CHAPTER FOUR
OPTIONS ANALYSIS

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CHAPTER SUMMARY AND CONCLUSIONS:

- Rigorous options analysis has been undertaken to determine the optimal solution to the problems identified. The recommended solution involves an infrastructure investment option focused on a rail public transport solution, with the CRR Project confirmed as the preferred approach. Key aspects of the CRR Project have been derived from previous studies and solutions including the CRR Project 2011 and the Bus and Train (BaT) Project.
- Options have been analysed across six levels, specifically:
  - strategic options
  - infrastructure investment options
  - rail infrastructure options
  - CBD alignment and station options
  - tunnel length options
  - northern connection options.
- The CRR Project has been optimised in comparison to the CRR Project 2011, with a shorter tunnel, new CBD alignment and a northern connection.

4.1 Purpose and Overview of this Chapter

The purpose of this chapter is to summarise the investment options analysed. The chapter draws upon analysis undertaken for the CRR Project 2011, work undertaken for the Bus and Train (BaT) Project, an options assessment undertaken by TMR in 2015–16 and updated investigations. By providing clarity on the options considered, it demonstrates transparency of process and generates confidence that the recommended option will deliver the required benefits.

This chapter outlines:

- the approach taken to identify, assess and confirm options
- the assessment of rail investment options used to determine the preferred infrastructure option
- the assessment of options regarding the CRR Project's alignment through the CBD and location of CBD stations, tunnel length and inclusion of a connection to northern rail networks.

4.2 Approach

This options analysis is primarily based on previous work outlined in Chapter 1: Project Background. Options and sub-options for the CRR Project were identified and assessed using qualitative criteria analyses, with feedback provided by project stakeholders.

4.3 Options Identification

Figure 4.1 shows the options considered to determine the preferred option for a rail infrastructure investment solution.

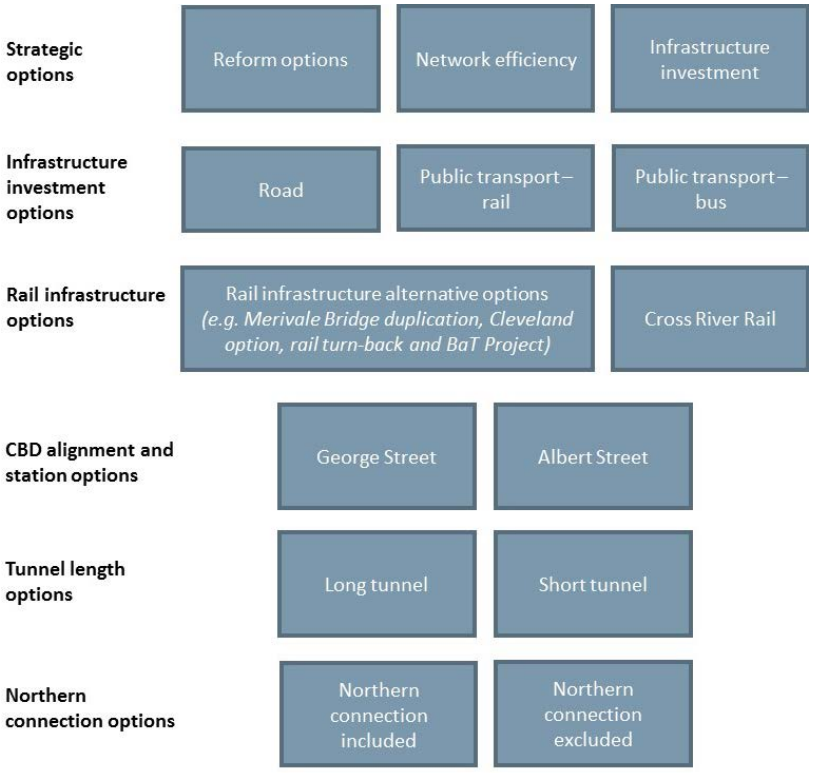

Figure 4.1: Options Identification Process

Options for a solution to meet the identified needs were assessed at six levels:

1. Strategic options: Alternative options aimed at meeting the service requirements were examined including reform options, operational efficiency measures and infrastructure options.
2. Infrastructure investment options: Options for infrastructure investment, whether in roads or in public transport (either bus or rail), were assessed at the strategic level.
3. Rail infrastructure options: Various heavy rail alternative options were examined including the CRR tunnel and a combined bus and rail tunnel.
4. CBD alignment and station options: The placement of the southern CBD station – whether at George Street or Albert Street – was examined along with the alignment through the CBD.
5. Tunnel length options: The value of a long tunnel versus a short tunnel was considered.
6. Northern connection options: Connection of the CRR Project to northern rail networks, and supporting activities required, were examined.

Options were assessed at each of these levels, with the outcomes presented in the sections below.

4.4 Options Assessment and Confirmation

4.4.1 Strategic Options

The strategic options analysis undertaken prior to preparing the CRR Detailed Business Case 2016 considered reform, network efficiency and infrastructure investment options. The assessment found the following:

- Identified reform options have been largely implemented to the extent possible.
- New generation signalling through the European Train Control System (ETCS) – Inner City Project is the preferred network efficiency option that will enable the rail network to meet short-term demand, as well as providing additional safety, reliability and efficiency benefits.
- An infrastructure solution is still required to address long-term demand and realise broader social and economic benefits.

4.4.2 Infrastructure Investment Options

The next stage in the options assessment process was to determine the most appropriate transport mode for investment: road (private vehicles) or public transport. This analysis relied heavily on the significant body of work completed as part of the State Infrastructure Plan (SIP) and supporting planning documents including the South East Queensland Regional Plan 2009–2031 (SEQRP) and Connecting SEQ 2031 (CSEQ).

4.4.2.1 Road Network Investment

As discussed in Chapter 3: Problem, the SEQ road network has seen significant expansion in the last 20 years through the development of toll roads and a program of enhancements to local, sub-arterial and arterial roads and motorways in the remainder of the road network.

While these projects have increased the capacity of the SEQ road network, they have not sought to increase road capacity directly into the inner-city core as this would encourage more cars into the congested CBD. Increasing traffic through the CBD would reduce the efficiency of road-based bus services, impacting on the quality of service for CBD commuters.

The current and future constraints in the road network discussed in Chapter 3: Problem, reinforce the need for investment in public transport capacity.

4.4.2.2 Bus Network Investment

Bus is the most flexible form of public transport. Generally, it is best used to service low-to-medium levels of demand, spread over a low-density urban area, with dispersed destinations. Buses are better utilised on local or short-length transport tasks due to travel speed, passenger capacity and comfort levels.

The bus network (including busways) has less capacity to move passengers than an efficient rail network. As shown in Chapter 3: Problem, a six-carriage train car has a carrying capacity of 750 people, compared to a 250-person standard light rail capacity and a 95-person articulated bus capacity. This chapter also outlines a range of current and future capacity challenges facing the SEQ bus network.

Without major upgrades to busway infrastructure into the CBD and to bus stations, the reliability of buses will continue to be impacted by worsening traffic congestion as transport demand increases. Opportunities for future growth in the bus network are limited by accessibility constraints in the CBD including direct busway access to the CBD, capacity of underground bus stations and the availability of kerbside space for bus stops.

Based on the investment strategy outlined in CSEQ, improvements to the bus network could complement the CRR Project but will not be able to meet forecast demand for more trips and longer trips to the CBD.

Using additional rail capacity as the spine of trunk services to and within the inner city opens up opportunities to reorient the bus network. This could be used to more effectively link bus and rail networks at key interchanges, catering for communities not serviced by rail or the busway network. This contrasts sharply with the bus network's current operating paradigm, which accommodates customer preferences for a 'single-seat' journey, with most bus services terminating in the CBD. This network design results in dense and complex bus operations within the city and a lack of integration between bus and rail services.

