

# CROSS RIVER RAIL BUSINESS CASE

August 2017





# EXECUTIVE SUMMARY





# TRANSFORMING THE PUBLIC TRANSPORT SYSTEM

Cross River Rail will create the foundation for a world-class, integrated public transport system in South East Queensland (SEQ). It will alleviate the constraints at the core of the rail network so it can grow and evolve to benefit communities across the region.

SEQ is growing, with an extra 1.9 million people expected by 2036. While most residential growth is forecast to be outside Brisbane in areas such as the Gold Coast, Moreton Bay, Ipswich and the Sunshine Coast, almost half of all new jobs will remain in Brisbane. This means more people travelling longer distances to and from work in Brisbane each day.

Cross River Rail will release the capacity of the rail network so it can meet SEQ's future transport needs, particularly for these longer distance commutes. It will also unlock the potential for smarter integration of rail and bus networks through a broader restructuring of the public transport system. SEQ will be positioned for a more sustainable and competitive future with Cross River Rail accelerating sustainable regional growth and urban revitalisation, offering a framework around which Brisbane can grow.

At an estimated cost of delivery of \$5.4 billion, Cross River Rail will deliver a new 10.2-kilometre rail line between Dutton Park and Bowen Hills, with 5.9 kilometres of tunnel under the Brisbane River and the CBD. New, high-capacity stations at four inner-city locations and upgrades of Dutton Park

and Exhibition stations will provide direct access to more places of work, study and recreation.

Protecting the quality of life that attracts people from across the globe to live, work and play in SEQ as it grows is critical. But roads are already reaching capacity, costing the state nearly \$2 billion a year, with no room for new roads into the inner city. Commuters face the choice of adding to congestion or swapping to a bike, bus or train, yet SEQ's public transport system cannot deliver the fast, frequent and reliable services commuters need now and into the future. Despite the introduction of strategic reforms and operational efficiencies, the rail network is reaching its limits, constrained by infrastructure that is nearing capacity.

By delivering new rail infrastructure to the inner city, Cross River Rail will release the capacity of the entire rail network. Clearing the bottleneck on the Merivale Bridge through a second CBD river crossing will allow for rail extensions to growing parts of the region and additional services on existing lines, bringing relief to the city's most crowded services. A regional spine for fast, frequent rail services will be formed, setting the foundation for a new type of travel in SEQ. Local bus networks will be able to build on and integrate with this spine, with many future services feeding directly to rail. Brisbane City Council's Brisbane Metro would further support the strategic evolution of the network.



All transport users across SEQ will benefit. Passengers will access faster, less crowded and more reliable services. Car users who spend less time in traffic jams will enjoy faster and more efficient trips. Road freight operators will share in the benefits of future congestion relief.

Cross River Rail is an economical and efficient transit solution. With a benefit cost ratio (BCR) of 1.41, for every \$1 of total expenditure Cross River Rail is expected to return \$1.41 of benefits. The benefits of the project exceed costs by \$1.9 billion in net present value terms. This does not take into account \$1.2 billion (present value) of wider economic benefits, such as greater density of economic activity, reduced transport cost for business or more people participating in the workforce. Cross River Rail is expected to generate about 1,500 jobs a year during construction and 500 jobs a year during its operation.

With a procurement and delivery timeframe of seven to eight years, and rail demand forecast to almost double in this time, there is justification to invest in Cross River Rail now to ensure SEQ's transport infrastructure network can meet the demands of expected future growth.

## ABOUT THIS DOCUMENT

Building Queensland finalised the Detailed Business Case for Cross River Rail in June 2016, the core elements of which are now presented in this document. This document has been prepared in response to the Ministerial direction issued under the Building Queensland Act 2015 on 13 June 2017 by the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning to make the Detailed Business Case publicly available.

Commercially sensitive information has been removed to protect the state's commercial position during future project stages.

In line with the Ministerial direction, an independent peer review was undertaken to ensure the Business Case appropriately facilitates public awareness of, and accessibility to, information about Cross River Rail.

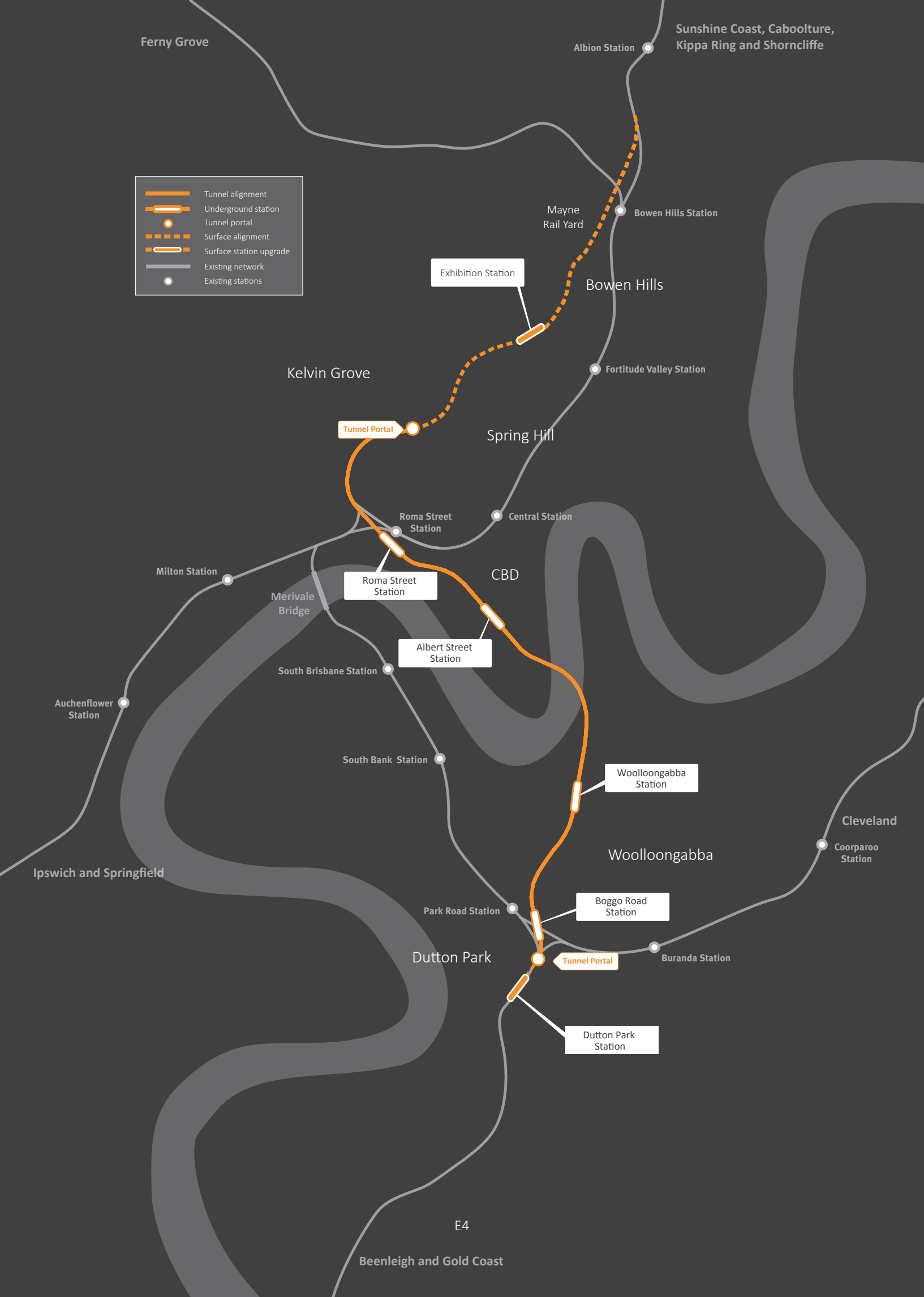
In preparing the Detailed Business Case in June 2016, expert advisors were engaged to undertake transport patronage modelling (Jacobs/PwC) and economic modelling (KPMG), which contributed to the key findings of the Detailed Business Case. The transport patronage and economic modelling were subject to independent peer review by leading industry experts including Bitzios Consulting (transport patronage modelling) and Douglas Economics (economic modelling).

The same expert advisors and independent peer reviewers were engaged to review recent updates to the modelling undertaken to account for policy and other changes that have occurred over the past year. For example, government population and employment projections reflecting most recent information from the Queensland Government Statistician have been updated; the capacity of the rail network is being increased through the European Train Control System – Inner City Project; and public transport patronage is up due to reduced fare prices introduced through the Fairer Fares package. Related assumptions that previously underpinned the Detailed Business Case have been updated and have resulted in a stronger economic case for the project.











10.2 kilometre  
north-south  
rail line



from Dutton park in the  
south to Bowen Hills in the  
north.

5.9 kilometre  
twin tunnels



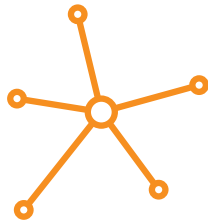
crossing under the Brisbane  
River and CBD.



**4 new underground  
stations** at Boggo Road,  
Woolloongabba, Albert Street  
and Roma Street.



**2 upgraded surface  
stations** at Dutton Park  
and Exhibition.



**Innovative systems**  
with platform screen doors,  
world-class signalling and  
accommodation for new  
generation rollingstock.



Designed to allow for  
**nine-car trains.**

# CROSS RIVER RAIL WILL:

**2X** the rail capacity across the Brisbane River and through the CBD from the south

reduces travel time from jobs to home so more people live within **30** minutes of where they work



improve rail services with less train crowding, shorter waiting times and better reliability



provide **turn-up-and-go** rail services in the inner city

take rail into new parts of Brisbane's city centre with the first new CBD station in more than 120 years



provide capacity to connect new cities and SEQ regional centres such as Caloundra, Flagstone and Coomera to the CBD by rail



enable greater **integration** of bus and rail services

free up road space for commercial vehicles, enabling faster speeds and quicker trips



generate about **1,500** direct and indirect jobs each year during construction



**Support** urban revitalisation in key inner-city growth areas such as Woolloongabba and Bowen Hills



manage congestion and reduce greenhouse gasses by shifting more people onto public transport



position Brisbane and SEQ for a more **sustainable and competitive future**







# A growing region

More people living outside Brisbane and commuting to the city every day for work will see demand for longer distance trips continue to grow over the next 20 years (see figure 1).

As Queensland’s capital city and primary commercial, industrial and services hub, Brisbane is the state’s most significant employment precinct. Moving people easily into and around the inner

city will be critical to sustaining Queensland’s future economic vitality as the region grows. Governments at all levels are committed to better linking major population centres to their neighbouring capital cities, as highlighted in the Australian Government’s Smart Cities Plan and the Queensland Government’s draft regional plan, ShapingSEQ.

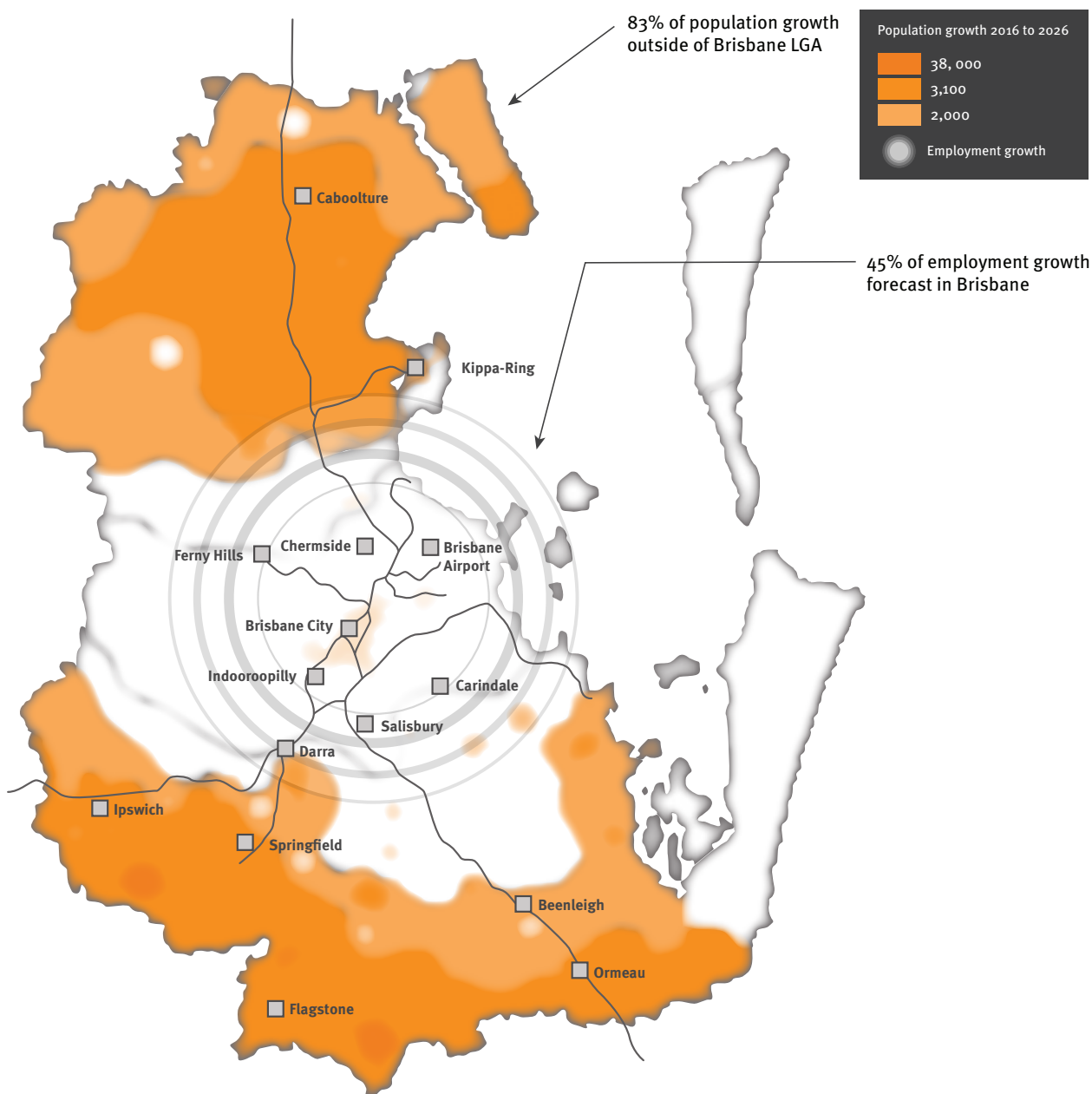


Figure 1: While most new SEQ residents will settle outside Brisbane, many new jobs will be in the city and surrounds which means more people commuting to Brisbane from around the region each day



SEQ’s current and future transport challenges cannot be met by building more roads that funnel traffic into the CBD. Busy parts of the network are already at capacity during peak times, with limited room for more roads. Congestion costs are rising with delays reducing economic efficiency and costing industry millions every year. The Australian Infrastructure Audit<sup>1</sup> estimates the cost of delays on the Brisbane–Gold Coast–Sunshine Coast transport network caused by congestion in 2011 was around \$2 billion. In the absence of any additional capacity, the cost of delays across the region is projected to grow to around \$9 billion in 2031<sup>2</sup>.

Good public transport underpins the region’s liveability and global competitiveness. It drives economic prosperity by enabling interaction between businesses, workers to access job opportunities and residents and visitors to enjoy leisure activities. It’s the foundation of a sustainable region and has the power to reshape cities.

Rail is one of the most efficient and sustainable forms of mass transit. It is also the backbone of the regional transport system and the public transport mode best suited to meet the demand for longer trips from residential areas beyond Brisbane to the inner city. Rail demand is expected to almost triple between 2015 and 2036 (see Figure 2) yet the regional network cannot accommodate this growth. Insufficient and outdated rail infrastructure in the inner city is limiting the network’s capacity and restricting its expansion.

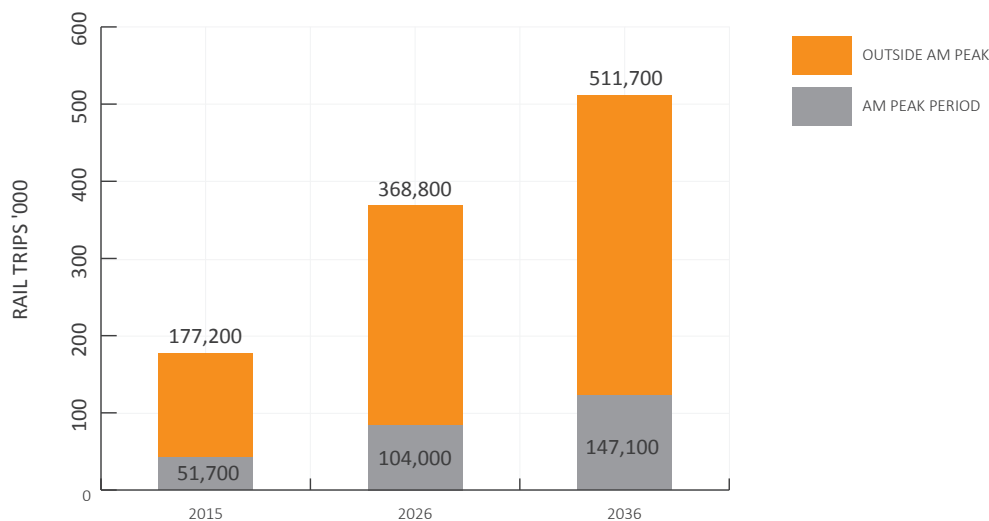


Figure 2: Driven by population and employment growth in the region, demand for passenger rail services is forecast to double from 2015 to 2026 and nearly triple by 2036, beyond the capacity of the system to handle

<sup>1</sup> Infrastructure Australia, Australian Infrastructure Audit, (2015)  
<sup>2</sup> State Infrastructure Plan

## Core of the network

Public transport trips are forecast to more than double between 2015 and 2036 but key parts of the network are reaching capacity, impacting service performance and constraining growth. Considered planning and investment is required to ensure the future performance of the transport network.

A significant volume of trips to urban centres such as Brisbane's CBD are made on public transport. Yet bus and rail services converge in Brisbane's city centre, which clogs the entire network and results in some bus services competing with, rather than complementing, rail services. Significant inner-city public transport infrastructure is also operating at or over its design capacity.

Compared to other major Australian cities, Brisbane's rail network has limited coverage in many areas and is relatively indirect in many corridors, which often means longer trips (door-to-door) by train than car. Rail's success relies on regular and reliable bus services to stations, sufficient park 'n' ride facilities and short waiting times for train services. Deficiencies in these areas, combined with limited coverage of the city, means that rail currently caters for a much lower share of trips than in other capital cities.

Pressure on inner-city rail and bus networks will intensify as demand grows. Brisbane's metropolitan rail system, which already experiences periodic overcrowding in key corridors, will need to cater for an additional 52,000 passengers in the morning two-hour peak period by 2026. By 2036, an extra 95,500 passengers will need to be moved, equivalent to 212 full train loads.

Figure 3 highlights key inner-city rail network constraints that Cross River Rail will alleviate, including:

### ✱ **Insufficient inner-city infrastructure clogging the system and reducing resilience**

All services across the region merge in the city centre and stop at Bowen Hills, Fortitude Valley, Central and Roma Street stations. Everything slows as trains share limited tracks and wait to pass through existing inner-city stations. Not only does the current inner-city set up constrain operations and limit services but it makes the whole system less reliable and resilient. Incidents in inner-city

stations disrupt services across the entire region, with effects cascading on to road and bus networks, intensifying congestion. By providing a second rail corridor through the city centre and four new underground stations, Cross River Rail will greatly expand inner-city rail infrastructure.

### ✱ **Limited inner-city stations restricting network capacity**

While the city centre is the region's most popular destination for rail commuters, there are only two CBD stations, both on the northern edge of the CBD. Central station caters for the majority of passengers but its capacity is constrained, with platforms already overcrowded during peak hours. The new Albert Street station will alleviate pressure at Central station by catering for rail commuters travelling to the southern CBD.

### ✱ **CBD station locations not responding to growth**

Roma Street and Central stations are a 10 to 15-minute walk from southern and eastern parts of the CBD. Major activity centres such as the Queensland University of Technology's Gardens Point campus and City Botanic Gardens, and future destinations such as the Queen's Wharf Brisbane precinct, are all outside a comfortable five-minute walk to an existing train station. Albert Street station will make each of these destinations easily accessible.

### ✱ **Limited river crossings constraining network expansion**

Cross-regional links are critical to SEQ's ongoing economic vitality but extending the rail network to regional growth areas cannot occur effectively until Cross River Rail is in place. Adding new lines and extra services would increase congestion at the core, pushing the network beyond its limits and reducing service quality. The city's only CBD river crossing, Merivale Bridge, serves three of the busiest lines – Cleveland, Beenleigh and the Gold Coast – which limits the number of trains able to enter the city. Cross River Rail will double the rail capacity across the Brisbane River and through the CBD from the south, enabling greater frequencies on existing lines and network expansion.



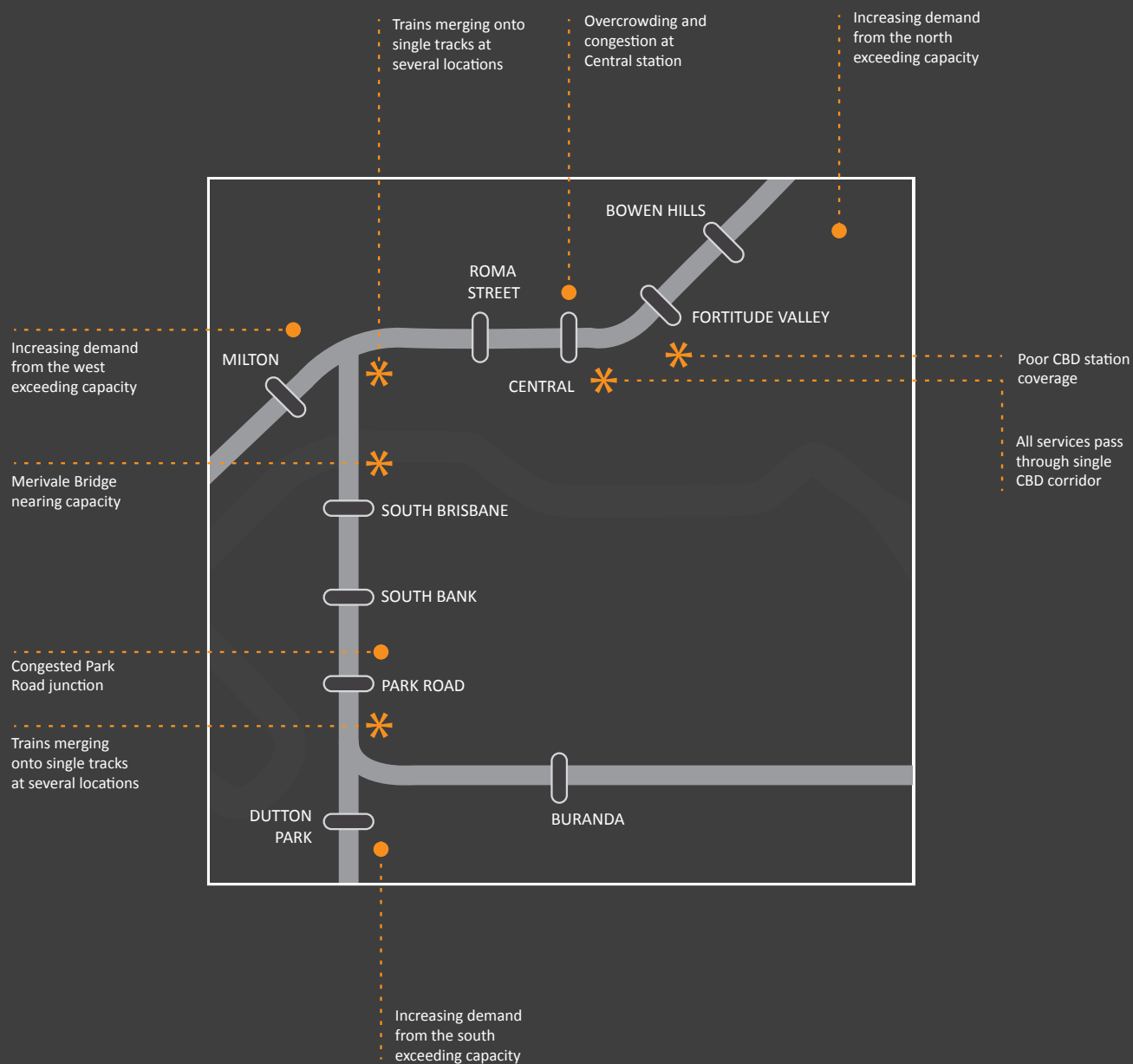


Figure 3: Limited inner-city infrastructure capacity is constraining the growth of SEQ's rail network

# Maximising existing networks

With the greatest carrying capacity of all public transport types (see Figure 4), rail is best suited to meeting SEQ’s future transport needs. Options to maximise the existing rail network however are now largely exhausted, with optimisation initiatives already complete or underway. New generation trains are being introduced to expand and modernise the fleet and deliver extra services. Automated fare collection (via *go card*) and ‘fairer fares’ are encouraging greater off-peak use, and a new advanced train control system is increasing the safety and operating capacity of the inner-city rail network. New infrastructure is now required. Without significant infrastructure investment, overcrowding will increase, reliability will diminish, journeys will take longer and passengers will opt for cars, adding to congestion and slowing freight supply chains that are so vital to economic prosperity.

Significant scope still exists to optimise Brisbane’s bus network but key to this is evolving the overall structure of the public transport network through Cross River Rail. Buses perform an essential task in SEQ, connecting hundreds of thousands of people to work, shopping, entertainment and education, every day. But bus networks are also struggling under the weight of population growth, with constraints highly visible during peak periods, especially in Brisbane’s inner city. Based on the current operating profile, existing bus infrastructure cannot accommodate significant growth. Additionally, buses are not well suited to meeting the anticipated demand for longer distance trips. Bus and rail must work together to ensure an effective and efficient transport system, with rail functioning as the unifying regional spine.

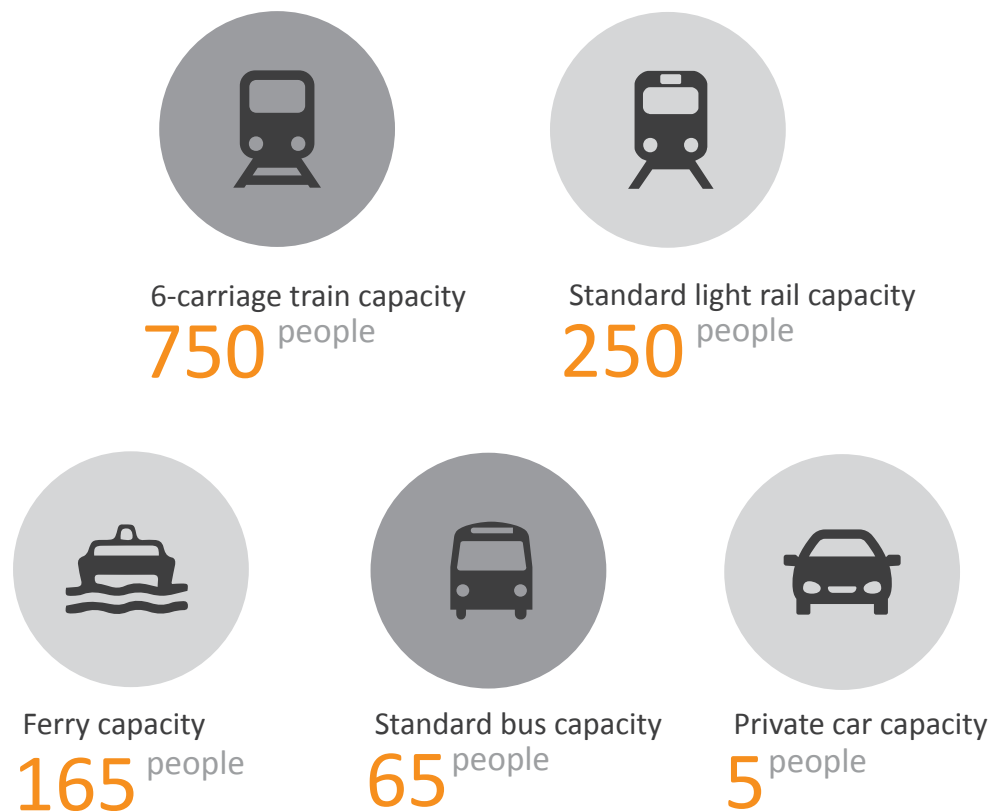


Figure 4: Trains have the greatest carrying capacity of any transport mode

# A new approach to travel

Cross River Rail will enable rail to perform its role as the backbone of the public transport network, moving large numbers of people quickly between Brisbane’s CBD and centres within SEQ. Customers will enjoy faster, more frequent and reliable services, with less time spent waiting at stations.

Boosting infrastructure at the core of the rail network paves the way for network expansions to emerging communities such as Flagstone and Caloundra. Extending the existing Ipswich, Springfield and Gold Coast lines will also become possible, as well as new options to address major growth over the longer term in the western corridor, specifically Springfield, Ipswich and the Ripley Valley.

By adding new track, an extra river crossing and four new stations to the inner-city network, Cross River Rail will deliver transport capacity where it is needed most. Inner-city rail services will reach turn-up-and-go levels, with services arriving initially every five minutes in the peak and 10 minutes in the off-peak.

As demand for trips from regional areas to the CBD increases, and road capacity remains relatively static, more people are forecast to opt for trains as their preferred way to travel. With Cross River Rail in place, rail is expected to cater for the majority of all new peak-hour trips to the

CBD over the next 20 years based on patronage modelling undertaken for Cross River Rail. Around 23,000 trips each day will shift to public transport by 2036, relieving pressure on the road and bus network and reducing travel times and operating costs for road users.

Evolving the structure of the rail network through Cross River Rail opens up broader opportunities to reshape the public transport system. Currently, SEQ’s public transport network gives most people a ‘single-seat’ journey to work, with buses and trains converging in the city centre causing duplication of public transport services.

Brisbane City Council’s proposed 21-kilometre metro system through the city centre would complement Cross River Rail by addressing problems at the core of the bus network. With Cross River Rail and Brisbane Metro unlocking key inner-city constraints, a truly integrated network can be formed featuring suburban bus routes feeding into turn-up-and-go rail and metro services at transport hubs.

Together, Cross River Rail and Brisbane Metro would achieve greater integration of the public transport network and higher customer demand than either solution on its own, setting a strong foundation for future economic, urban and social development.

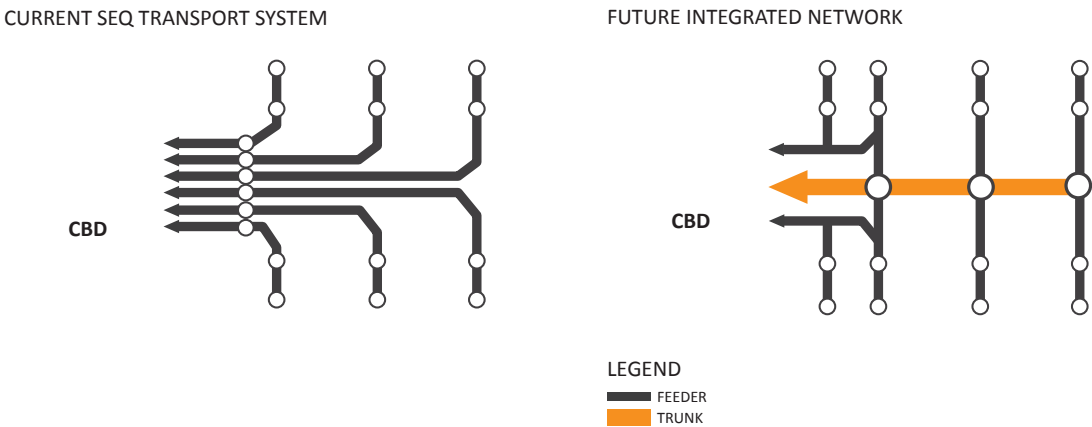


Figure 5: Most public transport services in Brisbane currently go from their origin to the city centre but Cross River Rail will enable a shift to an integrated trunk and feeder network



## Platform for growth

Cross River Rail offers a platform for urban renewal and agglomeration economies in the heart of Queensland's most significant economic centre.

Each station sits at the centre of a precinct that is undergoing or will undergo significant redevelopment over the next 20 years. Cross River Rail will boost the scale of planned redevelopment, shorten timeframes, improve the quality of outcomes and revitalise surrounding neighbourhoods.

Stations will support the growth of Brisbane's specialist health, science, cultural and education precincts, amplifying their contribution to the region's growing knowledge economy by connecting them to each other. Co-locating knowledge businesses enables the 'agglomeration' benefits of sharing resources, collaborating and innovating. As well as providing direct employment, knowledge hubs act as a catalyst for wider economic growth by generating exports and supporting new industries.

Cross River Rail stations will also:

- improve access and frequency of services to the region's premier sporting and event destinations such as The Gabba, Suncorp Stadium and Brisbane Showgrounds, strengthening tourism offerings and lifestyle opportunities
- improve access to SEQ's primary government districts in the southern CBD
- extend retailing and commercial opportunities in the city centre
- expand the CBD across the Brisbane River.

Better, faster connections between major centres across SEQ and Brisbane's CBD will drive sustainable regional growth and economic development, giving people more choice about where to call home or set up business. High-quality transport links get people to work faster and give businesses access to a broader pool of workers.

More than a link for fast, frequent train services, Cross River Rail will help achieve national economic objectives of long-term growth and job creation and continue the transition of the state's economy to high-value activities such as financial, creative and knowledge-based services.

CENTRES OF ACTIVITY AROUND  
CROSS RIVER RAIL STATIONS

-  Hospitals
-  Key Employment Zone
-  Arenas
-  CRR alignment & stations

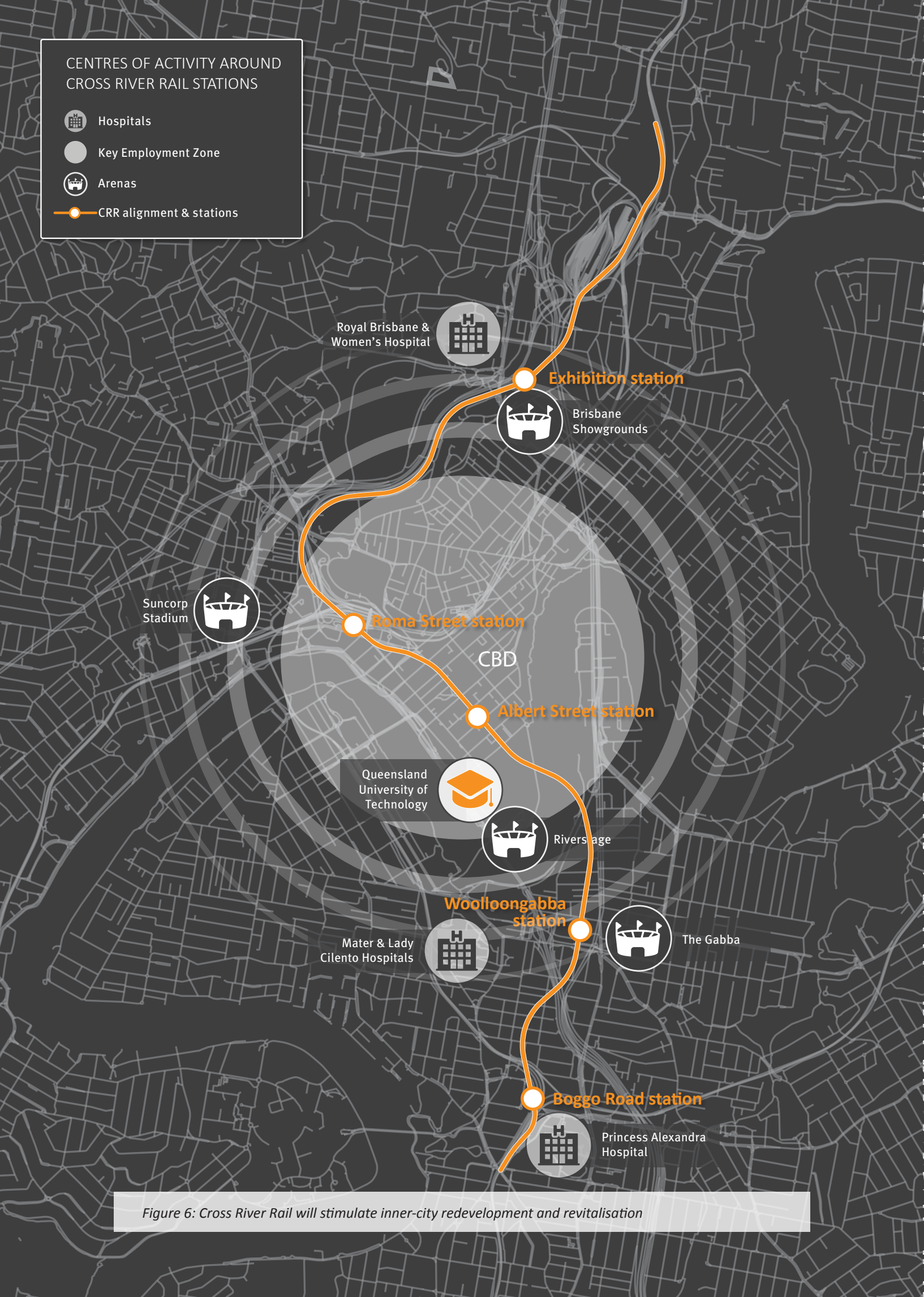


Figure 6: Cross River Rail will stimulate inner-city redevelopment and revitalisation

## Development around stations

### Boggo Road station

Boggo Road station will become SEQ's second busiest transport interchange, connecting directly to the existing Park Road rail and Boggo Road busway stations, and future Brisbane Metro services. A new pedestrian connection between the Cross River Rail station and existing stations will improve access to services across the region by allowing interchange between the rail network and busway system. The station will support the development of the Boggo Road Urban Village, The University of Queensland and the broader health and education precinct incorporating the Princess Alexandra Hospital and the Ecosciences Precinct.



### Woolloongabba station

Woolloongabba station will take rail to one of Australia's most iconic sporting venues, The Gabba, as well as nearby health precincts and entertainment areas. Located beside the existing busway station, it will become part of a major transport interchange for southern suburbs. A nationally significant sport and events precinct will emerge around the station, with pedestrian pathways along all major roads including the

northern side of Stanley Street where people cannot currently walk. Opportunity exists for Stanley Street to become an important pedestrian and cycle link from the renewal and intensification areas of Woolloongabba Central and Kangaroo Point South to South Bank, South Brisbane and the CBD.



### Albert Street station

This 'central' city station will enliven the southern CBD and assist in Albert Street's evolution into a subtropical boulevard. Brisbane's first new inner-city station in more than 120 years, Albert Street station supports the emergence of a mixed-use residential and employment precinct adjoining the City Botanic Gardens, and will extend retail opportunities into new parts of the CBD. Commuters will save an average 10 minutes' walking time to key destinations such as the Queen Street Mall, Eagle Street Pier, QUT Gardens Point and the Queen's Wharf Brisbane precinct. People with a physical or mobility disability will also access these places more easily. Pedestrianising Albert Street as part of the station development will enhance Brisbane's green spine, which stretches from the City Botanic Gardens to Roma Street Parkland.





#### Roma Street station

Cross River Rail supports the revitalisation of Roma Street into a vibrant precinct, with opportunities for commercial, residential and mixed-use development. It will assist in releasing the redevelopment potential of the Brisbane Transit Centre and other key development parcels to catalyse future growth in the city's western sector. It would also connect to Brisbane Metro. Easy access to event and cultural venues including Suncorp Stadium and the Kurilpa Bridge will support the planned expansion of the CBD across the river into Kurilpa and South Brisbane.



#### Exhibition station

The area surrounding Exhibition station is experiencing rapid residential and commercial development. The station will support the next redevelopment phase of this 108-hectare precinct, which includes the \$2.9 billion Brisbane Showgrounds Regeneration Project. The existing station, which serves the annual Ekka, will be upgraded to become fully operational, promoting rapid market uptake of development opportunities and greater commercial yields. Located within walking distance of the new Herston Quarter development and close to sporting and entertainment venues, the upgraded station will provide thousands of residents with easy access to the CBD, and connections to northern, southern, eastern and western rail lines. It will also give patients, visitors and staff at the Royal Brisbane and Women's Hospital new access to train travel, with dedicated pedestrian links connecting the station to Bowen Bridge Road.





## Economic foundation for delivery

Detailed economic analysis undertaken for Cross River Rail demonstrates significant gains to the Queensland economy from delivering the project.

A cost benefit analysis (CBA) was conducted as part of this economic analysis in mid-2016. CBA is universally accepted as the preferred technique to assess the priority of infrastructure investments, allowing for the comparison of projects across Australia. It considers the 'whole-of-life' cost of the infrastructure, both capital and operating costs.

The CBA resulted in a positive BCR of 1.21 in June 2016. Recently, the CBA was updated to reflect policy and other changes that have occurred over the last year. The updated CBA shows a BCR of 1.41, which means Queensland will receive \$1.41 of benefits for every dollar invested. (Factors such as increased public transport patronage due to lower fares, the rollout of a new rail signalling system prior to Cross River Rail and updated Queensland Government demographic data led to this improvement in the BCR.) This is a positive result, comparable with BCR's for Sydney Metro and Melbourne Metro. Sensitivity testing demonstrates that Cross River Rail remains viable under a range of potential scenarios such as increased construction costs. Independent specialists reviewed and confirmed the appropriateness of inputs and outcomes of the Cross River Rail patronage and economic modelling.

Brisbane has relatively low public transport use compared to Sydney and Melbourne, with a large percentage of all trips made by car. Until recently, fares were the highest in Australia following large increases over a number of years. Inner-city congestion-busting investments have focussed on road rather than rail networks over the past decade, which has also drawn commuters away from trains. Fairer Fares has seen an uplift in patronage, and with limited scope for future inner-city road investments, and major arteries into the CBD already operating at 90 per cent capacity in the peak, more people are expected to opt for public transport. As the main transport connection to regional areas, rail will capture the largest share of this growth.

Cross River Rail's estimated cost of delivery is \$5.4 billion<sup>3</sup>. Underground station works such as excavation and structural works represent the largest capital cost item, with tunnelling works,

rail systems and surface works also accounting for a significant proportion. Analysis was also completed on the ongoing costs associated with operating and maintaining the new infrastructure over a 30-year operating period. Figure 8 presents a summary of project costs.

Cross River Rail is expected to deliver wider economic benefits of \$1.2 billion<sup>4</sup>, and land-use benefits such as positive impacts on the density of economic activity and city-building. These wider economic benefits are not captured by the CBA and include benefits such as more people participating in the workforce and reduced transport costs leading to optimal business performance.

Modelling suggests Cross River Rail will contribute \$3.282 billion<sup>4</sup> to Queensland's gross state product during the project's construction and operation<sup>5</sup>.

Cross River Rail is expected to generate about 1,500 direct and indirect full-time equivalent jobs each year during construction with 500 jobs per year ongoing.

Passenger transport users will be significant beneficiaries of Cross River Rail through faster, less crowded and more reliable services, and less time wasted waiting at stations. As more people shift to rail and congestion eases, freight operators and car drivers will also feel the benefits. Road users account for around half of all anticipated benefits due to the sheer volume of daily trips taken across the region.

In accordance with Australian Government requirements regarding the investigation of value capture as a means of alternative funding for infrastructure projects, the Detailed Business Case explored a broad range of value capture scenarios. While Cross River Rail presents real opportunity for value creation through urban revitalisation, the Queensland Government's commitment to fully fund Cross River Rail is not contingent on funding from alternative mechanisms including value capture. The Cross River Rail Delivery Authority is currently developing strategies to facilitate economic development for community purposes within Cross River Rail Priority Development Areas around station precincts. Value uplift to government-owned land within these precincts presents a potential opportunity to contribute to project funding.

<sup>3</sup> Costs are presented in nominal terms.

<sup>4</sup> Benefits are presented in present value.

<sup>5</sup> Assumes a 30-year operation period.

# Economic Analysis Results (7% discount rate)



Figure 7: Key results of the economic analysis conducted for Cross River Rail show an overall positive benefit could be achieved by investing in the project

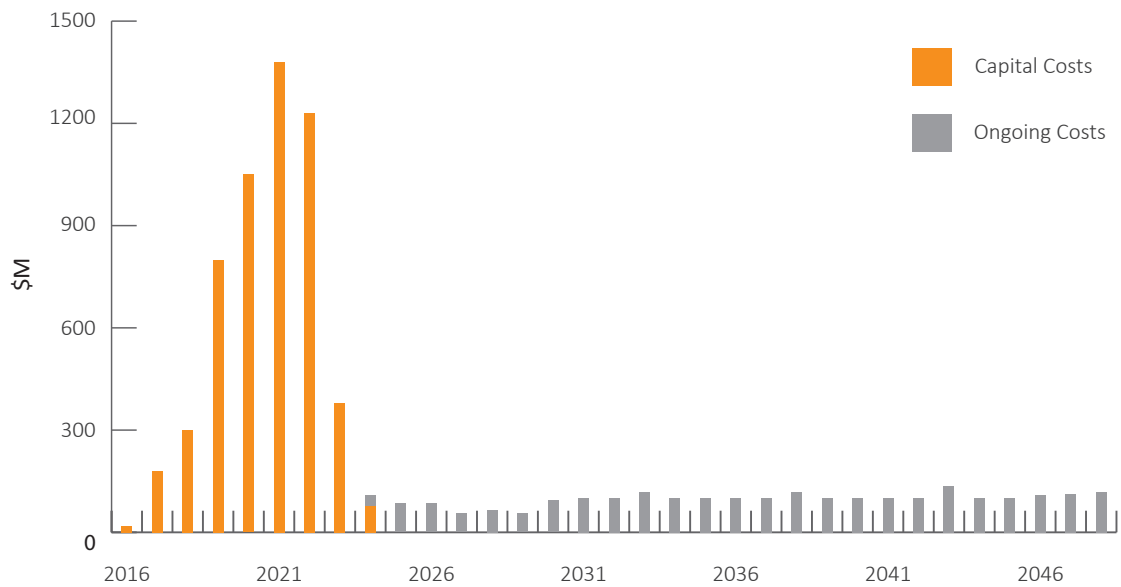


Figure 8: Cross River Rail's cashflow profile (years 2016 to 2048)



# Planning the future

Years of planning and investigation underpin Cross River Rail, with a six-stage process used to assess the best solution and determine its final design and alignment (see Table 1). An extensive body of work undertaken for numerous transport infrastructure projects, government planning processes and Cross River Rail itself informed this decision-making process.

Cross River Rail was first proposed in 2010 and a business case was initially completed in 2011. In 2012, Infrastructure Australia nominated Cross River Rail as one of the nation’s most critical projects. The same year, an independent panel of experts commissioned by the Queensland Government, reviewed the business case and concluded it was robust.

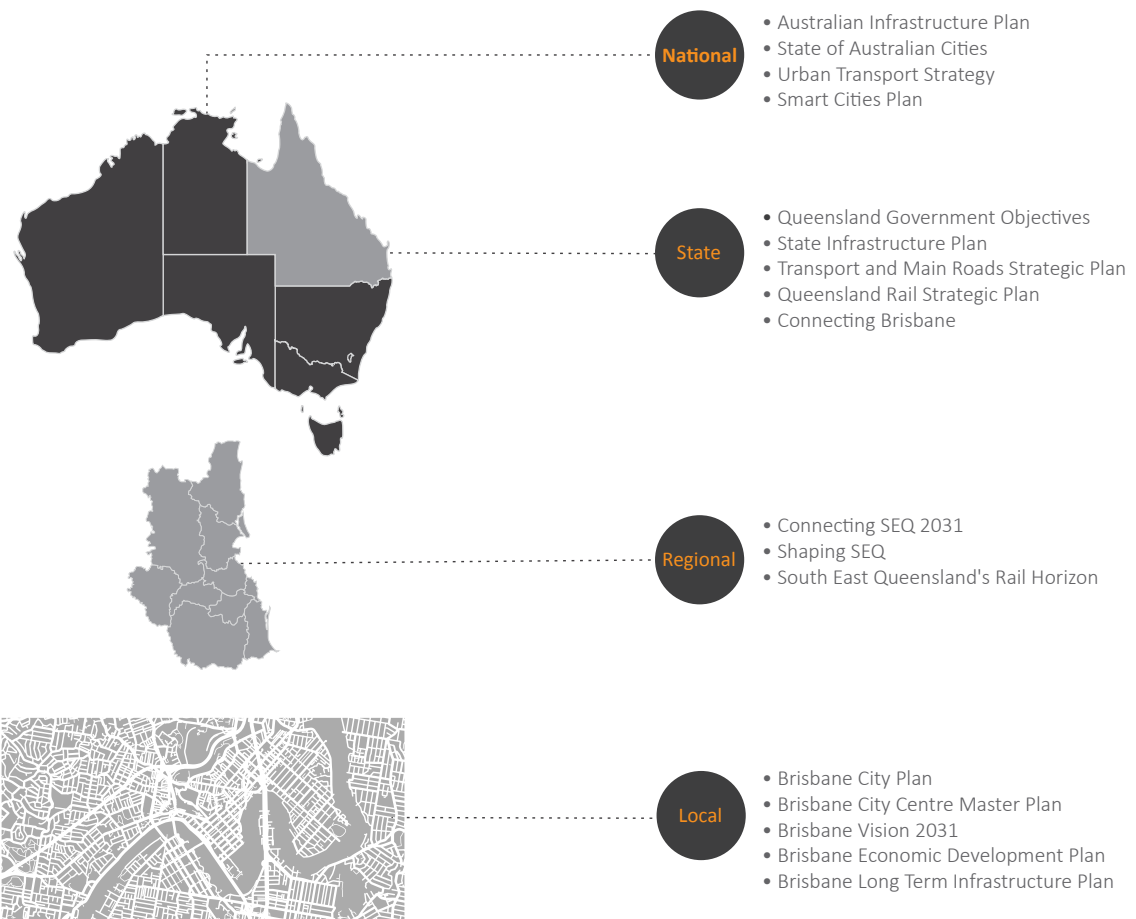
In June 2016, the business case was updated to reflect current market conditions and costs, respond to regulatory changes and incorporate recent technical investigations, up-to-date

forecasting, revised modelling and a refined design and alignment.







Cross River Rail today is more affordable than the solution proposed in 2011, with a shorter tunnel, optimised station locations and design, reduced community impacts and an alignment that better matches transport needs.

These changes and their potential impacts on the natural environment and surrounding communities are detailed in the Cross River Rail Request for Project Change (February 2017). The Queensland Coordinator-General approved this request in June 2017<sup>6</sup>, effectively providing the key environmental approval needed to proceed to delivery.

Cross River Rail directly aligns with key plans and policies at all tiers of government.



<sup>6</sup> Both the Cross River Rail Request for Project Change and the Coordinator-General's response can be downloaded from [www.statedevelopment.qld.gov.au](http://www.statedevelopment.qld.gov.au)

 <b>Strategic Options Analysis</b>	<p>The analysis began by examining different ways to meet forecast transport demand including reforms to optimise existing networks such as better timetabling or fairer fares, operational efficiency measures such as longer, newer trains or new infrastructure investments.</p>	<b>OUTCOME</b> Infrastructure investment required
 <b>Infrastructure Investment Options Analysis</b>	<p>The next stage considered whether to invest in road infrastructure or public transport infrastructure (either bus or rail).</p>	<b>OUTCOME</b> Rail network investment required
 <b>Rail Infrastructure Options Analysis</b>	<p>Various heavy rail solutions were examined such as duplicating the Merivale Bridge, replacing the Cleveland and Ferny Grove rail lines with light rail and a combined bus and train tunnel.</p>	<b>OUTCOME</b> Cross River Rail preferred solution
 <b>CBD Alignment and Station Options Analysis</b>	<p>The location of Cross River Rail's southern CBD station—whether at George Street or Albert Street—was examined along with the alignment through the CBD.</p>	<b>OUTCOME</b> Albert Street station preferred
 <b>Tunnel Length Options Analysis</b>	<p>The value of including a long Cross River Rail tunnel (from Yeerongpilly to Spring Hill) versus a short tunnel (moving the southern portal to Dutton Park) was considered.</p>	<b>OUTCOME</b> Short tunnel preferred
 <b>Northern Connection Options Analysis</b>	<p>Whether or not to connect Cross River Rail to northern rail networks was considered, together with the supporting activities this would require.</p>	<b>OUTCOME</b> Northern connection preferred

*Table 1: A six-stage options analysis was used to select Cross River Rail as the transport solution for SEQ and to refine its alignment and design*

## Considering communities

As a large piece of infrastructure delivered in a highly urbanised environment, Cross River Rail will inevitably impact on roads, public utilities, existing and planned developments and public and private land. The design and alignment however minimises impacts on the natural environment and surrounding communities. Much of Cross River Rail is underground or on existing Queensland Government land. Analysis demonstrates there is equity between the recipients of benefits and bearers of associated costs. For example, homeowners around stations will be affected by construction traffic but they will benefit later from better public transport. A sustainability assessment shows that, overall, Cross River Rail will contribute to positive economic, environmental and social outcomes (see Table 2).

An environmental impact statement conducted for Cross River Rail in 2012 comprehensively examined potential impacts and outlined how they would be managed. The Request for Project Change updated this assessment. A new environmental management plan has been prepared, based on the reference project considered in the Detailed Business Case<sup>7</sup>.

Not all social impacts can be quantified but they must be accounted for in decision-making. Altering traffic flows during construction, for example, can impact how locals move around. An additional

social impact assessment helped articulate these impacts for the Detailed Business Case. It found that negative impacts would be less likely, with smaller consequences, compared to the solution proposed in 2011 due to changes in the design and alignment.










Residential property resumptions are no longer required and fewer commercial properties will be impacted. Affected property owners have been contacted about potential impacts, including volumetric resumptions of land beneath properties.

Extensive public consultation has been undertaken for Cross River Rail by the Queensland Government, giving local residents and the broader community opportunity to shape the design of Brisbane's new river crossing. This consultation revealed broad support for an inner-city public transport solution, with many people recognising the need to improve public transport capacity and frequency.

The Queensland Government will continue to engage with the community and key stakeholders throughout future phases of the Cross River Rail project.

<sup>7</sup> The Cross River Rail Request for Project Change Draft Outline Environmental Management Plan is the key reference document for managing potential impacts of project construction and operation. It also outlines sustainability considerations and can be downloaded from [www.statedevelopment.qld.gov.au](http://www.statedevelopment.qld.gov.au)



SUSTAINABILITY ASSESSMENT OUTCOMES					
SUSTAINABILITY PRINCIPLES	RATING ACHIEVED				
	POOR	COMPLIANT	BASIC	MODERATE	ADVANCED
Connected to the wider system					
Fit for the future (resilient and adaptive)					
Biodiversity					
Reduced resource use					
Social and community benefits					
Equity					
Local and regional context					
Economic advancement					
Innovation					

*Table 2: A sustainability assessment, conducted for the Detailed Business Case, demonstrates that Cross River Rail will contribute to positive economic, environmental and social outcomes*

## Delivering Cross River Rail

A delivery authority has been established to lead the development, procurement and delivery of Cross River Rail. It operates outside the political framework with an independent board, while still being subject to the oversight of the Queensland Government.

Cross River Rail is expected to take around five years to construct. Procurement is scheduled to begin later this year, along with some early construction works. Construction should be completed in 2023, with system testing and commissioning extending into 2024.

Analysis of legislative issues such as planning and environmental approvals shows that Cross River Rail can be delivered within Queensland's existing legislative framework. Procurement activities will be undertaken in accordance with government policies such as the Queensland Procurement Policy. Local industry will be provided with full, fair and reasonable opportunities to tender for work on Cross River Rail, according to the Queensland Charter for Local Content. Opportunities to be involved in the project will also extend to Queensland industry beyond the South East Queensland region.

Cross River Rail may be procured and delivered as a single package or multiple packages of work by government alone or in partnership with the private sector. The Cross River Rail Delivery Authority is now examining these options. Analysis undertaken for the Detailed Business Case indicates that a long-term contract (construction and maintenance), with significant and appropriate risk transfer to the private sector, would be appropriate to deliver the tunnel and new underground stations, which account for the bulk of construction works.





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# CHAPTER ONE

## PROJECT BACKGROUND





## CHAPTER 1

### PROJECT BACKGROUND

#### CHAPTER SUMMARY AND CONCLUSIONS:

- First proposed in 2010, the Cross River Rail (CRR) Project is the Queensland Government's highest priority infrastructure project and is deemed as a High Priority Initiative by Infrastructure Australia.
- Numerous investigations into South East Queensland's (SEQ) public transport network undertaken over the past decade have identified the capacity of the inner-city rail network as a key constraint to the transport network's expansion.
- In May 2012, the Queensland Government commissioned an expert independent panel to review the CRR Project. The panel concluded that the assessment of the CRR Project had been comprehensive over a period of time and exhibited no obvious major flaws.
- In the seven years since the CRR Project was first proposed, additional studies investigating solutions to SEQ's transport challenges have been undertaken. Key findings from these studies include:
  - The Queensland Government has investigated and implemented many reform options to improve the efficiency of the transport network.
  - Rail is the backbone of the region's future passenger transport system.
  - New generation signalling will enable the existing network to more effectively meet forecast increases in demand and is the preferred way to improve network efficiency.
  - The CRR Project is the preferred infrastructure investment option to meet demand for future capacity.
- In June 2016, the Queensland Government completed the CRR Detailed Business Case 2016, which was subsequently submitted to the Australian Government. Policy and other changes have occurred since then that require consideration, such as the following:
  - The Queensland Government has committed funding to deliver a new inner-city rail signalling system through the European Train Control System (ETCS) – Inner City Project. Recent Analysis confirms that the CRR Project provides substantial net benefits over and above the benefits of the ETCS – Inner City Project (refer section 1.4).
  - In December 2016, the Department of Transport and Main Roads (TMR) lodged a request for project change application with the Queensland Coordinator-General. The Coordinator-General's published response concluded that the CRR Project, together with amended conditions, would result in acceptable overall outcomes.
  - In response to the recommendations of the independent Fare Review Taskforce, the Queensland Government introduced the Fairer Fares package, which took effect from 19 December 2016.



## 1.1 Purpose and Overview of this Chapter

The purpose of this chapter is to provide an overview of the history of the CRR Project. This chapter outlines:

- previous studies, reports and business cases completed that identified the CRR Project as the preferred infrastructure solution and confirmed the strategic need for the project
- related projects that may be impacted by, or have an impact on, the delivery of the CRR Project.

## 1.2 Project Background

First proposed in 2010, the CRR Project is the Queensland Government's highest priority infrastructure project. It ranked number one on the Queensland Government's list of projects submitted to Infrastructure Australia in September 2015.

In 2012, Infrastructure Australia nominated the CRR Project as one of the nation's most critical projects, recognising the CRR Project's capacity to transform Brisbane, support critical freight networks and grow the state's economy. Infrastructure Australia assessed the first stage of the project (the north–south core) as 'ready to proceed' in February 2012.

In June 2016, the Queensland Government completed the CRR Detailed Business Case 2016. In preparing the CRR Detailed Business Case 2016, expert advisors were engaged to undertake transport patronage modelling (Jacobs/PwC) and economic modelling (KPMG), which contributed to the key findings of the CRR Detailed Business Case 2016. The transport patronage and economic modelling were subject to independent peer review by leading industry experts including Bitzios Consulting (transport patronage modelling) and Douglas Economics (economic modelling).

The CRR Detailed Business Case 2016 was subsequently submitted to the Australian Government for consideration.

### 1.2.1 Activities Following Completion of the CRR Detailed Business Case 2016

The business case prepared for the CRR Project in September 2011 was used as the basis for the approval granted by the Queensland Coordinator-General on 20 December 2012.

On 5 December 2016, TMR lodged a request for project change application with the Coordinator-General. It outlined the key changes made to the CRR Project since 2011, the potential impacts of these changes on the natural environment and surrounding communities and how they would be managed.

The proposed changes included:

- reducing the total project length from 18 kilometres to 10.2 kilometres, including some alterations to the underground alignment of the tunnel
- reducing the extent of underground tunnelling from 10 kilometres to 5.9 kilometres
- changing the location of the southern and northern portals
- slightly altering the location of the proposed Albert Street, Boggo Road, Woolloongabba, Roma Street and Exhibition stations
- pedestrianising sections of Albert Street between Charlotte Street and Elizabeth Street
- changing the tunnel construction method from bored to mined for some sections



- reducing the number of surface properties requiring acquisition from 108 to 29 (no residential properties are now required)
- realigning Roma Street Station
- increasing the number of spoil placement locations from one (Swanbank) to five potential sites (Brisbane Airport, Swanbank, Pine Mountain, Larapinta and Port of Brisbane).

In June 2017, the Coordinator-General published an evaluation of the proposed project changes. The Cross River Rail Project: Coordinator-General's Change Report (Change Report) concluded that the changes to the CRR Project, together with amended conditions imposed in the report, would result in acceptable overall outcomes. The Change Report, including details of conditions and recommendations, can be found on the Department of State Development webpage.

Following the finalisation of the CRR Detailed Business Case 2016, a number of assumptions and parameters underpinning the transport and economic analysis changed. These changes, and their impacts on the CRR Project analysis, were outlined to the Coordinator-General.

Changes include the following:

- Revised SEQ demographics: In April 2016, Queensland Treasury publicly released revised demographics (population and employment) for the region (2015 edition). The previous set of demographics was initially used as the basis for analysis in the CRR Detailed Business Case 2016.
- Confirmation of funding for the ETCS – Inner City Project: In June 2016, the Queensland Government approved the ETCS – Inner City Project to proceed to procurement. The economic appraisal conducted for the CRR Project initially did not include the ETCS – Inner City Project as part of the central (or 'most likely') case, given the project was unapproved at the time. However, the ETCS – Inner City Project was included in other economic scenarios to better understand its potential impact.
- Announcement of the Fairer Fares scheme: In June 2016, the SEQ Fare Review was completed and the Queensland Government announced a revised fare scheme. Fairer Fares adopted a simplified public transport zoning structure and reduced fare levels to make fares more affordable for commuters. The modelling and economic analysis conducted for the CRR Project initially used the previous public transport zone system and fares as the basis for forecasting patronage numbers.

The economic analysis conducted for the CRR Project was updated in July 2017 to incorporate these changes. Further detail can be found in Chapter 7: Economic Analysis.

Refinements to the CRR Project's design and engineering have also been made since June 2016. These are reflected in the Reference Project presented in Chapter 5: Reference Project.

In June 2017 the Queensland Government committed to fully fund the CRR Project.

### 1.2.2 Background Studies

A number of previous studies have assessed SEQ's public transport network over the past decade. Key studies, reports and projects include:

- Inner City Rail Capacity Study (2008)
- Rail Assessment of Capacity Alternatives Study (2008)
- Integrated Transport and Land Use Strategy – Inner City (2009)



- Rail Strategy for South East Queensland (2010)
- Cross River Rail Business Case (2011)
- Cross River Rail Environmental Impact Statement (EIS) including Coordinator-General Evaluation Report and Conditions (2012)
- Independent Panel Review – CRR (2012)
- Brisbane Inner Rail Solution (2012-2014)
- Cross River Rail Business Case Addendum (2013)
- Bus and Train Project (2014)<sup>1</sup>
- South East Queensland Capacity Improvement Project (2014).

These studies and business cases reached the common conclusion that the capacity of Brisbane's inner city to grow and support the region's population, employment and economic growth will be limited if transport constraints are not addressed.

### 1.2.2.1 Inner City Rail Capacity Study

The Inner City Rail Capacity Study (ICRCS), released in October 2008, identified that the limited capacity of the inner-city rail network significantly constrains the number of additional trains that can be introduced on rail lines servicing the region. It also found that additional capacity is needed to meet forecast passenger demand.

The ICRCS assessed various options to increase rail services through the inner city. These were considered as part of an integrated inner-city transport network that would support the future expansion of the central business district (CBD) and inner city.

The ICRCS identified two new rail links to meet inner-city rail capacity requirements. The CRR Project is the first of these projects and is designed to provide additional north-south corridor capacity through the inner city. A tunnel to address western line capacity constraints, further expanding inner-city capacity, is the second link. Three corridor options for each of the two new rail links were identified in the ICRCS. The assessment of a north-south river crossing constituted pre-feasibility work for the CRR Project 2011.

### 1.2.2.2 Rail Assessment of Capacity Alternatives Study

The Rail Assessment of Capacity Alternatives Study (RACAS) was commissioned in 2008 by the then Queensland Transport and TransLink Transit Authority. It sought to identify and investigate the feasibility, impact, cost and capacity benefit of operating policy options and any associated infrastructure measures to improve rail capacity. RACAS recognised that the relatively long lead time for proposed major rail infrastructure upgrades meant that urgent alternative action was required to prevent significant erosion of service levels on the rail network.

RACAS recommended a prioritised program of alternative capacity measures for possible implementation over five to seven years. The measures were designed to preserve current capacity, change passenger travel demand patterns and ultimately enhance network capacity. This package of initiatives included peak spreading, eliminating Mayne Yard stabling conflict movements, active management of passenger loading and unloading, rescheduling the Express Passenger Train service and fine-tuning inner-city headways.

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<sup>1</sup> Not formally considered by government.





RACAS noted that these solutions alone would not fully meet the forecast capacity and demand gap on all lines, nor remove the need for major investment in passenger rollingstock and infrastructure (above and beyond that currently committed). RACAS did, however, identify significant opportunities to narrow the gap.

#### 1.2.2.3 Integrated Transport and Land Use – Inner City Strategy

The 2009 Integrated Transport and Land Use – Inner City Strategy (ITALICS) considered capacity constraints faced by rail and bus and the difficulties associated with increased demand in and through Brisbane’s CBD. The strategy informed Connecting SEQ 2031 (CSEQ) (transport policy supporting the regional plan) and the detailed feasibility phase of the CRR Project 2011.

The strategy examined how gaps in the transport network could be addressed in a coordinated way and aligned with preferred land-use development patterns, along with planned and committed investments. Key findings include:

- Brisbane’s inner city will experience significant intensification of land-use activity and development, as will areas adjacent to the CBD along major transit corridors.
- With coordinated land-use planning and provision of adequate public and active transport, inner Brisbane has the capacity to accommodate a significant proportion of employment and dwelling targets outlined in the South East Queensland Regional Plan 2009–2031 (SEQRPlan).
- Accessibility between nodes within the inner city will be key to the future success of Brisbane’s CBD. Inner-city employment forecasts will only be realised if travel to and within the inner city remains convenient and reliable.

The preferred ITALICS strategy proposed a new north-south rail link via Park Road, Woolloongabba, the CBD and the Exhibition line (initially). Ultimately the line would extend to the north-west. This strategy was considered the most complementary to the preferred land-use strategy by serving areas most in need of additional capacity and most likely to grow first.

The ITALICS also suggested a program of policy interventions, network improvements and additional infrastructure to address capacity issues facing inner Brisbane, particularly the inner-city passenger distribution task over the short, medium and long-term.

Recommendations implemented by state and local government include:

- better integration between regional land-use planning and transport planning
- developing a CBD master plan for Brisbane
- implementing neighbourhood plans
- delivering sections of the Eastern and Northern busways.

#### 1.2.2.4 Rail Strategy for South East Queensland

The Rail Strategy for South East Queensland (Rail Strategy for SEQ), completed in 2010, was an input to CSEQ. Key guiding principles for the rail network identified by the strategy include: safety; ecological sustainability; financial responsibility; and supporting government priorities.



Taking a long-term view (50 years) of the rail network, the Rail Strategy for SEQ proposed a master plan that:

- supports the optimum performance of the total network
- supports the rail transport needs of the community
- supports the rail transport needs of industry
- exploits opportunities for future growth
- provides the framework for informing Queensland Government investment in the rail network
- facilitates external investment in the rail network
- facilitates effective management of the rail network asset.

The key relevant issues and emerging challenges identified include:

- Population growth: Increased population is driving a significant increase in travel demand, placing further pressure on the capacity and performance of the existing system.
- Economic growth: Commercial and industrial activity is driving significant growth in freight volumes, including international, interstate, inter-regional and local freight.
- Congestion: Transport activity associated with population and economic growth may exceed the capacity and performance of the transport system, with consequent congestion limiting the network's overall capacity and performance.
- Cost of infrastructure: Planning must consider innovative solutions to maximise the use of existing infrastructure capacity. This emphasises the importance of investing in the existing network to maintain it to a fit-for-purpose standard.
- Competitiveness of Queensland industry: Industry must be supported by a transport system that delivers higher standards of freight transport.

### 1.2.2.5 Cross River Rail Business Case 2011

Infrastructure Australia assessed the CRR Business Case 2011 and gave the project 'ready to proceed' status in mid-2012. The Queensland Government undertook a comprehensive assessment of the impacts of the CRR Project to prepare an environmental impact statement (EIS). The process involved extensive consultation with key stakeholders, including the broader community. The Coordinator-General approved the EIS in December 2012 and indicated that, subject to the conditions of the EIS being met, project impacts could be avoided or minimised to an acceptable degree.

The CRR Project 2011 consisted of 10 kilometres of twin single-track tunnels between Yeerongpilly (in the south) and Victoria Park (in the north). Four new underground stations were proposed at Woolloongabba, Boggo Road, Albert Street and Roma Street as well as five kilometres of additional surface tracks south of Salisbury. At the southern end, a new surface station at Yeerongpilly and minor upgrades to Moorooka and Rocklea stations were proposed.

At the northern end, a new surface station at the Exhibition site was planned. From the northern portal at Victoria Park, three kilometres of two additional surface tracks on the Exhibition Loop was proposed, plus additional track construction and realignment through Mayne Yard.



#### 1.2.2.6 Independent Panel Review – Cross River Rail

In May 2012, the Queensland Government commissioned an expert independent panel to review the CRR Project. The panel concluded that the assessment of the CRR Project had been comprehensive over a period of time and exhibited no obvious major flaws.

The panel noted that the cost estimates and business case appeared robust and that the CRR Project would deliver significant benefits and a step-change in public transport capacity to support future growth. The panel also recommended implementing, as a priority, a program of short to medium-term initiatives to increase rail capacity and optimise the use of existing infrastructure and services.

The panel recommended developing more accurate capital costings for the CRR Project, confirming the extent of capacity enhancements and developing a detailed implementation plan, including funding arrangements.

#### 1.2.2.7 Brisbane Inner Rail Solution

The Brisbane Inner Rail Solution (BIRS) is a program of works and initiatives to accommodate growth and address inner-city capacity constraints in the existing rail system. It was initiated in light of the findings of the independent panel appointed to review the CRR Project.

The program includes delivery of an early capacity works program – a package of value-for-money, short to medium-term solutions that include capital works such as signal enhancements – and routine operational improvements such as revisions to timetabling to defer the need for the CRR Project from 2016 to approximately 2021. The BIRS also includes delivery of the CRR Project between Yeerongpilly and Victoria Park.

The Queensland Government submitted the BIRS (both early capacity works and the CRR Project) as part its 2012 submission. Key elements of the early capacity works program have now been delivered.

#### 1.2.2.8 Core Cross River Rail Business Case Addendum (2013)

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

In March 2013, TMR developed an addendum to the CRR Business Case 2011 (the CRR Addendum). The CRR Addendum focussed on the core CRR Project. Assessment included in the CRR Addendum confirmed the core CRR Project as a viable project in its own right. The core CRR Project did not change the full reference design proposed in the CRR Business Case 2011, but rather offered a staged solution to deliver the full project, with minimal redundant works. It also indicated the core CRR Project could be delivered within the conditions of the EIS report and approvals for the CRR Project.

The core CRR Project consisted of 10 kilometres of twin single-track tunnels between Yeerongpilly and Victoria Park, four new underground stations at lower Albert Street, Roma Street, Woolloongabba and Boggo Road Urban Village and southern and northern surface works.

#### 1.2.2.9 Bus and Train Project (BaT Project)

From late 2013, TMR, as part of an integrated project team including Projects Queensland, Queensland Rail and Brisbane City Council (BCC), developed a reference design for the BaT Project. Concurrently, an EIS process commenced, including several rounds of community consultation on the reference design.



The BaT Project combined previous planning for the CRR Project with BCC's Suburbs 2 City study. It proposed a bus and rail solution to capacity constraints at key inner-city locations, including the inner-city rail network, Merivale Bridge, Central Station, Cultural Centre bus precinct and Captain Cook Bridge.

The BaT Project proposed a four-kilometre integrated bus and rail link extending from Dutton Park (in the south) to Spring Hill (in the north). Passing under the Brisbane River and CBD, the BaT Project included new underground bus and rail stations at Woolloongabba, George Street and Roma Street.

The BaT Project commenced but did not complete the business case phase. It was afforded 'threshold status' by Infrastructure Australia in 2014.

Recent investigations have confirmed the value of a rail-only solution and the Queensland Government has selected the CRR Project as the preferred solution (see further discussion in Chapter 4: Options Analysis).

### 1.2.2.10 South East Queensland Capacity Improvement Project

The South East Queensland Capacity Improvement Project (SEQCI), undertaken by TMR in 2014, assessed network improvement scenarios available to meet future passenger and freight demand. The SEQCI project aimed to:

- identify infrastructure and operational options that align with, and realise, passenger and freight benefits and support efficient operations over the next 10 and 20 years
- undertake a holistic, integrated assessment of operational and infrastructure options to identify the most cost-effective, value-for-money investments for passenger and freight travel
- develop 10 and 20-year investment options for the SEQ rail system to support passenger and freight requirements
- provide the basis for the development and implementation of a 10-year rail investment strategy for the SEQ rail network (a priority initiative for TMR), having regard to the development of the SEQ rail network.

SEQCI considered infrastructure and non-infrastructure enhancements that would be required if demand for trains reached certain levels. (Strategic transport models were undertaken for 2021 and 2031.)

SEQCI provided a range of potential options to improve network capacity in the northern, southern, eastern and western rail corridors. These options all offered incremental improvements, rather than the step-change afforded by a major new infrastructure solution.

