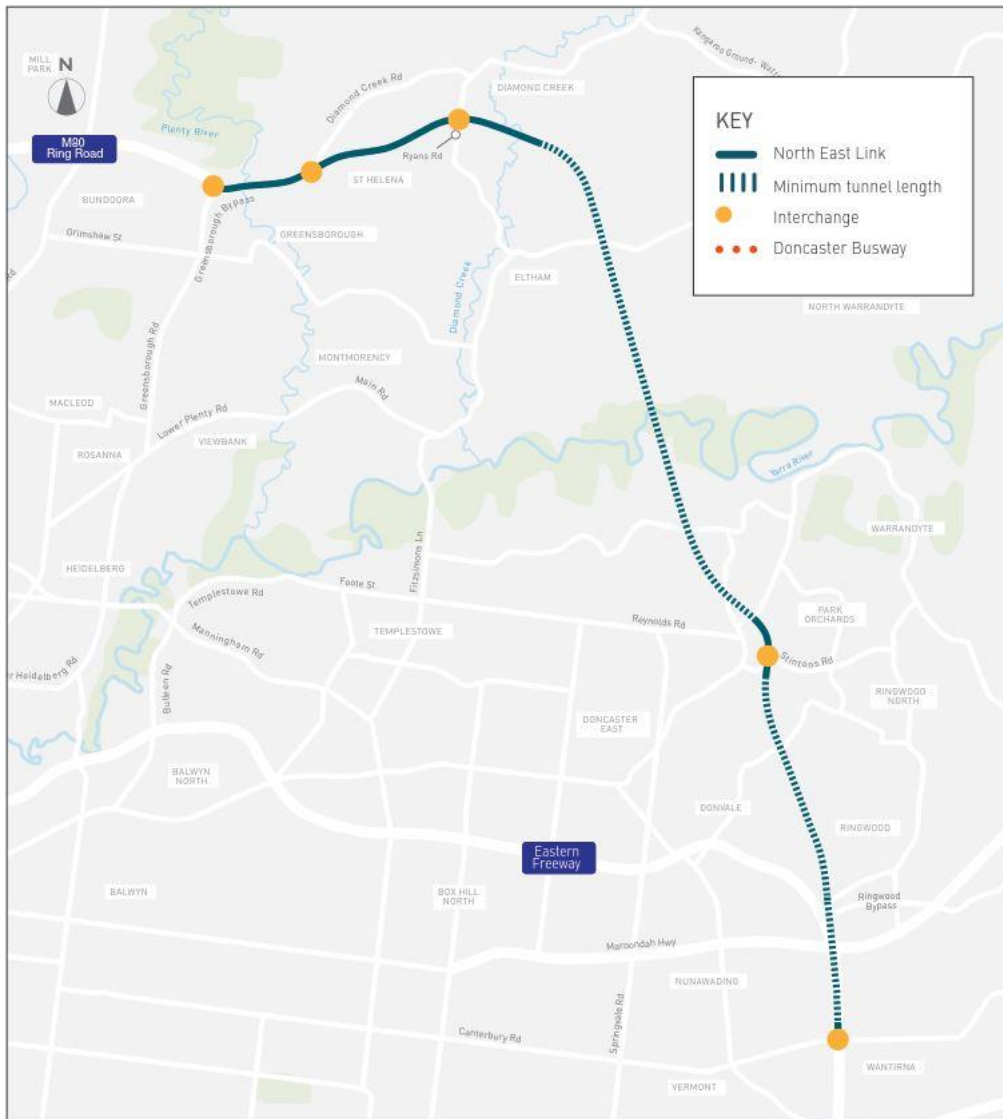


Figure 10 Corridor C concept



2.3.2 Results of detailed appraisal against Project Objectives

This section summaries the results of the detailed appraisal of the identified corridor alignment solutions against the Project Objectives. Options were evaluated against the same criteria used for the rapid appraisal, but using more complex and detailed quantitative measures.

2.3.2.1 Project Objective 1

Improve business access and growth in Melbourne's north, east and south east

Increasing the size of the labour force available to firms is a significant factor in driving productivity growth for businesses. A larger available labour pool means businesses have greater access to highly skilled workers, can better match workers with jobs and can achieve overall productivity gains. This reduces the average cost of production and promotes business growth. Ultimately, growth in the NEICs and MACs within the project catchment will bring jobs closer to workers and generate important benefits, including increased productivity and earnings.

The ability to access additional workers will make locations more attractive for businesses to locate. This may provide opportunities for more intense commercial or industrial development. This can potentially create development pressures where areas have no capacity or plans for growth or it can create development opportunities for places with capacity for growth.

For the detailed appraisal, each corridor was assessed in relation to its ability to improve labour market accessibility, travel time and travel reliability for businesses within the project catchment, all of which lead to improved potential for growth. Each of these indicators has been linked empirically to improved business and worker productivity.

Key findings – Project Objective 1

Corridor A performs more strongly than Corridor C due to:

- Greater ability to improve labour force access for NEICs and MACS, including key business locations at La Trobe, Box Hill, Broadmeadows and Epping
- Similar ability to improve access to labour markets in the broader project catchment
- Ability to provide greater accessibility benefits across the rest of Melbourne (inside the Urban Growth Boundary).

The analysis identifies that Corridor A has the greatest potential to improve businesses access to more workers along the project corridor around the La Trobe NEIC and through the northern suburbs between the M80 and the Eastern Freeway, as well as areas near the Epping MAC – one of the key growth corridors in Melbourne.

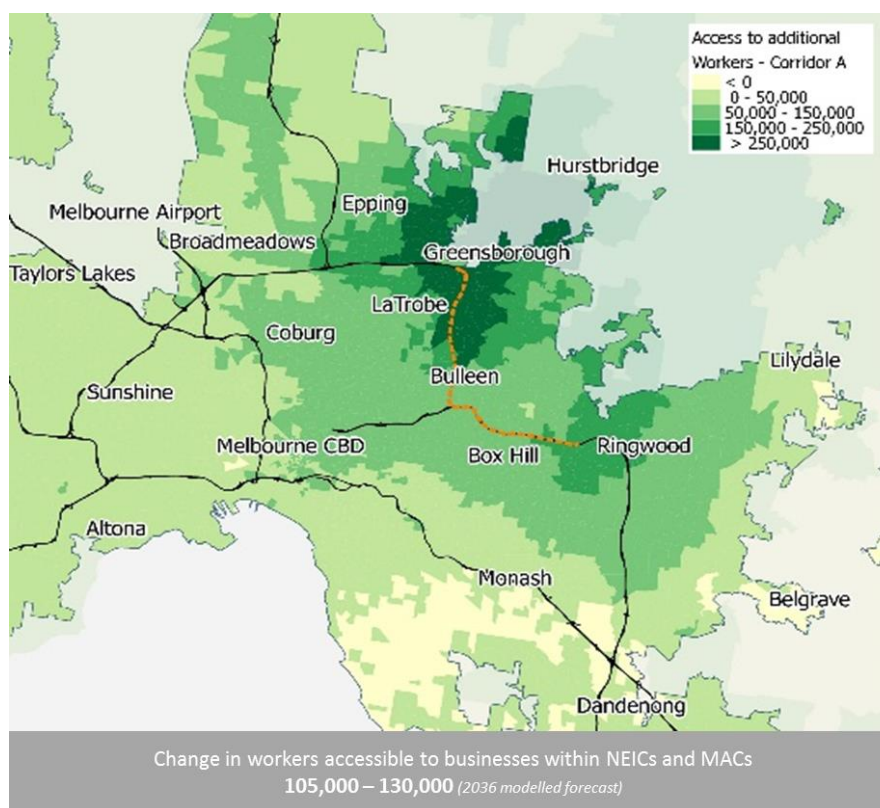
This will make these areas more attractive business locations and lead to business growth, as new firms choose to base themselves in these areas to take advantage of improved access to workers.

The analysis shows that Corridor C is projected to deliver a slightly lower level of improvement in accessibility to key business locations in the project catchment.

A significant proportion of the accessibility gains provided by Corridor C will be to areas outside the Urban Growth Boundary. This could make these areas more attractive for residential, commercial and industrial development, potentially placing pressure on the UGB.

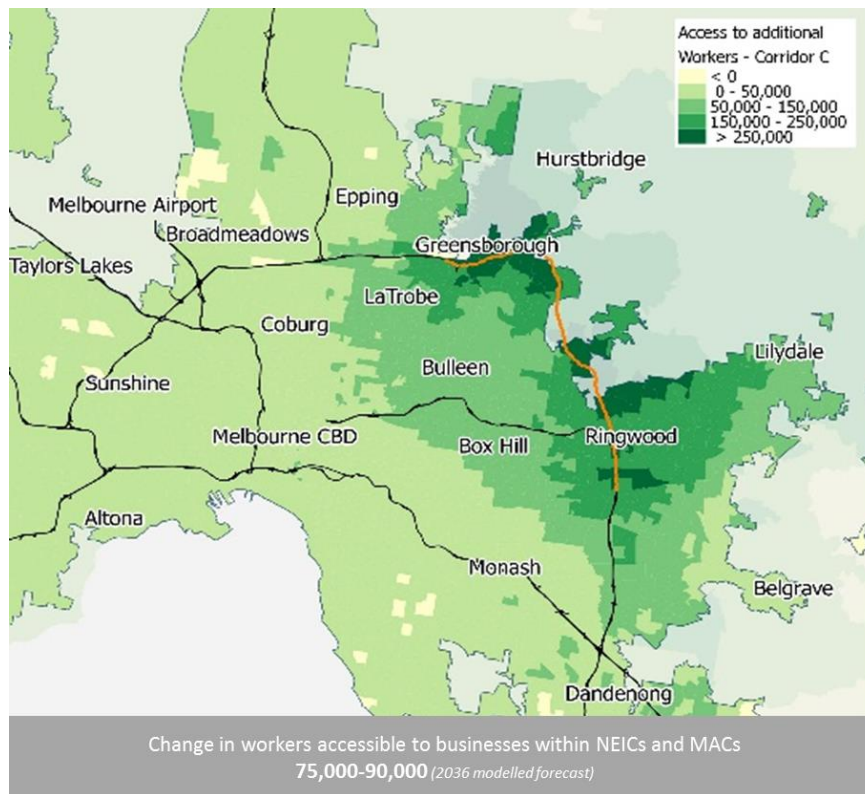
Changes to the level of accessibility across the transport network can often impact future land use patterns. Improving labour market catchments for firms (that is, their ability to access additional workers) and business-to-business accessibility in certain locations are likely to increase the attractiveness of these locations for firms to establish operations. This can result in increased demand for commercial and industrial development in these areas, potentially placing pressures on areas with little or no capacity for such development. Conversely, in locations with capacity, changed levels of accessibility can create opportunities for intensification and business and jobs growth. Further, the additional commercial or industrial activities attracted to areas with improved accessibility are likely to dampen demand for similar commercial or industrial development in other parts of the city.

Figure 11 Change in workers accessible to businesses – Corridor A



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

Figure 12 Change in workers accessible to businesses – Corridor C



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

2.3.2.2 Project Objective 2

Improve household access to employment and education in Melbourne's north, east and south east

This Project Objective requires an assessment of how each corridor option may provide the opportunity to better connect residents in Melbourne's north, north east and south east to employment and education opportunities.

Each corridor option was analysed for its potential to impact on accessibility to employment and education for key residential locations in the project catchment. These locations were identified as being significantly impacted by conflicting local and strategic orbital movements between the M80 and Eastern Freeway/EastLink. They include suburbs such as Rosanna, Eltham, Heidelberg, Bundoora, Greensborough and Bulleen

The potential changes in accessibility to employment and education opportunities for each corridor option were identified by comparing the difference in the number of jobs within a 45-minute car travel time radius from a given location, based on strategic transport modelling of the base case (without the project) and an indicative project case.

Similarly, the change in accessibility to education was calculated by comparing the difference in the number of tertiary places within a 45-minute car travel time radius from a given location based on strategic transport modelling of the base case and an indicative project case for each corridor option.

Changes to the level of accessibility across the transport network can often impact future land use patterns. Improving residents' and households' access to jobs in certain locations is likely to increase the attractiveness of these locations as places to live. This can result in increased demand for residential development in these areas. To analyse the likely areas impacted by this potential change in land use, a land use and transport interaction model was used to estimate the potential redistribution of population. The redistribution of population is used as a proxy to represent the potential impacts of each corridor option in attracting additional residential development due to improved accessibility.

Key findings – Project Objective 2

Both corridors provide similar levels of improved access to employment and education for key residential locations such as Greensborough, Bundoora and Epping. Corridor A provides better access to the broader project catchment and the rest of Melbourne in terms of access to jobs and education.

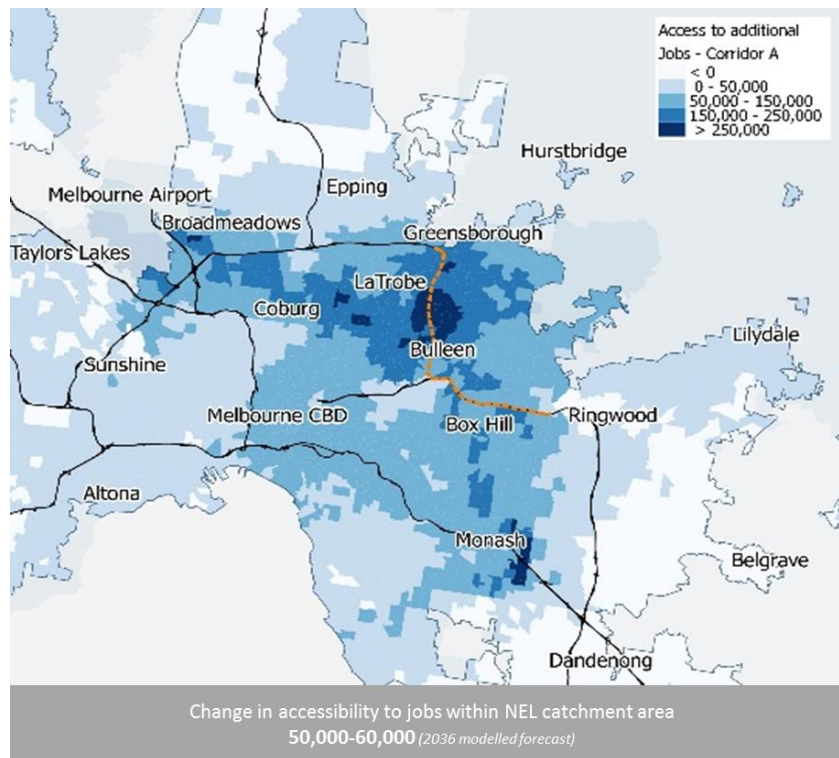
Corridor A is expected to improve accessibility to jobs for a number of key residential locations along the corridor, with the largest improvements in Lower Plenty, Watsonia and Greensborough. Accessibility is also projected to improve modestly across the rest of the project catchment, including around the areas of Box Hill and Ringwood, as shown in Figure 13.

Corridor A also provides the largest improvement in accessibility to jobs and education for Bundoora, which is of particular importance due to the presence of La Trobe University in the area.

Corridor C is expected to provide considerable improvements in accessibility to employment for households in key residential locations along the corridor from the M80 through to Eastlink, with the largest improvements in accessibility occurring in the suburbs of Diamond Creek, Eltham North and Greensborough.