A comparison of the current paradigm and a trunk and feeder system is shown in Figure 4.2. Strategic assessments (including CSEQ) have determined that this approach will be the focus of future network developments.

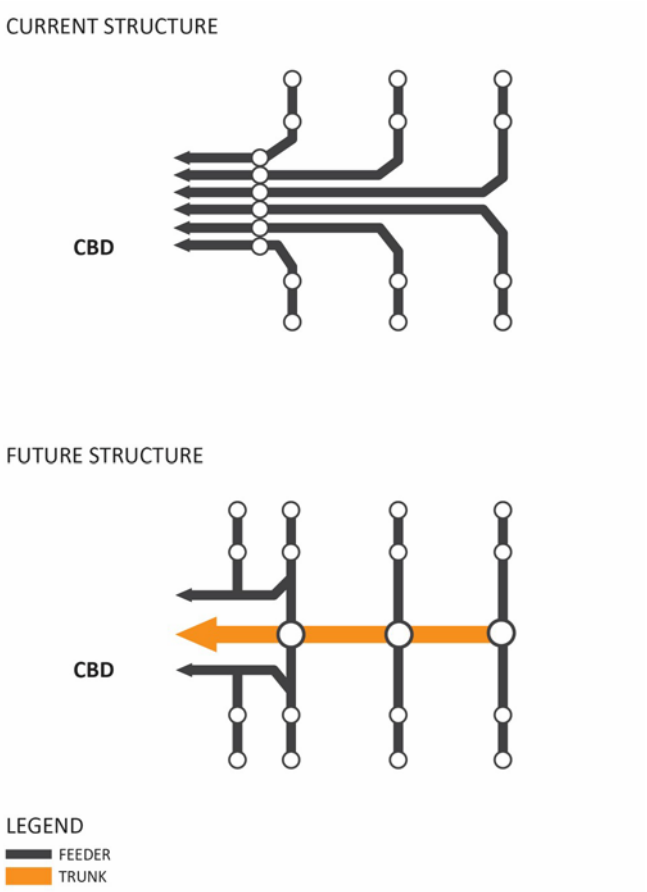

Figure 4.2: Comparison Between the Current SEQ Network Operating Paradigm (Upper) and a Trunk and Feeder System (Lower)[40]

[40] Connecting SEQ 2031

4.4.2.3 Rail Network Investment

CSEQ and other previous studies have identified rail as the transport mode best suited to meeting SEQ's forecast transport demand. It has the high capacity needed to meet demand growth and to serve intercity and long-distance commuting.

A substantial amount of SEQ's future growth is expected to occur outside of greater Brisbane in areas north of Caboolture, south of Beenleigh and west of Ipswich. This will generate greater demand for longer trips to the region's primary employment centre, the Brisbane CBD. These trips are inefficiently serviced by road-based public transport due to inner-city road constraints such as limited capacity on cross-river bridges. Buses are also less suited to longer line-haul journeys – they cannot compete with rail in terms of travel time and level of comfort.

Possible reform and network efficiency measures have either been implemented or are currently being implemented such as timetable improvements, measures to reduce train waiting times and ETCS – Inner City Project. The Queensland Government is now focusing on initiatives to unlock the rail network's capacity and expand it to meet forecast demand. Boosting inner-city rail network capacity will enable more frequent services from all parts of the region and allow the network's reach to broaden.

4.4.2.4 Transport Investment Strategy

The transport investment strategy outlined in the SIP and CSEQ, and used for the investigations conducted for the CRR Project 2011 and BaT Project, is based on a multimodal investment program incorporating the following principles:

- a progressive shift to rail as the backbone of the region's passenger transport system
- bus playing a 'workhorse' role, supporting rail and filling in gaps in the rail network and existing busways
- completing the strategic road network
- ensuring arterial roads cater for all users (buses, cyclists, pedestrians, cars and commercial vehicles)
- targeting freight investment to support the economy
- providing for increased active transport use.