## 1.3 Options Assessment

Before Building Queensland commenced the CRR Detailed Business Case 2016, TMR assessed various options to meet the region's transport needs in consultation with other Queensland Government agencies.

This options assessment drew on previous studies and analysis, as well as relevant policy documents such as the State Infrastructure Plan (SIP), SEQRP and CSEQ. As required by the SIP, the assessment considered reform, network efficiency and infrastructure investment options. Options and sub-options were assessed through a multi-criteria analysis as required by the Queensland Government's Project Assessment Framework.

Options for a solution to meet identified needs were assessed at multiple levels that considered strategic options, infrastructure investment options, rail infrastructure options and details regarding alignment, length and connection points.





The options assessment confirmed that transport services to Brisbane's CBD are compromised, with all modes either at, or near, their effective capacity. High-capacity public transport is needed to support the inner-city economy, given the city's spatial constraints and limits on private vehicle travel. More is required from rail given its high capacity and suitability for longer distance travel from residential areas to employment centres. Currently, rail is unable to perform its role given the limited capacity of the rail system through the heart of the network (that is, through the CBD). If left unaddressed, this will lead to delays with unacceptable costs and lost opportunities.

Options to address these challenges and issues were categorised as reform, network efficiency or infrastructure investment options. Identified reform options have been largely implemented to the extent possible.

Rail has been identified by the SIP and other strategic and planning studies as the backbone of the region's future passenger transport system (refer to Chapter 2: Strategic Context).

New generation signalling (see Section 1.4.1) will enable the existing network to more effectively meet forecast increases in demand and, as such, was identified as the preferred network efficiency option. The CRR Project was identified as the preferred infrastructure investment option to address the investment need.

## 1.4 Related Projects

### 1.4.1 ETCS – Inner City Project

In June 2016, the Queensland Government approved the ETCS – Inner City Project to proceed to procurement. The ETCS – Inner City Project will deliver ETCS Level 2 (L2) technology within Brisbane's inner city. The ETCS – Inner City Project is expected to become operational in 2021, bridging existing capacity constraints on the SEQ rail network and the medium-to-long term capacity benefits of the CRR Project. The signalling system will boost inner-city rail capacity by allowing trains to travel more frequently.

Introducing ETCS L2 in advance of the CRR Project will reduce implementation risks associated with bringing CRR into service by ensuring key enabling activities are completed and that stakeholders are familiar with tunnel systems (as ETCS L2 signalling must be delivered in the tunnel section).

The CRR Project delivers substantial net benefits to rail passengers and the SEQ rail network over and above the benefits delivered by ETCS L2. The scope of the ETCS – Inner City Project is the area of rail network between Northgate and Milton, including both mains and suburban lines. This encompasses the key network section through which all trains must pass and includes the railway stations of Roma Street, Central, Fortitude Valley and Bowen Hills. While the ETCS – Inner City Project will improve the network capacity in the northern and western corridors, it does not provide additional capacity to the Gold Coast and Beenleigh lines.

### 1.4.2 Queensland Rail Stabling Program

Additional stabling facilities are required to meet the growing demand for rail services in SEQ. The Queensland Rail Stabling Program will provide purpose-built, modern train stabling facilities across the network and increase stabling capacity to accommodate expansion of the passenger train fleet.

Well-located stabling facilities increase reliability, reduce network operating costs, improve network capacity (relieving pressures, junction conflicts and freeing up valuable track space) and ensure faster response times in case of track or train failure.



Trains return to the stabling facility at the end of service and are parked on the site throughout the night (or when they are not in use). At night, trains parked on the site are cleaned and prepared for the next day's service. Sometimes this might include minor maintenance activities, removing waste, decanting and routine inspections.

Queensland Rail has begun delivering the first stage of this project, which includes constructing new facilities at:

- Banyo (capacity for four six-car trains)
- Elimbah (capacity for eight six-car trains)
- Robina (capacity for four six-car trains, additional to current capacity)
- Woombye (capacity for four six-car trains).

A fifth stabling facility has been constructed at Kippa-Ring (10 six-car trains) as part of the Moreton Bay Rail Link Project.

TMR is progressing planning for an upgrade to the existing Mayne Yard stabling facility.

### 1.4.3 Brisbane Metro

Brisbane Metro proposes a 21-kilometre metro system on the existing busway linking Eight Mile Plains, Royal Brisbane and Women's Hospital (RBWH) and UQ Lakes busway stations.

It features two new high-capacity metro lines:

- Metro 1 – Eight Mile Plains busway station to Roma Street busway station
- Metro 2 – RBWH busway station to UQ Lakes busway station.

Brisbane Metro will introduce a new fleet of around 60 metro vehicles, each with the capacity to carry up to 150 passengers, which can use the busway alongside regular bus services.

Brisbane Metro will also deliver:

- a new underground metro station at the Cultural Centre
- metro services to 18 existing busway stations
- interchange opportunities at 11 locations
- conversion of Victoria Bridge to a 'green bridge' for metro and bus services, as well as pedestrians and cyclists
- a new depot facility for metro vehicles.

The complementary nature of Brisbane Metro and the CRR Project would help connect people to where they want to go at times they want to travel in and around the city and create options for the future. By unlocking the core of the transport network, the CRR Project and Brisbane Metro would underpin future economic, urban and social development within Brisbane, in surrounding areas and beyond. Together, they would achieve greater integration of the public transport network and higher customer demand than either solution on its own.

There is the opportunity for the Brisbane Metro Project to be configured to complement both the CRR Project and the extensive network of busways. Impacts and interdependencies of both projects were considered in the Brisbane Metro Business Case (May 2017) which was developed by BCC. For example, the



business case proposed interchange opportunities between bus, metro and rail at Boggo Road and Roma Street and avoided impacting on land in the CRR corridor, including the Goprint site at Woolloongabba.

The CRR Delivery Authority (CRRDA) is working with BCC to ensure an appropriate level of planning and coordination as the two projects are implemented.

### 1.4.4 Inland Rail

Inland Rail is a new 1,700-kilometre freight rail connection between Melbourne and Brisbane that avoids the congested Sydney network and travels via regional Victoria, New South Wales and Queensland. It will connect Australia's capital cities, farms, mines and ports, creating jobs, reducing supply chain costs and making Australian exports more competitive. The Australian Government committed \$594 million in the 2016-17 budget towards land acquisitions and environmental studies for the project. As part of the 2017–18 budget, the Australian Government committed to the full delivery of Inland Rail (excluding a connection to the Port of Brisbane), with an additional \$8.4 billion equity investment in the Australian Rail Track Corporation.

Ultimately, the delivery of Inland Rail will increase the demand for rail freight on the SEQ rail network, particularly to the Port of Brisbane. Under the CRR Project, passenger and freight services will continue to share rail track through Brisbane, with a curfew on freight during peak passenger demand periods. This is manageable in the short to medium-term, based on existing freight forecasts and provision of minor rail infrastructure upgrades in the corridor to improve operational efficiencies.

A long-term solution for rail freight access to the Port of Brisbane will still be needed. A recent study undertaken by the Australian Rail Track Corporation concluded that the existing rail corridor to the port will be insufficient to meet long-term freight demand and investing in a dedicated route to the port will be required.



# CHAPTER TWO

## STRATEGIC CONTEXT





## CHAPTER 2

### STRATEGIC CONTEXT

#### CHAPTER SUMMARY AND CONCLUSIONS:

- Significant population growth in SEQ, coupled with economic and employment growth, underpins increasing demand for infrastructure and services.
- Around 80 per cent of population growth will be outside Brisbane, with more than 1.2 million new residents forecast to settle in areas such as the Gold Coast, Ipswich, Sunshine Coast, Moreton Bay and Logan. Conversely, much of the employment growth is expected to remain within Brisbane, which will accommodate around 45 per cent of total SEQ jobs growth between 2011 and 2041.
- This distribution of homes and jobs across SEQ reflects the desired strategic direction established by key plans and policies at all levels of government.
- SEQ's transport network must cater for increased demand to Brisbane's CBD by better linking outlying residential areas to the region's key employment hub. Employment growth in the CBD and inner city – and related economic spinoffs – depends on residents across the region being able to get to workplaces in a reliable and reasonable time, particularly during peak periods.
- SEQ's transport challenge cannot be met by building more roads that funnel more traffic into an already congested urban core. Limited scope exists to develop the road network into Brisbane's dense inner core and doing so would negatively impact the city's urban amenity, city-building and community and environmental outcomes.
- Better public transport offers the solution to SEQ's future transport needs. Public transport accessibility is a key driver of economic growth, jobs growth, lifestyle enhancements and urban regeneration.
- The rail system offers the greatest potential efficiency and capacity benefits of all public transport modes. A range of rail network optimisation initiatives have already been implemented however infrastructure will be needed to address the future capacity constraints in the inner-city rail network.

#### 2.1 Purpose and Overview of this Chapter

The purpose of this chapter is to provide an overview of the forecast economic drivers of demand impacting current and future transport service needs for the SEQ region. It also confirms the strategic need for transport infrastructure investment and its alignment with relevant government objectives and policies.

This chapter outlines:

- forecast economic growth of the Brisbane and wider SEQ region, including a focus on:
  - population growth and changes
  - current and future distribution of employment
  - future demand for transport.
- relevant federal, state and local government strategic policies



## 2.2 Demographics and demand

SEQ's significant population growth, coupled with economic and employment growth, underpins increasing demand for infrastructure and services. This includes transport infrastructure, which provides the means for people to access jobs and services. Demand for travel is expected to grow in response to population growth and the associated increase in economic activity. These drivers of demand are discussed below.

### 2.2.1 Population

SEQ has experienced significant population growth over the last decade, from 2.7 million people in 2006 to approximately 3.2 million in 2016<sup>2,3</sup>.

The population of SEQ is forecast to continue growing rapidly, with an additional 1.45 million people expected between 2016 and 2036. Figure 2.1 presents these figures and shows a forecast annual average growth rate of 1.9 per cent. Around 80 per cent of the expected population growth to 2036 will be outside the Brisbane LGA. Almost 1.2 million new residents are forecast to settle in areas outside Brisbane, primarily in the Gold Coast, Ipswich, Sunshine Coast, Moreton Bay and Logan areas, between 2016 and 2036. This population growth (combined with expected growth in employment in the Brisbane LGA – see Section 2.2.2) is one of the principal factors driving increases in travel demand within SEQ.

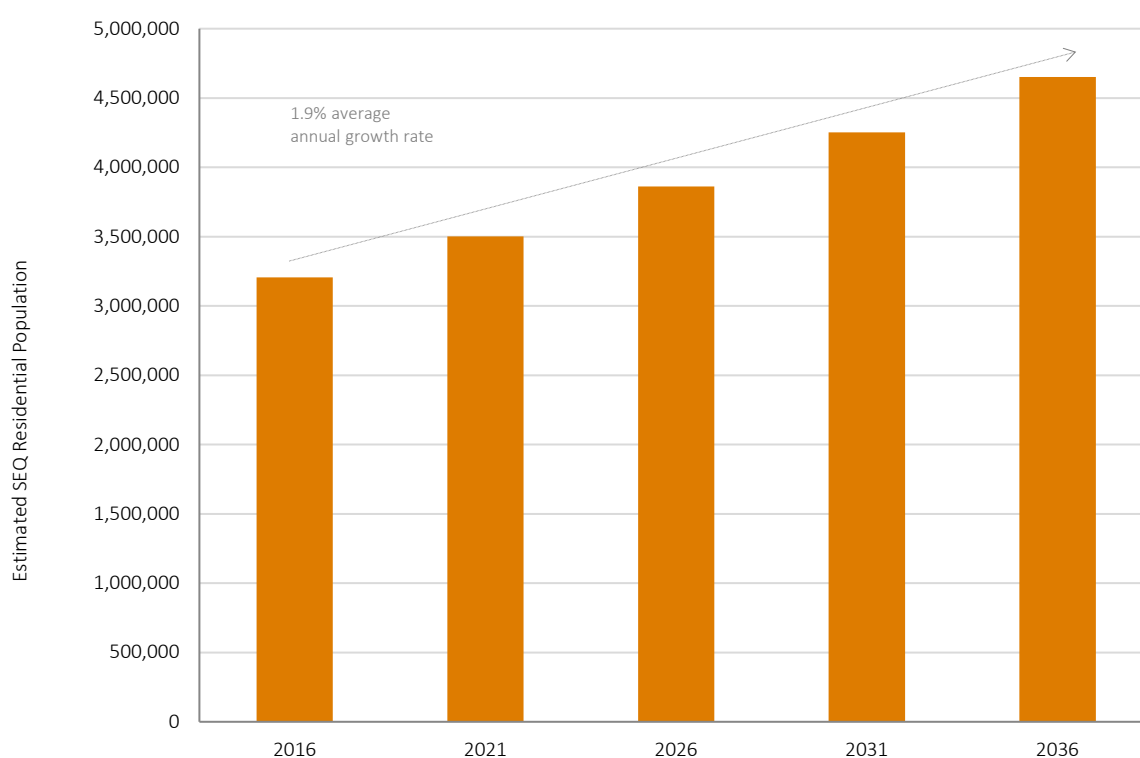


Figure 2.1: SEQ Population Projections<sup>4</sup>

<sup>2</sup> Queensland Government population projections

<sup>3</sup> References in Chapter 6: Project Benefits to population and employment forecasts are based on the geographic area covered by the CRR Project model (refined BSTM-MM) and may therefore differ to those described here. The BSTM-MM roughly covers the Brisbane metropolitan region.

<sup>4</sup> Queensland Government population projections



Population growth within the Brisbane LGA itself will compound the growth in transport demand resulting from population increases in surrounding areas. By 2036, around 257,000 additional people will live in the Brisbane LGA compared to 2016, increasing to around 1.4 million. The residential population of Brisbane's inner city is also expected to almost double in the next 20 years, with almost 64,000 additional people to reside in and around the CBD<sup>5</sup>. Further, the inner city is forecast to grow at an annual rate of 3.3 per cent between 2016 and 2036. A significant proportion of the growth in demand for travel is likely to be met by the public transport network<sup>6</sup>.

Providing frequent, high-quality public transport services to Brisbane's inner city and CBD from commuter catchments outside of Brisbane, as well as inner-city distribution services, will be critical to respond to and drive population growth across SEQ and economic growth in Queensland's primary activity centre.

## 2.2.2 Brisbane's Economy and Employment Growth

Brisbane's economy is projected to increase from a \$114 billion economy today to a \$217 billion economy by 2031, which will support approximately 1.5 million jobs<sup>7</sup>.

Accessibility from other suburbs and urban centres will be critical to supporting Brisbane's future growth and the CBD's function as a wealth creator for the region.

Reflecting its economic importance to Queensland and the nation, Brisbane currently provides around one third of Queensland's workforce.

Employment brings with it obvious economic benefits to the region, state and nation. However, it also results in more commuter trips from new residential areas to the inner city and CBD. While forecast population growth is strongest in areas outside Brisbane, much of the employment growth is expected to remain in Brisbane, which will accommodate around 45 per cent of total SEQ jobs growth. Employment forecasts indicate that the Brisbane LGA will grow by 458,200 jobs between 2011 and 2041 to a reach total employment of around 1.25 million. By 2041, approximately 30 per cent of the SEQ population will be in the Brisbane LGA but this area will host approximately 48 per cent of the region's jobs<sup>8</sup>.

As shown in Figure 2.2, this will lead to a significant increase in the number of people travelling from these outer areas into the Brisbane LGA for work. Around 37 per cent of the new jobs in the Brisbane LGA are expected to be located in the Brisbane CBD and inner-city frame, driving demand for improved capacity and performance of bus and rail services to inner Brisbane<sup>9</sup>.

<sup>5</sup> Defined as Brisbane City (CBD), South Brisbane, Spring Hill, Fortitude Valley, West End, New Farm, Kangaroo Point and Highgate Hill.

<sup>6</sup> Census 2016

<sup>7</sup> Brisbane Economic Development Plan 2012–2031

<sup>8</sup> ShapingSEQ

<sup>9</sup> National Institute of Economic and Industry Research in conjunction with the Council of Mayors (SEQ) Economic and Employment Activity Forecasts



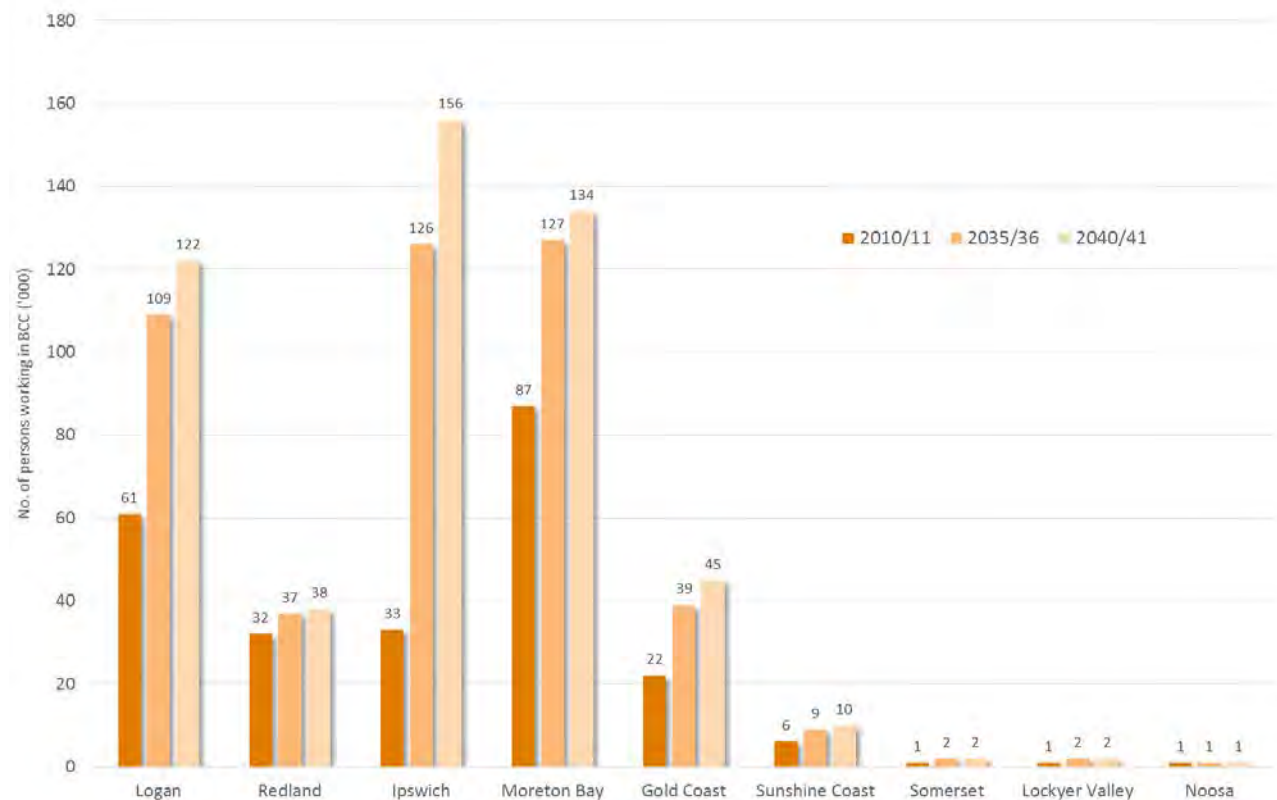


Figure 2.2: Persons Working in Brisbane City Council LGA by LGA of Residence (2011-2041) <sup>10</sup>

<sup>10</sup> Queensland Treasury and Trade Regional Projections





## 2.3 Strategic Policy Frameworks

The CRR Project supports a number of key federal, state and local government policies and frameworks, discussed in the following section.

### 2.3.1 Australian Government

#### 2.3.1.1 Australian Infrastructure Plan

The Australian Infrastructure Plan, released by Infrastructure Australia, provides a positive reform and investment roadmap for Australia. The plan sets out the infrastructure challenges and opportunities Australia faces over the next 15 years and the solutions required to drive productivity growth, maintain and enhance the nation's standard of living and ensure Australian cities remain world class.

The plan outlines a long-term strategy that lays the foundation for a more productive Australia. Key proposed reforms are summarised into the following:

- Productive cities, productive regions:
  - Productivity: Better utilise infrastructure networks and emerging technologies to improve productivity.
  - Population: Capitalise on the opportunities delivered by population growth in cities to enhance our economic prosperity and world-renowned liveability.
  - Connectivity: Deliver efficient infrastructure to connect people to jobs, goods to markets and Australia to the world.
  - Regional: Maximise opportunities for growth in productive regional economies and support sustainable regional communities.
- Efficient infrastructure markets:
  - Funding: Increase and sustain funding to deliver the infrastructure Australia requires.
  - Competitive markets: Complete, refine and create the world's most sophisticated infrastructure markets to deliver more efficient, customer-focused and cost-effective infrastructure services.
- Sustainable and equitable infrastructure:
  - Sustainability and resilience: Deliver infrastructure that is resilient to dynamic risks and supports a transition to a more sustainable economy.
  - Remote and Indigenous communities: Implement infrastructure solutions that are well-coordinated, make use of new technology and support broader reforms to make remote and Indigenous communities more resilient and sustainable.
- Better decisions and better delivery:
  - Governance: Establish a culture of infrastructure decision-making guided by long-term planning, rigorous evidence and transparent engagement with the community.
  - Best practice: Establish frameworks and use data to identify and drive improvements throughout the infrastructure lifecycle.



The Australian Infrastructure Plan indicates that Australia must upgrade its urban passenger transport networks so they are more integrated, have higher capacity and are able to meet the twin demands of population growth and rising expectations for service levels. At the same time, the structure, operation and use of these networks should be transformed to meet connectivity needs.

Infrastructure Australia has identified several proposals to extend the capacity of urban passenger rail networks as high priority initiatives. The CRR Project is included as a high priority public transport initiative on The Infrastructure Priority List (February 2016), contained in the Australian Infrastructure Plan.

#### 2.3.1.2 State of Australian Cities

The State of Australian Cities 2014–2015 report analyses cities in relation to population, settlement, economy, human capital and infrastructure and transport. The report states that issues of space and the potential conflicts and usability of cities, long-term capacity of freight hubs and the movement of goods and people are key concerns for the continued growth of productive cities. Economic output of the major cities has grown, and as such, increasing demand is being placed on the transport network.

Australia's cities are now increasingly characterised by the significant spatial divide between areas of highly productive jobs and the areas of population-based services, reflected through the price premiums associated with houses that have better access to the city centre.

Dwelling stock in Australian cities has shown a shift towards construction of semi-detached and apartment dwellings. Detached dwellings have declined as a portion of all dwellings, while medium and high-density dwellings have increased slightly. While there is evidence that Australia's major cities are increasing in density because of the construction of higher-density apartment developments in inner-city locations, growth in the detached housing market in urban fringe locations remains strong. Urban fringe areas are, however, becoming more distant from many of the established employment, education and health opportunities.

Section 2.2 of this chapter outlines key demographic statistics including forecast population and employment growth across SEQ. The data shows that employment growth will be the highest in Brisbane, while population growth will be stronger in areas outside of Brisbane. This is driving increased demand for travel to Brisbane, particularly the inner city and CBD. The CRR Project is an important initiative to meet forecast demand for rail services and to relieve pressure on other modes.

#### 2.3.1.3 Urban Transport Strategy

The Urban Transport Strategy (2013) identifies the following as key transport issues:

- integrating transport systems
- integrating long-term infrastructure planning and land-use planning
- the impact of urban transport systems on productivity
- the importance of urban access and equity, coherent and consistent funding and financing, consistent measurement and reporting of results.

The Australian Government has a strong interest in ensuring urban transport systems allow for productive national outcomes and that systems are planned in conjunction with land use. The strategy states that, while large infrastructure projects are not the only urban transport issue, they can be very influential on system performance and land use over time. Finding the right balance between private car use and public transport use is a key issue which impacts not only on travel but also on freight.



The CRR Project closely aligns with the objectives of the Urban Transport Strategy by providing a more efficient, resilient and integrated transport system. The CRR Project will help drive economic growth by improving accessibility and connectivity in the Brisbane region, Queensland's key economic and employment centre. It will also improve integration of transport and land-use outcomes, encourage more sustainable urban development through improved public transport connections and provide a stimulus to the Queensland economy during construction.

#### 2.3.1.4 Smart Cities Plan

The Smart Cities Plan sets out the Australian Government's vision for Australian cities and outlines three pillars for maximising their potential including Smart Investment, Smart Policy and Smart Technology as summarised below:

- We will become smarter investors in our cities' infrastructure:
  - prioritising projects that meet broader economic objectives
  - treating infrastructure as an investment wherever possible
  - getting involved early to ensure rigorous planning and business cases
  - increasing investment.
- We will coordinate and drive smarter city policy:
  - delivering 'City Deals'
  - leading regulatory reform
  - measuring success.
- We will drive the take-up of smart technology to improve the sustainability of our cities and drive innovation:
  - thinking of technology solutions first
  - leveraging open and real-time data
  - driving use of energy efficient technologies.

The Smart Cities Plan highlights the challenges facing cities of economic transition, jobs, housing and transport. Businesses have an incentive to locate in areas with access to the largest numbers of potential employees. Likewise, people have incentives to settle where they can access the greatest number of employment opportunities. As economic activity becomes more concentrated, demand for housing and land in nearby areas rises. To deal with rising prices, Australians have taken on relatively high levels of household debt, or moved to the outer suburbs, or both. With more people in outer suburbs, more people are travelling longer to get to work.

Congestion affects freight as well as passenger networks. While no city around the world has eliminated congestion, most world-class cities have invested in fast, efficient public transport systems to provide viable alternatives to passenger vehicles. Well-designed public transport networks including heavy and light rail, buses, ferries and integrated active transport are an efficient, convenient and environmentally friendly way of transporting large numbers of people within and between cities. Better accessibility needs a combination of demand management and investment in public transport, roads and active transport networks, including walking and cycling facilities.



The Smart Cities Plan outlines the concept of a 30-minute city where everyone can easily access the places they need to visit on a daily basis, wherever they live. It involves planning cities so residents can access employment, schools, shopping, services and recreational facilities within 30 minutes of home.

City Deals will be structured around nationally and locally informed objectives, with a focus on economic growth, jobs creation, housing affordability and environmental outcomes. Each City Deal will be unique; however, the foundational elements will include a defined geographical area, clear outcomes and actions, specific capital investment connected to reforms, clear governance arrangements, delivery timeframes and accountabilities and performance measurement.

The CRR Project aligns with the Smart Cities Plan by providing a more efficient and resilient transport system to improve accessibility and connectivity in Brisbane, Queensland's key economic and employment centre, and drive regional economic growth.

### 2.3.2 Queensland Government

#### 2.3.2.1 Queensland Government Objectives for the Community

The Queensland Government has four key objectives for the community. These objectives are underpinned by a commitment to integrity, accountability and consultation. These four objectives also include specific economic and social commitments relevant to the CRR Project:

- Creating jobs and a diversified economy:
  - increasing workforce participation
  - ensuring safe, productive and fair workplaces
  - stimulating economic growth and innovation
  - delivering new infrastructure and investment.
- Delivering quality frontline services:
  - providing responsive and integrated government services.
- Protecting the environment:
  - enabling responsible development.
- Building safe, caring and connected communities:
  - providing an integrated and reliable transport network
  - encouraging safer and inclusive communities.

#### 2.3.2.2 State Infrastructure Plan

The State Infrastructure Plan (SIP) was released in March 2016. It outlines a new strategic direction for the planning, investment and delivery of infrastructure in Queensland. The SIP sets out the Queensland Government's strategic direction for infrastructure by identifying what is required from infrastructure (objectives) and how these objectives can be best achieved (directions). These objectives and directions seek to address the high-level challenges Queensland will face over coming decades.





The four objectives that will guide infrastructure priorities are:

- improving prosperity and liveability
- infrastructure that leads and supports growth and productivity
- infrastructure that connects our communities and markets
- improving sustainability and resilience.

Queensland's infrastructure directions set out in the SIP are:

- finding the right solutions: better planning and assessment
- the most effective funding and financing options available
- the most efficient procurement: lower costs for business
- getting the most from what we have: better use of existing assets
- better engagement: understanding needs and setting expectations.

Specific to the transport infrastructure requirements in Queensland, the SIP outlines the strategic responses and priorities to the key objectives. This will enable Queensland Government departments and industry to align their activities in response to these priorities. The responses include the following:

- Focusing on maintenance and rehabilitation of existing infrastructure to reduce the long-term cost of repair and improve network resilience.
- Unlocking the potential of critical supply chains by identifying and improving the freight network.
- Seeking innovation and technology solutions to create a better performing and lower emissions transport system.
- Seeking public transport solutions including demand management to address the strong growth of SEQ.
- Digitally connected smart infrastructure to improve capacity, safety and security.
- Connecting regional communities with access to essential services and opportunities.

Of particular relevance to the CRR Project are responses relating to public transport solutions that address regional growth, unlocking and improving the freight network and solutions to create a better performing and lower emissions transport system.

The CRR Project is the Queensland Government's highest priority infrastructure project. It was included on the Queensland Government's list of priority infrastructure projects submitted to Infrastructure Australia in September 2015.

#### 2.3.2.3 South East Queensland's Rail Horizon

Published in 2016, South East Queensland's Rail Horizon (SEQ's Rail Horizon) outlines the strategic priorities for the region's rail network, which include optimising the existing network, upgrading services and infrastructure and delivering critical new infrastructure. It identifies the key capacity challenges facing the rail network and solutions to address them. SEQ's Rail Horizon aligns with the Queensland Government's desired outcomes for the community and the objectives of the SIP.



SEQ's Rail Horizon responds to key challenges facing the SEQ rail network by identifying the key initiatives needed to unlock network capacity. The CRR Project will unlock the inner-city rail network, triggering a transformation of the regional transport system and providing a platform for regional growth, development and prosperity. The New Generation Rollingstock Project will increase the train fleet by 30 per cent to meet growing rail demand. A total of 75 six-car trains will be progressively rolled out over a number of years.

SEQ's Rail Horizon acknowledges the need to maintain, manage and optimise the current network to meet future growth and demand, while minimising investment in temporary measures and maximising investment in long-term solutions.

Network optimisation measures being investigated include new generation signalling, next generation ticketing, simplifying services, timetable improvements and station and platform management. The Queensland Government has funded the European Train Control System (ETCS) – Inner City Project, which will provide a more modern, reliable and safe system that allows more services, more often, through the network.

A range of other rail network optimisation initiatives have already been implemented including timetable improvements and measures to reduce train waiting times at CBD stations.

As part of the Next Generation Ticketing Project, investigations are underway for an easy-to-use automated fare collection system to replace the *go* card. In the future, longer trains will also be used on parts of the network to further boost capacity and provide more seats. This will contribute to the Queensland Government's vision for a modern, high-capacity rail system.

#### 2.3.2.4 Transport and Main Roads Strategic Plan

The Department of Transport and Main Roads Strategic Plan 2016-2020 (revised for 2017-18) (TMR Strategic Plan) presents a vision of 'creating a single integrated transport network accessible to everyone'. The plan shows the alignment between TMR's objectives and the Queensland Government's objectives for the community. The plan is also used as a blueprint for delivering on the government's commitments and a tool to guide business at all levels of the department.

Key objectives and strategies of the TMR Strategic plan include:

- Customer Focus: A customer-centric organisation that better meets the needs of our customers
- Innovation: An organisation that embraces change and adapts to external influences to minimise the impact of disruption
- Liveable Regions and Active Cities: A network that connects communities and contributes to Queensland's quality of life
- Building Prosperity: A network that advances economic prosperity across our cities and regions
- Sustainable Funding: Responsive finance and investment arrangements that deliver value for money
- Contemporary Workforce: A prepared and capable workforce that meets the future mobility needs of Queenslanders

The notion of a safe, reliable, integrated, accessible transport network has been a fundamental consideration for the CRR Project when identifying options for addressing inner-city transport network constraints.



#### 2.3.2.5 Queensland Rail Strategic Plan

The Queensland Rail Strategic Plan 2015–2019 (QR Strategic Plan) vision is ‘Connecting communities and communities connecting’. The QR Strategic Plan directly supports key Queensland Government objectives by optimising service delivery and costs to keep passenger fares low and rail access for freight affordable, underpinning Queensland’s economic growth and development.

The purpose of the QR Strategic Plan is to provide a safe, reliable, on-time, value-for-money and efficient rail service that benefits the community and supports industry. The key strategic objectives are:

- People: Improve safety outcomes and increase productivity.
- Progress: Optimise operational expenditure and target capital investment.
- Performance: Sustain operational performance.

Strategic risk and challenges outlined in the QR Strategic Plan of particular relevance to the CRR Project include:

- Safety of the network: Ensuring the safety of services and passengers always comes first and that rail operations and the community safely exist.
- Investment in asset renewals and network capacity: Ensuring sufficient infrastructure investment to maintain and grow the rail network.
- Growth in rail patronage and network utilisation: Ensuring growth in services and utilisation meets population and economic growth.

Strategic opportunities identified that are particularly relevant for the CRR Project include:

- providing more services, more often, through investment in new rollingstock and network capacity enhancements
- utilising technology to enhance the customer experience.

#### 2.3.2.6 Connecting SEQ 2031

Connecting SEQ 2031 (CSEQ) is the current regional transport plan guiding development of a sustainable transport system in SEQ. The document reinforces the planning framework outlined in the South East Queensland Regional Plan 2009–2031 (SEQRP). It adopts an integrated approach that considers land-use planning and the various modes of transport. CSEQ contains more than 150 strategic policies, actions and projects to develop a sustainable transport system in the region. CSEQ outlines six priorities for action:

- Creating compact and connected communities: Ensuring the transport system supports desired regional outcomes of the SEQRP.
- Changing travel behaviour: Making it easier for people to choose sustainable travel options.
- Improving transport system efficiency and safety: Using cost-effective measures to improve the efficiency, reliability and safety of the transport system.
- Supporting economic vitality: Ensuring the transport system supports economic development and growth.
- Protecting environmental quality and health: Ensuring the transport system protects the environment.



- Delivering an integrated transport network: Expand and upgrade the transport network to provide a complete and fully functional multimodal network.

CSEQ also has a strong focus on rail as the backbone of the future transport network due to its ability to efficiently move large numbers of people.

Various initiatives have been proposed to improve the rail network's capacity such as high-frequency services over extended peak periods and improved signalling and timetabling. Many of these have now been implemented. CSEQ recognises that infrastructure will be needed to address the future capacity constraints in the inner-city rail network.

TMR is currently preparing new regional transport plans across QLD to guide planning and development of the transport system to support regional goals. In SEQ, regional transport planning will be focused on building on strategies for network reform and optimisation as outlined in Connecting SEQ.

#### 2.3.2.7 ShapingSEQ

ShapingSEQ: Draft South East Queensland Regional Plan (ShapingSEQ) is the new regional planning framework for SEQ. Currently released for consultation, ShapingSEQ will replace the existing regional plan, SEQRP, once finalised. It provides a framework for sustainably managing the region's growth over the next 25 years and sets a 50-year vision. It responds to anticipated changes in the region's population, both in demographics and size. The draft has been informed by significant consultation across government and with the community.

Five key themes underpin the 50-year vision for SEQ's future: Grow, Prosper, Connect, Sustain and Live. ShapingSEQ presents a long-term vision of a more sustainable, healthy and fair transport system and prioritises public and active transport. It focuses on making the most of existing systems and targeting strategic investment in new region-shaping infrastructure. Integrated land-use and infrastructure planning is also highlighted as fundamental to achieving community aspirations, economic growth and efficient and affordable infrastructure delivery.

ShapingSEQ identifies the CRR Project as essential to achieving the prosperity and connectivity outcomes detailed in the plan, as well as desired settlement patterns.

#### 2.3.3 Joint Queensland and Local Government

##### 2.3.3.1 Connecting Brisbane

Jointly delivered by the Queensland Government and BCC, in conjunction with the Australian Government, Connecting Brisbane is a contemporary, holistic strategy for Brisbane's passenger transport system. It aims to set Brisbane up for the future by establishing a customer-friendly, efficient, integrated and reliable passenger transport system that promotes connectivity and offers a foundation for growth and innovation.

Connecting Brisbane highlights the need to transform the passenger transport system from a radial network – with buses and trains making long journeys into the city centre – to a high-frequency trunk network with local feeders. Fast, frequent, turn-up-and-go services are essential to achieving the transport vision for the future.

The CRR Project and Brisbane Metro are fundamental components of the Connecting Brisbane strategy. Together, the projects will help achieve key elements of the vision for the transport network for all levels of Government including:



- Creating an attractive customer experience where public transport becomes the preferred mode of travel.
- Providing an efficient, reliable and modern service and network which offers on-time services on a high-frequency trunk network (supported by appropriate feeders), responding to community needs.
- Connecting people, businesses and places through a system that provides a high level of access to major facilities, services and hubs in Brisbane.
- Establishing a foundation for growth and innovation through a cohesive network that is flexible enough to continue to grow and evolve in response to present and future needs.

The CRR Project and Brisbane Metro are seen as complementary projects, essential to creating a world-class passenger transport network for Brisbane – one that supports economic and employment growth, and sustainable development, both in the city centre and the broader region.

Connecting Brisbane has clearly articulated the complementary benefits of delivering both the CRR and Brisbane Metro projects. The estimated future demand for travel across SEQ described in both business cases are consistent, being derived using the same transport model (based on the Brisbane Strategic Transport Model) with similar assumptions. This includes key assumptions such as the Queensland Government's population and employment projections and forecast changes to out of pocket costs of travel such as public transport fares, parking charges and toll charges.

### 2.3.4 Local Government

#### 2.3.4.1 Brisbane City Plan

The Brisbane City Plan 2014 (City Plan) commenced on 30 June 2014. The plan's strategic framework is based on a range of BCC and Queensland Government documents and plans, including:

- Brisbane Vision 2031
- The Draft Brisbane CityShape 2026
- Brisbane Economic Development Plan 2012-2031
- Brisbane's Unique Window of Opportunity
- SEQRP.

The key strategic outcome, contained in the City Plan, regarding the city's transport networks is that they provide efficient and reliable travel options for:

- workers to access jobs
- residents and visitors to access services
- business and industry to operate effectively and productively.

Part of the plan's strategic intent is for significant levels of new growth in Brisbane to be leveraged off public transport.

#### 2.3.4.2 Brisbane City Centre Master Plan

Published in 2014, the Brisbane City Centre Master Plan (BCCMP) outlines a five-year implementation plan containing priority projects to facilitate investment in Brisbane's city centre. The BCCMP is designed to





ensure planning and development within the city centre provides an attractive market for investment and that the city centre remains a competitive location on the world stage.

The BCCMP's transport strategy 'where people connect' states that public transport will be the best way to commute to the city centre and that investment will be made in high-capacity and high-frequency transit to keep the city growing strong. It also indicates Brisbane will boast an extensive intermodal network, new transit infrastructure and improved services to sustain continued growth and prosperity. Investment in underground transit will reduce impacts on city streets and improve amenity for pedestrians and business. The BCCMP identified 'going underground', through projects such as the CRR Project, and the CityGlider buses as vital to ensuring 'convenient, comfortable and hassle-free' journeys to the city centre.

The BCCMP proposes transforming key CBD streets into city boulevards – vital public spaces for dining, shopping and events – as well as conduits for movement. Under the plan, Albert Street will become a subtropical corridor, with unique public spaces, outdoor dining, public activities, pop-up events and space for pedestrians and active transport. Functioning as a green, vegetated spine through the CBD, it will support the city's outdoor lifestyle and connect city streets and gardens. The progressive revitalisation of Albert Street (block by block as opportunities arise) will formalise it as a key north-south pedestrian link between Roma Street Parklands and the City Botanic Gardens and support the prosperity of the Queen Street Mall. Achieving the vision for Albert Street involves both short and long-term initiatives that deliver on the economic and public realm potential of the street. The CRR Roma Street and Albert Street Stations complement the BCCMP by supporting the revitalisation of Albert Street, which is a priority BCC project.

#### 2.3.4.3 Brisbane Vision 2031

Brisbane Vision 2031 (Brisbane Vision) is BCC's long-term community plan for the city. Published in 2013, it details the aspirations for the city's future and outlines ideas for achieving the vision. The first theme of the vision, 'Our accessible, connected city', is particularly relevant to addressing inner-city public transport constraints. It includes the following aims:

- Brisbane is an accessible city for everyone. Residents, workers, students, visitors and business people can move easily throughout the city.
- Public transport and active transport networks provide safe, efficient, fast and reliable travel options throughout the city. These networks help deliver economic benefits to Brisbane and support our growing community and changing economy.
- There is equitable access to high-quality, interconnected public transport services that move through Brisbane. These services are affordable, offer good customer service and are frequent, reliable and safe.

#### 2.3.4.4 Brisbane Economic Development Plan

The Brisbane Economic Development Plan 2012–2031 (BEDP) indicates that significant capacity building will be required across all sectors to meet the growth opportunities ahead, including expanding transport infrastructure and improving public transport services, particularly those that serve commercial and industrial precincts.

The BEDP notes that business precincts across the inner city must be linked by good public transport networks for corporate businesses to enjoy efficient connectivity and associated agglomeration benefits. Sustainable development along the corridor and at station precincts will drive economic growth.

The plan indicates that moving people efficiently into inner-city employment hubs from across the region, particularly from areas beyond Brisbane as SEQ grows, will be critical to future economic growth.



#### 2.3.4.5 Brisbane Long Term Infrastructure Plan

The Brisbane Long Term Infrastructure Plan 2012–2031 (BLTIP) is intended to guide the prioritisation and alignment of Brisbane’s infrastructure as the city grows. It acts as a reference for other levels of government and the private sector. The key objectives of the plan include:

- Grow the economy: Road and public transport networks provide efficient and reliable travel options for workers to access jobs, residents and visitors to access services, and business and industry to operate effectively and productively.
- Build the community: The transport network delivers people to their desired destination.

The CRR Project is identified as a proposed major public transport project in the plan. The plan states that short-term investments in modern rail signalling and high-quality, real-time passenger information may be necessary to manage the growth in public transport demand in the interim (depending on preferred projects and construction timeframes).

#### 2.3.4.6 Council of Mayors

The Council of Mayors (SEQ) produced several documents that consider the role of public transport in SEQ’s economic prosperity. These include:

- Shared Future Report: Collaborative Opportunities for South East Queensland (Shared Future Report) – which highlights that SEQ generates one fifth of Australia’s economic growth. With a high projected population growth, SEQ faces the challenge of planning for, and delivering, the infrastructure and services needed to improve productivity, reduce cost of living pressures and maintain liveability.
- Public Transport in SEQ (2012) – which considers innovation and value-for-money options for regional public transport investment. The report indicates that meeting the needs of a growing region within a financially constrained fiscal environment is a key challenge.
- Getting SEQ Moving: 2011–2012 – which highlights the pressure SEQ is under due to population growth, increasing private vehicle use and growing freight movements, resulting in peak-hour traffic congestion and overcrowding of passenger transport services.

#### 2.3.5 Summary of Strategic Policies

Table 2.1 summarises these key government policies and frameworks and their strategic alignment with the CRR Project.

POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
<b>AUSTRALIAN GOVERNMENT</b>	
Australian Infrastructure Plan	<p>The CRR Project is specifically mentioned in the ‘Connectivity’ section of the Australian Infrastructure Plan. This plan indicates that Australia must upgrade its urban passenger transport networks so that they are more integrated, have higher capacity and are able to meet the twin demands of population growth and rising expectations for service levels. At the same time, the structure, operation and use of these networks should be transformed to meet connectivity needs.</p> <p>Infrastructure Australia has identified several proposals to extend the capacity of urban passenger rail networks as high-priority initiatives. The CRR Project is included as a high priority public transport initiative on The Infrastructure Priority List (February 2016), contained in the Australian Infrastructure Plan.</p>



POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
State of Australian Cities	<p>This report discusses the overarching demand for public transport. It points out that as Australia's urban economies have transitioned, and more jobs are now located in city centres, patronage on public transport has grown significantly.</p> <p>In the past decade, the rate of average annual growth of public transport patronage (2.4 per cent) surpassed the rate of population growth in capital cities (1.8 per cent). Furthermore, demand for heavy rail is continuing to increase and, as such, a strategy to address the demand on the heavy rail network is required.</p>
Urban Transport Strategy	<p>The CRR Project aligns closely with the objectives of this strategy by providing a more efficient, resilient and integrated transport system. The CRR Project will help drive economic growth by improving accessibility and connectivity in the Brisbane region, Queensland's key economic and employment centre.</p> <p>The CRR Project will improve integration of transport and land-use outcomes and encourage more sustainable urban development through improved public transport connections, specifically, between the areas where people will live and the places where they will work. It will also stimulate the Queensland economy during construction.</p>
Smart Cities Plan	<p>The CRR Project aligns with this plan as it will provide a more efficient and resilient transport system to improve accessibility and connectivity in Brisbane, Queensland's key economic and employment centre, and drive regional economic growth.</p>

#### QUEENSLAND GOVERNMENT

Queensland Government Objectives	<p>The Queensland Government has four key objectives for the community that are underpinned by a commitment to integrity, accountability and consultation. These are:</p> <ul style="list-style-type: none"> <li>▪ creating jobs and a diversified economy</li> <li>▪ delivering quality frontline services</li> <li>▪ protecting the environment</li> <li>▪ building safe, caring and connected communities.</li> </ul> <p>The CRR Project closely aligns with these objectives as it will unlock the inner-city public transport network, stimulate economic growth through increased network capacity and deliver safe and optimised rail services.</p>
State Infrastructure Plan	<p>The CRR Project not only supports the key objectives of the SIP but also addresses the following key transport responses contained in the SIP:</p> <ul style="list-style-type: none"> <li>▪ Focusing on maintenance and rehabilitation of existing infrastructure to reduce the long-term cost of repair and improve network resilience.</li> <li>▪ Seeking innovation and technology solutions to create a better performing and lower emissions transport system.</li> <li>▪ Seeking public transport solutions including demand management to address the strong growth of SEQ.</li> <li>▪ Digitally connected smart infrastructure to improve capacity, safety and security.</li> <li>▪ Connecting regional communities with access to essential services and opportunities.</li> </ul> <p>The CRR Project is the Queensland Government's highest priority infrastructure project and was included on the Queensland Government's list of priority infrastructure projects submitted to Infrastructure Australia in September 2015.</p>



POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
SEQ's Rail Horizon	<p>SEQ's Rail Horizon addresses the CRR Project at length. It highlights the CRR Project's potential to unlock the inner-city rail network, triggering a transformation of the regional transport network and providing a platform for regional growth, development and prosperity.</p> <p>Recent investigations confirmed the value of a rail-only solution – rather than a bus and rail transport solution – for the inner city. The Queensland Government supports the CRR Project as the preferred rail solution with opportunity for further bus network optimisation enabled by the CRR Project.</p> <p>The report notes that ETCS is the preferred new signalling technology for the SEQ rail network and that ETCS Level 2 will be implemented on the inner-city network. In the future, nine-car trains will also operate on some parts of the rail network. Longer trains, coupled with a new signalling system, will contribute to the vision of a modern, high-capacity rail system.</p> <p>SEQ's Rail Horizon acknowledges the need to maintain, manage and optimise the current network to meet future growth and demand, while minimising investment in temporary measures and maximising investment in long-term solutions.</p>
Transport and Main Roads Strategic Plan	<p>The vision articulated by this plan is 'Creating a single integrated transport network accessible to everyone'. One of the key opportunities identified is for 'Liveable regions and active cities: Deliver a single integrated transport network that promotes prosperity in our cities and regions.'</p> <p>The CRR Project aligns with the key objectives of the TMR Strategic Plan. It also closely aligns with the key opportunities and challenges including keeping pace with technological change, keeping pace with customer and stakeholder expectations and ensuring regions and cities remain prosperous.</p> <p>The CRR Project will improve accessibility, utilisation and service quality of the existing SEQ rail network and reduce congestion on the broader transport network.</p>
Queensland Rail Strategic Plan	<p>Strategic risks and challenges outlined in the QR Strategic Plan of particular relevance to the CRR Project include:</p> <ul style="list-style-type: none"> <li>▪ Safety of the network: Ensuring the safety of services and passengers always comes first and that rail operations and the community safely exist.</li> <li>▪ Investment in asset renewals and network capacity: Ensuring sufficient infrastructure investment to maintain and grow the rail network.</li> <li>▪ Growth in rail patronage and network utilisation: Ensuring growth in services and utilisation meets population and economic growth.</li> </ul> <p>Strategic opportunities of particular relevance to the CRR Project include providing more services, more often, through investment in new rollingstock and network capacity enhancements and utilising technology to enhance the customer service.</p>



POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
Connecting SEQ 2031	<p>CSEQ provides specific detail on the rail network's critical function in SEQ and the need for initiatives to improve the rail network's capacity.</p> <p>The plan outlines six priorities for action:</p> <ul style="list-style-type: none"> <li>▪ creating compact and connected communities</li> <li>▪ changing travel behaviour</li> <li>▪ improving transport system efficiency and safety</li> <li>▪ supporting economic vitality</li> <li>▪ protecting environmental quality and health</li> <li>▪ delivering an integrated transport network.</li> </ul> <p>CSEQ also has a strong focus on rail as the backbone of the future transport network due to its ability to efficiently move large numbers of people.</p>
ShapingSEQ	<p>ShapingSEQ presents a vision of a connected, prosperous region, where residents enjoy greater choice in how they move around, more trips are made by public transport and transport investments enable a more compact urban form. It discusses the long-term challenge of changing the region's transport priorities to achieve a more sustainable, healthy and fair transport system, one that prioritises public and active transport.</p> <p>ShapingSEQ identifies the CRR Project as essential to achieving the prosperity and connectivity outcomes detailed in the plan, as well as desired settlement patterns.</p>

#### JOINT QUEENSLAND AND LOCAL GOVERNMENT

Connecting Brisbane	<p>Connecting Brisbane is a strategy to evolve Brisbane's passenger transport system into a customer-friendly, efficient, integrated and reliable system. Connecting Brisbane highlights the need to transform the passenger transport system from a radial network into a turn-up-and-go, high-frequency trunk network with feeders.</p> <p>The CRR Project and Brisbane Metro are seen as complementary projects, essential to creating a world-class passenger transport network for Brisbane – one that supports economic and employment growth, and sustainable development, both in the city centre and the broader region.</p>
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#### LOCAL GOVERNMENT

Brisbane City Plan	<p>The CRR Project aligns with the City Plan's overall strategic intent as it supports significant quantities of new growth in Brisbane being built on the principles of transit-oriented development and leveraged of public transport.</p> <p>The following key strategic transport objectives are reflected in the City Plan:</p> <ul style="list-style-type: none"> <li>▪ Brisbane having a safe and efficient public transport network.</li> <li>▪ Public transport is the preferred mode of travel to the city centre and the city's major centres and provides a high level of access to all facilities and services in Brisbane, reducing the need to use a car.</li> </ul> <p>The CRR Project will better integrate transport modes and support connections between sustainable land use and transport infrastructure to strengthen the economy.</p>
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POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
Brisbane City Centre Master Plan	<p>The CRR Project aligns with the following key strategic transport objectives contained in the BCCMP:</p> <ul style="list-style-type: none"> <li>▪ A first-class transit network that will provide convenient, high-frequency connections between major employment centres, health, knowledge and education precincts, the airport and cultural destinations.</li> <li>▪ New transit infrastructure and improved services that will sustain the continued growth and prosperity of the city centre.</li> <li>▪ Increasing capacity for additional rail services through peak service timetabling and signalling improvements and reduced conflicts during peak hours.</li> </ul> <p>The BCCMP identified ‘going underground’, through projects such as the CRR Project as vital to ensuring convenient, comfortable and hassle-free journeys to the city centre.</p> <p>The CRR Roma Street and Albert Street Stations, in particular, complement the BCCMP and its vision for a green spine from Roma Street Parklands, down Albert Street to the City Botanic Gardens.</p>
Brisbane Vision 2031	<p>The CRR Project aligns with the following key aspirations in Brisbane Vision 2031 including:</p> <ul style="list-style-type: none"> <li>▪ Road, public transport and active transport networks provide safe, efficient, fast and reliable travel options throughout the city. These networks help deliver economic benefits to Brisbane and support our growing community and changing economy.</li> <li>▪ Brisbane has planned its development and infrastructure so that it is easy to get from the places we live to where we work, study, shop, meet and play.</li> <li>▪ Planning and development in our city prepares effectively for population, employment growth and demographic change, with efficient use of new and existing infrastructure and public assets.</li> </ul> <p>The CRR Project will increase the cross-river capacity of the public transport system and boost inner-city public transport, reshaping the network to cater for Brisbane’s growing and changing travel demands.</p>
Brisbane Economic Development Plan	<p>The CRR Project closely aligns to the following priority actions in the BEDP:</p> <ul style="list-style-type: none"> <li>▪ BCC and TransLink to continue to improve public transport connectivity between economic precincts.</li> <li>▪ Special attention to ensuring the inner city/CBD maintains competitiveness and provides for economic growth.</li> </ul> <p>The CRR Project will strengthen the region’s economic development through improved connectivity and accessibility to employment growth areas in the Brisbane region and population growth areas.</p>
Brisbane Long Term Infrastructure Plan	<p>The CRR Project is identified as a proposed major public transport project in the BLTIP. The plan states that short-term improvements in modern rail signalling systems and high-quality, real-time passenger information may be necessary to manage the growth in public transport demand in the interim.</p>
Shared Future Report	<p>One of the report’s key recommendations is to focus on the backbone of the transport system, the priorities being public transport, freight and road infrastructure. The report outlines a range of significant projects, some of which are currently being delivered or are under evaluation.</p>



POLICY/INITIATIVE	CROSS RIVER RAIL PROJECT ALIGNMENT
Public Transport in SEQ	This report proposes removing the Cleveland and Ferny Grove rail lines from the network and reintroducing them as independent lines. This solution also requires fast-tracking a supporting light rail or metro system. Key barriers to the Cleveland Solution include cost, property impacts, significant CBD construction impacts, network crossover impacts and forced transfers. Also, the new line would only serve the western edge of the CBD and the additional catchment is minimal.
Getting SEQ Moving	This report highlights the importance of growing Queensland's infrastructure and services in line with population and economic growth. It acknowledges that government must continue to invest in the SEQ rail network to meet the objectives of the SEQRP and to address the inner-city transport bottleneck. It highlights the importance of considering the rail network holistically.

**Table 2.1: Strategic Policies and Project Alignment**



# CHAPTER THREE

## PROBLEM



## CHAPTER 3

### PROBLEM

#### CHAPTER SUMMARY AND CONCLUSIONS:

- Population and employment growth in SEQ, and the need to support economic growth and manage urban land use, are driving the need for investment in passenger transport.
- Problems to be addressed by the CRR Project have been investigated at three levels, specifically:
  1. Strategic problems facing SEQ:
    - Growing demand for mobility and connectivity is increasing pressure on SEQ's transport network.
    - Economic growth and productivity cannot be achieved without an effective transport system.
  2. Transport problems facing SEQ:
    - Growing road congestion, increasing car dependency and overcrowded public transport services are challenging the region's growth aspirations, restricting economic activity and impacting liveability.
    - Public transport trips are forecast to more than double between 2015 and 2036, which is beyond the capacity of the system. Limited capacity at the heart of the network is restricting its growth.
    - Servicing forecast growth in public transport demand, particularly for travel to and within Brisbane's inner city, will be impossible without additional infrastructure investment.
  3. Rail problems experienced on the SEQ network:
    - Rail is unable to function as the backbone of the transport network.
    - Brisbane's rail network has limited capacity and coverage compared with other major Australian cities, particularly across the inner city and CBD.
    - Limited inner-city rail tracks, river crossings and stations are creating bottlenecks in the system. Train services are becoming overcrowded, people are waiting longer at stations and reliability is decreasing as more passengers load onto limited services.
    - Demand for rail is expected to nearly triple by 2036 but the network will be unable to cater to this demand without new infrastructure.



### 3.1 Purpose and Overview of this Chapter

The purpose of this chapter is to clearly identify and articulate the problems to be addressed by the CRR Project.

This chapter outlines:

- The strategic context driving the need for a step-change in public transport capacity through Brisbane's inner city and CBD to improve access to inner-city jobs and unlock rail capacity constraints.
- Potential lost opportunities from continuing with the status quo, through a review of the role of high-capacity public transport in supporting economic growth and productivity objectives for the SEQ region.
- The current and future transport task and capacity constraints that are causing network congestion, overcrowding and reduced reliability.

### 3.2 Approach

The chapter initially discusses the relationship between land use, transport and the economy. It then describes current and future problems at three levels, specifically:

1. strategic problems facing SEQ
2. transport challenges facing SEQ
3. rail problems experienced on the SEQ network, considering rail's role as the mode best suited to meeting future travel demand.

Figure 3.1 summarises the key issues described in this chapter.

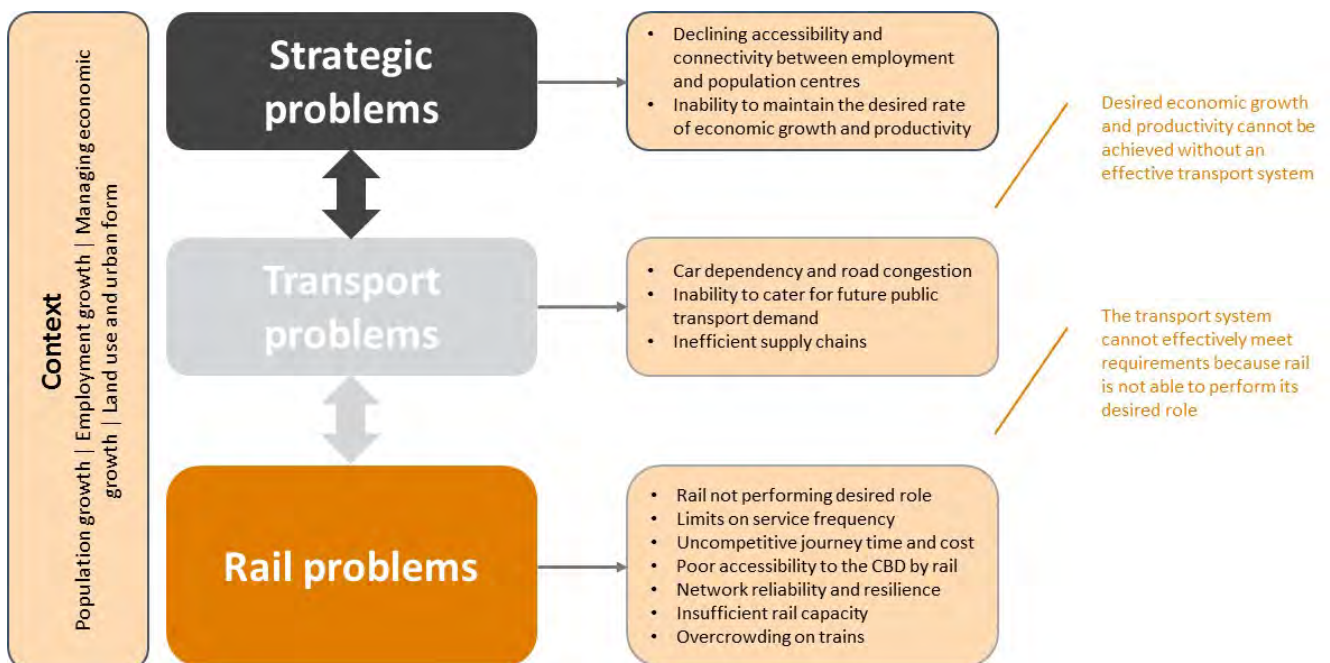


Figure 3.1: Summary of Key Issues as Presented in this Chapter





### 3.3 Context – Relationship Between Land Use, Transport and Economy

Efficient and effective transport infrastructure is essential to the growth and competitiveness of a city or a region. It is a key economic enabler, allowing efficient trading between businesses, workers to access job opportunities and residents and visitors to enjoy leisure activities.

It also shapes land-use planning by signalling where new or intensified urban development is feasible and underpins an appropriate spatial distribution of economic activity. By supporting denser land uses, well-planned transport infrastructure directly generates opportunities for agglomeration economies. Agglomeration is fundamentally about the productivity benefits that come from proximity, both in the physical sense and through good connectivity. Proximity lowers the costs of trade and of exchanging ideas and increases the pool of shared resources, both labour and capital, making cities more productive and attractive.

A well-planned transport initiative, coupled with appropriate land-use policies and interventions such as investment attraction, can make the transport system a catalyst for a wider site and city transformation.

The Australian Government's Smart Cities Plan indicates that most world-class cities have invested in fast, efficient public transport systems to provide viable alternatives to private vehicles<sup>11</sup>. These cities have used transport investments to reduce congestion, and its associated costs, and enable economic opportunity and growth.

Integrating transport, land use and the economy improves a city's competitiveness by:

- reducing the cost of commuting and trade by relieving congestion pressures
- improving the quality of life and the environment
- enabling efficient land use
- enhancing connectivity between businesses and people, thus boosting productivity.

Figure 3.2 presents an example of the city-building benefits of transport initiatives in Australia, specifically, Melbourne's City Loop (rail), City Link (road) and Western Ring Road projects (measured in gross value added between 1981 and 2011). This demonstrates the ability of rail projects to continue to deliver benefits in the long term.

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<sup>11</sup> Smart Cities Plan



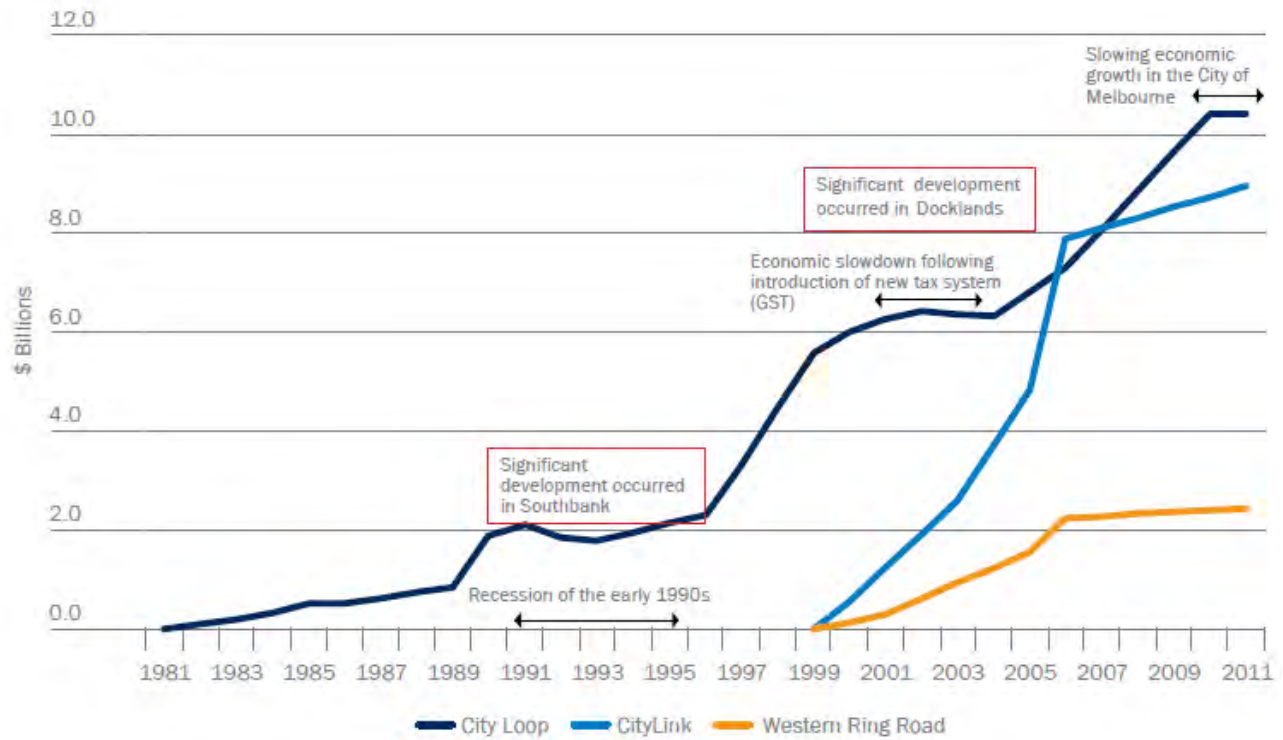


Figure 3.2: Benefit Stream Across Time of Selected Melbourne Transport Projects (\$ billions), 1981–2011<sup>12</sup>

<sup>12</sup> State of Australian Cities 2014–15



### 3.4 Strategic Problems

When transport infrastructure does not achieve its primary purpose of connecting people with goods, activities and employment, economic growth and productivity become constrained. This erodes a city's attractiveness to residents, businesses and investors. Strategic infrastructure investment however can boost productivity, drive greater economic output and overcome accessibility constraints.

#### 3.4.1 Accessibility

Growing demand for mobility and connectivity is increasing pressure on the SEQ transport network, resulting in longer and more variable travel times, crowding and congestion. As discussed in Chapter 2: Strategic Context, one of the biggest challenges facing the region is the distribution of forecast population and employment growth. As illustrated in Figure 3.3, the vast majority of the region's residential growth to 2036 is forecast to be outside Brisbane City but much of the employment growth is forecast to remain in Brisbane. This presents a considerable transport challenge.

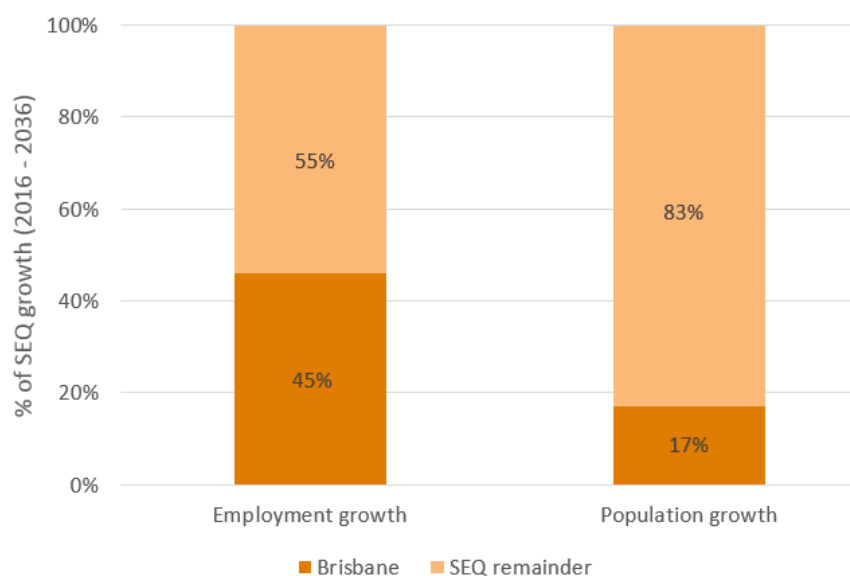


Figure 3.3: Forecast Brisbane Share of Population and Employment Growth 2016 to 2036<sup>13</sup>

The Bureau of Infrastructure, Transport and Regional Economics estimates that congestion costs in metropolitan capital cities was around \$16.5 billion in 2015. It is forecast to reach between \$27.7 billion and \$37.7 billion by 2030<sup>14</sup>.

When the costs of rapid population and economic growth increase faster than the benefits, regions can face significant issues. In SEQ, accessibility and connectivity decreases as the transport network struggles to meet demand under the weight of rapid population growth.

<sup>13</sup> Queensland Government population and employment projections, 2015

<sup>14</sup> Australian Government, Department of Infrastructure and Regional Development, Traffic and congestion cost trends for Australian capital cities, 2015



Poor land-use outcomes, such as unstructured growth in the form of urban sprawl, can also erode regional accessibility and connectivity. Areas with primarily homogenous land uses force residents to commute from their place of residence to areas of employment. The top corridors impacted by congestion within the Brisbane region, as identified by the 2015 Australia Infrastructure Audit, include north and south Brisbane extending to Logan and the Gold Coast. These hotspots represent core areas of concentrated transport movement, influenced by daily trips between residential areas and employment growth hubs.

Infrastructure that overcomes the issues of land-use segregation by connecting communities and markets is central to regional growth and productivity.

### 3.4.2 Economic Growth and Productivity

The world is becoming increasingly urbanised as people respond to the opportunities found in cities. Concentrating economic activity into urban areas boosts productivity, generating more jobs and jobs that are more productive.

The Australian experience of urbanisation is similar to the rest of the developed world. Australia has quickly become one of the most urbanised countries in the developed world with nine out of 10 Australians now living in urban areas. The United Nations forecasts that by 2050, around 93 per cent of Australians will be living in urban areas, as shown in Figure 3.4.

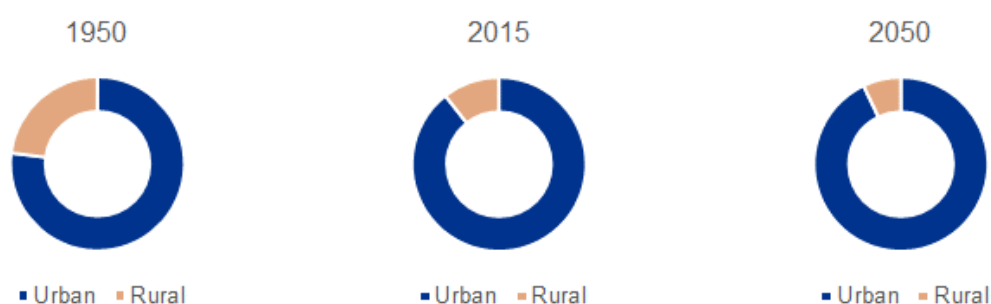


Figure 3.4: Australian Urbanisation Trends<sup>15</sup>

Connecting residential areas in the greater urban area with employment is essential to maintaining a productive city. Longer and more variable commute times, crowding and congestion are detrimental to meeting this fundamental need.

The Smart Cities Plan states that in the 21st century, cities need to be productive and accessible. Both Sydney and Melbourne are investing heavily in urban public transport to improve accessibility and enable economic opportunity. Without similar investment in strategic public transport infrastructure, Brisbane's economic strength will be weakened and SEQ will lag behind Melbourne and Sydney in urban competitiveness.

<sup>15</sup> United Nations World Urbanisation Prospects, 2015



## 3.5 Transport Problems

### 3.5.1 Introduction

SEQ's transport network is at a critical juncture as issues such as growing road congestion, increasing car dependency and overcrowded public transport services challenge the region's growth aspirations. This section explores the key regional transport problems, which are summarised in Figure 3.5, and how they culminate in the need for a major investment in the public transport system.



Figure 3.5: Summary of Transport Problems Presented in this Chapter

### 3.5.2 Car Dependency and Congestion

Private cars currently dominate the way people move around in SEQ, with more than 80 per cent of all trips made by car<sup>16</sup>. Figure 3.6 shows that cars and commercial vehicles have gradually become more dominant in Australia, over time.

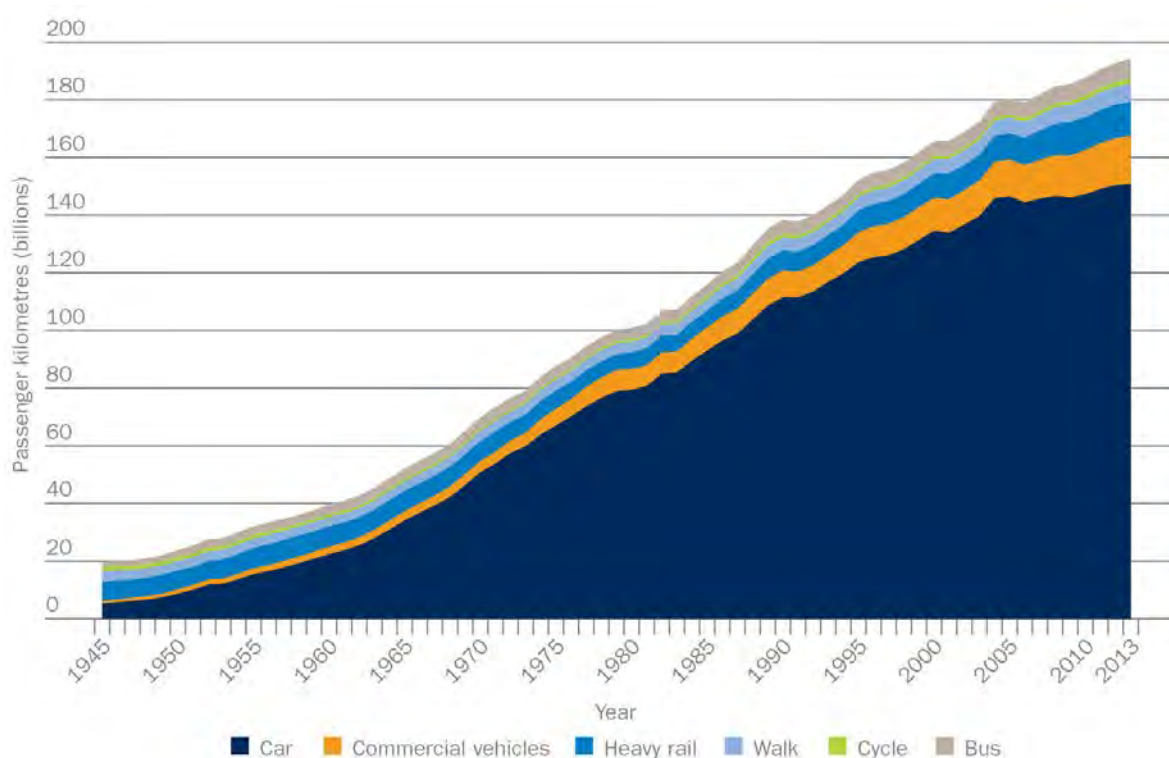


Figure 3.6: Total Urban Passenger Task for Australia (Selected Modes) 1945–2013<sup>17</sup>

<sup>16</sup> South East Queensland Travel Survey 2009–2012

<sup>17</sup> State of Australian Cities 2014–2015





Not only is the private car Australia's dominant mode of transport but the last 10 years have seen a steady decline in average vehicle occupancy, with most cars in SEQ increasingly having only one occupant for work-related trips.