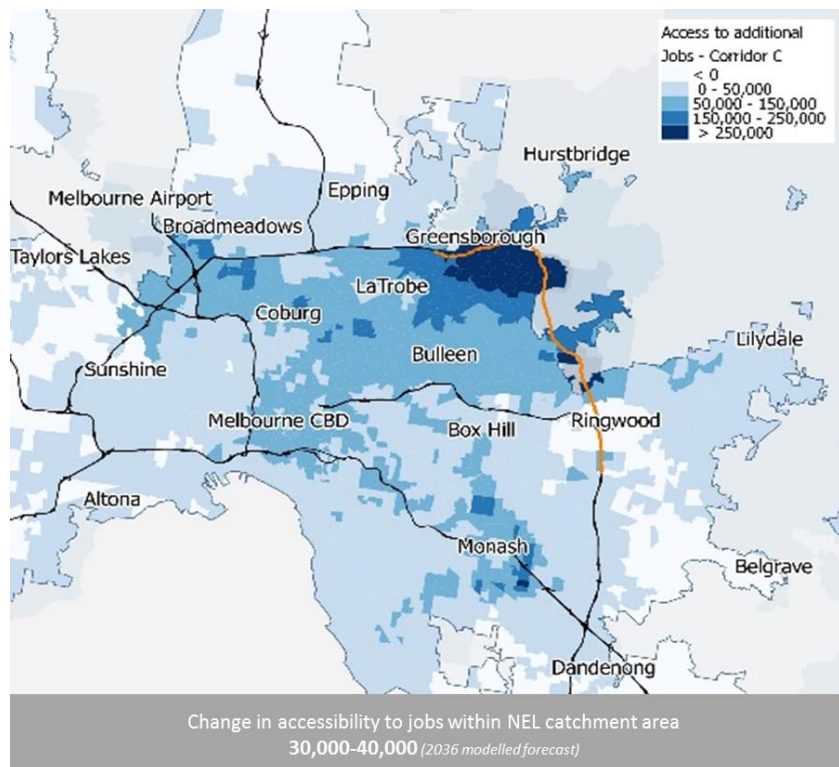
Corridor C is also projected to provide strong benefits to the rest of the project catchment. However, as the figure below shows, while there would be accessibility improvements to areas to the north and east of the proposed alignment, a proportion of those improvements would be in areas outside the Urban Growth Boundary, potentially placing development pressure on these areas (and the UGB), as shown in Figure 14.

Figure 13 Change in accessibility to jobs – Corridor A



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

Figure 14 Change in accessibility to jobs – Corridor C



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

2.3.2.3 Project Objective 3

Improve freight and supply chain efficiency across the north, east and south east

Key attributes of improving freight and supply chain efficiency include providing travel time savings between key industrial locations and providing better access to suppliers. In the context of North East Link, travel time savings occur due to the creation of a new freeway link bypassing signalised intersections and congestion, enabling more direct and reliable travel between key origins and destinations for freight.

Key industrial locations assessed for freight journeys include:

- Dandenong South industrial precinct
- Northern industrial precinct (Somerton, Epping)
- Beveridge Interstate freight precinct
- Scoresby industrial precinct
- Melbourne Airport/Tullamarine industrial precinct.

The change in accessibility to suppliers was estimated using a proxy of access to industrial workers (including manufacturing, construction and wholesale trade employment), based on the understanding that the distribution of industrial workers roughly aligns with the distribution of suppliers throughout Melbourne. Therefore, by proxy, an increase in accessibility to industrial workers would also mean an improvement in accessibility to suppliers.

Change in accessibility to industrial workers has been calculated by the difference in the number of industrial workers within a 45-minute travel time by road between the base case and an indicative project case representative of each corridor option.

Consideration was also given to the ability of a corridor option to provide relief to freight travel on the M1, the ability to carry placarded loads and over-dimensional vehicles, and the ability to integrate with the High Mass Limit (HML) network.

Key findings – Project Objective 3

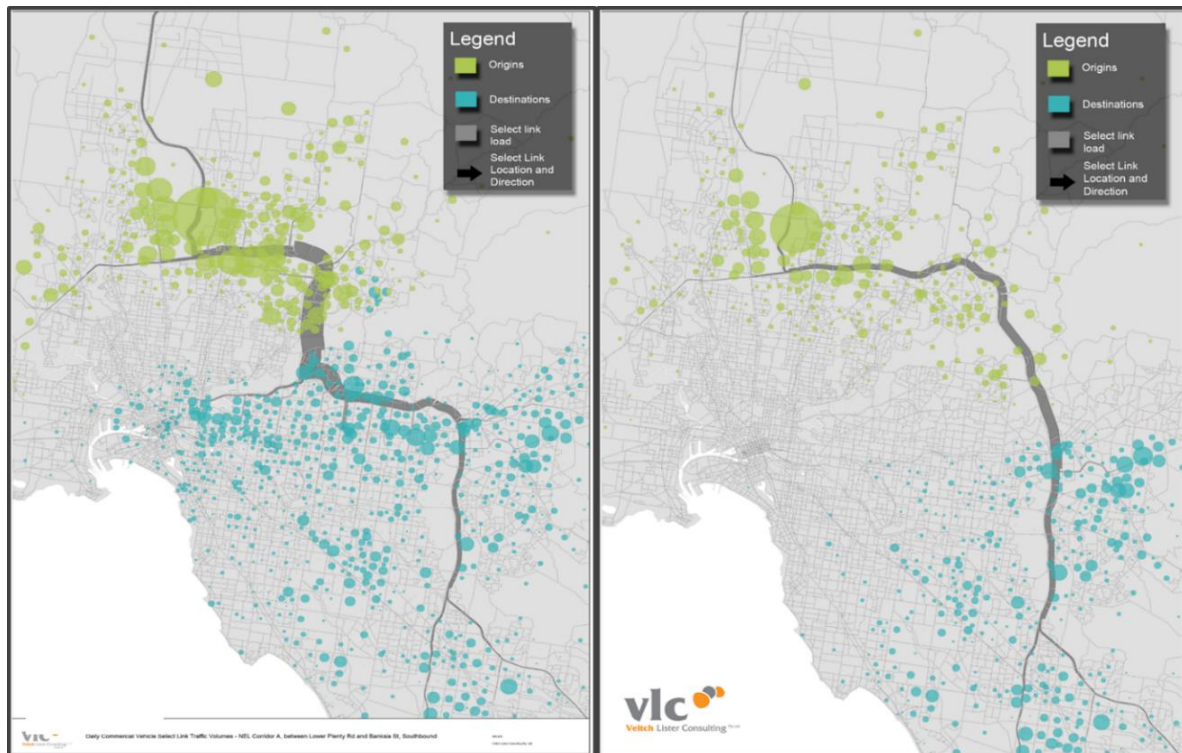
The performance of both corridors is relatively comparable for a number of the criteria that make up the assessment for this objective. However, the following are key differentiators between Corridor A and Corridor C:

- Corridor A provides greater network resilience and redundancy through the redistribution of more trucks from other key routes onto North East Link.
- Corridor A increases the potential for employment growth in key industrial locations.
- Corridor A provides an increased ability to cater for placarded and over-dimensional loads.

Corridor A provides better opportunities to improve freight efficiency across the north east and the whole of Melbourne as it captures more freight trips and provides better travel time savings. Corridor C acts as a bypass for freight, connecting fewer areas of commercial activity and therefore does not provide the same freight transport outcomes as Corridor A.

The detailed appraisal of these measures indicated that Corridor A provides greater opportunity to improve freight and supply chain efficiency and industrial growth for key industrial locations in the project catchment. This is primarily evidenced by its capture of a greater number of freight origins and destinations, as indicated by Figure 15.

Figure 15 Freight origins and destinations for Corridor A and Corridor C



Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

2.3.2.4 Project Objective 4

Improve access, amenity and safety for communities in the north east

The absence of alternative direct freeway or high capacity arterial road connections between industrial precincts and distribution centres in the north, east and south east of the city has led to a number of roads abutting residential properties becoming heavy vehicle routes and routes for medium to long trips through the north east. Trips into and out of the north east and between locations such as Dandenong and Epping typically use the arterial road network in the north east, travelling through residential neighbourhoods along Rosanna Road, Lower Plenty Road, Greensborough Road and Para Road.

These heavy vehicles are often in conflict with the residential or community nature of the road network, passing land uses such as residential properties, schools, community facilities and shops.

The current use of the network in the north east by trucks and heavy through traffic has an impact on the way local communities can use these roads, making public transport slow and unreliable and limiting people who would like to walk and cycle on or across these routes.

To estimate the potential of the corridor options to improve local amenity for households, the assessment considered the ability of each corridor to:

- Reduce traffic on key arterial roads, resulting in improved access and faster and more reliable commutes
- Cater for truck trips, resulting in amenity (air quality and noise) and safety improvements
- Improve access to and provide for improved public transport;

- Improve conditions and connections for cyclists and pedestrians
- Improve connectivity for communities in the north east.

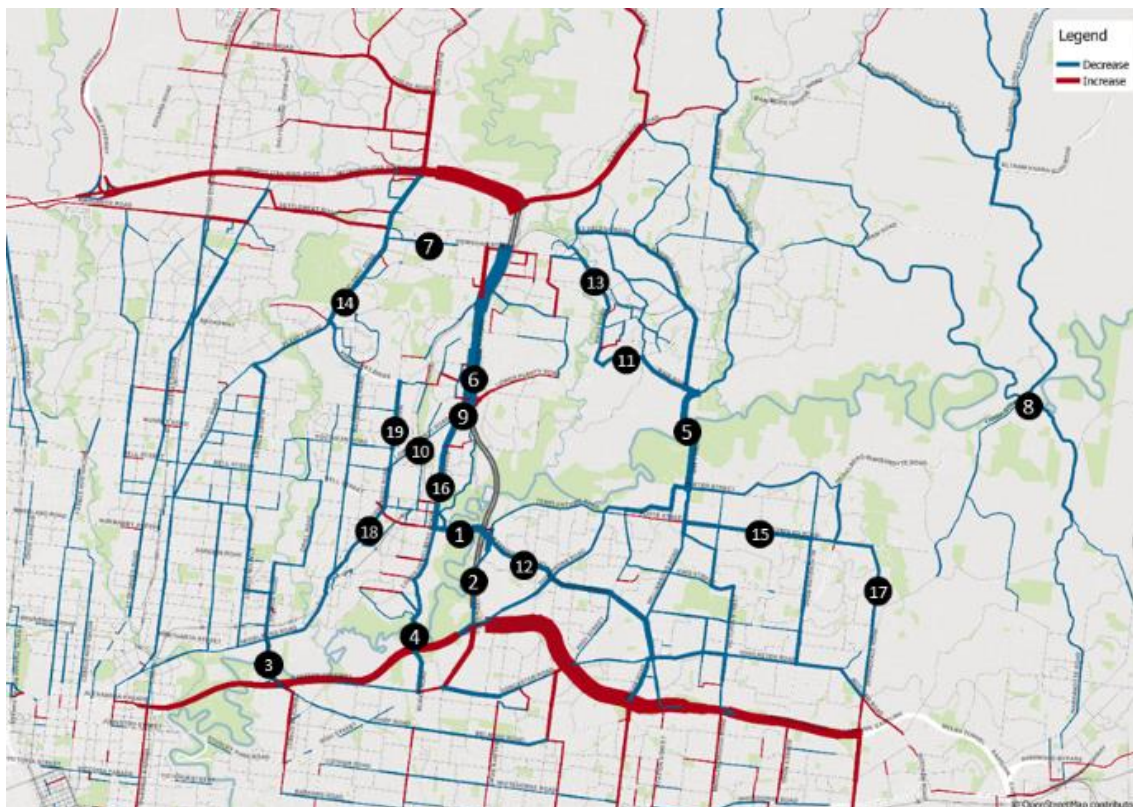
Key findings – Project Objective 4

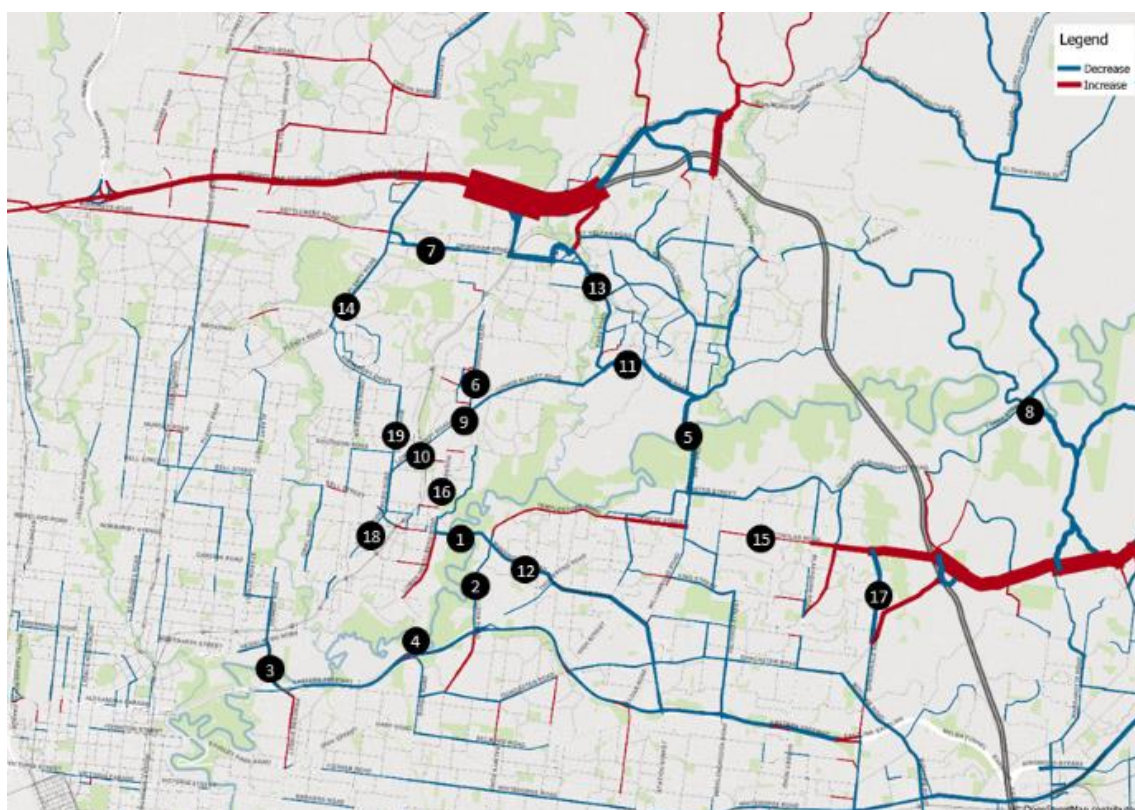
Corridor A significantly outperforms Corridor C with regard to improving access, amenity and safety for communities in the north east. Corridor A connects more places of activity and provides greater attraction for medium to long distance trips through and into and out of the north east; therefore, it has the greater ability to take trucks and longer trips off the existing road network. In summary, Corridor A provides:

- Increased ability to divert heavy vehicle traffic from key arterial and local roads in the north east
- Reductions in traffic volumes on routes currently used by public transport, improving travel times and reliability
- Increased ability to provide improvements for pedestrians and cyclists.

Figure 16 provides an overview of how traffic volumes change on the local road network in 2036 as a result of Corridor A and Corridor C. Table 4 summarises the key locations where traffic reductions are expected to occur.