The SIP, CSEQ, SEQRP and transport modelling analysis undertaken for the CRR Project all indicate that passenger transport demand will increase across the SEQ transport network and, more specifically, for trips to and from the Brisbane CBD. Public transport is the preferred mode for investment, with an emphasis on rail as the backbone of the region's passenger transport system.

4.4.3 Rail Infrastructure Options

This section discusses key previous projects investigated, outlining the nature of each project – including the planned scope of work – and its ability to meet the required transport task. These projects include:

- duplication of the Merivale Bridge
- conversion of the Cleveland and Ferny Grove railway lines to light rail
- heavy rail turn-back options (supported by inner-city bus, light rail or metro networks)
- combined bus and rail tunnel beneath the Brisbane River and CBD
- CRR tunnel.

A high-level summary of the issues associated with each of the options above is provided below.

4.4.3.1 Merivale Bridge Duplication

Duplicating the Merivale Bridge was considered as an alternative to a north-south rail tunnel in several studies. However, duplicating the bridge would be insufficient to address capacity constraints in the inner-city rail network; it would merely force more trains into the congested core.

To be viable, duplicating the Merivale Bridge would also require duplicating the inner-city rail corridor from the south of Park Road to Bowen Hills.

The south-side works would start with a major grade separation at Park Road. It would incorporate a tunnel for the Cleveland line, while maintaining the Beenleigh line at surface level. North of the Park Road grade separation, the corridor would combine at surface level to become a four-track corridor, continuing through upgraded South Bank and South Brisbane stations. These stations would be expanded to feature four platforms. Once across the duplicated bridge, and after a very short section of elevated structure, the rail alignment would, as quickly as possible, proceed to dive on the north side of the river, entering a tunnel system that would provide for an underground station at Roma Street station. This tunnel would continue to meet with new underground platforms at Central, Fortitude Valley and Bowen Hills stations.

This option has not been progressed due to a number of issues, which are summarised below:

- Freight: This option would require utilising spare capacity on rail infrastructure currently used for freight services.
- Access: By using the same route as the existing rail corridor, this option does not improve access to the public transport network, specifically, from CBD areas with poor rail access and to current and future development precincts. This option fails to support growth in new transit-orientated developments and priority development areas (PDA's) such as Woolloongabba and Bowen Hills.
- Time savings: This option would provide only limited travel time savings for customers since it follows the same rail alignment.
- Sustainability: This option fails to support sustainability outcomes. In particular, despite encouraging some increased use of rail services, it does not support redevelopment and densification of precincts within the inner city. As a result, it would not assist in meeting SEQRP targets that aim to encourage settlement trends away from unsustainable, low-density, greenfield urban development in Brisbane.
- Constructability: This option presents a number of constructability issues including (but not limited to):
  - construction in a heavily constrained environment both north and south of the Brisbane River
  - geographical restrictions for widening the corridor to enable a four-track alignment from South Brisbane to Park Road
  - significant property impacts
  - potential conflicts with access to the Roma Street fire station associated with the cut-and cover-tunnel required in upper Roma Street
  - impacts for Roma Street and Central stations including significant disruption to rail operations and difficulties with design (spatial limitations) for access and egress
  - extremely tight spatial requirements at South Brisbane station resulting in a platform width smaller than recommended standards, with implications for safety and capacity

  - significant impacts on rail operations during construction as a result of changes to existing rail infrastructure (stations and track), as well as the addition of new rail infrastructure in a brownfield operating environment.

- Cost: This option was estimated to cost less than a north-south tunnel, but with a higher risk profile.

4.4.3.2 Cleveland Light Rail Conversion Option

This option explored replacing heavy rail services on the Cleveland and Ferny Grove lines with light rail or metro services. It proposed constructing a new light rail or metro line across the Brisbane River and through the CBD. This would remove these suburban rail services from the Merivale Bridge and congested inner-city rail network.

This option was proposed by the SEQ Council of Mayors in 2012 as a lower cost alternative to the CRR Project. It would involve constructing a new light rail line from Park Road station to Roma Street station, via:

- tunnel to Woolloongabba
- a new bridge over the Brisbane River beside the Captain Cook Bridge and Riverside Expressway
- tunnel beneath Herschel Street to a new underground platform under Roma Street station.