Strong growth in private car use can incur significant infrastructure costs and restrict economic activity, if there is insufficient capacity to accommodate growth. In SEQ, continued growth in car travel will increase congestion and impact freight and commercial movements, increasing the cost of conducting business and transporting goods.

Focusing transport investment on private car travel can result in fewer quality alternatives, making it difficult for people who are unable to drive or afford a car to access employment, services and recreation opportunities.

Cars have less capacity to provide the same level of connectivity as in the past, especially to key economic nodes such as the CBD. Congestion caused by excessive demand – relative to road capacity – or incidents is already an issue, affecting network reliability.

Forecasts show that across the Brisbane metropolitan transport network, total trips will increase by around 36 per cent from 2015 to 2036 to almost 10.3 million trips per day. Of this, 8.2 million trips will be made by private vehicle, growing 30 per cent from 2015. Growth in public transport trips is forecast to increase at a much faster rate, more than doubling over the same period to 1.1 million trips per day. Modelling shows that worsening road congestion, coupled with strong jobs growth in the dense inner-Brisbane area where public transport is more competitive, will result in a strong increase in the share of daily trips made by public transport, from 6.8 per cent in 2015 to 10.9 per cent in 2036<sup>18</sup>.

Even so, the expected increase in private vehicle trips and vehicle kilometres travelled will place further pressure on the road network, leading to increased travel times and economic costs. Congestion costs are already rising with delays reducing economic efficiency and costing industry millions per year. The Australian Infrastructure Audit estimates the cost of delays on the Brisbane–Gold Coast–Sunshine Coast transport network caused by congestion in 2011 was around \$2 billion. In the absence of any additional capacity, the cost of delay across the region is projected to grow to around \$9 billion in 2031<sup>19</sup>.

Regular high-level congestion during weekday peak hours also affects the region's bus system, much of which relies on the road network. The resultant increased travel time impacts business and leisure time, with flow-on effects to the region's economy and lifestyle. Figure 3.7 shows the forecast state of the road network during the morning peak in 2036, illustrating chronic congestion across much of the network. Congestion is measured using the volume/capacity ratio (V/C ratio), which compares the number of vehicles (volume) to the road capacity. A V/C ratio of greater than one indicates that forecast demand will exceed available capacity.

Unless regional congestion is managed effectively, business will face significantly increased costs and the city's liveability and amenity will be undermined. In Brisbane, the challenge cannot be met by building more roads that funnel more traffic into an already congested urban core. This is due to the difficulty in channelling ever increasing numbers of vehicles through a fixed number of entry points, all competing for limited road space that is also being consumed by other functions such as pedestrian and social spaces.

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<sup>18</sup> CRR Project model 2016

<sup>19</sup> State Infrastructure Plan



Recent road projects such as Clem7, Airport Link and Legacy Way have created bypass routes around the city to avoid further congesting the inner-city core. Significant investment has also been made in urban busways to increase capacity for commuters close to the CBD. However, bus-based systems are reaching their limits and are constrained in key areas through the inner city. Constraints on the busway network are already highly visible – during peak hours, queues of buses can be observed on key entries into the CBD such as the Victoria Bridge and the approach to the Melbourne Street portal. Similar constraints exist on the city street system where high bus volumes, limited on-street stopping space and mixed traffic operations cause queuing and reduce the reliability of services.

Importantly, bus services do not provide the geographic reach needed to cater for the significant expected growth in longer distance commutes. A step-change increase in the capacity of public transport is required, which balances the demand across both bus and rail modes and allows each travel mode to perform its function within an integrated transport network.



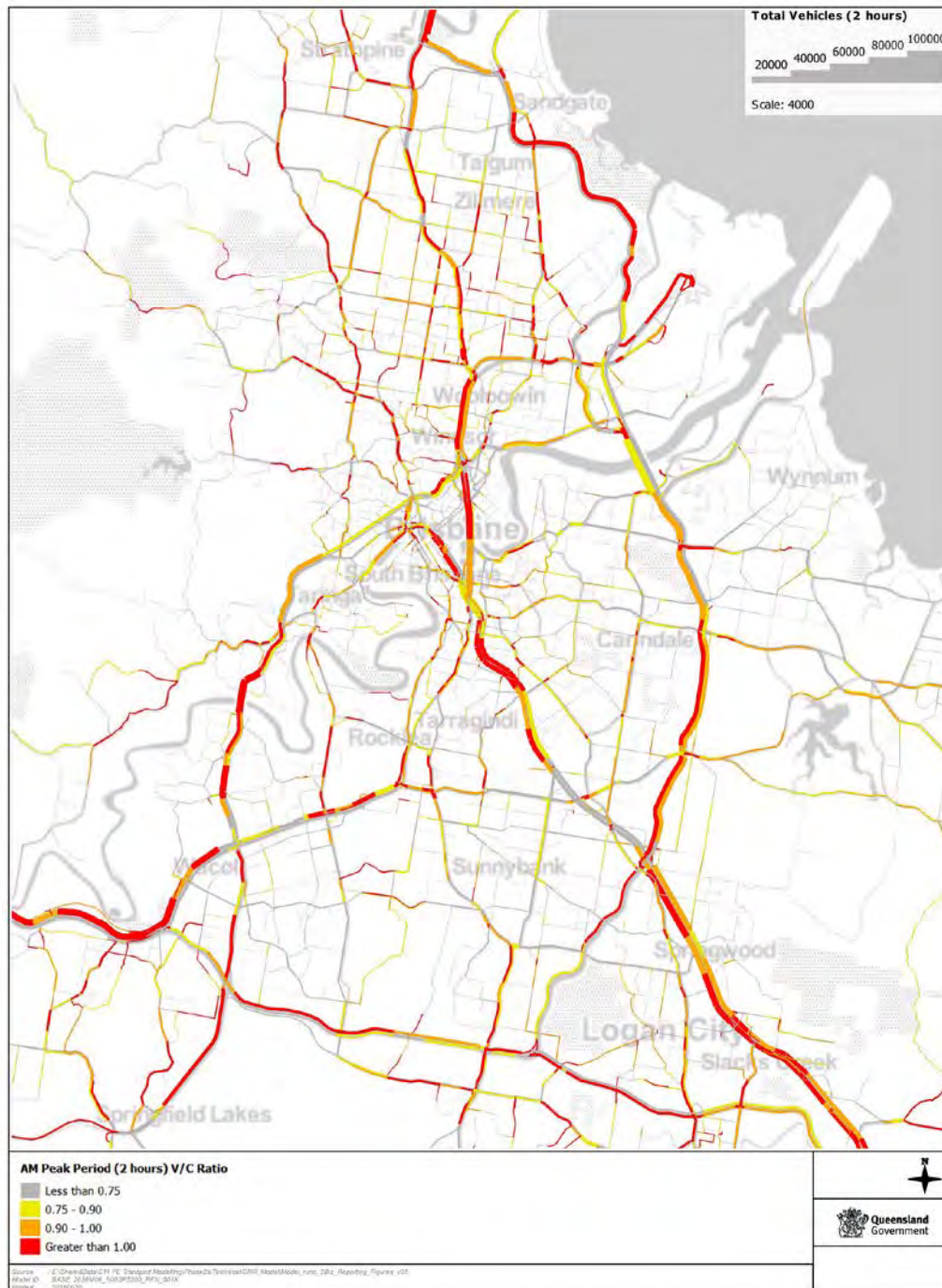


Figure 3.7: Forecast Morning Peak Period Congestion in 2036



### 3.5.3 Inability to Meet Future Public Transport Demand

Public transport activity in SEQ is generally concentrated in the Brisbane metropolitan area and, to a lesser extent, on the Gold and Sunshine coasts<sup>20</sup>. However, public transport provides a key role in supporting longer distance travel from outer areas such as the Gold Coast to Brisbane. Public transport meets the bulk of travel demand to urban centres, such as Brisbane's CBD, where space is limited for infrastructure such as roads and parking spaces.

High-density destinations make public transport a more competitive mode over private vehicles. For example, currently about four in five people (78 per cent) who commute directly to work in the Brisbane CBD travel by public transport in the morning peak period<sup>21</sup>.

Growth in demand means the SEQ rail network and Brisbane's busway system are both approaching capacity in Brisbane's inner city<sup>22</sup>. Capacity limitations through this central area will greatly impact on the overall capacity of both networks.

Public transport trips are forecast to more than double between 2015 and 2036, with peak period growth illustrated in Figure 3.8. Growth in rail demand is expected to be twice that of bus, primarily due to rail's ability to service increasing demand for longer distance travel (in line with the growth in population and employment illustrated in Figure 3.3). Additionally, rail is not affected by road congestion. Over the period to 2036, the share of public transport trips taken on bus compared to rail will experience a rebalancing. Currently bus accounts for 60 per cent of all peak period public transport trips. This will decline relatively to 51 per cent, with rail increasing from 40 per cent currently, to 49 per cent – which is an increase of 95,400 rail trips. Passenger rail demand is forecast to more than double from 2015 to 2026 and nearly triple by 2036<sup>23</sup>. This represents a significant rail travel task, well beyond the capability of the existing system to handle.

On current forecasts, it will be impossible to service the growth in public transport demand across the region without additional infrastructure, particularly for travel to and within Brisbane's inner city. A range of critical network constraints limit the ability to cater for future growth in demand. These are discussed in the following sections.

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<sup>20</sup> Connecting SEQ 2031

<sup>21</sup> South East Queensland Travel Survey 2009–2012

<sup>22</sup> Connecting SEQ 2031, South East Queensland's Rail Horizon

<sup>23</sup> CRR Project model 2016



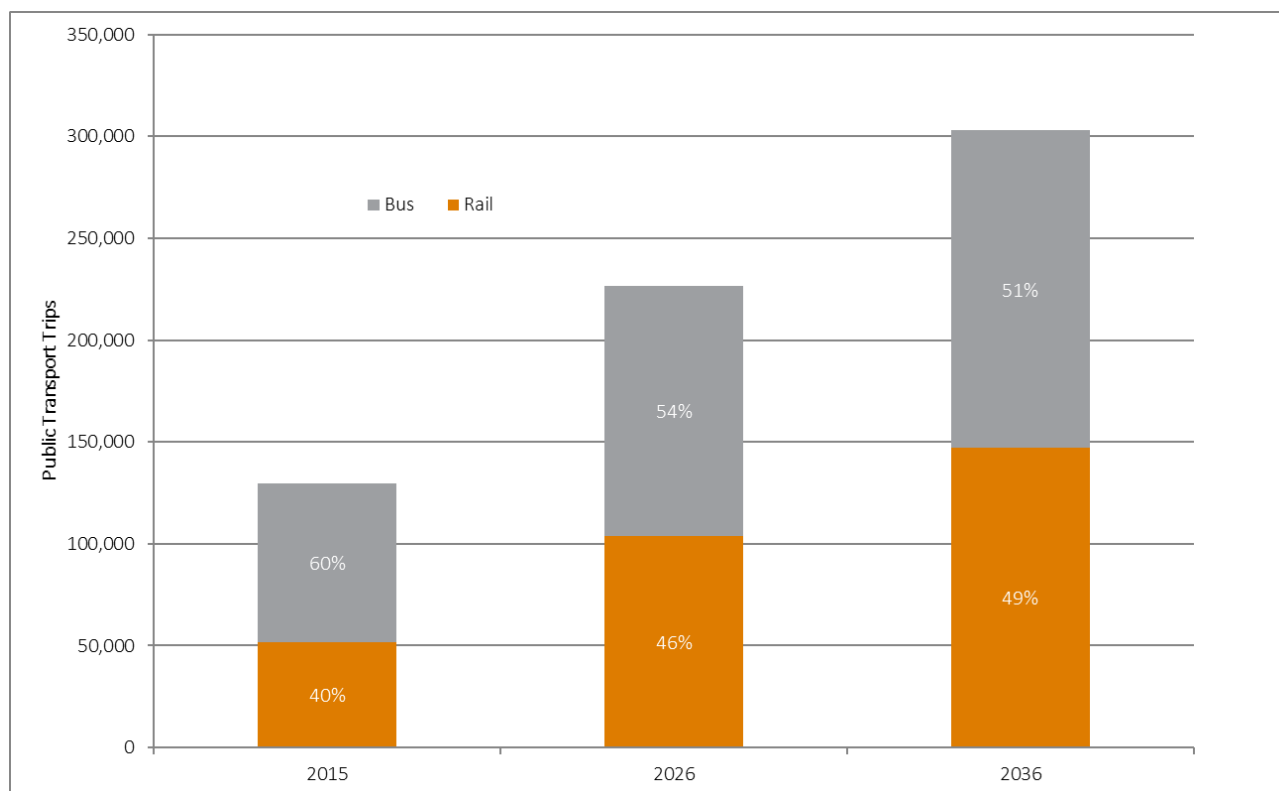


Figure 3.8: Forecast Peak Period Public Transport Trips<sup>24</sup>

### 3.5.3.1 Bus Network Capacity Constraints

Brisbane's busways have been a transport success but their popularity is pushing the system to its limits. Brisbane's bus network operates with limited interchange opportunities so most buses converge on inner-city and CBD infrastructure. As a result, key areas within the inner-city bus network are operating at or over their nominal capacity.

The current bus operating paradigm in Brisbane means most people have a single-seat journey from their suburb into the CBD, with limited need or opportunity to interchange. However, this style of operation can be inefficient – very large numbers of buses ultimately converge on inner-city sections of the busway and road networks.

Overall, existing bus infrastructure cannot accommodate significant growth based on the current operating profile. Moreover, while bus is ideal for short to medium-distance services, it is not well suited to meeting the anticipated demand for longer distance trips<sup>25</sup>.

Restructuring Brisbane's bus network to optimise the network design and operations offers potential efficiency gains. BCC is examining aspects of this approach through the Brisbane Metro project. Efficiency measures to maximise the use of rail infrastructure have already been implemented including timetable improvements and measures to reduce train waiting times at CBD stations.

<sup>24</sup> CRR Project model 2016

<sup>25</sup> Connecting Brisbane





### 3.5.3.2 Rail Network Capacity Constraints

Like the Brisbane bus network, the SEQ rail network converges in Brisbane's inner city. Both systems depend on having sufficient capacity through this area. While the SEQ rail network is the 'heavy lifter' for longer distance travel, ongoing population and employment growth in outer areas is placing increasing pressure on the network.

Rail services to and through Brisbane's inner core continue to grow as more people travel there for work and services. Based on current forecasts, the rail network will be unable to meet the demand for travel to the CBD from city growth areas and regional greenfield development sites.

Figure 3.9 shows the key constraints on the inner-city rail network, which include:

- increasing demand from the north and south approaching or exceeding the capacity of the rail network in peak travel times
- limited inner-city rail tracks forcing merging and creating bottlenecks in the system including flat junctions at Park Road, Roma Street, Roma Street west and South Brisbane
- overcrowding on trains and station platforms as more passengers load onto limited services
- poor coverage of rail stations in the inner city reducing the attractiveness of rail as a preferred mode of travel to the CBD
- outdated signalling technology (which will be enhanced in some corridors to the west and north by the European Train Control System (ETCS) – Inner City Project currently being delivered by Queensland Rail)
- indirect nature of the rail network servicing the CBD
- junction conflicts, for example, at Mayne Yard.

As discussed in Chapter 1: Project Background and Chapter 2: Strategic Context, the Queensland Government's strategic vision for the transport system identifies rail as the backbone of the public transport network. As the highest capacity transport mode (refer Figure 3.10), it is best aligned with the region's forecast growth profile, which will see a greater number of longer distance trips between residential growth areas and Brisbane's inner city. Rail also provides urban development and city-building opportunities offered by no other transport mode. Expanding and modernising the SEQ rail network is critical to realising the economic potential of SEQ.



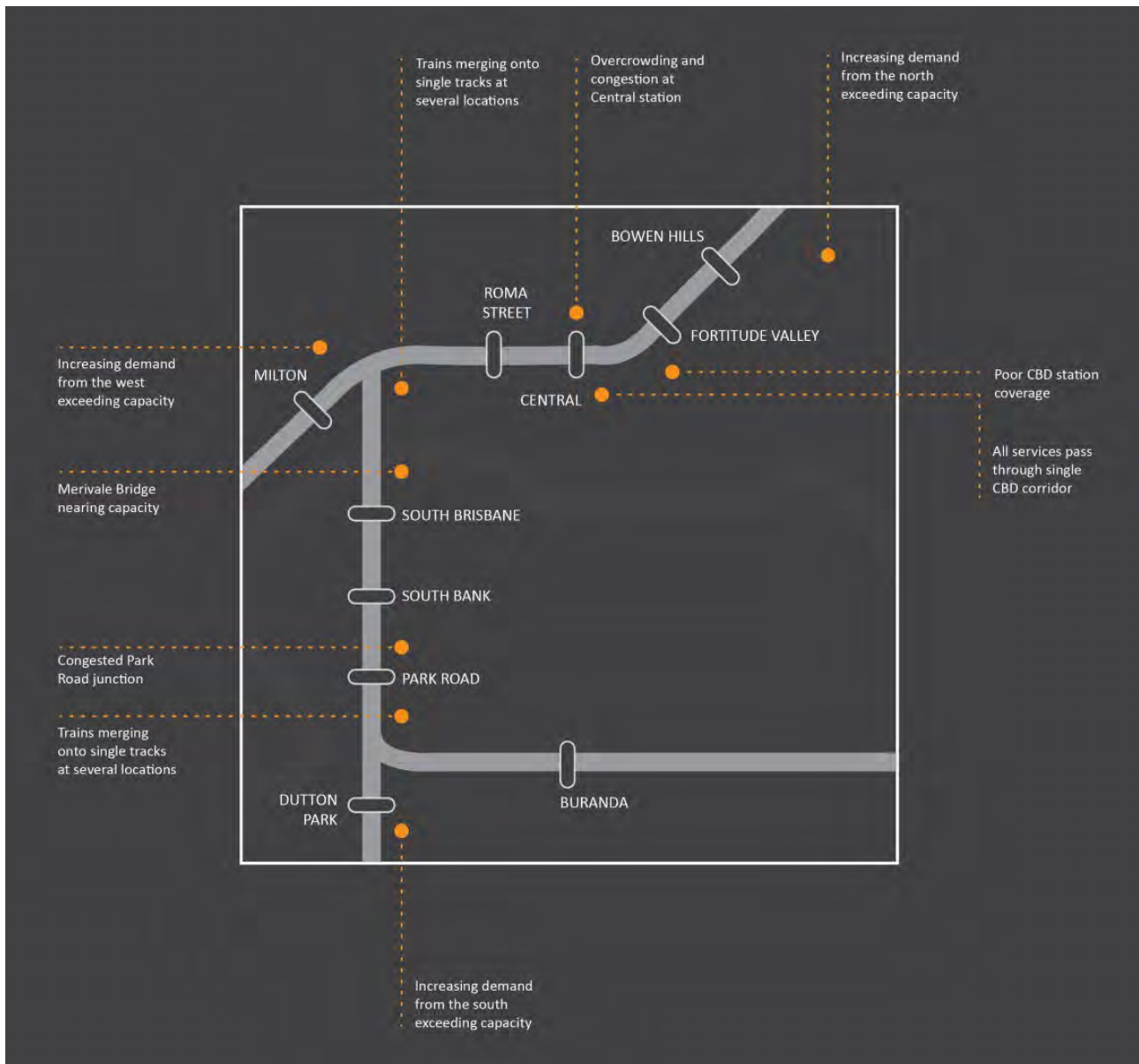


Figure 3.9: Existing Inner-City Rail Network Constraints<sup>26</sup>

<sup>26</sup> South East Queensland's Rail Horizon



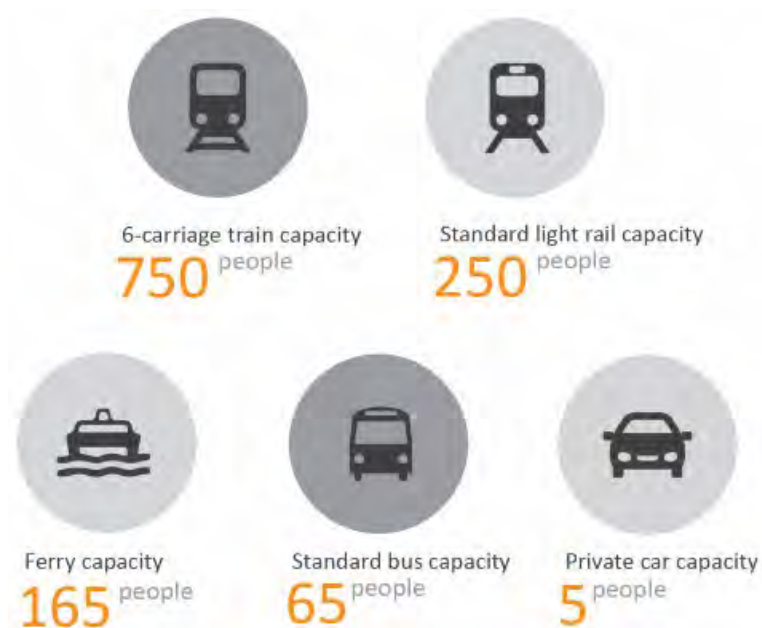


Figure 3.10: Indicative Maximum Capacity of Transport Modes

#### 3.5.4 Inefficient Supply Chains

There is a strong relationship between freight demand and economic growth. As individuals become wealthier, their level of consumption increases. The need to connect goods to markets both locally and for export also grows as the economy grows. This increased production and consumption directly increases demand for freight to effectively link supply chains across the economy.

Freight movement (both rail and road) includes transit freight that traverses Brisbane, freight with an origin or destination in Brisbane and trans-urban freight for which both the origin and destination are within Brisbane.

The rail network needs to accommodate shared use of rail tracks between passenger and freight trains where there is limited rail infrastructure. As such, rail freight is prevented from using the metropolitan network during peak-passenger travel periods.

Information on the relationship between passenger and rail freight is provided in Section 3.6.2.2.

## 3.6 Rail Problems

### 3.6.1 The Role of Rail

Rail is currently unable to perform the role envisaged for it by government as the backbone of SEQ's public transport network. It simply does not have the capacity to accommodate additional services and future expansions of the network into new growth areas. This section provides a more detailed description of challenges facing the rail network, which are summarised in Figure 3.11.

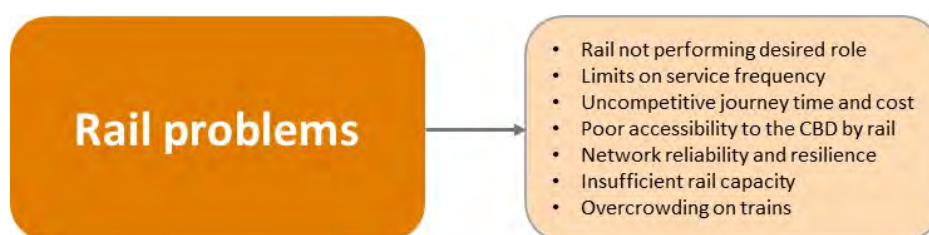


Figure 3.11: Summary of Key Problems Undermining the Rail Network

Compared to other major Australian cities, Brisbane's rail network has limited capacity and coverage, particularly within the region's economic heart, the Brisbane CBD. In part, this is due to limited river crossings and poorly located inner-city stations. Sydney and Melbourne's rail networks move almost twice the number of people into the inner-city areas as Brisbane, every day, and with much better coverage of the city.

Several aspects of the current rail network are undermining its desired function within the public transport system:

- Large areas of the region are not serviced by rail, placing greater pressure on the bus and road network.
- Rail service to the CBD from south of the Brisbane River is less direct – around 30 per cent longer (1.2km) – than a trip by car or bus using the Captain Cook Bridge.
- In some areas, services are not sufficiently frequent to make rail more attractive than other modes.
- Limited rail and bus service integration has led to rail and bus competing within similar corridors.
- Inner-city growth areas such as Woolloongabba, southern CBD, Bowen Hills, Newstead and West End are not well serviced by existing rail corridors.

Strategically, rail is the mode most suited to meeting the forecast public transport travel demands and economic growth aspirations of the region. In many cities around the world, rail network capacity is being expanded, not only to provide transport outcomes but to facilitate economic growth and city-building outcomes. For example, London's Crossrail project (under construction) will be used by an estimated 200 million passengers annually and is expected to add £42 billion to the United Kingdom economy for a reported investment of around £14.8 billion<sup>27</sup>.

### 3.6.2 Limits on Service Frequency

The ability to improve rail service frequency levels is currently limited due to infrastructure constraints. As a result, the network cannot offer a true 'turn-up-and-go' level of service. Some of these limitations are discussed below.

<sup>27</sup> [www.crossrail.co.uk/news/crossrail-in-numbers](http://www.crossrail.co.uk/news/crossrail-in-numbers)



### 3.6.2.1 Constrained Inner-City Rail Capacity

As described in Section 3.5.3.2, the inner-city rail network in SEQ is nearing capacity. In essence, there are too many rail lines converging into a limited number of inner-city tracks. Currently, five lines from the south–west and six lines from the north merge into two through the CBD. This limits the ability to increase services on each line and creates inefficient use of the approaching rail corridors. Furthermore, it reduces the system’s overall resilience since all services pass through one corridor. This means an incident in the inner area impacts the whole network (discussed in Section 3.6.5).

Capacity assessments indicate the number of paths available on the main line (Caboolture–Ipswich sector) is limited currently to 20 trains per hour (tph) per direction during peak times and 24tph per direction for suburban lines (Merivale Bridge sector). With the completion of the ETCS – Inner City Project in this corridor, capacity will be increased to up to 24 tph per direction on the main line. It is forecast that by around 2021 demand for rail services in the peak periods will be at or beyond the capacity of the existing key inner-city corridors.

Once all available peak-train ‘paths’ are utilised, further growth in peak services will not be possible without the provision of additional inner-city rail capacity. As the population of SEQ grows, the capacity to put on additional train services for outer regions like the Gold Coast, Cleveland, Ipswich and Caboolture will be severely constrained. Only the construction of an additional Brisbane River crossing allows for the introduction of services to these regions to meet the demand resulting from this increased population growth.

The rail system is also increasingly constrained by other inner-city track and platform capacity issues with continuing growth in travel to the CBD. This is predominantly due to two further issues:

- Flat junctions, particularly at Roma Street West, require all trains from the west to merge at Milton so trains from the Merivale Bridge can operate on the second track heading to the city and further north. Adjacent development and the proximity of major roads limit the options for grade separation or augmentation of lines at this location.
- Passenger and service capacity growth through Central station is limited by space constraints on the platform and concourse areas, a combination of the low approach speed caused by the narrow and often crowded platforms (with potential implications for passenger safety) and the dated signalling technology currently in use.

It is critical that the rail network constraints within the inner city, including river crossing capacity, be addressed if the rail network is to cater for future growth. Without this, service frequency increases will be impossible and the network will be unable to expand into new growth areas.

### 3.6.2.2 Conflict Between Passenger and Freight Trains

Freight and passenger trains share some lines within the metropolitan network, with these lines operating under a ‘freight curfew’ during the peak period. This allows express passenger trains into and out of the CBD, increasing the overall capacity of the passenger service. After peak periods, freight trains are typically allocated paths not required for passenger services.

Without additional investments, passenger demand may require this curfew to be increased to cater for more passenger services in the ‘shoulder’ of the peak period. Freight paths would be reduced, potentially impacting freight capacity to the port of Brisbane and intermodal hubs.



The interaction and potential conflicts between passenger trains and freight trains in the metropolitan network will require a longer term solution to accommodate growth in both services.

### 3.6.2.3 Current Signalling System

Queensland's current rail signalling technology is based on a traditional track-side system that relies on train drivers interpreting visual signals. This visual system, mixed with variability in driver behaviour, limits the operational efficiency of the rail network and throughput of trains.

Recently, the Queensland government committed to begin the rollout of ETCS Level 2 (L2) in parts of the metropolitan network. This will improve operational characteristics that benefit both the capacity and safety performance of the rail network. Ultimately, this innovative technology solution will provide a better performing rail system for both the customer and the train operator.

The scope of the ETCS – Inner City Project is the area of rail network between Northgate and Milton, including both mains and suburban lines. This encompasses the key network section through which all trains must pass and includes the railway stations of Roma Street, Central, Fortitude Valley and Bowen Hills. While the ETCS – Inner City Project will improve the network capacity in the northern and western corridors, it does not provide additional capacity to the Gold Coast and Beenleigh lines.

### 3.6.3 Journey Time and Cost

As discussed in Section 3.6.1, the current rail network does not have good coverage over many areas in Brisbane and beyond and is relatively indirect in many corridors, particularly from the south and east (for example, the Cleveland line). Since the rail network cannot cover all areas, its success relies on good local access to stations and park 'n' ride opportunities (where appropriate) as well as relatively short waiting times (service frequency). In terms of station access, the rail network is not currently well supported by the bus network, which could provide a greater 'feed-to-rail' role as is common in most mature public transport networks.

When considering door-to-door travel times, even with the lower road speeds during congested conditions, rail often does not provide a competitive alternative to road travel due to the less direct route. Given the limitations in the rail network in terms of geographic coverage, travel times, service frequency and potential for overcrowding, the relative 'perceived cost' of a journey using the rail network in many areas is greater than that of private vehicle and bus travel.

The overall impact of the functional deficiencies and constraints in the SEQ rail network is that rail travel caters for a relatively low mode share, at around one third of morning peak travel into the CBD. This is low compared to Sydney and Melbourne, where rail accounts for around 50 per cent<sup>28</sup>. Brisbane consequently has a high reliance on buses, which are required to perform much of rail's line-haul role.

While the Brisbane busway network has been a success story, it too has reached its limits. Importantly, bus-based systems only have so much 'reach'; expansion of the busway network cannot cater for the significant increase in demand for longer distance trips expected in the region. Both bus and rail must work together to ensure an effective and efficient transport system.

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<sup>28</sup> Australian Bureau of Statistics Census, 2001-2011





### 3.6.4 Poor Accessibility to the CBD by Rail

#### 3.6.4.1 Limited Capacity of CBD Stations

The greatest demand on the rail network is in the morning and afternoon peak periods. Records of passenger boardings from 2015 show that more than half of the 200,000 passengers who used the system each day did so during the four 'peak' hours, with 60,000 and 46,000 passengers recorded in the morning and afternoon peaks respectively.

The key origins or destinations of these peak period passengers are inner-city rail stations, with more than 34,000 passengers alighting during the morning peak at Roma Street, Central or Fortitude Valley station in 2015. Central station is the principal destination for CBD-bound passengers, with 22,000 (65 per cent of passengers to the CBD) alighting there in the morning peak period in 2015<sup>29</sup>.

Higher patronage in the limited morning peak period and associated overcrowding on services impacts on the time for loading and unloading of trains at stations, exacerbating inner-city capacity limitations. Reliance on Central station capacity can only go so far, beyond which the ability of passengers to board and alight trains within the normal station dwell times would be impacted with flow-on impacts across the entire network.

As demand stretches network capacity, growing passenger numbers increase congestion around doorways (driven by increasing numbers of standing passengers) and on platforms (particularly in the afternoon peak). These factors drive increases in dwell times and the likelihood of passenger issues affecting service reliability. This reduces the likelihood of on-time operations and ultimately impacts on the achievement of service numbers.

Brisbane's passenger rail network is partially sectorised and comprises main lines and suburban lines to limit crossing conflicts and improve operations. Both these systems run through the inner-core area and are constrained by availability of rail paths and platforms through the CBD stations, including Central station (six platforms), Roma Street station (nine platforms with one for regional travel and two not generally suitable for through peak period operations), Fortitude Valley station (four platforms) and Bowen Hills station (four platforms). This limits the overall capacity of the system, the capacity of individual lines feeding into the core and service frequencies.

In comparison, Central station in Sydney has 10 'through' platforms used for regular suburban services and Flinders Street station in Melbourne has 12 platforms dedicated to the urban passenger task. The Victorian Government is currently planning the Melbourne Metro project to expand the underground rail network and enable independent running of suburban rail lines, providing a considerable capacity increase. The Sydney Metro project is predicted to increase the number of trains entering the CBD in the peak hours from 120 services to 200 services (an increase of around 60 per cent)<sup>30</sup>.

The combined impact of station capacity and broader constraints in the SEQ rail network drives a need for a significant investment in new infrastructure to boost inner-city rail station capacity. Achieving throughput levels prior to this investment is highly sensitive to station dwell times and reliability of on-time operations through the key junctions.

<sup>29</sup> CRR Project model 2016

<sup>30</sup> [www.sydneymetro.info](http://www.sydneymetro.info)



With demand for rail expected to almost triple by 2036, continued reliance on one main station in Brisbane's CBD to service the majority of passengers and facilitate a growing CBD will result in a range of issues, particularly as this station nears its capacity limits. Minor incidents and variability in demand at Central station will compromise its operational performance and the rail network more broadly. For example, a delay in services in the afternoon peak would quickly result in extreme levels of crowding on platforms, affecting operations and possibly fire and life safety requirements.

Overall, existing rail stations do not have the capacity to effectively provide for forecast levels of passenger demand while maintaining network reliability and operational efficiencies, nor are they well located within the CBD to adequately service the new high-growth areas of the CBD and inner city. The poor location of stations is discussed below.

#### 3.6.4.2 Poor Location of CBD Stations

Beyond having an appropriate level of capacity (and other critical factors in meeting the needs of the customer), rail stations need to be adequately located to ensure destinations are easily accessible. Generally, a walking catchment of 400 metres around a quality public transport station or stop is considered attractive for customers. Although customer's preparedness to walk this distance may increase with the quality of the service (for example, express rail) the walking distances starts to become a limiting factor beyond 800 metres and by one kilometre the service may be considered only marginally attractive. For Brisbane's CBD, the topography and the historical development of the public transport system results in many areas of the city being outside the limit of the generally accepted walkable catchments.

The Brisbane rail network passes across the northern end of the CBD, providing good access to the northern areas, but there are considerable walking distances from new growth areas in the southern areas of the CBD. Brisbane rail passengers wishing to travel to and from the southern end of the CBD must walk from either Central station (1.2km) or South Brisbane or South Bank stations across the river. Alternatively, commuters can wait for an interchange service with a city loop bus (7am to 6pm, Monday to Friday) which passes Central station to connect passengers to the southern end of the CBD.

Figure 3.12 shows current walk access times to existing rail stations servicing the CBD, illustrating the significant gap in accessibility to the south-eastern part of the CBD, an area that will undergo a major transformation over coming years. Even in more central parts of the CBD, the walk to the nearest rail station is up to 15 minutes. Table 3.1 shows the growth in employment and population around the existing CBD stations (Central and Roma Street) between 1986 and 2011. It also shows that the southern part of the CBD has grown much more strongly for both employment and population compared to the existing CBD station catchments. This supports the need for a new rail station in the southern part of the CBD.

The commercial office tower at 1 William Street combined with new development in the Queen's Wharf Brisbane precinct will significantly increase the demand for frequent, efficient and reliable public transport services to this part of the city. Currently, there is no high-frequency, high-capacity public transport option within close proximity.



STATION	EMPLOYMENT GROWTH (1986–2011)	POPULATION GROWTH (1986–2011)
Southern CBD	152%	360%
Central	73%	280%
Roma Street	71%	71%

**Table 3.1: Population and Employment Growth in CBD Station Precincts<sup>31</sup>**

By comparison, both the Melbourne and Sydney rail networks provide excellent coverage of the inner city with stations that provide direct access to key areas. Melbourne also has an extensive tram network that further enhances passenger mobility around the inner-city areas. Sydney is also implementing a light rail system through the spine of the CBD to replace buses and enhance mobility.

Poor accessibility by rail also extends beyond the Brisbane CBD. While rail passengers travelling to inner Brisbane are able to access Central, Roma Street, South Brisbane, South Bank, Milton, Albion, Fortitude Valley and Bowen Hills, many major inner-city areas are outside a walkable catchment, including Woolloongabba–Kangaroo Point, Brisbane Showgrounds–Royal Brisbane and Women’s Hospital, Newstead, West End, New Farm and Kelvin Grove.

To improve accessibility, more rail stations are needed in more parts of inner Brisbane. This will establish new trip opportunities, attract more passengers to the rail system, alleviate pressure on the bus network and help reduce urban congestion into the future. It will also catalyse growth in the CBD, helping to realise agglomeration benefits and contributing to broader city-building outcomes.

<sup>31</sup> Australian Bureau of Statistics





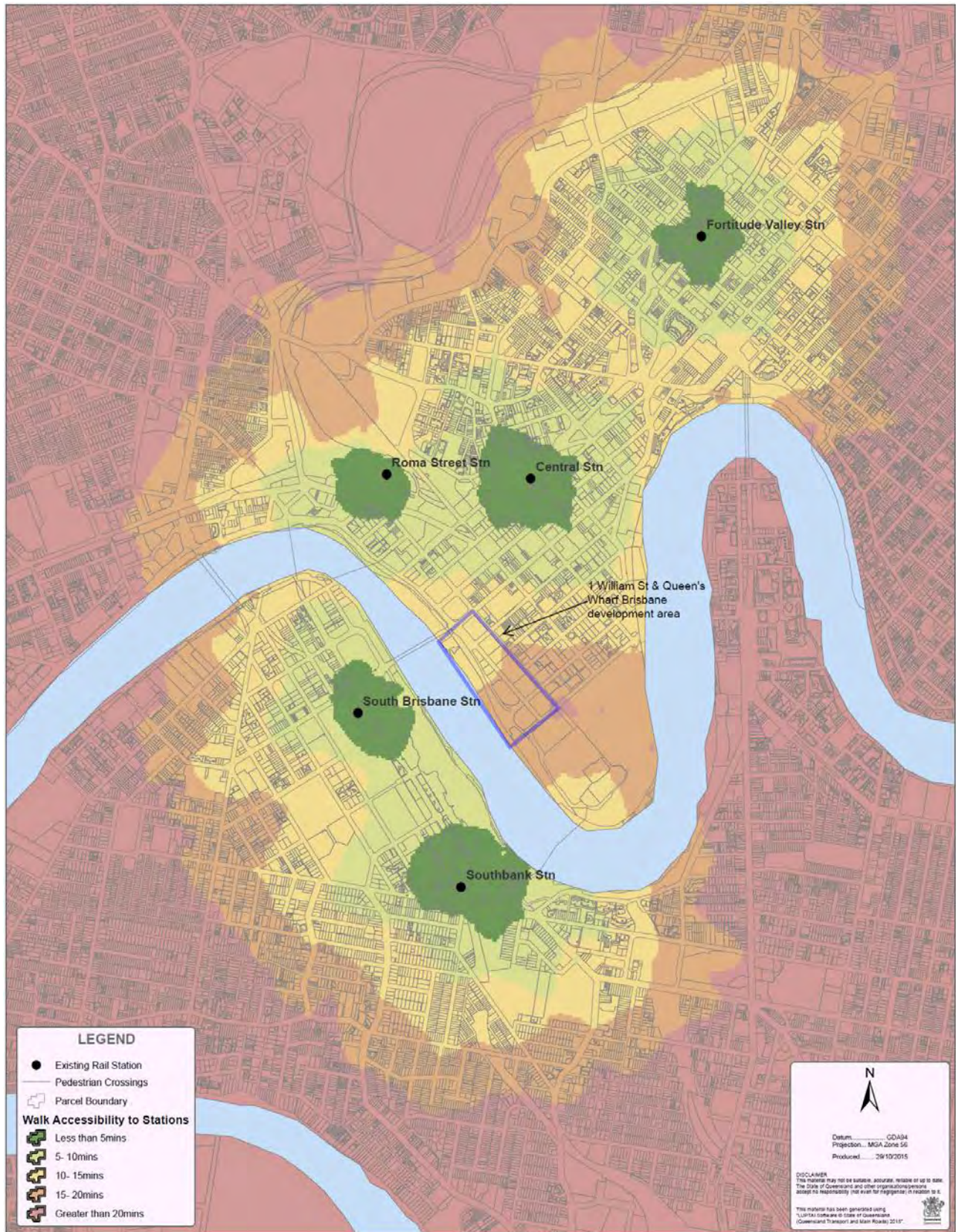


Figure 3.12: Walk Accessibility to Existing Rail Stations in the Brisbane CBD



### 3.6.5 Network Reliability and Resilience

The complex nature of rail network operations causes rail network operators to consider the concept of reliability when defining the capacity of the system. That is, once the minimum acceptable level of reliability is defined, there will be a flow-on impact on the operational capacity of the system under that adopted standard. This may be less than the absolute capacity of the system that can be achieved when all factors are working towards an optimal outcome for rail operations.

Once the reliability requirements are factored in, the number of services that can be operated under that regime, during a defined period, will define rail track capacity. As such, the key issues with future rail network capacity are as follows:

- As service frequency increases towards maximum capacity, the reliability of services can deteriorate rapidly across the whole network, due to the way rail operations need to be managed. As the capacity is utilised, despite mitigation measures, reliability is expected to continue to deteriorate, with minor delays, such as the increased dwell times required for boarding and alighting in overcrowded conditions having the potential to cumulatively escalate into significant impacts.
- Without an infrastructure or rail systems solution boosting line capacity to allow higher frequency services, peak period service performance on the passenger rail network is forecast to decline, resulting in significant reductions in service reliability and increased overcrowding.

Closely linked to network reliability is the concept of resilience – that is, the ability of the rail system to maintain acceptable operational performance in the face of planned or unplanned faults and challenges. It describes the adaptability of the network and its ability to recover from an incident within a reasonable timeframe. For SEQ it also relates to the system's resilience to adverse weather conditions such as storms and flooding.

Currently, the inner-city rail network funnels through a select number of stations on a single corridor through Roma Street, Central, Fortitude Valley and Bowen Hills stations. As such, incidents on this part of the network or at one of these stations can have serious flow-on impacts for the entire SEQ rail network. Because of the cascading effect across the network, it can take significant time to recover to normal operations. A new corridor through the inner city would considerably boost network resilience.

### 3.6.6 Insufficient Rail Capacity to Accommodate Growth

#### 3.6.6.1 Strong Demand for Rail

As discussed in previous sections, passenger rail demand is forecast to double from 2015 to 2026 and nearly triple by 2036, as shown in Figure 3.13. The growth rate is expected to remain strong between 2015 and 2026 (with a total change of around 100 per cent in the morning peak period), with growth continuing at a lower rate between 2026 and 2036. For trips to the CBD, the share of travel by rail is expected to increase from 31 per cent in 2015 to 47 per cent in 2036<sup>32</sup>.

The growth analysis also shows that peak period growth rates are similar to those across the day. Notably, growth in interpeak services remains strong across much of the network, while overnight off-peak growth is lowest, demonstrating the continued success of introducing 15-minute interpeak services on selected lines.

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<sup>32</sup> CRR Project model 2016





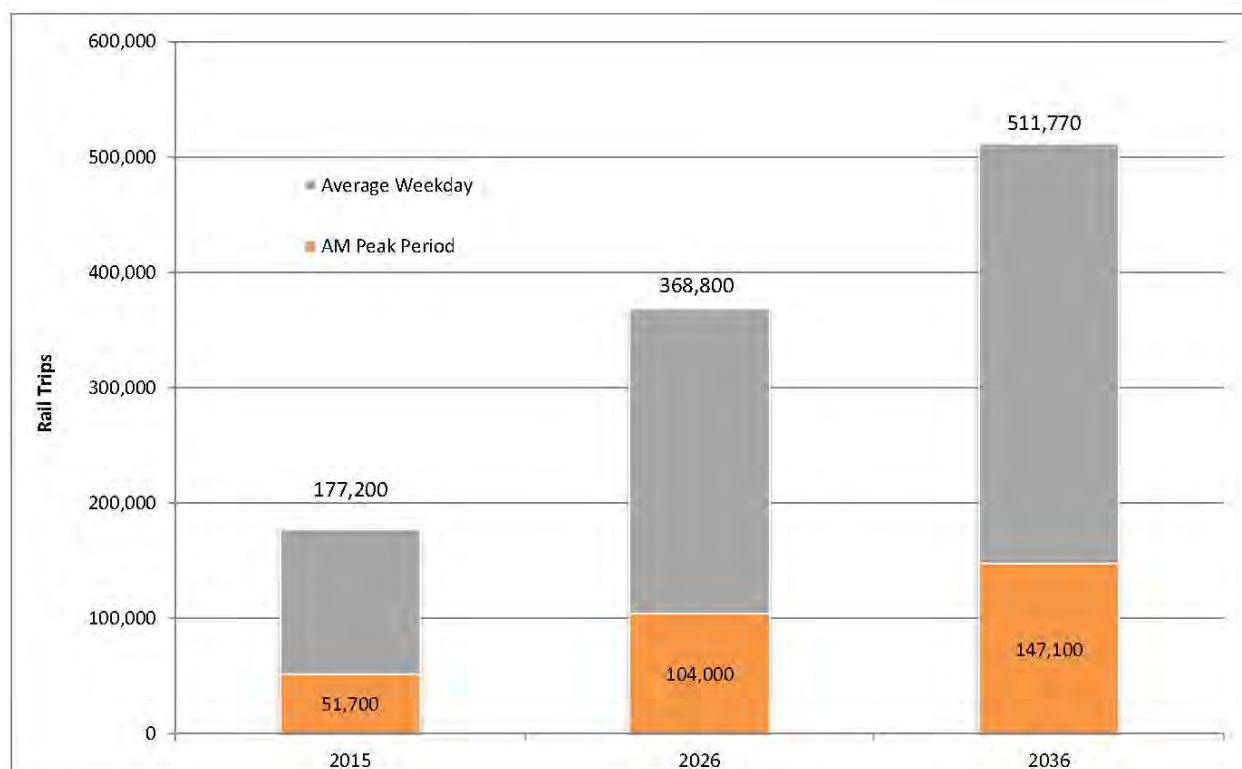


Figure 3.13: Forecast Growth in Rail Patronage (Without the CRR Project)

Historical trends support the forecast growth in rail. For almost the decade to 2009, rail patronage across Brisbane grew strongly and consistently at rates of between three and six per cent. The three years to 2013 saw a flattening of demand, which evidence suggests was due to a large real increase in fares (40 per cent), minimal employment growth in inner Brisbane, a slowing of the economy and multiple infrastructure projects to increase road capacity. These projects include 14 traffic lanes across the Brisbane River in 2010, removing through traffic from the CBD and completion of the Northern Busway and Gateway Upgrade South in 2013. Since 2013, demand has picked up<sup>33</sup> and is expected to reflect pre-2009 rates – or slightly higher – in the period to 2026 as employment and economic growth picks up, fares remain steady, congestion increases, the inner-city bus network reaches capacity and SEQ’s population grows.

The forecast growth in rail patronage of 6.9 per cent per annum between 2015 and 2026, is not without precedent in Brisbane or elsewhere in Australia. Research conducted by the Bureau of Infrastructure, Transport and Regional Economics, which compares urban public transport growth rates across Australian cities (2014) indicates that similar, sustained high periods of growth were evidenced in Brisbane (6.7 per cent per annum between 1979 and 1989), Melbourne (6.1 per cent per annum between 1999 and 2009) and Perth (15.2 per cent per annum between 1991 and 2001 and 7.4 per cent per annum between 2004 and 2014). Figure 3.14 below shows the recorded annual growth in rail patronage in Brisbane, Melbourne and Perth between 1970 and 2015.

<sup>33</sup> TransLink ticketing data





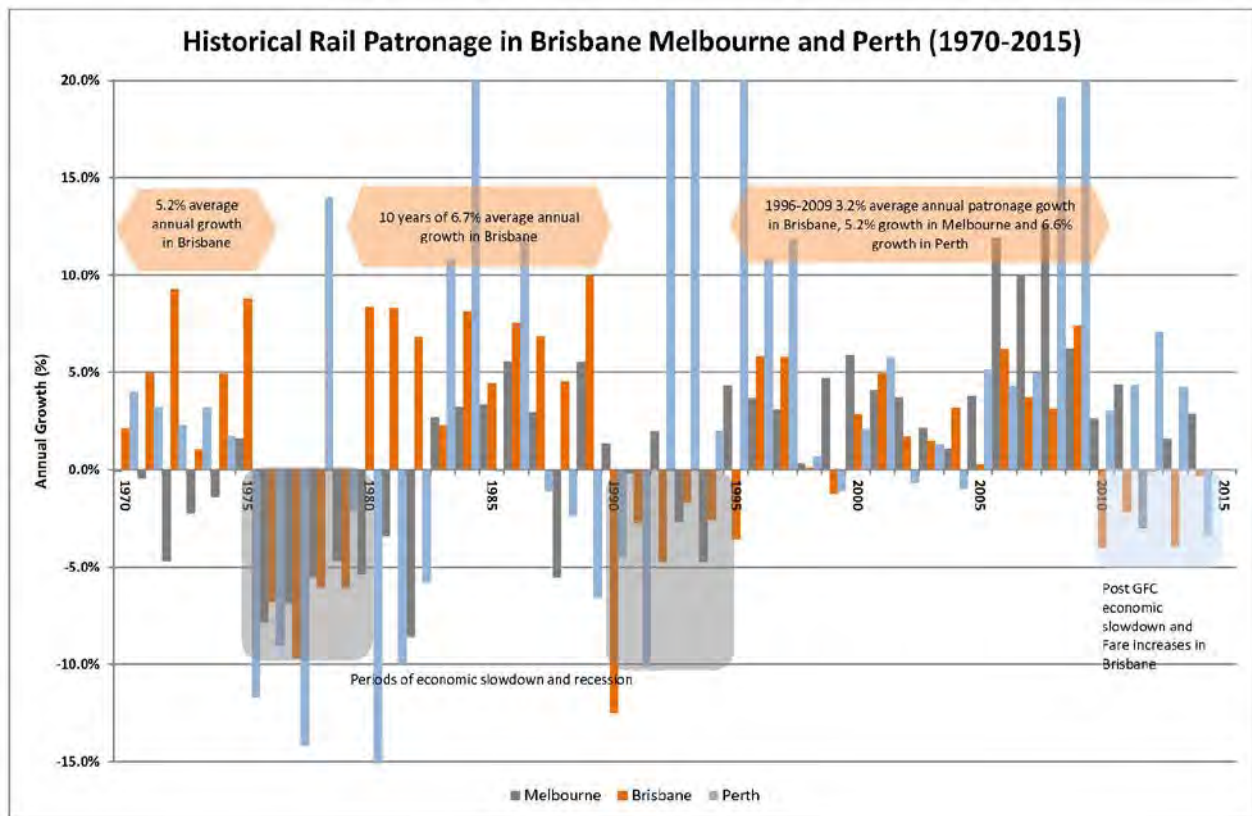


Figure 3.14: Historical Rail Patronage in Brisbane, Melbourne and Perth (1970-2015)

The primary drivers of the forecast growth in rail patronage are the population and employment projections for SEQ and the Brisbane LGA and the increase in rail capacity delivered by the CRR Project. Figure 3.15 below shows the inputs contributing to the forecast growth in rail patronage between 2016 and 2026 and their contribution to the total forecast growth in rail patronage.



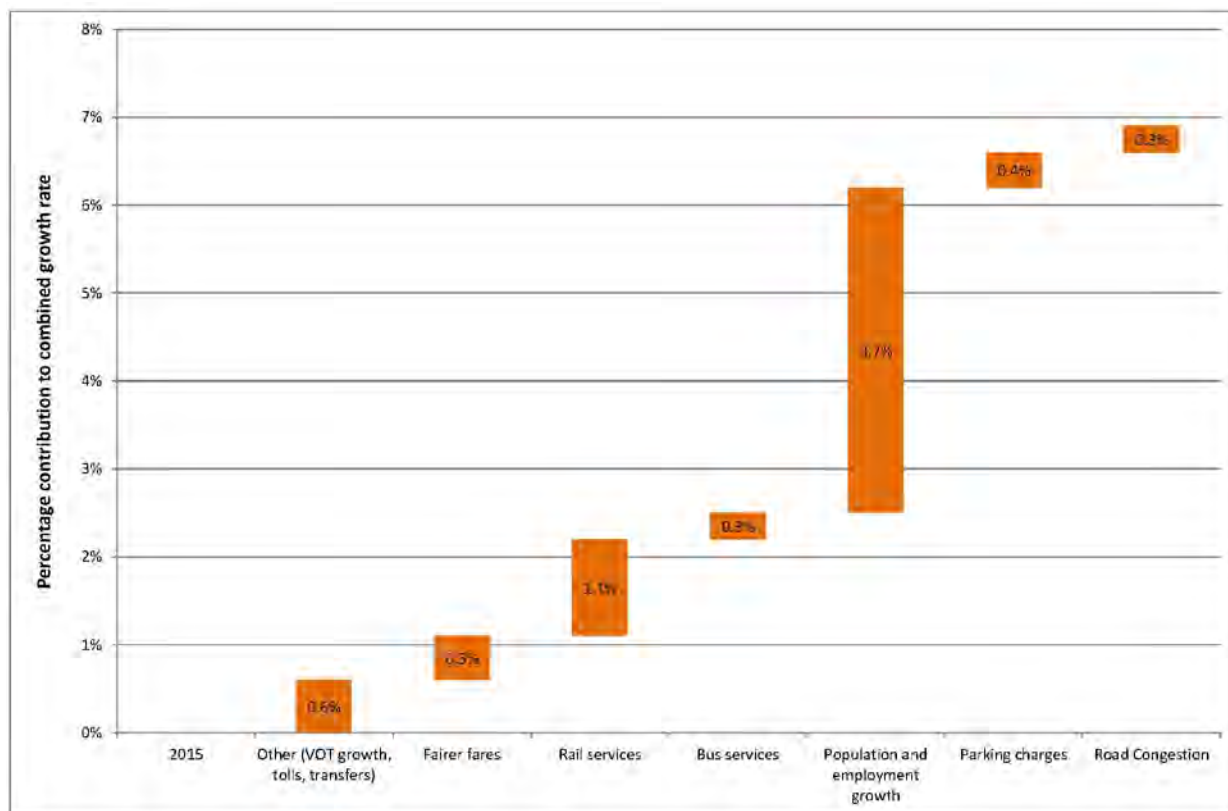


Figure 3.15: Contribution of inputs to forecast growth in rail patronage

Anticipated growth in longer distance commuting due to the continued expansion of residential areas outside the Brisbane LGA underpins these demand forecasts. Figure 3.16 shows the predicted growth in employed people who commute to Brisbane for work. The data predicts growth of approximately 200,000 commuters between 2015 and 2036 and includes approximately 60,000 commuters from the Gold Coast and Logan, more than 90,000 commuters from Ipswich and 45,000 commuters from Moreton Bay and the Sunshine Coast. This represents a very significant growth in demand for travel during the peak periods, which is likely to place pressure on the rail network.



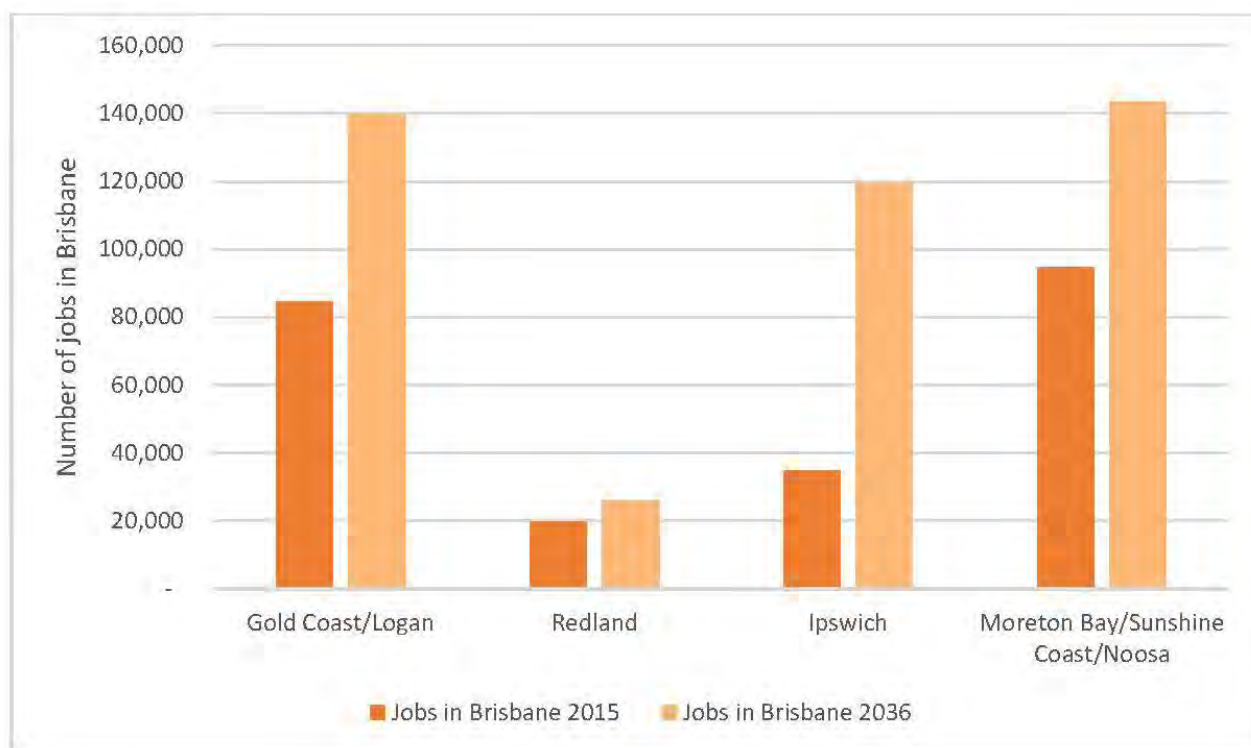


Figure 3.16: Growth in Employment within the Brisbane LGA by Place of Residence, 2015 to 2036<sup>34</sup>

The rail system already experiences periodic overcrowding on key corridors yet it would need to cater for an additional 52,500 passengers in the morning two-hour peak period by 2026, equivalent to 116 full seated train loads (six-car train with 450 seats). By 2036, an extra 95,500 passengers would need to be catered for, equivalent to 212 full train loads in the peak hour.

This demand, if not carried by rail, will be forced to other parts of the transport network, primarily the already constrained road network with associated congestion and lost economic opportunities. Forecasts show the road network will already be heavily congested, particularly on key links through Brisbane's inner city, even without the additional demand that would be forced away from an unattractive rail network. Without a step-change in capacity for the rail network, Brisbane's long-term future and economic aspirations could be at risk.

#### 3.6.6.2 Demand Growth on the North–South Corridors

While very strong demand growth is anticipated across the entire rail system, the pressure on the rail network will differ by corridor and ultimately depend on where residential population growth occurs most strongly.

Forecasts show that pressure will initially be most concentrated on the southern (Brisbane–Gold Coast) and northern (Brisbane–Sunshine Coast) corridors. In the longer term, substantial pressure is also expected on the western (Brisbane–Ipswich) corridor.

<sup>34</sup> Queensland Government Statistician's Office 2015



Figure 3.17 summarises the forecast combined demand for rail in the morning one-hour peak from south of the Brisbane River on the Gold Coast, Beenleigh, Cleveland and Flagstone<sup>35</sup> lines in 2021, 2026 and 2036, and compares this to available capacity. It shows that by 2021, in order to meet passenger demand, the corridor will need to operate above its theoretical maximum capacity in terms of the number of trains. Prior to and irrespective of investment in future growth corridors by 2026, in order to meet demand an additional six (full) trains per hour would be required beyond the capacity of the corridor to run, rising to an additional 19tph in 2036.

Significant increases in demand for rail services are also expected from the north, fuelled by population growth to the north of Brisbane and the extension of the rail network to Kippa-Ring. As illustrated in Figure 3.18, in 2021 the corridor will also have passenger demand beyond its capacity threshold. In 2026 there is demand for an additional five trains per hour beyond corridor capacity, rising to an additional 11 in 2036.

The shortfall in trains is based on the difference between passenger demand and the theoretical maximum capacity of the network. In practice, it is unlikely that maximum capacity could be achieved without impacting operational performance (reliability) since the network would be operating at its limit.

If left unaddressed, as passenger demand increases towards the limit of available capacity, overcrowding (beyond accepted loading standards) will worsen on individual services. This will result in higher numbers of boarding and alighting passengers and increased congestion around doorways and on platforms. These factors will drive an increase in dwell times (time a train is stopped at a station), reducing the likelihood of on-time operation and ultimately reducing the number of services able to be run. The overall result is that passengers would choose alternative methods of transport (primarily private vehicles), change residential location or be forced to travel outside peak periods.

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<sup>35</sup> The Flagstone line is assumed to be operational from 2036 only.



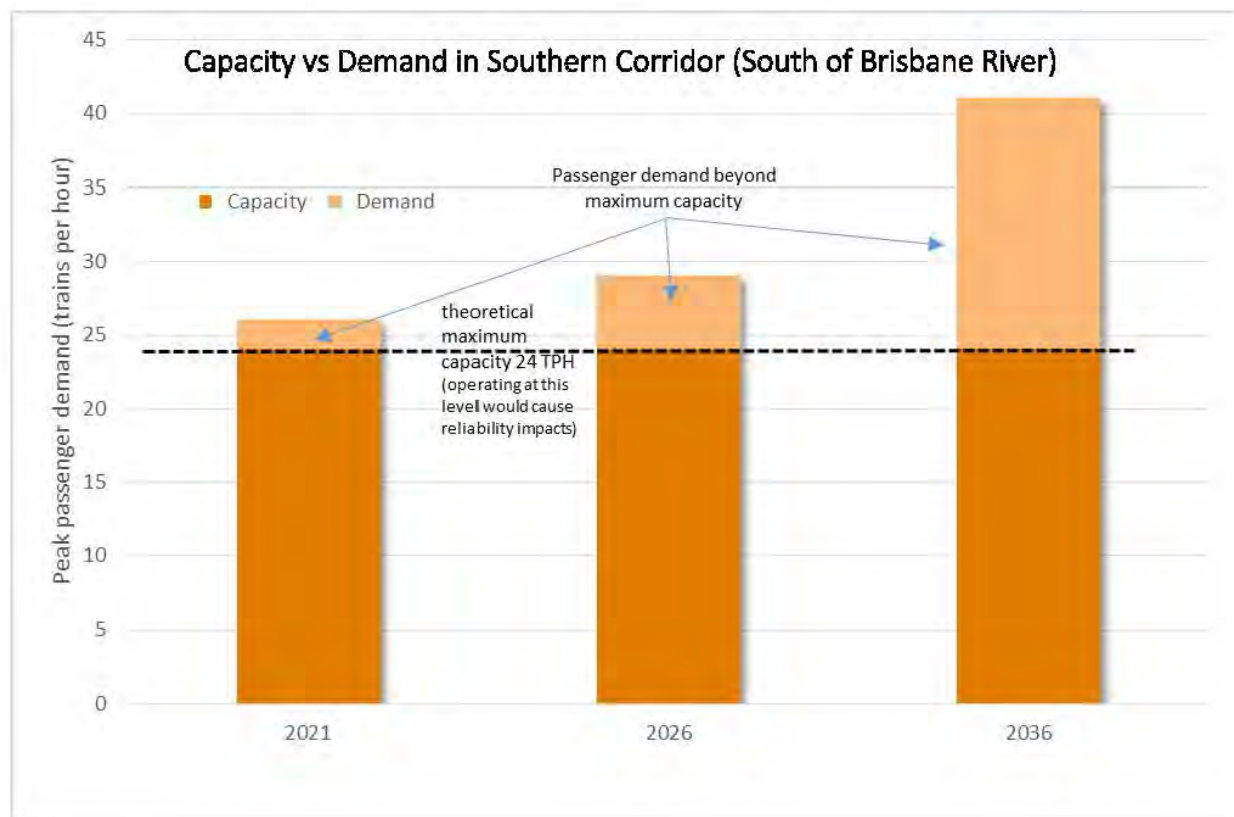


Figure 3.17: Rail Demand in Brisbane's South: Corridor Versus Available Capacity in the Morning One-Hour Peak<sup>36 37</sup>

<sup>36</sup> CRR Project model 2016

<sup>37</sup> Note the Merivale Bridge has a capacity of 24tph. In 2036, bridge paths are allocated to: Cleveland/Manly (8tph); Flagstone (4tph); and Gold Coast/Beenleigh (12tph) making up the theoretical maximum capacity across the southern and eastern corridors. In 2021 and 2026 capacity constraints are limited to the Gold Coast–Beenleigh corridor.



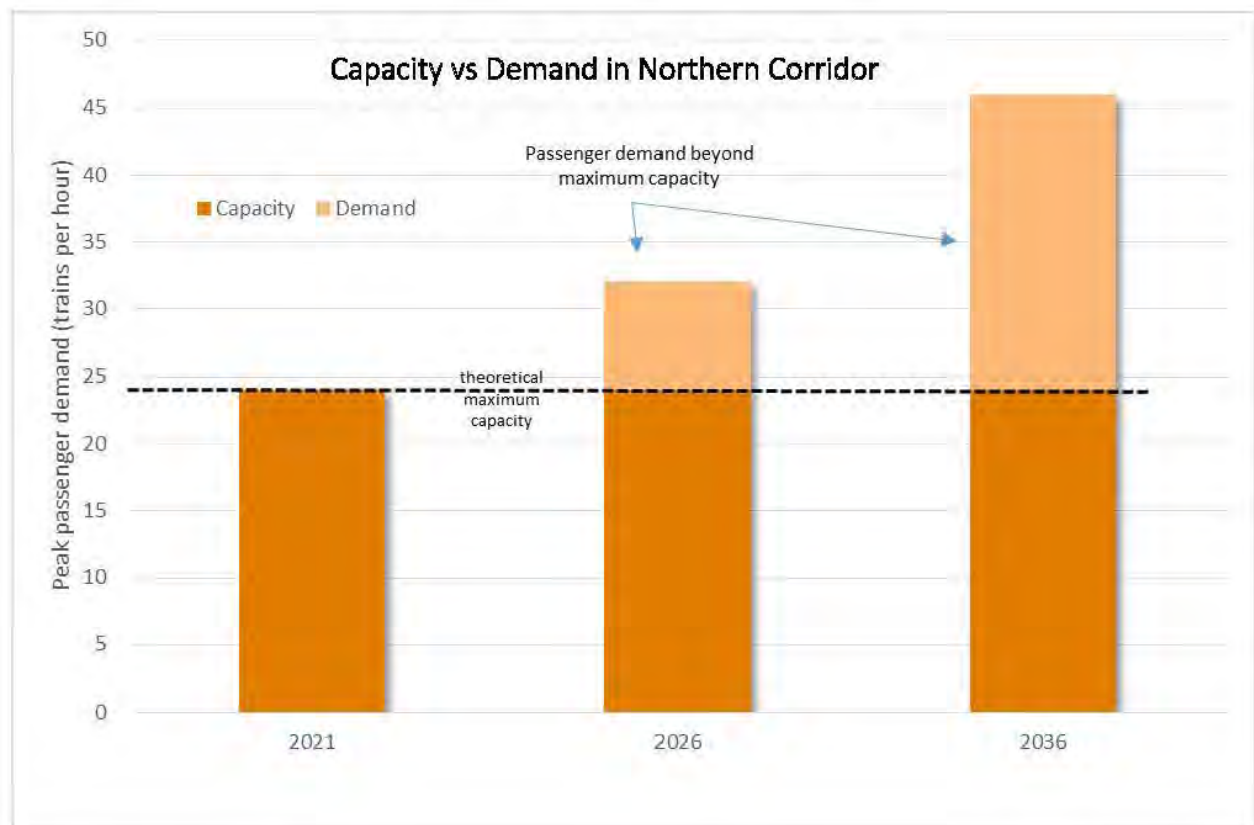


Figure 3.18: Rail Demand in Brisbane's North: Corridor Versus Available Capacity in the Morning One-Hour Peak<sup>38</sup>

<sup>38</sup> CRR Project model 2016





### 3.6.6.3 Overcrowding on Trains

As part of its 'customer first' focus, TransLink aims to ensure a 'comfortable load' for passengers on train services. The definition of comfortable load is based on the principle of minimising the number of passengers having to stand for an extended period. This is defined as standing for 20 minutes or longer, measured from Roma Street and Fortitude Valley stations. The location of the 20-minute threshold therefore varies by rail corridor, for example on the Gold Coast–Beenleigh line it would be around Salisbury station. The 20-minute criteria has a direct impact on the design capacity of trains. Continuing the Gold Coast–Beenleigh line example, currently a train travelling from Beenleigh to the CBD has a design capacity of 450 passengers until around Salisbury (20 minutes from Roma Street station) where it 'increases' to 750 since it can now count both standing and seated passengers (the equivalent of 1.67 times the seated capacity)<sup>39</sup>.

Passenger loads above 750 passengers on individual services would result in passengers unable or unwilling to board the overcrowded trains, and the resulting dwell times of these overcrowded services would reduce the maximum number of trains that could be operated.

Without additional rail network capacity, it will be impossible to run the additional train services necessary to meet demand. Peak period service crowding is expected to increase without intervention. In 2026, considerable crowding is expected on all but one rail corridor approaching the CBD, measured as over 25 per cent of all passengers are standing. By 2036, the degree and extent of crowding will worsen significantly. The extent of crowding will be beyond inner-city stations on all rail approaches to the CBD such that, on average, over 50 per cent of passengers will be standing.

Without intervention, passenger overcrowding on the rail network will lead to customer dissatisfaction and service deterioration. Resulting delays, for example from longer dwell times in overcrowded conditions, have the potential to cumulatively escalate into significant impacts across the rail network.

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<sup>39</sup> This capacity applies to individual trains and not average hourly loads produced in the CRR Project model.



### 3.7 Benefits Sought

The previous sections outlined a number of key strategic, transport and rail specific problems for SEQ over the next 20 years. Table 3.2 summarises the problems in this chapter and links them to identified business requirements and provides a list of benefits sought.

PROBLEM	BUSINESS REQUIREMENT (OUTCOME SOUGHT)	BENEFIT SOUGHT
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Note: SIP objectives:

1. improving prosperity and liveability
2. infrastructure that leads and supports growth and productivity
3. infrastructure that connects our communities and markets
4. improving sustainability and resilience.