Figure 16 Corridor A and Corridor C change in daily traffic volumes (2036 project vs no-project)





Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

Table 4 Comparison in traffic reductions Corridor A and Corridor C (2036 modelled volumes)

Location	Corridor A	Corridor C
1 Banksia Street (at Yarra River)	-7,000 to -9,000	-1,000 to -2,000
2 Bulleen Road (north of Eastern Freeway)	-2,000 to -3,000	-500 to -1,000
3 Chandler Highway (at Yarra River)	-4,000 to -5,000	-1,000 to -2,000
4 Burke Road (north of Eastern Freeway)	-6,000 to -8,000	No change
5 Fitzsimons Lane (at Yarra River)	-11,000 to -14,000	-7,000 to -9,000
6 Greensborough Road (between Blamey Road and Watsonia Road)	-20,000 to -30,000	-500 to -1,000
7 Grimshaw Street (west of Watsonia Road)	-1,000 to -2,000	-3,000 to -4,000
8 Kangaroo Ground-Warrandyte Road (Warrandyte Bridge at Yarra River)	-5,000 to -6,000	-5,000 to -7,000
9 Lower Plenty Rd (between Greensborough Road and Rosanna Road)	-11,000 to -14,000	-500 to -1,000
10 Lower Plenty Road (west of Rosanna Road)	-500 to -1,000	-500 to -1,000
11 Main Road (between Para Road and Bolton Street)	-3,000 to -4,000	-3,000 to -4,000
12 Manningham Road (between Bulleen Road and Thompsons Road)	-7,000 to -9,000	-3,000 to -4,000
13 Para Road (between Rattray Road and Main Road)	-2,000 to -3,000	-1,000 to -2,000
14 Plenty Road (north of Kingsbury Drive)	-7,000 to -9,000	-1,000 to -2,000

Location		Corridor A	Corridor C
15	Reynolds Road (between Blackburn Road and Williamsons Road)	-5,000 to -6,000	-500 to -1,000
16	Rosanna Road (south of Lower Plenty Road)	-9,000 to -11,000	-500 to -1,000
17	Springvale Road (north of Mitcham Road)	-4,000 to -5,000	-7,000 to -9,000
18	Upper Heidelberg Road (between Banksia Street and Studley Road)	-2,000 to -3,000	-500 to -1,000
19	Wairoa Road (between Southern Road and Dougharty Road)	-6,000 to -8,000	-1,000 to -2,000

Source: VLC Zenith Model – Strategic transport modelling outputs for North East Link

2.3.3 Results of detailed appraisal assessment against Guiding Principles

2.3.3.1 Guiding Principle 1

Minimise impacts on communities

As with any major project, there will be impacts on communities whichever option is selected and each option would affect different individuals and communities.

To identify the potential impacts of each corridor option on communities, the following areas were assessed:

- Potential property acquisition
- Alignment with community values, including local government strategic planning, Plan Melbourne and valued places
- The option's impact on community cohesion (promotes safe places, limits or reduces severance, integrates land uses)
- How the option affects landscape and visual characteristics
- How the option affects sensitive receptors (including social infrastructure), with consequent amenity impacts (air quality, noise and vibration).

Key findings – Guiding Principle 1

Both corridors have the potential to impact significantly on communities due to the scale of the North East Link Project and its construction and operation within an urban setting.

Incorporating tunnels into the design provides a means to avoid areas of community sensitivity and minimise impacts, however both corridors would have surface and elevated elements, particularly in the vicinity of interchanges.

Direct effects on properties would be significant for both corridors. Corridor A has a greater potential to directly affect business properties while Corridor C has a greater effect on residential properties. Both corridors would affect areas of open space, with Corridor A having potentially greater effects.

In terms of key State policies such as Plan Melbourne and the *Yarra River Protection Act 2017*, Corridor A has greater possibility of affecting the Yarra River environs, while Corridor C would place greater pressure on the Urban Growth Boundary.

Both corridors have the potential for severance and visual impacts associated with surface and elevated road elements which would require mitigation through design and close consultation with affected councils and residents. Overall, the severance and visual impacts associated with Corridor A were considered to be comparable to those associated with Corridor C.

The number of residences with exposure to potential changes in air quality and noise conditions is expected to be greater for Corridor A than Corridor C, largely due to the higher density of population in the immediate area.

Overall, both corridors are assessed as performing comparably in relation to impacts to communities due to the scale of the project and lack of existing road reservation.

2.3.3.2 Guiding Principle 2

Minimise impacts on environmental and cultural assets

This Guiding Principle considers the potential for the corridor options to impact on the environment and cultural assets in the north east, including the potential impacts of the corridor option on:

- Areas of high ecological value and native vegetation
- Victorian heritage places and areas of aboriginal cultural significance to the Wurundjeri people
- Waterways, including waterway health and flooding
- Groundwater
- Greenhouse gas emissions.

Key findings – Guiding Principle 2

Corridor A and Corridor C pass through areas containing significant ecological and cultural assets. The corridor alignments have been informed by the location of the key ecological and heritage constraints and tunnels have been used to avoid direct impacts on key features such as the Yarra River. Nevertheless, surface works on both corridors have the potential to impact on ecological and cultural assets.

Corridor C is likely to have more severe ecological impacts than Corridor A, largely due to the greater amount of native vegetation that would require removal. While some important remnant vegetation exists along Corridor A, Corridor C is less developed and contains superior ecological values such as more extensive intact native vegetation remnants.

Corridor C is assessed as better than Corridor A in relation to protection of heritage values, due to the higher concentration of known heritage places and more significant areas of Aboriginal cultural heritage sensitivity in Corridor A.

Both corridors would avoid significant impacts on the Yarra River through tunnelling. Potential impacts on waterways are considered comparable between the corridors. While flooding issues are likely to be more challenging to manage for Corridor A, the potential risks to waterway health (in particular Plenty River, Diamond Creek and Mullum Mullum Creek) are considered greater for Corridor C.

Groundwater issues are considered comparable for both corridors. While Corridor C has a greater length of underground works, the hydrogeological conditions are more amenable for this alignment.

Construction and operations greenhouse gas emissions are estimated to be significantly higher for Corridor C than for Corridor A due to the scale of construction and materials required and the greater energy requirements for tunnels during the project's operations phase.

Overall, Corridor A and Corridor C perform comparably in relation to minimising impacts on environmental and cultural assets.

2.3.3.3 Guiding Principle 3

Minimise impacts during the construction phase

Construction of North East Link will take approximately seven years and has the potential to impact on the local community over this time depending upon construction methodology and the alignment of the corridor.

This criterion assesses how each option impacts the arterial and freeway road network during the construction phase. Construction of the project can cause significant disruption to the road network, with road closures and additional trucks on the network needed to move construction material and equipment causing lengthy delays for motorists. Measures investigated at this stage include:

- How the option has the potential to impact on rail-based public transport.
- How the option has the potential to impact on the existing road network during construction.
- How the option has the potential to affect amenity during construction.

Key findings – Guiding Principle 3

The construction of a major project on the scale of North East Link has the potential to have significant impacts on local and surrounding areas, particularly during construction; this is true for the construction of both the Corridor A and Corridor C alignments.

Corridor C benefits from being constructed through a predominantly greenfield environment where most construction activities are generally further away from residential areas. However, the undulating topography would create greater construction challenges.

While Corridor A would be constructed through a built-up environment, the flatter topography and shorter alignment length make construction marginally easier to manage. The complexity in Corridor A lies in the deep cut sections leading up to Lower Plenty Road, the quality of ground material for tunnelling and the connection to the Eastern Freeway.

The detailed appraisal of this measure indicated that Corridors A and C are comparable with respect to minimising impacts on rail-based public transport during construction.

The key differentiator between the two corridors is the reduced scale and duration of the project, with a significant difference in excavated material to be managed and transported. Corridor C is estimated to generate approximately seven million cubic metres of spoil compared to an estimated four million cubic metres generated by Corridor A. The additional three million cubic metres for Corridor C is due mainly to tunnelling under the Yarra River and the EastLink connection. The removal of spoil is expected to require up to 500,000 truck movements for Corridor A and over 1,000,000 truck movements for Corridor C during the construction period.

Potential Corridor A haul routes have easier access to major arterial roads, which will ease the removal of spoil from site. Corridor C is mostly a rural alignment with a limited road network; haul routes will be required to use local roads to remove spoil, which will increase traffic congestion and cause greater road degradation due to higher truck use.

Overall, Corridor A outperforms Corridor C in minimising impacts during the project's construction phase.

2.3.3.4 Guiding Principle 4

Optimise the efficient use of resources

Guiding Principle 4 assesses the degree to which each corridor option provides an optimal and efficient use of resources – from a transport network perspective and a value for money perspective. In assessing the ability of each option to optimise the efficient use of resources, the following measures have been identified:

- The estimated cost of the option
- How well the option might perform in relation to benefits
- Ability of the option to unlock spare capacity in the existing network
- Ability for the option to ‘future proof’ the transport network.

Key findings – Guiding Principle 4

Corridor A provides a more effective response than Corridor C in relation optimising the efficient use of resources. Key differentiators are:

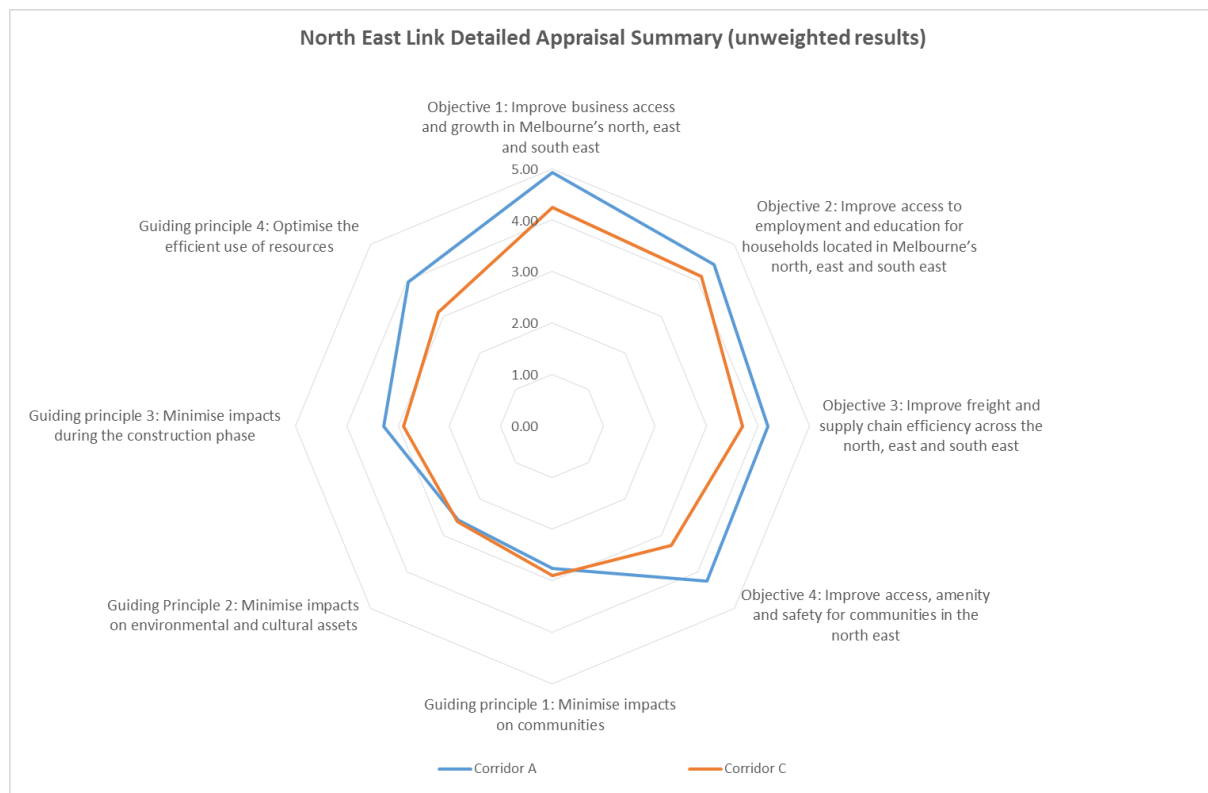
- Lower capital cost: Corridor A (up to \$16.5 billion (nominal D&C costs at P90)) provides a significantly lower capital cost outcome than Corridor C (up to \$24 billion (nominal D&C costs at P90)).
- Lower operational cost: Corridor A provides a significantly lower operational cost outcome than Corridor C at up to \$6 billion and \$9 billion respectively.
- More efficient use of the asset: Corridor A provides a more optimal, efficient and well-used roadway than Corridor C - with a greater volume to capacity ratio.
- Unlocks greater capacity on the arterial road network: Corridor A outperforms Corridor C in that it is expected to provide a net decrease in arterial road vehicle kilometres travelled (VKT) across metropolitan Melbourne. Corridor C is not expected to cause a net change in VKT on arterial roads.

Based on this assessment, Corridor A provides a more efficient use of resources.

2.3.4 Selection of corridor

Both shortlisted corridor options have the potential to deliver significant benefits to the transport network and have significant impacts on communities due the scale of the project and its presence within an urban setting. The detailed assessment process has undertaken a comprehensive assessment of Corridors A and C, aimed at balancing the objectives of the project to improve the economic output of the north east of Melbourne and Victoria more broadly and the amenity of communities in the north east. This assessment identified that Corridor A performs more effectively in relation to the Project Objectives and Guiding Principles than Corridor C.

Figure 17 Detailed appraisal summary



Appendix A – Transport Integration Act

The Transport Integration Act 2010 (Vic) (the TIA) is Victoria's main transport statute. It brings together the transport portfolio under one framework with the aim of developing 'an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State'.

The TIA aims to ensure that Victoria's transport system delivers balanced economic, environmental and social outcomes, and requires all transport agencies to work together toward the common goal of an integrated, sustainable transport system. Agencies responsible for urban and regional planning must have regard to the TIA when making land use decisions that impact on the transport system.

The Project Objectives and Guiding Principles developed for North East Link (which provided the basis for assessing project options) were formulated having regard to the transport system objectives and decision-making principles of the TIA. This is demonstrated in the tables below which summarise the alignment of each transport system objective with corresponding Project Objectives and Guiding Principles along with the more detailed evaluation criteria and measures.