As well as underground platforms at Roma Street, new underground light rail stations would be provided at Park Road and Woolloongabba, with elevated light rail stations near the Queensland University of Technology (QUT) Gardens Point campus and Queen Street. After Roma Street station, the line would run on surface along the Exhibition line corridor, with a new Exhibition station and a new Bowen Hills (West) station, before joining into the Ferny Grove line at Breakfast Creek.

This option was not progressed due to a number of issues, some of which are outlined below:

- This option would be subject to alignment and constructability issues as the proposed alignment is not optimal for a modern railway and would constrain vehicle speeds significantly, impacting travel times adversely.
- The key growth from the north will be on the northern main lines from Caboolture, Redcliffe and Sunshine Coast. These two tracks would not be assisted by incremental capacity relief offered by the Cleveland option.
- This option would have significant operational impacts on the heavy rail network for freight and passenger services, including the following:
  - The current Ferny Grove flyover is used by passenger rail services for positioning into and from Mayne Yard. Additional infrastructure and cost would be required to separate light metro operations from the heavy rail services using the Ferny Grove flyover, otherwise the operation of Mayne Yard would be severely compromised.
  - The proposal would reduce the current capacity of the Cleveland line for movement of freight, noting this is a key corridor to the Port of Brisbane.
- This option would effectively reduce public transport capacity by operating smaller light rail vehicles (90 metres long) that would not carry the same number of passengers as existing trains.
- While the project was proposed as a lower cost alternative to the CRR Project, cost consultants estimated the cost to be of a similar order of magnitude to the core CRR Project (the first stage of the CRR Project consisting of the 10-kilometre tunnel section only proposed in 2013). Costs were increased by risk, higher

cost of conversion, underground stations and additional rail infrastructure required (for example, duplication of the Cleveland line).

4.4.3.3 Rail Turn-Back Options

This option involves terminating rail services at CBD-fringe stations, upgrading those stations as major passenger interchanges and completing the 'last mile' using an alternative transport mode. This option proposed expending less on the heavy rail network and allocating remaining funding to either an enhanced bus network, new light rail system or new metro system. Major rail terminus and passenger interchange stations were investigated at South Brisbane, Milton and Bowen Hills.

Consistent with the outcomes of the Independent Panel Review 2012, these alternative options were subject to a rapid economic appraisal and were found to have costs that exceeded the benefits.

4.4.3.4 Combined Bus and Rail Tunnel

The BaT Project presented an alternative to the CRR Project 2011. This five-kilometre integrated busway and rail tunnel stretched from Dutton Park (in the south) to Spring Hill (in the north), along a similar alignment, with stations at Woolloongabba, George Street and Roma Street. The key difference between the CRR Project 2011 and this project was the inclusion of buses in the tunnel.

Issues with the BaT Project include:

- Duplication of transport capacity: While bus and rail typically service different markets, with bus catering for shorter trips and rail catering for longer distances, the BaT Project saw both bus and rail networks merge for around five kilometres through the inner city. This would create unnecessary and inefficient duplication of transport capacity through the location of competing modes in the same corridor.
- Not addressing key rail growth markets: The passenger capacity benefit of the BaT Project was derived from trains entering the inner city from the south. It would not provide any benefit to rail passengers on the northern rail lines, which are expected to experience significant growth in the medium term.
- Lower utilisation of rail infrastructure: The CRR Project encourages greater utilisation of the rail network than the BaT Project, with associated environmental benefits (reduced emissions). Greater utilisation of the rail network is aligned with a number of government policies and plans, including the SIP, SEQRP and CSEQ.
- Poor customer outcomes: Combining bus and train services in the same tunnel would require platforms to be located much deeper in the ground – leading to longer transport times – and greater crowding around station entrances and exits.
- Technical complexity: A significant proportion of the BaT Project's cost would be allocated to bus infrastructure, resulting in a sub-optimal outcome for the core issue of providing a step-change in rail capacity through the inner city. Importantly, the inclusion of bus made the rail component more expensive through the need for a larger tunnel profile, deeper river crossing, more complex and deeper stations, greater ventilation and fire and life safety requirements and longer dive structures to meet the grade requirement.