#### STRATEGIC

Inability to maintain desired levels of economic growth and productivity	<ul style="list-style-type: none"> <li>▪ Ensure sustainable outcomes for the transport system by providing the right choice of mode for each transport task.</li> <li>▪ Provide connections to markets.</li> <li>▪ Support economic growth opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Connect people, places and businesses to the Brisbane CBD, the economic heart of the region.</li> <li>▪ Provide new and improved opportunities to connect to markets and improve productivity.</li> </ul> <p><i>Links to the State Infrastructure Plan (SIP) objectives 2 and 3 (see table note)</i></p>
Declining accessibility and connectivity between population and employment centres	<ul style="list-style-type: none"> <li>▪ Ensure residential growth areas are well connected with employment centres through efficient transport modes.</li> <li>▪ Enable the transformation of the city to support agglomeration opportunities.</li> <li>▪ Support the move to a knowledge-intensive economy by providing improved access to knowledge-based inner-city jobs.</li> <li>▪ Increase transport capacity during peak periods to service access to the job market.</li> <li>▪ Provide efficient and effective connections to the surrounding region.</li> <li>▪ Improved access by rail to growth areas in the Brisbane inner city and CBD.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increase accessibility to more areas of the CBD and inner city.</li> <li>▪ Maximise agglomeration benefits at key growth locations in the CBD and inner city.</li> <li>▪ Allow the rail network to expand to connect new communities e.g. Flagstone.</li> <li>▪ Improve accessibility at local and regional levels.</li> <li>▪ Improve access for people who are transport disadvantaged.</li> </ul> <p><i>Links to SIP objectives 1, 2 and 3</i></p>



PROBLEM	BUSINESS REQUIREMENT (OUTCOME SOUGHT)	BENEFIT SOUGHT
City building and urban growth	<ul style="list-style-type: none"> <li>Support new urban development opportunities.</li> <li>Manage urban growth in a sustainable manner.</li> <li>Support city-building outcomes.</li> <li>Provide better rail station coverage in the inner city.</li> </ul>	<ul style="list-style-type: none"> <li>Provide the frame around which the city grows.</li> <li>Facilitate and catalyse urban renewal opportunities at station precincts.</li> <li>Improve the level of transport service, triggering further urban consolidation around rail corridors.</li> <li>Provide new stations in key inner-city growth areas.</li> <li>Avoid externalities such as emissions and congestion costs.</li> </ul> <p><i>Links to SIP objectives 1, 2, 3 and 4</i></p>

## TRANSPORT

Car dependency and road congestion	<ul style="list-style-type: none"> <li>Increase inner-city public transport capacity and service frequency to support improved access to jobs and services.</li> <li>Enable a mode shift from private cars to public transport.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce road congestion and associated costs.</li> <li>Enable more efficient use of scarce road space, allowing for greater business travel and good access for road-based public transport and freight.</li> <li>Improve access to the inner city, the location of high-productivity jobs, for more community members.</li> <li>Reduce reliance on private vehicle access to the CBD.</li> <li>Reduce journey times and improve accessibility for a larger portion of the resident population.</li> </ul> <p><i>Links to SIP objectives 1 and 3</i></p>
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PROBLEM	BUSINESS REQUIREMENT (OUTCOME SOUGHT)	BENEFIT SOUGHT
Inability to cater for public transport demand	<ul style="list-style-type: none"> <li>Support increased travel demand.</li> <li>Alleviate inner-city rail network constraints.</li> <li>Match expected rail network demand with capacity.</li> <li>Allow rail network expansion to outer areas and new greenfield sites.</li> <li>Increase inner-city public transport capacity and service frequency to support improved access to jobs and services. (Rail is to provide the backbone of the public transport network.)</li> <li>Enhance the integration between the bus and rail networks.</li> <li>Increase the use and mode share of rail to the Brisbane inner city and CBD.</li> <li>Position rail as the preferred mode for longer distance commuter travel to the CBD and key urban centres.</li> </ul>	<ul style="list-style-type: none"> <li>Provide a 'step change' in public transport capacity.</li> <li>Meet forecast demand.</li> <li>Enable connections to growth areas.</li> <li>Increase service frequency.</li> <li>Reduce crowding.</li> <li>Increase incremental fare revenue.</li> <li>Achieve a mode shift to rail.</li> <li>Provide better interchanges with the bus network.</li> <li>Allow bus network operational changes (feed to rail) and more efficient use of the bus network.</li> </ul> <p><i>Links to SIP objectives 1, 3 and 4</i></p>
Inefficient supply chains	<ul style="list-style-type: none"> <li>Improve road conditions with reduced congestion.</li> <li>Reduce travel time for freight by road.</li> <li>Preserve sufficient rail freight capacity to meet the projected freight task.</li> </ul>	<ul style="list-style-type: none"> <li>Improve connectivity to markets by both road and rail freight.</li> <li>Improve opportunities to leverage rail freight opportunities.</li> </ul> <p><i>Links to SIP objective 3</i></p>
<b>RAIL</b>		
Rail not performing desired role	<ul style="list-style-type: none"> <li>Make rail the 'backbone' of the public transport system.</li> <li>Encourage travel by the most efficient and sustainable mode (i.e. allow rail to perform its intended role).</li> <li>Match capacity to expected rail network demand.</li> <li>Enable the rail network to expand into new growth areas.</li> <li>Achieve a competitive level of service to other modes.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure capacity to meet long-term demand forecasts.</li> <li>Unlock SEQ rail network capacity, enabling the network to expand and meet demand.</li> <li>Increase service frequency.</li> <li>Improve accessibility.</li> <li>Reduce journey times.</li> <li>Increase service reliability.</li> </ul> <p><i>Links to SIP objectives 2, 3 and 4</i></p>
Limits on service frequency	<ul style="list-style-type: none"> <li>Ensure public transport supports turn-up-and-go frequencies during peak periods.</li> <li>Enable service frequency to expand in-line with passenger demand forecasts.</li> </ul>	<ul style="list-style-type: none"> <li>Increase the frequency of services.</li> <li>Enable a mode shift to rail.</li> </ul> <p><i>Links to SIP objectives 2, 3 and 4</i></p>



PROBLEM	BUSINESS REQUIREMENT (OUTCOME SOUGHT)	BENEFIT SOUGHT
Uncompetitive journey times and cost	<ul style="list-style-type: none"> <li>▪ Enable sustainable journey times to be achieved.</li> <li>▪ Integrate the bus and train networks with enhanced opportunities for interchanging.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduce travel time, across all transport modes.</li> <li>▪ Reduce wait times.</li> <li>▪ Enable a mode shift to rail.</li> <li>▪ Provide better interchange opportunities with the bus network.</li> </ul> <p><i>Links to SIP objectives 3 and 4</i></p>
Network reliability and resilience	<ul style="list-style-type: none"> <li>▪ Enhance the resilience of the public transport network to unplanned outages and incidents.</li> <li>▪ Reduce reliance on a single rail corridor through the CBD.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provide an alternative route and improved resilience in the core rail network.</li> <li>▪ Reduce downtime due to incidents.</li> <li>▪ Increase customer confidence in the rail system.</li> </ul> <p><i>Links to SIP objective 4</i></p>
Overcrowding	<ul style="list-style-type: none"> <li>▪ Ensure the capacity of the rail network matches forecast demand.</li> <li>▪ Ensure crowding does not impede effective and efficient operations and network reliability.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduce crowding.</li> <li>▪ Make the customer experience more comfortable.</li> <li>▪ Increase service reliability.</li> </ul> <p><i>Links to SIP objectives 1 and 2</i></p>

Table 3.2: Benefits Sought



# CHAPTER FOUR

## OPTIONS ANALYSIS





## CHAPTER 4

### OPTIONS ANALYSIS

#### 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.

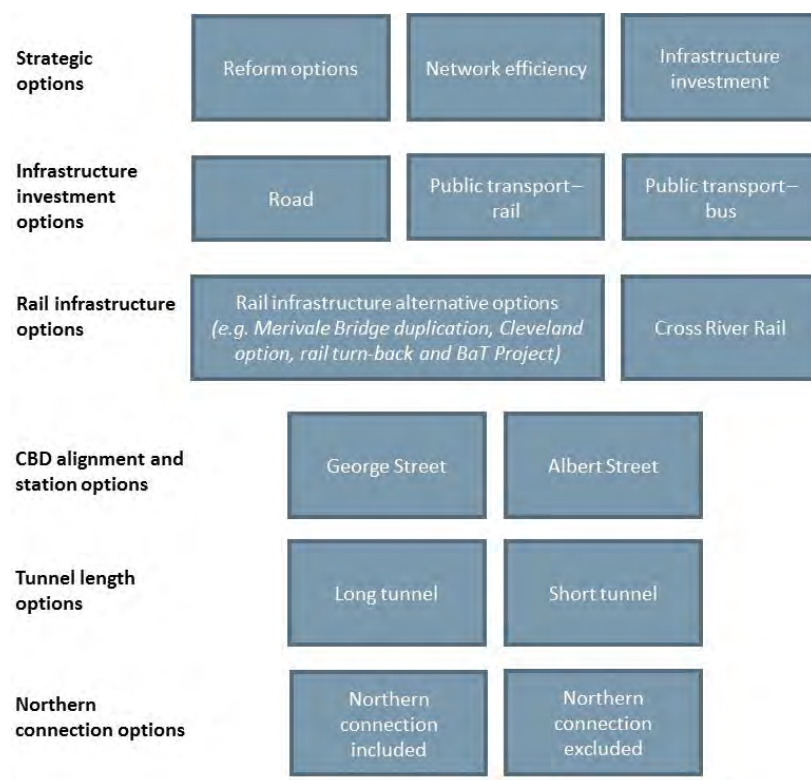


Figure 4.1: Options Identification Process

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.

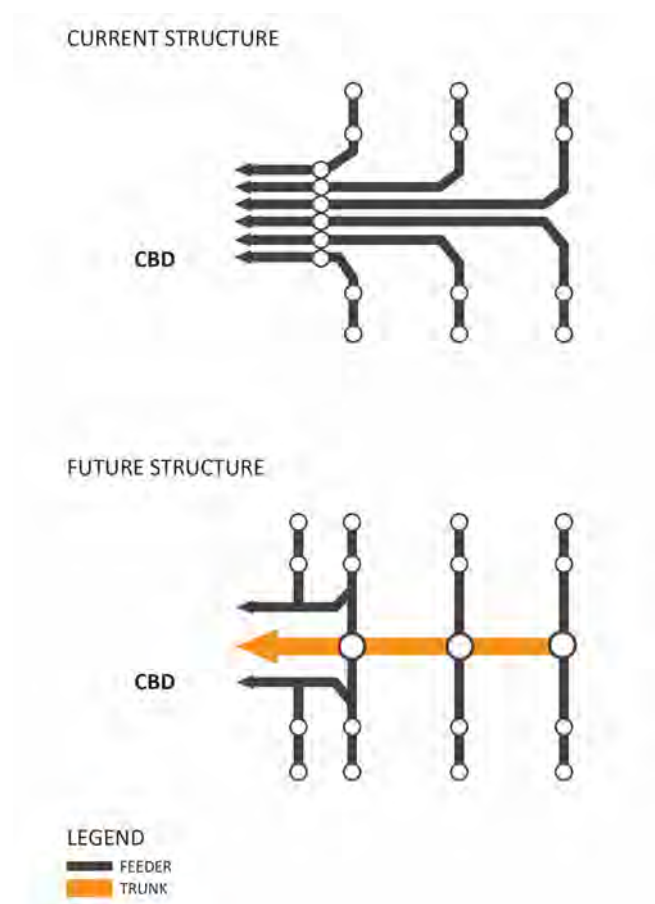


Figure 4.2: Comparison Between the Current SEQ Network Operating Paradigm (Upper) and a Trunk and Feeder System (Lower)<sup>40</sup>

<sup>40</sup> 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
<ul style="list-style-type: none"> <li>As per CRR Project 2011 and core CRR Project (2013)</li> <li>10km in length between Yeerongpilly (in the south) and Spring Hill (in the north)</li> <li>Provides for a dedicated rail freight route from the west to the Port of Brisbane when combined with additional surface works in the south</li> <li>Includes additional new station at Yeerongpilly with associated intermodal interchange opportunities and land-use benefits</li> <li>Allows for greater level of operational flexibility for Queensland Rail</li> </ul>	<ul style="list-style-type: none"> <li>As per BaT Project</li> <li>5.9km in length between Dutton Park (in the south) and Spring Hill (in the north)</li> <li>Rail freight restrictions continue during peak periods as per current arrangements</li> <li>Reduced impact on local community</li> <li>Significant cost savings (capital and operations)</li> </ul>

**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 Woolloowin 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.



CHAPTER FIVE

REFERENCE PROJECT



## CHAPTER 5

### REFERENCE PROJECT

#### CHAPTER SUMMARY AND CONCLUSIONS:

- The key components of the CRR Reference Project include:
  - 10.2km link including 5.9km of twin running tunnels from Dutton Park in the south to Bowen Hills in the north
  - northern surface works consisting of a new track from the portal around the Exhibition Loop and through Mayne Yard
  - underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street
  - upgraded Dutton Park and Exhibition stations
  - provision for additional stabling at Mayne Yard (North)
  - provision of European Train Control System - Level 2 (ETCS L2) through the tunnel and northern surface connection
  - enabling works including ETCS L2 signalling from Dutton Park to Salisbury and southern platform faces for stations from Salisbury to Fairfield.
- The CRR Project alignment reduces the length of the corridor proposed by the CRR Project 2011 and significantly reduces private property impacts.

#### 5.1 Purpose and Overview of this Chapter

The purpose of this chapter is to provide a detailed technical description of what the project will and will not include (scope of the Reference Project). The Reference Project is used as the base for the project analysis and is subject to minor changes as the project is further developed and procured.

#### 5.2 Scope of the Reference Project

The key components of the Reference Project are as follows:

- 10.2km link including 5.9km of twin running tunnels from Dutton Park in the south to Bowen Hills in the north
- underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street
- northern surface works consisting of a new track from the portal around the Exhibition Loop and through Mayne Yard to the Breakfast Creek bridges
- upgrade of Dutton Park and Exhibition stations
- provision for additional stabling at Mayne Yard (North) and ETCS L2 through the tunnel and northern surface connection.



In addition to the scope of works listed above, the CRR Project will also require some future associated investment to realise the full project benefits by 2036. This includes some station and signalling works at Northgate and Woolloowin.

While not required for day one of operations the future acquisition of additional rollingstock will also be required to support the enhanced level of service facilitated by the CRR Project.

The CRR Project study corridor is located in the Brisbane LGA within SEQ. It is approximately 19km long, extending from Salisbury in the south, via Woolloongabba and Brisbane's CBD to Woolloowin in the north.

The study corridor in the south generally follows the existing rail corridor from Salisbury and includes the existing train stations of Salisbury, Rocklea, Moorooka, Yeerongpilly, Yeronga, Fairfield and Dutton Park. Between Rocklea and Dutton Park, the study corridor widens towards the west to include Fairfield Road. The northern part of the study corridor generally follows the existing rail corridor from Boggo Road Urban Village, through the Woolloongabba priority development area (PDA), widening to include Brisbane's CBD and Spring Hill. The corridor then narrows to the existing Exhibition station at Bowen Hills continuing along the existing rail corridor past Mayne Yard and Bowen Hills, Albion and Woolloowin stations.

The Reference Project alignment includes a southern portal at Dutton Park, the southern CBD station located at Albert Street, the inclusion of Exhibition station and a connection to the North Coast line, south of Albion station.

The key enabling works for the proposed Reference Project include the following:

- Station upgrades will be undertaken between Salisbury and Fairfield (inclusive), with a third platform added to all stations. Where required, new or upgraded *Disability Discrimination Act 1992* (DDA) compliant pedestrian bridges will be provided for each station.
- ETCS L2 signalling will be installed on the down suburban line from Dutton Park to Salisbury. This will accommodate the portal arrangements of the tunnel and maintain the operational integrity of the network.

The key elements of the CRR Reference Project are discussed in the following sections.

### 5.2.1 Alignment

The Reference Project alignment ties into the existing above-ground Queensland Rail network near Dutton Park station in the south and Breakfast Creek Bridge in the north. The route is approximately 10.2km long and features new underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street, as shown in Figure 5.1. The existing Exhibition station will be upgraded and included on the CRR main line. Figure 5.2 depicts the alignment as a line diagram. The existing Dutton Park station will also be upgraded, with the addition of a third platform on the dual-gauge line.

Approximately 5.9km of the route is tunnelled, starting at the Boggo Road precinct in the south and surfacing between Roma Street station and Exhibition station. Where possible, the alignment tunnel sections are wholly located in rock.

The remaining above-ground sections utilise the existing corridor where possible<sup>41</sup>. To avoid conflicts of mainline train movements, the Reference Project up lines and down lines diverge at Mayne Yard with the up line bypassing to the east and the down line proceeding through Mayne Yard.

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<sup>41</sup> The corridor is owned by the Department of Transport and Main Roads and is being leased to Queensland Rail.







Figure 5.1: Reference Project Alignment



### 5.2.2 Track Configuration

The Reference Project includes two tracks passing under the city for the movement of trains from the north and south. Trains heading south from locations like Nambour and Caboolture will access the CRR lines just south of Albion station and pass through Mayne Yard and join the Exhibition line.

Realignment of the down main line and construction of a new stabling facility at Mayne Yard removes a key crossing conflict from the network, allowing effective connection of the project to the north.

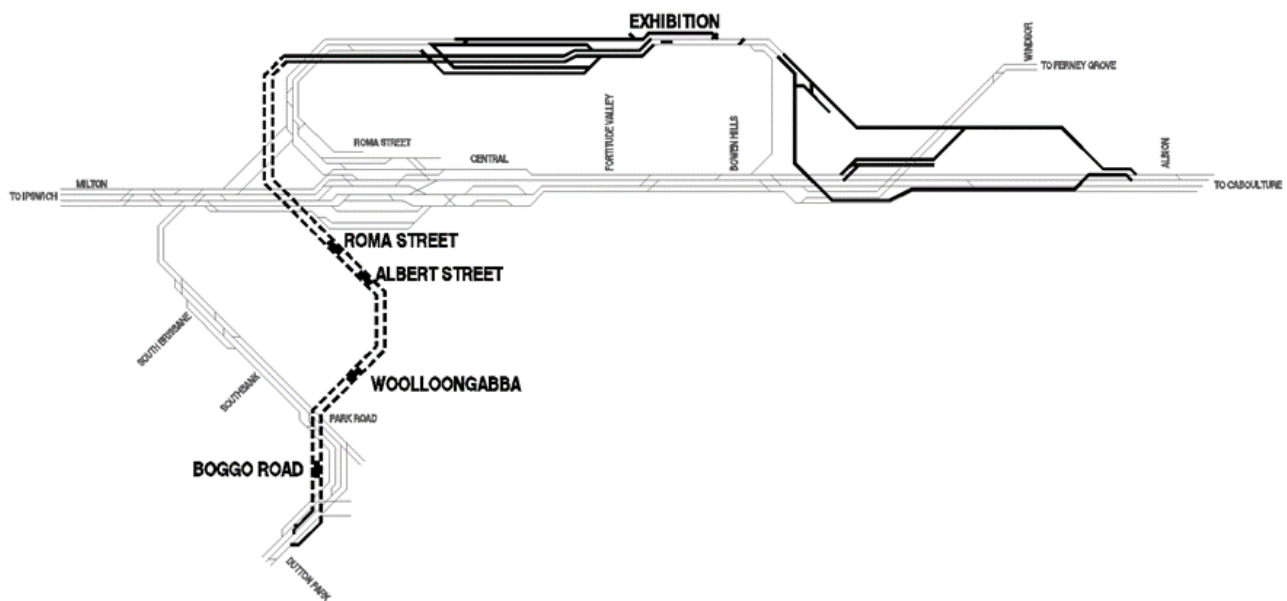


Figure 5.2: Reference Project Line Diagram

On the Exhibition line, three tracks are required between the CRR portal and Mayne Yard to facilitate the required operations. Two are CRR tracks, with the third required for non-passenger services moving between Mayne Yard and Roma Street, freight services and track maintenance vehicles.

CRR trains will enter the portal and resurface just north of Dutton Park. They will then either continue down as a service to Beenleigh–Gold Coast or end service at Clapham Yard.

Services from the south will come from Gold Coast and Beenleigh and enter the CRR portal at Dutton Park. Services in the afternoon contra peak will utilise the dual-gauge track. Stations from Salisbury to Dutton Park will require new platforms to allow passenger services to stop.

#### 5.2.2.1 Technical Parameters

The Reference Project alignment has been developed to comply, where possible, with the Queensland Rail Civil Engineering Track Standard (CETS).

The vertical alignment of the Reference Project is depicted in Figure 5.3.



Figure 5.3: Vertical Alignment of the Reference Project

The following parameters have been adopted for the Reference Project:

- CRR tracks will be narrow gauge (1,067mm).
- Track will be electrified using 25KV alternating current overhead line equipment.
- The desired design speed is 80km/h, with an absolute minimum of 50km/h.
- The maximum compensated vertical grade is three per cent.
- The desired minimum horizontal radius is 400m. The absolute minimum horizontal radius is 212m to achieve a 50km/h design speed. The desired minimum horizontal radius of 400m has not been achieved at the following locations:
  - Between Dutton Park and Park Road station the alignment adopts a 212m radius to pass under existing tracks. The combination of curves and transitions achieves a 50km/h design speed. This radius is tighter than those adopted in the Bus and Train (BaT) Project alignment. However, it is necessary to ensure Boggo Road platforms are on tangent track and that the station can be constructed with minimal impact on above-ground infrastructure and residential properties.
  - Between Albert Street station and Roma Street station the tunnels have reverse curves with 300m minimum radius to minimise volumetric impacts. This provides a 60km/h design speed.
  - In the proximity of Exhibition station, the alignments adopt radii as low as 300m to match and tie in to the existing tracks, while remaining within the boundary of the CRR Project 2011.
  - Near and within Mayne Yard, the alignment adopts radii as low as 215m radius, which is similar to the existing tracks and can achieve 50km/h.
- Platforms are 220m long to accommodate future nine-car rollingstock.
- Tangent track through platforms and for 21m beyond the platform ends (where possible) to avoid throw issues relating to platform gauging and clearance.
- Platforms are designed on a constant gradient between platform ends. The preferred track gradient on underground sections is zero per cent (level track). This has been achieved on all stations except Boggo Road station and Exhibition station, which both have a gradient of 0.5 per cent. This gradient, of 0.5 per cent is permitted in accordance with the CETS.

#### 5.2.2.2 Alignment at Stations

Where possible, all stations have been positioned on zero per cent grades (flat). These stations include Woolloongabba, Albert Street and Roma Street.

Boggo Road station is on a vertical grade of 0.5 per cent to achieve sufficient depth below Park Road station and to connect to the surface north of Dutton Park.



### 5.2.3 Tunnelling and Portals

#### 5.2.3.1 Portals and Transitions

##### Southern Portal and Dive Structure

The tunnel portal is located between the existing Dutton Park station and the proposed Boggo Road station. It is constrained by the:

- connection to the existing lines before Dutton Park station
- clearance under the existing lines between the Dutton Park and Boggo Road stations
- need to avoid the existing Eastern Busway.

The preferred scheme for the southern portal and connecting structure with Boggo Road station is a cut-and-cover tunnel solution, as shown in Figure 5.4. The proposed solution consists of:

- two trough structures as the CRR tracks come to grade
- two single-track, cut-and-cover tunnels, where the dual-gauge and suburban tracks pass over the CRR tracks (these cut-and-cover structures connect to the station box).

The southern portal and dive structure are located approximately 300m north of the existing Dutton Park station. Between Dutton Park station and Boggo Road station the CRR tracks have a horizontal radius of 212m, which provides a design speed of 50km/h.

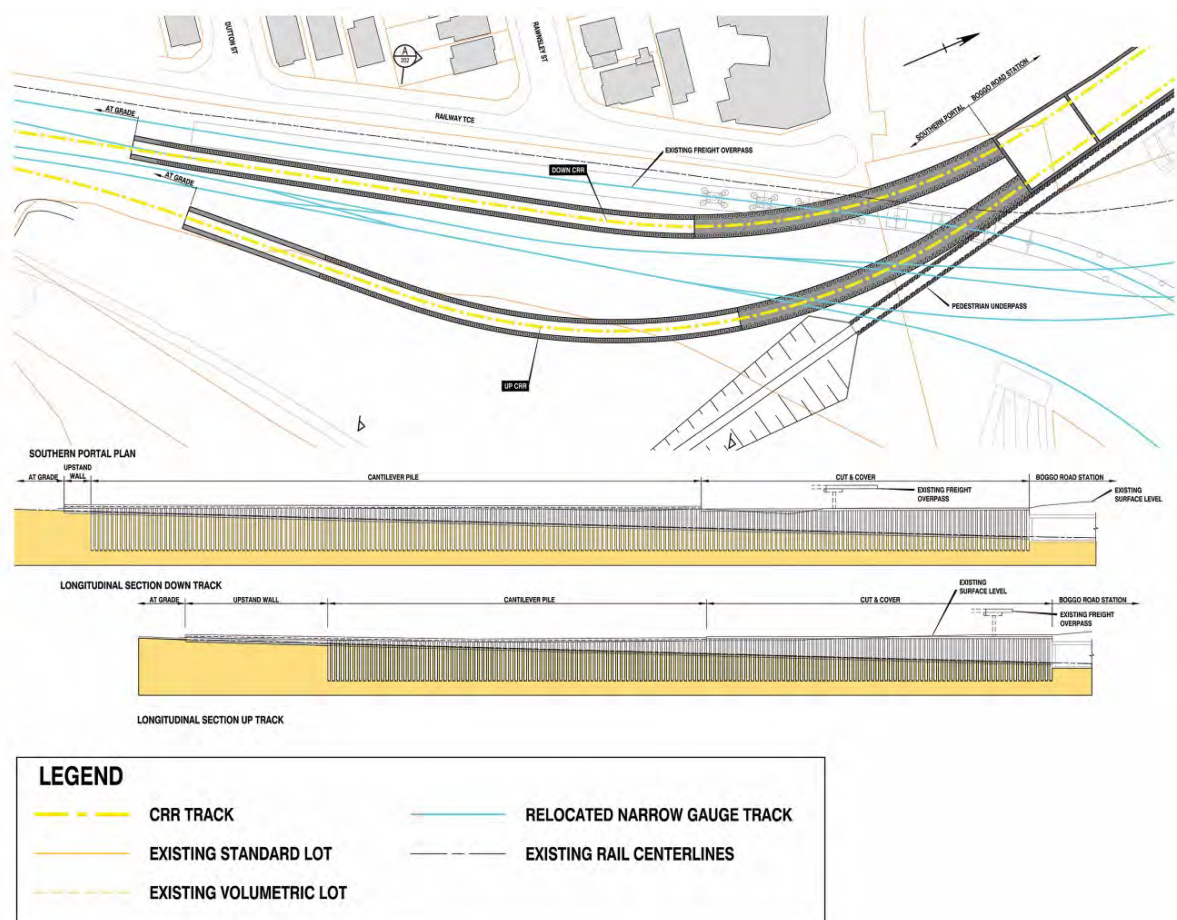


Figure 5.4: Southern Portal and Dive Structures



### Northern Portal and Dive Structure

The 330m long northern portal and dive structure for CRR is located in the rail corridor adjacent to the Inner City Bypass, as shown in Figure 5.5. Both the CRR up lines and down lines will use the same portal structure. The vertical alignment returns to grade prior to (south of) the existing land bridge. The total length of the dive structure is approximately 180m.

The cut-and-cover section extends 150m, linking the daylight portal and the bored tunnel section. It is envisaged that the required lateral restraint for the piled walls will initially be provided by temporary anchors to allow full access from surface down into the trough for extraction, disassembly and removal of the tunnel boring machines (TBMs).

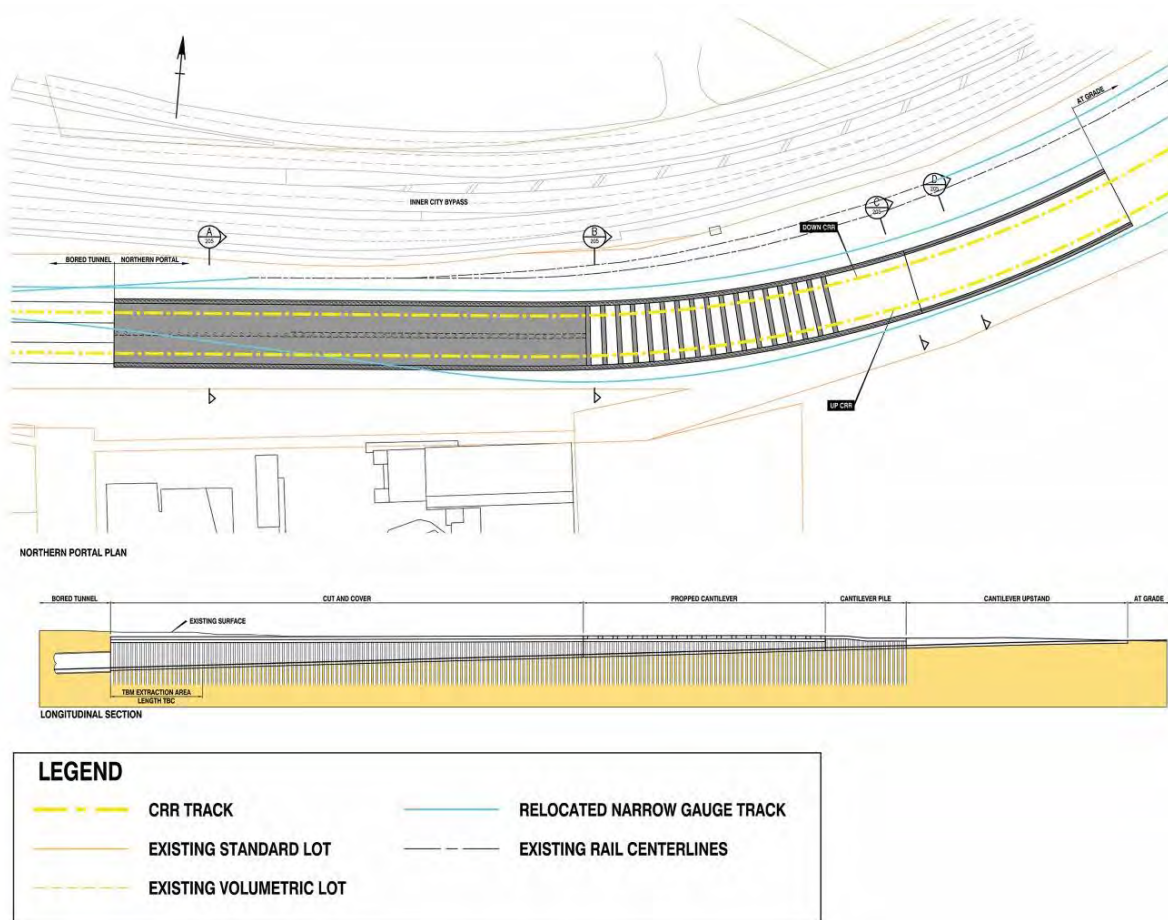


Figure 5.5: Northern Portal and Dive Structure



### 5.2.3.2 Tunnels

#### Mined Tunnel (Boggo Road to Woolloongabba)

The mainline tunnels are proposed to be constructed as twin single-track mined tunnels between Boggo Road station and Woolloongabba station, with an excavated width and height of approximately 5.7m and 6.2m respectively. The track separation for the two mined tunnels is 13.7m centre to centre.

#### Bored Tunnel (Woolloongabba to Northern Portal)

The mainline tunnels comprise twin bored tunnels with an internal diameter of 6.2m and a centre-to-centre separation of 13.7m, as shown in Figure 5.6. The permanent tunnel support is provided by a precast concrete segmental lining, with a typical thickness of 275mm.

The running tunnel for the train allows for a headroom clearance of 4.2m minimum from top of rail to contact rod. Also in the tunnel is a 700mm-high walkway level provided for emergency egress on one side and a maintenance walkway on the other. Tunnel services will be attached to the tunnel lining.

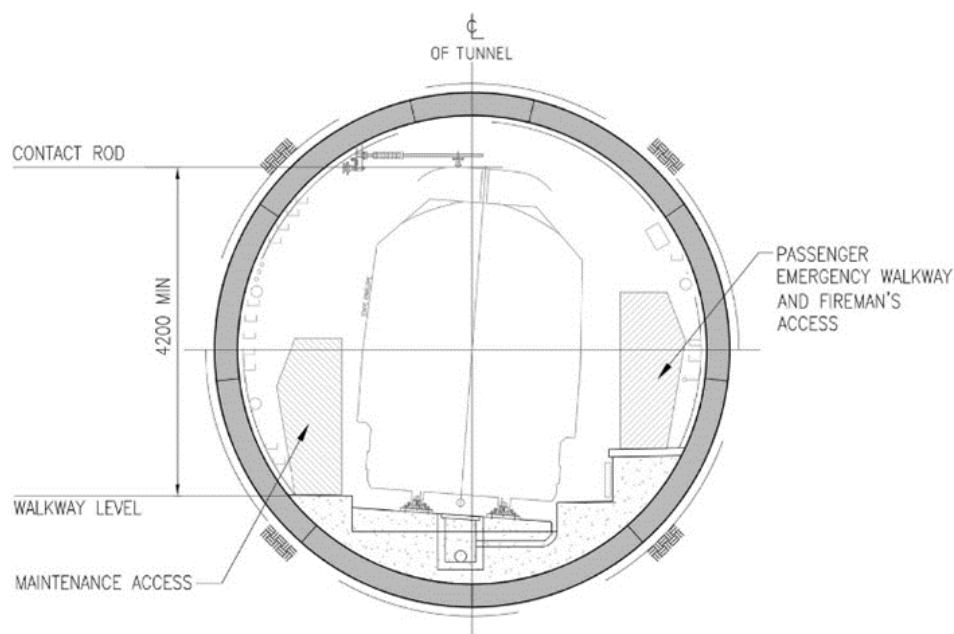


Figure 5.6: Bored Tunnel Cross-section

#### Caverns

The mined station caverns accommodate the platforms where they are longer than the cut-and-cover station box. Beyond each station cavern there is typically an oversized cavern to provide adequate space to receive or launch the TBMs. After tunnel construction, this space will be used to house emergency egress walkways, and mechanical and electrical equipment.

#### Cross Passages

From a fire safety perspective, cross passages have been provided at maximum 240m centres.





#### 5.2.4 Stations

The underground stations for the Reference Project include Boggo Road, Woolloongabba, Albert Street and Roma Street stations. The Reference Project also includes the Exhibition station, which is at surface level and located in the vicinity of the existing Exhibition station. All stations have 220m platforms to accommodate nine-car trains to provide for additional future capacity. Refer to Chapter 6: Project Benefits for further detail on the new CRR stations and the outcomes that they provide.

Between the southern portal and Salisbury, the Reference Project includes upgrades to suburban stations to accommodate passenger services for both CRR and non-CRR services. This requires a third platform to be added on the dual-gauge tracks at Dutton Park, Fairfield, Yeronga, Yeerongpilly, Moorooka, Rocklea and Salisbury. At Yeerongpilly, additional track work is required due to the interaction with the Tennyson Loop. At Moorooka, the dual-gauge track is repositioned to allow stabling of CRR trains between the suburban tracks and dual-gauge tracks.

##### 5.2.4.1 Station Design

A consistent approach to station layout has been adopted to improve cohesion and identity across the CRR Project while enhancing user experience, wayfinding and providing equitable access within stations. This has been achieved through reviewing the urban realm, land availability, passenger demand on vertical transport, constructability and relative cost.

The station entrances have been rationalised while ensuring entrances are in keeping with the subtropical environment and precinct planning.

##### 5.2.4.2 Underground Station Layout

The context of each station entry point varies. Therefore, the functional layout varies, especially the location and level of the transition between paid and unpaid areas. As a result, methods of providing cohesion and identity across the underground station layouts have been considered.

This has influenced the development of a consistent underground station layout with a central station box that extends down to platform level and houses the vertical transport (or most thereof), emergency egress, maintenance access and ventilation risers. A minimum of 1,500m<sup>2</sup> floor area is provided for each station. Generic station configurations are described in Figure 5.7 and in Figure 5.8. Beyond each end of the station box, the platform continues in a mined cavern.

The use of platform screen doors (PSDs) is assumed in all underground stations. In keeping with modern standards for an underground urban railway, this offers the following benefits of:

- providing improved safety by separating passengers from trains
- enabling more effective air management in stations, giving an improved environment for passengers
- providing for separation of station and tunnel ventilations systems, simplifying fire and life safety (FLS) provisions.





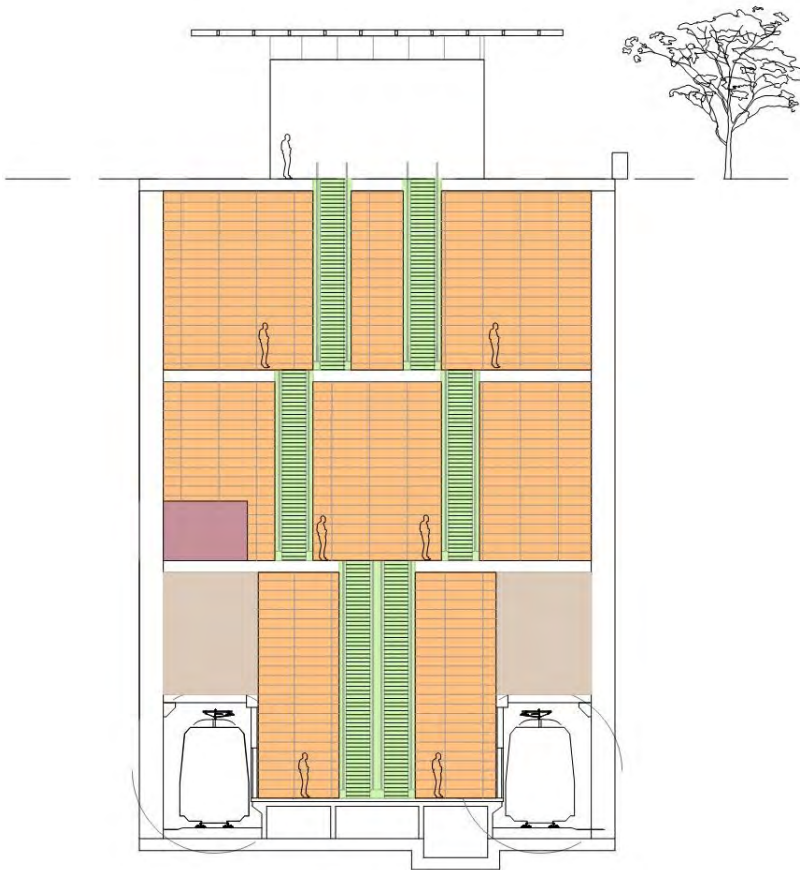


Figure 5.7: Cross-section of Generic Station Configuration

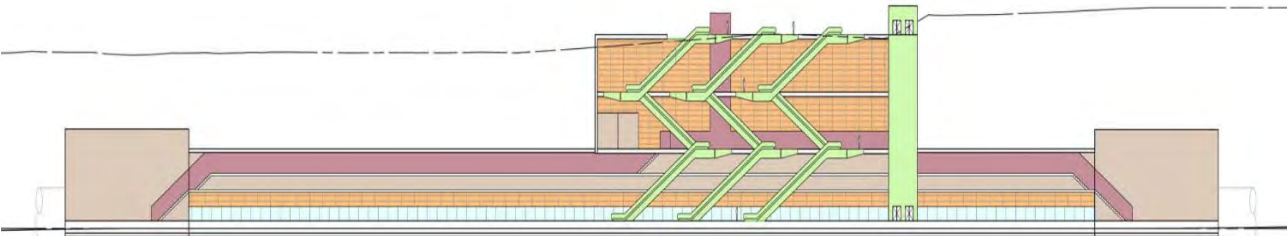


Figure 5.8: Long-section of Generic Station Configuration



### Dutton Park Station

A new Dutton Park station dual-gauge platform has been positioned on the eastern side of the dual-gauge line to form a staggered island platform (with the existing platform). The existing inbound platform will need to be widened and a new 150m-long platform face added to cater for six-car trains. A new stair and DDA-compliant lift from the western side of the Annerley Road footpath will also be provided.

### Boggo Road Station

The Boggo Road station will provide a new station in the Boggo Road–Princess Alexandra (PA) Hospital precinct, as shown in Figure 5.9. The station will be located adjacent to, and integrated with, the existing Park Road rail and Boggo Road busway stations. The station will perform a critical role in facilitating interchange between rail services and the rail network and busway system. This network junction is forecast to become the second busiest location for passenger interchange on the SEQ public transport network, after Roma Street station. The new Boggo Road station will support the further development of the Boggo Road Urban Village and surrounding precincts.

The Boggo Road station will be an underground station, with the station box primarily located on Lot 2 on Joe Baker Street, adjacent to the Ecosciences Precinct. This is currently a vacant, Queensland Government-owned site. The platform extends to the north of Lot 2, within a cut-and-cover section, under the Eastern Busway.

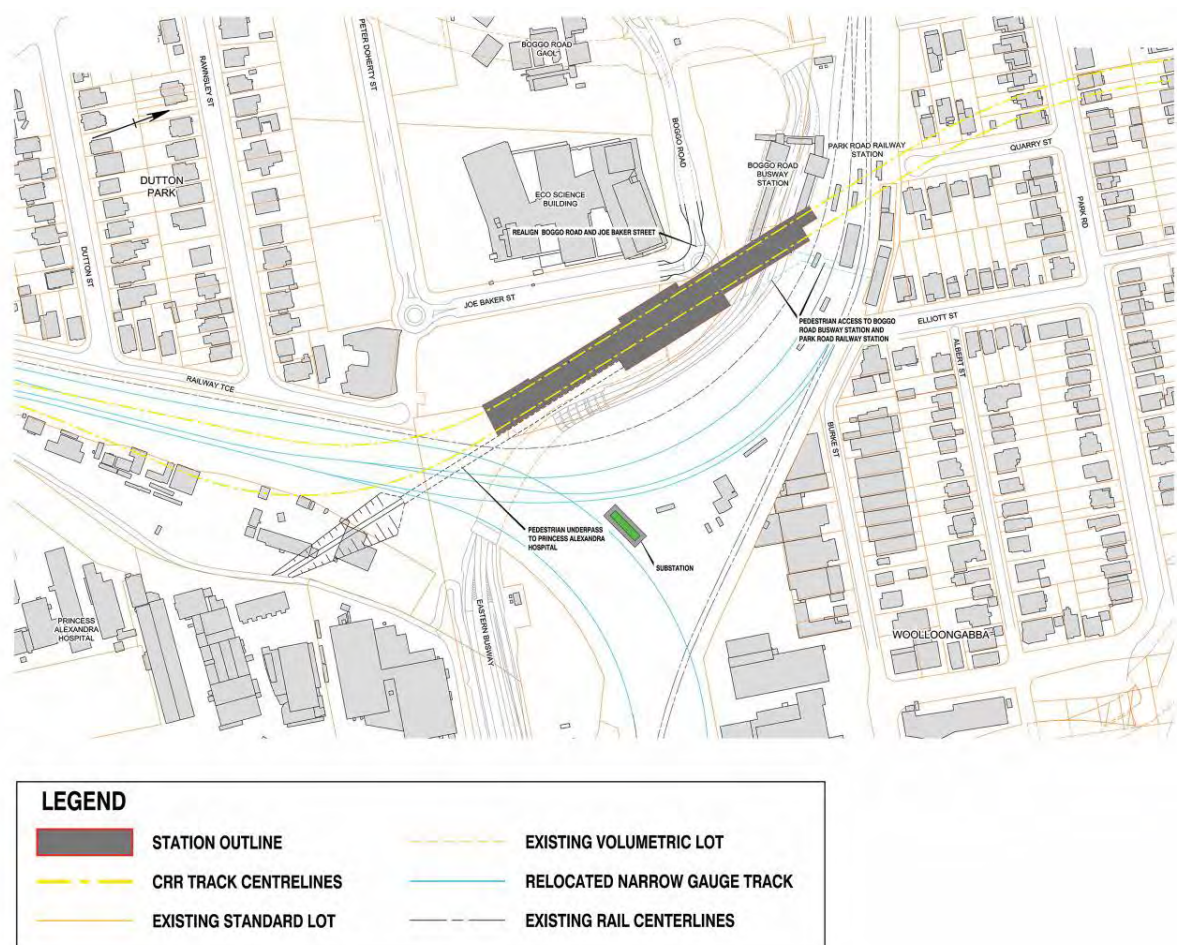


Figure 5.9: Boggo Road Station

The platform is approximately 19m below ground level. This is required to ensure there is adequate cover to the existing tracks that the tunnels to the south pass beneath.

Access for pedestrians to the site is quite constrained due to the existing busway and surface rail and variation in ground levels. In order to provide the required connectivity to the surrounding origin and destination points, the following is proposed:

- The station entrance will be located at the eastern end of the Boggo Road precinct.
- A pedestrian bridge will link the main entrance with the Boggo Road busway station and Park Road station.
- A DDA-compliant pedestrian underpass will link the station concourse level with the PA Hospital.

The island platform is slightly staggered to minimise construction impacts to Park Road station and the adjacent dual-gauge track.

### Woolloongabba Station

The Woolloongabba station is located within the designated Woolloongabba PDA to support planned urban growth in that location, as shown in Figure 5.10. The station will provide passenger rail access to the Woolloongabba PDA, the Brisbane Cricket Ground (The Gabba) and offer interchange opportunities with the busway system.

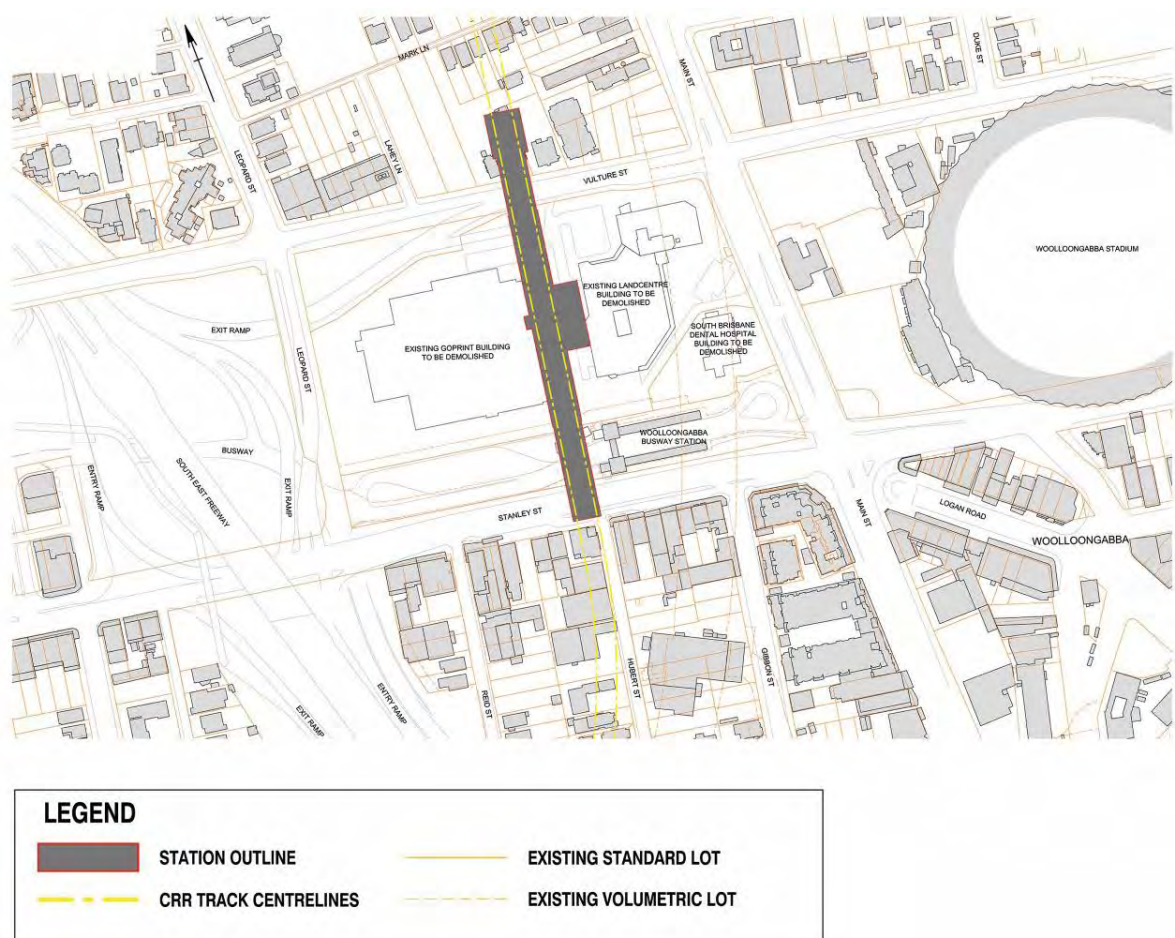


Figure 5.10: Woolloongabba Station





The proposed station is positioned at the eastern side of the Queensland Government-owned Goprint site, which is similar to the BaT Project. This will require the resumption and demolition of the Goprint building and resumption and demolition of the Landcentre building and dental clinic.

The position of Woolloongabba station is heavily influenced by the rail alignment from Boggo Road. The location also allows for better rock cover further along the alignment at the river. Also, the proposed station location provides better connectivity with the busway station, as well as being closer to The Gabba. Northern and southern entrances will be provided.

This site accommodates the central station box. Since there is ground-level entrance and connectivity, there is no perceived benefit in a below-ground level concourse. The platform will be approximately 27m below ground level. The escalator layout has achieved a single landing level between ground and platform level.

### Albert Street Station

Albert Street station will be the most centrally located rail station in the Brisbane CBD. It will be critical in enabling passengers to access the city centre, particularly areas currently not well served by rail. The station will significantly improve access to existing areas of employment, recreation, parklands and the Queensland University of Technology campus at Gardens Point. It will be integrated with ongoing development to revitalise the southern sections of the CBD. It will also support BCC's vision for Albert Street as a green spine connecting Roma Street Parklands to the City Botanic Gardens. BCC plans to reduce the street's road traffic function in favour of pedestrian uses over time.



Figure 5.11: Albert Street Station



The proposed station is located under Albert Street, extending from Margaret to Elizabeth Streets, as shown in Figure 5.11. The new station will require the resumption and demolition of properties located north of the intersection with Mary Street, on either side of Albert Street. The sites accommodate a section of the central station box, with one offline ground-level entrance. Three additional in-line ground-level entrances (along Albert Street) connect through a high-level concourse.

The platform will be approximately 31m below ground level, requiring four levels of escalators. This results in three below-ground levels before platform level that have the escalator landings.

With the proposed station layout, either the existing Myer Centre car park exit ramp to Albert Street is permanently closed or a relocation and right turnout extension of the existing Myer Centre car park exit ramp to Charlotte Street is potentially required.

### **Flooding at Albert Street**

Flood protection at Albert Street station requires particular consideration. The Brisbane floods of January 2011 saw Albert Street inundated to a depth of around half a metre. In the context of the CRR Project, this would be considered a Type B intermediate flood event with mitigations articulated below.

The northern station entrance is separated from the Myer Centre car park exit ramp, which provides fire isolation and improved flood resilience. Ventilation outlets and the like will need to extend above the Q10,000 design flood level, consistent with flood mitigation standards for other major infrastructure projects.

Flood immunity is a critical design requirement for Albert Street station and the design solutions are integrated with BCC'S green spine vision. Having smaller entrance structures enables discrete flood protection measures that can be easily and quickly deployed. There are three levels of flood protection, depending on the flood event, which are discussed below.

#### Type A: Minor Flood Events

As part of the urban design, the entrances will be locally raised, while still being DDA compliant. This will reduce surface water runoff from entering the station and provide flood immunity from small flood events.

#### Type B: Intermediate Flood Events

During intermediate flood events, Albert Street station will be closed but other CRR stations could remain operational.

Each entrance location will have low-height flood mitigation measures, such as an upstand wall, approximately one metre high, on three sides.

For intermediate flood events, a vertical flood barrier, approximately one metre high, will be activated at each entrance location, immediately in front of the escalators or lifts. This flood barrier adjoins the low height upstand walls to provide a barrier around the full perimeter of each entrance.

#### Type C: Extreme Flood Events

For more significant events there will be sufficient time to activate the next level of flood protection measures.

Placing a small structure horizontally above the low height wall upstands offers a suitable solution to an extreme flood event. These would have gaskets and other seals to provide water cut-off. This will be



designed for the required hydrostatic water pressure from a Q10,000 flood event. As such, the only elements that will not be protected are the small entrance structures.

### Roma Street Station

Roma Street station will extend the region's primary transport interchange hub and support the continued development of commercial and mixed-use activities in this quarter of the CBD. Constructing the new station provides the opportunity to redevelop the Brisbane Transit Centre (BTC) in line with BCC's vision for a new western 'gateway' to the city at this location.

Roma Street station interchanges with the existing Roma Street train network and Roma Street busway station, as shown in Figure 5.12.

This site accommodates the central station box and the single entry. Furthermore, having the station box on this site provides connectivity with the existing pedestrian subway that services the railway and busway platforms. A below-ground level concourse therefore has no benefit, given this ground-level entrance and connectivity.

To accommodate the proposed northern portal arrangement, the rail alignment is skewed in plan relative to Roma Street and the existing rail and busway platforms. As such, part of the station is below the existing rail and busway corridor.

The platform will be approximately 27m below ground level, requiring three levels of escalators. This results in two below-ground levels that serve as landings between ground level and platform level.

With the proposed station layout, temporary support of the Inner Northern Busway will be required during excavation.





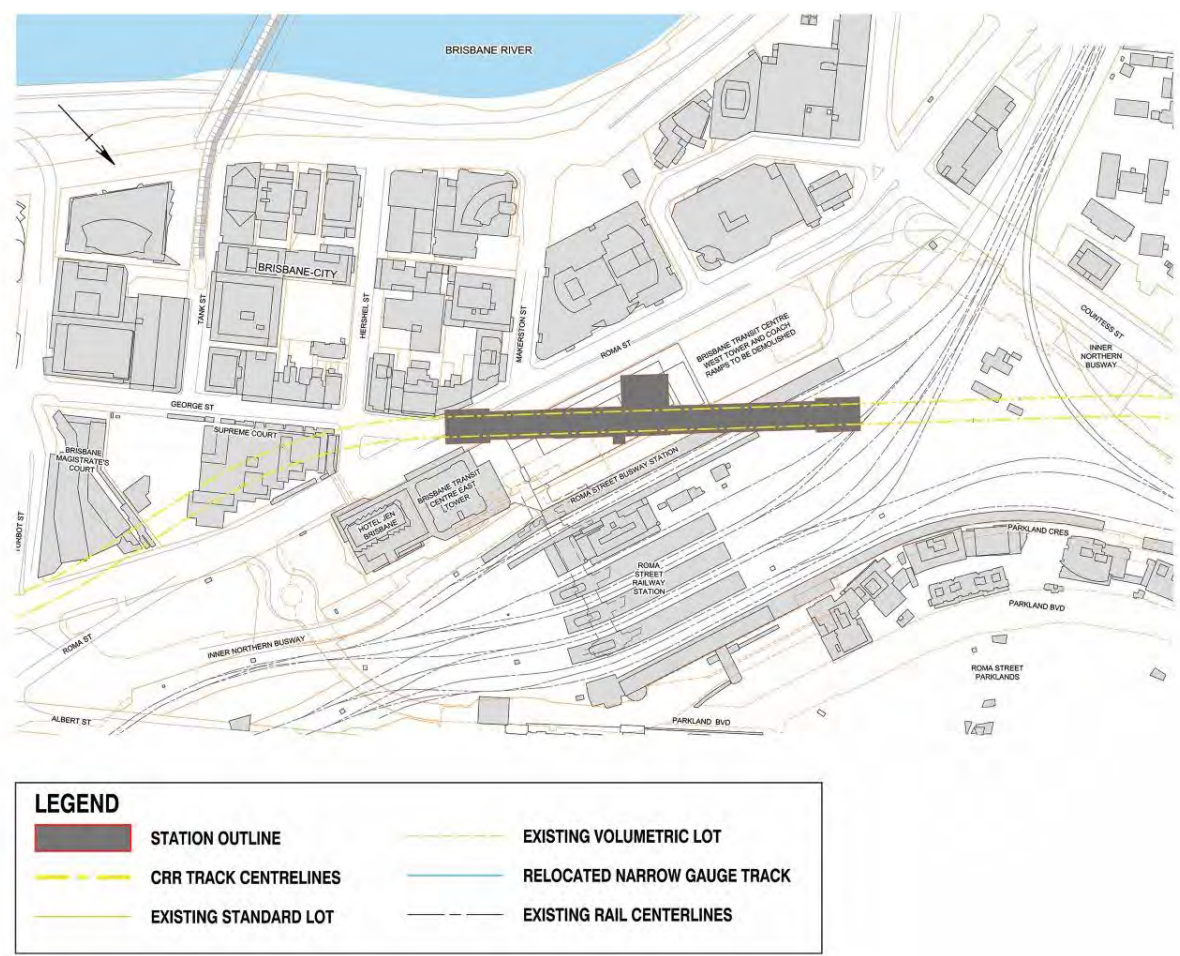


Figure 5.12: Roma Street Station



### Exhibition Station

The existing Exhibition station is changing from an event-only station to a general commuter station. It is located between Bowen Bridge Road and O'Connell Terrace, as shown in Figure 5.13. A reference design has been proposed that upgrades the existing station, resulting in:

- reduced impacts to rail operations during construction by retaining the existing rail lines between Bowen Bridge Road and O'Connell Terrace
- avoiding re-grading of O'Connell Terrace by utilising the existing O'Connell Terrace Bridge (also eliminating construction impacts of a new bridge)
- a pedestrian connection between the station, O'Connell Terrace and Bowen Bridge Road.

The existing station is being retained and modified to cater for CRR trains. The two existing platforms are being lengthened to 220m to cater for nine-car trains. The northbound platform will be widened to provide a 6.5m-wide platform.

Over the length of the station, the natural ground level rises from the south to the north. This means that the northbound platform will be widened and lengthened using retaining walls, or suspended structure, as there is up to a five-metre difference between the platform level and the adjacent existing ground. The northern end of the platform will be extended using a suspended structure to maintain the existing pedestrian underpass (below rail level).

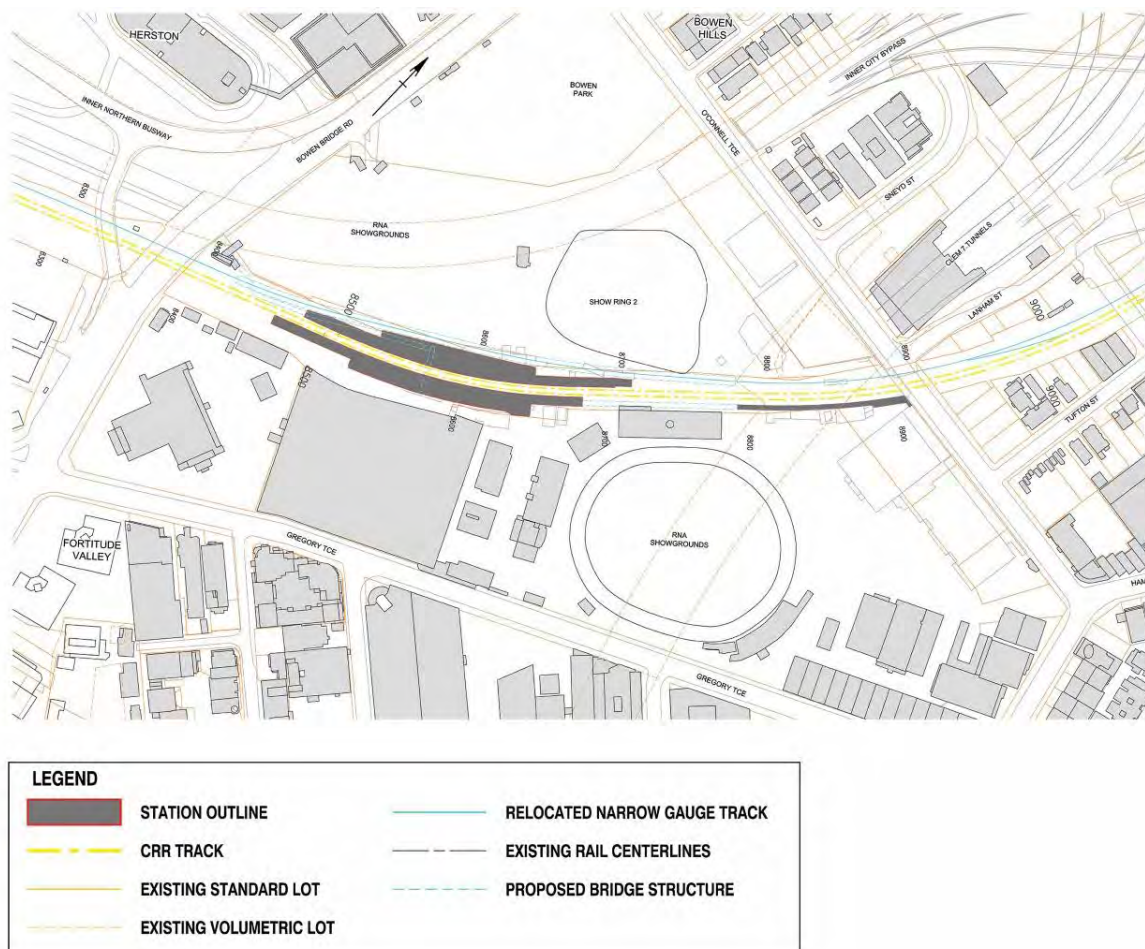


Figure 5.13: Exhibition Station



Pedestrian access is provided between the station and both Bowen Bridge Road and O'Connell Terrace. Pedestrian access to Bowen Bridge Road and O'Connell Terrace is as follows:

- pedestrian bridge from the northbound platform to the footpath on Bowen Bridge Road
- pedestrian bridge between platforms, which directly connects to the Bowen Bridge Road pedestrian bridge
- pedestrian path from the southbound platform to the footpath on O'Connell Terrace
- pedestrian bridge over the rail corridor, adjacent to the existing O'Connell Terrace Bridge, to provide footpath connectivity either side of rail corridor (for the southern O'Connell Terrace footpath).

Pedestrian access to the Brisbane Showgrounds is as follows:

- ramp access from the northbound platform to the Brisbane Showgrounds (with stairs at the northern end of the platform for use during showground events only)
- existing at-grade access from southbound platform to the Brisbane Showgrounds.

### 5.2.5 Track

#### 5.2.5.1 Track Structure

For surface sections, ballasted track with concrete sleeper will be adopted in accordance with Queensland Rail guidelines.

For tunnels and their approaches, non-ballasted track (i.e. slab track) is proposed. Details of the slab track shall be proposed at later stages in design development and will be subject to recommendations from noise and vibration modelling. Floating slab track technology may be required.

#### 5.2.5.2 Junction Work

All switches and crossings are to Queensland Rail standard layouts. Location of switches and crossings include:

- southern portal and connection to existing mainline
- northern portal and connection to mainline
- Mayne Yard access
- northern tie-in.

### 5.2.6 Rail Signalling and Systems

The Reference Project includes the following works in relation to rail signalling, communications and train control systems:

- ETCS L2 through the CRR tunnel and northern surface connection, including the supporting telecommunications and radio systems and interfaces with conventional signalling at either end
- automatic train operation (ATO) through the CRR tunnel, overlaid on ETCS L2
- wider signalling works to support CRR operations.

An overview of each component of works is provided below.



### 5.2.6.1 ETCS L2

The CRR Project will incorporate ETCS L2 throughout the tunnel sections with connections into the surface network. An ETCS L2 system with associated ancillary systems is illustrated in Figure 5.14.

Under ETCS L2, the network controller requests routes to be set or cancelled via the traffic management system (TMS). Once a route request is issued, it is passed to the interlocking to prove it is safe. Train detection continues to be performed trackside by devices such as track circuits and axle counters. Once a route has been set and proved by the signal interlocking, the radio block centre (RBC) issues a movement authority to the train via the radio system. The movement authority is displayed to the driver on the driver-machine interface (DMI).

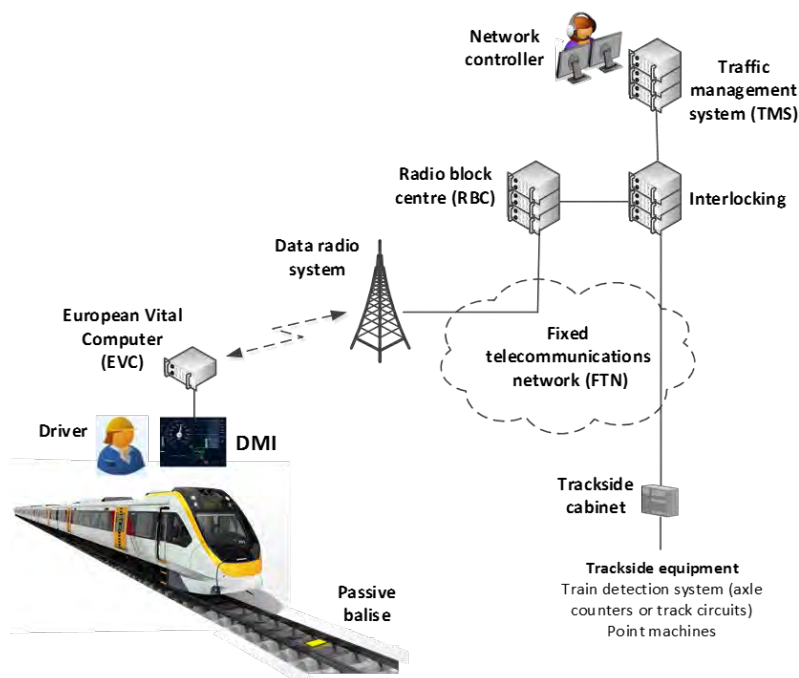


Figure 5.14: ETCS L2 Components

Using ETCS L2 in the CRR tunnel will:

- enable capacity to be maximised as the restrictions that apply to signal placement are eliminated (modelling indicates that the capacity targets for CRR would not be achieved using conventional signalling)
- minimise the tunnel profile and overall CRR cost as there is no need to accommodate lineside signals
- minimise the amount of equipment in the tunnels, providing greater maintainability
- provide a technology basis for enhanced technology and higher performance, including ATO (see section 5.2.6.2).

ETCS L2 is consistent with the technology strategy developed for the SEQ network through the 2011 Rail Safety Systems Assessment and is currently being implemented through the inner-city rail network via the ETCS – Inner City Project being delivered by Queensland Rail.





The scope of works for ETCS L2 that has been included in the Reference Project includes the following:

- ETCS L2 and trackside equipment: All trackside and technical equipment to be installed on CRR, including interlocking and RBC, forms part of the scope. The design has allowed for the use of axle counters for train detection. A single interlocking and RBC have been assumed and will have adequate capacity to cover the entire corridor.
- Fixed telecommunications network (FTN): A FTN has been allowed for throughout the CRR tunnel, integrating with Queensland Rail's existing infrastructure at the north and south interface locations.
- Data radio: A new data radio will be provided by the ETCS contractor. This will be compatible with the supplier's ETCS L2 system and will work on the frequency band that has been allocated by Queensland Rail for this purpose (1,800MHz). The reference design assumes that coverage through CRR will be achieved by a leaky coaxial feeder installed through the tunnels. Coverage will also be required in the area on approach to CRR, for approximately two kilometres, and the reference design has allowed one base station transceiver site north and south of the tunnel for this purpose.
- Interfaces: CRR's ETCS L2 system will interface with existing Queensland Rail signalling at the north and south. The Reference Project allows for the transition between conventional and ETCS L2 as trains divert from the existing corridor. The junction itself will be controlled using conventional signalling, however the train will establish contact with the CRR ETCS system on approach. This means the authority to proceed across the junction and into CRR will be under ETCS L2. In the event that a train does not establish contact with the CRR ETCS system (for any reason, including equipment failure), it may come to a stand at the junction until a movement authority is received or may continue along the existing corridor under conventional signalling.

#### 5.2.6.2 Train Operations

ETCS provides a safety envelope (permissible speed and limit of authority) within which each train can operate. As noted above, the use of ETCS L2 in CRR will provide the required capacity at a lower cost and better outcomes for reliability and maintainability than conventional signalling.

The use of ATO in conjunction with ETCS will further enhance network capacity and the performance of trains. For the CRR Project, ATO is also required due to the use of PSDs, ensuring the train stops in the required position.

For the CRR Project, ATO will involve a driver being present. Four different levels of ATO are defined, known as Grade of Automation (GoA). These are:

- GoA 1: ATP fitted but no ATO
- GoA 2: ATO used for all normal operations, with a driver present to supervise the corridor, manage station departures and to manage degraded operations
- GoA 3: ATO used for all normal operations, with a driver or train attendant present for irregular operations
- GoA 4: Driverless operation; ATO manages all functions.

For the CRR Project, GoA 2 has been assumed. This is consistent with ATO-over-ETCS developments worldwide but also reflects the need for a driver on the train to travel in non-ATO fitted areas on the approach to CRR.



These grades of automation are illustrated in Table 5.1.

GRADE OF AUTOMATION	TYPE OF TRAIN OPERATION	SETS TRAIN IN MOTION	STOPS TRAIN	CLOSES DOOR	OPERATES IN EVENT OF DISRUPTION
GoA 1	ETCS L2 with driver	Driver	Driver	Driver	Driver
GoA 2	ETCS L2 and ATO with driver	Automatic	Automatic	Driver	Driver
GoA 3	Driverless	Automatic	Automatic	Train attendant	Train attendant
GoA 4	Unattended train operation	Automatic	Automatic	Automatic	Automatic

**Table 5.1: Grades of Automation Defined for ATO**

In addition to the ETCS L2 scope described above, ATO will require:

- an ATO server, which will communicate to the TMS to obtain timetable information and transmit messages to trains via the RBC
- additional onboard equipment to manage ATO messages and functions, fitted to new generation rollingstock (NGR)
- additional enabling works, in rules development, training, testing and proving and operational trialling.

ATO makes use of the same DMI as provided for ETCS, giving a consistent interface to the driver.

The normal sequence of operation under ATO is as follows:

- On approach to CRR, the train will establish communication with the CRR ETCS system (as above) and receive a movement authority to proceed into the tunnel.
- When fully transitioned to ETCS, the driver will select 'ATO start'. ATO will drive the train to the next station, in accordance with the movement authority and the timetable (i.e. the required arrival time).
- ATO will stop the train at the station, aligning the train doors with the PSDs, and will initiate the door opening process.
- The driver or guard will monitor passenger movements at the station. When complete, the driver will initiate the door closing process.
- Once the doors have closed, the driver will authorise the starting of the train by pressing the ATO start button. ATO will then drive the train to the next station.
- At the exit to CRR, the train will transition back to conventional signalling and driver control.

#### 5.2.6.3 Wider Signalling Works

Signalling works will also be required at several locations as enabling works. These include:

- ETCS L2 signalling from Dutton Park to Salisbury
- upgrades to signalling at Mayne Yard.





#### 5.2.6.4 Relationship to ETCS – Inner City Project

Deployment of ETCS L2 in the inner-city network in advance of the CRR Project (via the ETCS – Inner City Project) reduces the risk of bringing CRR into service by ensuring that key enabling activities are completed and stakeholders are familiar with the systems to be used within the CRR tunnel. In particular, the ETCS – Inner City Project will:

- develop rules and procedures for operators working under ETCS L2, which will be equally applicable within CRR
- undertake training of drivers and other staff in processes related to ETCS L2, ensuring a baseline of familiarity in advance of the introduction of the CRR Project
- introduce the new TMS into the SEQ network and resolve all interfaces between the TMS and other systems
- fit all Queensland Rail rollingstock with ETCS L2, as well as undertake integration testing with NGR trains
- undertake all testing, proving and operational trialling activities, including gaining regulatory approval for the new system of working.

The prior completion of the ETCS – Inner City Project will also result in a simpler and lower risk signalling interface between CRR and the existing network at the northern end of the tunnel (as this will involve no ETCS transition) and will provide additional options for the southern interface.

The ETCS – Inner City Project does not include the development, testing and operational introduction of ATO, which will remain as part of the CRR Project. However, the step to ATO has been identified as a potential ‘next step’ in the ETCS – Inner City Project to ensure that the selected technology supplier has a roadmap to delivering this capability.

#### 5.2.7 Power

Each station will be provided with power from two transformers.

The electrical distribution systems will provide power to all systems including general and emergency lighting, general power, intelligent transport systems, FLS systems, mechanical plant and general power distribution.

All essential supplies in the station will be fed from both main switchboards via an automatic transfer switch to ensure sufficient redundancy. Low-voltage power supplies will be provided at each underground station via transformers located within the station. The transformers will be supplied via high-voltage feeder cabling run in diverse paths along the tunnel length. The transformer and high-voltage supply arrangement should cater for a double failure of two primary power feeds into the station.

Electrical supplies for non-CRR equipment can be provided via Energex local supplies. Non-essential CRR equipment can be provided via Energex local supplies.

##### 5.2.7.1 Backup Power Supplies

In addition to the dual feed to essential services in the station and tunnels, additional backup power supplies will be provided to allow for further redundancy, including:

- generator backup power provided for essential systems
- an uninterruptible power supply provided for FLS systems, such as tunnel lighting (currently indicated to be located at platform level).



#### 5.2.7.2 Rail Traction Supplies

Traction power has been designed to integrate with the SEQ rail network. Queensland Rail's electrical network is being upgraded with new technologies. This has resulted in the scale of the electrical system upgrade requirements being reduced for the CRR network. Introducing a static frequency converter has allowed the system to be connected in a mesh fashion. This allows loads to be shared across the meshed network, increasing system robustness and redundancy, while lowering the amount of injection points or bulk supply points. Because of these changes, the CRR traction network will only require:

- one new sectioning substation at Park Road, with supply from the feeder station at Moolabin (Yeerongpilly)
- one new traction feeder substation at Exhibition
- new supply to the existing Mayne feeder station from Exhibition substation.

The Exhibition feeder station is servicing the CRR lines to Mayne and providing the additional supply to the existing Mayne feeder station.

At Woolloongabba, temporary construction supply for the TBMs will be provided, with the possibility of converting it into the final supply for the stations.

#### 5.2.8 Tunnel Ventilation

Major equipment components required for the tunnel ventilation system include:

- reversible axial fans
- acoustic attenuators (to limit noise levels both at the surface and within the station)
- fire dampers (to configure the system to provide the required flow directionality)
- screening (to prevent objects from entering the tunnel ventilation system).

#### 5.2.9 Fire and Life Safety

Protection measures will be provided for fire events in the stations and the running tunnels. This includes:

- tunnel ventilation systems
- the provision of an emergency walkway along each tunnel with cross passages between the tunnels
- emergency egress stairs at each end of all underground stations
- back-of-house spaces being designed to the Building Code of Australia
- FLS capability of NGR.

Other assumptions include the following:

- The egress strategy is four minutes maximum to a point of relative safety and six minutes maximum to exit the station.
- Escalators will be used at a reduced capacity during emergency egress.
- Only one train will be in each section of tunnel at any one time.



As noted in Section 5.2.4, it is assumed that PSDs will be adopted at all underground stations. This will improve safety by separating passengers from trains and simplify FLS provisions through the separation of station and tunnel ventilations systems.

In the underground stations, the emergency egresses have been designed to be DDA compliant. At platform level, ramps lead down to an emergency egress passageway under the platform. This, in turn, leads to a fire-isolated lift core, typically containing two fire-isolated emergency lifts with fire-isolated stairs wrapping around them. An emergency egress review has been carried out, resulting in three-metre-wide ramps and stairs being adopted.

The use of fire isolation and pressurisation of the egress route and stairwell within the station is consistent with Australian and international practice.

### 5.2.10 Station Pedestrian and Vertical Transport

Stations have been architecturally designed to achieve a functional layout and an enjoyable user experience. Various elements are discussed below.

#### 5.2.10.1 Fare Gates

Automated fare gates for underground stations are proposed. The location of the fare gates needs to consider where the various pedestrian flows meet, the escalator layouts and the physical space available.

#### 5.2.10.2 Escalators

Generally, linear station arrangements are preferred as this provides clear wayfinding with improved sightlines and a minimal number of turns. Given the station depths, and the corresponding escalator lengths, this is generally not possible to achieve. However, if the escalators use switchbacks, wayfinding can be improved through the use of larger voids near the escalators to increase sightlines. This also provides architectural enhancements to the underground space.

No public stairs have been provided in the underground stations as the platform depths make the use of stairs impractical.

#### 5.2.10.3 Lifts

Lifts will provide DDA-compliant access from the ground level or concourse level down to the platform level. They will be provided at each station entrance to ensure stations have equitable access at each entry point. Table 5.2 summarises these features for each station.

STATION	FARE GATE LOCATION	TOTAL VERTICAL TRAVEL DISTANCE (METRES)	ESCALATORS	LIFTS	PUBLIC STAIRS AND RAMPS	EMERGENCY STAIRS
Boggo Road station	Concourse level	19	6	2	0	2
Woolloongabba station	Ground level	27	8	2	0	2
Albert Street station	Concourse level	31	10 ground to concourse 8 concourse to platform	2	0	2



STATION	FARE GATE LOCATION	TOTAL VERTICAL TRAVEL DISTANCE (METRES)	ESCALATORS	LIFTS	PUBLIC STAIRS AND RAMPS	EMERGENCY STAIRS
Roma Street station	Ground level	27	6	2	0	2
Exhibition station	Platform level	7	0	2	1 stair 1 ramp	N/A

Table 5.2: Vertical Transport Summary

#### 5.2.10.4 Redundant Vertical Transport

The underground stations are deep and require redundancy to cater for an escalator being taken out of operation due to breakdown or maintenance. This can be achieved with additional escalators or stairs. Stairs are only effective for level differences up to five metres – the CRR escalator layouts for the underground stations generally have run heights well in excess of five metres.