Table A1 Alignment with TIA transport system objectives

Transport system objective	Relevant Project Objectives and Guiding Principles	Evaluation criteria and measures
Social and economic inclusion	<p>Project Objective 2: Improve access to employment and education for households in Melbourne's north, east and south east</p> <p>Project Objective 4: Improve access, amenity and safety for communities in the north east</p> <p>Guiding Principle 1: Minimise impacts on communities</p>	<p>Evaluation criteria and measures to assess the ability of corridor options to foster social and economic inclusion included:</p> <ul style="list-style-type: none"> Jobs growth in key locations Additional jobs accessible to households Additional placements accessible to students Change in travel times for commuting and education trips Change in travel times between residential areas and key local destinations in the north east Improved access to public transport Improved conditions and connections for cyclists and pedestrians. <p>These criteria were applied to the project corridor, the broader project catchment and the rest of Melbourne. Options were also evaluated for their potential impacts on community cohesion.</p>
Economic prosperity	<p>Project Objective 1: Improve business access and growth in Melbourne's north, east and south east</p> <p>Project Objective 3: Improve freight and supply chain efficiency and industrial growth across the north, east and south east</p> <p>Guiding Principle 4: Optimise the efficient use of resources</p>	<p>Evaluation criteria and measures to assess the improved economic prosperity delivered by corridor options included:</p> <ul style="list-style-type: none"> Additional workers accessible to firms Travel time savings and improved travel reliability for businesses Change in business access to suppliers Change in travel times for freight trips. <p>These criteria were applied to NEICs, MACs and other key business and industrial locations along the project corridor, the broader project catchment and the rest of Melbourne.</p>

Transport system objective	Relevant Project Objectives and Guiding Principles	Evaluation criteria and measures
Environmental sustainability	<p>Project Objective 4: Improve access, amenity and safety for communities in the north east</p> <p>Guiding Principle 2: Minimise impacts on environmental and cultural assets</p>	<p>Evaluation criteria and measures to assess each option's environmental sustainability included:</p> <ul style="list-style-type: none"> • Potential impacts on parks and public open space • Potential impacts on matters of national environmental significance • Potential impacts on flora and fauna, including rare or threatened species and native vegetation of conservation significance • Potential to affect waterways, including river and catchment health • Potential to affect groundwater flow, levels and use • Flooding risk. <p>Estimates were also made of greenhouse gas emissions generated by project options during construction and operation.</p>
Integration of transport and land use	<p>Project Objective 1: Improve business access and growth in Melbourne's north, east and south east</p> <p>Project Objective 2: Improve access to employment and education for households in Melbourne's north, east and south east</p> <p>Project Objective 3: Improve freight and supply chain efficiency and industrial growth across the north, east and south east</p> <p>Project Objective 4: Improve access, amenity and safety for communities in the north east</p>	<p>The options assessment process considered how changes to accessibility delivered by the project may affect future land use patterns. This included evaluating how some locations may become more attractive for commercial, industrial and residential development. Consideration was also given to potential development pressures on the Urban Growth Boundary.</p> <p>Specific evaluation criteria included:</p> <ul style="list-style-type: none"> • Change in commercial development and employment growth in key locations • Change in residential development potential and population growth in key locations • Compatibility with Victorian Government planning policies.
Efficiency, coordination and reliability	<p>Guiding Principle 3: Minimise impacts during the construction phase</p> <p>Guiding Principle 4: Optimise the efficient use of resources</p>	<p>Evaluation criteria and measures to assess the ability of project options to foster greater efficiency, coordination and reliability included:</p> <ul style="list-style-type: none"> • Extent of impacts on the road network and public transport services during construction • Number of additional truck movements during construction • Efficient use of the asset • Ability to unlock spare capacity in the arterial road and freeway networks • Ability to 'future proof' the transport network, including provision for future public transport improvements and catering for future technologies.

Transport system objective	Relevant Project Objectives and Guiding Principles	Evaluation criteria and measures
Safety and health and wellbeing	<p>Project Objective 4: Improve access, amenity and safety for communities in the north east</p> <p>Guiding Principle 1: Minimise impacts on communities</p> <p>Guiding Principle 3: Minimise impacts during the construction phase</p>	<p>Evaluation criteria and measures for determining the contribution of project options to safety, health and wellbeing included:</p> <ul style="list-style-type: none"> • Change in heavy vehicle traffic on key arterial roads in the north east • Improved connectivity for communities in the north east • Improved conditions and connections for cyclists and pedestrians • Extent of land acquisition impacts • Potential impacts on community facilities • Potential to reduce severance • Extent of impacts on visual amenity and sensitive landscapes. <p>Options were also evaluated for their potential amenity impacts on sensitive receptors (such as residences, schools and hospitals) during construction and operation.</p>

Table A2 Alignment with TIA decision-making principles

Decision-making principle	Features of North East Link
Integrated decision-making	<p>This principle means seeking to achieve Victorian and national policy objectives through coordination between levels of government and with the private sector.</p> <p>The North East Link Project has been developed jointly by the Victorian Government and the North East Link Authority. This process has included collaboration across multiple areas of government on concept development and technical aspects.</p> <p>The Project Objectives and Guiding Principles were developed through consultation and workshops with key agencies and stakeholders including Transport for Victoria (TFV), Department of Treasury and Finance (DTF), Department of Premier and Cabinet (DPC), Victorian Planning Authority (VPA) and VicRoads.</p> <p>The project considered and is consistent with national and Victorian policy objectives, including Victoria's 30-year infrastructure strategy, the Australian Infrastructure Plan, the national Smart Cities Plan and Plan Melbourne 2017-2050.</p> <p>Integrated decision-making will be an ongoing feature of the project, with NELA continuing to consult with government agencies, local councils, community and business organisations and service providers throughout the project's assessment through the EES process, design development and delivery phases.</p>
Triple bottom line assessment	<p>This principle means assessing the economic, social and environmental costs and benefits, taking into account externalities and value for money.</p> <p>The framework used to assess, refine and select options for the project is supported by evaluation criteria designed to compare options based on a triple bottom line assessment. These criteria are aligned directly with the Project Objectives and Guiding Principles. Guiding Principle 2 (minimise impacts on environmental and cultural assets) and Guiding Principle 4 (optimise the efficient use of resources) are particularly aligned with triple bottom line assessment.</p> <p>When assessing project options against this principle, 'costs' and 'benefits' equate with anticipated economic, social and environmental impacts. These impacts were identified for the detailed appraisal of corridors A and C and will be subjected to further assessment as part of the EES process for Corridor A. Measures to mitigate adverse impacts will also be identified during this process.</p>

Decision-making principle	Features of North East Link
Equity	<p>This principle means equity between persons irrespective of their personal attributes or location, and equity between generations.</p> <p>Project Objective 2 (improve access to employment and education for households in Melbourne's north, east and south east) and Project Objective 4 (improve access, amenity and safety for communities in the north east) are relevant to this principle as they seek to significantly improve accessibility and connectivity across the project catchment and Melbourne more broadly, including for households in areas of relatively high socio-economic disadvantage.</p> <p>The assessment of project options has included a preliminary assessment of matters relevant to intergenerational equity. This includes indicative estimates of resource use and greenhouse gas emissions in the concept for the project, and identifying potential ecological impacts during the project's construction and operation. Lifecycle costs have been incorporated into the project concept and proposed delivery strategy to reduce the operational and maintenance costs of the asset over the longer term.</p> <p>Project structures (such as pedestrian bridges and bicycle paths) will comply with the national Disability Discrimination Act 1992.</p>
Transport system user perspective	<p>This principle means understanding the requirements of transport system users and enhancing the quality of their experiences when using the transport system.</p> <p>Options assessment has considered in detail the requirements of motorists, freight operators, bus operators and customers, and pedestrians and cyclists. These requirements provided the basis for selecting the corridor.</p> <p>Feedback from potential users of North East Link has informed the development of the project to date and engagement with individual and community stakeholders will continue as the project proceeds through the reference design, environmental assessment, planning approvals and delivery phases.</p> <p>Urban design principles developed for the project will include requirements related to accessibility, legibility and safety, and to providing an engaging driver experience for users of North East Link. The project's proposed managed motorway system will incorporate the use of real-time messaging to give drivers information about traffic conditions on the link.</p>
Precautionary principle	<p>The precautionary principle means that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</p> <p>The assessment of project options included consideration of environmental impacts to meet Guiding Principle 2 (minimise impacts on environmental and cultural assets). No threats of serious or irreversible damage have been identified. Where potential adverse impacts have been identified, these will be investigated further during the EES process and measures identified to avoid, mitigate and manage these impacts.</p>
Stakeholder and community participation	<p>This principle means considering the interests of stakeholders (including transport system users) and adopting appropriate processes for community engagement.</p> <p>Extensive community and stakeholder engagement has been undertaken in developing the Project Objectives and Guiding Principles and applying these to the assessment of corridor options. NELA sought early input from the community, local councils and non-government organisations before starting to investigate potential project corridors, including seeking views on issues such as individual and community values that are important to people in the north east, and feedback on the opportunities and challenges a project like this presents.</p> <p>The options assessment considered opinions and information provided by the community and stakeholders where these were supported by evidence and technical investigations. The assessment also considered questions raised by community members and stakeholders. The Community Engagement Report August – October 2017 published by NELA in early November shows how community input informed the corridor assessment.</p> <p>There will be further opportunities for community and stakeholder input into the development of the project as part of subsequent design, planning and environmental assessment processes.</p>

Decision-making principle	Features of North East Link
Transparency	<p>The principle of transparency means that members of the public should have access to reliable and relevant information to facilitate a good understanding of transport issues and the process by which decisions in relation to the transport system are made.</p> <p>NELA has used a range of activities and tools to inform members of the public about the project and its progress, and to understand the concerns and requirements of users of the transport system, residents, businesses, freight operators and local councils. Channels of communication have included drop-in community information sessions, a website and Facebook page, and the publication of Community Update newsletters, factsheets and technical documents.</p> <p>Proactive communication about next steps and time frames in the planning and procurement processes and engagement activities will continue to be undertaken as the project proceeds to delivery. The EES process will make detailed information about the project and its potential environmental effects publicly available and give members of the public the opportunity to provide comments.</p> <p>Ultimately, the project will be designed, constructed and operated in accordance with a detailed Environmental Management Framework documented in the EES. The EMF is a transparent framework that identifies who is accountable for managing the environmental aspects of the project and auditing, monitoring and reporting about specific potential environmental impacts.</p>

Appendix B – Appraisal Criteria and Measures for Detailed Appraisal

Project Objectives/ Guiding Principles	Criteria	Measure
Objective 1: Improve business access and growth in Melbourne's north, east and south east	How does the option improve access and growth for key business locations in the project catchment?	Additional workers accessible to firms within 45 minutes for NEICs and MACs
		Change in travel times for business trips between key business locations
		Change in reliability for business trips between key business locations
		Change in commercial development potential and employment growth for key business locations
	How well does the option improve business access and growth for the rest of the project catchment?	Additional workers accessible to firms within 45 minutes the project catchment
		Change in travel times for business trips in the project catchment
		Change in reliability for business trips in the project catchment
	How well does the option improve business access and growth for other metropolitan areas?	Additional workers accessible to firms within 45 minutes for the rest of metropolitan Melbourne
		Change in travel times for business trips across the rest of metropolitan Melbourne
		Change in reliability for business trips across metropolitan Melbourne
Objective 2: Improve access to employment and education for households located in Melbourne's north, east and south east	How does the option improve household access to employment and education for key residential locations in the project catchment?	Additional jobs accessible to households within 45 minutes for key residential locations
		Additional placements accessible to students within 45 minutes for key residential locations
		Change in residential development potential and population growth for key residential locations
	How does the option improve household access to employment and education for the rest of the project catchment?	Additional jobs accessible to households within 45 minutes for the project catchment
		Additional placements accessible to students within 45 minutes for the project catchment
		Change in travel times for commute and education trips in the project catchment
	How does the option improve household access to employment and education for other metropolitan areas?	Additional jobs accessible to households within 45 minutes for the rest of metropolitan Melbourne
		Additional placements accessible to students within 45 minutes for the rest of metropolitan Melbourne
		Change in travel times for commute and education trips across metropolitan Melbourne

Project Objectives/ Guiding Principles	Criteria	Measure
Objective 3: Improve freight and supply chain efficiency across the north, east and south east	How does the option improve freight and supply chain efficiency and industrial growth for key industrial locations in the project catchment?	Change in access to suppliers within 45 minutes for key industrial locations
		Travel time savings between key industrial locations
		Change in traffic volumes on M1
	How does the option improve freight and supply chain efficiency and industrial growth for the rest of the project catchment?	Change in access to suppliers within 45 minutes for other industrial areas in the project catchment
		Change in travel times for freight trips in the project catchment
		Ability to carry placarded loads
		Ability to carry over-dimensional loads
	How does the option improve freight and supply chain efficiency and industrial growth for other metropolitan areas?	Change in access to suppliers within 45 minutes for other industrial locations across metropolitan Melbourne
		Change in travel times across metropolitan Melbourne
	How does the option integrate with the existing freight network?	Integration with Higher Mass Limit (HML) network
Objective 4: Improve access, amenity and safety for communities in the north east	How does the alignment divert heavy vehicles away from roads used by locals, resulting in amenity (air quality and noise) and safety improvements?	Change in heavy vehicle traffic on key arterial roads in the north east
		Attractiveness of each corridor for trucks
	How does the option improve access to and provide for improved public transport?	Provision for future PT services on existing roads
		Priority for PT on the new road
	How does the option improve conditions and connections for cyclists and pedestrians?	Provision for separate dedicated cycle and walking paths on existing roads
		Provision for shared use paths on existing roads
		Potential to improve connection of existing walking and cycling paths in the north-east
		Change in heavy vehicle traffic on/near existing pedestrian and cycling links
	How does the option improve connectivity for communities in the north east?	Change in travel times between local residential, retail, employment and services locations for road users in the north east
		Change in travel times between local residential, retail, employment and services locations for public transport users in the north east
		Interchanges and access to local areas previously disconnected

Project Objectives/ Guiding Principles	Criteria	Measure
Guiding principle 1: Minimise impacts on communities	How does the option directly affect communities and businesses?	Number of residential properties potentially directly affected
		Number of businesses potentially directly affected
		Number of community facilities potentially directly affected
		Area of public open space potentially directly affected
		Area of State or National Park potentially directly affected
	How does the option align with community values including local government strategic planning, Plan Melbourne, valued places?	Compatibility with local government strategies and vision
		Compatibility with state government strategies
	How does the option affect community cohesion, (promotes safe places, limits or reduces severance, integrates land uses)	Impacts on community facilities as the result of reduced function and viability
		Severance of residential or other cohesive areas
	How does the option affect landscape and visual characteristics?	Extent of impact on the visual amenity of adjacent residents
		Extent of visual impact on parks and open spaces, relevant historical heritage sites and tourism sites
		Extent of impact on sensitive landscape character types
	How does the option affect sensitive receptors (including social infrastructure), with consequent amenity impacts (air quality, noise and vibration)?	Residential properties above a tunnel alignment (construction vibration)
		Sensitive receptors (schools, hospitals, aged care) above a tunnel alignment (construction vibration)
		Residential properties within 80m of edge of new surface roads and interchanges
		Sensitive receptors (schools, hospitals, aged care) with 80m of edge of new surface roads and interchanges
		Residential properties within 100m of centreline of existing surface roads experiencing higher traffic volumes
		Sensitive receptors (schools, hospitals, aged care) with 100m of centreline of existing surface roads experiencing higher traffic volumes
		Residential properties within 400m of indicative tunnel portals and likely ventilation outlet
		Sensitive receptors (schools, hospitals, aged care) with 400m of indicative tunnel portals and ventilation outlet locations