It should be noted that some design elements of the BaT Project were further considered in the options assessment conducted for the CRR Project, including the short tunnel and George Street station.

4.4.3.5 Cross River Rail Tunnel

The CRR Business Case 2011 documented the thorough process undertaken to determine the best infrastructure solution to meet SEQ's forecast transport demand.

The CRR Project 2011 consisted of 10-kilometre, twin, single-track tunnels between Yeerongpilly (in the south) and Victoria Park (in the north). Four new underground stations were proposed along the tunnel at Woolloongabba, Boggo Road, Albert Street and Roma Street. The CRR Project 2011 also proposed five kilometres of additional surface tracks south of Salisbury. At the southern end, a new surface station at Yeerongpilly and minor upgrades at Moorooka and Rocklea railway stations were proposed. At the northern end, a new surface station at the Exhibition site was planned. From the northern portal at Victoria Park, the CRR Project 2011 also proposed three kilometres of two additional surface tracks on the Exhibition Loop, plus additional track construction and realignment through Mayne Yard.

The CRR Business Case 2011 demonstrated the underlying need for the project and the benefits of proceeding with the CRR Project 2011. The project was subsequently afforded 'ready to proceed' status by Infrastructure Australia in 2012 and was nominated as Queensland's highest priority infrastructure project.

The CRR Business Case 2011 found that the CRR Project 2011 would address fundamental rail network constraints by delivering a new river crossing and additional rail capacity in the CBD and inner city. This would allow for future growth beyond 2031.

The CRR Project 2011 was consistent with the transport investment strategy outlined in CSEQ. It proposed contributing to SEQ's mode share targets and other transport goals by:

- increasing the mode share of public transport trips in the region by increasing network capacity and providing alternative city station locations
- increasing the mode share of active transport trips in the region
- reducing the mode share of private vehicle trips in the region.

The CRR Business Case 2011 recommended proceeding with the core of the project (10-kilometre tunnel section only) as the first stage, with minimal redundant works. This had a significantly reduced capital spend compared to the full CRR Project 2011 while still playing a key role in achieving the required transport goals of CSEQ.

Options assessment undertaken prior to preparing the CRR Detailed Business Case 2016 confirmed the value of a rail-only solution, identifying the CRR Project as the preferred rail infrastructure solution to meet service requirements. However, the assessment also recognised that some elements of the BaT Project could be used to enhance the CRR Project 2011's reference design. These project options are the focus of the following section.

4.4.4 CBD Alignment and Station Options

A new train station servicing the southern part of the CBD was identified as a requirement by the detailed feasibility investigations for both the CRR Project 2011 and BaT Project.

The location of the southern CBD station and its corresponding alignment through the city was a key consideration for the CRR Project. The preferred alignment passes beneath Roma Street station under the Brisbane Transit Centre (BTC) and surfaces around the Normanby Yards. Positioning the northern portal at the Normanby Yards avoids significant impacts on Victoria Park. This is similar to the solution developed for the BaT tunnel, which was generated in response to community concerns about Victoria Park, expressed

during public consultation. The alignment through Roma Street to the northern portal was evaluated, with the preferred outcome for the western Roma Street station underneath the BTC, connecting into the Exhibition Loop.

Figure 4.3 shows the locations considered for the southern CBD station. The connection between this station and the Roma Street station was integral to the selection of possible locations. Work was undertaken to demonstrate that both the Albert Street and George Street stations are compatible with the preferred northern portal alignment. Each option is discussed in more detail below.

Figure 4.3: Southern CBD Station Location Options

4.4.4.1 Option 1: Albert Street Option

This option positions the southern CBD station on Albert Street, extending from Alice Street to Charlotte Street as per the CRR Project 2011. A cavern is required over the extent of the station platform, which is connected through passages to the cut-and-cover entrance structures.