#### 5.2.11 Flood Protection

##### 5.2.11.1 Flood Immunity

The desired flood immunity is for a 1 in 10,000-year flood for portals and entrances.

The estimated design entrance levels, interpolated Q10,000 design flood levels and flood protection requirements are summarised in Table 5.3.

LOCATION	DESIGN ENTRANCE LEVEL (METRES)	ESTIMATED Q10,000 DESIGN FLOOD LEVEL RANGE (METRES)	FLOOD PROTECTION REQUIREMENTS
Southern rail portal	20.5	13.5–16	Above Q10,000 level Local runoff protection required
Boggo Road station	17.5 at PA Hospital underpass 30.0 at station entrance	13.5–16	Above Q10,000 level Local runoff protection required
Woolloongabba station	12–14	7–8	Above Q10,000 level Local runoff protection required
Albert Street station	4.3	9–10.5	Susceptible to flooding Flood mitigation measures required
Roma Street station	16	10–12	Above Q10,000 level Local runoff protection required
Northern rail portal	23	5.5–6.5	Above Q10,000 level Local runoff protection required

Table 5.3: Q10,000 Design Flood Levels



It is expected that each station entrance will be locally raised from the surrounding surface level and have suitably sized entrance roofs to minimise ingress to the stations from surface runoff and heavy localised rainfall events. This can be achieved with short DDA-compliant ramps.

Section 5.2.4 outlines consideration of flooding issues at Albert Street station.

#### 5.2.12 Enabling Works

Enabling works are those works which are outside the geographic scope of the project and are separate to the project approvals process. These works are typically time-critical in terms of their delivery for day one operations for the CRR Project.

##### 5.2.12.1 Southern Platform Faces

New platform faces will be provided to allow all-stopping afternoon contra-peak trains to run on the dual-gauge line and stop at these inner-suburban stations (Salisbury to Fairfield–Dutton Park is included in the CRR works due to its proximity to the southern portal).

##### 5.2.12.2 ETCS L2 Signalling Salisbury to Dutton Park

New signalling (extending ETCS L2) is required to provide bi-directional running capability on the suburban down line between Salisbury and Dutton Park. This will maintain the operational integrity of the network and accommodate the portal arrangements of the CRR tunnels.

### 5.3 Property Requirements

Project construction will require the acquisition of private property and the conversion of purpose and tenure of some Queensland Government freehold land and reserves.

The CRR alignment has endeavoured to minimise private property acquisitions by locating portals and most of the station structures within Queensland Government-owned land, including roads and rail corridors.

The CRR Project alignment reduces the length of the corridor proposed by the original CRR Project and significantly reduces the extent of private property impacts.

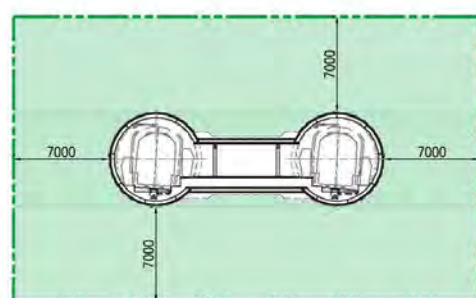
The majority of the private property impacts will entail acquiring a volumetric stratum from properties for the tunnels and underground stations and a surrounding perimeter of the supporting subterranean, as depicted in Figure 5.15.

The extent of the volumetric stratum will vary depending on factors including:

- tunnel and station proportions and structural design scope
- surrounding subterranean conditions
- proximity and nature of existing and approved structures
- contingency for design and final alignment flexibility during construction.

The volumetric stratum will be acquired from beneath residential areas of Woolloongabba and Kangaroo Point and part of commercial areas in Woolloongabba and in the CBD adjoining Albert and Roma Streets.





VOLUMETRIC REQUIREMENTS FOR BORED (TBM) TUNNELS  
MINED TUNNEL SIMILAR



VOLUMETRIC REQUIREMENTS FOR CAVERNS

Figure 5.15: Volumetric Requirements for Bored Tunnels and Caverns

Stations at Woolloongabba and Boggo Road will require excision of land and volumetric stratum from Queensland Government properties, including freehold sites, stratum, reserves, roads and other transport land tenures. Albert Street, Roma Street and Exhibition stations will impact some private freehold sites and volumetric stratum in roads and other transport land tenures.

In addition to permanent land requirements, during the construction phase the project will need to temporarily use some property for establishing safe work perimeters, vehicle movement and management, machinery and materials set down, spoil handling, site amenities and management. The period of temporary use will vary dependent on location and purposes.

Table 5.4 summarises the number and types of property acquisitions that will be required for the construction and operation of the project reference design.

PROPERTY AND ACQUISITION TYPE	NO. OF PROPERTIES
<b>SURFACE ACQUISITION</b>	
Residential	0
Commercial or industrial	15
Other (park, showground etc.)	14
Subtotal	29
<b>VOLUMETRIC ACQUISITION</b>	
Residential	141
Commercial or Industrial	38
Other (park, showground etc.)	16
Subtotal	195
<b>TOTAL</b>	<b>224</b>

Table 5.4: Property Acquisitions





## 5.4 Construction of the Reference Project

Major infrastructure projects need to balance the competing tensions of the construction program, project cost, construction-related impacts and staging opportunities and maximise benefits for government. These competing interests generate the construction objectives for the CRR Project as identified below:

- a reference scheme that is robust enough to be able to be constructed while remaining cost effective
- definable staging options that maintain flexibility for project delivery
- optimisation of land requirements to provide the most cost and time-efficient construction while minimising the need to acquire additional land
- minimal disruptions to existing road, rail and pedestrian traffic or businesses
- minimal construction risks and impacts, particularly those associated with potential third-party impacts and sensitive receptors
- protection of future development along the corridor.

The timeframe for the procurement and delivery of the Reference Project is described in Chapter 14: Implementation Plan.

### 5.4.1 Tunnels

It is anticipated that the majority of tunnelling operations will be supported from the Woolloongabba station construction worksite. This construction worksite offers the benefit of:

- being centrally located within the project
- sufficient area to support the logistics required for operating TBMs and simultaneous mined tunnel construction
- good direct access to the motorways
- a station that is relatively straightforward to construct.

Concentrating most of the tunnel works at Woolloongabba also has the benefit of creating materials handling and logistical support efficiencies. It will, however, also concentrate the majority of the spoil handling movements and material deliveries in this location, increasing construction traffic impacts around Woolloongabba.

The CRR Project will utilise two TBMs travelling north until they are retrieved at the northern portal location within the Exhibition Loop. The twin running tunnels between Boggo Road and Woolloongabba stations will be mined from Boggo Road and from Woolloongabba.

The TBMs will interface with underground stations at Albert Street and Roma Street. At these locations, it is anticipated that the TBMs will break through into the station caverns in an enlarged cavern opening and be 'walked' through the station box and cavern excavations. The TBMs will then be relaunched from cavern widening at the opposite end of the station.

TBM retrieval is currently proposed to occur within the Exhibition line at the northern portal.

A locally mined sump and pump well will be required at the tunnel low point under the Brisbane River.



### 5.4.2 Stations

Station excavation of the four underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street follows a similar construction methodology. The central access to these deep stations is constructed using mainly traditional bottom-up cut-and-cover construction methods. The extent of these cut-and-cover works will be used to accommodate the required vertical transport and back-of-house facilities such as mechanical and electrical plant. The cut-and-cover portion of the works dictates somewhat the layout of the vertical transportation.

It is expected that the temporary works for these cut-and-cover excavations will be very robust in order to prevent damage to existing high-rise buildings adjacent to the station sites. Before and during the station construction works, extensive monitoring systems for ground movements will be required.

It is anticipated that station caverns will be constructed using roadheaders with a temporary and permanent lining installed.

Station fit-out will occur after the tunnelling works have passed through and will include ventilation, mechanical and electrical fit-out, permanent civil works, architectural finishes and installing rail and rail systems. Commissioning of the station and rail systems will then follow.

### 5.4.3 Surface Works

Most of the proposed surface works at the southern and northern portals significantly interface and impact on the existing operational railway network, so the network will need to remain operational as these works are delivered. Delivery will need to be staged into manageable, safe and reliable increments acceptable to Queensland Rail. These works will be subject to the Queensland Rail's corridor safety requirements.

Where possible, surface rail works will be carried out offline, which may involve temporary slewing of tracks. Other works will typically be carried out during evenings or weekend possessions.

#### 5.4.3.1 Southern Portal

Much of the enabling works interface with the existing Queensland Rail operational network and therefore will involve complex brownfield urban rail construction. As with all brownfield urban rail works, detailed planning will be required to enable Queensland Rail to appropriately programme, in advance, the many weekend and night-time track possessions likely to be needed for the project.

The interface and interaction between the permanent CRR works and the existing rail track will thus be key to the construction of the southern portal. The two cut-and-cover portals will also need to be installed beneath the existing freight rail overpass, while keeping it operational.

The position of Boggo Road station has been determined to minimise impact on rail operations by avoiding, where possible, cut-and-cover works in the rail corridor at Park Road station. Minor platform closures will be required to allow for the construction of the new bridge and accesses.

The construction of the station across the Eastern Busway will need to be staged to allow for busway operations.



#### 5.4.3.2 Northern Portal and Exhibition Rail Loop

The northern portal will have to be constructed within a narrow corridor between the Exhibition and freight holding lines.

As the main construction works are close to the Grammar schools, providing access for materials and removal of soil will be confined. Slewing of the existing rail tracks will be required to construct the new works through to the Exhibition station.

#### 5.4.3.3 Mayne Yard

There will need to be extensive rail changes through Mayne Yard, from alignments through to buildings, controls and overheads. It is expected that Queensland Rail will do most of these works in advance of the CRR Project. However temporary track arrangements for stabling and other activities may still need to occur to suit operations and construction staging.

There is no construction over the operating electrified railway. Suitable protection works between the existing rails and the underpass will minimise the impact of construction on rail operations.

#### 5.4.4 Commissioning

As part of the completion of the new CRR Project, a program of testing will be undertaken over a commissioning phase. The commissioning phase will test all of the elements of the project individually, as coordinated systems and as an overall project-wide system. This system will work through the functionality, operation and integration with the existing systems and procedures of key stakeholders including Queensland Rail and the Queensland Fire and Emergency Services (QFES).

As this is a complicated new part of an existing railway network, there is a lot of new infrastructure, mechanical and electrical equipment, FLS systems and rail systems to be integrated into the existing network and tested for functionality. While factory acceptance testing of individual items and site acceptance testing of these items will always be required, there is need for a coordinated approach to testing the functionality and interoperability of new systems that are being introduced into the existing network. The commissioning phase will undertake this coordinated approach to testing, training and operation.

The commissioning phase will include the following:

- commissioning of the four new underground stations including their additional mechanical and electrical equipment required for standard operations, the FLS systems and their associated safety and communication systems
- testing and commissioning of the tunnel systems including the FLS systems and the tunnel ventilation, including smoke control
- commissioning of the surface works that connect the tunnel into the existing network
- commissioning of the rail systems including traction power, track work, signalling and communications
- training of drivers for the new rail environment and training of station staff working in underground stations.

The commissioning of the above items will require specific plans and testing regimes to be developed. It will also require coordination and liaison with affected stakeholders including Queensland Rail, QFES, Queensland Police and Queensland Ambulance Service to ensure that the functionality of the newly introduced systems can be successfully implemented.



# CHAPTER SIX

## PROJECT BENEFITS



## CHAPTER 6

### PROJECT BENEFITS

#### CHAPTER SUMMARY AND CONCLUSIONS:

- The CRR Project offers significant city-building, transport and economic benefits. It will help create vibrant, connected and liveable communities, provide a frame around which Brisbane can grow and improve public transport between homes, workplaces and social infrastructure across the region.
- The CRR Project will enable the growth of SEQ to be more sustainably managed by providing additional transport capacity into key employment growth areas, improving intercity connectivity and promoting urban renewal around new station precincts.
- It will allow rail network expansion projects to commence into emerging residential areas, connecting new residents with jobs, services and community facilities.
- The CRR Project will unlock more than 300 kilometres of highly accessible rail network by removing inner-city capacity constraints, significantly increasing the transport capacity of the existing SEQ rail network.
- The CRR Project will influence land-use patterns and increase infill development, acting as a catalyst for urban renewal around the new stations. By providing well-designed urban spaces within each station precinct, the CRR Project will enrich Brisbane's network of public spaces.
- The CRR Project will:
  - double public transport capacity across the river into Brisbane CBD from the south, providing ultimate capacity for 24 rail services per hour in each direction
  - increase daily public transport patronage in 2026 by 9,000 passengers and 23,000 passengers in 2036
  - reduce private vehicle kilometres travelled by 526,000km per day
  - provide significant relief in public transport crowding (a 24 per cent decrease in daily crowded hours in 2026 and 29 per cent in 2036)
  - provide accessibility and interchange opportunities, with a new CBD station and further interchange opportunities at Roma Street and the new southern stations at Woolloongabba and Boggo Road.



## 6.1 Purpose and Overview of this Chapter

The purpose of this chapter is to present the benefits expected from delivering the Reference Project. The projected benefits are based on analysis of the key problems identified in Chapter 3: Problem. This chapter demonstrates how the CRR Project will address identified problems.

This chapter outlines:

- Strategic benefits – those provided by the CRR Project at the strategic level, with a focus on enhancing economic growth and productivity by improving accessibility and connectivity between population and employment centres.
- Transport network benefits – including the CRR Project's impact on road congestion, future public transport demand and the freight task.
- Rail benefits – that will enable the rail network to more effectively perform its desired role including improved service frequency, journey times and costs, network reliability, resilience and reduced overcrowding.

The benefits of the CRR Project have been derived through detailed rail and transport modelling. This is supported by detailed operational modelling, which has been used to determine the optimal allocation of rail services on the network. The results of the transport modelling for the Reference Project, including any sensitivity testing, are presented in this chapter.

Table 6.1 summarises the relationship between the benefits sought by the CRR Project and those that can be expected. The CRR Project Benefits have been aligned with the objectives of the State Infrastructure Plan (SIP). Chapter 14: Implementation Plan outlines how these benefits will be maximised and monitored through the development of a benefits management plan.





BENEFITS SOUGHT	CRR BENEFITS EXPECTED
<p>Note: SIP objectives:</p> <ol style="list-style-type: none"> <li>1. improving prosperity and liveability</li> <li>2. infrastructure that leads and supports growth and productivity</li> <li>3. infrastructure that connects our communities and markets</li> <li>4. improving sustainability and resilience.</li> </ol>	
<p><b>MAINTAIN DESIRED LEVELS OF ECONOMIC GROWTH AND PRODUCTIVITY</b></p> <ul style="list-style-type: none"> <li>■ Connect people, places and businesses to the Brisbane CBD, the economic heart of the region.</li> <li>■ Provide new and improved opportunities to connect to markets and improve productivity.</li> <li>■ Provides new stations in the inner city's key employment hubs and urban growth areas, namely the southern CBD, Woolloongabba, Bowen Hills, Roma Street and Boggo Road. The southern CBD and Woolloongabba currently do not have passenger rail access.</li> </ul>	
<p><b>IMPROVE ACCESSIBILITY AND CONNECTIVITY BETWEEN POPULATION AND EMPLOYMENT CENTRES</b></p> <ul style="list-style-type: none"> <li>■ Increase accessibility to more areas of the CBD and inner city.</li> <li>■ Maximise agglomeration benefits at key growth locations in the CBD and inner city.</li> <li>■ Allow the rail network to expand to connect new communities e.g. Flagstone.</li> <li>■ Improve accessibility at local and regional levels.</li> <li>■ Improve access for people who are transport disadvantaged.</li> </ul>	
<ul style="list-style-type: none"> <li>■ Allows rail network expansion projects to commence with adequate service levels e.g. rail connection to the new population centre at Flagstone.</li> </ul> <p><i>Links to SIP objectives 2 and 3 (see table note)</i></p>	
<ul style="list-style-type: none"> <li>■ Increases the proportion of the population in metropolitan Brisbane within 30 minutes of employment to 20 per cent in 2026 with the CRR Project from 15.2 per cent in 2015 without the CRR Project.</li> <li>■ Doubles the rail capacity across the Brisbane River and through CBD from the south.</li> <li>■ Increases peak period public transport capacity through the CBD from 86 to ultimately 134 trains per hour.</li> </ul> <p><i>Links to SIP objectives 1, 2 and 3</i></p>	



BENEFITS SOUGHT		CRR BENEFITS EXPECTED
<b>OPPORTUNITY FOR CITY-BUILDING AND URBAN GROWTH</b>		
<ul style="list-style-type: none"> <li>▪ Provide the frame around which the city grows.</li> <li>▪ Facilitate and catalyse urban renewal opportunities at station precincts.</li> <li>▪ Improve the level of transport service, triggering further urban consolidation around rail corridors.</li> <li>▪ Provide new stations in key inner-city growth areas.</li> <li>▪ Avoid externalities such as emissions and congestion costs.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Provides new stations in the inner city's key employment hubs and urban growth areas, namely the southern CBD, Woolloongabba, Bowen Hills, Roma Street and Boggo Road. The southern CBD and Woolloongabba currently do not have passenger rail access.</li> <li>▪ Reduces private vehicle kilometres travelled by 526,000km per day by 2036, considerably reducing greenhouse gas emissions (carbon dioxide) compared to 'without' the CRR Project.</li> </ul> <p><i>Links to SIP objectives 1, 2, 3 and 4</i></p>
<b>REDUCE CAR DEPENDENCY AND ROAD CONGESTION</b>		
<ul style="list-style-type: none"> <li>▪ Reduce road congestion and associated costs.</li> <li>▪ Enable more efficient use of scarce road space, allowing for greater business travel and good access for road-based public transport and freight.</li> <li>▪ Improve access to the inner city, the location of high-productivity jobs, for more community members.</li> <li>▪ Reduce reliance on private vehicle access to the CBD.</li> <li>▪ Reduce journey times and improve accessibility for a larger portion of the resident population.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Reduces the number of private vehicles entering the CBD in the morning peak by 1,300.</li> <li>▪ Increases the mode share of public transport in the region from 6.8 per cent currently to 11.2 per cent in 2036.</li> <li>▪ Avoids costs to the economy of \$240 million annually in 2036 due to road congestion, compared to 'without' the CRR Project.</li> </ul> <p><i>Links to SIP objectives 1 and 3</i></p>



BENEFITS SOUGHT		CRR BENEFITS EXPECTED
<b>CATER FOR PUBLIC TRANSPORT DEMAND</b>		
<ul style="list-style-type: none"> <li>Provide a 'step change' in public transport capacity.</li> <li>Meet forecast demand.</li> <li>Enable connections to growth areas.</li> <li>Increase service frequency.</li> <li>Reduce crowding.</li> <li>Increase incremental fare revenue.</li> <li>Achieve a mode shift to rail.</li> <li>Provide better interchanges with bus network.</li> <li>Allow bus network operational changes (feed to rail) and more efficient use of the bus network.</li> </ul>		<ul style="list-style-type: none"> <li>Doubles the rail capacity across the Brisbane River and through CBD, from the south.</li> <li>Allows for a doubling of rail demand by 2026 and almost a tripling of demand by 2036 to be carried on the rail network.</li> <li>Results in higher public transport use across the region with an increase of 23,000 trips per day in 2036 compared to 'without' the CRR Project.</li> <li>Reduces overcrowded conditions by 14,000 hours per day in 2036 on the rail network or 29 per cent.</li> </ul> <p><i>Links to SIP objectives 1, 3 and 4</i></p>
<b>IMPROVE SUPPLY CHAINS</b>		
<ul style="list-style-type: none"> <li>Improve connectivity to markets by both road and rail freight.</li> <li>Improve leverage of rail freight opportunities.</li> </ul>		<ul style="list-style-type: none"> <li>Maintains sufficient rail freight paths across the network.</li> <li>Enables faster travel speeds and trip times for commercial vehicles on the road network.</li> </ul> <p><i>Links to SIP objective 3</i></p>
<b>ENSURE RAIL PERFORMS DESIRED ROLE</b>		
<ul style="list-style-type: none"> <li>Ensure capacity to meet long-term demand forecasts.</li> <li>Unlock SEQ rail network capacity, enabling the network to expand and meet demand.</li> <li>Increase service frequency.</li> <li>Improve accessibility.</li> <li>Reduce journey times.</li> <li>Increase service reliability.</li> </ul>		<ul style="list-style-type: none"> <li>Increases the share of journeys (as a proportion of all trips, including those made by car) made by rail to the CBD from 46.6 per cent without the CRR Project to 50.5 per cent with the CRR Project in 2036.</li> <li>Enables up to 24 trains per hour to move through the inner city, in each direction.</li> <li>Enables a train to depart Boggo Road/Park Road every minute by 2036.</li> </ul> <p><i>Links to SIP objectives 2, 3 and 4</i></p>



BENEFITS SOUGHT		CRR BENEFITS EXPECTED
<b>INCREASE SERVICE FREQUENCY</b>		
<ul style="list-style-type: none"> <li>▪ Increase the frequency of services.</li> <li>▪ Enable a mode shift to rail.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Enables 102 services accessing the CBD in the morning peak hour in 2026 with an ultimate capacity of 134 services.</li> </ul> <p><i>Links to SIP objectives 2, 3 and 4</i></p>
<b>COMPETITIVE JOURNEY TIMES AND COST</b>		
<ul style="list-style-type: none"> <li>▪ Reduce travel time, across all transport modes.</li> <li>▪ Reduce wait times.</li> <li>▪ Enable a mode shift to rail.</li> <li>▪ Provide better interchange opportunities with the bus network.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Reduces journey times across the network to the southern CBD.</li> <li>▪ Reduces wait times through more frequent services.</li> </ul> <p><i>Links to SIP objectives 3 and 4</i></p>
<b>IMPROVE NETWORK RELIABILITY AND RESILIENCE</b>		
<ul style="list-style-type: none"> <li>▪ Provide an alternative route and improved resilience in the core rail network.</li> <li>▪ Reduce downtime due to incidents.</li> <li>▪ Increase customer confidence in the rail system.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Improves on-time running of trains.</li> <li>▪ Provides a second corridor through the inner city, minimising disruption during incidents.</li> </ul> <p><i>Links to SIP objective 4</i></p>
<b>REDUCE OVERCROWDING</b>		
<ul style="list-style-type: none"> <li>▪ Reduce crowding.</li> <li>▪ Make the customer experience more comfortable.</li> <li>▪ Increase service reliability.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Reduces the percentage of commuters standing on scheduled Gold Coast services to less than 25 per cent and those standing longer than 20 minutes to less than five per cent in 2036.</li> </ul> <p><i>Links to SIP objectives 1 and 2</i></p>

Table 6.1: Summary of CRR Benefits Expected



## 6.2 Strategic Benefits

The Australian Government, in the State of Australian Cities 2014–15 report, recognises that Australia's cities are important gateways to the global economy. Major cities generate much of Australia's gross domestic product and contain most of the nation's key economic infrastructure, which supports industries across the country. Importantly, the report highlights that cities also host most of Australia's jobs. In this way, a city's transport system has an important role to play in supporting productivity improvements and enabling the city to deliver economic benefits to the national economy.

The CRR Project will position Brisbane and SEQ for a more productive and competitive future. Specifically, the CRR Project will unlock more than 300 kilometres of highly accessible rail network by removing inner-city capacity constraints and significantly increase the transport capacity of the existing SEQ rail network. The CRR Project will also enable the rail network to expand into emerging residential areas by increasing the capacity of the inner-city network, connecting new residents with jobs, services and community facilities.

Investment in the CRR Project will also facilitate city-shaping outcomes consistent with SEQ's strategic planning policies. These are outlined in the State Infrastructure Plan (SIP), which identifies the need for public transport solutions to support SEQ's strong growth. Shaping SEQ also articulates a vision for more compact communities. It supports higher residential densities and clustering of employment and other activities along existing and planned public transport corridors.

Supporting this, Connecting SEQ 2031 specifically recognises the importance of public transport in facilitating urban infill targets within regional activity centres and along priority transit corridors. The CRR Project offers a unique opportunity to realise the collective policy vision of compact communities in close proximity to employment, education and recreational opportunities.

### 6.2.1 Economic Growth and Productivity

At a strategic level, the CRR Project will support economic growth and productivity through improved accessibility and connectivity and Brisbane's city-building ambitions by enabling infill development and urban renewal. These outcomes will facilitate inner-city employment growth, as well as improved health, education and lifestyle opportunities across the region.

Transport infrastructure shapes cities. Infrastructure investments have the power to influence a city's size, shape and employment patterns and determine its attractiveness as a place to live, work, visit and do business.

#### 6.2.1.1 Improved Accessibility

Shaping SEQ identifies a network of regional activity centres suitable for concentrated businesses, services and facilities for employment, research and education, as well as higher density residential development serving a regional population. The presence of well-functioning centres will assist in achieving a high level of self-containment of each subregion, reducing the need to travel across the region for work, education, shopping and entertainment.

The CRR Project will support the development of regional areas by enabling the rail network to connect principal regional activity centres to Brisbane's CBD. This will allow these centres to become vital nodes in the city's economic network.



The CRR Project will significantly improve:

- access to high-growth employment areas
- linkages to major planned renewal areas and education precincts
- public transport capacity to the city's premier sporting and events facilities
- direct access to each of the major public and private health facilities in the inner city.

Without the CRR Project, the ability to connect principal regional activity centres to Brisbane's CBD via high-quality transit links will be compromised. Inevitably, this will reduce the activity centre's ability to reach a critical mass and lead to more dispersed regional activities and a more car-dependent region.

Accessibility modelling indicates that the proportion of the population in metropolitan Brisbane within 30 minutes of employment would increase to 20 per cent in 2026 with the CRR Project compared to 15.2 per cent in 2015 without the CRR Project.

### 6.2.1.2 Inner-City Connectivity

Transport and accessibility are consistently identified as key factors determining the economic performance, attractiveness and liveability of a city or region. A critical opportunity exists to boost the competitiveness of Brisbane and SEQ through targeted investment in core infrastructure, particularly public transport, to improve the city's connectivity. The State of Australian Cities 2014–15 report (DIRD) outlines how large-scale investments in Melbourne's transport have impacted long-term economic and land-use outcomes. For example, Melbourne's City Loop rail project (completed in 1985) added an estimated \$10.4 billion to the Melbourne economy in 2011, largely through clustering an estimated additional 74,000 jobs in central Melbourne. The project also facilitated significant development at Southbank and in Docklands.

The CRR Project will establish rapid, high-frequency connections between some of Brisbane's primary inner-city destinations and activity areas. A new Albert Street station will support the ongoing development of the CBD and the emergence of a vibrant mixed-use residential, employment and retail precinct adjoining the City Botanic Gardens. It also provides direct access to the financial district, the new Queen's Wharf Brisbane integrated resort development, the government precinct and Queensland University of Technology (QUT) at Gardens Point.

New CRR platforms at Roma Street will support continued development of commercial and mixed-use activities in the city's north quarter and preserve long-term city expansion opportunities associated with this precinct.

A new station at Woolloongabba will support the planned renewal of Woolloongabba Central, particularly the Woolloongabba priority development area (PDA) and Kangaroo Point South.

The new station at Boggo Road will support the continued development of the Boggo Road Urban Village, planned growth at Buranda, and improved access to The University of Queensland (UQ) campus and the Princess Alexandra Hospital and associated health, medical and eco-science activities.

### 6.2.1.3 Agglomeration Benefits

The emerging global economy will rely more heavily on a talented workforce involved in diverse industries. The quality of people that a city, region, state or nation can attract is fundamental to its economic performance. Evidence indicates that while job opportunities remain an important driver, more people are choosing to live and work based on lifestyle and quality-of-life factors.





The State of Australian Cities 2014–15 report states that labour mobility and voluntary migration for economic gain are a part of agglomeration, where educated workers gain from being in close proximity to others, so human capital flows to where it is abundant, not where it is scarce. This agglomeration process contributes to the boosting of the productivity of cities. The report also identifies that city centres are increasingly becoming the single largest location of employment.

The CRR Project will directly support inner-city growth projections by providing additional transport capacity into key employment growth areas.

### 6.2.1.4 Connecting New Communities

The relationship between mass transit and land use is well documented. A number of studies have concluded that the existence or introduction of rail is a significant driver of development activity and opportunities to manage population growth.

The increased transit amenity provided by heavy rail results in a number of outcomes including:

- the probability that access to mass transit is likely to encourage individuals and families to relocate to areas where accessibility to mass transit is improved
- the increased likelihood that workers will commute to work via rail where they reside in close proximity to railway stations
- high-density developments located in or around business districts, or close to mass transit stations, that can support a higher population of workers located closer to their workplaces.

International research has found that access to mass transit can lead or follow land use; however, in all cases, improving land-use outcomes must follow some form of mass transit network. If the existing mass transit network is insufficient to support higher density land uses, then higher density outcomes are unlikely to be achieved.

The CRR Project will enhance the existing rail network to the point where it can influence land-use patterns and development activity in an efficient and sustainable manner. The cycle of transport supply and accessibility will encourage individuals and families to reside near railway stations, necessitating development activity that supports higher density living.

Without the CRR Project, the transit capacity provided by the rail network will be constrained. This, in turn, will limit the ability for the passenger rail network to support the urban development densities envisaged in Shaping SEQ. Pressure to expand the urban footprint will increase, leading to greater levels of urban sprawl and related negative social, environmental and economic impacts.

Achieving the outcomes outlined in Shaping SEQ will be supported by targeted investment in the transport network, which will lead the pattern and pace of development to achieve the best land-use outcomes. The CRR Project will help realise SEQ's growth management aims by encouraging infill development in areas close to transport corridors, facilitating sustainable, compact settlement patterns and planned residential growth in key locations.

The planned development of a number of strategic regional development areas, in particular, Caloundra South, Flagstone, Fitzgibbon, Coomera and Yarrabilba relies on good transport accessibility. Each of these locations lies within the northern and southern catchments of the rail network, which will be directly supported by the CRR Project.



Without the CRR Project, the ability to connect new towns and principal activity centres by high-quality transit will be compromised. The result will be car-dependent communities, more congestion and greater growth for road space.

### 6.3 Opportunities for City Building and Urban Growth

The CRR Project is a once-in-a-generation, city-changing project. It will position Brisbane and the broader region for a more sustainable and competitive future through support of a more compact urban form, a vibrant inner-city centre and a connected region.

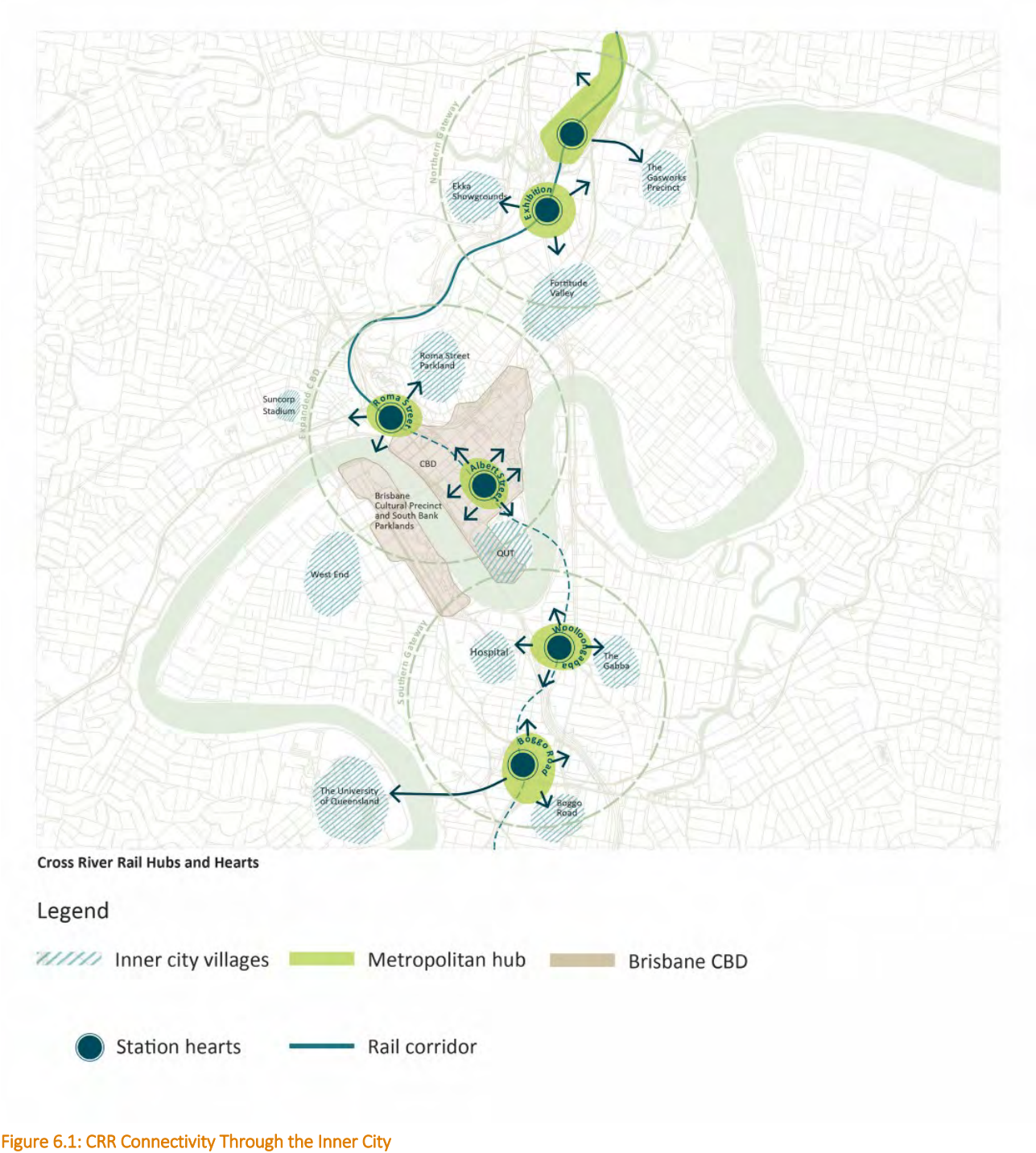
The CRR Project will influence land-use patterns and increase infill development, enable inner-city employment expansion, connect regional centres, better link inner-city areas and be a catalyst for urban renewal around the new stations. CRR will become the framework around which the city can grow.

Each CRR station sits at the centre of a precinct that is undergoing or will undergo significant redevelopment over the next 20 years. Redevelopment of station precincts, combined with improved local public transport, will also revitalise surrounding local neighbourhoods, generating new opportunities for redevelopment and renewal.

Station and precinct-specific redevelopment opportunities identified include the following:

- Exhibition station – catalysing the next redevelopment phase of the 108-hectare, high-density commercial and residential Bowen Hills PDA, including the \$2.9 billion Brisbane Showgrounds Regeneration Project.
- Roma Street station – enabling high-density commercial and residential development.
- Albert Street station – enabling high-density commercial and residential development with supporting retail on land acquired for the station construction.
- Woolloongabba station – enabling high-density commercial and residential development on land used for the construction of the tunnel and underground station, and supporting broader redevelopment of the Woolloongabba PDA.
- Boggo Road station – supporting development of the Boggo Road Urban Village and the broader precinct to achieve outcomes consistent with BCC's Draft Dutton Park–Fairfield Neighbourhood Plan Strategy and government's Brisbane Knowledge Corridor vision.





Each station precinct is discussed in the following sections, with detail provided on the vision for its future development, city-building outcomes anticipated, the broader planning context and likely development opportunities.

CRR station precincts will become subtropical urban places, with station structures set in green and public spaces activated by a range of uses and programs. Featuring a small footprint, stations will be made of robust, repeatable elements to create legible branding and wayfinding for the network. Station buildings will contribute shade while allowing natural daylight into the concourse level.

By providing well-designed urban spaces within each station precinct, the CRR Project will enrich Brisbane's network of public spaces. Cool and shaded, these will become places for people to interact, play, eat and relax within the city environment. Public spaces can be supported by active street frontages, outdoor dining, markets, performance space and multi-functional green spaces.

Guiding design principles for stations include:

- Magnetic people places: Stations will contribute to value uplift and precinct regeneration while improving connections for people. Uses around station edges, and movement into and out of the station, will activate and enliven stations and the surrounding precinct.
- Subtropical and green: Stations will contribute to the city's subtropical identity through the creation of green, vegetated urban spaces and station entries framed by nature.
- Embedded within the place: Stations will be embedded in the public space with legible branding and wayfinding for the network.



### 6.3.1 Northern Gateway Station Precincts

#### 6.3.1.1 Exhibition Station

##### Local Context

Exhibition station is located in the heart of a major redevelopment area, the Bowen Hills PDA. Just three kilometres from the CBD, this 108-hectare parcel of land has been identified for specific accelerated development with a focus on economic growth. The station is located close to major health services and sporting and entertainment venues, with direct rail access to the Brisbane Airport. The Royal Brisbane and Women's Hospital (RBWH) lies west of the Bowen Hills PDA, while landmark places within the PDA include the Brisbane Showgrounds, Old Museum and Perry Park.

The existing Exhibition station primarily serves the Royal Queensland Show (Ekka), Queensland's largest event, held annually at the Brisbane Showgrounds.

A fully operational station would promote more rapid market absorption of planned development and support greater commercial yields, particularly within the Brisbane Showgrounds Regeneration Project area. New high-density developments, in various stages of completion, are already taking advantage of this potential.

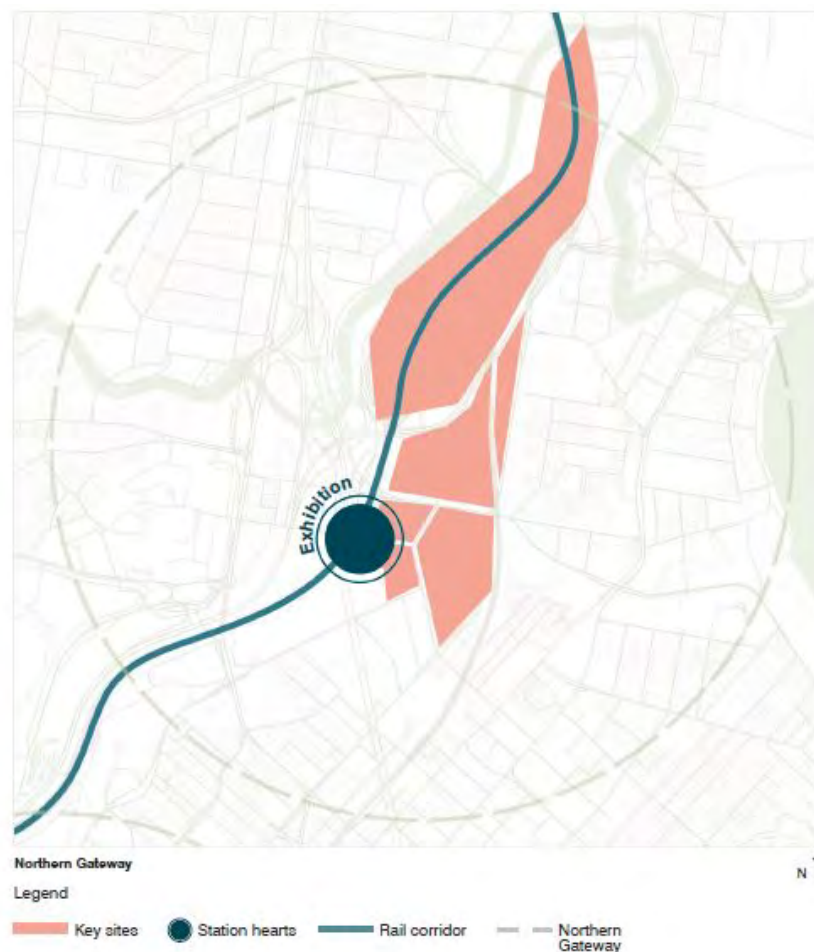


Figure 6.2: Location of Exhibition Station





### Planning Context

The Bowen Hills PDA Development Scheme outlines zoning for the Exhibition station precinct. Identified zoning and land uses surrounding the precinct include mixed-use development comprising a range of commercial, retail and residential uses complementary to the RBWH and Brisbane Showgrounds precincts.

The Bowen Hills PDA Development Scheme's vision is to rejuvenate and activate the Bowen Hills area, establishing it as the northern gateway to the Brisbane CBD. Surrounded by all northern train lines and numerous roads connecting to the city centre, the Bowen Hills PDA has potential to see significant acceleration in both development volume and density.

The CRR Project will complement this vision by improving the area's accessibility and amenity. The development scheme notes that significant demand exists for high-density residential development and commercial office floor space outside the city centre. The CRR Project would accelerate the provision of both, leading to significant increase in density across the area. The development scheme supports this through a number of 'residential very high intensity' and 'residential high intensity' zones located near the proposed CRR station location.

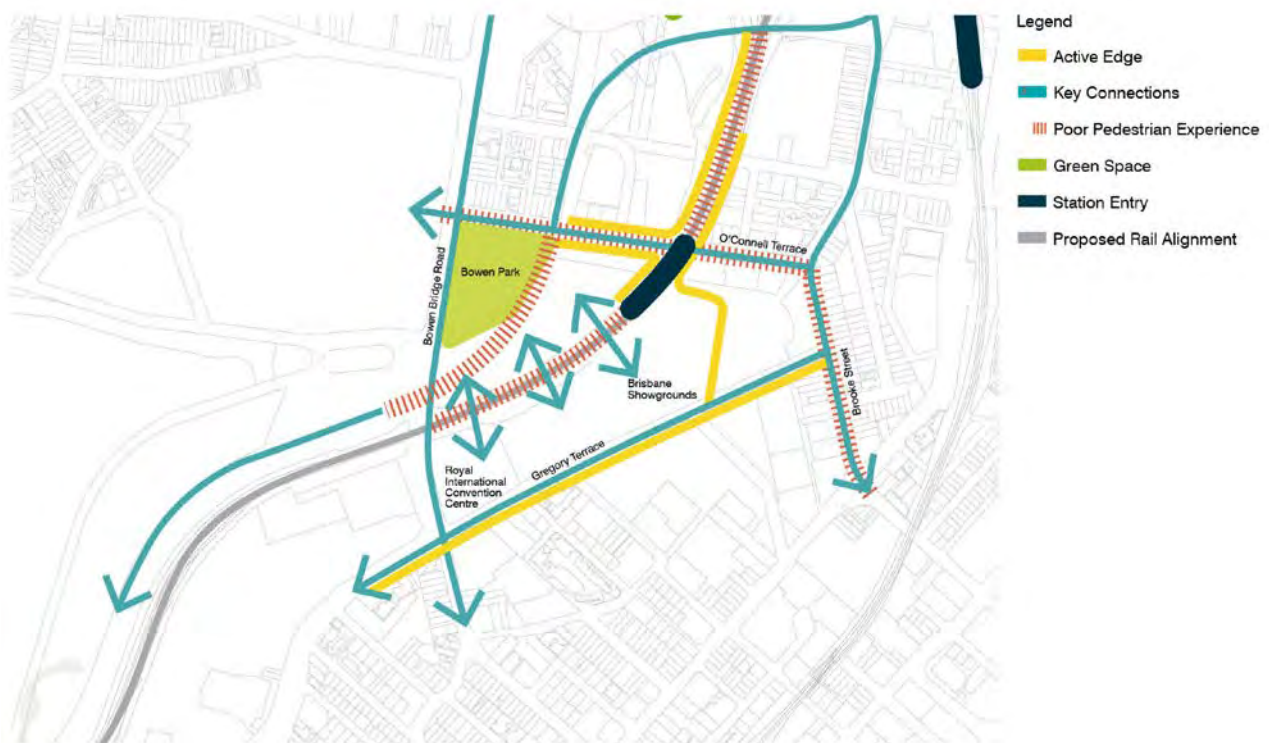


Figure 6.3: Exhibition Station Precinct Context





### Precinct Vision

Exhibition station will become a busy transit hub and a core element of Bowen Hills' revitalised urban fabric.

Activated street frontages, convenient links to station entrances and new urban spaces around the station will support the safe movement of people to the precinct. Precinct design incorporating wide circulation spaces will provide seamless transition to and from stations to enhance pedestrian flows and improve commuter convenience.

The new station, with its high-quality public realm and fast, frequent rail services, will set the foundation for the emergence of a true transit-oriented, mixed-use 'urban village', catalysing planned development for the suburb.

### City-Building Outcomes

Development of Exhibition station will:

- support the redevelopment of the Brisbane Showgrounds and broader Bowen Hills PDA
- preserve the planned intent for all passenger lines to pass through the Bowen Hills area
- facilitate the ongoing growth and development of a major health and knowledge precinct focused on the RBWH
- reinforce the role and function of O'Connell Terrace as an important people street and inner-city east–west connection
- provide a critical missing link in the northern cycle network
- reinforce the major public pedestrian route through the Brisbane Showgrounds from Fortitude Valley.

### Station Development Opportunities

The Exhibition station will support, facilitate and catalyse a range of development including:

- mixed-use development
- commercial development (employment, small business and service industry)
- high-density residential development (long and short-term accommodation)
- entertainment (supporting the existing Brisbane Showground and Ballymore Stadium events)
- medium-density residential development.



### 6.3.2 CBD Expansion Area Precincts

The CRR Project facilitates the expansion of the CBD by supporting the redevelopment of both Roma and Albert Street station precincts.

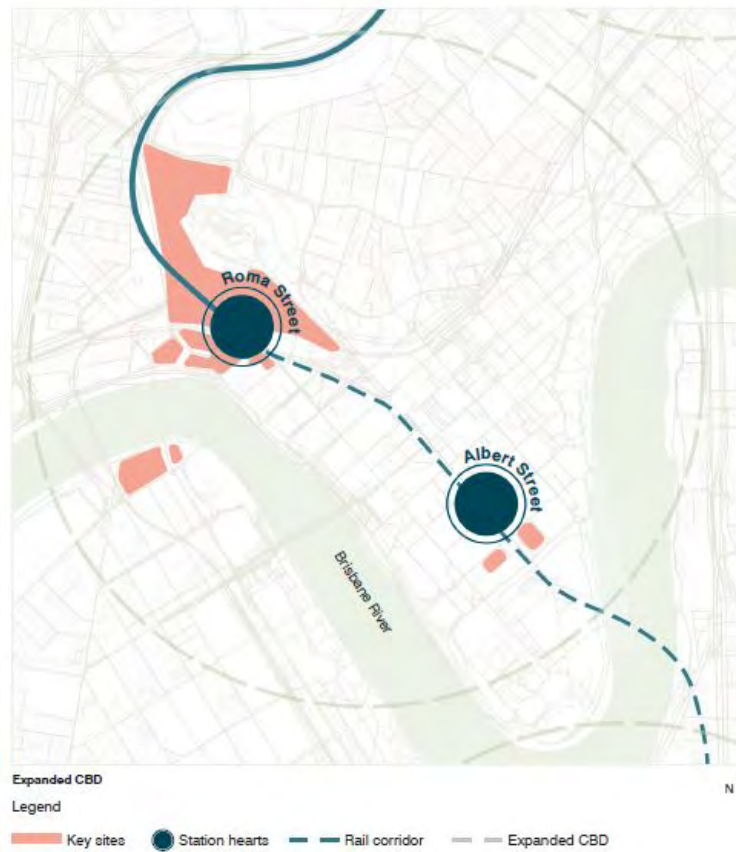


Figure 6.4: Location of CBD Stations

### 6.3.2.1 Roma Street

#### Local Context

A major CBD street, Roma Street is located on the north-western edge of the city centre. Roma Street also hosts an iconic transit hub, with suburban bus and rail connections at the existing Roma Street station adjoining wider regional bus and rail links at the Brisbane Transit Centre (BTC). This premier transport interchange is the city's primary gateway for long-distance tourists and the everyday gateway for residents and workers.

Surrounded by high-density residential and commercial development, Roma Street is also a focal point for legal and judicial activity, with the presence of the supreme, district and magistrate's courts and the Queensland Police headquarters. An entertainment precinct borders the precinct's north-west perimeter, with destinations such as The Barracks and Caxton Street which attract thousands of people particularly before and after events held at nearby Suncorp Stadium.

A unique aspect of this station precinct is the adjacent open space, Roma Street Parklands, the CBD's second largest green space. Roma Street Parklands provides important pedestrian and cycle links from Roma Street to Spring Hill and nearby landmarks such as the Normanby Fiveways and Tower Mill.

#### Planning Context

The Brisbane City Plan 2014 (City Plan) details the planning outcomes and framework for the Roma Street station site. More detail is provided in the City Centre Neighbourhood Plan. The planning framework supports high-density mixed-use development across Brisbane's CBD, with a development height limit of 274 metres, as set by the Civil Aviation Safety Authority (CASA). Land-use zoning within the Roma Street station precinct provides for the largest and most diverse range of uses, consistent with existing development in Brisbane's CBD across residential, retail and commercial uses.

The Brisbane City Centre Master Plan 2014 (BCCMP) outlines a number of transformative projects for Brisbane's CBD, referencing the Roma Street precinct as the city's premier transport interchange. The BCCMP outlines BCC's vision for Roma Street station to become an attractive gateway marking the western entry into the city centre. It also highlights its role in connecting the city's green spaces via a pedestrianised Albert Street, with a high level of integration between development and the public realm.

The CRR Project is consistent with current planning frameworks and desired outcomes. As a result, the CRR Project is not expected to solely drive increased density within the precinct. Potential development opportunities across the precinct would largely be driven by precedent development in the Brisbane CBD, as well as identified market demand. Due to the current planning use and density allowances, development around the precinct can be accommodated without changing the planning schemes.

It is noted that the CRR Project may positively affect development opportunities in the city's inner-west. The Draft City West Neighbourhood Plan identifies a level of uplift in density allowances on some sites located within proximity to the Roma Street station.





Figure 6.5: Roma Street Station Precinct Context

### Precinct Vision

The Roma Street station precinct will become the western gateway to the CBD and a new transit portal to the city centre. The CRR Project will unlock the potential of the BTC and other key development parcels to create an enlivened, mixed-use precinct, helping realise BCC's vision for a grand transit interchange. Roma Street itself will be enhanced as a subtropical boulevard that celebrates arrival into the city centre with a distinctly Brisbane welcome.

Anchoring the view corridor along George Street, Roma Street station will become a landmark public space – a new 'outdoor urban room' of human scale. Designed for Brisbane's subtropical climate, this space will mix gardens with cafes, retail, event spaces and possible new arts and cultural facilities. Redevelopment of the station precinct offers the potential to connect inner-western suburbs to city parks, with new pedestrian bridges and, potentially, new development spanning transport infrastructure to the Roma Street Parklands, Memorial Park and the city centre itself.

Together, the CRR Project and Roma Street station redevelopment will catalyse future growth in the city's western sector, attracting investment, inspiring renewal and delivering new connections to the city centre and surrounding suburbs. Redevelopment will also support BCC's plans to expand Roma Street Parklands into an impressive, integrated parkland connected to other green spaces on the city's ridgeline.

### City-Building Outcomes

Development of Roma Street station will:

- establish a regional transport interchange for all local, city-wide, regional and interstate public transport
- reinforce Albert Street's transformation into a green spine connecting Roma Street Parklands and the City Botanic Gardens



- reinforce the western gateway to the CBD and improve the quality of the public realm
- reconnect the Brisbane River to Spring Hill
- protect long-term renewal and CBD-expansion opportunities associated with the Roma Street rail corridor and station and BTC.

### Station Development Opportunities

Roma Street station development will support, facilitate and catalyse a range of development and uses include:

- entertainment and recreation precinct
- mixed-use development
- commercial (employment, small business and service industry)
- high-density residential (long and short-term accommodation).



### 6.3.2.2 Albert Street

#### Local Context

The southern section of Albert Street lies within the heart of the CBD, running north-west from the City Botanic Gardens to the Queen Street Mall. Albert Street is an important pedestrian link, connecting the Queen Street Mall, traditionally the retail hub of the CBD, and major central transport services to the lesser serviced southern CBD. Albert Street is also located close to major employment areas such as the Eagle Street commercial zone, new riverside development such as Queen's Wharf Brisbane, administrative services concentrated at nearby lower George Street and QUT's Gardens Point campus.

Albert Street's southern end, near the City Botanic Gardens, has traditionally been a CBD-edge precinct with secondary uses and lower-scale buildings. Recent development activity and current applications indicate a renewed interest in this area resulting in more intensive development and a more active mix of uses.

BCC's vision is to transform Albert Street into a subtropical corridor linking Roma Street Parklands to the City Botanic Gardens.

#### Planning Context

City Plan details the planning outcomes and framework for the Albert Street station site. More detail is provided in the City Centre Neighbourhood Plan. The planning framework supports high-density mixed-use development across Brisbane's CBD, with a development height limit of 274 metres, as set by CASA. Land-use zoning within the Albert Street station precinct provides for the largest and most diverse range of uses, consistent with existing development in Brisbane's CBD across residential, retail and commercial uses.

The BCCMP outlines a number of transformative projects for Brisbane CBD, with specific reference made to the pedestrianisation of Albert Street. This is further covered in BCC's Albert Street Vision, which details the integration of public space with development, including CRR station access portals, between Roma Street Parklands and the City Botanic Gardens.

The CRR Project is consistent with current planning frameworks and desired outcomes. As a result, the CRR Project is not expected to solely drive increased density within the precinct. Potential development opportunities across the precinct would largely be driven by precedent development in the Brisbane CBD, as well as identified market demand. Due to the current planning use and density allowances, development around the precinct can be accommodated without changing the planning schemes.







Figure 6.6: Albert Street Station Precinct Context

### Precinct Vision

The Albert Street station will become a truly ‘central’ station that enlivens the southern CBD and assists in Albert Street’s transformation into a subtropical boulevard. Generous public spaces will create welcoming meeting places and allow the easy flow of patrons and pedestrians onto Albert Street.

Living design elements will enrich Brisbane’s green spine down Albert Street, with vegetated ‘green collars’ around the station doubling as performance and dining spaces. Trees planted within multiple public spaces within the station precinct will frame long vistas down the street. Design elements will also improve east-west connections between Queen’s Wharf Brisbane and Eagle Street.

The station’s location will optimise the station’s catchment by serving areas with a recognised deficit in public transport and an identified cluster of renewal and future development sites. Together, the CRR Project and initiatives to open up Albert Street through its partial closure to road traffic will catalyse future commercial, residential and retail growth in the southern CBD, alleviating growing pressure on the Queen Street Mall and delivering new connections to primary CBD destinations.

### City-Building Outcomes

Development of Albert Street station will:

- establish a truly central station that addresses public transport shortages in the southern CBD
- promote Albert Street as a premier people street and support the street’s transformation into a green spine connecting Roma Street Parklands and the City Botanic Gardens
- create a new public space at the heart of the southern CBD
- promote a more legible structure for the CBD, with improved pedestrian connections
- facilitate the ongoing renewal and intensification of the CBD and opportunity sites.



### Station Development Opportunities

Albert Street station development will increase the commercial and residential density directly adjacent to the station while supporting, facilitating and catalysing a range of development and uses including:

- mixed-use development
- commercial development (employment, small business and service industry)
- high-density residential development (long and short-term accommodation)
- green links between Roma Street Parkland and the Botanic gardens.

#### 6.3.3 The Southern Station Precincts

The two southern stations, Woolloongabba and Boggo Road, will activate residential redevelopment around the stations while strengthening Brisbane's 'knowledge corridor' by linking regionally significant health and education precincts.



Figure 6.7: Location of Southern Stations



### 6.3.3.1 Woolloongabba Station

#### Local Context

Just one kilometre south of Brisbane's CBD, Woolloongabba has been identified as a key location for city growth and a major near-city employment and mixed-use precinct in the future.

Woolloongabba station sits adjacent to one of Brisbane's premier sporting arenas, the Brisbane Cricket Ground, commonly known as The Gabba. Attracting large volumes of spectators all year round, this venue requires a station precinct able to cater for times of high movement and activity, while also being adaptable to moderate and peak-hour commuter everyday use. The station is also located near the Mater Hospital precinct.

The station precinct already has access to high-frequency public transport including the South East Busway. This, coupled with its proximity to the CBD, gives it great potential for an increased uplift in residential and mixed-use development.

#### Planning Context

The Woolloongabba PDA Development Scheme outlines the desired planning and density outcomes for the Woolloongabba CRR station precinct. Land use under the development scheme across the precinct supports the broader health uses in the Mater Hospital precinct and entertainment uses at The Gabba.

The PDA's vision is for an urban transit-oriented precinct incorporating residential, retail, commercial and recreation facilities supported by transit amenity. The CRR Project will support the achievement of this vision by greatly improving accessibility.

The development scheme identifies a range of preferred land uses including primarily retail, community and cultural uses at ground level, with supporting residential and commercial office space located above, in most areas. This is consistent with the intent of the CRR Project.

Significant opportunities exist across the entire site for high-density staged development with mixed uses, where previously zoning would have allowed development of this type. As a result of current planning and density allowances, the CRR Project is not expected to drive a change in land use or density, however, it will support development in the Woolloongabba PDA.



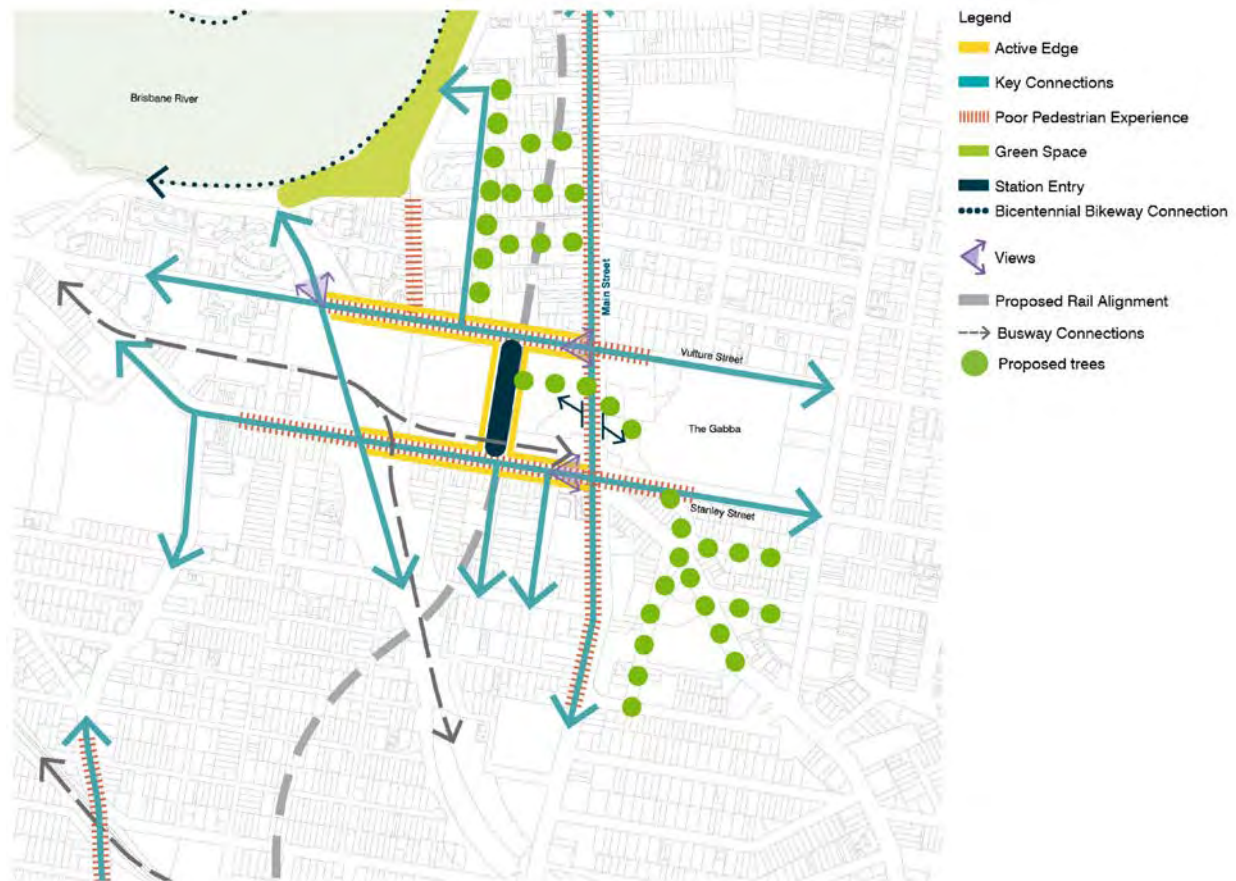


Figure 6.8: Woolloongabba Station Precinct Context

### Precinct Vision

The Woolloongabba station precinct will be transformed from an under-utilised inner-urban site into a mixed-use hub, coupling commercial, residential and retail development with world-class public transport. Adding a new CRR station to the existing busway station will give the site outstanding access to public transport, enabling it to become a major intermodal transit interchange.

The station's location near The Gabba creates the opportunity for a nationally significant sport and events precinct to emerge. Enhanced pedestrian connections along all major road frontages – including along the northern side of Stanley Street where people cannot currently walk – will create an attractive link between The Gabba and Mater Hospital precinct and provide direct access to the main plaza and proposed public transport interchange. Opportunity exists for Stanley Street to become important pedestrian and cycle link between the renewal and intensification areas of Woolloongabba Central and Kangaroo Point South and South Bank, South Brisbane and the CBD.

The station precinct itself will become a multi-purpose public realm. During game days at The Gabba, generous and central public realm circulation spaces will enable large volumes of patrons to move through the space while providing venues for activities such as market stalls. Outside of game day, the highly activated public realm, potentially containing a mix of retail, cafes, and restaurants, will cater for the local residents and commuters. This activation will enable the station to integrate within its local context and build upon the finer grain commercial uses along Stanley Street and Ipswich and Logan roads. This will prioritise Stanley Street as a high-street retail precinct and draw patronage through the station precinct.



### City-Building Outcomes

Development of the Woolloongabba station will:

- catalyse redevelopment of Woolloongabba PDA, Woolloongabba Central and Kangaroo Point South
- establish Woolloongabba as a key southern intermodal interchange
- support the emergence of a vibrant sports and events precinct
- enable improved pedestrian access and walkability
- reinstate the function of Stanley Street as an important street and reinforce it as a major connection from the southern suburbs to the CBD.

As a result of the increased in high-capacity public transport, transit amenity in the local area will increase substantially (see Chapter 13: Value Creation and Sharing Assessment for more detail).

### Station Development Opportunities

Woolloongabba station development will increase in the commercial and residential density directly adjacent to the station while supporting and catalysing a range of development and uses including:

- mixed-use development
- commercial development (employment, small business and service industry)
- high-density residential development (long and short-term accommodation)
- high-quality and high-frequency transit interchange to significant cultural and sporting events.

#### 6.3.3.2 Boggo Road Station

##### Local Context

Three kilometres south of Brisbane's CBD, the Boggo Road area contains a mix of residential, commercial and light industrial uses. Boggo Road station is located in the heart of Brisbane's 'knowledge corridor', a spine of tertiary campuses, research precincts, cultural facilities and medical institutions stretching from the RBWH to UQ. Part of the Boggo Road Urban Village and Ecosciences Precinct, which also houses CSIRO, the station is adjacent to the PA Hospital, which hosts biomedical research institutes including the Pharmacy Australia Centre of Excellence and Translational Research Institute.

The popular Eastern Busway passes through the area, providing a high-frequency public transport connection from the PA Hospital to the Eleanor Schonell Bridge and UQ. It also connects to the CBD via the South East Busway. Passengers can interchange between bus and train services at the Boggo Road busway station.

Local neighbourhoods are dominated by older character housing, commonly known as 'timber and tin', which is protected through City Plan and the Draft Dutton Park Fairfield Neighbourhood Strategy. Neighbourhoods are typically low-density, with individual dwellings on generous lots, however, this will change in some areas with significant land-use diversification and residential intensification planned, particularly around the Buranda precinct to the east.





### Planning Context

Zoning contained in City Plan focuses on preserving the land use for the Dutton Park area as low-density residential (including character residential). Land-use plans around the CRR station support the PA Hospital precinct as an important medical, education and research precinct and Boggo Road Urban Village as a mixed-use area including residential, retail, commercial, environmental research and recreational facilities.

A neighbourhood plan strategy for the Dutton Park–Fairfield area has been drafted. This strategy broadly retains the current land-use intent while opening small pockets up for low to medium-density residential, retaining the role of the PA Hospital and the Boggo Road Urban Village and widening the protected area of character residential.

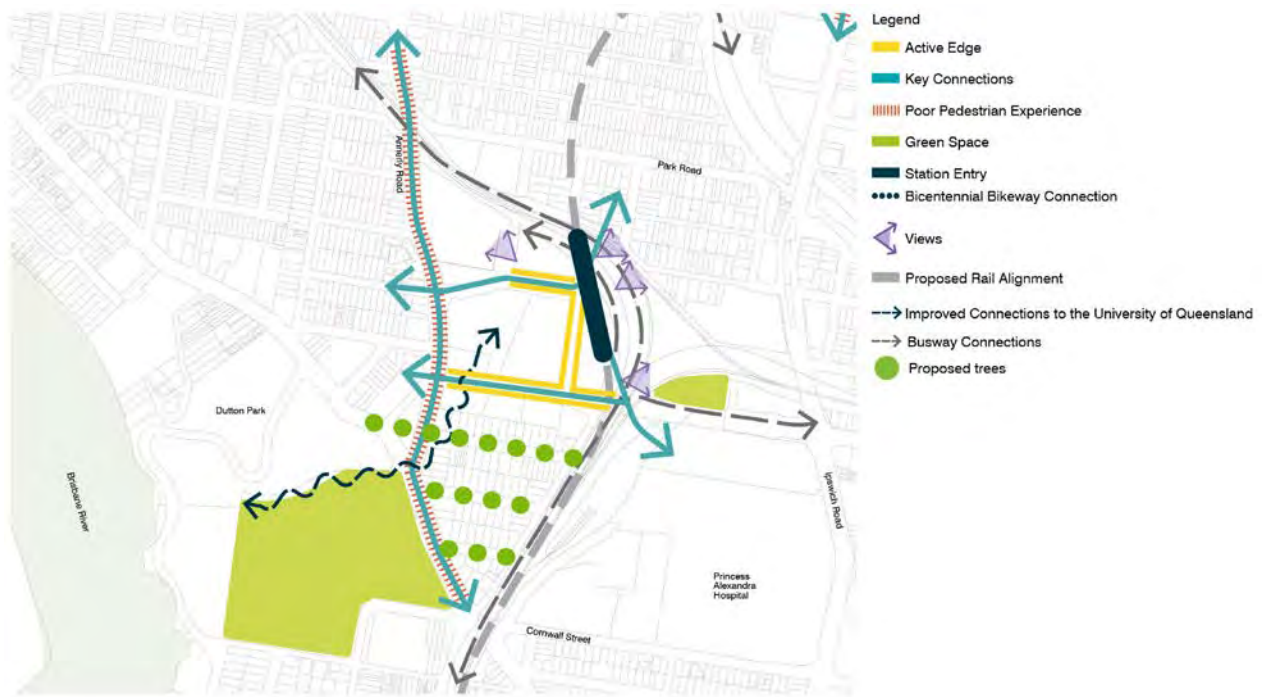


Figure 6.9: Boggo Road Station Precinct Context

### Precinct Vision

The Boggo Road station precinct will become a world-class health, science and knowledge cluster and mixed-use precinct connecting Boggo Road Urban Village, UQ and PA Hospital to Brisbane’s CBD and the Gold Coast.

Elements central to achieving this vision, including a high proportion of government-owned land, high levels of transport accessibility and the agglomeration of major health, knowledge and research activities, are already in place, making it well-positioned to cater for anticipated future growth in these sectors. The surrounding residential zoning also offers opportunity for new higher density development, while new active transport links will promote a more sustainable approach to inner-city living.

Cross connections over the current rail and bus corridors will link the Boggo Road precinct to the PA Hospital and other health services, creating permeability through what is currently a solid barrier within the urban footprint. Developing over the rail corridor would utilise a currently inaccessible part of the existing urban fabric and, in turn, provide new opportunities for extra green open space and an attractive public realm interface.





The combination of mixed-use and residential development opportunities, underpinned by city and river views, give this area the capacity to support a major specialist centre outside the CBD and to boost the region's knowledge economy.

### City-Building Outcomes

Development of Boggo Road station will:

- facilitate the continued development of a major health, science and knowledge precinct
- create new connections between communities and activities currently separated by rail and road infrastructure
- promote convenient and rapid rail–rail and rail–bus interchange
- encourage intensification of land uses in close proximity of the station to take advantage of city and river views.

### Station Development Opportunities

Boggo Road station development will increase the commercial and residential density directly adjacent to the station while supporting and catalysing a range of development and uses including:

- mixed-use development
- commercial development (employment, small business and service industry)
- residential development (long and short-term accommodation)
- research, science and knowledge industry expansion.

## 6.4 Transport and Network Benefits

This section details the key transport benefits resulting from the CRR Project and outlines:

- transport modelling methodology, including key assumptions
- transport modelling forecasts, including discussion on alternate population forecasts
- transport outcomes related to the CRR Project
- benefits used in the CRR Project's economic assessment, including reliability improvements
- future enabled investments associated with the CRR Project.



### 6.4.1 Transport Modelling Methodology

An assessment framework – based on detailed rail operations and transport modelling – has been used to assess the capacity and reliability benefits provided by the CRR Project. The modelling process undertaken is depicted in Figure 6.10.

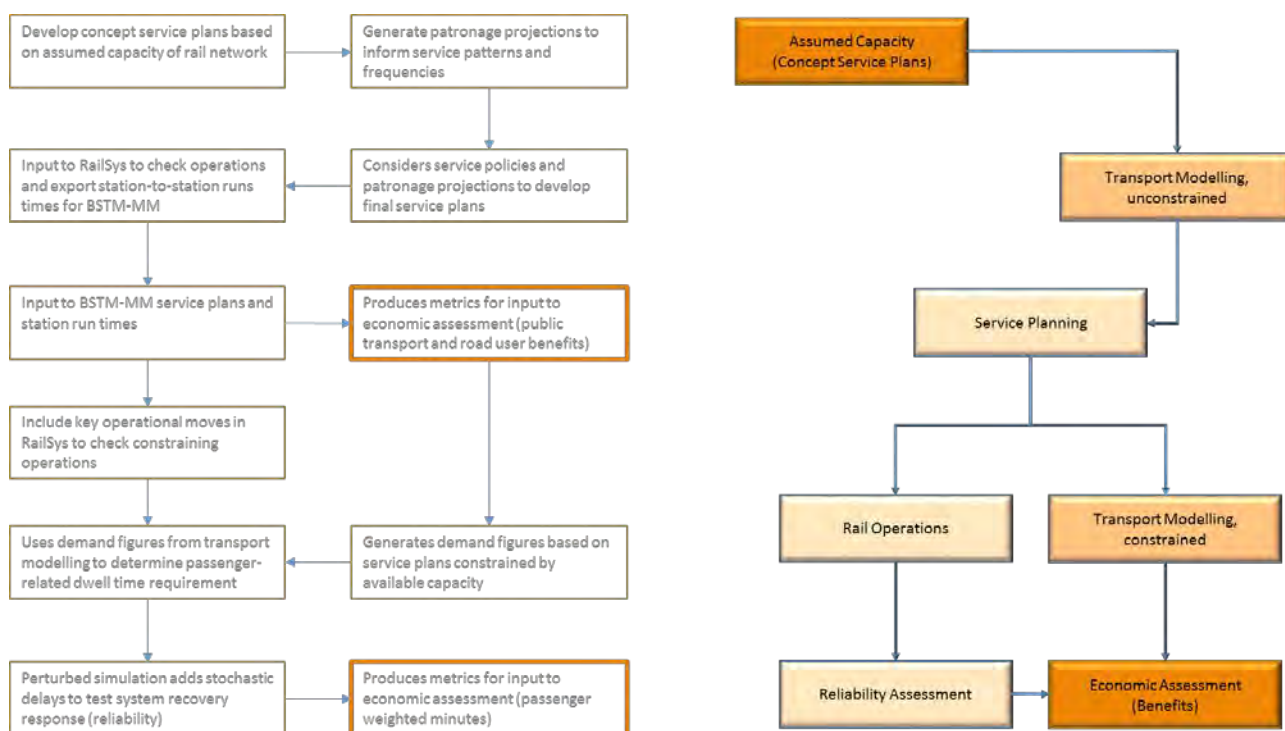


Figure 6.10: The CRR Project Modelling Framework

#### 6.4.1.1 Rail Operations Modelling

Rail operations modelling was undertaken to determine the optimal allocation of rail services to match demand and capacity in corridors for a base case ‘without’ the CRR Project and a project case ‘with’ the CRR Project.

The rail operational modelling allowed for a mix of service types such as express and all-stop services. It provides a key input into both the strategic modelling task and assessments of operational costs and rollingstock requirements.

The existing capacity of each corridor through the inner city, both ‘with’ and ‘without’ the CRR Project, has been assessed as the basis for future peak timetables and included in the rail model. Future demand growth on the network has been considered in the development of train service plans that optimise network operations (interlinking of service corridors) and allocate services to meet train demand.

These service plans, both ‘with’ and ‘without’ the CRR Project become a key input into the strategic transport modelling.



#### 6.4.1.2 Strategic Transport Modelling

The purpose of the strategic transport modelling was to estimate the impact of the additional capacity and frequency for rail services, provided by the CRR Project, on travel demands in Brisbane. This includes:

- the mode shift (reallocation of travel demand) to rail
- reduced congestion on competing transport modes
- reduced crowding on rail services
- reduced travel time associated with higher frequencies, with less time spent waiting for a train.

Modelling was undertaken using TMR's Brisbane Strategic Transport Model – Multi Modal (BSTM-MM), which is employed for strategic transport planning in Brisbane. The BSTM-MM was further developed to assess patronage forecasts and revenue associated with rail. This model is known as the CRR Project model and provides the basis of all patronage and benefit forecasts reported in this chapter.