Project Objectives/ Guiding Principles	Criteria	Measure
Guiding Principle 2: Minimise impacts on environmental and cultural assets	How does the option affect flora and fauna?	Potential for impacts to Environment Protection and Biodiversity Conservation (EPBC) Act matters of national environmental significance
		Potential for impacts to species, communities and processes listed under the FFG Act
		Extent of impact to native vegetation which is of very high conservation significance
		Extent of impact on areas of high ecological value (identified using NaturePrint)
	How does the option affect aboriginal cultural and historical heritage?	Extent of impact on registered cultural heritage places on the Victorian Aboriginal Heritage Register (VAHR)
		Extent of impact on culturally sensitive areas (within 200 metres of watercourses)
		Extent of impact on significant heritage sites (Victorian Heritage Register, Victorian Heritage Inventory, Heritage Overlay places)
	How does the option affect waterways?	Number of waterway crossings
		Footprint that intersects with waterway area and riparian zone
		Extent of impact to waterway value, local scale river health and health of the catchment system.
		Potential to increase flooding risk (taking into account effective width of the floodplain and complexity of floodplain interactions)
	How does the option affect groundwater?	Extent of disruption to groundwater flow and availability
		Potential for long term alteration of groundwater levels
		Extent of potential impact to groundwater quality and implications for beneficial uses
	How does the option perform in relation to greenhouse gas emissions	Estimated quantity of greenhouse gas emissions during construction
		Estimated quantity of greenhouse gas emissions during operation (based on estimated operational power consumption, linked to length of tunnel)
Guiding principle 3: Minimise impacts during the construction phase	How does the option impact on public transport during construction?	Extent of impacts on rail operations
	How does the option affect the existing road network during construction	Impacts on road users (including road-based public transport) during construction
		Estimated number of truck movements during construction phase
		Extent to which construction traffic affects surrounding road network and intersection performance
	How does the option affect amenity during construction?	Number of residential properties within 100m of construction activities
		Number of sensitive receptors (schools, hospitals, aged care) within 100m of construction activities

Project Objectives/ Guiding Principles	Criteria	Measure
Guiding principle 4: Optimise the efficient use of resources	What is the estimated cost of the option?	Estimated capital expenditure
		Estimated operational expenditure
	How well might the option perform in relation to benefits	Average volume to capacity ratios
		Change in Vehicle Kilometres Travelled (VKT) on freeways in Melbourne
	How well does the option unlock spare capacity	Change in VKT on arterial roads in Melbourne
		Ability to cater for future freeway connections (e.g. Outer Metropolitan Ring (OMR) Road and East West Link (EWL)
	How does the option future proof the transport network?	Ability to cater for future PT network improvements
		Ability to cater for future technologies

Appendix C – Rapid Appraisal Outcomes

Results of rapid appraisal against Project Objectives

This section summaries the results of the rapid appraisal of the identified corridor alignment solutions against the Project Objectives as outlined in section 1.6 and the rating system identified in Table 3. For this stage of the options assessment, options were evaluated against criteria that focused on potential benefits and impacts at specific locations in the project catchment, in the rest of the project catchment and across metropolitan Melbourne.

Project Objective 1

The identified alignment solutions for each corridor were evaluated against three criteria to estimate their potential to improve business access and growth in Melbourne’s north, east and south east, as presented in Table C1.

Results for these criteria were determined using the following measures:

- Worker accessibility to specific NEICs and MACs in the project catchment
- Worker accessibility to firms within the project catchment and across metropolitan Melbourne
- Changes in travel time and reliability for business trips within the project catchment and across metropolitan Melbourne.

Table C1 Criteria and results for the rapid appraisal of Project Objective 1

Criteria	Corridors		
	A	B	C
How does the option improve access and growth for key business locations in the project catchment?	Green	Light Green	Yellow
How well does the option improve business access and growth for the rest of the project catchment?	Green	Green	Light Green
How well does the option improve business access and growth for other metropolitan areas?	Yellow	Light Green	Green

The rapid appraisal with respect to Project Objective 1 found:

- All corridors are expected to result in accessibility gains for the project catchment. Corridor A provides the best accessibility increase to the La Trobe employment and innovation cluster and is the only corridor expected to produce a net gain in accessibility for the three NEICs within the catchment.
- Analysis of change in travel time savings and reliability for business trips shows that, although corridors B and C provide significant travel time savings across the project catchment, Corridor A provides relatively more benefits for key business locations.

- Analysis of potential locations of employment change suggests that Corridor A is likely to support and encourage the intensification of commercial and industrial development in employment and innovation clusters such as La Trobe and key activity centres such as Epping – in comparison to other options where areas with little or no potential for commercial and industrial development are expected to benefit from improved accessibility for businesses.

In summary, Corridor A performs very well against Project Objective 1 because it is expected to deliver significant gains in accessibility for businesses located in key employment clusters such as La Trobe and MACs such as Epping and Ringwood. Corridors B and C perform well as they may deliver some improvement in labour market accessibility to businesses in MACs such as Ringwood and Box Hill; however, these corridors result in a reduction in accessibility for businesses in key employment clusters such as La Trobe, Monash, Epping and Dandenong.

Project Objective 2

The identified alignment solutions for each corridor were evaluated against three criteria to estimate their potential to improve household access to employment and education for households located in Melbourne's north, east and south east, as presented in Table C2.

Results for these criteria were determined using the following measures:

- Accessibility for households to jobs for key residential locations, for the rest of the project catchment and across metropolitan Melbourne
- Accessibility for households to education for key residential locations, for the rest of the project catchment and across metropolitan Melbourne.

Table C2 Criteria and results for the rapid appraisal of Project Objective 2

Criteria	Corridor		
	A	B	C
How does the option improve household access to employment and education for key residential locations?			
How does the option improve household access to employment and education for the rest of the project catchment?			
How does the option improve household access to employment and education for other metropolitan areas?			

The rapid appraisal with respect to Project Objective 2 found that:

- All corridors are expected to result in a level of accessibility gains for the project catchment.
- Corridors A and C perform best with respect to the ability to deliver better accessibility and opportunity for households for key residential locations. Corridor B performs the least effectively against this criterion.
- Corridors B and C perform best with respect to the ability to deliver better household accessibility across the project catchment. Corridor A performs the least effectively against this criterion.
- Corridor A and Corridor C performs best with respect to the ability to deliver better household accessibility across metropolitan Melbourne for key residential locations. Corridor B performs the least effectively against this criterion

In summary, Corridor C is expected to provide better accessibility and opportunity for households. Corridor B provides the least effective response in meeting Objective 2.

Project Objective 3

The identified alignment solutions for each corridor were evaluated against four criteria to estimate their potential to improve freight and supply chain efficiency across the north, east and south east, as presented in Table C3.

Results for these criteria were determined using the following measures:

- Accessibility for suppliers to and travel time savings between key industrial destinations in the project catchment
- Accessibility for suppliers and travel time savings for the broader project catchment and across metropolitan Melbourne
- Accessibility for suppliers within the project catchment in relation to the corridor's ability to carry placarded and over dimension vehicles
- Change in traffic volumes on the M1.

Table C3 Criteria and results for the rapid appraisal of Project Objective 3

Criteria	Corridor		
	A	B	C
How does the option improve freight and supply chain efficiency and industrial growth for key industrial locations in the project catchment?			
How does the option improve freight and supply chain efficiency and industrial growth for the rest of the project catchment?			
How does the option improve freight and supply chain efficiency and industrial growth for other metropolitan areas?			
How does the option integrate with the existing freight network?			

The rapid appraisal findings for Project Objective 3 are somewhat different to the findings for this objective as part of the SMT. This is due to the increased complexity and accuracy of the data used to support the evaluation and the further development of concepts. The appraisal found that:

- Corridor A performed well against Project Objective 3 as it is expected to deliver significant travel time improvements between key freight locations in the north east. The concept options offer some potential for integration with over-dimensional load and placarded load networks.
- Corridors B and C generally perform well against Project Objective 3. However, due to the location of interchanges and lengths of the tunnels, these corridors do not provide for over-dimensional or placarded loads, which is considered a significant flaw in their performance against this objective.
- All corridors resulted in a reduced reliance for freight on the M1.

In summary, Corridor A is expected to provide better opportunity to improve freight and supply chain efficiency. Corridor B provides the least effective response in meeting this objective

Project Objective 4

The identified alignment solutions for each corridor were evaluated against four criteria to estimate their potential to improve access, amenity and safety for communities in the north east, as presented in Table C4.

Results for these criteria were determined using the following measures:

- Amenity and safety improvements, measured by the reduction in traffic on key arterial roads and the ability for each corridor alignment solution to cater for truck trips
- Public transport improvements, measured by the ability of each corridor alignment solution to improve access to and provide for improved public transport
- Walking and cycling improvements, measured by the ability of each corridor alignment solution to improve conditions and connections for cyclists and pedestrians
- Improving access and connectivity for communities in the north east, measured by the change in traffic on key arterial roads and the change in travel times between local residential, retail, employment and services locations for road users in the north east.

Table C4 Criteria and results for the rapid appraisal of Project Objective 4

Criteria	Corridor		
	A	B	C
How does the alignment divert heavy vehicles away from roads used by locals, resulting in amenity (air quality and noise) and safety improvements	Green	Orange	Light Green
How does the option improve access to and provide for improved public transport	Green	Yellow	Light Green
How does the option improve conditions and connections for cyclists and pedestrians	Green	Light Green	Light Green
How does the option improve connectivity for communities in the north east	Green	Yellow	Light Green

The rapid appraisal with respect to Project Objective 4 found that

- Corridors A and C perform well against all aspects of objective four, with Corridor A providing the best response due to its ability to capture a greater number trip origins and destinations and therefore providing the best relief to the existing road network.
- Corridor B provides a mixed response through:
 - Providing potential for public transport services along the project corridor and reductions in traffic volumes on some key roads; however, some roads would experience increased traffic volumes on roads used by public transport services
 - Accommodating some truck movements in the north east, but would not serve trucks immediately south of the Eastern Freeway
 - Unattractiveness for trucks due to road design and vertical grade constraints, making it unlikely that the option would divert trucks away from local roads
 - Offering improvements to cycling connections in activity centres such as Greensborough, Eltham and Diamond Creek.

In summary, Corridor B performs the least effectively in meeting Project Objective 4.

Results of rapid appraisal against Guiding Principles

The section summaries the results of the rapid appraisal of the identified corridor alignment solutions against the Guiding Principles.

Guiding Principle 1

The identified alignment solutions for each corridor were evaluated against two criteria to estimate their potential to minimise impacts on communities, as presented in Table C5.

Results for these criteria were determined using the following measures:

- Potential acquisition impacts to residential properties, businesses and community facilities
- Compatibility with State and local government strategic planning.

Table C5 Criteria and results for the rapid appraisal of Guiding Principle 1

Criteria	Corridor		
	A	B	C
How might acquisition associated with the option directly affect communities and businesses?			
How does the option align with community values including local government strategic planning, Plan Melbourne and valued places			

The rapid appraisal with respect to Guiding Principle 1 found that:

- All corridors are expected to result in a significant volume of residential and business acquisitions. Corridor A requires less residential acquisitions, but more business acquisitions than corridors B and C
- Corridor A requires the most acquisition of public open space, with Corridor C requiring the least
- Corridors B and C have major severance impacts affecting a significant portion of residential or cohesive areas. Corridor A is considered to have a moderate severance impact.
- Corridor C is considered to perform poorly against government strategic planning in that it places development pressure on the Urban Growth Boundary as defined under Plan Melbourne 2017-2050. Corridors A and B are considered to place low and moderate development pressure on the Urban Growth Boundary.

In summary, all three corridors perform relatively consistently against Guiding Principle 1. Corridor A performs marginally better than corridors B and C, primarily as it places less development pressure on the Urban Growth Boundary and therefore provides better alignment with Government strategic planning.

Guiding Principle 2

The identified alignment solutions for each corridor were evaluated against five criteria to estimate their potential to minimise impacts on environmental and cultural assets, as presented in Table C6.

Results for these criteria were determined using the following measures:

- Impact on areas of high ecological value and native vegetation

- Impact on Victorian heritage places and areas of aboriginal cultural significance to the Wurundjeri people
- Impact on sensitive landscape character types
- Impact on sensitive receptors, including residential properties, schools and hospitals
- Impacts to waterways, including waterway health and flooding.

Table C6 Criteria and results for the rapid appraisal of Guiding Principle 2

Criteria	Corridor		
	A	B	C
How does the option affect flora and fauna?			
How does the option affect historical and cultural heritage?			
How does the option affect landscape and visual characteristics?			
How does the option affect sensitive receptors, with consequent amenity impacts (air quality, noise and vibration)?			
How does the option affect waterways?			

The rapid appraisal with respect to Guiding Principle 2 found that:

- Overall, Corridor A performs better than Corridors B and C with respect to Guiding Principle 2. The alignment includes 5km of tunnel to protect areas of high ecological value, sensitive landscapes and areas with cultural heritage and historical significance (including the Banyule Flats, the Yarra River, Bolin Bolin Billabong and the Heide Museum of Modern Art). There may be some moderate to minor impacts on flora and fauna, aboriginal cultural and historical heritage sites, landscape and visual and sensitive receptors which will need to be avoided or minimised.
- Corridors B and C would have moderate to major negative impact on environmental and cultural assets. The alignment options also provide opportunities to protect sensitive areas including the Yarra River by tunnelling, but these options involve a greater area of surface works. Corridor B would have a major negative impact on the ecological value of the area, while Corridor C would have major negative amenity impacts on sensitive receptors such as increased noise and vibration and reduced air quality. Both corridors would have moderate impacts for the remaining criteria under Guiding Principle 2.

In summary, Corridor A is expected to perform better than corridors B and C in minimising impacts on environmental and cultural assets.

Guiding Principle 3

The identified alignment solutions for each corridor were evaluated against one criterion to estimate their potential to minimise impacts during the construction phase, as presented in Table C7.

Results for this criterion were determined by examining how the option would affect the existing road network during construction, considering likely truck volumes, impacts to the road network and ease of access to existing motorways.

Table C7 Criterion and results for the rapid appraisal of Guiding Principle 3

Criterion	Corridor		
	A	B	C
How does the option affect the existing road network during construction?			

The rapid appraisal with respect to Guiding Principle 3 found that:

- Corridor A would have the least impact on the existing road network during construction, primarily due to a significantly lower number of construction truck movements compared to corridors B and C. In addition, Corridor A has access to multiple alternate roads to divert traffic or use for haulage, which will assist in mitigating impacts on the surrounding road network.
- Corridors B and C perform poorly against Guiding Principle 3. A significant volume of construction trucks would be generated due to the length of tunnels; this is compounded by the minimal number of roads available to divert traffic or use for haulage.

In summary, Corridor A performs marginally better than Corridors B and C against Guiding Principle 3.

Guiding Principle 4

The identified alignment solutions for each corridor were evaluated against four criteria to estimate their potential to optimise the efficient use of resources, as presented in Table C8.

Results for these criteria were determined using the following measures:

- Potential construction cost
- Asset utilisation considering volume to capacity ratios on North East Link
- Change in vehicle kilometres travelled on motorways and arterial roads.

Table C8 Criteria and results for the rapid appraisal of Guiding Principle 4

Criteria	Corridor		
	A	B	C
What is the estimated cost of the option?			
How well might the option perform in relation to benefits?			
How well does the option unlock spare capacity?			

The rapid appraisal with respect to Guiding Principle 4 found that:

- Corridor A performed well to very well against all criteria, based on:
 - Lowest estimated capital cost
 - High, but not congested, volume to capacity ratio on North East Link, which indicates best utilisation of the new asset

- Greatest potential for increased motorway travel and reductions to vehicle kilometres travelled on the arterial road network; indicating the right traffic travelling on the right roads.
- Corridor B performed well against the criteria, based on
 - Poor performance from a cost perspective with a very high estimated capital cost, but some potential for value capture at key locations along the corridor
 - Good utilisation of the new asset, identified through a medium to high volume to capacity ratio on North East Link
 - Strong potential for increases to vehicle kilometres travelled on motorways, but limited potential for reductions on arterial roads.
- Corridor C performed neutrally to poor against the criteria, based on
 - Poor performance from a cost perspective with a high capital cost.
 - Poor utilisation of the new asset, identified through a low to medium volume to capacity ratio on North East Link
 - Low potential for increases to vehicle kilometres travelled on motorways and low potential for reductions on arterial roads, indicating a potential for the right traffic not utilising the most appropriate road network.