As identified in the CRR Project 2011 reference design, significant flood mitigation measures are required at the Albert Street location, with some geotechnical issues.

A modification to the CRR Project 2011 alignment is required to account for the revised Roma Street station location. The alignment follows Albert Street to Turbot Street, where there is a horizontal curve so the alignment can pass under the Queensland Law Court complex to connect to Roma Street station under the BTC.

4.4.4.2 Option 2: George Street Option

This option positions the southern CBD station on George Street, extending from Alice Street to Charlotte Street. The station consists of a central cut-and-cover station box, which extends along George Street from Margaret Street to Mary Street, with platform caverns either side of the cut-and-cover box.

While locating the station at George Street would enable it to integrate with the Queen's Wharf Brisbane (QWB) development, this integration has associated construction programming complexities and construction risks.

The proposed alignment is largely as per the BaT Project (revised reference design). The alignment passes below George Street, under the BTC, and continues to near the Exhibition Loop, with the northern portal located between the Brisbane Grammar School footbridge and Victoria Park land bridge.

Both of the southern CBD station options can be viably constructed and connect into the preferred location of the northern portal. To assess these options, a qualitative multi-criteria analysis (MCA) was completed using the criteria presented in Table 4.1, which were adapted from the SIP.

OPTIONS ASSESSMENT CRITERIA	
OBJECTIVE	**CRITERIA**
Improving prosperity and liveability	Reduce the amount of time commuters spend accessing the region's principal activity centre (CBD) by public transport.
	Improve the level of comfort and convenience commuters experience using the rail system to the CBD.
	Improve the choice for commuters accessing the CBD by public transport.
	Increase the reliability for commuters accessing the CBD by public transport.
Infrastructure that leads and supports growth and productivity	Increase use of commuter rail as the preferred mode for accessing employment opportunities in the CBD.
	Reduce the cost of traffic congestion to limit impacts on economic growth.
	Maximise the efficiency of the existing rail system.
Infrastructure that connects communities and markets	Increase the capacity of rail to cater for freight.
	Improve the alignment of rail network to the preferred land-use plan.
	Improve public transport to existing and emerging education and knowledge centres in the inner city.
	Improve overall inner-city station capacity.
Improving sustainability and resilience	Reduce the use of fossil fuels in the passenger transport fleet.
	Reduce the impact of the project on the natural environment.
	Minimise operational impacts on the community.
	Minimise construction impacts on the community.
Optimise investment outcomes	Develop an affordable option that maximises project outcomes.

Table 4.1: Options Assessment Criteria (Adapted from State Infrastructure Plan)

In terms of delivering transport outcomes and a high-quality customer experience, the outcome of the MCA indicated that both options significantly improve accessibility in the southern CBD and perform equally well in this regard.

The Albert Street option, however, provides greater coverage of the CBD and therefore better access for more residents, workers and students.

In achieving city-building outcomes, both station locations provide a compelling long-term vision for the evolution of the CBD and a logical evolution of growth. George Street is closer to city 'landmark' precincts such as QUT Gardens Point, Parliament and QWB. Albert Street is more central to the core of the CBD. There are potentially greater development opportunities associated with Albert Street, while development around George Street station is already underway. The project would also have cumulative impacts and coordination issues with QWB that would have to be resolved.

Given the above, it was determined that the proposed Albert Street station is marginally preferable and should be retained as the preferred CBD station due to:

- the potential for a better passenger experience in terms of public realm circulation, quality and clarity of journey
- its location in the heart of the CBD, enabling it to service government and business precincts
- its capacity to effectively spread passenger movements across the city and support broader CBD development
- its support for short-term property development and long-term city transformation outcomes.

4.4.5 Tunnel Length Options

The BaT Project reduced the length of the CRR tunnel 2011 by moving the southern portal from Yeerongpilly to Dutton Park. While this modification significantly reduced costs and community impacts, it did not provide additional rail freight capacity in the southern rail network.