#### 6.4.1.3 Modelled Transport Network

The modelled transport network includes both existing and future rail, bus and road network infrastructure across the study area for both the 'with' and 'without' cases. Model inputs are based on current TMR and local government project commitments and were informed by documents such as the Queensland Transport and Roads Investment Program.

The CRR Project was included in the model for the 'with' project case. The Reference Project consists of two parallel tunnels extending from Dutton Park to the Exhibition Loop at Spring Hill, via the Brisbane CBD. It includes new underground rail stations at Boggo Road, Woolloongabba, Albert Street, Roma Street and an upgraded Exhibition station.

The transport network assumptions underpinning the assessment of the CRR Project were developed prior to the release of information regarding BCC's Brisbane Metro proposal. While this proposed enhancement to the busway is therefore not included in the transport modelling undertaken for the CRR Project, a qualitative assessment of the complementary benefits of Brisbane Metro and the CRR Project is discussed in Section 6.4.7.

For the base case ('without' project), indicative train service plans were developed to meet demand using available infrastructure capacity. Service plans and operating strategies for the 'without' case were kept consistent with existing operations on the rail network but maximised to make best use of existing infrastructure and the additional capacity benefits of the European Train Control System (ETCS) – Inner City Project on the main lines. This includes consideration of the service planning policy and supporting measures such as encouraging peak spreading and improved efficiencies due to further sectorisation of the rail network.

For the 'with' project case, train service plans maximise the use of additional new infrastructure. This enables a higher frequency of rail service to meet projected increases in passenger demand. The 'with' service plans provide for 18 trains per hour (tph) in the morning peak hour (northbound) in 2026 in the CRR tunnel.



In the southbound direction, the CRR Project is able to meet passenger demand for 12tph in 2026. Beyond that the ability to utilise the ultimate capacity of the tunnel (24tph) would be dependent on further augmentation of the connecting surface network to the north and south of the project. The CRR Project would also support north–south sectorisation with Nambour, Caboolture and ultimately Caloundra in the north able to run through the city and connect with Varsity Lakes (Gold Coast) in the south. In the future, the CRR Project would be able to accommodate longer trains (i.e. equivalent length nine-car train sets) however these have not been modelled as they are beyond the timeframes of the evaluation period.

Indicative future service plans for 2026 and 2036 ‘with’ CRR are shown in Figure 6.11 and Figure 6.12.

### 2026 AM Peak Period Services per Hour with CRR + ETCS



Figure 6.11: 2026 Morning Peak Hour Rail Service Plan



2036 AM Peak Period Services per Hour with CRR + ETCS



Figure 6.12: 2036 Morning Peak Hour Rail Service Plan



### 6.4.2 Land-Use Demographics

The geographic distribution of population and employment growth are the most influential factors driving forecast changes in travel demand. The CRR Project model is able to forecast future travel demand based on calibrated relationships between these socio-economic variables and travel behaviour. The population and employment forecast assumptions used were the most up-to-date and complete set of data provided by the Government Statistician at the time of modelling (2015 edition, medium series). Based on these forecasts, by 2036, the Brisbane Statistical Division is forecast to reach a population of 3.1 million (1.6 per cent per annum growth), with more than 80 per cent of the growth in population outside of the Brisbane LGA. This is highlighted in Figure 6.13 with the Brisbane LGA shown in yellow against the broader Brisbane Statistical Division. Over the same period, total employment for the study area is forecast to reach 1.7 million (1.6 per cent per annum), with over 207,700 jobs in the Brisbane CBD compared to approximately 145,700 jobs in 2015.

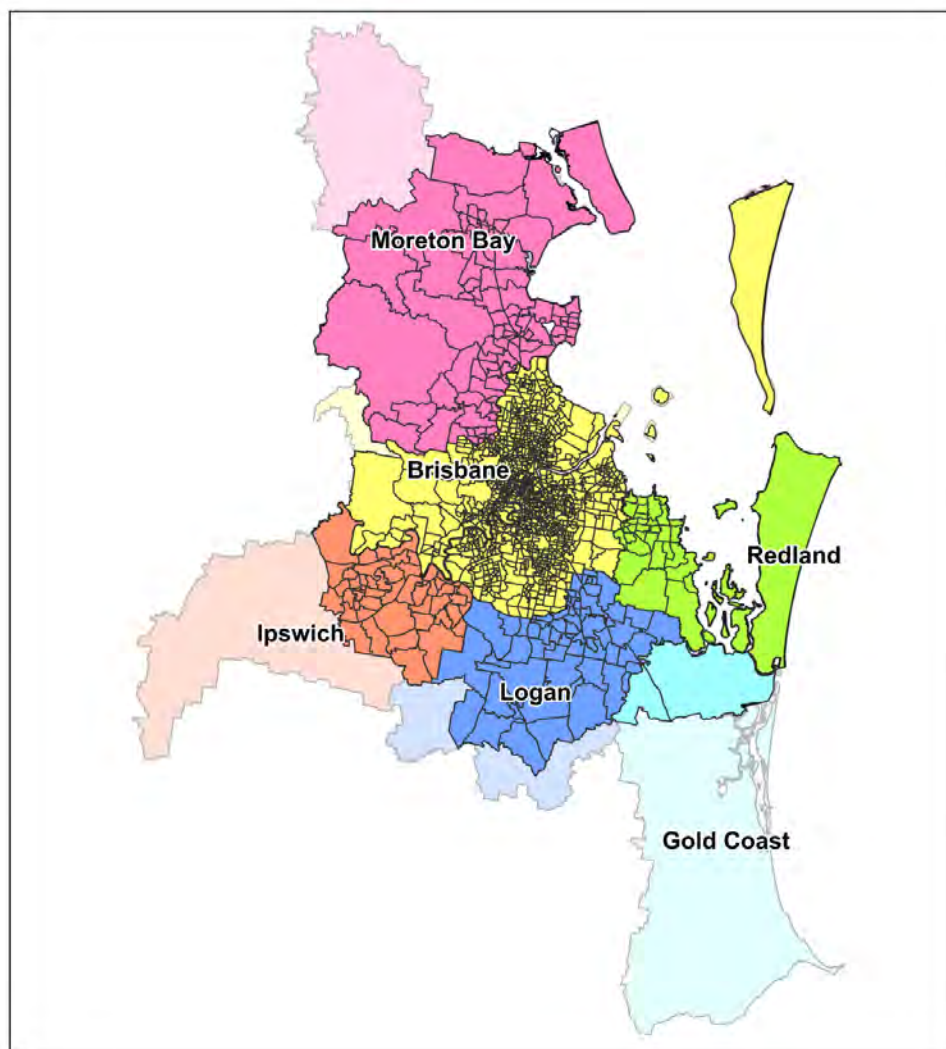


Figure 6.13: Brisbane Statistical Division and Brisbane LGA map





### 6.4.3 Fairer Fares

In response to the recommendations of the independent Fare Review Taskforce, the Queensland Government introduced the Fairer Fares package, which took effect from 19 December 2016. Fairer Fares impacted on the CRR Project model in two primary ways:

- It altered the fare zoning system, with the existing 23 zone system across SEQ consolidated to eight zones. This was achieved by aggregating a number of zones, with some fine-tuning of the new zone boundaries. Details on the new fare zone boundaries were sourced from TransLink.
- Fare prices were adjusted for each zone (typically downwards). Additionally, the price rise anticipated in 2017 (with CPI) was delayed to 2018. In the model, this was assumed to represent an additional 2.5 per cent saving on the 2017 fares. Beyond 2017, it was assumed that fares will rise with CPI.

### 6.4.4 Other Assumptions

Changes in the cost of travel and user's sensitivity to costs are important factors in travel behaviour. Compared to the base year prices, the transport model assumes:

- inflation – to grow at 2.5 per cent per annum
- CBD parking charges – to grow at 2.5 per cent per annum above the rate of inflation
- toll road charges – to grow in line with the rate of inflation
- vehicle operating costs (fuel) – to grow in line with the rate of inflation
- value of time – to grow at 1.5 per cent per annum above the rate of inflation (in line with assumed average weekly earnings growth of four per cent per annum).

### 6.4.5 Model Validation

The performance of the updated, calibrated base year model (2015) was compared to available, observed data for an average weekday in 2015. This included:

- daily and peak period rail transaction data at each station (boardings, alightings and line loadings)
- daily and peak period bus and ferry ticketing data (boardings) by operator and corridor
- daily and peak period traffic counts across key cordons through the study area (including a Brisbane River and CBD circle cordon).

The validation comparisons illustrate an appropriate match to observed data.

Independent peer review of the strategic transport modelling processes, assumptions and outcomes was undertaken. It concluded that the modelling methodology and level of validation are considered fit for purpose in assessing the benefits of the CRR Project.

### 6.4.6 Transport Modelling Forecasts

Transport forecasts have been run 'with' and 'without' the CRR Project for the following scenarios:

- 2015 – the base year model (existing networks)
- 2026 – the modelled forecast year 'with' and 'without' the CRR Project
- 2036 – the final modelled forecast year 'with' and 'without' the CRR Project.



Transport forecasts for the Brisbane area, using the CRR Project model, indicate that demand for public transport is forecast to double from 2015 to 2036. Chapter 3: Problem shows that ‘without’ the CRR Project, future public transport service levels will significantly decline – more people will face overcrowded rail and bus services and increasing traffic congestion on all major roads, especially key arterial roads near the inner city. The modelling shows that total person trips across the modelled network<sup>42</sup> increase by 2.74 million trips per day from 2015 to 2036.

Of these trips, public transport accounts for more than 10 per cent of the total transport task in 2036, up from a 6.8 per cent mode share in 2015. Despite this, car trips will continue to grow significantly and increase by 1.9 million car users per day by 2036 – an increase of 30 per cent over today’s car travel on the network. However, with the CRR Project in place, there will be a shift to public transport of 23,000 trips per day, relieving pressure on the road network and providing improved access to destinations such as the CBD. The modelling forecasts the share of journeys (as a proportion of all trips) made by rail to the CBD to increase from 47 per cent without the CRR Project to 51 per cent with the CRR Project in 2036.

Table 6.2 shows the breakdown of the daily public transport task between the two primary modes in SEQ (rail and bus). This table shows that on a person-trip basis in 2015, buses carry a higher proportion of the transport task compared to rail. However, on a passenger-kilometre basis, rail carries a higher proportion of trips (12 per cent more than bus), given it is servicing destinations further from the CBD. Over time, as the region expands and road travel becomes more congested, rail is forecast to grow at a faster rate than bus and carry a similar proportion of the daily travel task. With the CRR Project in place, rail will carry 559,000 daily person trips in 2036 compared to buses carrying 628,500 person trips. On a passenger-kilometre basis, rail will carry the bulk of the public transport task by 2036 (1.43 times more than buses).

PERIOD	2015	2026				2036			
		USERS		GROWTH		USERS		GROWTH	
		WITHOUT CRR	WITH CRR	WITHOUT CRR	WITH CRR	WITHOUT CRR	WITH CRR	WITHOUT CRR	WITH CRR
RAIL USERS									
AM 2hr peak	51,700	104,000	110,100	101%	113%	147,100	160,300	185%	210%
PM 2hr peak	41,500	95,100	101,100	129%	144%	132,200	146,500	219%	253%
Daily	177,200	368,800	386,800	108%	118%	511,700	559,300	189%	216%
BUS USERS									
AM 2hr peak	77,800	122,700	120,100	58%	54%	155,800	149,700	100%	92%
PM 2hr peak	55,600	95,600	94,700	72%	70%	122,600	116,800	121%	110%
Daily	321,600	509,800	508,400	59%	58%	638,600	628,500	99%	95%
TOTAL PUBLIC TRANSPORT USERS									
Daily	513,700	875,200	883,300	70%	72%	1,130,600	1,152,400	120%	124%

Table 6.2: Daily Public Transport Demand By Mode<sup>43</sup>

<sup>42</sup> The modelling network includes the areas in the BSTM-MM boundary.

<sup>43</sup> The totals in this table include the ‘ferry mode’ which is not included in the data above. The rail and bus data also includes ‘chain-trips’ (that is, bus to rail interchanges) which are only counted as one trip in the totals.



Table 6.3 provides a breakdown on the travel demand and mode into the CBD during the morning peak period (two hours). This table shows that car travel to the CBD will remain relatively static over the next 20 years as there is limited potential for road capacity and car parking space to increase during peak periods. Rail travel currently shares this travel market with bus (in terms of person trips). Rail will grow significantly to 94,800 person trips in the morning peak period by 2036 'with' the CRR Project. Bus travel to the CBD will also grow from 35,400 person trips in 2015 to 51,200 in 2036 'with' the CRR Project (increasing by a further 10 per cent if the CRR Project is not provided). Over the next 20 years, rail will cater for the majority of all new trips to the CBD with bus continuing to play a strong supporting role, catering for around 20 per cent of all new CBD trips.

TWO - HOUR MORNING PEAK	2015	2026			2036		
		BASE	CRR	PERCENTAGE CHANGE	BASE	CRR	PERCENTAGE CHANGE
Car	41,400	40,500	39,800	-1.8%	40,600	39,300	-3.1%
Rail	35,500	65,200	68,800	5.6%	87,700	94,800	8.1%
Bus	35,400	48,000	44,600	-7.1%	57,500	51,200	-10.8%
Ferry	1,000	1,900	1,900	0.7%	2,300	2,200	-0.7%
<b>TOTAL</b>	<b>113,300</b>	<b>155,600</b>	<b>155,100</b>	<b>-0.3%</b>	<b>188,000</b>	<b>187,600</b>	<b>-0.2%</b>

Table 6.3: Forecast Morning Peak Travel Demand to the Brisbane CBD

Figure 6.14 shows the two-hour person trips to the CBD for 2026 and 2036 both 'with' and 'without' the CRR Project. This figure further demonstrates the role of the CRR Project into the future, with rail carrying the largest proportion of travel demand to the CBD during the morning peak and bus playing an important supporting role.



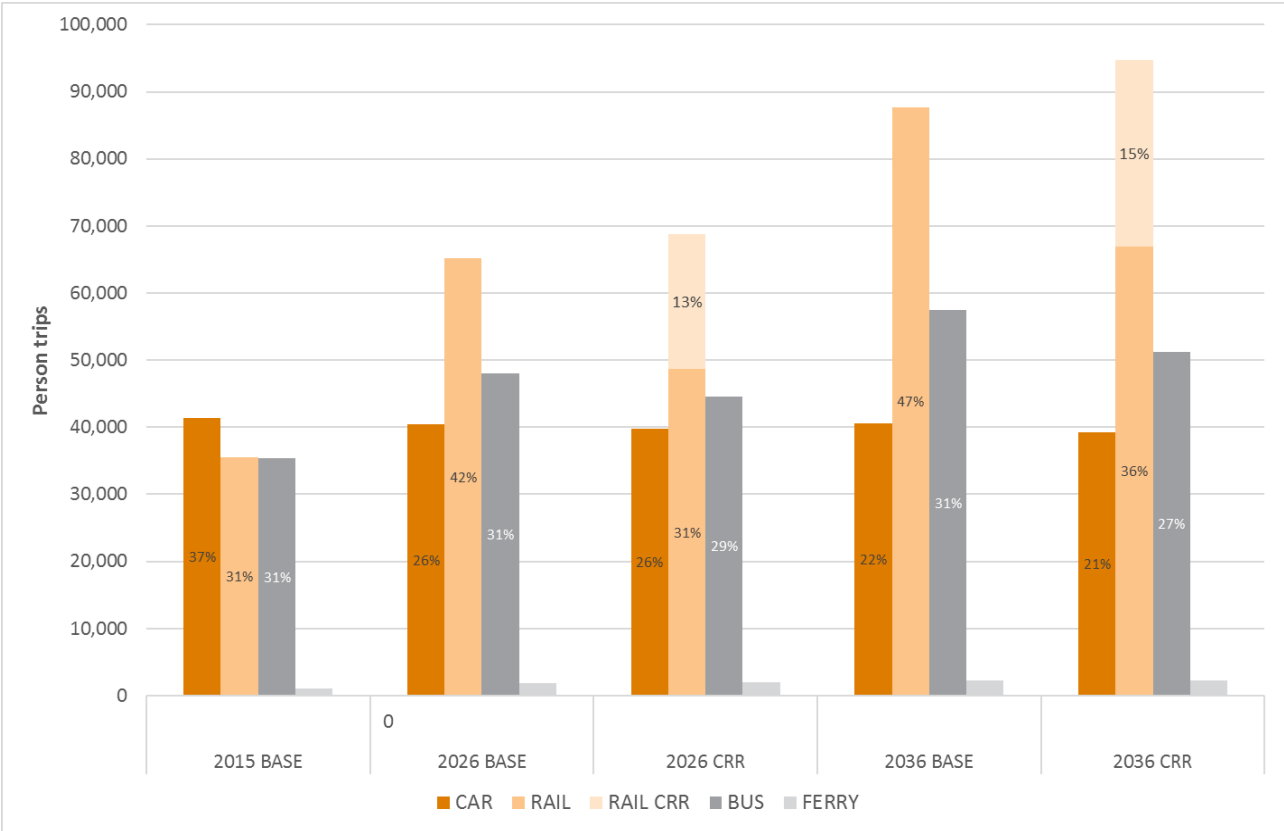


Figure 6.14: Two-Hour Peak Person Trips to the CBD by Mode

6.4.7 Transport Network Benefits

As outlined in Chapter 3: Problem, the region’s transport network is now at a critical juncture in its evolution. The CRR Project will be a key enabling project in the revitalisation of the SEQ rail network. Specifically, it will reinforce the role of public transport as the preferred mode of travel especially when accessing key activity centres such as Brisbane’s CBD. The project will unlock the region’s rail capacity, alleviating existing constraints and cementing the future function of the rail network as the ‘backbone’ of the public transport network.

Forecasts indicate there will be a tripling of rail demand between now and 2036 across the region as people seek improved access to jobs and services at key economic hubs such as the CBD. The CRR Project will enable the rail network to meet forecast demand, provide travel time benefits to commuters and influence travel choice. It will increase network capacity and create a more direct route to the CBD, enabling faster and more frequent services from across the region and new opportunities to expand the rail network.



The benefits of the CRR Project quantified in this section exclude any benefit due to BCC's Brisbane Metro proposal, however it is anticipated that together, the CRR Project and Brisbane Metro will:

- Enable a strengthened focus on feeder services to higher frequency and capacity trunk routes (rail / busway), with the bus services withdrawn from the busway re-invested in the suburban network. This will provide more opportunities for passengers to connect to the higher frequency rail services afforded by the CRR Project.
- Provide an enhanced ability to cater for the distribution of passengers around the inner city, freeing up capacity on CRR and at new CRR stations to cater for long distance commuters from the dormitory catchment areas.
- Provide more opportunities for passengers to easily transfer between bus and rail at key interchange locations such as Boggo Road station and Roma Street station.
- Serve complementary catchment areas. Rail, including CRR, predominantly serves the long-distance commuter market from areas such as the Moreton Bay Regional Council area, the Sunshine Coast, Gold Coast and Springfield / Ripley corridors. Brisbane Metro will serve shorter trips within the Brisbane LGA.

### 6.4.7.1 Future Public Transport Demand

Rail services to and through Brisbane's inner core continue to experience growth as more people across the region access services and jobs in the region's primary activity centre. However, the existing inner-city rail network will be unable to meet forecast future demand for CBD access from growth areas along Brisbane's rail corridors and to emerging greenfield development sites. In response, the CRR Project will provide new dedicated rail infrastructure and connect areas previously remote from the city's existing main rail stations (Roma Street and Central stations) to fast and frequent rail travel. With a new station at the southern end of the CBD, passengers will have shorter trips to the station, with less time spent in vehicles, walking in the CBD and on interchange transfers.

The new CRR Project will unlock public transport capacity, with key outcomes for the network including:

- a doubling of public transport capacity across the river into the Brisbane CBD from the south, providing ultimate capacity for 24 rail services per hour in each direction
- higher public transport use equating to an increase of 23,000 trips on public transport per day in 2036, predominantly due to an increase in forecast rail demand with a minimal reduction in daily bus patronage
- enables 116 services to access the CBD in the morning peak hour in 2036 with an ultimate capacity of 134 services
- reduced public transport journey times, waiting times, access times and a relief of public transport crowding
- improved CBD public transport accessibility and modal integration.

### 6.4.7.2 Road Congestion

Chapter 3: Problem explains that increasing private car use could add to infrastructure costs and stifle economic activity by worsening congestion, which in turn, would limit freight and commercial movements and make it more expensive to do business. With the CRR Project operational, more commuters are forecast to use the train as their preferred mode of travel to the city.



Overall, implementation of the CRR Project is forecast to reduce private vehicle kilometres travelled by 526,000km per day and generate a small increase average private vehicle travel speeds (1km/hr)<sup>44</sup>.

This will reduce congestion in the busiest part of the road network, with substantial savings in urban road congestion costs. The Australian Infrastructure Audit (Infrastructure Australia) indicates that the cost of congestion on the Brisbane–Gold Coast–Sunshine Coast transport network is approximately \$2 billion. The CRR Project will help avoid these costs, which are predicted to increase to around \$9 billion in 2031<sup>45</sup>.

With the CRR Project in place, the avoided costs to the economy of road congestion are estimated at \$240 million annually in 2036, compared to a scenario ‘without’ the CRR Project.

Specific benefits accruing to the road network include:

- reduced private car use (CRR Detailed Business Case 2016 estimated a decrease of 18,500 people travelling each day by car)
- reduced private vehicle kilometres travelled
- increased road speeds
- improved network reliability (for road, bus and rail networks) with benefits to transport operators.

### 6.4.7.3 Supply Chains

Increasing the capacity and use of the rail system will result in faster travel times and speeds on the road network. These benefits will be most pronounced on the motorway network, given the CRR Project will tend to attract commuters from outer greenfield areas that might otherwise use the motorway network. These benefits will accrue to road-based freight vehicles and improve their ability to service their markets in a timely manner.

From a rail freight perspective, the potential impacts of the CRR Project are manageable considering service levels and forecast freight demand. Where uncertainty exists, mitigation measures can be implemented on an incremental basis to ensure the rail freight system is able to meet its obligations prior to a long-term solution being provided, potentially as part of the Inland Rail project.

### 6.4.8 Rail Network Benefits

#### 6.4.8.1 Service Frequency

The CRR Project will enable the broader rail network to perform its desired role within SEQ’s transport system. With the CRR Project, service frequency – a core determinant in travel behaviour – will increase significantly in order to meet forecast demand, making rail more attractive to patrons.

The higher frequencies enabled by the CRR Project will mean that commuters spend less time waiting for a train with service frequencies on some lines approaching a turn-up-and-go (no timetable required) type of service. For example, commuters from the Gold Coast will save on average four minutes in waiting time for a train with the CRR Project.

Table 6.4 provides an outline of the ‘boardings and alightings’ (daily throughput) at each CRR station in 2026 and 2036.

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<sup>44</sup> CRR Project model 2016

<sup>45</sup> State Infrastructure Plan





YEAR	STATION	BOARDING	ALIGHTING	TRANSFER (BOARDING + ALIGHTING)	TOTAL
2026	Boggo Road	1,070	760	13,320	15,150
	Woolloongabba	2,280	2,040	5,020	9,340
	Roma Street	5,420	5,530	18,450	29,400
	Albert Street	20,660	25,150	800	46,610
	Exhibition	1,820	3,310	640	5,770
	<b>TOTAL</b>	<b>31,250</b>	<b>36,790</b>	<b>38,230</b>	<b>106,270</b>
2036	Boggo Road	1,610	1,530	19,680	22,820
	Woolloongabba	5,110	4,630	8,240	17,980
	Roma Street	8,340	8,560	29,420	46,320
	Albert Street	29,130	36,840	1,290	67,260
	Exhibition	2,950	5,140	1,340	9,430
	<b>TOTAL</b>	<b>47,140</b>	<b>56,700</b>	<b>59,970</b>	<b>163,810</b>

Table 6.4: Boardings and Alightings at CRR Stations

Supporting this improved frequency, the CRR Project will also provide more stations in more parts of the inner city, primarily in key identified growth precincts. The forecast estimate of daily throughput at the CRR stations in 2026 and 2036 is shown in Figure 6.15. This illustrates the predominance of the two inner-city stations at Roma Street and Albert Street and again highlights the important transfer functions of both Roma Street and Boggo Road stations for the CRR Project.

The data shows:

- total daily passenger flows at the CRR stations of 106,000 in 2026 and 164,000 in 2036
- daily patronage at the new Albert Street station of 46,600 in 2026 growing to 67,300 passengers per day by 2036
- significant transfer activity at Roma Street, with 18,450 transfer boardings and alightings per day by 2026 and 29,400 per day by 2036, between surface rail and CRR as well as between bus and CRR
- Boggo Road becoming a significant interchange station in the public transport network due to its close proximity to the Eastern Busway and connecting key health, education and business precincts.



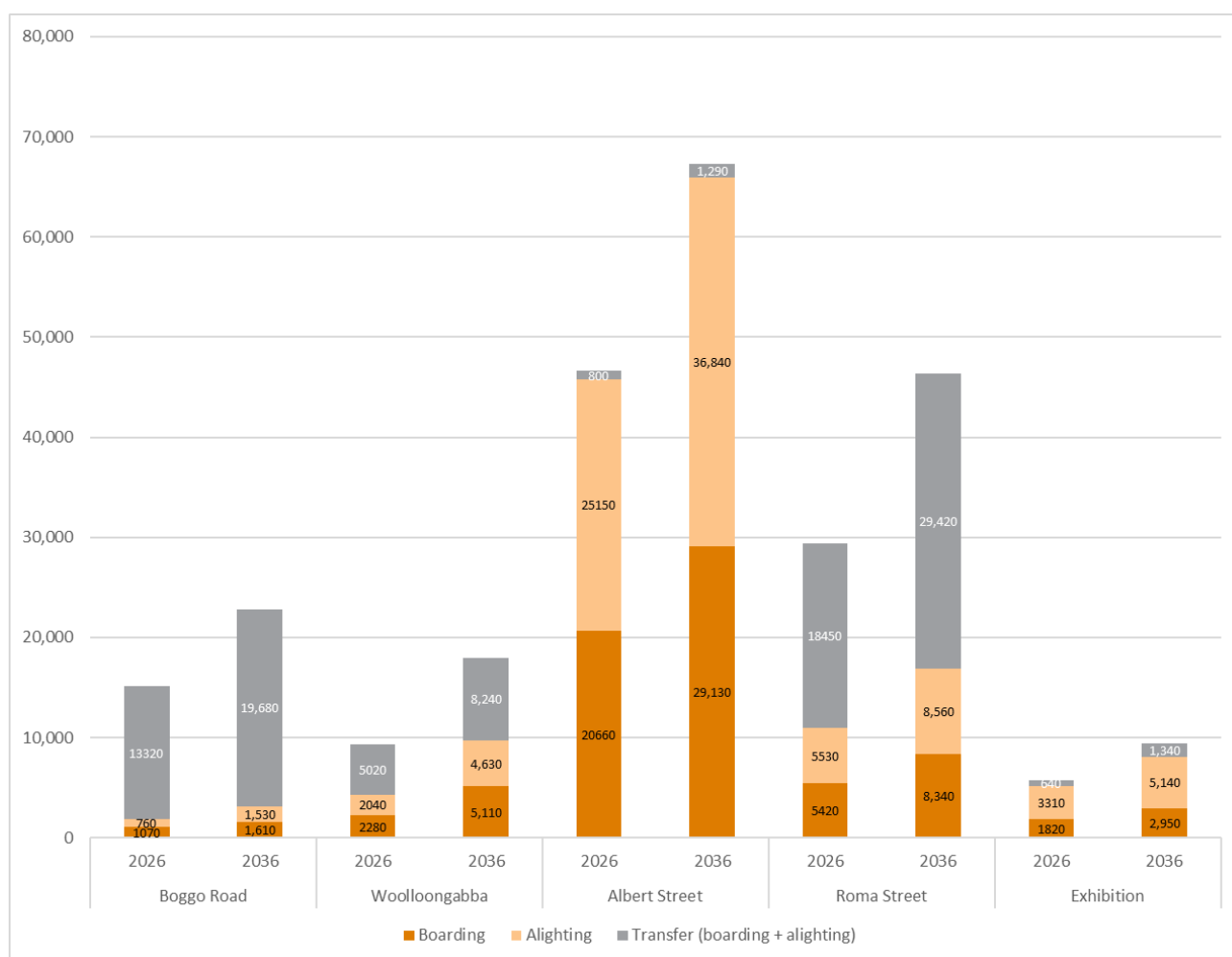


Figure 6.15: Forecast CRR Station Daily Passenger Movements, 2026 and 2036

The CRR stations are forecast to serve about 40,000 passengers in the morning peak period (nearly 40 per cent of the total daily use of CRR) comprising 10,500 at Roma Street station, 17,700 at Albert Street station in the southern CBD, 5,400 at Boggo Road station, 3,700 at Exhibition station and 2,800 at Woolloongabba station. This is forecast to grow to almost 56,000 by 2036.

At Woolloongabba, the new station will also help clear crowds from sporting events at The Gabba. The new Boggo Road station will become a primary interchange location in the network, enabling commuters to interchange between the rail and bus networks. For example, the Boggo Road/Park Road stations are forecast to be SEQ's second busiest place for interchange, second to Roma Street station, and will see 134 trains passing through during the morning peak period, nearly double the amount of trains running today. At this number of trains, interchanges will be supported given the significant reduction in waiting times. For example, a rail service will depart Boggo Road/Park Road every minute by 2036. Commuters will benefit by being able to easily and quickly change trains to directly access the southern part of the CBD from this location or to change to a bus services travelling to UQ.



#### 6.4.8.2 Journey Times

Reduced journey times is the key benefit public transport users will enjoy due to the CRR Project. This reduction can be made up of a number of different elements, including:

- Travel time (or in-vehicle time) – the time a commuter spends within the vehicle, which can be influenced by journey distance, speed and the type of service (e.g. an all-stops service versus an express service).
- Wait time – the time that a commuter spends waiting for a train. Higher frequencies will mean that commuters would spend less time waiting for a train. Once the service reaches a turn-up-and-go level of service the waiting time is virtually eliminated.
- Access time – the time a commuter spends in accessing the service, which can be made up of a combination of modes (e.g. walking or car). This time is heavily influenced by the proximity of the service to the commuter's origin or destination.

Reduction in wait time is broken down as follows:

- The average wait time per passenger trip is about 7.7 minutes today (2015). Additional rail services into the inner city and CBD in 2026 and 2036 due to the CRR Project will reduce this average wait time to 6.9 minutes by 2026 and 6.6 minutes by 2036.
- These wait time benefits will accrue primarily to passengers on long-distance commute services from the south and north. Afternoon peak period passengers waiting at CBD stations will also enjoy reduced wait times.

Reduction in travel time is broken down as follows:

- Average public transport trip times will fall slightly in 2026 across the network due to the shorter distance and faster commute for passengers from the south to the southern CBD.
- Overall, there will be a small increase in total public transport passenger hours across the average weekday, which is in line with the projected increase in public transport patronage in 2026 and in 2036.

Reduction in access times (walking) is broken down as follows:

- The new Albert Street and Roma Street stations will improve access and egress times for passengers using these stations, compared to using existing stations.
- The total number of public transport interchanges will be higher in 2026 and 2036 than in 2015 as a result of a greater number of passengers. With the CRR Project, there will be an increase in the average number of interchanges used per passenger, compared to the 'without' base case of 0.02 in 2026 and 0.05 in 2036 due to the increased interchange opportunities, particularly at Roma Street and Boggo Road stations.

#### 6.4.8.3 Crowding

The CRR Project will address many of the negative perceptions of public transport such as limited service frequency and overcrowding. Forecasts indicate that as many as 300 people per trip will be forced to stand for long periods of time on each express service from Petrie and Beenleigh by 2036 if the CRR Project is not completed by then. Modelling undertaken for the CRR Project shows that by 2036, there will be an increase from 4,900 crowded hours per day in 2015 to 48,200 crowded hours on the rail network without the project. These outcomes are summarised in Table 6.5.



	2015	2026			2036		
	BASE	WITHOUT CRR	WITH CRR	DIFFERENCE	WITHOUT CRR	WITH CRR	DIFFERENCE
<b>CROWDING RELIEF</b>							
Additional crowded time (hours)	4,900	14,600	11,100	-23.7%	48,200	34,200	-29.0%

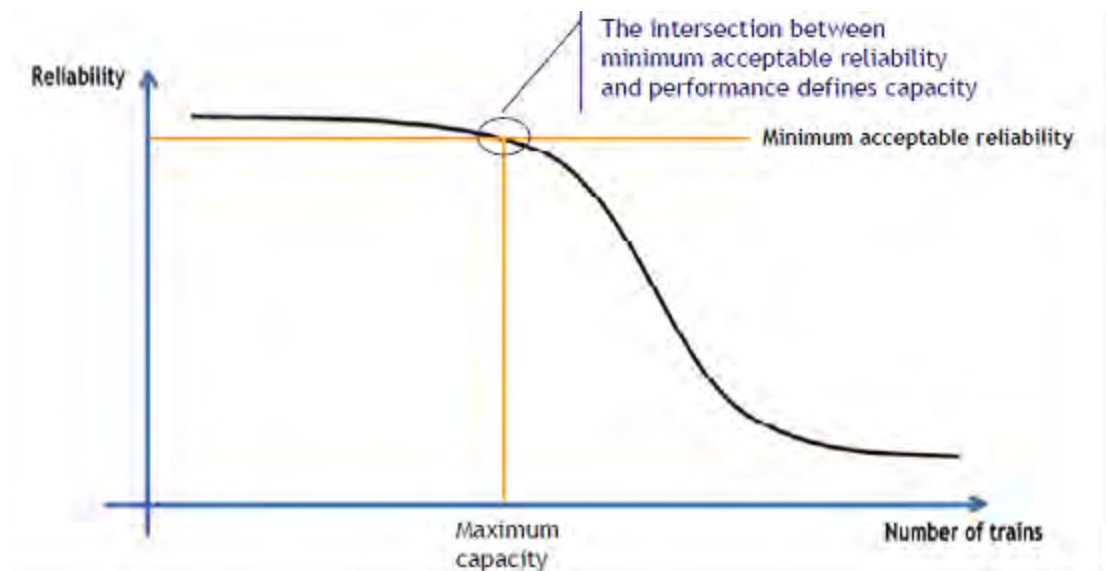
**Table 6.5: Reduction in Crowded Hours Due to CRR Project across the SEQ Network (Daily Peak Period)**

The CRR Project will reduce the number of passengers required to stand for long periods or spend time on overcrowded trains. The additional services enabled by the CRR Project will see a 24 per cent reduction in crowding, with significantly improved service levels for customers in 2036. The CRR Project reduces the percentage of commuters standing on scheduled Gold Coast services to less than 25 per cent and those standing longer than 20 minutes to less than five per cent in 2036.

This will see the forecast crowded time on the network reduced by 14,000 hours per day in 2036 and by 3,500 hours per day in 2026. This crowding relief will predominantly be gained by passengers travelling in peak periods on longer commuter train services from the south (Gold Coast) and north (Sunshine Coast).

#### 6.4.8.4 Reliability

In the base case, against a backdrop of increasing passenger demand, the rail network is likely to become increasingly unreliable in future years as more and more services are crowded onto limited rail infrastructure. This highlights a key concept in rail capacity assessment: capacity and on-time reliability are inseparably linked. That is, minimal acceptable reliability defines capacity as shown in Figure 6.16.



**Figure 6.16: Minimum Acceptable Reliability**



The direct relationship between capacity and on-time reliability is further illustrated in Figure 6.17. Adding more services to the network will negatively impact on-time reliability as more capacity is used. When the network approaches or exceeds its capacity limit, the cumulative effect of more risk of delay accelerates the deterioration in on-time running.

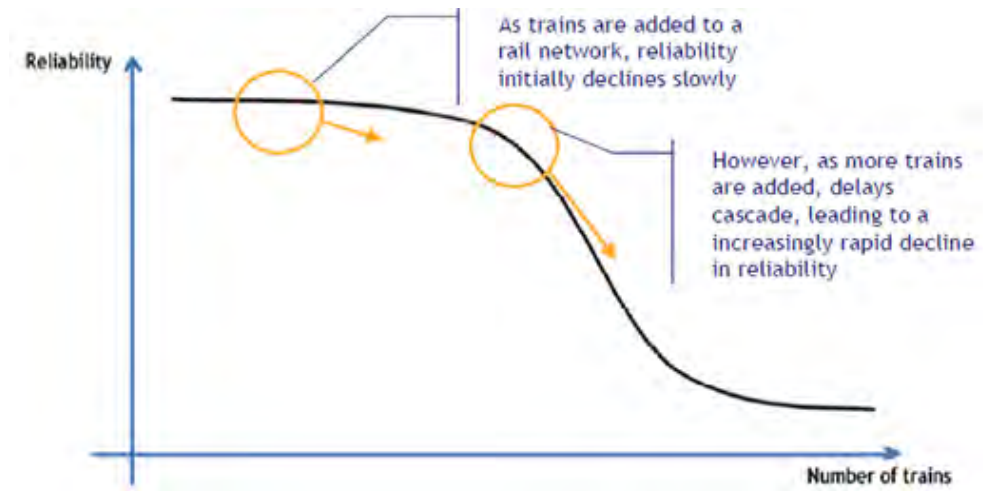


Figure 6.17: Declining Reliability

As a result of this projected unreliability, the incidences of train services not running to the scheduled timetable is likely to increase. Operational analysis was used to assess the reliability of train service plans 'with' and 'without' the CRR Project based on the level of demand across the network. On-time reliability was forecast for both the 'with' and 'without' project scenarios for 2026 and 2036. These forecasts were derived using dynamic simulation of the detailed timetables developed to match proposed service plans in the RailSys software package. Passenger and service lateness was then forecast for services operating across a typical day.

In summary, performance (reduced lateness) demonstrably improves across nearly all time periods and forecasts years when the 'with' project case is compared to the 'without' base case. This is most noticeable in the morning peak period when the rail network is typically under in the most stress. This demonstrates that even when services are increased 'with' the CRR Project, the trains are able to maintain their schedule and run more reliability.

#### 6.4.8.5 Enabled Investments

While the CRR Project will increase capacity on SEQ's rail network from the first day of operations, it will also enable program-level infrastructure investments to further unlock network capacity. These investments are outlined in South East Queensland's Rail Horizon (2016) and include:

- Higher capacity, longer trains: The CRR Project will provide enabling works to facilitate the future rollout of nine-car trains, which offer a cost-effective means to increase network capacity. All CRR stations will be developed to allow easy conversion for longer trains.
- New generation signalling: The CRR tunnel will incorporate new generation signalling within the tunnel. This, combined with an additional rollout in the inner city, will facilitate the future rollout of new generation signalling across the entire SEQ rail network.
- Contiguous network augmentation: Additional surface works to the north and south of the tunnel will provide additional capacity to increase trains throughput in the inner city.



## PROJECT BENEFITS

- Network expansions: By increasing capacity in the inner core, the CRR Project will enable new rail lines into greenfield areas, expanding the reach of the rail network.

While these options will be subject to their own business cases, the CRR Project will enhance their investment rationale.





# CHAPTER SEVEN

## ECONOMIC ANALYSIS



## CHAPTER 7

### ECONOMIC ANALYSIS

#### CHAPTER SUMMARY AND CONCLUSIONS:

- Mass transport solutions such as rail will remain critical to meeting the regional transport task as the economic contribution of SEQ's major centres continues to grow.
- Investing in the CRR Project will:
  - improve the competitiveness of rail services to the CBD
  - eliminate rail capacity constraints that cap service frequencies and make rail unattractive, particularly through the congested urban core
  - alleviate pressure on overcrowded bus and road networks
  - provide an integral enhancement to connect the region's labour markets in growth areas to jobs.
- Timely investment in inner-city rail capacity will not only benefit the wider transport network but also improve SEQ's liveability and economic prosperity.
- A cost benefit analysis (CBA) of the CRR Project was initially undertaken in mid-2016, which resulted in a positive Benefit Cost Ratio (BCR) of 1.21.
- In July 2017, the CBA was updated to reflect the latest available information, new funding commitments and improvements to the transport system delivered over the past year. Assumptions used in the updated CBA include:
  - Current SEQ demographics: The latest demographics published by Queensland Treasury have been adopted, including population and employment estimates.
  - Delivery of Fairer Fares: The current fare structure and pricing scheme, which became effective in December 2016 through the Fairer Fares package, have been adopted.
  - Funding for new generation signalling: Modelling scenarios assume the delivery of a new generation signalling system through the European Train Control System (ETCS) – Inner City Project.
- The updated CBA shows a BCR of 1.41. This represents \$1.41 of benefits generated per dollar invested. This is a positive result, with sensitivity testing demonstrating that the CRR Project is viable under a range of potential scenarios.



## 7.1 Purpose and Overview of this Chapter

The purpose of this chapter is to outline the economic impacts of the CRR Project. A detailed economic analysis was undertaken to determine the economic viability of the CRR Project, using three core methods:

- comprehensive cost benefit analysis (CBA)
- wider economic benefits (WEBs) appraisal
- macroeconomic impact assessment.

This chapter outlines:

- the economic need for future investment in SEQ's transport network
- the approach and key results of the economic analysis, including:
  - the Benefit Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR)
  - key implications for wider economic benefits, including agglomeration economies and increased labour supply
- the approach and key results of the macroeconomic impact assessment, particularly:
  - the expected boost to gross state product (GSP)
  - the number of jobs that will be created
- a summary of the economic findings for the CRR Project.

## 7.2 The Economic Case for Investment

Transport infrastructure is an essential economic asset that shapes land use and drives productivity, growth and prosperity. It provides easy access for people seeking connections between places of residence, employment, recreation and public and private institutions. Improving transport infrastructure and services can allow individuals, firms and industries to operate more efficiently, raising both the standard of living and productivity.

Queensland is one of Australia's most strategically important economic regions. Its modern, diverse economy and proximity to Asia mean it is well-placed to transition into a key international trading partner. Brisbane City, in particular, can become a major link between the Australian and Asian economies by growing export volumes and supplying Queensland's portfolio of sector, technical and knowledge expertise to meet international demands.

Improving rail capacity will be central to meeting SEQ's future transport demand; rail offers an efficient alternative to congested road corridors, particularly during peak periods. Investing in rail infrastructure not only presents the opportunity to address the public transport capacity constraint at the core of the network but also provides a platform for wider land-use transformation.

The CRR Project offers significant advantages, including:

- mass transit capability, with the ability to move more commuters, more rapidly, than other forms of transport (a six-car train has capacity to move up to 750 people)
- the ability to efficiently service longer trips, which is of particular importance to SEQ's dispersed residential population



- the capacity to avoid congestion, as passenger rail is not exposed to the same network constraints as the road network
- the opportunity to increase access to the rail network, supporting future land-use and transport development.

Without significant investment in new rail infrastructure, SEQ's growth will hamper the efficiency of the transport network. Remaining road and rail capacity will be exhausted, adding to growing congestion costs, obstructing supply chains and ultimately constraining regional economic output. Improving the rail network is critical to avoiding future economic constraints caused by poor accessibility.

## 7.3 Cost Benefit Analysis

### 7.3.1 Approach and Methodology

A CBA framework was utilised as part of the detailed economic appraisal to build an understanding of the relative merits of the CRR Project. This analysis compared project benefits against up-front and ongoing investment requirements.

CBA is universally accepted as the preferred economic analysis technique to assess the relative priority of competing infrastructure investment. The application of CBA, uniformly and consistently, allows for the effective comparison of projects across Australia. The frameworks used to develop the CBA are based on guidance documents that are nationally endorsed for transport appraisal. These guidelines include:

- Cost Benefit Analysis Guide: Supporting Business Case Development, Building Queensland, April 2016: While not prescriptive, this guideline provides a framework for the development of a detailed CBA.
- The Australian Transport Assessment and Planning Guidelines (ATAP), 2016: Guidance contained within the ATAP guidelines has been utilised as the preferred source of contemporary economic unit values.
- Infrastructure Australia, Reform and Investment Framework, 2013: While this guideline does not provide specific monetary unit values and parameters for use in the economic appraisal, the economic appraisal has been developed in accordance with the principles identified in the framework.

A CBA for the CRR Project was developed in mid-2016, as required for Infrastructure Australia's submission process. This detailed analysis resulted in a positive BCR of 1.21. The Queensland Government has continued work on the CRR Project since then and the CBA was recently updated to reflect more current information, new funding commitments and improvements to the transport system delivered over the past year.

Assumptions used in the updated CBA include:

- Current SEQ demographics: The latest demographics published by Queensland Treasury have been adopted, including population and employment estimates.
- Delivery of Fairer Fares: The current fare structure and pricing scheme, which became effective in December 2016 through the Fairer Fares package, have been adopted.
- Funding for new generation signalling: Modelling scenarios assume the delivery of a new generation signalling system through the ETCS – Inner City Project. The Queensland Government committed \$634 million over eight years to fund the ETCS – Inner City Project in June 2016.



Scenarios have been modelled to measure the relative economic performance of investing in the CRR Project. These scenarios are typically defined as either a 'project' or 'base' case, representing network performance 'with' the project and 'without' it. The difference between them is described as the 'net benefit'. The base and project cases for the 'central case' (most likely scenario) are outlined below:

- The base case is defined as the transport network without investment in the CRR Project and is inclusive of the typical level of investment in the transport network. This represents works required to maintain the existing service levels (status quo) and includes funded, planned or required investment.
- The project case is defined as the CRR Project and includes works that sit within the geographic scope of the CRR Project.
- Both the base case and project case include the ETCS – Inner City Project.

#### 7.3.1.1 Key Assumptions and Parameters

Key assumptions and parameters adopted for use in the economic appraisal for the CRR Project are presented in Table 7.1.

PARAMETER	ASSUMPTION	SOURCE
Discount rate	A headline rate of seven per cent real Sensitivities provided at four per cent	Infrastructure Australia
Price year	December 2015	Adopted from Project Cost Estimates
Evaluation period	30 years of benefits post construction (a sensitivity of 50 years has been conducted)	ATAP (2016)
Indexation	Unit costs and parameter values indexed from the price year by the Consumer Price Index (including sub-categories as appropriate) and Average Weekly Earnings which have been utilised to escalate the real value of time (1.5% <sup>46</sup> per annum).	Australian Bureau of Statistics (ABS) (2016)
Unit costs and parameter values	Adopted from ATAP and other sources. Vehicle operating costs have been derived specifically through ATAP guidelines as endorsed by COAG.	ATAP (2016), WEBTag (United Kingdom) and Austroads (2012)
Modelled years	Demand model outputs have been provided for 2021, 2026 and 2036 as appropriate. Linear interpolation has been utilised to estimate benefits between these years while benefits have been extrapolated and capped at 2050 to the end of the evaluation period (2054) based on advice from the rail operations modelling <sup>47</sup> .	CRR Transport Modelling Advisor and CRR Economic Advisor analysis

**Table 7.1: Cost Benefit Analysis Key Assumptions and Parameters**

<sup>46</sup> Value of time escalation of 1.5% has been determined as an appropriate value to estimate real wage growth by assessing historical values from 2002-2013. Sensitivity analysis has also been undertaken at 0.75% real wage growth.

<sup>47</sup> Further work undertaken on the reference design post the June 2016 business case to understand the capacity of the CRR system, in regards to station and network capacity. The analysis indicated that prior to the introduction of 9 car trains, the CRR system has the capacity to continue to grow and accrue benefits until the end of the 30-year assessment period.



### 7.3.2 Costs

CBA considers the cost of infrastructure delivery by including whole-of-life costs for a project (both capital and operating costs). For the CRR Project, probabilistic, risk-based modelling has been applied to the raw construction estimates to develop risk-adjusted project costs at the P50 level of confidence, representing the most likely project cost. P50 capital costs are provided in Table 7.2.

Project costs have been adjusted to account for real price escalation above inflation. In this instance, real wage growth of 1.5 per cent per annum has been applied to the labour components of the cost elements to derive a total real capital cost.

COST ELEMENT	PRESENT VALUE (7% RATE) \$ MILLION
TOTAL – Capital Costs	3,492.2

**Table 7.2: Capital Cost**

For the purposes of the CBA, the total real capital costs for the CRR Project have been estimated at approximately \$3.49 billion in present value terms.

Operating costs for the first year of operation (2023) are presented in Table 7.3. Operating costs presented are representative of the net incremental costs compared against the base case. In this instance, positive figures are considered a net cost increase to the rail operator. P50 operating costs have also been developed for the CRR Project.

As per the approach adopted for capital costs, real wage growth of 1.5 per cent per annum has been applied to the labour elements contained within each cost element to derive a total real operating cost.

COST ELEMENT	PRESENT VALUE (7% RATE) \$ MILLION
TOTAL – Operating Costs (2023)	30.1

**Table 7.3: First Year (2023) Operating Cost**

In accordance with the CBA guideline, all costs associated with the project required to fully realise future benefits must be considered. As such, while not required for day one operations, additional rollingstock will be required to support enhanced level of service enabled by the project into the future. In line with the above, rollingstock capital costs are reported separately in Table 7.4 below:

COST ELEMENT	PRESENT VALUE (7% RATE) \$ MILLION
TOTAL – Rollingstock Capital Costs	182.3

**Table 7.4: Rollingstock Capital Cost**





### 7.3.3 Benefits

Quantifiable project benefits were estimated for the purpose of the CBA utilising conventional appraisal techniques. These were derived from guidance materials outlined in Section 7.3.1 and are reflective of the benefits identified in Chapter 6: Project Benefits. Key benefit streams associated with the CRR Project captured in the CBA are outlined in Table 7.5.

CATEGORY	ECONOMIC BENEFIT
User benefits	Public transport time and generalised cost savings (work and non-work)
	Improved reliability for public transport
	Car transport time savings (work and non-work)
	Car vehicle operating cost (VOC) savings (work and non-work)
	Commercial vehicles (trucks) – road freight savings (travel time and VOC)
	Network resilience
	Station amenity
Crash savings	Crash cost savings (including fatal, hospitalisation, minor injury and property damage only)
Environmental externalities	Environmental externality cost savings (including greenhouse gas emissions and noise)
Residual value	Residual value (including transport infrastructure and rollingstock)
Farebox revenue	Incremental farebox revenue

**Table 7.5: Economic Benefit Summary**

It is noted that there are also a number of additional potential economic benefits which were not quantified as part of the CBA which would likely increase the economic return. These include for instance the consideration of freight benefits, road reliability benefits, active transport benefits, station crowding benefits and an improved customer environment.

A summary of each benefit category is provided below.

#### 7.3.3.1 User Benefits

Improved travel choices for commuters on the rail and road networks account for the vast majority of benefits generated by the CRR Project. Additional rail services and new stations will improve travel times for rail patrons and attract more car drivers to public transport. This, in turn, will ease congestion and improve travel times for remaining road users.

Benefits for public transport users are estimated by considering the total journey cost with and without the project, as perceived by commuters. In deciding to undertake a journey, a transport user considers how to get to their destination by factoring in convenience factors such as waiting time, crowding, access, in-vehicle time, reliability and transfers between different services.

Improved rail services due to the CRR Project reduces a user's perceived journey cost, generating a user benefit. If the total journey cost is less for public transport than a motor vehicle, the user may be encouraged to change from driving to public transport. Shifting users to public transport frees up road space, reduces congestion and improves travel times for remaining drivers. Given the low occupancy rate of private



vehicles, even a small shift can bring significant congestion relief. Reduced road use also reduces vehicle operation costs.

Increasing the capacity of the rail network also improves its resilience, with resulting benefits for both public transport and road users. The remaining benefit that accrues to transport users is the benefit derived from improved amenity at rail stations.

#### 7.3.3.2 Crash Savings

A decrease in road use reduces the likelihood of crashes occurring on the road network. The value of crash cost savings is based on a willingness to pay approach for different levels of crash severity (fatal, hospitalisation, minor injury and property damage only), consistent with ATAP guidelines.

#### 7.3.3.3 Environmental Externalities

Externalities are defined as the costs incurred by a third party as a result of the transport market, such as car pollution to nearby residential areas. They typically relate to environmental and social costs, including greenhouse gas emissions, noise and amenity costs.

#### 7.3.3.4 Residual Value

Residual value is also a significant benefit, representing the capacity of planned investment to continue to accrue benefits beyond the appraisal period. It includes the tunnel, surface and station works, as well as additional rollingstock purchased in the latter years of the appraisal, which are then discounted to present value.

#### 7.3.3.5 Farebox Revenue

The remaining economic benefit captured within the CBA is farebox revenue, which is added back into the evaluation as public transport fares that are not incorporated into the perceived cost of a journey.

#### 7.3.3.6 Summary of Benefits

A summary of the estimated economic benefits is shown in Table 7.6 below. Road user benefits account for around 58 per cent (48 per cent for private car users including car passengers and 10 per cent for commercial vehicles) of the estimated benefits through reduced congestion and the resultant reduced travel time and vehicle operating costs. Benefits to public transport users account for around 32 per cent of total benefits.

BENEFITS	PRESENT VALUE <sup>48</sup> (7%) \$ MILLION	PERCENTAGE OF TOTAL BENEFITS
Public transport – crowding	1,174.2	18.1%
Public transport – generalised cost (exc crowding)	648.4	10.0%
Public transport – reliability	118.2	1.8%
Public transport – station amenity	84.3	1.3%
Public transport – resilience	6.2	0.1%
Road users – car travel time savings	2,023.4	31.2%
Road users – car vehicle operating cost savings	1,085.7	16.8%

<sup>48</sup> Any errors in addition are due to rounding.



BENEFITS	PRESENT VALUE <sup>48</sup> (7%) \$ MILLION	PERCENTAGE OF TOTAL BENEFITS
Road users – commercial vehicle travel time savings	349.0	5.4%
Road users – commercial vehicle operating costs	328.9	5.1%
Crashes	137.1	2.1%
Externalities	116.5	1.8%
Farebox	136.9	2.1%
Residual value	268.7	4.1%
<b>Total</b>	<b>6,477.5</b>	<b>100.0%</b>

Table 7.6: CBA benefits summary

While road user benefits make up a high percentage of benefits, this is primarily a result of the number of trips that have been forecast in the transport model. The demand profile and benefits derived from the transport model are consistent with the expectations of the independent peer reviewer. As shown in Table 7.7, when the benefit per trip is calculated over the 30 year evaluation period it shows that, on average, public transport users will benefit by 87 cents per trip compared to 19 cents for private car users (drivers and passengers), a difference of around 346 per cent. Likewise, public transport users will benefit by more than 57 per cent when compared to commercial vehicles (87 cents compare to 55 cents per trip). This shows that while public transport users will benefit more on a per trip basis, the significant number of road user trips compared to public transport user trips results in a higher proportion of total benefits for road users.

TRIP TYPE	PRESENT VALUE TRIPS	PRESENT VALUE BENEFITS (\$)	PRESENT VALUE BENEFITS \$ / TRIP
PT trips	2,339.2	2,031.3	<b>\$0.87</b>
Car trips	15,954.5	3,109.1	<b>\$0.19</b>
CV trips	1,228.6	677.8	<b>\$0.55</b>
Total/average	19,522.3	5,818.2	<b>\$0.30</b>

Table 7.7: Benefit per trip



The discounted benefit per trip for public transport users, car trips and commercial vehicles is also presented in Figure 7.1 below. The figure illustrates that the economic benefit on a per trip basis is greatest for public transport users.

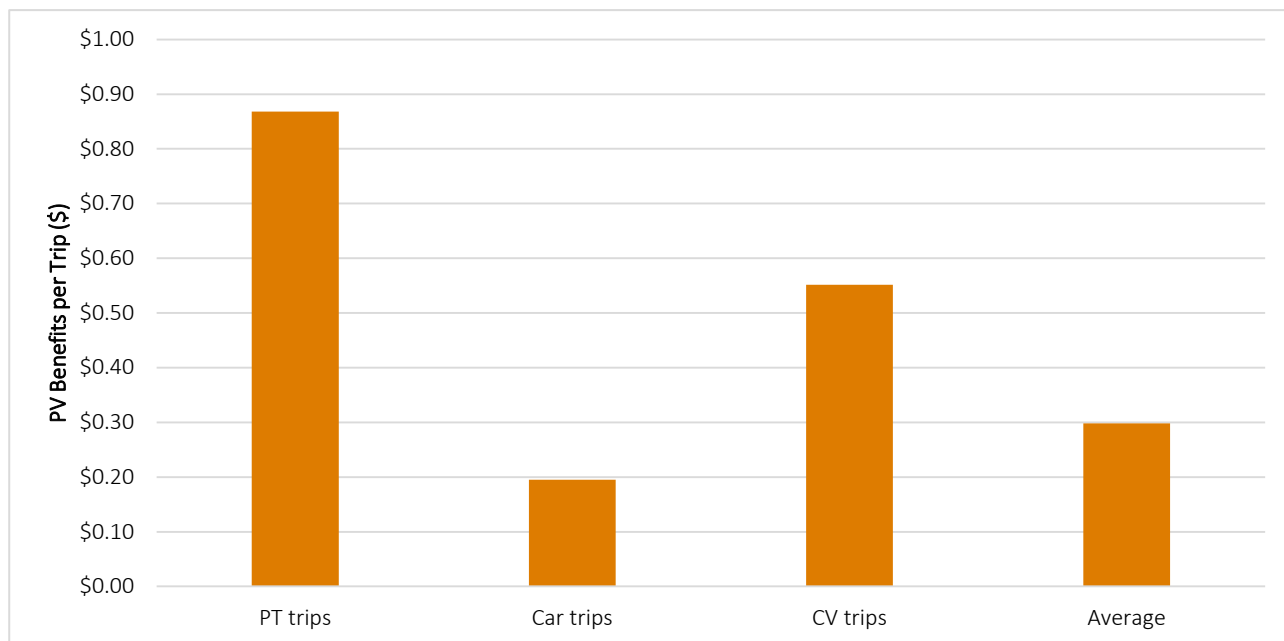


Figure 7.1: Benefit per Trip, Present Value, \$



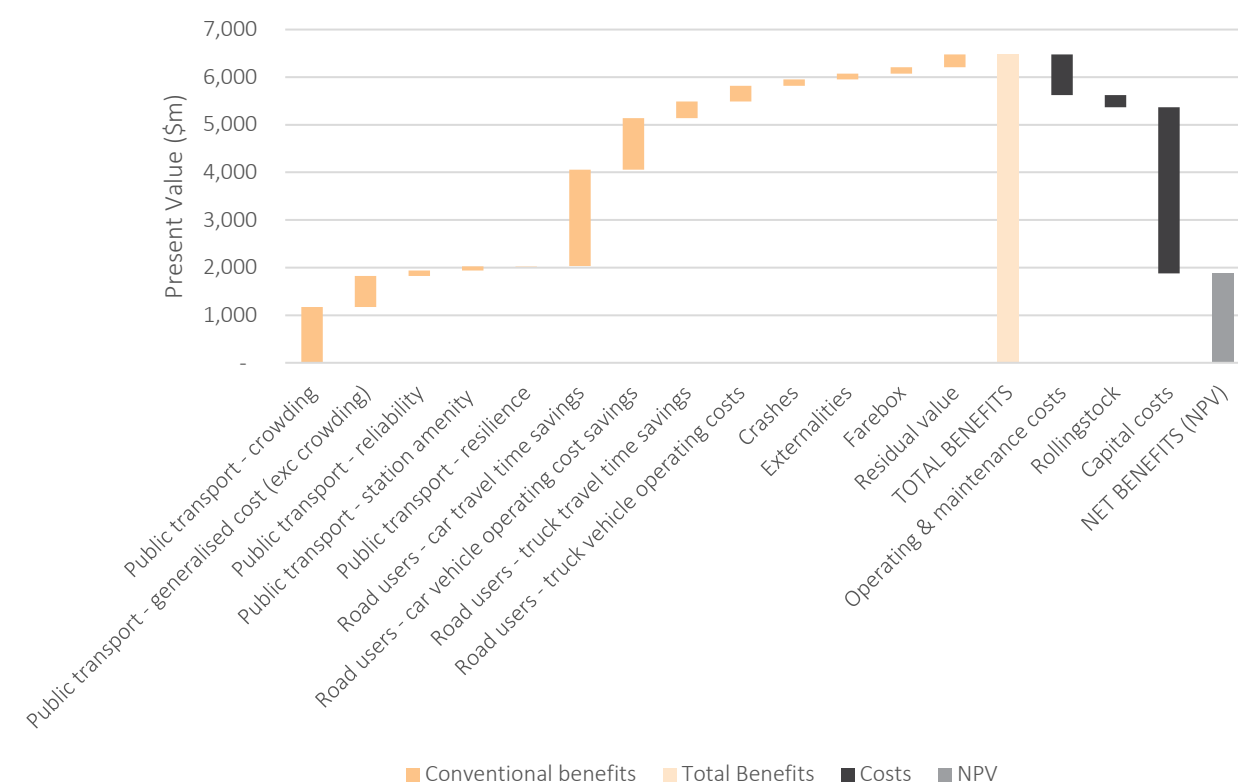
### 7.3.4 Cost Benefit Analysis Results

The summary results of the CBA for the CRR Project's central case are presented in Table 7.8 using capital costs with the P50 level of risk. All economic performance measures demonstrate an economic return for the community in excess of the net whole-of-life costs for the project.

CBA DECISION CRITERIA	RESULTS
BCR	1.41
NPV (\$m)	1,877.2
IRR	9.3%

**Table 7.8: CBA Results Summary – Central Case**

The disaggregated CBA results for the project are presented in Figure 7.2 below.



**Figure 7.2: Disaggregated CBA Results for CRR Project**

The CRR Project is expected to deliver benefits to public transport and road users along with the wider community. These are validated by a BCR of 1.41 for the P50 case. The NPV also shows positive results at \$1,877.2 million. The IRR shows results higher than the discount rate, which is expected for a positive NPV.

As the economic contribution of Australia's major centres to regional and domestic output continues to grow, mass transport solutions such as rail will remain critical to meeting the transport task. Delaying investment in the CRR Project would have significant negative impacts across SEQ including:

- rail being unable to perform its role due to the uncompetitive nature of rail services to the CBD, with over-reliance on existing crowded station infrastructure



- rail capacity limiting service frequencies, making rail less attractive than other modes, even for existing journeys on the inner-city rail network
- greater pressure on the already overcrowded bus and road network, causing failure in these transport systems as they approach the CBD
- exacerbation of the ongoing, avoidable costs of congestion prior to construction.

Network constraints within the inner city, including river crossings, must be addressed if the rail network is to cater for future growth. Without investment, the network will be unable to expand into new growth areas or to increase service frequencies.

As identified in Chapter 3: Problem, an urgent solution is required to address the transport challenges facing SEQ. Timely investment in inner-city rail capacity will not only benefit the wider transport network but also improve regional liveability and economic prosperity.

### 7.3.5 Sensitivity Analysis

A detailed sensitivity analysis was undertaken for the CRR Project's CBA. Sensitivity analysis measures the uncertainty associated with estimating costs and benefits. It measures the change in key economic decision criteria (the NPV and BCR) through a change in single or multiple parameter values.

This test is particularly important where decision-makers wish to understand the effects of a significant change in economic conditions. The CBA for the CRR Project considered a number of sensitivity tests designed to test the veracity of the economic results.

A break-even analysis was undertaken (i.e. BCR = 1) of the benefits and costs. It identified that there would need to be a significant increase in costs (41 per cent) or a decrease of 29 per cent in total benefits to return a BCR equal to or less than one.

An alternative benefit estimation approach to value of time did not reduce the BCR below 1 while the change to a 50 year appraisal period also had a significant positive impact on the economic results.

The results of the sensitivity analysis are presented in Table 7.9 below.

SENSITIVITY TEST		BCR	NPV \$ MILLION
<b>CENTRAL CASE</b>		<b>1.41</b>	<b>1,877.2</b>
1	Discount rate four per cent	2.22	7,069.9
2	P90 costs	1.31	1,512.4
3	Value of Time (VoT) – 0.75% per annum escalation	1.29	1,294.8
4	50-year appraisal period	1.71	3,374.8

**Table 7.9: Sensitivity Analysis Results**





## 7.4 Wider Economic Benefits Appraisal

A wider economic benefits (WEBs) analysis of the CRR Project was undertaken in June 2016. This analysis has not been updated to reflect recent transport improvements or policy changes outlined in Section 7.3.1.

Best practice methodologies – as set out within state, national and international guidelines including the ATAP guidelines and Building Queensland’s Cost Benefit Analysis Guide – were used to identify the wider economic impacts of the CRR Project.

WEBs were identified for the following three categories:

- WB1: Agglomeration economies
- WB2: Labour market deepening
- WB3: Output change in imperfectly competitive markets.

The WEBs analysis undertaken for the CRR Project is consistent with the approach applied to other major Australian infrastructure projects including Melbourne Metro and Westconnex in Sydney.

### 7.4.1 WB1: Agglomeration Economies

Agglomeration economies (WB1) make up the majority of WEBs for the CRR Project. Agglomeration economies result from increased density of economic activity. This leads to firms being able to increase productivity through input sharing, knowledge spillovers and output sharing. Agglomeration economies include ‘cluster effects’, which arise from increased physical density of employment enabled by enhancements in transport network capacity. Also included are ‘proximity effects’, which arise from reduced travel times between employment clusters. Both cluster effects and proximity effects contribute to increases in ‘effective density’ enabled by a transport intervention.

Land-use impacts must be estimated in order to consider cluster effects. For this reason, only proximity effects have been considered for the CRR Project.

The process for estimating agglomeration economies includes the following steps:

- Estimate ‘business to business’ effective density’ (B2BE<sub>d</sub>) in Brisbane using an appropriate decay curve. The decay curve represents the characteristics of business travel in Brisbane, specifically how the propensity to undertake business travel declines as travel times increase.
- Estimate the elasticities of productivity with respect to effective density for Brisbane by industry (agglomeration elasticities).
- Estimate the percentage change in B2BE<sub>d</sub> for Brisbane between base and project cases for forecast years (2026 and 2036).
- Apply the agglomeration elasticities to the changes in B2BE<sub>d</sub> to estimate the total value of increases in labour productivity enabled by the project.

### 7.4.2 WB2: Labour Market Deepening

Transport projects have the potential to enable labour market deepening (WB2) by reducing the barriers for new and existing workers to either take up new work or increase participation in the workforce.

Increased labour supply benefits result from reduced commuting costs encouraging unemployed or underemployed individuals to enter or increase participation in the workforce.



### 7.4.3 WB3: Output Change in Imperfectly Competitive Markets

Transportation costs act as a barrier to competition and therefore introduce market imperfections. Imperfectly competitive markets mean businesses sell products at a higher price and at a lower quantity than would be the case in a perfectly competitive market. A reduction in transport costs results in the optimal quantity of production for businesses in imperfectly competitive markets. This benefit is known as output change in imperfectly competitive markets (WB3).

### 7.4.4 Summary of WEBs Analysis

As at June 2016, the CRR Project is projected to generated total wider economic benefits of \$1,209 million in present value, real terms.

## 7.5 Economic Impact Assessment – Computable General Equilibrium (CGE)

An economic impact assessment of the CRR Project was undertaken using a CGE model in June 2016. This CGE model has not been updated to reflect recent transport improvements and policy changes outlined in Section 7.3.1.

The CGE model was utilised to estimate the CRR Project's impact on key macroeconomic measures, specifically GSP, consumption expenditure, investment expenditure, exports and imports. The primary benefit of CGE modelling is the ability to measure indirect economic impacts through capturing the upstream and downstream linkages between the CRR Project and the rest of the economy<sup>49</sup>.

A dynamic regional CGE model of the Australian economy was utilised for this assessment. The model was configured to model two regions: Queensland and the rest of Australia.

### 7.5.1 Simulation Results

#### 7.5.1.1 GSP Generated

As at June 2016, the CRR Project is expected to contribute \$1.03 billion present value to Queensland's GSP during the project's construction phase from 2015–16 to 2023–24 in real terms at a seven per cent discount rate. The CRR Project is projected to contribute \$2.251 billion to GSP during its operation phase from 2024–25 to 2053–54. The total projected contribution of the CRR Project to GSP is \$3.282 billion present value in real terms.

#### 7.5.1.2 Jobs Created

As at June 2016, the CRR Project is expected to generate, directly and indirectly, an average of 1,547 full-time equivalent (FTE) jobs per annum during the construction phase, with the peak year recording 2,932 supported jobs. During the operational phase, the CRR Project is expected to generate an average of 576 supported FTEs per annum, with the peak year during this phase recording 1,255 supported jobs.

<sup>49</sup> The direct benefits of the CRR Project can be identified from key project financial parameters.



## 7.6 Economic Analysis Outcomes

In summary, a detailed economic analysis was undertaken for the CRR Project, which incorporated:

- A detailed CBA, which measured the direct benefits associated with the CRR Project against a 'without' base case. The CBA considered a detailed sensitivity analysis designed to test any uncertainty in the parameters utilised in the appraisal.
- A WEBS appraisal, which considered agglomeration, increased labour supply and changed output in imperfectly competitive markets.
- An economic impact assessment utilising CGE modelling to measure the macroeconomic impacts resulting from economy-wide productivity shocks following delivery of the CRR Project.

The results of the appraisal demonstrate significant gains to the Queensland economy from the delivery of the CRR Project. These outcomes are summarised in Table 7.10.

	RESULTS – 4% DISCOUNT RATE	RESULTS – 7% DISCOUNT RATE
BCR	2.22	1.41
NPV (\$ million)	7,069.9	1,877.2
IRR	9.3%	9.3%

**Table 7.10: Economic Appraisal Summary Results**

### 7.6.1 Productivity Benefits

Productivity gains anticipated from the CRR Project have also been identified.

Well-targeted transport investment results in significant, long-term productivity benefits for local, regional and national economies. Productivity is the efficiency of transforming inputs (including capital and labour) into outputs (goods and services).

Reduced transport costs reduce the costs of doing business, lowering the costs of production and increasing the efficiency of business interactions.

Productivity gains for the CRR Project have been estimated from the CBA. Productivity gains derived from the CBA include work-related benefits as a subset of the benefits identified in the CBA. Each anticipated productivity gain is provided in Table 7.11.

ANALYSIS	CATEGORY	TOTAL \$ MILLION	PV (7%), \$ MILLION
CBA	<b>BUSINESS TRAVEL TIME SAVINGS</b>		
	Total cashflow – travel time savings	3,767.3	710.6
	<b>VEHICLE OPERATING COST SAVINGS</b>		
	Total cashflow – VOC	2,169.7	391.5
	<b>Total productivity (CBA)</b>	<b>5,937.0</b>	<b>1,102.1</b>

**Table 7.11: Anticipated Productivity Gains**



# CHAPTER EIGHT

## POLICY AND LEGISLATIVE FRAMEWORK



## CHAPTER 8

### POLICY AND LEGISLATIVE FRAMEWORK

#### CHAPTER SUMMARY AND CONCLUSIONS:

- Procurement of the CRR Project will be undertaken in accordance with the Queensland Procurement Policy and the Queensland Government's Project Assessment Framework.
- The estimated full-time equivalent (FTE) direct and indirect employment sustained by the delivery of the CRR Project is 1,547 jobs per year, on average, during construction. The projected employment peaks at 2,932 jobs during construction.
- The estimated direct and indirect employment generated during the operations phase of the CRR Project is 576 FTEs per year, on average, over the 30-year assessment period. The projected employment peaks at 1,255 jobs during operation.
- The Queensland Government's Building and Construction Training Policy and the Queensland Charter for Local Content are applicable to the CRR Project as it progresses to procurement and delivery phases.
- The Building and Construction Training Policy requires at least 10 per cent of the total labour hours be undertaken by apprentices or trainees and through other workforce training.
- Local industry will be provided with full, fair and reasonable opportunities to tender for work on the CRR Project, according to the Queensland Charter for Local Content.
- Fare pricing is an important consideration for the CRR Project. The Queensland Government's Fairer Fares package was implemented on 19 December 2016, after the CRR Detailed Business Case 2016 had been finalised. By delivering cheaper fares and a reduced number of travel zones, the scheme increases the need for the CRR Project by boosting public transport demand.
- Legislative issues pertaining to planning approvals, environmental legislation, industrial relations, rail safety and accreditation, property, native title and cultural heritage have been considered.
- The review determined that the Reference Project can be delivered within the existing legislative framework in Queensland.



## 8.1 Purpose and Overview of this Chapter

The purpose of this chapter is to identify any relevant agency or whole-of-government policy considerations that may impact the CRR Project and assess and compare potential impacts on the Reference Project, where appropriate.

This chapter outlines policies relevant to the CRR Project, specifically relating to:

- employment, including building and construction training
- procurement, including local industry participation
- fare pricing
- alternative funding and financing
- energy management and carbon emissions.

This chapter also describes the legislative framework that applies to the CRR Project.

## 8.2 Whole-of-Government Policy Considerations

### 8.2.1 Employment and Training

The CRR Project will generate employment and industry development opportunities during the construction, and operations phases of the project. Table 8.1 presents the estimated full-time equivalent (FTE) employment provided by the CRR Project. The data represents the sum of direct and indirect employment.

PHASE	AVERAGE FTES PER ANNUM	PEAK FTES
Construction phase (2015–16 to 2023–24)	1,547	2,932
Operational phase (2024–25-2053–54)	576	1,255

**Table 8.1: Average Number of Direct and Indirect Jobs Generated by the CRR Project per Annum (FTEs)**

During the implementation phase, highly skilled personnel will be required to design, construct and commission the CRR Project, ensuring its effective integration with the SEQ rail network.

Advanced technology employment opportunities – for example, installing new generation signalling in the CRR tunnel – will open up opportunities for further business investment within SEQ. Developing and implementing recruitment and training processes will be integral to the start-up of the CRR systems and operations. Training will include a combination of system knowledge, specific skills and safety training, as well as technical training such as vehicle-specific maintenance, driver and station staff training. The level and types of training will be in accordance with the procedures and requirements of Queensland Rail.