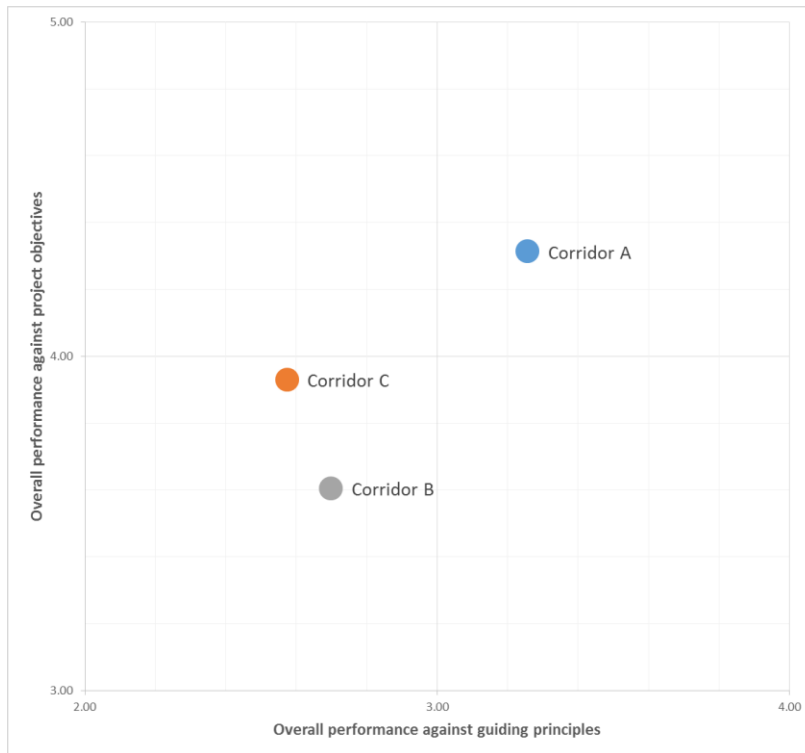
In summary, Corridor A is expected to perform better across all criteria compared to the other alignment options for optimising the efficient use of resources.

Rapid appraisal outcomes

Figure C1 illustrates how the corridor alignment solutions performed against the Project Objectives and Guiding Principles. The results of the rapid appraisal demonstrate the following:

- Project Objectives – Corridors A and C performed significantly better than Corridor B against the Project Objectives
- Guiding Principles – Corridor A out-performed corridors B and C against the Guiding Principles
- Overall – Corridor B is the worst performing corridor, primarily due to poor results against the Project Objectives where Corridor B was less effective than Corridor C at improving household access to jobs at key locations and across metropolitan Melbourne, at improving access to suppliers across metropolitan Melbourne and at diverting trucks away from local roads. Corridor B also performed less effectively at improving access for public transport and increasing connectivity for communities in the north east.

Figure C1 Results of rapid appraisal



In addition to its relatively poor performance against the Project Objectives and Guiding Principles, Corridor B would be significantly more expensive to construct than Corridor C. This is taken into consideration in the assessment of Guiding Principle 4; however, it is considered a significant differentiator in assessment and decision-making for the rapid appraisal.

On this basis, no further development and assessment of Corridor B was undertaken. Corridor A and Corridor C proceeded to the detailed appraisal stage of the options assessment process and the corridor concepts further developed to address areas where they performed poorly against the Project Objectives and Guiding Principles.

Appendix D – Detailed Appraisal Outcomes

Project Objective 1 - Improve business access and growth in Melbourne's north, east and south east

Business criterion 1: How does the option improve access and growth for key business locations in the project catchment?

Results for this criterion were determined using the four measures presented in Table D1. The measures are calculated using the strategic transport model outputs and land use and transport interaction (LUTI) modelling. LUTI modelling is used to identify areas likely to be impacted by changes in demand arising from improved accessibility and estimates the potential redistribution of employment. The redistribution of employment is used as a proxy to represent the potential impacts of the project in attracting additional commercial or industrial activities due to improved accessibility.

Change in travel times identifies the total number of hours saved per day for all business trips.

Table D1 Results for the detailed appraisal of business criterion 1

Measure	Corridor A	Corridor C
Additional workers accessible to firms within 45 minutes for NEICs and MACs	104,000 – 127,000	76,000-92,000
Change in travel times for business trips between key business locations	1,300 – 1,600 hours per day	800 – 1,000 hours per day
Change in reliability for business trips between key business locations	230 – 280 hours per day	130 – 160 hours per day
Change in commercial development potential and employment growth for key business locations	Increased commercial potential for Rosanna, La Trobe, Preston, Greensborough	Increased commercial potential in Eltham, Rosanna, Greensborough, Mill Park and areas outside the UGB

Business criterion 2: How well does the option improve business access and growth for the rest of the project catchment?

Results for this criterion, which focuses on key business-to-business corridors within the broader project catchment, were determined using the three measures presented in Table D2.

Table D2 Results for the detailed appraisal of business criterion 2

Measure	Corridor A	Corridor C
Additional workers accessible to firms within 45 minutes in the project catchment	57,000-70,000	53,000-65,000
Change in travel times for business trips in the project catchment	4,200 – 5,200 hours per day	4,600 – 5,600 hours per day
Change in reliability for business trips in the project catchment	710 - 860 hours per day	710 - 870 hours per day

Business criterion 3: How well does the option improve business access and growth for other metropolitan areas?

Results for this criterion, which focuses on broader business connectivity and accessibility across the Melbourne metropolitan area, were determined using the three measures presented in Table D3.

Table D3 Results for the detailed appraisal of business criterion 3

Measure	Corridor A	Corridor C
Additional workers accessible to firms within 45 minutes for the rest of Metropolitan Melbourne	33,000-40,000	22,000-27,000
Change in travel times for business trips across the rest of Metropolitan Melbourne	3,000 – 3,700 hours saved per day	1,700 – 2,100 hours per day
Change in reliability for business trips across Metropolitan Melbourne	500 - 610 hours per day	270 - 330 hours per day

Project Objective 2 - Improve household access to employment and education in Melbourne's north, east and south east

Household criterion 1: How does the option improve household access to employment and education for key residential locations in the project catchment?

Results for this criterion were determined using the three measures presented in Table D4. This criterion focuses on additional jobs and education opportunities made accessible to key residential locations in Melbourne's north and north east. It also identifies the potential changes in development potential that may provide development opportunities or development pressure on locations due to greater accessibility of residents to jobs and education in these locations.

Table D4 Results for the detailed appraisal of household criterion 1

Measure	Corridor A	Corridor C
Additional jobs accessible to households within 45 minutes for key residential locations?	54,000-66,000	68,000-83,000
Additional placements accessible to students within 45 minutes for key residential locations?	9,000-11,000	7,000-8,000

Measure	Corridor A	Corridor C
Change in residential development potential and population growth for key residential locations	Increased residential development opportunities in Greensborough, Eltham, Viewbank, Reservoir	Increased residential development pressure Eltham, Greensborough, Hurstbridge, Outside the UGB

Household criterion 2: How does the option improve household access to employment and education for communities in the rest of the project catchment?

Results for this criterion were determined using the three measures presented in Table D5. This criterion focuses on a wider range of communities located in the project catchments and the broader spread of improvement in household access to jobs and education opportunities.

Table D5 Results for the detailed appraisal of household criterion 2

Measure	Corridor A	Corridor C
Additional jobs accessible to households within 45 minutes for the Project Catchment	51,000-62,000	32,000-39,000
Additional placements accessible to students within 45 minutes for the Project Catchment	8,000-10,000	4,000-5,000
Change in travel times for commute and education trips in the project catchment	29,000 – 36,000 hours saved per day	15,000 – 18,000 hours saved per day

Household criterion 3: How does the option improve household access and growth for other metropolitan areas?

Results for this criterion were determined using the three measures presented in Table D6. This criterion focuses on how the option provides opportunities for improved access to jobs and education more broadly across the Melbourne metropolitan region.

Table D6 Results for the detailed appraisal of household criterion 3

Measure	Corridor A	Corridor C
Additional jobs accessible to households within 45 minutes for the rest of Metropolitan Melbourne	22,000-26,000	17,000-20,000
Additional placements accessible to students within 45 minutes for the rest of Metropolitan Melbourne	2,500-3,500	2,000-3,000
Change in travel times for commute and education trips across Metropolitan Melbourne	4,200 – 5,100 hours saved per day	13,300 – 16,200 hours saved per day

Project Objective 3 - Improve freight and supply chain efficiency across the north, east and south east

Freight criterion 1: How does the option improve freight and supply chain efficiency and industrial growth for key industrial locations in the project catchment?

Results for this criterion were determined using the three measures presented in Table D7. These measures were evaluated using strategic transport modelling outputs to determine changes in accessibility, travel time and traffic volumes.

Table D7 Results for the detailed appraisal of freight criterion 1

Measure	Corridor A	Corridor C
Change in access to suppliers within 45 minutes for key industrial locations	900-1,100	400-600
Travel time savings between key industrial locations	16 - 19 minutes	8 – 9 minutes
Change in traffic volumes on M1	1 to 5% reduction in freight volumes	1 to 5% reduction in freight volumes

Freight criterion 2: How does the option improve freight and supply chain efficiency and industrial growth for the rest of the project catchment?

Results for this criterion were determined using the four measures presented in Table D8. Results for the first two measures were determined using strategic transport modelling outputs. A qualitative assessment was used to determine the ability of each corridor to carry placarded and over-dimensional loads.

Table D8 Results for the detailed appraisal of freight criterion 2

Measure	Corridor A	Corridor C
Change in access to suppliers within 45 minutes for other industrial areas in the project catchment	6,800 - 8,300	4,000 – 4,800
Change in travel times for freight trips in the project catchment	Travel time savings of up to 19% between key locations	Travel time savings of up to 19% between key locations
Ability to carry placarded loads	Usage by placard vehicles possible for part of the route	Cannot accommodate placard vehicles
Ability to carry over-dimensional loads	Usage by OD vehicles possible for part of the route	Cannot accommodate OD vehicles

Freight criterion 3: How does the option improve freight and supply chain efficiency and industrial growth for other metropolitan areas?

Results for this criterion were determined using the two measures presented in Table D9. Strategic transport modelling outputs were used to determine change in accessibility and travel time.

Table D9 Results for the detailed appraisal of freight criterion 3

Measure	Corridor A	Corridor C
Change in access to suppliers within 45 minutes for other industrial locations across metropolitan Melbourne	7,900-9,700	6,500 – 7,900
Change in travel times across metropolitan Melbourne	1300 hours saved per year	1500 hours saved per year

Freight criterion 4: How does the option integrate with the existing freight network?

Results for this criterion were determined using the measure presented in Table D10. A qualitative assessment was made of the potential for each corridor to integrate with the existing freight network.

Table D10 Results for the detailed appraisal of freight criterion 4

Measure	Corridor A	Corridor C
Integration with High Mass Limit (HML) network	Ties into the existing HML network at both ends	Ties into the existing HML network at both ends

Project Objective 4 - Improve access, amenity and safety for communities in the north east

Amenity criterion 1: How does the alignment divert heavy vehicles away from roads used by locals, resulting in amenity (air quality and noise) and safety improvements?

Results for this criterion were determined using the two measures presented in Table D11. Strategic transport modelling outputs were used to determine change in heavy vehicle traffic on key roads in the north east, as follows:

- Chandler Highway
- Bulleen Road
- Bell Street
- Burke Road
- Grimshaw Street
- Lower Plenty Road
- Main Road
- Greensborough Road
- Fitzsimons Lane
- Manningham Road
- Para Road
- Heidelberg Road
- Templestowe Road
- Thompsons Road
- Upper Heidelberg Road

An assessment was also undertaken to determine the attractiveness of each corridor for trucks, considering gradient, length of tunnel and connectivity to the road network.

Table D11 Results for the detailed appraisal of amenity criterion 1

Measure	Corridor A	Corridor C
Change in heavy vehicle traffic on key arterial roads in the north east	26% reduction in heavy vehicles across all roads	16% reduction in heavy vehicles across all roads
Attractiveness of each corridor for trucks	Generally meets truck standards and has suitable grades for trucks	Generally meets truck standards and has suitable grades for trucks

Amenity criterion 2: How does the option improve access to and provide for improved public transport?

Results for this criterion were determined using the two measures presented in Table D12. A qualitative assessment was undertaken, based on modelled traffic reductions on the arterial road network to determine the potential for public transport provision and priority.

Table D12 Results for the detailed appraisal of amenity criterion 2

Measure	Corridor A	Corridor C
Provision for future public transport services on existing roads	Moderate reduction in traffic on roads used by PT	Minor reduction in traffic on roads used by PT
Priority for public transport on the new road	Potential for PT services on the EF and along the project corridor	Potential for PT along the project corridor

Amenity criterion 3: How does the option improve conditions and connections for cyclists and pedestrians?

Results for this criterion were determined using the four measures presented in Table D13. Qualitative assessments of the existing and planned strategic bicycle network were used for the first three measures. Strategic transport modelling outputs were analysed to measure the change in general and heavy vehicle traffic on or near walking and cycling links.

Table D13 Results for the detailed appraisal of amenity criterion 3

Measure	Corridor A	Corridor C
Provision for separate dedicated cycle and walking paths on existing roads	Opportunity to connect to and utilise existing cycle and walking paths (local and strategic)	Passes through greenfield sites which require new infrastructure
Provision for shared use paths on existing roads	Opportunity to connect to and utilise existing cycle and walking paths (local and strategic)	Passes through greenfield sites which require new infrastructure
Connection to existing paths on existing roads	Opportunity to provide complementary measures to improve existing connections	No changes to existing paths
Change in heavy vehicle traffic on/near existing pedestrian and cycling links	Reduction of over 10,000 freight vehicles	Reduction of over 5,000 freight vehicles

Amenity criterion 4: How does the option improve connectivity for communities in the north east?

Results for this criterion were determined using the three measures presented in Table D14. Strategic transport modelling outputs were used to evaluate these measures.

Table D14 Results for the detailed appraisal of amenity criterion 4

Measure	Corridor A	Corridor C
Change in travel times between local residential, retail, employment and services locations for road users in the north east	10 to 15% reduction	5 to 10 % reduction
Change in travel times between local residential, retail, employment and services locations for public transport users in the north east	Travel time savings of up 12% between key locations	Travel time savings of up 8% between key locations
Interchanges and access to local areas previously disconnected	Provides opportunity to improve existing connectivity	Connect previously disconnected communities (i.e. Reynolds Road and Ryans Road)

Guiding Principle 1 - Minimise impacts on communities

Social criterion 1: How does the option directly affect communities and businesses?