The options considered for the CRR Detailed Business Case 2016 include a:

1. long tunnel from Yeerongpilly to Spring Hill as per the CRR Project 2011
2. short tunnel from Dutton Park to Spring Hill similar to the BaT Project.

Table 4.2 summarises the key features of each tunnel option.

KEY SUMMARY POINTS – TUNNEL LENGTH OPTIONS	
OPTION 1: LONG TUNNEL	**OPTION 2: SHORT TUNNEL**
▪ As per CRR Project 2011 and core CRR Project (2013) ▪ 10km in length between Yeerongpilly (in the south) and Spring Hill (in the north) ▪ Provides for a dedicated rail freight route from the west to the Port of Brisbane when combined with additional surface works in the south ▪ Includes additional new station at Yeerongpilly with associated intermodal interchange opportunities and land-use benefits ▪ Allows for greater level of operational flexibility for Queensland Rail	▪ As per BaT Project ▪ 5.9km in length between Dutton Park (in the south) and Spring Hill (in the north) ▪ Rail freight restrictions continue during peak periods as per current arrangements ▪ Reduced impact on local community ▪ Significant cost savings (capital and operations)

Table 4.2: Key Features of Tunnel Options

Similar to the CBD alignment and station options assessment, presented in Section 4.4.4, a qualitative MCA was undertaken to evaluate the tunnel length options. The outcome of the assessment clearly favoured the shorter tunnel due to its lower cost and complexity. The shorter tunnel has reduced community impacts and avoids many of the community concerns associated with impacts on private property from the long tunnel option. Acknowledging that affordability is a key consideration for the CRR Project, the shorter tunnel is seen to provide acceptable outcomes when measured against the objectives and service requirements. However, this will be accompanied by the loss of some long-term benefit for rail freight, operational efficiencies and land-use outcomes around Yeerongpilly.

The short tunnel option offers a more favourable Benefit Cost Ratio and economic outcome over the long tunnel and was identified as the preferred option for the CRR Project.

4.4.6 Northern Connection Options

Staging investigations for the core CRR Project (2013) did not include a connection to northern railway networks, in part because the proposed viaduct over Mayne Yard incurred considerable additional project cost. Also, capacity constraints on the northern lines reduced the potential benefits offered by a northern connection. These factors deferred the inclusion of the northern connection in the first phase of work until northern capacity issues could be resolved (via the proposed North West Transport Corridor) and further planning work through Mayne Yard could be completed.

Recent planning work highlighted opportunities to increase capacity of the northern line via low-cost infrastructure and signalling upgrades. The updated preliminary transport modelling confirmed a higher level of demand from the north. Including the northern connection through Mayne Yard in the Reference Project would enable the rail network to meet this forecast demand.

Unlocking capacity constraints north of the portal will require enabling works between Albion and Northgate, in addition to the northern connection. These works propose reconfiguring platforms at Northgate and Wooloowin stations so they can function as double-sided platforms. Supported by express running and upgraded signalling, this would shorten headways between trains and increase the corridor's capacity by enabling increased throughput.

The options considered for the CRR Detailed Business Case 2016 include:

1. including a northern connection in the new project scope
2. not including a northern connection in the new project scope.

Similar to the CBD alignment and station options assessment, presented in Section 4.4.4, a qualitative MCA was undertaken to determine the preferred northern connection option. Modelling shows that within a decade the current network will be unable to satisfy demand from the north, even with a new signalling system in place in the inner city. Additional inner-city rail capacity for services coming from the north will be required.

Balancing this, affordability remains a significant consideration as the northern connection carries substantive capital costs. The alternate option – Exhibition line termination – has a much lower cost and lower community impacts. However, this is also offset by the environmental benefits offered by a northern connection such as reduced reliance on private vehicles to access the CBD.

Options assessment undertaken prior to preparing the CRR Detailed Business Case 2016 recommended that the northern connection and works between Albion and Northgate be included in the scope of the CRR Project.