### 8.2.2 Queensland Procurement Policy

The Queensland Procurement Policy (QPP) is the government’s overarching policy for the procurement of goods and services, including construction. Its purpose is to deliver excellence in procurement outcomes for Queenslanders.

The QPP and the Queensland Government’s Project Assessment Framework (PAF) are complementary documents and are closely aligned. The PAF directs users to the QPP in the first instance and then supplements that with guidance on how the QPP is applied within the various stages of the PAF.





Procurement of the CRR Project will be undertaken in accordance with the QPP and delivery agency procedures as they apply at the time the project enters the procurement stage. Procurement activities will be designed to:

- extract the best commercial value from procurement transactions
- effectively manage risk
- ensure probity, transparency and accountability for outcomes.

More detailed discussion of the QPP, as it relates to transparency and accountability, is provided in Chapter 9: Public Interest Considerations.

Further detail regarding the delivery strategy for the CRR Project can be found in Chapter 14: Implementation Plan.

### 8.2.3 Queensland Government Building and Construction Training Policy

The Queensland Government Building and Construction Training Policy supports the Queensland Government's commitment to job creation and lowering unemployment by prioritising more apprenticeships and traineeships for Queenslanders. It also aligns with the Queensland Government's commitment to increasing the economic independence of Aboriginal and Torres Strait Islander people.

The training policy replaces the Queensland Government Building and Construction Contracts Structured Training Policy and the Indigenous Employment Policy for Queensland Government Building and Civil Construction Projects. A core requirement is that a minimum of 10 per cent of the total labour hours on eligible projects is to be undertaken by apprentices or trainees and through other workforce training. All Queensland Government departments and statutory bodies, as defined in the *Financial Accountability Act 2009*, are required to comply with the training policy.

The policy applies to eligible Queensland Government building and civil construction projects throughout Queensland. It supports employment opportunities and skills development in Queensland's building and construction industry. The training policy also focuses on increasing the economic independence of Aboriginal and Torres Strait Islander people in the industry in Queensland. Eligible projects are Queensland Government building projects with a contract sum of \$500,000 or greater (including GST), and civil construction projects with a contract sum of \$3 million or greater (including GST). From 1 July 2015, all building and civil construction projects with a contract sum above \$20 million (including GST) tendered by government-owned corporations also became eligible projects.

### 8.2.4 Local Industry Participation

The Queensland Government is committed to delivering genuine opportunities for Queensland businesses by giving them full, fair and reasonable opportunities to tender for infrastructure and resource-based projects and major procurements in Queensland.

Accordingly, the CRR Project procurement documentation will incorporate the government's expectations<sup>50</sup> that proponents will:

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<sup>50</sup> As outlined in the Queensland Charter for Local Content.



- recognise that involving local industry in projects and capital asset acquisitions provides economic benefits to all parties and is crucial to the long-term development of a strategic manufacturing and service capability
- ensure that Queensland and Australian suppliers, contractors and manufacturers are given full, fair and reasonable opportunities to tender and participate in all stages of projects and acquisitions, subject to the Queensland Charter for Local Content
- apply the principles of achieving value for money in government procurement as described in the Queensland Procurement Policy
- work in partnership with regional communities to develop industry capability and capacity and secure broader economic and societal benefits, as appropriate
- build transparency into their local content policies, processes and criteria to ensure clarity
- comply with Australia's international obligations, including those under free trade agreements<sup>51</sup>.

This will ensure that investing in the CRR Project provides opportunities for local industry, where possible, without adverse effects on cost, quality or timeliness.

#### 8.2.5 Alternative Funding and Financing

The State Infrastructure Plan 2016 (SIP) identifies the importance of effective funding and financing options for infrastructure (in Part B: Program).

Through the SIP, the Queensland Government commits to:

- developing and implementing a value capture/sharing policy
- improving the Queensland Government's capability to apply value capture to infrastructure project development and delivery
- piloting new value capture models
- incorporating value capture into major infrastructure proposals as part of business case development, in conjunction with Building Queensland
- increasing awareness of value capture through research and stakeholder events.

Regarding alternative funding and financing options, the Queensland Government commits to:

- improving the Queensland Government's capability to apply alternative finance and funding methods to infrastructure project development and delivery
- considering arrangements to facilitate private investment, including interaction with private sector participants and, if appropriate, establishing a panel
- incorporating alternative funding and financing approaches into major infrastructure proposals, in conjunction with Building Queensland

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<sup>51</sup> Queensland is currently a party to three international agreements that impact on procurement:

- Australia-New Zealand Government Procurement Agreement
- Australia-United States Free Trade Agreement
- Australia-Chile Free Trade Agreement.



- working with local government and the private sector to investigate alternative infrastructure funding and financing options, including superannuation funds and infrastructure bonds.

To inform the policy development process, alternative and innovative funding options to deliver state infrastructure were discussed at the Exploring Value Sharing in Queensland symposium in Brisbane in March 2016. The symposium engaged stakeholders in exploring the benefits of alternative and innovative funding models, including value capture, and examined local, national and global case studies. A formal value capture/sharing policy has not yet been adopted by the Queensland Government.

The suitability and potential for alternative funding of the CRR Project will be better understood following further analysis by the CRRDA of delivery model options and the finalisation of a Queensland Government value capture/sharing policy.

#### 8.2.6 Ticketing and Fare Pricing

Over the past decade Brisbane public transport fares have been high by Australian and international standards (particularly when service frequencies are taken into account). Prices were increased by 15 per cent in January 2012, 7.5 per cent in January 2013 and a further 7.5 per cent in January 2014. The higher ticket prices reduced demand and slowed patronage growth.

In August 2015, the Queensland Government appointed a Fare Review Taskforce to review the existing fare structure for public transport in SEQ and design a fare path strategy that promotes fairness, addresses affordability and grows patronage. Examining the existing fare structure holistically, the taskforce provided options to increase patronage, ensure value for money for users and government, reduce revenue leakage, simplify the network and continue to encourage take-up of *go* cards.

On 12 June 2016, the Queensland Government announced its new Fairer Fares package in response to the review. It reduced the number of travel zones from 23 to eight and reduced fares for most commuters between four and 34 per cent per trip. The off-peak discount was extended from 3am to 6am. The new fare pricing structure commenced on 19 December 2016. Fairer Fares has contributed to an increase of over 500,000 trips across the public transport network in the last year<sup>52</sup>.

Further detail on the implications of the Fairer Fares package for the CRR Project can be found in Chapter 6: Project Benefits, Chapter 7: Economic Analysis and Chapter 13: Value Creation and Sharing Assessment.

#### 8.2.7 National Greenhouse and Energy Reporting

Private vehicles are a major contributor to greenhouse gases in Queensland. The CRR Project is expected to improve the state's overall energy efficiency and reduce air pollution by encouraging more people to use the train, rather than their cars, as train services are improved. This issue is explored further in Chapter 3: Problem.

The largest portion of Queensland Rail's carbon emissions arise from the supply of traction electricity to the electric train fleet. Queensland Rail manages energy efficiency by:

- modelling and refining train movements, including energy use, to optimise the on-time delivery of services while keeping service costs to a minimum
- utilising regenerative braking on a number of trains to feed electricity back into the traction network

<sup>52</sup> Queensland Government TransLink Tracker, January-March 2017



- investing in new generation rollingstock with lower energy consumption.

### 8.3 Cross River Rail Delivery Authority

The *Cross River Rail Delivery Authority Act 2016* (Qld) (CRRDA Act) commenced on 14 April 2017. The CRRDA Act establishes the CRR Delivery Authority (CRRDA) and provides mechanisms to facilitate the efficient delivery of the CRR Project and transport-related projects.

### 8.4 Planning Approvals Processes

#### 8.4.1 Initial Advice Statement

The Queensland Coordinator-General declared 'the CRR project, as defined in the Initial Advice Statement dated 16 February 2010, to be a significant project for which an Environmental Impact Statement (EIS) is required' by gazette notice dated 26 March 2010. Through amendments to the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act), the CRR Project is now a 'coordinated project'.

#### 8.4.2 Coordinator-General Evaluation Report and Change Report

The Coordinator-General released an evaluation report for the CRR Project 2011 on 20 December 2012, recommending that it proceed subject to a number of conditions.

By request for project change dated February 2017, the proponent requested that the Coordinator-General evaluate changes (as discussed in Chapter 1: Project Background) to the project and to the conditions of the project. The request for project change was publicly notified from 25 February 2017 to 27 March 2017, and then extended from 3 April 2017 to 21 April 2017.

The Coordinator-General evaluated the proposed changes by the CRR Project: Coordinator-General's Change Report (Change Report), dated 8 June 2017. The Change Report approved the changes to the project, and amended the imposed, stated and recommended conditions based on those changes.

#### 8.4.3 Priority Development Areas

The Reference Project intersects the Woolloongabba priority development area (PDA) and the Bowen Hills PDA, which are declared under the *Economic Development Act 2012* (Qld) (EDA Act), however they do not restrict development of the transport infrastructure. The CRRDA Act also makes provision for CRR PDAs to be declared.

#### 8.4.4 Environment Protection and Biodiversity Conservation Act

In July 2017, the Australian Minister for the Environment and Energy has determined that the Reference Project was 'not a controlled action'. This means that the proposed action does not require further assessment and approval under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) before it can proceed.

### 8.5 Industrial Relations and Work Health and Safety Issues

During the construction phase of the CRR Project, the Queensland Government will contract specialised rail infrastructure, construction and tunnelling companies to build the works. These contractors are likely to be privately operated companies falling under the Australian Government employment regime. Depending on the contractor, there may also be federal and state government safety-related implications.

Provided the relevant contractor is engaged as Principal Contractor for the purposes of the work health and safety legislation, that contractor will bear the primary obligations to ensure the CRR Project is constructed



safely and in accordance with good practice. Under the relevant contract, the contractor would also ordinarily engage relevant personnel and bear the ongoing employment and industrial risks, including delay, during this phase. The Queensland Government would, however, continue to hold obligations with respect to health and safety, as they cannot be delegated to another party. This includes an obligation to consult, cooperate and coordinate with other parties who are responsible for health and safety duties in relation to these matters.

## 8.6 Rail Safety and Accreditation

On 28 February 2017, the Queensland Parliament passed the *Rail Safety National Law (Queensland) Bill 2016* (Qld). The effect of this is that from 1 July 2017, the Rail Safety National Law (RSNL), which is set out in the schedule to the *Rail Safety National Law (South Australia) Act 2012* (SA), applies in Queensland. The Office of the National Rail Safety Regulator is responsible for accrediting rail infrastructure managers and rollingstock operators under the RSNL.

The party carrying out 'railway operations' (which includes both construction and operation of railways) will need to be accredited in accordance with the process in the RSNL. The contracts for any railway operations will need to be carefully prepared to ensure that:

- the Principal Contractor has management and control over the workplace on which any physical works are carried out
- the construction of new rail infrastructure will be undertaken under the control and management of a person with suitable accreditation
- Queensland Rail maintains effective control and management of the existing rail infrastructure and rollingstock (which will likely necessitate variations to its existing accreditation).

## 8.7 Land Acquisition

### 8.7.1 Authority to Acquire Land

The CRRDA can negotiate to purchase land required for the CRR Project or compulsorily acquire land (including subsurface land) under the CRRDA Act.

The CRRDA Act also provides that the CRRDA is a constructing authority under the *Acquisition of Land Act 1967* (Qld) (AL Act) and can therefore take land for purposes relating to transportation under the AL Act, provided the purpose comes within a function of the CRRDA. The process to be followed when compulsorily acquiring land is the process set out in the AL Act. If the land is compulsorily acquired, a person with an interest in the land is entitled to claim compensation.

### 8.7.2 Compensation for Acquisition of Land

Compensation is also assessed under the AL Act. Compensation is payable to a person with an interest in the land as at the date the land (or part of the land) is resumed. The concept of an 'interest' in land is interpreted broadly and it covers, for example, owners, lessees, licensees, easement holders and mortgagees of the land. Chapter 5: Reference Project describes the specific property impacts associated with the Reference Project.

### 8.7.3 Native Title

Native title assessment of the CRR Project will be required if the assessment is that native title may continue to exist within any part of the CRR Project area, and the applicable provisions of the *Native Title Act 1993* (Cth) will need to be followed.



## 8.8 Approvals

Table 8.2 contains a list of regulatory approvals that may be required for construction, delivery and operation of the Reference Project. For many approvals, whether or not the approval is required will depend on the particular activity or land on which the project is carried out. This list is not exhaustive, and will be refined as the project progresses.

APPROVAL	DESCRIPTION
EIS change report	Request for the Coordinator-General to assess proposed changes to the previous CRR Project subject to outcomes of the Procurement Process.
<i>Transport Infrastructure Act 1994</i> (Qld)	Approval required for works on or interfering with a state government-controlled road or rail corridor land.
Rail safety and accreditation	Approvals required under the RSNL.
Cultural heritage management plan	Required under Part 7 of the <i>Aboriginal Cultural Heritage Act 2003</i> (Qld).
<i>Environmental Protection Act 1994</i> (QLD) (EP Act)	Approvals are likely to be required for environmentally relevant activities, depending on specific activities for construction.
Soil disposal permit for contaminated soil	Permits will be required under the EP Act for the removal and disposal of soil from a place listed on the Environmental Management Register.
Development approvals	Development approvals under the <i>Planning Act 2017</i> (Qld) may be required. Planning scheme approvals are unlikely to be required as the Reference Project is development for transport infrastructure that is government-supported transport infrastructure, which cannot be made assessable by a local planning instrument.
<i>Queensland Heritage Act 1992</i> (Qld)	Development by the Queensland Government on a registered heritage place.

**Table 8.2: Approvals Matrix**





CHAPTER NINE

PUBLIC INTEREST CONSIDERATIONS



## CHAPTER 9

### PUBLIC INTEREST CONSIDERATIONS

#### CHAPTER SUMMARY AND CONCLUSIONS:

- Public interest considerations including stakeholder impacts, public access and equity, accountability and transparency, consumer rights, safety and security and privacy have been examined. These issues have informed the development of the CRR Project.
- A significant infrastructure project, the CRR Project will be delivered in a highly urbanised environment, impacting roads, public utilities, existing and planned developments and public and private land.
- Previous iterations of the CRR Project have undergone extensive community consultation and an environmental impact statement (EIS) process.
- Formal community consultation was also undertaken as part of the CRR request for project change application. This involved communicating the proposed changes to the CRR Project and potential impacts on the community and stakeholders.
- A detailed Social Impact Evaluation (SIE) was undertaken as part of the CRR EIS Process and was addressed in the Request for Project Change (RfPC), with material improvements in social impacts identified compared to the CRR Reference Project 2011.
- Analysis undertaken demonstrates that the Reference Project is in the public interest and provides, on balance, equitable outcomes for all stakeholders.

#### 9.1 Purpose and Overview of this Chapter

The purpose of this chapter is to assess whether the Reference Project is in the public interest and to ensure that, on balance, it provides equitable outcomes for stakeholders.

This chapter outlines:

- identified stakeholders and the potential impacts the CRR Project may have on these stakeholders
- other public interest issues relating to:
  - public access and equity
  - accountability and transparency
  - consumer rights
  - safety and security
  - privacy.



The concept of the ‘public interest’ was defined by the New South Wales Ombudsman in November 2010, as

*Referring to considerations affecting the good order and functioning of the community and government affairs, for the wellbeing of citizens. The expression ‘for the common good’ is also used... Every policy decision, such as a decision to build a road or to approve a development application, requires a balancing of interests, at least to some extent. In most cases there will be winners and losers. The decision-maker needs to consider all of those who may be affected as individuals but more importantly, how the community at large may be affected<sup>53</sup>.*

Unlike financial and economic assessments that focus principally on the overall net impact, public interest assessments consider the distributional consequences of implementing the activity or project. The key concept of ‘public interest’ for the CRR Project is that, on balance, the project provides equitable outcomes for all project stakeholders and proceeds with a highly transparent process.

## 9.2 Impact on Stakeholders

A significant infrastructure project, the CRR Project will be delivered in a highly urbanised environment, impacting roads, public utilities, existing and planned developments, public and private land. The Reference Project (as described in Chapter 5: Reference Project) is expected to reduce negative stakeholder impacts compared to previous cross-river transport proposals due to changes in the project’s scope such as a shorter tunnel and modified tunnel portal locations.

The CRR Project is a ‘significant project’ under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). An environmental impact statement (EIS) was previously undertaken to assess environmental, social, employment and economic impacts of the CRR Project 2011. As discussed in Chapter 8: Policy and Legislative Framework, the CRR Request for Project Change (February 2017) assessed the impacts of proposed project changes. Key areas covered in the application include:

- transport
- land contamination
- land use and tenure
- water resources and flooding
- air quality
- noise and vibration
- settlement
- waste
- indigenous and non-indigenous cultural heritage
- nature conservation
- social
- economic benefits and impacts.

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<sup>53</sup> Public Interest – Public Sector Agencies Fact Sheet



The impacts can be broadly categorised in terms of impacts to the following major stakeholder groups:

- Businesses and residents: Potential short-term impacts on these stakeholders during construction may include noise, dust and vibration, and possible changes to access and in some areas occasional disruptions outside normal working hours.
- Motorists: Motorists may experience changes in access, delays associated with road network changes and resulting congestion.
- Community: Community members may experience occasional changes to normal train and bus services and construction close to sensitive areas.

The CRR Request for Project Change includes a Draft Outline Environmental Management Plan that outlines a comprehensive environmental management framework and possible mitigation measures for the construction and operations phases of the CRR Project. Operational impacts will be mitigated, as much as possible, through project design. The Coordinator-General has released a report on the proposed changes, including conditions of approval in order to manage and minimise potential impacts.

#### 9.2.1 Property Benefits and Impacts

Property owners are often the greatest beneficiaries of transport projects. They enjoy better accessibility and transport services in their local area, which can result in increased property prices over time. While it can be difficult to accurately predict the absolute value of this uplift, numerous studies confirm the benefits of increased transport capacity and other ancillary infrastructure enhancements on local commercial and residential property utility and value. Adverse impacts generally take the form of loss of property ownership, impacts on businesses operations due to construction or operational requirements and changes in property access.

Property ownership loss will be limited, as far as possible, through a design that seeks to minimise property impacts of the CRR Project. While much of the preferred alignment is underground or on existing Queensland Government land, a project of this size will require some land for construction, site establishment and volumetric land resumptions for the tunnel and station infrastructure. Acquisition of the volumetric corridor is planned to secure the underground land required for the CRR Project. This will guarantee the long-term integrity of the tunnel and stations, protecting the infrastructure from incompatible future development on surrounding lands.

Given the predominantly underground nature of the CRR Project, the private property volumetric acquisitions, and their impacts, will be significantly less than what would be required for comparable surface rail projects.

Consultation with many property owners for the CRR Project has been undertaken through the public notification phase of the request for project change process from February to April 2017. The scope of the CRR Project significantly reduces property impacts compared to previous solutions.



### 9.3 Community Consultation

A range of traditional and digital engagement activities were used to inform community members and key stakeholders about the CRR Project design. The project team liaised directly with potentially affected landowners and provided information to all stakeholders on how to make a submission to the Coordinator-General. Activities included:

- letters to 1,488 potentially affected property owners
- meetings with 60 government departments, key stakeholders, landowners and community groups
- doorknocking more than 600 properties
- distribution of more than one million newsletters
- distribution of 12,000 flyers at transport interchanges
- static displays at six libraries and four electorate offices
- three community information sessions, attended by more than 200 people
- seven staffed displays at shopping centres, attended by more than 500 people.

Traditional engagement was supported by a far-reaching awareness and digital engagement campaign including newspaper advertising, social media and a project website. A combination of paid and organic digital content reached 725,872 people on Facebook, 93,289 professionals on LinkedIn and 247,000 individuals on Twitter.

A detailed summary of feedback received during the consultation period has been collated with key areas of interest identified including:

- project design
- land tenure and property impacts
- employment and procurement
- project support
- traffic and transport impacts
- timing and funding.

Community feedback received throughout the course of the CRR Project since 2011 has generally indicated that the need for the CRR Project is well understood and support for the CRR Project and improved public transport is high. The consultation processes also revealed that physical elements such as parks, landscapes and pedestrian and cycle connectivity, and intangible qualities such as sense of place and community cohesion, are considered important to quality of life, health and wellbeing.

Comprehensive community consultation and key stakeholder engagement will continue throughout the future phases of the CRR Project.



## 9.4 Social Impact Assessment

A detailed evaluation of the potential environmental impacts resulting from the changes between the CRR Project 2011 and CRR Project is outlined in the CRR Request for Project Change (February 2017) Volume 4.

The Request for Project Change forms part of the CRR EIS 2011, under the *State Development and Public Works Organisation Act 1971*. While the impacts have been quantified where possible, this analysis is largely qualitative in nature. Potential mitigation strategies and a comprehensive environmental management and monitoring framework is outlined in the Request for Project Change Draft Outline Environmental Management Plan (RfPC EMP). The RfPC EMP is the key reference document for the management of potential impacts of project construction and operation.

A qualitative assessment of the potential direct, indirect and cumulative impacts (both positive and negative) of the CRR Project on the surrounding area was undertaken. It considered changes to the social environment and the way people interact with their socio-cultural environment.

Overall, the assessment found a material improvement in the potential identified social impacts when compared to the impacts identified for the CRR Project 2011. Table 9.1 summarises the nature of potential changes. With regard to commercial diversity impacts, compared to the CRR Project 2011, changes in the project design may marginally reduce the accessibility and mobility of some suburbs (primarily those in the southern section of the study area) to areas of economic density. The change is not considered material.

SOCIAL IMPACT RISK ASSESSMENT – NATURE OF CHANGE														
POSITIVE	●				●		●	●		●			●	
NEUTRAL			●	●		●			●		●	●		●
NEGATIVE		●												
	Relocated Residents	Commercial Diversity	Employment Changes	Income Changes	Property and Business	Needs of Social Groups	Heritage and Cultural Values and Beliefs	Community Identity and Cohesion	Cohesion of Development and Surrounds	Health	Property Values	Crime and Public Safety	Social Amenity	Residential Stability

Table 9.1: Summary of Social Impact Change, CRR Project 2011 to CRR Project

## 9.5 Public Access and Equity

The CRR Project has a responsibility to identify the nature and extent of public access needed throughout all project stages and to determine how this will be addressed. Legal and regulatory requirements, third-party access and mechanisms to address potential access deficiencies must all be considered. Community consultation, the EIS process and transport patronage modelling have all assisted in determining the nature and extent of public access required. This, in turn, has informed access, local land-use patterns and circulation elements specified during planning and feasibility stages of the CRR Project.

Technical specifications for the CRR Project must comply with specific statutory requirements and government policy standards, including those detailed in the Disability Standards for Accessible Public



Transport (DSAPT)<sup>54</sup>, *Disability Discrimination Act 1992* (DDA) and relevant building codes. As the CRR Project progresses to the procurement phase, a safety accreditation process will be undertaken. This will ensure compliance with the access and egress requirements of the Director (Rail Safety Regulation), Department of Transport and Main Roads. Applicable rail safety legislation is further discussed in Chapter 8: Policy and Legislative Framework.

The CRR Project must also protect third-party access to essential major infrastructure and services. The project design provides for emergency parking and emergency incident access and evacuation for essential service providers and others that contribute to the sustainability of the system. The CRR Project is also committed to ensuring that construction and operational impacts do not unreasonably impinge on access to essential third-party infrastructure or emergency services. (Essential infrastructure includes power, rail, water, sewerage and the road network.) Additional details on design and construction are provided in Chapter 5: Reference Project. Table 9.2 summarises the safeguards the CRR Project will put in place to ensure infrastructure and vehicle access for the community.

ACCESS SAFEGUARDS	
ACCESS REQUIREMENT	SAFEGUARD
Identify the nature and extent of required access.	<ul style="list-style-type: none"> <li>▪ Ongoing patronage demand modelling</li> <li>▪ Identify interest groups, including the disadvantaged</li> <li>▪ Application of DSAPT</li> </ul>
Develop strategies and mechanisms to ensure access.	<ul style="list-style-type: none"> <li>▪ Product development or specification</li> <li>▪ Project delivery</li> <li>▪ Establish performance criteria</li> </ul>
Ensure third-party access.	<ul style="list-style-type: none"> <li>▪ Identify third-party needs through normal business and contingency processes</li> <li>▪ Access assured under differing scenarios</li> </ul>
Protect design and ensure delivery of public access.	<ul style="list-style-type: none"> <li>▪ Consider establishing incentive and penalty regimes for both infrastructure and service delivery</li> </ul>
Deliver infrastructure to specification and government standards.	<ul style="list-style-type: none"> <li>▪ Establish CRR Project specifications and processes to ensure compliance to building codes and other statutory standards</li> </ul>

**Table 9.2: Access Safeguards during CRR Project Development**

For the CRR Project to be in the public interest, there must be equity between the recipients of benefits and bearers of associated costs.

As a major infrastructure project, the CRR Project will benefit the entire SEQ community but will temporarily impact on specific communities. These impacts are highest around the tunnel portals, new station sites and construction worksites. However, over the long-term, the CRR Project will positively impact many of these same affected communities. These communities will experience better public transport services, reduced congestion and faster car trips, potential increases in property values, better local amenity, improved local infrastructure and better access to employment centres and government services. Further details on benefits are discussed in Chapter 6: Project Benefits and Chapter 7: Economic Analysis.

<sup>54</sup> The DSAPT were developed to assist public transport operators and providers to meet their obligations under the DDA. The DDA makes it unlawful for any person to contravene a disability standard (including the DSAPT).





The CRR Project will implement mitigation measures through design and construction planning processes, as outlined in the CRR Request for Project Change, to maintain a reasonable environmental amenity and ensure any negative impacts are managed and minimised to the extent possible.

## 9.6 Accountability and Transparency

On larger, complex projects and activities that impact many people, transparency of process is particularly important, as is the opportunity for community members to participate and have confidence in the development of the project or activity.

Governance arrangements for the CRR Project clearly denote lines of accountability. As the CRR Project proceeds through to delivery, governance arrangements will evolve, ensuring continued clear lines of accountability and transparency. Future governance arrangements will consider the project's technical complexity, implementation time, decision-making mechanisms, funding arrangements, approvals, accreditation and commissioning arrangements.

The CRR Project will be delivered in accordance with the principles of accountability and transparency as outlined in the Code of Conduct for the Queensland Public Service. These principles include:

- exercising proper diligence, care and attention
- using public resources in an effective and accountable way
- managing information as openly as practicable within the legal framework.

Demonstrating accountability and transparency reduces the likelihood of unethical behaviour, reassures and informs the community and instils confidence in all stakeholders concerning the integrity of decisions. All phases of the CRR Project must comply with relevant legal requirements, policy standards and government commitments to stakeholders. These include:

- National Public Private Partnership Guidelines
- Queensland Government's Project Assessment Framework
- *Right to Information Act 2009*
- *Public Sector Ethics Act 1994*
- *Public Records Act 2002*
- *Integrity Act 2009* (Qld)
- *Transport Infrastructure Act 1994*
- *Transport (Rail Safety) Act 2010* and superseding *National Rail Safety Law*
- *Transport (Rail Safety) Regulation 2010* and superseding *National Rail Safety Regulation*
- *Transport Operations (Passenger Transport) Act 1994*
- *Transport Operations (Passenger Transport) Regulation 2005*
- *Financial Accountability Act 2009*
- *Queensland Industry Participation Policy Act 2011*
- Queensland Procurement Policy (QPP) and procedures
- Queensland Government Land Transaction Policy.



Procurement processes will be undertaken in accordance with the underlying intent of the QPP and related procurement procedures.

Transparency in procurement refers to the openness of a procurement activity to scrutiny by interested parties. It involves providing documented reasons for decisions and appropriate information to relevant stakeholders.

In the context of procurement, accountability involves being able to demonstrate how the CRR Project has achieved its procurement objectives<sup>55</sup> in a manner consistent with the QPP and government priorities associated with procurement, including the Queensland Charter for Local Content and Best Practice Guidelines for Agencies (2015). This will ensure:

- full, fair and reasonable opportunity for participation by local suppliers
- value for money
- regional and industry development
- transparency of process
- compliance with international obligations.

The charter does not mandate that government agencies must use local suppliers; rather it provides a mechanism for government agencies to effectively and efficiently consider potential suppliers when making procurement decisions.

The CRR Project has engaged a probity advisor to provide probity oversight. A probity plan has been developed setting out the general principles and practices necessary to ensure that processes are conducted properly and with regard to probity requirements. All participants in the CRR Project are required to complete appropriate documentation declaring any conflict of interest and binding them to confidentiality. This also involves attending a probity briefing.

## 9.7 Consumer Rights

The CRR Project is not anticipated to adversely impact those people to whom government has a higher duty of care. Furthermore, it is anticipated that the CRR Project will beneficially impact socially disadvantaged people who are more dependent on public transport, with safer, more frequent and reliable services. Other public transport patrons in the broader community will also enjoy these benefits.

## 9.8 Safety and Security

The CRR Project will be developed to address applicable security, health and safety requirements. The regulatory and legislative frameworks that inform the CRR Project include:

- *Transport Infrastructure Act 1994*
- *Work Health and Safety Act 2011*
- *Electrical Safety Act 2002*
- *Dangerous Goods Safety Management Act 2001*
- *Disability Discrimination Act 1992*

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<sup>55</sup> Outlined in the Queensland Purchasing handbook, Ethics, Probitry and Accountability in Procurement.



- *Transport (Rail Safety) Act 2010*
- Transport (Rail Safety) Regulation 2010
- *Transport Security (Counter-Terrorism) Act 2008*
- Building Code of Australia
- Queensland Counter-Terrorism Strategy 2013–2018
- Queensland Government Infrastructure Protection and Resilience Framework 2005
- Crime Prevention through Environmental Design: Guidelines for Queensland (2007)
- Bridges and Tunnels Security Risk Context Statement
- Surface Transport Security Assessment, Office of the Inspector of Transport Security
- Land and Water-based Mass Passenger Transport Security Risk Context Statement, August 2009.

In accordance with strict international, federal and state government standards, safety in design principles have been considered during the development of the CRR Reference Project. Safety is an integral part of a wider set of design objectives, including practicality, aesthetics, cost and functionality. Safe design successfully balances these sometimes competing objectives without compromising the health and safety of those potentially affected by the product over its lifetime. A detailed risk analysis has been undertaken for the CRR Project, the outcomes of which are presented in Chapter 11: Risk Analysis.

The fire and life safety elements incorporated into the Reference Project have been developed and peer reviewed by suitably qualified and experienced engineers. Queensland Fire and Emergency Services and Queensland Rail have been and will continue to be consulted to ensure the CRR Project is developed in a manner that addresses relevant security and health and safety requirements.

The CRR Project is not expected to adversely impact existing Queensland Rail security standards or practices. Queensland Rail is committed to ensuring customers and staff are safe at all times. Queensland Rail design standards take into account security and health and safety requirements to reduce the risk of accident, injury, antisocial behaviour and crime.

The CRR Reference Project considers crime prevention through environmental design principles to ensure that public spaces are safe and opportunity for crime is minimised. Features such as platform screen doors, adequate lighting, closed-circuit television cameras and barriers that encourage passive surveillance and allow clear sight lines are part of the Reference Project (refer Chapter 5: Reference Project).

Implementing the CRR Project will beneficially impact a wide range of stakeholders. Safety has been considered in the design and development phases and will continue to be a key driver in the implementation and operations phases.



## 9.9 Privacy

The CRR Project is responsible for complying with legislation relating to information privacy and must comply with the principles in the *Australian Government Privacy Act 1988*. Queensland's *Privacy Information Privacy Act 2009* and *Right to Information Act 2009* also provide safeguards for the handling of personal information in the public sector environment.

The Queensland Government's Information Standard 18: Information Security sets out the principles for addressing information security risks, including classification and control of material, personal security and physical and environmental security.

As part of probity requirements, all participants in the business case development process completed statements requiring them to maintain the confidentiality of designated confidential information. These obligations continue after their involvement has ceased, until participants are advised otherwise or until the information becomes public (other than through a breach of the obligations).

Any information supplied by the community, industry and stakeholders as part of the business case development process will be used solely for the purpose of developing the CRR Project in accordance with the Queensland Government's privacy guidelines. This information will not be disclosed to any third parties without the consent of the individual, unless otherwise required by law.



CHAPTER TEN

SUSTAINABILITY ASSESSMENT



## CHAPTER 10

### SUSTAINABILITY ASSESSMENT

#### CHAPTER SUMMARY AND CONCLUSIONS:

- A sustainability assessment was conducted to identify and document sustainability considerations relevant to the CRR Project.
- Nine sustainability principles were used to complete the sustainability assessment, with the CRR Project rated as follows:
  - Connected to the wider system: Advanced rating
  - Fit for the future (resilient and adaptive): Moderate rating
  - Biodiversity: Basic rating
  - Reduced resource use: Moderate rating
  - Social and community benefits: Advanced rating
  - Equity: Moderate rating
  - Local and regional context: Advanced rating
  - Economic advancement: Advanced rating
  - Innovation: Moderate rating.
- The sustainability assessment demonstrates that the CRR Project will contribute to positive economic, environmental and social outcomes. All sustainability principles scored a rating of 'moderate' or higher (with the exception of biodiversity which scored a 'basic' rating), indicating the Reference Project is 'increasing project sustainability'.

#### 10.1 Purpose and Overview of this Chapter

The purpose of this chapter is to identify sustainability considerations relevant to the CRR Project. A sustainability assessment was conducted in order to understand and mitigate immediate and long-term impacts. Undertaking a sustainability assessment also assists in documenting the economic, social and environmental impacts of the CRR Project, not just its financial performance.

This chapter outlines the:

- approach taken to complete the sustainability assessment for the CRR Project
- results of the sustainability assessment, presented under nine headings to demonstrate the impacts of the CRR Project on key economic, environmental and social dimensions.

A comprehensive environmental management framework has also been prepared and captured in the CRR Request for Project Change Draft Outline Environmental Management Plan (RfPC EMP). The RfPC EMP is the key reference document for the management of potential impacts of project construction and operation. It also outlines sustainability considerations.



## 10.2 Approach

The sustainability assessment for the CRR Project considered the extent and nature of consequences and opportunities relating to the following sustainability principles: connected to the wider system, fit for the future, biodiversity, reduced resource use, social and community benefits, equity, local and regional context, economic advancement and innovation.

The sustainability assessment indicates how well the CRR Project achieves the sustainability principles according to the levels in Table 10.1.

SUSTAINABILITY ASSESSMENT RATING		
LEVEL	CRITERIA	
<b>Advanced</b>	<ul style="list-style-type: none"> <li>Generates significant additional value and new opportunities not previously evident, such as changing a liability into an asset.</li> <li>'Designs out' the problem up-front rather than relying on managing impacts later.</li> <li>Solutions generate flow-on benefits outside the project boundary.</li> </ul>	Increasing project sustainability
<b>Moderate</b>	<ul style="list-style-type: none"> <li>Solutions to significant issues result in multiple benefits through economic, social and/or environmental outcomes.</li> <li>Meets immediate community and user needs and will be resilient and efficient into the future.</li> <li>Incorporates significant innovation and leading practice into the project.</li> </ul>	
<b>Basic</b>	<ul style="list-style-type: none"> <li>Avoids harm and negative effects.</li> <li>Solutions create project efficiencies.</li> <li>Solutions have an immediate or short-term focus.</li> </ul>	
<b>Compliant</b>	<ul style="list-style-type: none"> <li>Meets legislative and regulatory requirements.</li> </ul>	It is assumed that all projects will meet this level. Sustainable solutions are therefore expected to go beyond regulatory compliance.
<b>Poor</b>	<ul style="list-style-type: none"> <li>Fails to meet legislative and regulatory standards.</li> <li>Solutions may result in disbenefits and negative effects.</li> </ul>	

Table 10.1: Sustainability Assessment Ratings





### 10.3 Sustainability Assessment

The outcomes from the sustainability assessment for the CRR Project are presented in Table 10.2.

CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES	
DEMONSTRATE HOW THE CRR PROJECT FULFILS THE FOLLOWING SUSTAINABILITY PRINCIPLES.	ACHIEVEMENT LEVEL OF THE PRINCIPLE (INDICATE LEVEL ACHIEVED): ADVANCED, MODERATE, BASIC, COMPLIANT, OR POOR
<p><b>1. Connected to the wider system</b></p> <p>All infrastructure projects sit within a broader context and should be planned, designed and operated to connect with the wider system (including other infrastructure, economic activity, population hubs and movements, flows of resources, materials, goods and people). This could occur at neighbourhood, town, city, region or state scales.</p>	Advanced
<p><b>What are the key elements and interrelationships of the wider system or network for this project that are fundamental to its long-term effectiveness?</b></p> <ul style="list-style-type: none"> <li>Changes and predicted conditions in the wider demographic, economic and social systems that make up the SEQ region are the core drivers of the CRR Project.</li> <li>From a demographic perspective, the region continues to evolve rapidly. The SEQ population is forecast to increase by 1.45 million people by 2036. Much of this growth is set to occur outside Brisbane in areas such as the Gold Coast, Ipswich, Moreton Bay, Logan and the Sunshine Coast. At the same time, 45 per cent of the region's jobs growth is forecast to occur within Brisbane. This demographic profile will generate significant economic activity, culminating in the movement of people between population areas and employment hubs. These movements will be concentrated in peak periods and, on average, will involve longer distances than today. Overall, the region's forecast demographic characteristics and resulting travel demand are the key drivers of the CRR Project.</li> <li>Strategically, rail is the mode best suited to cater for the region's future travel patterns. Demand on the rail system is set to triple by 2036. The current rail system does not have the capacity to cater for this increase in demand. A rail system unable to meet demand will negatively impact the broader transport system and, ultimately, the economy.</li> <li>The CRR Project is designed to integrate with the regional rail network, ensuring seamless operations between the project and the broader system in which it functions.</li> </ul>	
<p><b>How will the project connect with, or respond to these elements?</b></p> <ul style="list-style-type: none"> <li>Inner-city capacity is constrained, with capacity limits expected to be reached in some areas by 2021 and progressively worsen. Network reliability reduces as this capacity threshold is approached. Beyond this threshold, the network will be unable to cater for demand, nor expand into new growth areas. The implications of not addressing this constraint go beyond the regional rail network: road network congestion will worsen, impacting on road freight and the already constrained bus network.</li> <li>By unlocking the crucial inner-city core, capacity will be released across the whole SEQ rail network. This will allow the network to expand into new growth areas and connect new communities with places of employment, education, recreation and community facilities.</li> <li>The CRR Project will enable the rail network to meet long-term demand forecasts for the region. It will become a critical link between existing and new communities and places of employment.</li> <li>The CRR Project will seamlessly integrate with existing regional rail operations and control systems, as well as TransLink's ticketing system.</li> </ul>	



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**2. Fit for the future (resilient and adaptive)**

Design infrastructure to be resilient and adaptive in response to long-term environmental, social and economic change. Focus on longer term use and outcomes so that the infrastructure leaves a positive (not negative) legacy.

**Moderate**

How will the infrastructure be resilient to climate change, including extreme weather events?

- While many uncertainties remain, climate change presents a risk to rail network infrastructure and operations, both above ground and underground. With a large part of the project located underground, the impacts of climate change have been considered, such as extreme weather events, and protection measures developed.
- Design components will reduce the level of risk for climate change impacts. These are based on information known at the time and include the following:
  - Planning and designing the project alignment to avoid areas of major, high-risk flooding, where possible. Vulnerability of the CRR Project to extreme events, particularly flooding, has been assessed through the environmental assessment and mitigation measures have been identified where necessary.
  - Locating and designing station entry points to ensure protection of underground infrastructure in the event of local flooding and more ‘extreme’ river flooding events. An example is the inclusion of dedicated flood-protection measures at Albert Street station to protect against extreme river flood events.
  - Using platform screen doors to maintain temperatures within station environments and facilitate the efficient use of cooling systems.
- While design measures have already been incorporated into the concept design, further actions may be considered in detailed design to enhance the sustainability aspects of the CRR Project, both during construction and operation.
- One expected project outcome is reduced greenhouse gas emissions through reduced private vehicle use, ultimately contributing to managing climate change. The economic assessment has quantified the saving in greenhouse gas emissions at \$24 million over the 30-year operating period adopted for the economic analysis, using a discount rate of seven per cent (further detail on the quantification method is provided under principle 4 below).

**How can the project respond to the most significant (i.e. those with greatest impact and most probable) drivers of change over the next two decades?**

- The CRR Project has been planned within a longer term planning framework and directly responds to major long-term drivers of change. This is important as rail infrastructure generally has a life of more than 100 years. The CRR Project is a proactive response to anticipated long-term trends and changes, such as a doubling of public transport demand, social evolution (with a highly mobile and interconnected population) and environmental issues (such as a push to reduce greenhouse gas emissions and local air pollution associated with road traffic).



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**3. Biodiversity**

Conserve or improve the condition of biodiversity and ecological integrity of terrestrial, aquatic or marine environments.

**Basic**

**How can the project not just avoid or minimise damage but maintain or improve the presence, condition and extent of vegetation, fauna and ecosystems?**

- The CRR Project has been designed primarily as a tunnel system, running deep underground through Brisbane's inner city and CBD. Surface connections are mostly contained within existing rail corridors or highly urbanised areas. These areas are generally considered to be of low natural habitat value and integrity, with most flora and fauna considered common and widespread in Brisbane.
- Most areas with some ecological or habitat value along the corridor have been avoided (for example, by tunnelling beneath them).
- An indirect benefit of the CRR Project is reduced demand for road travel and associated new road infrastructure. While difficult to quantify, these offset road infrastructure requirements may help maintain the presence, condition and extent of regional vegetation, fauna and ecosystems. Much of the demand catered for by the CRR Project involves longer journeys (e.g. from the Gold Coast) where road infrastructure expansion would potentially compromise existing interurban breaks (areas of green space).
- The CRR Project will also encourage redevelopment and densification of urban areas surrounding the corridor. This densification reduces pressure to expand the urban fringe into areas of greater environmental sensitivity through greenfield development.
- The previous CRR Project was designated a 'coordinated project' (requiring an environmental impact statement (EIS)) under the *State Development and Public Works Organisation Act 1971* and completed an Environmental Impact Statement (EIS). (This means the project met the legislative requirements for impact assessment, which includes detailed consideration of biodiversity impacts.) The impact assessment has been updated through the CRR Request for Project Change and in June 2017 the Coordinator-General released the Coordinator-General's change report, including new conditions of approval.

**4. Reduced resource use**

Achieve a low environmental footprint by reducing use of non-renewable resources, materials, water, energy, greenhouse gas emissions and reducing or avoiding waste.

**Moderate**

**What is the plan to reduce materials, water and non-renewable energy inputs?**

- The CRR Project has registered for an infrastructure sustainability (IS) rating through the Infrastructure Sustainability Council of Australia. A core aim of applying the IS rating system is the potential identification of a reduced environmental footprint through reduced use of materials, resources, water, energy and generation of waste. This applies to both construction and operational phases.

**How will greenhouse gas emissions be minimised?**

- On a per-person basis, electrified rail travel offers a much lower carbon footprint than low-occupancy private vehicles. As a public transport project, the CRR Project will help reduce greenhouse gas emissions by encouraging more people to swap their car for the train and reducing road congestion.
- As a result of the CRR Project and a shift towards public transport use, it is forecast that there will be a reduction in private vehicle kilometres travelled, thus a reduction in private vehicle greenhouse gas emissions. The economic analysis has found that the benefits of reduced environmental externalities as a result of the CRR project are estimated at \$116 million present value.
- Other opportunities exist to minimise construction and operational emissions. For example, selecting a spoil placement site closer to construction worksites would result in less emissions and overall total truck kilometres travelled. An indirect opportunity could stem from materials selection (e.g. low-carbon concrete). These will be explored through the detailed design phase – applying the IS rating tool may also assist in identifying opportunities.



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**5. Social and community benefits**

Contribute to vibrant, connected and liveable communities now and into the future.

**Advanced**

**How will the project respond to the expected changes in the community over the next decade?**

- The CRR Project is a direct response to anticipated demographic changes in the community over the next decade and beyond. Specifically, the expected 1.9 million additional people in SEQ by 2036 will triple the rail demand of 2015<sup>56</sup>.
- Rail is one of the most efficient and sustainable forms of mass transit. Investment in a rail network is an investment in the form and function of a city and its residents. Rail has a lifespan of more than 100 years and is therefore the frame around which a city grows and evolves.
- The CRR Project will improve accessibility for passengers. For example, pedestrian access (e.g. pedestrian paths, underpasses, ramps and bridges) and new stations will meet the *Disability Discrimination Act 1992* compliance standards. Social and community benefits will stem from the use of universal accessibility design principles.

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<sup>56</sup> CRR Project model 2016



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**How will the project contribute to community connectivity and liveability?**

- The CRR Project will strengthen community connectivity and enhance the region's lifestyle by enabling people to move more quickly and easily between places of residence, community facilities, employment and entertainment.
- Long-term beneficial social and community effects will be realised through better access and connections for the community (including more vulnerable groups such as children, the elderly and those that do not own cars) to district and regional-level social infrastructure such as:
  - major medical and health care facilities such as the Royal Brisbane and Women's Hospital, Princess Alexandra Hospital, Mater Hospital and Lady Cilento Children's Hospital
  - sport and entertainment facilities such as The Gabba and Brisbane Showgrounds
  - education facilities such as the Queensland University of Technology and The University of Queensland
  - major open spaces such as the City Botanic Gardens and Roma Street Parkland.
- The CRR Project will also make it easier to access community service organisations within Brisbane's inner city, particularly for clients from outer-northern and southern suburbs and the wider SEQ region.
- The CRR Project is of a sufficient scale to affect regional growth in SEQ. It will support the development of SEQ regional areas by connecting activity centres and residential growth hotspots by rail to Brisbane's CBD. The CRR Project addresses a number of key SEQ regional growth management strategies, including the following:
  - Infill development: The CRR Project will influence land-use patterns and development activity in an efficient and sustainable manner by enhancing the SEQ rail network. The cycle of transport supply and accessibility will encourage residential activity near railway stations, necessitating development activity that supports higher density dwelling outcomes. This, in turn, will help achieve infill dwelling outcomes sought by ShapingSEQ, the Queensland Government's regional planning framework.
  - Inner-city employment expansion: The CRR Project will directly support inner-city growth projections by providing additional transport capacity into key employment growth areas.
  - Connecting new cities and regional centres: Development of strategic regional development areas such as Caloundra South, Flagstone, Fitzgibbon, Coomera and Yarrabilba will occur within the rail catchments supported by the CRR Project. Without the additional regional rail network capacity provided by the CRR Project, the ability to connect these new areas to principal activity centres by high-quality transit will be compromised. The result will be car-dependent communities, which significantly contributes to continued growth in demand for road space and increased congestion.
  - Urban renewal around station precincts: The CRR Project will act as a catalyst for urban renewal in precincts surrounding stations and passenger catchment areas. Each station is located within precincts that are undergoing or will undergo significant redevelopment over the next 20 years. The CRR Project will facilitate this development by increasing the scale of development and shortening the timeframe for the broader precinct development outcomes to be achieved.



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**6. Equity**

Share the benefits and costs of infrastructure development in a fair and equitable way.

**Moderate****Who are disadvantaged or made vulnerable through this project? How is this being addressed?**

- As with all major transport projects, some local communities will be temporarily disrupted during the construction phase by impacts such as changes to traffic, pedestrian access and increased noise, dust and vibration. These short-term impacts are considered to be outweighed by the long-term benefits. The environmental assessment presented in the CRR Request for Project Change outlines possible mitigation measures to ensure any impacts are managed to the extent possible and that consultation is undertaken with affected areas.
- Queensland Rail projects and works operate under Queensland Rail's environment, planning and management framework. This framework provides targeted processes and plans to help individual projects manage environmental impacts, including construction disruption to sensitive receptors, throughout the implementation of works.
- The CRR Project requires the whole or partial acquisition of some properties for surface works and volumetric acquisition of properties above the tunnel alignment. The general project strategy for property is to clearly inform property owners whose properties may be directly affected. In some cases, this may result in the early purchase of property. The aim is to provide certainty and flexibility for these property owners in relation to property decisions.
- The CRR Project is not likely to disadvantage or increase the vulnerability of particular segments of the community in its operational phase. In fact, the CRR Project will improve access to public transport for many parts of the community. An example is the 7.7 per cent of Greater Brisbane households that do not own a private vehicle, or those not yet at driving age. These segments of the community will benefit from improved public transport options and accessibility to economic and social opportunities.

**How are the benefits shared equitably?**

- The CRR Project significantly boosts social infrastructure within the corridor. It encourages community cohesion by enhancing connections between individuals, groups, businesses and neighbourhoods.
- The new underground stations will comply with requirements of the *Disability Discrimination Act 1992* to ensure equitable and improved access for people with disabilities as well as the wider community. People with mobility difficulties will be able to easily and safely access rail services and travel opportunities.

**7. Local and regional context**

Be responsive to the local and regional heritage and sense of place and contribute to local character and amenity.

**Advanced****How is the local or regional 'sense of place' and identity shaped, maintained or improved by the project?**

- Sense of place refers to the relationship between people and their environment and denotes the existence of special characteristics that define the character and identity of a place. In the inner city, these features such as landscape elements, buildings, topographical features, aesthetic or character qualities are evolving as Brisbane grows and matures.
- These features were considered in a local context for the CRR station precincts. Station precinct planning and urban design is being undertaken to provide a 'vision' of how the stations and surrounding areas could look once fully developed. This process uses criteria that ensure unique characteristics in each area are enhanced, not lost. In addition, direct community engagement has occurred and will continue to inform this process, ensuring project outcomes match the local and regional context.
- As outlined, rail infrastructure is the frame around which a city grows. The CRR Project will contribute to city-building outcomes and ultimately to the evolution of place, character and amenity in key areas of Brisbane's inner city.



## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**8. Economic advancement****Advanced**

Contribute to economic development, diversity and growth.

**How will the project contribute to improving economic development and diversity at the local or regional scales?**

- During the construction phase, economic modelling indicates that the CRR Project will contribute a total of \$1,030 million to Queensland's gross state product (present value, seven per cent discount rate).
- During operations, the CRR Project will contribute a total of \$2,251 million to Queensland's gross state product (present value, seven per cent discount rate).
- Changes to the features of an urban economy can result in wider economic benefits. Direct gains attributable to the CRR Project can be magnified as they pass through the broader economy. These possible changes and impacts include the following:
  - Agglomeration effects from transport bringing activities and people closer together and raising the effective density of economic activity. This can result in more efficient labour markets.
  - Imperfect competition effects where companies that benefit from transport improvements experience lower costs, which can be converted to increased turnover. These effects tend to be more important for improvements that deliver significant time and cost savings to travellers in the course of work.
  - Additional labour supply due to improvements in travel times and reduced travel costs acting as an incentive to work. Reducing the cost of accessing jobs and improving accessibility can encourage non-participants, typical potential second-earners or family members with child-care responsibilities to take up employment.
  - More productive jobs, with better access to city centres and growth in employment in highly productive locations.
- The total wider economic benefits estimated for the CRR Project are \$1,209.2 million (present value, seven per cent discount rate).
- Integration of land-use and transport infrastructure planning and development is a significant consideration for the CRR Project. The CRR Project will increase the capacity of the inner-city rail network, strengthening the viability of the broader SEQ rail network and facilitating the region's continued growth and economic development. The CRR Project is strategically located within the urban footprint. It will integrate with high-growth residential and employment areas that have intense economic activity and high-trip-generating land uses. This includes the Woolloongabba PDA, Boggo Road Urban Village and Brisbane's CBD.

**How will small and medium businesses benefit and be able to take full advantage of the opportunities?**

- By better connecting residential areas to Brisbane's CBD and principle activity centres, the CRR Project will give small and medium-sized businesses greater access to the region's pool of workers and support greater agglomeration outcomes.
- Opportunities exist to stimulate the local economy in retail and commercial precincts through the CRR Project, particularly around stations. Co-locating public transport infrastructure adjacent to retail and commercial precincts makes it easy for patrons to use local businesses without an extra car trip. The new stations will be integrated with surrounding land uses such as commercial, retail and green open space areas.





## CROSS RIVER RAIL SUSTAINABILITY ASSESSMENT OUTCOMES

**How will the project help create stable, long-term local or regional employment opportunities?**

- The CRR economic analysis found that during construction, the CRR Project will generate a large demand for skilled workers as well as general civil construction labour. It will directly and indirectly generate an average of approximately 1,547 jobs (full-time equivalent (FTE)) annually over the construction period. The peak level of direct and indirect employment during the construction period is 2,932 FTEs. This level of employment is short term for the construction phase.
- During operation, the estimated direct and indirect contribution to employment from the CRR Project is an average of approximately 576 FTEs per annum, with a peak of 1,255 FTEs.
- The CRR Project is key to maintaining access to expected employment in the Brisbane CBD for workers from across the region. Without the CRR Project, access to these employment opportunities will be compromised, either resulting in relocation of jobs to other areas or stifled economic activity.
- The CRR Project will apply principles contained in Queensland Government policies about procurement, employment and training for major public construction projects to stimulate the local economy and job growth opportunities.

**9. Innovation**

Encourage innovative approaches and solutions that address the main project challenges and result in multiple benefits that not only improve efficiency, but also the project's overall effectiveness.

**Moderate**

**How are relevant global trends and leading practice likely to influence similar infrastructure in the future incorporated into the project?**

- The tunnelling industry is rapidly evolving, with experience being gained on similar projects across the world. Recent trends and leading practice in tunnelling technology will be adopted in the construction of the CRR Project. The concept design has been developed by a leading global engineering consultancy firm and includes application of international expertise.
- The CRR Project will incorporate European Train Control System Level 2, representing a significant development in rail signalling technology for the SEQ rail network. The system will replace the need for lineside signalling, thus reducing the space required for rail tunnels and improving train system reliability and safety.

**Where are opportunities to apply innovative thinking to design out problems up-front rather than rely on managing impacts later?**

- Techniques were applied as the concept design was planned and developed to deliver the best outcome while maintaining constructability and minimising environmental impacts. This has partly been driven by the need to identify and manage impacts in a timely manner (as the CRR Project is a 'coordinated project' under the *State Development and Public Works Organisation Act 1971*, requiring an EIS). An iterative process has existed between impact assessment and design.
- The procurement phase will seek innovation through a competitive tender process that drives innovation from bidders.

**Table 10.2: CRR Project Sustainability Assessment Results**



# CHAPTER ELEVEN

## RISK ANALYSIS



## CHAPTER 11

### RISK ANALYSIS

#### CHAPTER SUMMARY AND CONCLUSIONS:

- The risk analysis for the CRR Project was completed in accordance with Queensland Government guidance material including the Project Assessment Framework and the Department of Transport and Main Road's Project Cost Estimating Manual.
- The key risks for the CRR Project include:
  - requirements varying following detailed design
  - extra land being required for construction purposes
  - community reaction necessitating changes to portal locations
  - unavailability or delay in connection of utilities necessary for construction
  - industrial action or similar causing delay and additional costs.

#### 11.1 Purpose and Overview of this Chapter

The purpose of this chapter is to identify and assess the risks that might create, enhance, prevent, degrade, accelerate or delay the achievement of the CRR Project objectives and outcomes. This chapter summarises the outcomes of the risk analysis undertaken for the CRR Project, which will inform the risk management strategy required to deliver the CRR Project.

The Queensland Government's Project Assessment Framework requires a detailed risk analysis process to be conducted for the CRR Project and a project risk register to be developed. The methodology and process followed for the risk analysis complies with, and was guided by, the following frameworks and manuals:

- Australian Standard ISO31000:2009 Risk Management – Principles and Guidelines
- National Public Private Partnership Policy and Guidelines
- Department of Transport and Main Roads (TMR) Project Cost Estimating Manual
- Department of Infrastructure and Transport Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction.



## 11.2 Risk Identification and Assessment

Risk identification involves determining what, why, where, when and how events could prevent, degrade, delay or enhance the project outcome.

Project risks include (but are not limited to) the risk categories shown in Table 11.1.

RISK IDENTIFICATION	
PROJECT RISK CATEGORY	ONGOING RISK CATEGORY
Site	Operations and maintenance
Design and manufacture (including geotechnical)	Sponsor and financial
Construction and commissioning	Industrial relations
Operations and maintenance	Legislative and government policy
Sponsor and financial	Force majeure
Industrial relations	Asset ownership
Legislative and government policy	
Force majeure	
Market	
Network and interface	
Asset ownership	

**Table 11.1: CRR Project Risk Categories**

Project risks can be separated into two major categories – planned and unplanned – reflecting their different natures. Planned risks relate to the potential for the ‘known’ aspects of the project, which are measured in terms of scope, quantity and productivity, to vary over time. Unplanned risks relate to potential changes in circumstances that may impact on the scope or nature of works and, hence, the cost to deliver the project such as weather impacts, industrial issues, safety and design standards.

Together, the planned and unplanned risk assessment profiles represent the risk adjustment to the raw cost profile. When combined, the raw cost profile and the risk adjustment represent the total cost profile of the CRR Project.



### 11.3 CRR Project Key Risks

#### 11.3.1 Key Risks – Project Implementation

##### 11.3.1.1 Unplanned Risks

Key unplanned risks, and mitigation measures identified to accept, reduce or eliminate the likelihood or consequences of these risks, are outlined in Table 11.2.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Design risk	This is the risk that as a result of detailed design, requirements are variant.	Additional cost and time	Develop clear performance requirements with Queensland Rail, including how the possessions schedule in the area is managed that will provide the opportunity for proponents to optimise the staging solution.
Design risk	This is the risk that as a result of detailed design and investigations, such as geotechnical and contamination, cost and timetable vary. This includes variations in cross-sectional area, length of tanking, interchange work, more rock support, increased operational costs and increased maintenance requirements. This also includes discovery of errors and miscalculations from previous works.	Delays and additional costs	Additional investigations shall be identified throughout the procurement phase with tenderers and the CRRDA.
Design risk	This is the risk that the requirements to give emergency services access to the corridor will change the design requirements.	Changes to the design and increased cost	The Queensland Government will engage with emergency services including Queensland Fire and Emergency Services (QFES), Queensland Ambulance Service (QAS) and Queensland Police Service (QPS). This engagement needs to be accurately captured and included in the contract documentation.



## RISK ANALYSIS

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Site risk	This is the risk of extra land than originally proposed for construction purposes being required. This risk includes compensation (property price and disturbance) costs for additional land to be acquired.	Additional cost and time	Ensure sufficient design and construction planning is undertaken to identify the property extents of the project. Throughout procurement the CRRDA needs to work with tenderers to define property constraints.
Site risk	This is the risk that community reaction causes changes to portal locations, in terms of land acquisition or corridor.	Delays to the project in obtaining approvals due to changed portal locations Cost of acquiring additional land and delays Potential additional cost due to changed conditions of approval to project Infers changes after Coordinator-General's approval Requires a change report process	Use Queensland Government land to the extent possible. Undertake proactive community engagement.
Site risk	This is the risk that there is delay in the connection or unavailability of utilities necessary during construction (including power and water).	Delays and additional costs	Engagement and planning work and design with utility providers needs to be undertaken to understand needs and requirements against available supply. This planning work and design should be tested during procurement with the tenderers to ensure that utility supplies are adequate.
Site risk	This is the risk that during the design and construct phase the contractors cannot obtain reasonable access to the site, including roads, to undertake works in the most efficient manner.	Delays to the project Additional costs to reschedule and additional resources required	Develop access to worksites and identify the cumulative impacts through the approvals process. Engage with BCC and TMR to coordinate local road access.
Construction risk	This is the risk of damage to Queensland Rail infrastructure, impacting on services or community perceptions. Particular issues exist with Queensland Rail's Rail Management Centre.	Cost to repair Queensland Rail infrastructure Delays to the project	Identify sensitive assets to be protected and develop a process for accessing, protecting and repairing Queensland Rail assets. Include this within the contract documentation.



## RISK ANALYSIS

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Construction risk	This is the risk that there is a lack of integration between the major contracts. This includes integration between design, construction, civil engineering, signalling and mechanical and electrical. It also includes the integration of subcontractors (such as site handovers).	Delays to the project Increased costs to manage process, rectify errors or rework	Project delivery strategy should be developed to minimise the number and complexity of interfaces. The Queensland Government will sufficiently resource to manage the number and complexity of interfaces.
Industrial relations risk	This is the risk of industrial action (including strikes, lockouts, work bans, work-to-rules, blockades, picketing, go-slow action and stoppages) causing delays and costs. This includes the risk of significant employment changes due to industrial action and the risk of industrial action specifically as a result of safety concerns or a major safety incident (issue of ownership of safety case).	Delays and costs to the project	Clearly identify industrial relations requirements in the contract and identify (throughout procurement) how tenderers will successfully engage and manage this risk.

Table 11.2: CRR Project Key Unplanned Risks – Project Implementation





#### 11.3.1.2 Signalling System Risks

While not identified as key risks from a total value perspective, the project risk register includes a number of risks and mitigations for signalling systems design, commissioning and integration within the CRR Project. Examples include:

- technical interfaces/integration risk
- rail signals commissioning risk
- systems interference risk
- interface between the European Train Control System Level 2 and legacy trains risk
- testing and commissioning planning time risk.

#### 11.3.1.3 Planned Risks

The key planned risks were determined to be attributed to the following components and aspects of the project:

- underground stations
  - Boggo Road station
  - Albert Street station
  - Woolloongabba station
  - Roma Street station
- schedule delays
- southern surface stations
- northern portal
- tunnel power (including traction power)
- client costs (the risk that client costs vary from the current estimated baseline leading to larger or smaller owner's team sizes)
- Exhibition station.

There are planned risks identified for construction works that are the result of uncertainties in the known or planned scope. Specifically, this relates to quantities expected for the design, cost of materials, additional unknown utilities for which relocation is required and construction worksite location (if this is not optimally located).

The prominence of Boggo Road station in the rank order of planned risks is the result of its correlation with the southern portal works. The complexity of the southern portal works, combined with the underground station, escalates Boggo Road station to the uppermost planned risk among the underground stations.



## 11.3.2 Key Risks – Ongoing

## 11.3.2.1 Unplanned Risks

Table 11.3 presents the key unplanned operating risks for the CRR Project's ongoing costs.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Design risk	Operational impact of changes to output specifications.  This is the risk that there are changes to the required functionality of the project resulting in a change in the estimated operating costs.	Cost impacts	Engage with Queensland Rail and other related stakeholders to determine the functional requirements of the project.
Operating risk	This is the risk of a major incident constraining operations and subsequently causing loss of revenue. Key issues include tunnel damage requiring repair, consequential impacts on other operators (private and freight), consequential impacts on Queensland Government royalties, effects on fare box revenue, impact on Queensland Rail's service agreement, impact on Queensland Rail's reputation and impact on mode shift for freight (road impacts and market share).	Increased maintenance and repair costs Decreased revenue Loss of reputation Claims from third parties	This is managed through the functional requirements related to maintenance and availability periods.  It should also be mitigated through the use of key performance indicators (KPIs) associated with the performance specification.
Operating risk	This is the risk of a major breakdown in equipment. Key issues include: <ul style="list-style-type: none"> <li>■ failure of traction power</li> <li>■ failure of signalling</li> <li>■ broken rail, ventilation system, substation, switchboards, escalators and lifts</li> <li>■ failure at the Rail Management Centre.</li> </ul>	Increased maintenance costs Decreased revenue	This is managed through the functional requirements related to maintenance and availability periods.  It should also be mitigated through the use of KPIs associated with the performance specification.



## RISK ANALYSIS

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Operating risk	This is the risk that during operations, permanent infrastructure including the tunnel and stations does not comply with rail safety regulations. Issues such as fire and life safety hazards in the confined space would need detailed escape, evacuation and rescue assessment. The Rail Safety Regulator would also require detailed emergency management procedures from the accredited operator, specifically for the tunnel environment.	Disruption to services Increased cost	The Queensland Government will engage with the Rail Safety Regulator and other relevant stakeholders.  Identify management processes within the contract documents and strategies for management through the operating phases.
Operating risk	This is the risk of a fire in the tunnel during operations.	Increased maintenance and repair costs Decreased revenue	The Queensland Government will engage with emergency services including QFES, QAS and QPS.  Identify risks through a fire engineering brief (set out in the International Fire Engineering Guidelines) of suitable strategies for managing fire events.
Asset ownership risk	This is the risk that the system technology is no longer supported by the original or any other manufacturer.  It also includes a required change from an external system that requires a change to the CRR systems, causing an issue in implementation.	Cost to replace system with new technology	Engage with Queensland Rail and other related stakeholders to determine the functional requirements of the project.
Industrial relations risk	This is the risk of industrial action (including strikes, lockouts, work bans, work-to-rules, blockades, picketing, go-slow action and stoppages) causing delays and costs. This includes the risk of significant employment changes due to industrial action and the risk of industrial action specifically as a result of safety concerns or a major safety incident (issue of ownership of safety case).	Delay and costs to the project	Clearly identify industrial relations requirements in the contract and identify (throughout procurement) how tenderers will successfully engage and manage this risk.



RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Legislative and government policy risk	This is the risk associated with federal, state or local government changes to policy or regulation, impacting on the project. These changes in law or policy cannot be anticipated when the contract is signed. (This excludes planning at federal, state, local government levels and tax legislation. It also applies to operations and maintenance only.)	Cost impacts	Engage with the relevant levels of government to clearly identify policy in the contract documents. Clearly articulate the management process within contract documents for dealing with legislative change.

Table 11.3: CRR Project Key Unplanned Risks – Ongoing



#### 11.3.2.2 Planned Risks

In addition to the key unplanned risks presented in Table 11.3, other significant planned risk drivers may impact on the CRR Project objectives, particularly cost or schedule.

The key ongoing planned risks were determined to be attributed to the following components and aspects of the CRR Project:

- Station operations and maintenance – underground: This is the risk that the costs attributed to the operation and maintenance of the underground stations (including routine maintenance, inspection and repairs) vary from the estimated amount. The variance is largely characterised by changes in underground station design (floor area, platform screen doors, lighting requirements, artworks etc.), changes in maintenance crew size or build-up, sizing of station electrical equipment (including cost of power) and waste disposal and cleaning costs.
- Capital replacement – signalling: This is the risk that the costs of capital replacement for the signalling equipment vary, which can be characterised largely by the quantity of signalling equipment, cost of equipment and maintenance interval of equipment.
- Operational overhead – underground: This is the risk that the operational overheads required to maintain the underground stations change as a result of an alteration to the functional requirements of the station.
- Station operations and maintenance – surface: This is the risk that the costs attributed to the operation and maintenance of the surface stations (including routine maintenance, inspection and repairs) vary from the estimated amount. The variance is largely characterised by changes in surface station design (floor area, platform screen doors, lighting requirements, artworks etc.), changes in maintenance crew size or build-up, sizing of station electrical equipment (including cost of power) and waste disposal and cleaning costs.



# CHAPTER TWELVE

## FINANCIAL AND DELIVERY OPTIONS ANALYSIS



## CHAPTER 12

### FINANCIAL AND DELIVERY OPTIONS ANALYSIS

#### CHAPTER SUMMARY AND CONCLUSIONS:

- The capital cost of the CRR Project amounts to \$5.4 billion (P90 nominal)
- The capital costs is based on the delivery of the core elements of the CRR Project with future investment for additional station and signalling to be considered separately to support the enhanced level of service facilitated by the CRR Project.
- Market sounding was undertaken to establish market views on key aspects of the CRR Project such as potential packaging, staging and delivery options.
- Delivery model options were considered using the assessment approach outlined in the Queensland Government's Project Assessment Framework Delivery Options Analysis and Building Queensland Business Case Development Framework (BCDF).
- This assessment recommended the tunnels and stations be delivered through a form of long-term contract (construction and maintenance), with significant and appropriate risk transfer to the private sector.
- The CRRDA is responsible for refining the approach to packaging and delivery as part of the CRR Project's procurement phase, discussed in Chapter 16: Implementation Plan.

#### 12.1 Purpose and Overview of this Chapter

The purpose of this chapter is to outline the financial costs of the CRR Project and activities undertaken relating to packaging and delivery.

This chapter outlines:

- the approach taken to complete the financial analysis
- the capital and ongoing costs associated with the CRR Project
- a summary of the independent financial model audit outcome
- activities undertaken to identify packaging and delivery models.

The financial analysis serves a different purpose to the economic analysis as it focuses on the financial costs (the net direct financial impact to the Queensland Government including cash flow implications) from a Queensland Government financing perspective. In contrast, Chapter 7: Economic Analysis focused on the overall economic impacts of the CRR Project for the broader community.

#### 12.2 Costs

##### 12.2.1 Approach

To estimate the costs of the CRR Project, a financial cost model was developed that takes into account costs over the life of the project. This model is populated with inputs reflecting the capital costs, ongoing costs and risk adjustments. Changes to the delivery approach and timeline may impact on the total costs.





A Monte Carlo simulation was used to develop an aggregated statistical cost risk profile for the CRR Project cost estimate combining both planned and unplanned risks to determine appropriate risk adjustments. Quantitative risk adjustments for the CRR project costs have been undertaken at the P50 and P90 level. The P90 value represents an estimate a 90 per cent probability that the cost will not be exceeded

## 12.2.2 Capital Works

The financial analysis estimated a risk-adjusted capital cost of \$5.4 billion (P90 nominal) for the CRR Project. Capital costs include:

- surface works
- signals, rail systems and power
- underground station works
- tunnelling
- tunnel track
- project land costs.

Underground station works such as excavation, structural works, lifts/escalators and internal finishes represent the largest item of project cost. Tunnelling works, rail systems and surface works also account for a materially significant proportion of the total cost. Allowances have also been made for the cost of acquiring the required project lands.

## 12.2.3 Ongoing Works

Analysis was also completed on the ongoing project costs associated with operating and maintaining the new infrastructure over a 30-year operating period. In general terms these costs include maintenance, repairs, cleaning, security and running the new facilities (including lighting and ventilation). The majority of these costs are incurred within the new underground stations.

## 12.2.4 Project Cashflows

A summary of the capital and recurrent expenditures over the project life is presented in Figure 12.1.

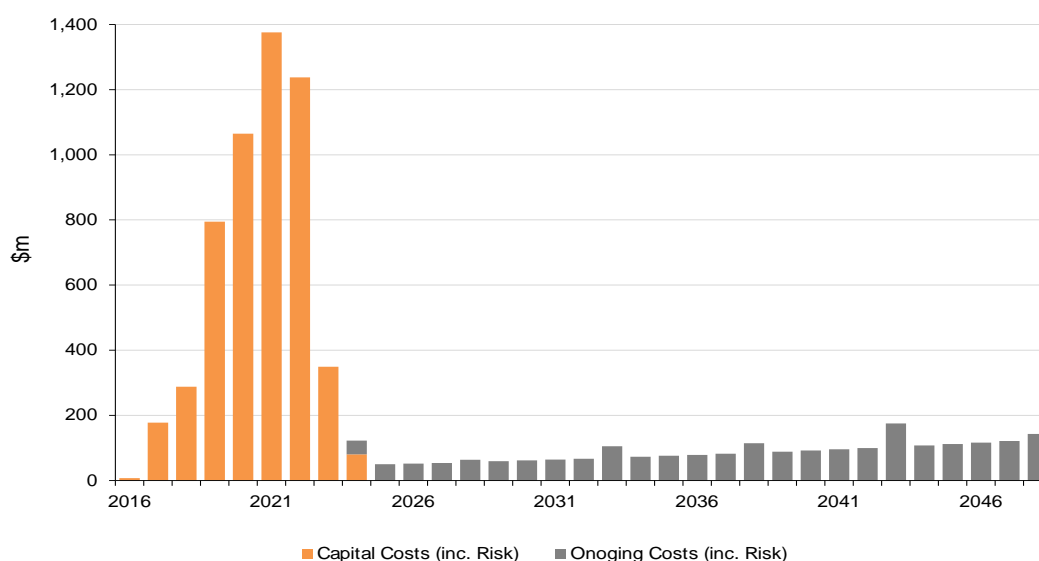


Figure 12.1: Cashflow Profile (Years 2016 to 2048)



Capital costs are spread over the project delivery period with a peak in year 2021. The increase in ongoing costs over time reflects inflation with peaks in years 2033, 2038, 2043 and 2048 when scheduled lifecycle replacements are expected to be undertaken.

### 12.3 Associated Investment and Rollingstock Considerations

The financial analysis has been based on the delivery of the core elements of the CRR Project.

To realise the full benefits of the CRR Project by 2036, future investment will be necessary in some station and signalling works at Northgate and Woolloowin and the acquisition of additional rollingstock and provision of additional train services to support the enhanced level of service facilitated by the CRR Project.

These future projects will be funded separately and may generate their own benefit streams.

### 12.4 Financial Model Audit

A suitably qualified model auditing firm was engaged to undertake an independent peer review of the financial model developed for the business case with no material issues identified.

### 12.5 Delivery Options Considerations

A targeted market sounding process was undertaken to establish market views on key aspects of the CRR Project, including potential approaches to scope, packaging, staging and delivery. Domestic and international contractors, property investors and financiers participated in the market sounding. Findings have informed the development of packaging and delivery options.

Delivery model options for the CRR Project were considered using the assessment approach outlined in the Queensland Government's Project Assessment Framework Delivery Options Analysis and Building Queensland BCDF. The assessment considered project-specific circumstances such as project objectives, project risks, market analysis, technical characteristics and precedent projects.

The CRRDA is responsible for refining the approach to packaging and delivery as part of the CRR Project's procurement phase, discussed in Chapter 16: Implementation Plan.

#### 12.5.1 Project Packaging Analysis

##### 12.5.1.1 Aggregated and Disaggregated Packages

The CRR Project could be packaged, procured and delivered as a single package or a number of separate packages.

To the extent that works are disaggregated, it is important to consider how best to package the various works elements (determining the size and scope of each package).

In general, procuring and delivering large, integrated packages has advantage of:

- reducing interface risk
- reducing cost through integrated design outcomes and economies of scale and scope
- creating a single point of accountability
- creating a more efficient and streamlined process
- creating greater capacity for the private sector to drive innovation and assume risk
- attracting major industry players.