Results for this criterion were determined using the five measures presented in Table D15. Measures relating to residential properties, businesses and State or National Parks were evaluated using GIS analysis, whereby the North East Link corridor concepts were overlayed on cadastral data. Directly affected properties were counted in cases where only a portion of a property was determined to be affected through the GIS analysis. The numbers and areas reported below are preliminary only and would be expected to change during design development of the corridor concepts – in particular, the exploration of changes that could minimise property impacts. A qualitative specialist assessment was used to evaluate the potential for reduced function or viability of community facilities.

Table D15 Results for the detailed appraisal of social criterion 1

Measure	Rating	
	Corridor A	Corridor C
Number of residential properties potentially directly affected	Approximately 60 to 100 properties	Approximately 100 to 140 properties
Number of businesses potentially directly affected	Approximately 110 businesses	Approximately 40 businesses
Number of community facilities potentially directly affected	Approximately 20 community facilities	Approximately 20 community facilities
Area of public open space potentially directly affected	Approximately 30ha of public open space	Approximately 15ha of public open space
Area of State or National Park potentially directly affected	No State or National Park affected	No State or National Park affected

The detailed appraisal of these five measures found that the potentially directly affected properties were marginally greater in Corridor A than in Corridor C for a range of private, public, commercial or community properties and facilities.

Corridor A would directly affect considerably fewer residential properties when compared to Corridor C. However, in relation to the direct affect to businesses, Corridor A would impact approximately three times more businesses than Corridor C. Around 20 community facilities would be directly affected in either a Corridor A or Corridor C scenario, albeit that it would be affecting a part of the property and not the whole property in many cases.

Public open space, which includes Crown and council land, plays an important role in facilitating passive and active recreation in communities. The potential directly impacts on public open space are considered greater for Corridor A than for Corridor C predominantly due to the additional land beyond the existing road reserve required to accommodate the project along the Eastern Freeway and the land requirements in the vicinity of the sports fields abutting Bulleen Road.

Both corridor options have direct impacts on land and properties across private, public, commercial and community interests. This could result in potential acquisition of part or whole properties. While Corridor A would have less direct impacts to residential properties, it performs worse or comparably in relation to the measures covering businesses, community facilities and open space.

Social criterion 2: How does the option align with community values including local government strategic planning, Plan Melbourne and valued places?

Results for this criterion were determined using the two measures presented in Table D16. The measures were evaluated through a qualitative specialist assessment of the consistency of the respective options with State and local government planning policies. In this analysis, significant consideration was attributed to Plan Melbourne and the Yarra River Protection Act 2017.

Table D16 Results for the detailed appraisal of social criterion 2

Measure	Rating	
	Corridor A	Corridor C
Compatibility with local government strategies and vision	Some inconsistencies identified	Some inconsistencies identified
Compatibility with State government strategies	Largely consistent	Largely consistent

The detailed appraisal of these measures found the compatibility of the North East Link Project with local and state government planning policies is comparable between the two corridors.

Both Corridor A and Corridor C align with local and state planning policies that advocate improved infrastructure provision, a reduction in traffic congestion and access within reasonable travel times to activity centres and residential areas.

The planning schemes guiding land use in both corridors generally discourage private vehicle use in favour of sustainable transport options and aim to protect areas of open space that contribute to improved residential amenity.

Points of difference between the two options relate to the potential impact on the Urban Growth Boundary and the Yarra River environs. Under Corridor C, two above ground sections of North East Link cross the UGB: approximately one kilometre of surface road and viaduct in Diamond Creek and the interchange in the vicinity of Reynolds Road in Warrandyte and Park Orchards. This corridor has greater potential to put pressure on the Green Wedge areas outside the UGB because land in the vicinity would become more attractive for development (noting that a change to legislation would be required to move the boundary). Further, the likely impacts of Corridor C on areas of open space will require consultation with local council(s) in relation to industrial land and open space policies.

Corridor A does not place increased pressure on the UGB, however it has greater potential for impact on the Yarra River and its environs, which are considered key community assets of cultural and environmental significance and will require consideration in light of the Yarra River Protection Act (Wilip-gin Birrarun murrn) that will come into effect 1st December 2017. Further, the likely impacts of Corridor A on the industrial area south of Banksia Street and impacts of areas of open space will require consultation with local council(s) in relation to industrial land and open space policies.

Social criterion 3: How does the option affect community cohesion, (promotes safe places, limits or reduces severance, integrates land uses)?

Results for this criterion were determined using the two measures presented in Table D17. These measures were evaluated through a qualitative specialist assessment, together with GIS analysis.

The assessment of the impacts on community facilities considered the understood importance of the facilities, the extent of loss of functionality and the duration of the effects. Facilities considered include shared use paths, sporting fields (including those associated with schools), other sporting facilities (including golf courses, tennis courts and swim centres), community buildings (including churches, aged care facilities and schools) and parks and reserves.

Table D17 Results for the detailed appraisal of social criterion 3

Measure	Rating	
	Corridor A	Corridor C
Impacts on community facilities as the result of reduced function and viability	Potential major negative impact – a large number in the vicinity of the alignment	Potential major negative impact – a large number in the vicinity of the alignment
Severance of residential and other cohesive areas	Potential for moderate negative impacts in the vicinity of Bulleen Road and Greensborough Road	Potential for moderate negative impacts at St Helena and Stintons Reserve

Both corridors have the potential to affect the function and viability of community facilities. While the specific effects for each corridor would be different and the detailed appraisal of these measures determined that Corridor C outperforms Corridor A to some extent, both corridors could have significant effects. Effects on functionality could include changes to access or acquisition of sections of properties requiring re-design of remaining areas.

For Corridor A, the facilities where functionality is potentially affected include golf courses, a swim centre, tennis courts, sporting fields, schools, shared use paths and reserves (notably Koonung Creek Linear Park and Koonung Creek Reserve and Koonung Reserve).

For Corridor C, the facilities where functionality is potentially affected include tennis courts, greyhound slipping tracks, sporting fields, churches, shared use paths and reserves (notably Challenger Park Reserve, Diamond Creek Linear Reserve, Mullum Mullum Reserve and Stintons Reserve).

In terms of severance and the potential effects on community cohesion, potential impacts have been identified for Corridor A in relation to the residential areas along the western side of Greensborough Road, south of Simpson Barracks west of Bulleen Road, and the active and open space areas south of Manningham Road. Some impacts of this type have also been identified for Corridor C, particularly in relation to the St Helena residential area, around Ryans Road and Stintons Reserve. In the St Helena residential area, the corridor would occupy an extensive area of open space.

Overall, both corridors have the potential to impact on the function and viability of community facilities to a comparable extent. Corridor A and corridor C were also assessed to have comparable impact on community cohesion due to severance.

Social criterion 4: How does the option affect landscape and visual characteristics?

Results for this criterion were determined using the three measures presented in Table D18. These measures were assessed through site inspections and a desktop appraisal of the options using Google Earth and Nearmap.

Table D18 Results for the detailed appraisal of social criterion 4

Measure	Rating	
	Corridor A	Corridor C
Extent of impact on the visual amenity of adjacent residents	Potential for moderate negative impacts	Potential for moderate negative impacts
Extent of impact on parks and open spaces relevant historical heritage sites and tourism sites	Potential for major negative impacts	Potential for major negative impacts
Extent of impact on sensitive landscape character types	Potential for major negative impacts, particularly for parks and open space areas along Bulleen Road	Potential for major negative impacts particularly in the vicinity of Diamond Creek and Stintons Reserve

Both corridor options have the potential for significant visual impacts, and were found to be comparable based on the assessment undertaken.

The potential for visual impacts relates to the nature, location and prominence of the project elements and the extent of intrusion on existing views. The main project elements with the potential to cause visual impacts are elevated roads and ventilation structures.

The potential visual impacts for Corridor A relate primarily to:

- Road infrastructure including the M80 and Grimshaw Road interchanges and surface road and elevated road sections along the existing alignment or Greensborough Road
- An elevated road connection to the Eastern Freeway at the southern end of the project
- Ventilation structures at the ends of the tunnel section (two structures in total).

The potential visual impacts for Corridor C relate primarily to:

- Road infrastructure including surface road and elevated road sections between the Greensborough Bypass and Diamond Creek, which would pass through established residential areas, occupy existing open space and traverse the Challenger Street Reserve and the Diamond Creek Linear Reserve
- Road infrastructure including an interchange at Reynolds Road, an elevated road connection between Reynolds Road and Stintons Road (traversing Stintons Reserve), and widening of Reynolds Road
- Ventilation structures at the ends of the two tunnel sections (four structures in total).

Overall, the visual impacts associated with Corridor A were considered to be comparable to those associated with Corridor C

Social criterion 5: How does the option affect sensitive receptors (including social infrastructure), with consequent amenity impacts (air quality, noise and vibration)

Results for this criterion were determined using the eight measures presented in Table D19. The ratings for these measures were determined using GIS data. Whilst the analysis does not purport to identify sensitive receptors that would be affected by changes in air quality or noise levels, proximity of receptors to key project elements is considered to be a useful proxy for air quality and noise impacts at this stage of project development.

Table D19 Results for the detailed appraisal of social criterion 5

Measure	Rating	
	Corridor A	Corridor C
Number of residential properties above the tunnel alignment (construction vibration)	Potential for minimal negative impact	Potential for moderate negative impact
Number of sensitive receptors (schools, hospitals, aged care) above the tunnel alignment (construction vibration)	Negligible negative impact	Negligible negative impact
Number of residential properties within 80m of edge of new surface roads and interchanges	Potential for major negative impact	Potential for moderate negative impact
Number of sensitive receptors (schools, hospitals, aged care) within 80m of edge of new surface roads and interchanges	Potential for major negative impact	Potential for major negative impact
Number of residential properties within 100m of centreline of existing surface roads experiencing higher traffic volumes	Potential for moderate negative impact	Potential for moderate negative impact
Number of sensitive receptors (schools, hospitals, aged care) within 100m of centreline of existing surface roads experiencing higher traffic volumes	Potential for major negative impact	Potential for major negative impact
Number of residential properties within 400m of indicative tunnel portals and likely ventilation outlet	Potential for major negative impact	Potential for minimal negative impact
Number of sensitive receptors (schools, hospitals, aged care) within 400m of indicative tunnel portals and ventilation outlet locations	Potential for minimal negative impact	Negligible negative impact

The detailed appraisal of these eight measures determined the potential impacts on sensitive receptors are marginally worse for Corridor A when compared to Corridor C. It should however be noted that the design and construction of the road, tunnels and ventilation structures would need to comply with State Environmental Protection Policies and relevant guidelines to address potential impacts to air quality, amenity impacts from noise and to human health.

Potential impacts on residential properties due to noise and vibration from tunnel construction are considered greater for Corridor C than Corridor A, due to the larger number of residential properties located above the tunnel alignments.

Potential impacts on other sensitive receptors due to noise and vibration associated with tunnelling activities are marginally greater for Corridor A than Corridor C, as Corridor C has fewer non-residential sensitive receptors above the tunnel alignment.

Potential impacts on residential properties within 80 metres of the edge of new surface roads and interchanges would be greater for Corridor A than Corridor C.

Potential impacts on sensitive receptors within 100 metres of the centreline of existing surface roads experiencing higher traffic volumes would be comparable for both alignments.

Guiding Principle 2 - Minimise impacts on environmental and cultural assets

Environmental criterion 1: How does the option affect flora and fauna?

Results for this criterion were primarily determined using the four measures presented in Table D20. The first two measures were evaluated using the Victorian Biodiversity Database (VBA), VicMap, site visits and habitat assessments. Vegetation Quality Assessments undertaken during site visits and VicMap were used to estimate the extent of impact to native vegetation of conservation significance. NaturePrint was used to model the potential extent of impact on areas of high ecological value. Some field work was also undertaken to validate the desktop information and confirm key ecological sensitivities.

Table D20 Results for the detailed appraisal of environmental criterion 1

Measure	Rating	
	Corridor A	Corridor C
Potential for impacts to EPBC Act matters of national environmental significance	Potential for EPBC listed flora and fauna to occur.	Potential for EPBC listed flora and fauna to occur.
Potential for impacts to species and processes listed under the FFG Act	Potential for FFG listed flora and fauna to occur.	Potential for FFG listed flora and fauna to occur.
Extent of impact to native vegetation which is of conservation significance	Loss of approximately 10 hectares of mapped EVC including approximately 8 hectares of endangered EVC.	Loss of approximately 60 hectares of modelled EVC including approximately 9 hectares of endangered EVC.
Extent of impact on areas of high ecological value identified using NaturePrint	Around 50 hectares.	Around 95 hectares.

The detailed appraisal of these measures determined that the potential impacts on flora and fauna overall are greater for Corridor C than Corridor A.

Potential impacts on matters of national environmental significance under the Commonwealth Environmental Protection and Biodiversity Act 1999 (EPBC Act) and species listed under the Victorian Flora and Fauna Guarantee Act 1988 (FFG Act) would be comparable between the corridors. Neither corridor is expected to have a significant impact of listed fish such as the Australian Grayling. There is the potential for rare or threatened flora and fauna species to occur in both corridors. The most critical ecological issue is likely to be potential impacts on the listed flora species Matted Flax-lily, which is known to occur within both corridors.

Potential impacts to native vegetation are anticipated to be greater in Corridor C, as there is five to six times more vegetation intersecting with the alignment, particularly around Currawong Bush Park and Mullum Reserve.

A search using the NaturePrint database found that Corridor C is likely to impact double the amount of areas of high ecological value than Corridor A.

Environmental criterion 2: How does the option affect aboriginal cultural and historical heritage?

Results for this criterion were determined using the three measures presented in Table D21. The first two measures were mapped using the Victorian Aboriginal Heritage Register (VAHR) and Planning Scheme Heritage Overlays (HO). The third measure was determined by reviewing the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI) and Planning Scheme Heritage Overlays (HO). Targeted fieldwork was also undertaken, which included inspections of the majority of the heritage places identified in the review.

Table D21 Results for the detailed appraisal of environmental criterion 2

Measure	Rating	
	Corridor A	Corridor C
Extent of impact on registered cultural heritage places on the Victorian Aboriginal Heritage Register (VAHR)	Potential impacts to four registered cultural heritage places.	Potential impacts to three registered cultural heritage places.
Extent of impact on culturally sensitive areas (200m of watercourses)	Potential impacts to around 45 hectares of areas of cultural heritage sensitivity but tunnelling would avoid the Yarra River including Banyule Flats, and Bolin Bolin Billabong.	Potential impacts to around 15 hectares of defined areas of cultural heritage sensitivity but tunnelling would avoid the Yarra River.
Extent of impact on significant heritage sites (Victorian Heritage Register, Victorian Heritage Inventory, Heritage Overlay places)	Avoids impacts on the majority of heritage places with the exception of a number of Heritage Overlay places.	Avoids impacts on heritage places with the exception of one Heritage Overlay place.

The detailed appraisal of these measures determined that the potential impacts on aboriginal cultural and historical heritage would be greater for Corridor A than for Corridor C. This is primarily because Corridor A intersects with a greater extent of culturally sensitive areas and a greater number of Heritage Overlay places. Potential impacts to currently registered Victorian Aboriginal Heritage Register places are considered to be comparable for both corridors, with low numbers of places likely to be impacted.

In relation to impacts on areas of Cultural Heritage Sensitivity, there is potential for more than three times the impact due to Corridor A compared to Corridor C. This is largely because Corridor A is in proximity to a greater number of waterways including Koonong Creek, Merri Creek, Banyule Flats and Bolin Bolin Billabong.

The potential impacts on significant historical heritage places are considered greater for Corridor A than Corridor C. Corridor A may impact a number of Heritage Overlay places and VHI sites including the Bulleen Drive-in site, a River Red Gum, a Moreton Bay Fig, Clarendon Eyre and archaeological site on Wetherby Road, while Corridor C is likely to impact one Heritage Overlay place and have negligible impacts on a number of other significant heritage places.

Corridor A includes tunnelling to protect areas with cultural heritage and historical significance including the Banyule Flats, the Yarra River, Bolin Bolin Billabong and the Heide Museum of Modern Art. However, this alignment could have some potential negative impacts on aboriginal cultural and historical heritage sites, which will need to be avoided or minimised.

Corridor C includes tunnelling to protect areas with cultural heritage and historical significance, including the Yarra River.

Environmental criterion 3: How does the option affect waterways?

Results for this criterion were determined using the four measures presented in Table D22. Results for the first two measures were determined using GIS analysis. To determine impacts to waterway values, local scale river health and health of the catchment system, a qualitative specialist assessment was used, based on degree of potential interaction and ecological condition – in particular, the Land Use Macroinvertebrate Response index (LUMaR Index). Potential to increase flooding risk was evaluated using a qualitative specialist assessment based on available flooding and catchment information.

Table D22 Results for the detailed appraisal of environmental criterion 3

Measure	Rating	
	Corridor A	Corridor C
Number of waterway crossings	Eight waterways crossed	Nine waterways crossed
Footprint that intersects with waterway area and riparian zone	Around 20 hectares of waterway area and riparian zone intersected	Around 20 hectares of waterway area and riparian zone intersected
Extent of impact to waterway values, local scale river health and health of the catchment system	Potential for moderate negative impact	Potential for major negative impact
Potential to increase flooding risk (taking into account effective width of the floodplain and the complexity of the floodplain interactions)	Major effort needed to address flooding risks	Moderate effort needed to address flooding risks

The detailed appraisal of these measures determined that the potential impacts on waterways are comparable for the two corridors.

Corridor A would cross eight waterways and Corridor C would cross nine waterways. By tunnelling, direct impacts on the Yarra River would be avoided for both corridors. Both corridors would intersect around 20 hectares of waterway area and riparian zone.

The potential impacts on waterway ecological values are considered greater for Corridor C due to the proposed crossings at Plenty River, Diamond Creek and Mullum Mullum Creek where EBPC or FFG listed aquatic species may occur. While Koonung Creek would be directly affected by Corridor A works, the creek is highly modified and the LUMaR index for the creek indicates very poor aquatic macroinvertebrate condition. Accordingly, these potential impacts were considered less significant from an ecological viewpoint.

In relation to flooding risk, the challenge of managing flooding risk is considered greater for Corridor A, especially in relation to a Banksia Street interchange and the tunnel portal being located in the vicinity, which would require major effort in design and planning to maintain existing flood levels during flooding of the Yarra River. The widening of the Eastern Freeway would also need careful consideration, as compensation would have to be provided for loss of flood storage associated with the Yarra River and Koonung Creek. While considered less challenging than the hydrological issues for Corridor A, potential flooding issues for Corridor C, associated with works in the vicinity of Plenty River, Diamond Creek and Mullum Mullum Creek would need to be addressed.

Environmental criterion 4: How does the option affect groundwater?

Results for this criterion were determined using the three measures presented in Table D23. These measures were evaluated using published geological mapping, Victorian Geological Survey (DEDJTR), the Water Measurement Information System (WMIS), historical drilling programs by VicRoads and the current NEL geotechnical drilling program. No site inspections were undertaken.

Table D23 Results for the detailed appraisal of environmental criterion 4

Measure	Rating	
	Corridor A	Corridor C
Extent of disruption to groundwater flow and availability	Around 5 km of tunnel	Around 16 km of tunnel
Potential for long term alteration of groundwater levels	Around 5 km of tunnel	Around 16 km of tunnel
Extent of potential impact to groundwater quality and implications for beneficial uses	Around 5 km of tunnel	Around 16 km of tunnel

The detailed appraisal of these measures indicated that the potential impacts on groundwater are potentially less pronounced for Corridor C when compared to corridor A. Despite the extent of tunnelling works being greater for Corridor C, the hydrogeological conditions along Corridor A are likely to be more challenging in terms of permeability and the greater likelihood of connections between groundwater and surface water systems. Whilst engineering solutions are likely to be readily available in either case to effectively minimise impacts on groundwater systems and uses of groundwater, the risks would be more complex for Corridor A due to the connectivity between groundwater and surface water systems.

Environmental criterion 5: How does the option perform in relation to greenhouse gas emissions?

Results for this criterion were determined for the projects construction and operations phases as presented in Table D24.

Construction greenhouse gas emissions were calculated based on indicative estimates of fuel use, energy consumption, construction materials and vegetation removal.

Operations greenhouse gas emissions were estimated giving consideration to the vehicles using the project together with the fuel and electricity that would be needed to operate the infrastructure (in particular the tunnels). The greenhouse gas emissions from vehicles using the project were estimated based on transport modelling predictions. This was done by comparing emissions at the metropolitan Melbourne scale for no-project and with-project scenarios for 2031.

Table D24 Results for the detailed appraisal of environmental criterion 5

Measure	Rating	
	Corridor A	Corridor C
Estimated quantity of greenhouse gas emissions during construction	Greenhouse gas emissions estimated to be around 500,000 tCO ₂ -e.	Greenhouse gas emissions estimated to be around 1,400,000 tCO ₂ -e.
Estimated quantity of greenhouse gas emissions during operation (based on estimated operational power consumption, linked to length of tunnel)	Greenhouse gas emissions estimated to be around 120,000 tCO ₂ -e or 20,000 tCO ₂ -e annually.	Greenhouse gas emissions estimated to be around 600,000 tCO ₂ -e or 100,000 tCO ₂ -e annually.

The detailed appraisal of these measures indicated that the potential impacts on greenhouse gas emissions would be greater for corridor C than corridor A.

Potential impacts on greenhouse gas emissions during construction relate primarily to electricity consumption for construction works and from construction materials. Corridor C is expected to produce more than double the amount of greenhouse gas emissions during construction than corridor A. This is attributable to the greater length of tunnelling required for corridor C, as tunnelling generally has greater energy requirements than surface works.

During operation, emissions associated with vehicles using the project are predicted to be comparable for the two options. However, corridor C is expected to generate almost five times the emissions generated by corridor A each year. This is largely because corridor C has a longer stretch of tunnel, which has greater energy requirements for operation.

Guiding Principle 3 - Minimise impacts during the construction phase

Construction criterion 1: How does the option impact on public transport during construction?

Results for this criterion were determined using the measure presented in Table D25. This measure was evaluated through a qualitative analysis of works to be undertaken in the vicinity of rail lines.

Table D25 Results for the detailed appraisal of construction criterion 1

Measure	Corridor A	Corridor C
Extent of impacts on rail operations	Minimal anticipated impact on rail	Minimal anticipated impact on rail

The detailed appraisal of this measure indicated that corridors A and C are comparable with respect to minimising impacts on public transport during construction.

Corridor A has construction close to the rail lines near Watsonia Station, with the need to construct over the rail lines. This will require closure of the rail line to ensure a safe work zone as well as to keep rail passengers safe. This work would need to be undertaken over weekend shutdown periods. Given the limited extent of works, this should be possible.

Corridor C requires construction of two rail crossings via bridge structures: one over the Hurstbridge Rail Line and one over the Belgrave Lilydale Rail Line. This work would need to be undertaken over weekend shutdown periods. Given the limited extent of works, this should be possible.

This assessment criteria focuses on the impact to rail operations. Construction criterion 2 (discussed below) assesses the impact to the arterial road network, including impacts on all road users, which includes bus services. A further public transport consideration is the impact to buses operating on the Eastern Freeway. Corridor A requires a significant expansion of the Eastern Freeway between Burke Road and Springvale Road. A large proportion of buses using the Eastern Freeway gain access at Doncaster Road and Bulleen Road. These buses would need to operate on a modified Eastern Freeway during construction outbound from Burke Road. During construction, it is anticipated that all lanes on the Eastern Freeway would remain open during the day and at peak times; however, the hard shoulder would be reduced in width, which would require buses to operate in the running lanes. This would result in increased travel times on the Eastern Freeway for buses between Doncaster Road and Burke Road. Inbound of Burke Road, it is anticipated that existing conditions would be unchanged during construction. Corridor C does not impact upon the Eastern Freeway and is therefore not anticipated to have an impact on Eastern Freeway operations.

Construction criterion 2: How does the option affect the existing road network during construction?

Results for this criterion were determined using the three measures presented in Table D26. These measures were evaluated through a qualitative analysis that considered estimated truck volumes and movements, likely impacts on the surrounding road network and proximity to existing freeways for major construction areas.

Table D26 Results for the detailed appraisal of construction criterion 2

Measure	Corridor A	Corridor C
Impacts on road users (including road-based public transport) during construction	Road closures with suitable alternatives	Road closures with suitable alternatives
Estimated number of truck movements during construction phase	<500,000	>1,000,000
Extent to which construction traffic affects surrounding road network and intersection performance	Multiple alternative roads to manage haulage	Minimal alternative roads to manage haulage

The detailed appraisal of these measures indicated Corridor A outperforms Corridor C with respect to the ability to minimise impacts to the existing road network during construction.

Corridors A and C would be constructed on and alongside active roadways, resulting in the need for works on active roadways and road closures. However, it is considered that suitable alternatives exist for each corridor; therefore, the corridors perform comparably.

The estimated number of construction phase truck movements required for each corridor is a good indicator on the impacts of construction. Corridor C would have significantly greater volumes of trucks operating during construction (>1,000,000) compared with Corridor A (<500,000), which would result in significantly greater impacts during construction.

The extent to which construction traffic would affect the surrounding road network is expected to be less under Corridor A than Corridor C due to the greater number of routes that would be available to trucks, the location of the tunnel portals in closer proximity to arterial roadways and the lower volume of trucks under Corridor A.

Corridors A and C both connect to the existing freeway network and this is expected to cause some form of disruption through speed reductions, lane closures or even full freeway closures during construction. It is anticipated that connections to the M80 in Greensborough would be comparative for both corridors.

Construction criterion 3: How does the option affect amenity during construction?

Results for this criterion were determined using the two measures presented in Table D27. These measures were evaluated using GIS analysis.

Table D27 Results for the detailed appraisal of construction criterion 3

Measure	Corridor A	Corridor C
Number of residential properties within 100m of construction activities	~3,500	~2,800
Number of sensitive receptors (schools, hospitals, aged care) within 100m of construction activities	15-20	15-20

These measures examined the number of residences and other sensitive receptors near to the construction works as an indicator of the level of clay disturbance that might be experienced during the construction phase. Corridor C outperforms Corridor A for this criterion, primarily due to the greater density of residential population in the vicinity of the Corridor A works. In relation to other sensitive receptors, both corridors were found to have similar numbers in their immediate vicinities.

Guiding Principle 4 – Optimise the efficient use of resources

Resource criterion 1: What is the estimated cost of the option?

Results for this criterion were determined using the two measures presented in Table D28. These measures entailed assessment of the estimated capital and operational expenditure of each corridor option. These expenditures were determined through development of a base cost estimate for the concept alignment identified in each corridor, including an assessment of risk to enable a risk adjusted estimate to be determined.

Table D28 Results for the detailed appraisal of resource criterion 1

Measure	Corridor A	Corridor C
Estimated capital expenditure	Up to \$16.5 billion (nominal D&C costs at P90)	Up to \$24 billion (nominal D&C costs at P90)
Estimated operational expenditure	Up to \$6 billion (O&M expenditure to 2065)	Up to \$9 billion (O&M expenditure to 2065)

The detailed appraisal with respect to this criterion shows that Corridor A performs more strongly than Corridor C in relation to cost, both in construction and operation. Primarily, this is due to the longer tunnel length that requires a longer construction period, greater labour and material costs in construction and increased operations cost due to the greater length of the connection and length of tunnel requiring ventilation.

Resource criterion 2: How well might the option perform in relation to benefits?

Results for this criterion were determined using the two measures presented in Table D29. These measures were evaluated through strategic transport modelling outputs.

Table D29 Results for the detailed appraisal of resource criterion 2

Measure	Corridor A	Corridor C
Average volume to capacity ratios	0.79	0.64
Change in VKT on freeways in Melbourne	30-35%	25-30%

Corridor A outperforms Corridor C in that the asset is likely to provide a more optimal, efficient and well-used roadway, thereby providing a more efficient use of the asset. This is demonstrated through an average volume to capacity ratio that is close to 0.8 for Corridor A, compared to 0.64 for Corridor C, which indicates underutilisation of the full asset in the 2036 forecast year.

Both corridors A and C result in an increase in vehicle kilometres travelled (VKT) on the freeway network, demonstrating an increased efficiency in total trips as arterial road trips are shifted onto the freeway. Corridor A outperforms Corridor C in that a greater number of trips are attracted to the freeway, demonstrated through a greater change in VKT on the freeway.

Resource criterion 3: How well does the option unlock spare capacity?

Results for this criterion were determined using the two measures presented in Table D30. Transport modelling analysis was used to evaluate the first measure; qualitative road network analysis and planning was used to evaluate the second measure.

Table D30 Results for the detailed appraisal of resource criterion 3

Measure	Corridor A	Corridor C
Change in VKT on arterial roads in Melbourne	-3%	0.2%

Corridor A outperforms Corridor C in that it is expected to provide a net decrease in arterial road vehicle kilometres travelled across metropolitan Melbourne. Corridor C is not expected to cause a net change in VKT on arterial roads.

Overall, Corridor A performs best with respect to how well the option unlocks spare capacity.

Resource criterion 4: How does the option future proof the transport network?

Results for this criterion were determined using the two measures presented in Table D31. These measures were evaluated using a qualitative assessment based on predictions and discussions regarding future technologies and knowledge of proposed public transport strategies.

Table D31 Results for the detailed appraisal of resource criterion 4

Measure	Corridor A	Corridor C
Ability to cater for future freeway connections (e.g. OMR and EWL)	Does not preclude future motorway connections	Does not preclude future motorway connections
Ability to cater for future public transport network improvements	Corridor A provides for future improvements	Less provision for PT improvements than Corridor A.
Ability to cater for future technologies	Equal opportunities	Equal opportunities

Corridors A and C perform comparatively in relation to the ability to cater for future freeway connections. The future freeway connections envisaged by long term Victorian transport planning are the Outer Metropolitan Ring/E6 Transport Corridor and the Eastern Freeway to CityLink Connection. Both corridors A and C have the ability to connect to these future freeways in an efficient manner. Neither Corridor A or C actively precludes the delivery of these future motorway connections.

The detailed appraisal with respect to this criterion found that Corridor A is marginally better than Corridor C with respect to future proofing the public transport network. There is a significant number of public transport services in the vicinity of Corridor A, which will benefit from the delivery of the North-East Link along the Corridor A alignment. This is primarily through the redistribution of vehicles from the arterial road network to the North-East Link, creating road space for public transport. Corridor A provides upgrades for the BRT, bus interchanges and railway line connections.

The Corridor C alignment traverses areas where there are few existing bus routes due to the limited road network and lower population density compared to corridor A. This reduces the opportunity to cater for future network improvements.

Both options allow the same opportunities to incorporate future new transport technologies, such as self-driving vehicles.