While procuring and delivering the CRR Project components as multiple packages may increase integration and interface challenges, this approach has the advantage of:

- creating increased flexibility in responding to differing characteristics of the various project elements
- creating a larger pool of bidders with the capability and capacity to bid for at least one package.

#### 12.5.1.2 Individual Project Component Analysis

To determine the optimal approach to packaging, the technical characteristics of each project component – and their relationship to each other – need to be considered, along with the implications for cost, risk, market capacity and appetite. Table 12.1 describes the core project components that need to be procured and delivered.

COMPONENT	DESCRIPTION
Early and enabling works	This would typically include works such as site demolition and clearing, service diversions, creation of access points and earthworks.
Surface works	This would comprise both new track and connections with the existing rail network i.e. connection between the tunnel and associated surface track works at the southern end and more substantial surface works from the northern portal (incorporating works through the Exhibition station and Mayne Yard and connection to the northern line).
Tunnelling	This would comprise all underground tunnelling works.
Station development	This would incorporate station development including station excavation, structural works and the development and fit-out of new underground stations. A key packaging consideration is whether to combine the underground tunnelling works and station development.
Rail systems and track	This would incorporate all rail systems including power and signalling works within the CRR Project, including associated track works. This new equipment will have significant levels of interface with the existing network.
Development opportunities	Property development opportunities are still under assessment at each station location.

**Table 12.1: Core Components of the CRR Project**

#### 12.5.1.3 Packaging Options

Packaging options for the delivery of the CRR Project that could be considered include:

- delivering the project components as one single integrated package
- separating individual project components such that each is procured and delivered independently
- a combination of the above options
- separating the package, or potential future packages, based on geographical factors.

In considering packaging options, the following key aspects of the CRR project are noted:

- The project is complex and interface risk is considered to be a significant project risk and critical success factor.
- Working underground carries with it unique project risks in terms of safety and access.
- A combination of greenfield and brownfield works is included within the project scope.



- The scale of the project is sufficient to attract market interest.

#### 12.5.1.4 Role of Queensland Rail

In considering packaging options, it is noted that the CRR Project will be closely integrated into the core of the SEQ rail network. On this basis, Queensland Rail is currently expected to remain responsible for:

- coordinating corridor and network access
- accepting assurance and acceptance of assets into operation and maintenance
- monitoring performance over the life of the asset
- first-line response for rail system maintenance
- planning and coordinating the delivery of any possible future stages of the rollout of European Train Control System Level 2 (ETCS L2) across the network
- undertaking rail operations
- coordinating on behalf of the project with the Office of the National Rail Safety Regulator (ONRSR) on matters relating to rail safety and interface with the QLD rail network.

Table 12.2 provides criteria for the assessment of works packaging.

PACKAGING CRITERIA	DESCRIPTION OF CRITERIA
Technical requirements	Similarities in technical requirements, skills and capabilities needed to deliver the components of the package.
Economies of scale	Scale of the package is of sufficient value to generate economies of scale and associated efficiencies.
Timeline and completion	Package has a natural and definable point of completion and handover that is consistent with the overall timetable for delivery of the CRR Project.
Interface and integration with other packages	The separation of the package creates a manageable point of interface with other packages or creates unworkable interface risks. Assisting or detracting from achieving effective system integration.
Brownfield versus greenfield works	Natural points of separation in terms of brownfield and greenfield works.
Market appetite and capacity	Sufficient market interest in delivering the project package. Market capacity (i.e. private finance and/or contractor) is sufficient to deliver the package such that a competitive outcome is likely to be achieved.
Value for money	Packaging of the works maximises value for money in project delivery and future maintenance and infrastructure development. Proposed packaging solution drives appropriate risk transfer, such that cost efficiencies can be achieved.

**Table 12.2: Packaging Criteria**

A further detailed assessment of packaging options will be undertaken by the CRRDA as part of the procurement phase activities.



## 12.5.2 Potential Delivery Model Options

### 12.5.2.1 Delivery Model Options

Table 12.3 provides a short list of potential delivery model options, taking into account the full suite of available delivery model options, the project-specific circumstances and potential project packaging solutions.

DELIVERY MODEL OPTION	DESCRIPTION
Alliancing	Alliancing is a form of relationship based contracting in which the government collaborates with one or more non-owner parties (e.g. designer, constructor or other key stakeholders) to share the risks and responsibilities in delivering the construction phase of a project. This may be structured as either a single target outturn cost (TOC) alliance or a competitive TOC alliance whereby a competitive TOC is developed by more than one contractor.
D&C	A D&C contract typically involves government engaging a party that undertakes both the design and the construction of a project. The key principle of a D&C contract is to seek to transfer a level of design risk as well as construction risk. This model can be used where there is a desire for a level of innovation and risk transfer in design, the scope can be well defined and where there is a desire for a reasonable level of cost certainty which can be developed under a competitive tender process. However, in the event that design and operational requirements are not clearly articulated or contractually enforced, the model can lead to a strong focus on construction costs which may not necessarily best reflect a whole-of-life, value for money outcome.
DCM	The design, construct and maintain (DCM) model is similar to the D&C model, with the inclusion of a period of maintenance to be delivered by the contractor.
DBOM	In a design, build, operate and maintain (DBOM) arrangement, the private sector party is responsible for designing, building, operating and maintaining the project.
PPP	<p>A PPP is typically a long-term service contract between the public and private sectors where the government pays the private sector (typically a consortium) a service fee to deliver infrastructure and related services over an agreed project term. The private sector consortium typically designs, builds and finances the facility and operates and maintains it to specified standards. PPPs typically make the private sector parties who build public infrastructure financially responsible for its condition and performance throughout the asset's lifetime.</p> <p>PPPs are typically used where government is seeking the whole-of-life innovation and efficiencies that the private sector can deliver in the design, construction and operating phases of the project. PPPs also have the potential to provide a greater degree of time and cost certainty than traditional delivery approaches through the discipline of private finance.</p> <p>PPPs also provide an opportunity for the transfer of project risk to the PPP consortium.</p>



DELIVERY MODEL OPTION	DESCRIPTION
Hybrid solution	There are many permutations for the structuring of a 'hybrid' delivery solution. The hybrid approach is assumed to involve implementing an alliance with respect to 'non-fixed' components and a D&C or DCM approach for the 'fixed' price components within the project package structure. The rationale for considering a hybrid approach is to seek a better value for money outcome for the project by adopting alliance delivery only for those project elements which show costing uncertainties.

Table 12.3: Short-listed Delivery Model Options

Criteria to evaluate potential delivery model options have been developed based on the project objectives, project characteristics and the outcomes of the market sounding process. These are outlined in Table 12.4.

EVALUATION CRITERIA	DESCRIPTION
Project objectives	Ability of the delivery model option to meet the project objectives.
Optimal risk transfer	Extent to which the delivery model option facilitates optimal allocation and management of project risks. The most critical risk is the ability to effectively address interface risks, in particular, recognising the difference between greenfield works conducted underground and brownfield works conducted in a live rail operating environment.
Innovation	Extent to which the delivery model option is able to achieve innovation in design, installation and whole-of-life considerations.
Budget certainty and value for money	Extent to which the delivery model option facilitates a cost-effective outcome and delivers value for money (taking into account price and other value criteria such as design, installation and other innovation factors, whole-of-life cost considerations and risk allocation).
Market appetite	Ability of the delivery model option to attract market appetite (in terms of both contractor capacity and availability of private finance), thereby ensuring effective competition and ultimately delivering value for money.
Timeline and complexity	Ability of the delivery model option to deliver the project in the required timeframes and appropriately deal with the complexity of the project's implementation requirements.
Whole-of-life design and maintenance	Extent to which the delivery model option promotes a whole-of-life design and management solution across the asset and services delivered.

Table 12.4: Evaluation Criteria for Delivery Model Options

### 12.5.2.2 Assessment of Delivery Model Options

As described above, delivery model options considered range from relationship-based, risk-sharing contracting through to models that feature greater levels of risk transfer to the private sector and which may even include a financing component.

The delivery model assessment found that a delivery model with a form of long-term contract (construction and maintenance) – with significant and appropriate risk transfer to the private sector – is recommended for the tunnels and stations. This is subject to further detailed planning and assessment by the CRRDA.



# CHAPTER THIRTEEN

## VALUE CREATION AND SHARING ASSESSMENT





## CHAPTER 13

### VALUE CREATION AND SHARING ASSESSMENT

#### CHAPTER SUMMARY AND CONCLUSIONS:

- In accordance with Australian Government requirements regarding the investigation of value capture as a means of alternative funding for infrastructure projects, the CRR Detailed Business Case 2016 explored a broad range of value capture scenarios. While the CRR Project presents real opportunity for value creation through urban revitalisation, the Queensland Government's commitment to fully fund the CRR Project is not contingent on funding from alternative mechanisms including value capture.
- A value creation and sharing assessment identified the beneficiary groups and benefits of the CRR Project, and considered value sharing mechanisms that may be appropriate for the CRR Project.
- International case studies suggest there is no consistent application of mechanisms, or level of funding generated from, value sharing. Domestically, the use of value sharing to fund large public/heavy rail transport infrastructure projects is limited.
- Value sharing investigations focussed on beneficiaries in and around CRR station precincts, the CBD and near the CBD.
- The CRR Project will give rise to property development opportunities above and around CRR stations, as well as within broader precincts across the SEQ transit network. These opportunities continue to be investigated.
- The Cross River Rail Delivery Authority (CRRDA) is currently developing strategies to facilitate economic development for community purposes within CRR Priority Development Areas around station precincts. Value uplift to government-owned land within these precincts presents a potential opportunity to contribute to project funding.

#### 13.1 Purpose and Overview of this Chapter

This purpose of this chapter is to identify and assess the opportunities for value sharing (or value capture) and alternative funding that could contribute to financing the up-front or ongoing costs of the CRR Project. This chapter:

- analyses the context and need for value sharing as a funding source for infrastructure project delivery, including the current policy context and precedent projects that have utilised value sharing
- identifies the key beneficiaries of, and broadly the benefits delivered by, investment in the CRR Project
- discusses the potential for both real estate-based and economic tax uplift that could occur as a result of investing in the CRR Project
- considers the potential for development above and around new CRR stations, as well as other economic development opportunities.

This chapter draws on information contained in Chapter 6: Project Benefits and Chapter 7: Economic Analysis.



## 13.2 Value Sharing Context

In an environment where the fiscal capacity of governments is constrained, funding large infrastructure projects via traditional sources (direct government contributions and user charges such as fares or tolls) can only be part of the solution. Increasingly, governments have looked to value sharing (also known as value capture) mechanisms to provide additional sources of funding.

Value sharing identifies the beneficiaries of the infrastructure investment and seeks to monetise a share of the benefit delivered. This monetisation can occur either passively through existing tax frameworks or more actively via the utilisation of mechanisms.

Value sharing mechanisms can either generate funding up-front, defraying part of the up-front capital outlay, or on an ongoing basis, which can assist in repaying any financing raised to undertake the project (e.g. funding ongoing public private partnership availability payments).

The premise of value sharing derives from international and domestic research demonstrating the nexus between improved transport accessibility and amenity, and the positive effect on real estate values and the wider economy from productivity improvements and agglomeration economies (i.e. clustering benefits).

As a transformative, city-shaping infrastructure project, the CRR Project generates benefits across greater Brisbane and SEQ.

In accordance with Australian Government requirements regarding the investigation of value capture as a means of alternative funding for infrastructure projects, the CRR Detailed Business Case 2016 explored a broad range of precinct-based value sharing mechanisms and region-wide value sharing mechanisms.

Precedent project analysis shows that land-use changes can enhance the benefits generated by investments in transit amenity and accessibility. This can occur through amendments to land-use planning frameworks that:

- encourage the formation and growth of economic or knowledge clusters (for example, through amendments that facilitate certain uses being prioritised around transit nodes)
- support improvements in job accessibility (for example, through uplift in the density of residential development around transit nodes).

Government can further stimulate the generation of benefits by:

- releasing underutilised government-owned land parcels to facilitate the outcomes envisioned for each transit node
- catalysing investment in preferred uses by either underpinning demand – to convert opportunities into projects – or through policies that encourage the emergence of preferred uses (e.g. by providing incentives to locate in these locations).

This framework is set out in Figure 13.1.



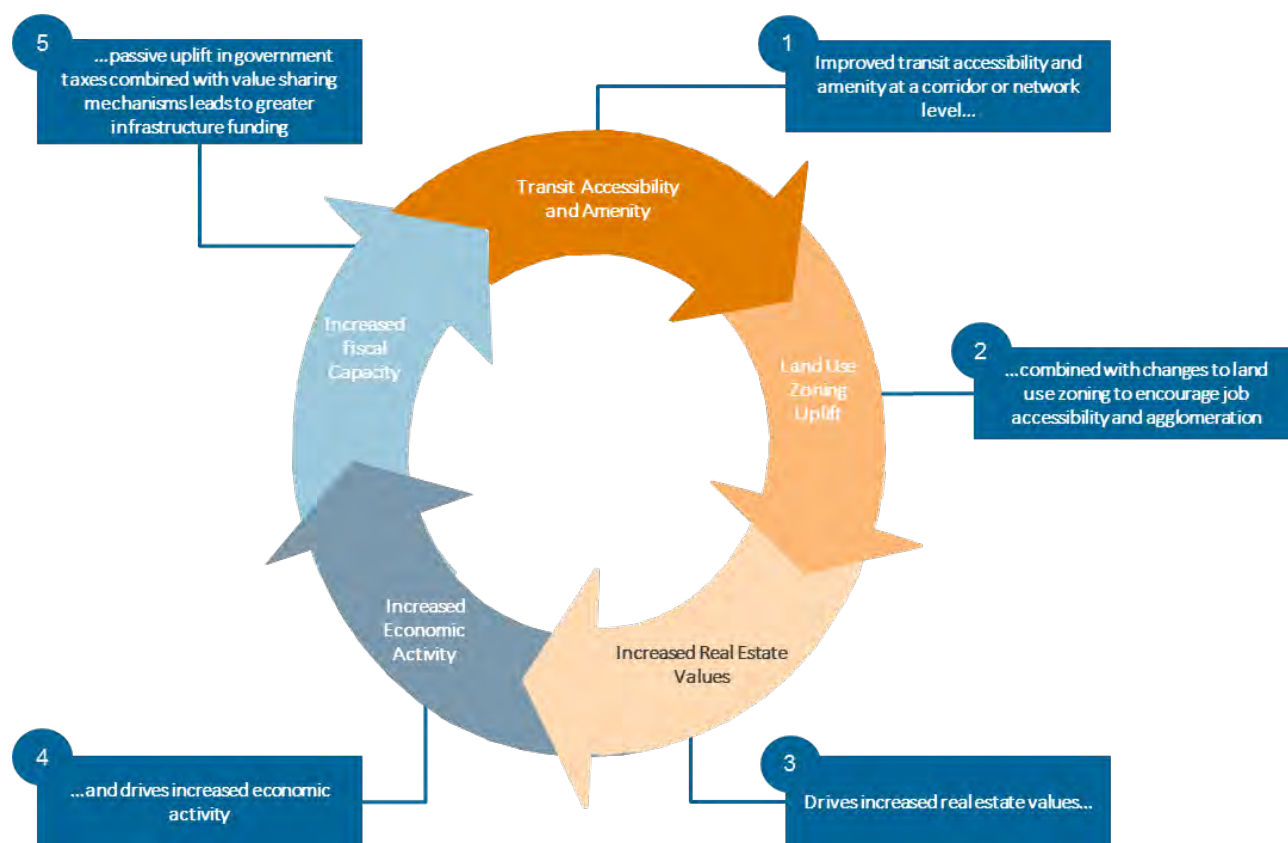


Figure 13.1: Value Creation and Sharing Overview

While the CRR Project presents real opportunity for value creation through urban revitalisation, the Queensland Government's commitment to fully fund the CRR Project is not contingent on funding from alternative mechanisms including value capture.

### 13.3 Strategic Policy Context

Policy announcements regarding infrastructure in Australia have focused on the obligation of governments to explore alternative sources of funding through value sharing.

#### 13.3.1 Australian Government

##### 13.3.1.1 Infrastructure Financing Principles

The Australian Government has released its principles for infrastructure funding and financing. The principles aim to ensure the cost of transport projects is shared fairly between those who benefit the most from the projects and the broader Australian community, and signal a move towards cost-reflective pricing. The principles also aim to optimise public investment in transport projects through private partnerships and innovative financing. They indicate that funding shares from federal and state governments should be determined after taking into account contributions made by beneficiaries.

##### 13.3.1.2 Australian Infrastructure Plan

Infrastructure Australia's recently released Australian Infrastructure Plan 2016 notes a greater reliance on value sharing to diversify the sources of funding to deliver Australia's infrastructure pipeline. The plan encourages government to consider road pricing, increased user fares for public transport and to ensure that value sharing opportunities are identified and implemented early in planning processes.



### 13.3.1.3 Smart Cities Plan

Setting out the Australian Government's vision for cities, the Smart Cities Plan highlights the importance of developing cities as knowledge-based centres with good access to jobs, affordable housing and a healthy environment. Three key initiatives outlined in the plan include:

1. providing \$50 million to fund infrastructure planning for major infrastructure projects including urban rail
2. establishing an infrastructure financing unit to broker investment in infrastructure via innovative financing solutions
3. inviting state and territory governments to partner with the Australian Government on City Deals.

City Deals is the initiative most relevant to the CRR Project given this project has potential to be transformational at a city-region level through its impact on urban form and the public transport system. The Smart Cities Plan is limited in detail regarding how City Deals would operate, noting only the following:

- Funding will be linked to reform and actions at the state and local level. These actions will be negotiated on a case-by-case basis.
- City Deals can be precinct, network, city or region-wide.
- City Deals will be structured around priorities that focus on economic growth, job creation, housing affordability and environmental outcomes.

### 13.3.1.4 Using value capture to help deliver major land transport infrastructure

In November 2016, the Australian Government released a discussion paper outlining a range of value capture approaches for the purpose of seeking feedback on how the Australian Government could use its various policy and funding levers to stimulate the use of value capture in the development and delivery of transport infrastructure.

The paper sets out evidence of the relationship between transport infrastructure and the benefits that flow from it, before turning to a consideration of different mechanisms to implement value capture. The following common value capture mechanisms are identified: user charges; sale of land, air rights or development rights; direct (public) or joint (public-private) development; private development of public infrastructure; developer contributions or charges, voluntary planning agreements; rezoning; taxation or rates 'automatic' uplift; payments in lieu of taxes (PILOTs); rates or property-based tax levy, benefit areas or betterment levy; sales tax levy; payroll tax levy; parking levy; and registration and fuel charges levy.

### 13.3.1.5 Capturing Value – Advice on making value capture work in Australia

In December 2016, Infrastructure Australia launched an advisory paper Capturing Value: Advice on making value capture work in Australia. In the advisory paper, Infrastructure Australia notes that value capture should be regularly considered for all public infrastructure projects, but it is important to be realistic about the role it can play in funding the infrastructure we need.

The advisory paper provides guidance to governments and the private sector on how value capture can be applied in the Australian context, noting that each value capture mechanisms has its own benefits, risks and implications for project funding and the economy more broadly. The paper examines the following types of existing and potential forms of value capture: betterment levies; developer charges; leveraging government land; taxes on property transactions; and taxes on land value.



### 13.3.1.6 Inquiry into the role of transport connectivity on stimulating development and economic activity

In November 2016, the Australian Government's Standing Committee on Infrastructure, Transport and Cities presented a report ("Harnessing Value, Delivering Infrastructure") of their findings following an inquiry that focused on the imbalance of settlement and its consequences, the deficit of infrastructure in the country's major cities and resulting congestion; the constriction on growth that these cities produce through lack of long term planning and timely construction of infrastructure; and the decline of the regions and lack of economic opportunity. The Committee focused their investigations on: the benefits of transport connectivity; the economic benefits of improved transport connectivity (especially through value creation and uplift); the role of government in coordinating improved transport connectivity and the role of value capture and other economic instruments in delivering transport infrastructure.

Among other matters, the Committee findings indicated that:

- The creation of new transport corridors and nodes has the dual advantage of allowing more efficient use of constrained urban space (densification and urban regeneration) while offering the opportunity to create value and use that value to pay for the development of public transport – value capture.

Planning transport without reference to land use and vice versa inevitably leads to sub-optimal outcomes. Integrated planning has significant benefits, not least of which is matching transport to land use in a way that optimises both, thereby increasing returns on investment to benefit landowners, developers and governments

### 13.3.2 Queensland Government – State Infrastructure Plan and Value Sharing

The Queensland Government's State Infrastructure Plan (SIP), released in March 2016, outlines the intention of the Queensland Government to 'explore the most cost effective funding and financing options available'.

Analysis of the value sharing options for the CRR Project has been informed by:

- key considerations in research papers on value sharing released by the Department of Infrastructure, Local Government and Planning
- current Queensland Government policy positions (e.g. restraining increases in public transport fares through the Fairer Fares package)

## 13.4 Value Sharing – Precedent Project Analysis

Various governments in Australia and internationally have used value sharing mechanisms to help fund transport infrastructure. Most examples of value sharing extending beyond property development at or around station precincts are from projects in the United Kingdom (UK) and United States (US).

In these examples, the project sponsors have typically focused on the following mechanisms:

- sale of development rights
- levies applied to areas receiving the benefit, typically on businesses or business activity at key rail station nodes
- direct contributions from developers where the transit is tied to urban renewal or land rezoning.

More recently, the UK's Crossrail 2 project has also proposed extending rates supplement levies to the general population.



Alternative financing – in the form of tax increment financing – has been used in some cases. This typically occurred in the US where there is a different devolution of taxation and revenue powers between municipal, state and federal governments. In these instances, repayment of the tax increment financing has typically been tied to the dedication of a business tax stream (e.g. sales, payroll or rates-based taxes). It is understood that in a number of instances, financiers have required tax increment financing bonds to be underwritten by the municipality issuing the bonds.

Examples where value sharing was used as a funding source reveal the following salient points:

- There is no one set level of funding that can be contributed by value sharing. However, precedent projects indicate the following:
  - Where there are significant urban renewal outcomes, 20 per cent to 25 per cent of funding was generated via contributions or levies that target development outcomes.
  - Where there are significant business benefits, 10 per cent to 30 per cent of funding was generated via levies on businesses or business properties.

As the base of a levy broadens, the nexus between benefit and charge reduces. That is, if a wide region is being charged, the benefits experienced will not be the same across the entire region – some will experience a minimal benefit, some a more significant benefit – however the charge will be the same regardless. An example is London's Crossrail, where 27 per cent of the project funding will be generated from a city-wide rates levy on commercial properties.

#### 13.4.1 Case Studies

##### Crossrail and Crossrail 2

The Crossrail Project in London UK, is funding approximately 27 per cent of the total cost of the project through mechanisms which target London businesses, including business rate supplement (BRS), in the form of an additional levy on commercial property rates, on London businesses who stand to benefit from increased accessibility and reduced travel times across London.

In addition to the BRS, developer contributions make up a further significant proportion of project funding (eight per cent). This has included contributions from a number of private sector organisations such as the City of London Corporation (£200 million direct contribution), Heathrow Airport Holdings Ltd (£70 million), Canary Wharf Group (£150 million towards a new Canary Wharf Crossrail station) and Berkeley Homes who have agreed to construct a station box at Woolwich.

Crossrail has a very clear and quantifiable range of benefits, which are heavily promoted by the City of London. This is a critical factor in increasing public acceptability of value capture, and importantly, proving the nexus between project beneficiaries and mechanisms designed to capture some of the associated increased revenue attributable to the project.

Crossrail 2 is currently in the planning stage and is an extension of the original Crossrail line. The funding strategy contemplates extending the business rates levies implemented for Crossrail beyond the original funding period. This could raise a further £1.81 billion in revenue via business rates levies, plus an additional £0.99 billion through levies on residential dwellings across London. Together, these council rates levies are estimated to contribute 16 per cent of the total central cost estimate of the project.

Crossrail 2 has also contemplated raising public transit fares across the London rail network



### The Denver Union Station (DUS)

The Denver Union Station (DUS) project in Colorado USA, used tax increment financing totalling approximately 60 per cent of the total cost to fund this US\$519 million PPP.

There were two main loans. The first loan of US\$145.6 million is to be repaid over 30 years via a 0.4 per cent 'sales and use tax' levy applied within special taxing districts established for the project. The repayment of this loan by RTD (Regional Transportation District, a government agency), was enabled by the issuing of a RTD bond secured by the gross sales tax revenue from the levy.

To repay the second US\$155 million loan, tax increment based on projected uplift in property values within the vicinity of the DUS has been pledged to DUSPA (Denver Union Station Project Authority) for 30 years. As the projected value uplift is speculative, in the event of a shortfall in the ability to service the debt, the City of Denver have confirmed that they will appropriate up to US\$8 million each year from city funds.

#### 13.4.2 Value Sharing as a Funding Tool for Recent Australian Infrastructure Projects

Examples of value sharing to fund Australian rail infrastructure are limited compared to international examples.

Current projects such as Melbourne Metro have not articulated strategies for value sharing beyond the development of land above and around station precincts. However, the New South Wales (NSW) Government is understood to be considering a special infrastructure levy on residential and commercial properties for Parramatta Light Rail and, potentially, the extension of Sydney Metro. The NSW Government is still investigating the use of these levies, and the extent of funding they may contribute to their respective projects has not been confirmed.

Local governments in Australia have used value sharing techniques more than other levels of government. Examples include developer contributions to fund public infrastructure and special area levies and rates to fund investments in community and local business area infrastructure. Councils have also used community-wide charges to support investments in public infrastructure. An example is the Gold Coast City Council's (GCCC) City Transport Improvement Charge, which was used to fund the GCCC's contribution to the Gold Coast light rail, as well as other transport projects.

### 13.5 Key Beneficiaries and Benefits of the CRR Project

Property value uplift stimulated by investment in transport infrastructure has a significant body of empirical research proving its relationship. The mechanisms used to capture, or share in, revenue created by land value uplift are also well known. These include the sale of property development rights above and around stations, and hypothecation of ad valorem taxes associated with land value (e.g. rates, transfer duty and capital gains tax).

In addition to land value uplift, other benefits are directly associated with the investment in transport infrastructure. Some of the value created by these benefits could be shared and directed towards funding the CRR Project by implementing alternative funding mechanisms such as levies or taxes for beneficiary groups.

#### 13.5.1 Key Beneficiaries of the CRR Project

The first step in identifying and developing value sharing mechanisms for the CRR Project, under the concept of 'beneficiary pays', is to identify the groups who will benefit and how the benefits will accrue. The beneficiaries of the CRR Project include:





- property owners whose property values are increased by improved transport access or through planning amendments to facilitate land-use outcomes
- public and private transport users who benefit from greater transport alternatives, increased service amenity, reduced travel times and reduced road network congestion
- business owners, where increased accessibility drives improved business revenues and a greater ability to attract or retain staff
- government, as a result of the increased economic activity and the land value uplift, which can generate substantial revenue uplift for all tiers of government.

In addition, the CRR Project will:

- deliver opportunities for property development above or adjacent to CRR stations (revenue from the sale of property development rights)
- stimulate development, and potentially regeneration, opportunities in and around both the CRR corridor and station precincts
- provide benefits to the Queensland Government and local government by avoiding or deferring other infrastructure investment.

Value sharing mechanisms and innovative funding approaches need to be evaluated for their appropriateness to particular infrastructure projects. Key considerations include:

- ensuring that public interest and equity aspects are addressed (e.g. proving the nexus between project benefits and the value sharing mechanism, capacity to pay and equitable allocation of funding responsibility)
- ensuring that the quantum of any value sharing is reflective of the benefits received.

### 13.5.2 Key Benefits of the CRR Project

The foundation for developing a value sharing strategy is to identify the benefits of the CRR Project for the key beneficiaries. Mechanisms to share in the value created can then be considered. The significant transport, economic and city-building benefits offered by the CRR Project are detailed in Chapter 6: Project Benefits.

#### 13.5.2.1 Transport Benefits

The transport benefits include:

- better access to the inner city and CBD
- greater public transport use
- more frequent services for commuters
- reduced private vehicle demand and road congestion
- better access to rail.

Specific public transport benefits include:

- less crowding
- reduced waiting times



- less time spent travelling on public transport
- quicker walking times to stations
- more interchange opportunities.

#### 13.5.2.2 Economic Benefits

Significant economic benefits associated with the CRR Project are relevant to the value sharing analysis. Within the Cost Benefit Analysis, outlined in Chapter 7: Economic Analysis, five categories of economic benefits were quantified:

- transport user benefits:
  - travel time and generalised cost savings, increased reliability, car transport time savings, car vehicle operating cost savings, truck – road freight savings, network resilience and station amenity
- crash savings:
  - cost savings including fatal, hospitalisation, minor injury and property damage
- environmental externalities:
  - cost savings including greenhouse gas emissions and noise
- residual value:
  - including transport, infrastructure and rollingstock
- farebox revenue:
  - incremental farebox revenue

Wider economic benefits (WEBs) were also considered. Benefits were assessed for three categories of WEBs:

- WB1: Agglomeration economies – positive externalities that result from increased density of economic activity, leading to increased productivity through input capture, knowledge spillover and output capture.
- WB2: Labour market deepening – refers to two direct impacts: increased labour supply and the move to more or less productive jobs (not quantified due to lack of land-use impacts).
- WB3: Output change in imperfectly competitive markets – reduced transport costs resulting in the optimal quantity of production for businesses in imperfectly competitive markets. The benefit is estimated as the increase in quantity supplied and the price-cost margin applicable to the sector.

These WEBs are relevant for the value sharing analysis as they indicate the economic benefits that will accrue to employers and businesses through the CRR Project.



### 13.5.2.3 Real Estate Value Uplift

Investment in mass transit networks, while reducing travel times and providing economic benefits to the wider community, also influences patterns of urban land use, development activity and property values. In the context of urban transit, numerous international studies have attempted to demonstrate that transit accessibility benefits are capitalised in property values.

The consensus among these studies is that property values are generally higher when there is both good proximity and accessibility to rail transit.

The CRR Project will introduce or enhance accessibility to rail transit for properties located near CRR stations as well as unlocking development capacity. Where coupled with commensurate and targeted changes to land use and development densities, there is opportunity for substantial value uplift to accrue to the properties within the vicinity of new stations.

#### International Research on the Impact of Transit on Land Values

Although studies tend to agree that proximity and accessibility to rail delivers value uplift to properties, international research demonstrates that this occurs to different degrees, with findings varying widely.

In a paper analysing 36 studies covering 40 rapid transit projects (Baker & Nunns, 2015), the range of property impact values was large, however, the uplift for most of the studies ranged between zero and 15 per cent. Regarding notable rail projects in the US and UK, the analysis identified the following uplift in land value:

- Dallas Area Rapid Transit – 18 per cent to 20 per cent
- MAX Light Rail, Portland – 10.6 per cent
- Hudson-Bergen Light Rail – 18.4 per cent
- Metra CRS, Chicago – 20 per cent
- Bay Area Rapid Transit, San Francisco – 15 per cent to 26 per cent
- London Crossrail – five per cent (construction period uplift only)
- Dublin Area Rapid Transit – seven per cent to eight per cent.

While the percentage uplift in land value varies widely across the body of available international research, it is evident that transit amenity adds value to surrounding land. More specifically, over the long-term, properties with high transit amenity enjoy higher average property growth rates. Furthermore, the research confirms that value uplift, if it is to occur, will typically be within 800 metres of new stations.



### 13.6 Uplift in Government Taxes and Government-Owned Land

Due to the expected uplift in economic activity and real estate values resulting from the CRR Project, some existing tax revenues are expected to experience an uplift, including:

- consumption-based taxes (i.e. the GST)
- income and corporate taxes
- real estate-based taxes including rates.

The extent of uplift from the CRR Project has been quantified through the application of a series of bespoke models and estimated at approximately \$4.8 billion (NPV) for a range of revenue streams raised by Federal, State and local governments.

The anticipated uplift in real estate values is also expected to increase the value of government-owned land in the CRR station precincts.

### 13.7 Land Development Value Sharing Opportunities

The CRR Project will require parcels of land to be acquired for construction of the tunnel, stations and supporting CRR infrastructure. There will be opportunities for new development above and around CRR stations, and on land acquired for the CRR Project that is surplus post-construction.

#### 13.7.1 Development Opportunities on Surplus Construction Land

There are opportunities to develop key sites directly adjacent to, and around, CRR stations. Some of these locations will enable development to commence with CRR construction works; others will be more appropriately developed post-construction.

Each opportunity merits its own assessment to ensure the most appropriate development outcome is facilitated.

The property development rights above and around the stations are being considered in conjunction with CRR station infrastructure, particularly where there is significant design and construction interface with station infrastructure.

#### 13.7.2 Facilitating Development of Surplus Underutilised Government-owned Land

The CRR Delivery Authority (CRRDA) is responsible for facilitating economic development and development for community purposes within CRR Priority Development Areas (PDA's).

The CRRDA is currently developing strategies to guide this activity, as well as identifying parcels of surplus or underutilised Government-owned land to inform this process.

### 13.8 Project Implementation Potential Funding Contributions

The Queensland Government has committed to fully fund the CRR Project. Therefore no new value sharing mechanisms are required to be further assessed for the project to proceed to procurement and delivery. However as discussed previously, value uplift of significant government land holdings at station precinct locations presents the opportunity to contribute funding to the CRR Project.



CHAPTER FOURTEEN

IMPLEMENTATION PLAN



## CHAPTER 14

### IMPLEMENTATION PLAN

#### CHAPTER SUMMARY AND CONCLUSIONS:

- A governance structure for the delivery of the CRR Project has been developed, which involves a new statutory body (the CRR Delivery Authority) leading the implementation of the CRR Project.
- Anticipated timeframes show procurement commencing in Q3 2017 and concluding in Q1 2019. Project delivery will be largely completed in 2023 with some elements of rail system testing and commissioning extending into 2024.
- Key operational readiness activities will need to be addressed prior to commissioning the CRR Project.
- A preliminary benefits management plan (BMP) has been developed in accordance with the Department of Transport and Main Road's Benefits Management Framework. The BMP articulates the key steps in defining, planning and reviewing project benefits throughout the project development lifecycle. It will be further developed during the procurement phase, with a focus on investigating potential opportunities to enhance the level of benefit derived from the CRR Project.

#### 14.1 Purpose and Overview of this Chapter

The purpose of this chapter is to outline the implementation plan for the CRR Project. The CRRDA is primarily responsible for delivering the CRR Project.

This chapter outlines the:

- proposed governance framework for the implementation of the CRR Project
- key activities and milestones for the CRR Project across the various phases of the implementation schedule
- key operational readiness activities to be undertaken including managing the CRR Project's interface with Queensland Rail
- proposed benefits management plan (BMP) to ensure the expected benefits from the CRR Project are realised.

#### 14.2 Governance

##### 14.2.1 CRRDA – Overview

##### 14.2.1.1 The Role of the CRRDA

The CRRDA was established under the *Cross River Rail Delivery Authority Act 2016* (Qld) (CRRDA Act) to lead the development, procurement and delivery of the CRR Project and associated prescribed 'transport-related projects'. The CRRDA will also support wider community outcomes by taking responsibility for economic and community development and other transport-related projects within CRR Priority Development Areas (CRR PDAs). The CRRDA operates outside the political framework with an independent board, while still being subject to the oversight of the Queensland Government.



## 14.2.1.2 Functions of the CRRDA

The fundamental purpose of the CRRDA is to:

- plan, carry out, promote or coordinate activities to facilitate economic development, and development for community purposes, within the CRR PDAs
- facilitate the effective delivery of the CRR Project and other transport-related projects.

The CRRDA Act lists other key functions of the CRRDA as being to:

- give advice to the Minister or other relevant entity in relation to these main functions and options for funding and delivering the project
- invite and evaluate proposals for the delivery of the CRR Project
- facilitate the procurement and supply of infrastructure and services for the CRR Project
- ensure that any approvals or authorities required for the CRR Project under other laws are obtained
- enter into and manage contractual and other arrangements for the delivery of the CRR Project
- consult with relevant entities about funding and delivery of the CRR Project
- provide or manage infrastructure and other services and facilities for or relating to the CRR Project.

## 14.2.2 Governance Structure

### 14.2.2.1 Statutory Body Under Special Purposes Legislation

The CRRDA is an independent statutory body, operating on a commercial basis, with the power to acquire land connected to the CRR Project and associated prescribed transport-related projects.

The CRRDA Act also amends section 169 (Delegations) of the *Economic Development Act 2012* (Qld) to facilitate the delegation of powers relating to value sharing and the declaration of PDAs from the Minister for Economic Development Queensland to the CRRDA.

### 14.2.2.2 Governance Structure

The governance structure of the CRRDA is set out in Figure 14.1. This structure is preliminary and subject to review and approval by the CRRDA CEO and Board.

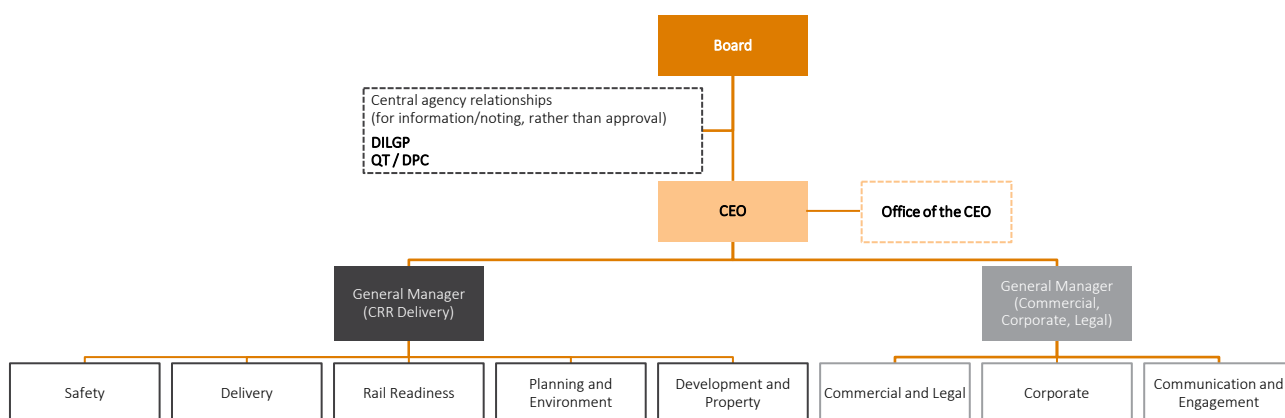


Figure 14.1: CRRDA Governance Structure





### Deputy Premier

The Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning (the Deputy Premier) has ultimate responsibility for the CRRDA.

The Deputy Premier has the power to provide written direction to the CRRDA for the exercise of its power, as well as ensuring the CRRDA retains an appropriate level of operational independence. The Deputy Premier also has responsibility for approving the annual budget and financial management policies.

### The Board

The CRRDA has a decision-making governance board (the Board), composed of both permanent and appointed members. The CRRDA Act states that the membership of the Board must comprise the Chief Executive (or senior executive) of:

- the department in which the *Auditor-General Act 2009* is administered
- the department in which the *Financial Accountability Act 2009* (Qld) is administered
- the department in which the *Transport (Rail Safety) Act 2010* is administered
- the department in which the CRRDA Act is administered.

Additional members – no more than six other members – may be appointed on the recommendation of the Minister. An appointed Board member will hold office for a term no longer than three years (which will be stated in the member's instrument of appointment).

The Board is the key accountable body for the delivery of the CRR Project. Its primary functions are to:

- ensure the proper, efficient and effective performance of the CRRDA's functions
- decide the objectives, strategies and policies to be followed by the CRRDA
- ensure that the CRRDA complies with the strategic plan, and operational plan, under the *Financial Accountability Act 2009* (Qld) for a financial year
- report to the Minister about the performance of the CRRDA's functions
- in consultation with the Minister, appoint a chief executive officer (CEO) as an employee of the CRRDA.

The Board has broad decision-making powers under the CRRDA Act, including the power to direct the CEO and delegate any powers; however the Deputy Premier retains the power to provide written direction to the Board.

### CEO and Executive Leadership Team

The CEO is appointed by the Board, in consultation with the Minister, and is accountable to the Board. Based on the preferred structural option, the CEO will be supported by a permanent executive leadership team.

#### 14.2.3 External Stakeholder Engagement and Governance Arrangements

Given the size and breadth of the CRR Project, the CRRDA will have numerous interfaces and interactions with various external stakeholders in order to effectively perform its functions. These stakeholders include Queensland Treasury, Department of Premier and Cabinet, local governments, Infrastructure Australia, Australian Government Department of Infrastructure and Regional Development and the private sector.



### 14.3 Procurement and Delivery Program

The timeframe for the procurement and delivery of the Reference Project is described in Figure 14.2. These times are subject to change in response to development of the detailed procurement and delivery strategy and industry feedback provided during market sounding activities.

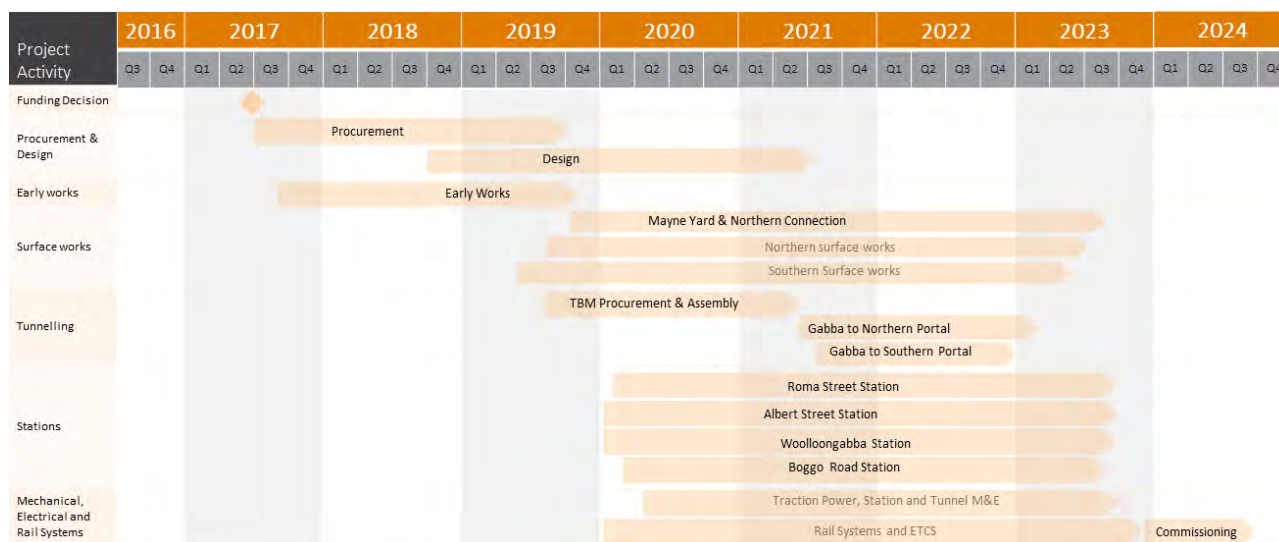


Figure 14.2: Timeframe for Procurement and Delivery of the CRR Project

### 14.4 Procurement Phase

The key objective of the procurement phase is the appointment of suitably experienced proponents for each package of work through processes that are transparent, accountable and drive value for money for the Queensland Government.

#### 14.4.1 Procurement Phase Objectives

Objectives for the procurement phase include:

- to procure the CRR Project in a way that encourages private sector participation and innovation
- to achieve a value-for-money outcome for the Queensland Government
- to procure the CRR Project in a way that encourages competition
- to secure timely delivery of the CRR Project within budget and agreed timeframes
- to ensure an equitable and transparent procurement process.

#### 14.4.2 Delivery Model Considerations

When developing the delivery model for the CRR Project it is necessary to consider a range of factors, including:

- Project-specific circumstances - such as project objectives, project risks, market analysis, technical characteristics and precedent projects that may influence the structuring of the delivery solution.
- Potential packaging options - whether the project should be packaged, procured and delivered as a single package or whether the project's key components should be split, and procured and delivered as a number of separate packages.



- Potential delivery model options – taking into account their suitability for each project package based on key considerations such as optimal risk transfer, potential for innovation, budget certainty and value for money, market appetite, complexity of implementation and whole-of-life design and maintenance.

Delivery model options considered range from relationship-based, risk-sharing contracting through to models that feature greater levels of risk transfer to the private sector and which may even include a financing component.

The bulk of the works included in the CRR Project are focused around the tunnel and new underground stations. For these works, it was found that the preferred delivery model should provide for the following:

- incentivisation to deliver the project on time and on budget
- effective management of whole-of-life risks
- promotion of innovative and efficient whole-of-life solutions
- a high degree of budget certainty for the Queensland Government
- market appeal.

This would indicate that a delivery model with a form of long-term contract (construction and maintenance) with significant and appropriate risk transfer to the private sector is recommended for the tunnel and station works.

A final decision on the appropriate level of private finance to be included in the delivery solution will be made based on further analysis and market input.

### 14.4.3 Procurement Phase Activities

The procurement phase will be informed by, and build upon, the activities developed during earlier phases, including the detailed procurement and packaging plan. Subject to the confirmed delivery model, it is expected to be a two stage EOI and RFP across relevant packages of work.

The CRRDA needs sufficient resources and decision-making autonomy to progress activities and ensure the procurement phase schedule and target dates for milestones are achieved. Resourcing and autonomy will also enable the CRRDA to professionally interact with bidders, which is critical to securing and maintaining the confidence of the market.

Activities to be undertaken during the procurement phase include the following:

- appoint specialist advisers for technical, commercial and financial, legal and probity advice
- undertake the expression of interest (EOI) process and evaluate EOI responses
- plan and prepare the request for proposal (RFP) phase including:
  - developing and refining RFP documents (including the technical output and service specifications, returnable schedules and evaluation criteria), ensuring that future network enhancements, and horizontal and vertical development outcomes, are not precluded by the preferred reference design
  - developing the commercial framework
  - developing the draft project agreements
- undertake effective interactive bidder workshops to facilitate effective two-way communication (while having appropriate regard to probity)



- establish a bid strategy and evaluation methodology
- respond to bidder requests for clarifications
- develop an evaluation framework, evaluate bidder proposals and prepare the RFP evaluation report
- undertake negotiations with selected proponents
- manage government/CRRDA approvals processes
- finalise commercial and contractual documentation for contractual close and financial close
- develop contract management processes (in conjunction with a review of the project agreements).

### 14.5 Construction and Contract Management Phase

During this phase, government will work with the CRR Project proponents to deliver the CRR Project effectively and efficiently. Government must also ensure its rights are protected during this phase.

The CRRDA will adopt an approach that is responsive to the unique requirements and risks associated with the delivery methods chosen for packages.

As such, a key responsibility for the CRRDA will be taking lead responsibility for contract management. To perform this responsibility, the CRRDA will need to develop robust contract management processes.

#### 14.5.1 Construction and Contract Management Phase Objectives

Objectives for the construction and contract management phase include:

- Ensuring the private sector proponents for each project package are efficiently and effectively delivering and constructing the CRR Project in accordance with their contractual obligations so work is completed by the specified date.
- Ensuring the CRRDA is ready to begin constructing each works package and has appropriate resources (personnel and budget) to manage the construction contracts and to oversee construction.
- Ensuring that the CRR Project is constructed and satisfies all commissioning requirements so that it can commence operations by the specified date and meet specified service requirements over the operating period of the CRR Project.
- Ensuring the CRRDA actively manages construction contracts in accordance with contract management processes by:
  - monitoring the private sector proponents' performance and compliance with their contractual obligations
  - undertaking and performing the Queensland Government's contractual obligations.
- Engaging with the community and other key stakeholders to help ensure the CRR Project is accepted and supported by the public.
- Ensuring that the CRR Project meets all necessary approval conditions by undertaking required activities (i.e. where the condition is a government responsibility) and monitoring the private sector proponents' compliance with conditions (i.e. where the condition is the proponent's responsibility).
- Ensuring interface issues between each of the works packages and other projects such as the European Train Control System (ETCS) – Inner City Project are effectively managed by the CRRDA.



### 14.5.2 Construction and Contract Management Phase Activities

Table 14.1 summarises the key activities to be undertaken by the CRRDA (and Queensland Government) during the construction and contract management phase.

KEY ACTIVITY	KEY CONSIDERATIONS
Establish contract management processes.	<p>Contract management will be one of the most significant areas of activity the CRRDA will be responsible for undertaking during this phase. As the project agreements (including construction agreements) are yet to be drafted and negotiated, it will be important to undertake a detailed review of these agreements during the procurement phase. These reviews should be done in conjunction with establishing contract management processes to consider and detail the:</p> <ul style="list-style-type: none"> <li>▪ obligations of the CRRDA (and Queensland Government)</li> <li>▪ obligations of the private sector proponents</li> <li>▪ allocation of responsibility (within the CRRDA) for performance of these obligations</li> <li>▪ CRRDA's approval processes and authority for variations</li> <li>▪ contract payment, review and approval processes</li> <li>▪ skills required by CRRDA personnel during construction such as construction and engineering, commercial, legal, negotiation and financial management.</li> </ul>



KEY ACTIVITY	KEY CONSIDERATIONS
Undertake contract management (i.e. monitoring the project agreements).	<p>Given the likely nature of project agreements, key elements of agreements that will be a focus for contract management include:</p> <ul style="list-style-type: none"> <li>▪ construction milestones (e.g. monitor progress and achievement of interim milestones by private sector proponents and consequences for failure to achieve milestones)</li> <li>▪ practical completion (e.g. monitor progress towards achievement of practical completion by private sector proponents by the specified date, certification of practical completion by the independent certifier and consequences for failure to achieve practical completion by the specified date)</li> <li>▪ commissioning (refer to key activity below)</li> <li>▪ liquidated damages (e.g. monitor potential liability of private sector proponents to pay liquidated damages for delays to achieving critical milestones such as practical completion and commissioning)</li> <li>▪ payments (e.g. payment of invoiced amounts to the private sector proponents, subject to satisfactory performance of the required services)</li> <li>▪ interface risks (refer to key activities below)</li> <li>▪ access and inspection (e.g. CRRDA exercising its rights to access the construction sites to inspect the construction works and assess whether the private sector proponents are complying with their contractual obligations)</li> <li>▪ variations (refer to key activities below)</li> <li>▪ reporting (refer to key activities below)</li> <li>▪ security (e.g. ensure all required security (i.e. bank guarantees, corporate guarantees) from private sector proponents have been provided and maintained, monitoring the financing position of security providers)</li> <li>▪ disputes (ensure the CRRDA provides, or responds to, dispute notices, identifies an appropriate representative to seek to resolve disputes, complies with its obligations (and exercises its rights) where a third party is required to resolve the dispute)</li> <li>▪ default and termination (e.g. monitoring whether there have been any events of default or termination, exercising the Queensland Government's rights (subject to approval processes and appropriate authority) in relation to such events).</li> </ul> <p>These issues will be refined as the CRR Project progresses, for example, to reflect differences between contracting methods for each package, as well as differences with contracting approach and requirements for the property and development opportunities.</p>



KEY ACTIVITY	KEY CONSIDERATIONS
Establish reporting processes.	<p>The project agreements will define the KPIs and reporting obligations of the private sector proponents. This will help ensure the CRRDA is adequately informed of construction progress and other issues during this phase. These will be fine-tuned to reflect the requirements of each contracting method and where more direct involvement from the CRRDA may be required.</p> <p>The reporting obligations of the private sector proponents may include items such as construction progress (both cost and time), anticipated dates for practical completion and commissioning, provision of audited annual financial statements, provision of unaudited management accounts, provision of annual business plans and provision of annual budgets.</p> <p>However, it will also be important for the CRRDA to establish its own internal reporting procedures to ensure key Queensland Government stakeholders (e.g. the shareholding ministers and CRR Board) are appropriately informed during the construction and contract management phase (and throughout operations).</p> <p>These procedures should include:</p> <ul style="list-style-type: none"> <li>▪ details of the key Queensland Government stakeholders to receive reports</li> <li>▪ reporting schedules and templates to be used</li> <li>▪ details of the reporting frequency.</li> </ul>
Undertake project commissioning.	<p>Commissioning will be of critical importance to both the CRRDA (including the Queensland Government) and the private sector proponents. From the government's perspective, it will enable them to be satisfied that the CRR Project can commence operations, provide the required services and deliver identified benefits.</p> <p>Key areas of focus for the CRRDA, in relation to commissioning, are likely to include:</p> <ul style="list-style-type: none"> <li>▪ commissioning plan (e.g. monitor whether there have been any agreed variations to the plan following execution of the project agreements)</li> <li>▪ commissioning tests (e.g. monitor whether proponents have undertaken all tests in accordance with the commissioning plan, noting these tests and the plan will likely be agreed up-front as part of the project agreements)</li> <li>▪ certification (e.g. monitor whether the independent certifier has certified commissioning, consequences for failure to achieve commissioning by the specified dates).</li> </ul> <p><b>Coordination and engagement with Queensland Rail</b></p> <p>It will be critical for the CRRDA to actively engage with Queensland Rail on commissioning issues (and other key operational issues). This will ensure that Queensland Rail's requirements are appropriately incorporated and that the CRR Project meets the operational readiness requirements of Queensland Rail.</p>





KEY ACTIVITY	KEY CONSIDERATIONS
Manage interface risks.	<p><b>Between project packages</b></p> <p>Interface risk between the works packages is considered to be a significant project risk and a critical success factor. However, these interface risks are considered to be manageable with clear demarcation between packages and natural points of potential separation and completion.</p> <p>To help ensure this risk is appropriately managed, as part of developing the detailed procurement and packaging plan, an interface risk management plan will also be developed which:</p> <ul style="list-style-type: none"> <li>▪ details the overall approach of the CRRDA to managing interface risk</li> <li>▪ allocates primary and secondary responsibility for managing the risk to personnel within the CRRDA</li> <li>▪ identifies key interdependencies between the works packages</li> <li>▪ aligns with the reporting obligations of the private sector proponents to ensure that any interface issues or potential delays with an individual package (that may impact other works packages) are identified and reported quickly so the CRRDA is informed and can take action as required.</li> </ul> <p><b>Between interdependent projects</b></p> <p>Interface risk between the CRR Project and other major projects being undertaken by the Queensland Government, such as the ETCS – Inner City and New Generation Rollingstock projects, is also considered a significant project risk.</p>
Undertake community and stakeholder management.	<p>Given the scale and potential impact of the CRR Project during the construction phase, maintaining an effective and proactive approach to stakeholder management throughout the phase will be crucial.</p> <p>The ‘commuting public’, in particular, will be a critical stakeholder given the potential for construction works to disrupt the public transport and road networks.</p> <p>During this phase, key issues to be addressed, and which should be considered as part of the stakeholder management plan, are likely to include the CRRDA’s approach (and that of the private sector) to the following:</p> <ul style="list-style-type: none"> <li>▪ engaging with the community and providing updates on construction progress and potential community impacts</li> <li>▪ ensuring that community issues and needs are understood and addressed.</li> </ul>
Manage project variations.	<p>The project agreements will include detailed processes for managing project variations requested by either the CRRDA or private sector proponents.</p> <p>It will also be important for the CRRDA to develop robust internal processes to manage variations. This will ensure that potential impacts on cost, risk, scope and delivery schedule are understood prior to the CRRDA seeking variations or agreeing to variations requested by proponents.</p>

Table 14.1: Construction and Contract Management Phase – Activities



## 14.6 Operational Readiness Activities

A number of operational readiness activities will need to be addressed by Queensland Rail prior to commissioning the CRR Project. This section identifies and describes these activities. Some of these activities, such as timetable changes, involve changes that Queensland Rail regularly implements and has business-as-usual processes for managing. Where suitable processes exist for managing change, these will be adopted by the CRR Project.

### 14.6.1 Related Projects

The CRR Project is one of a number of projects taking place that will impact upon the nature of Queensland Rail's passenger operations in SEQ. The projects are interrelated and will require coordination between the CRRDA and Queensland Rail to ensure a smooth transition in terms of procurement, project delivery, integration, commissioning, operational readiness and change management.

To address these challenges, CRRDA and Queensland Rail have commenced planning and a process of dialogue and engagement. This builds on collaboration to date and will ensure that Queensland Rail is fully and appropriately involved in developing and implementing all aspects of the procurement, project delivery, integration, commissioning, change management and operational readiness strategies for the project.

#### 14.6.1.1 ETCS – Inner City

The ETCS – Inner City Project involves the rollout of ETCS Level 2 (ETCS L2) technology on railway lines from Milton to Northgate, as well as onboard fitment of new and existing rollingstock, and is presently in its procurement phase. The CRR Project will be delivered in a post-ETCS operating environment.

Undertaking the ETCS – Inner City Project ahead of the CRR Project creates opportunities and challenges in relation to:

- Rail systems: The ETCS – Inner City Project will impact the design and installation of CRR rail systems.
- Scheduling of works: Some CRR-related works will need to be coordinated with, and may be able to be undertaken in conjunction with, aspects of the ETCS – Inner City Project.
- Concept of operations: The ETCS – Inner City Project will enable an increased frequency of passenger rail operations and is a key enabling project for the CRR Project. The CRR Project, in turn, will facilitate a revised approach to timetabling and scheduling on other parts of the network. The concept of operations developed for the ETCS – Inner City Project will need to be reviewed once the CRR Project is delivered.
- Change management: The ETCS – Inner City Project has significant change management implications for Queensland Rail's business, and is already the subject of change management and operational readiness planning.

#### 14.6.1.2 New Generation Rollingstock

The Queensland Government's New Generation Rollingstock (NGR) Project will substantially increase the SEQ train fleet to meet the growing demand for rail services. The NGR Project includes:

- design, construction and maintenance of 75 new six-car passenger trains for SEQ
- design and construction of a purpose-built maintenance centre at Wulkuraka, west of Ipswich
- procurement of three NGR training simulators for train crews.



Only NGR trains will operate in the CRR tunnel and stations. Operational readiness considerations relating to the NGR Project include:

- The current technical solution for the CRR Project requires platform screen doors, which are typically associated with automatic train operation (ATO) fitment of rollingstock. The current rollout of NGR trains does not include fitment of ATO elements, therefore this will be implemented as part of the CRR Project.
- The operation of ATO in an ETCS L2 environment is not part of the current ETCS – Inner City Project, creating a requirement for project coordination and integration.
- Rollout of the NGR Project has highlighted the importance of driver training and operational readiness activities within Queensland Rail. A significant change management process is currently being undertaken within Queensland Rail to facilitate driver training and the operation of NGR trains on the network.

### 14.6.1.3 Redcliffe Peninsula Line (Moreton Bay Rail Link)

The Redcliffe Peninsula line is a 12.6km dual-track passenger rail line between Petrie and Kippa-Ring, including six rail stations at Kallangur, Murrumba Downs, Mango Hill, Mango Hill East, Rothwell and Kippa-Ring. The Redcliffe Peninsula line opened for services in October 2016 and two key operational readiness learnings for the CRR Project have emerged from this project:

- There must be an effective integration and commissioning plan to ensure that the CRR Project is able to be commissioned and operate seamlessly and safely as an integrated part of the broader passenger rail network.
- Queensland Rail, as the rail operator and infrastructure manager, must be able to demonstrate effective management control over all aspects of the rail infrastructure and that it is ready and able to accept the handover of the project for operation.

The CRR Project will present further significant changes for the Queensland Rail business in terms of driver training, train control and management, passenger experience and network operations. Implementing a comprehensive change management strategy across the organisation will therefore be required. This must be coordinated with other change management and operational readiness activities.

### 14.6.2 Training and Competency

Information for affected staff will be a key input into training plans developed for the new CRR infrastructure, equipment and processes. This will ensure that implementing the CRR Project does not negatively affect normal network operations. Information regarding existing Queensland Rail training systems and competency tracking systems used for these impacted groups will be prepared. This will allow training programs to be developed and rolled out.

The CRR tunnels will introduce new facets to train operations due to their length and steep grades. Specific training programs will be required to acquaint train crews with the acceleration and braking characteristics of the tunnel and emergency procedures.

New procedures and training programs will also be required for infrastructure maintenance personnel if Queensland Rail maintains the new tunnel infrastructure.



Queensland Rail will also need to consider its workforce requirements, including recruitment and training across all functions, given the CRR Project will result in new rail track, yards, stations and extra services. Emergency management procedures, maintenance and the security of the network and operations (relating to station, train and rail management) will all require consideration. Recruitment and training lead times vary according to the role and complexity of the task.

### 14.6.3 Tunnel Management

The tunnels and stations will incorporate a variety of new electrical and mechanical systems. Depending on the operating model, Queensland Rail may be responsible for managing these systems. Although they may be managed separately to existing rail systems, all systems must be integrated.

The train control systems for the tunnels and other CRR infrastructure will also need to integrate with existing systems on the SEQ rail network.

### 14.6.4 Station Management

The new underground stations will require new operational procedures. Depending on the operating model, Queensland Rail may need to develop specific operational procedures for these stations.

### 14.6.5 Emergency Management

Introducing an underground rail line brings with it obligations to develop emergency management procedures and guidelines. These plans will need to be coordinated and integrated with local and district disaster management groups. Prior to operating in these tunnels and associated stations, Queensland Rail would seek to ensure new emergency procedures are fit-for-purpose through tunnel evacuations exercises.

### 14.6.6 Timetable

Timetable modelling will be used to confirm the benefits of the CRR Project and understand the possible outcomes of capacity increases. These outcomes will feed into other operational readiness elements such as dwell initiatives, traction requirements and stakeholder engagement.

Queensland Rail has a well-established and documented process for developing timetables. This process incorporates all aspects of stakeholder management, including those concerning the travelling public.

The use of additional and alternate stabling yards as turnout locations is of particular relevance to the CRR Project. Timetable demands must also be in line with available units and traction power.

Given significant network change will be made through the CRR Project, a detailed customer awareness program will also need to be developed and implemented.

### 14.6.7 Mayne Yard Management

A new yard management plan will be required due to the provision of a main line through Mayne Yard, which will cut off the Eastern and Western stabling yards, and the removal of the Balloon Loop. Whether or not to retain Mayne Yard as a shunting and maintenance yard or just a stabling yard will need to be considered.

A stabling plan should be developed in conjunction with the new timetable to ensure units are available and in the right position for their next scheduled activity, be it maintenance or revenue service.



### 14.6.8 Management of Other New Stabling Facilities

Operation of new stabling yards will require new operational and yard management procedures. These will need to be developed prior to project implementation. These yards may also require the presence of staff at some stage during the day.

### 14.6.9 Maintenance Activities

#### 14.6.9.1 Rollingstock Maintenance Activities

Given the changes to operations at Mayne Yard, and the separation of the yard, the following issues require further consideration:

- how and where maintenance will be conducted on the Queensland Rail fleet
- how Queensland Rail will 'feed' the maintenance facilities
- the operation of light maintenance and the use and access of all units through the wash shed at Normanby.

#### 14.6.9.2 Tunnel Infrastructure

The tunnel maintenance and access regime requires consideration. Closure and maintenance windows should be developed in conjunction with timetables, ensuring the safe provision of preventative maintenance in what is effectively a new asset type for Queensland Rail.

#### 14.6.9.3 Other Supporting Infrastructure

Any new train management systems, data radio systems and operational systems – and associated maintenance process – will need to be developed in conjunction with defined operating parameters.

### 14.6.10 Safety Case

Queensland Rail has an existing safety change management standard for managing infrastructure changes with the potential to 'impact on the safety of rail operations' (requiring notification to the Rail Safety Regulator). A safety change management plan (SCMP) demonstrating compliance with the relevant elements of the *Transport (Rail Safety) Act 2010*, *Work Health and Safety Act 2011* and the *Electrical Safety Act 2002* will be prepared and provided to regulatory bodies. Queensland Rail will prepare the SCMP, with inputs from subject matter experts from within Queensland Rail's regulation and network safety units. Queensland Rail's discipline head for safe working is accountable for ensuring rail safety accreditation is obtained and retained and will therefore lead the early and ongoing engagement with the Rail Safety Regulator.

Evidence produced through assurance activities undertaken for project delivery will be a key input into the safety case. (Safety cases are used to demonstrate that safety risks have been adequately identified and mitigated.)

### 14.6.11 Commercial Considerations

Queensland Rail must be remunerated for operating additional services and rail stations under the Rail Transport Services Contract (Rail TSC). Queensland Rail, together with TransLink, has well-established and documented processes encompassing management of the Rail TSC.



Other commercial arrangements that may be encountered – depending on the model of operation adopted – must also be considered.

## 14.7 Benefits Management Plan

The development of the BMP is an important step in articulating, monitoring and realising the benefits of the CRR Project during delivery and post-construction. The BMP was developed at the business case stage of project development and is therefore representative of the anticipated project benefits. The BMP is designed to assist the project owner in tracking and delivering on these benefits throughout construction and operation.

The BMP has been developed in accordance with the Department of Transport and Main Road's Benefits Management Framework. This framework articulates the key steps in defining, planning and reviewing project benefits throughout the project development lifecycle. The approach was used to further identify, define and confirm the potential benefits of the CRR Project and to allow the CRRDA to conduct post-project assessments as per Queensland and Australian Government requirements.

The BMP will be further developed during the procurement phase. A focus of this work will be to investigate potential opportunities to enhance the level of benefit derived from the project.

### 14.7.1 Project Benefits

Chapter 6: Project Benefits provides a comprehensive analysis of the potential benefits to be derived from the CRR Project.

Further explanation of these benefits is provided in Table 14.2.

BENEFIT CATEGORY	BENEFIT	DESCRIPTION
Rail benefits	Higher service frequencies	Improves the attractiveness of rail services through improved service levels and quality on the entire rail network.
	Reduced journey times	Improves the attractiveness of rail services through improved travel times.
	Reduced crowding	Addresses many of the negative perceptions of public transport such as limited service frequency and overcrowding by providing new services.
	Increased service reliability	Improves on-time rail reliability (measured by a reduction in lateness) due to the additional capacity provided.
Transport benefits	Higher public transport use	Unlocks public transport capacity making rail and public transport more attractive.
	Road network de-congestion	Increases the number of commuters forecast to use the train as their preferred mode of travel to the city, resulting in a reduction in cars trying to access the CBD. This will see a reduction in congestion in the busiest part of the road network with substantial savings in costs associated with urban road congestion.
	Improvements to supply chains	Attributable to improvements in road-based freight, particularly on the motorway network, enabled by increased numbers of commuters forecast to use the rail network.



BENEFIT CATEGORY	BENEFIT	DESCRIPTION
Strategic benefits	Managing growth of the region	Enables the rail network to connect principal regional activity centres to Brisbane's CBD. This will allow these centres to become vital nodes in the city's economic framework.
	Infill dwelling targets	Enables infill development in areas close to transport corridors to facilitate a more sustainable and compact settlement pattern with reduced reliance on private car use.
	Inner-city employment expansion	Provides transport capacity to facilitate and support inner-city growth projections.
	Connecting new cities and regional centres	Enable connection with strategic regional development areas to the CBD, in particular Caloundra South, Flagstone, Fitzgibbon, Coomera and Yarrabilba.
	Improving inner-city connectivity	Establishes rapid, high-frequency connections between some of the primary destinations and activity areas in Brisbane's inner city.
Other benefits	Enabled investments and opportunities	Provides an opportunity to facilitate future investment to unlock network capacity, for example, through longer trains, new generation signalling, network augmentation and expansion opportunities.

Table 14.2: Detailed Benefits Summary

#### 14.7.2 Benefit Measures and Targets

A benefits mapping process was undertaken to demonstrate the investment logic of the CRR Project by aligning strategic needs, project outcomes and benefits. The aim of this process was to group benefits to restrict the total number of benefits to be measured and reported to a manageable number.

This process identified ways to ensure potential measures of success align with core benefits management principles, including:

- Measures should be 'SMART' – Specific Measurable Attainable Realistic and Time-bound.
- Where possible, measures of successful outcomes identified in the business case should be preferred to new measures.
- The number of measured benefits should be limited to a manageable number, with preferred measures aligning with the most significant categories of benefit.
- The availability, cost and feasibility of attaining benefit measures and their ongoing reliability and accuracy should be considered in determining which measures are adopted.

The business case benefits have been integrated for the purposes of the BMP as summarised in Figure 14.3.





CRR DETAILED BUSINESS CASE NEEDS	CRR DETAILED BUSINESS CASE OUTCOMES			CRR BENEFITS MANAGEMENT PLAN TREATMENT
<b>Rail problems</b> <ul style="list-style-type: none"> <li>▪ Rail not performing its desired role in the transport system</li> <li>▪ Limits on service frequency</li> <li>▪ Uncompetitive journey times and costs</li> <li>▪ Network reliability and resilience</li> <li>▪ Insufficient rail capacity</li> <li>▪ Overcrowding on trains</li> </ul>	Higher public transport use	Increase service frequencies	Expand the role of the rail system	Greater capacity and service frequency
			Reduce journey times	Reduced journey times
			Reduce crowding	Reduced crowding
			Increase network reliability	Increased service reliability
<b>Strategic problems</b> <ul style="list-style-type: none"> <li>▪ Declining accessibility and connectivity between employment and population centres</li> <li>▪ Inability to maintain desired rates of economic growth and productivity</li> </ul>			Facilitate city building and urban growth	Urban growth and city building
			Improve population and employment linkages	Improved population and employment centre connectivity
			Improve SEQ's economic potential	Improved economic potential of SEQ
<b>Transport problems</b> <ul style="list-style-type: none"> <li>▪ Car dependency and road congestion</li> <li>▪ Inability to cater for future public transport demand</li> <li>▪ Inefficient supply chains</li> </ul>			Road de-congestion	Road de-congestion
			Supply chain improvements	Supply chain improvements
<b>Legend:</b>		<div>Identified benefits for measurement and reporting in this BMP</div> <div>Identified benefits proposed for inclusion in other (program-level) BMPs</div>		

Figure 14.3: Benefits for Measurement and Reporting



### 14.7.3 Benefits Governance

This section outlines indicative roles and responsibilities in delivering the project benefits. Roles and responsibilities presented in Table 14.3 will be further developed during future project phases.

ROLE	RESPONSIBILITIES
Deputy Director-General TransLink Transport Benefits Owner	The Transport Benefits Owner is responsible for the project realising the rail outcomes and benefit measures.
CRRDA Chief Executive Officer Strategic Benefits Owner	The Strategic Benefits Owner is responsible for the project realising the strategic outcomes and benefit measures.
CRRDA Project Manager	<p>The Project Manager is responsible for:</p> <ul style="list-style-type: none"> <li>▪ coordinating with the Project Owner and Strategic Benefits Owner and their stakeholders to align project activities and outputs with realising agreed benefits</li> <li>▪ actively managing project benefits to identify ways of ensuring success against the agreed measures</li> <li>▪ organising reports on progress against the BMP's targets to the Board</li> <li>▪ handing over the ongoing management of project benefits to the Portfolio Management Office if the CRRDA is dissolved or re-purposed.</li> </ul>
CRRDA Board	<p>The Board is expected to have the general responsibilities of:</p> <ul style="list-style-type: none"> <li>▪ ensuring the efficient and effective performance of the CRRDA's functions, which are expected to include: <ul style="list-style-type: none"> <li>– facilitating the efficient delivery of the CRR Project and transport-related projects</li> <li>– carrying out activities to facilitate economic development and development for community purposes in a CRR PDA</li> <li>– deciding the objectives, strategies and policies to be followed by the CRRDA.</li> </ul> </li> </ul> <p>With respect to this BMP, the role of the Board is to oversee progress towards realising the intended benefits of the CRR Project.</p>

**Table 14.3: Roles and Responsibilities of Key Agencies**

Reporting against benefit measures should be provided at least every twelve months, or as otherwise determined to be appropriate by the CRRDA Board.



# GLOSSARY



## GLOSSARY

ACRONYMS AND ABBREVIATIONS		
ACRONYM	FULL DEFINITION	EXPLANATION
ABS	<u>A</u> ustralian <u>B</u> ureau of <u>S</u> tatistics	
ACH Act	<u>A</u> boriginal <u>C</u> ultural <u>H</u> eritage <u>A</u> ct 2003	
AL Act	<u>A</u> cquisition of <u>L</u> and <u>A</u> ct 1967	
ARTC	<u>A</u> ustralian <u>R</u> ail <u>T</u> rack <u>C</u> orporation	
ATO	<u>a</u> utomatic <u>t</u> rain <u>o</u> peration	The non-safety-critical component of an ATC system. ATO is the part that controls the acceleration, running and braking of trains automatically on information supplied.
ATP	<u>a</u> utomatic <u>t</u> rain <u>p</u> rotection	<i>ATP</i> is a generic name given to systems that predictively prevent trains from exceeding their limits of authority and from travelling too fast. An <i>ATP</i> system continuously monitors the speed of a train in relation to its route authorities and permitted speed profile, and intervenes such that a train is prevented from exceeding an <i>EOA</i> or target speed, through the application of either the train's Service or Emergency brake. <i>ATP</i> systems are considered safety-critical. Within <i>Queensland Rail</i> , the term <i>ATP</i> also denotes the <i>WESTECT ATP</i> System.
BaT	<u>B</u> us and <u>T</u> rain	Bus and Train Project
BCC	<u>B</u> risbane <u>C</u> ity <u>C</u> ouncil	
BCCMP	<u>B</u> risbane <u>C</u> ity <u>C</u> entre <u>M</u> aster <u>P</u> lan	Brisbane City Centre Master Plan 2014. Outlines a five-year implementation plan that identifies priority projects to facilitate investment in Brisbane's city centre.
BCR	<u>B</u> enefit <u>C</u> ost <u>R</u> atio	A decision support tool that considers quantified benefits compared to costs. Equal to the discounted benefits over the life of the project divided by the total of the discounted capital costs plus discounted operating and maintenance costs.
BEDP	<u>B</u> risbane <u>E</u> conomic <u>D</u> evelopment <u>P</u> lan 2012–2031	
BIRS	<u>B</u> risbane <u>I</u> nnner <u>R</u> ail <u>S</u> olution	Brisbane Inner Rail Solution (2012–2014). A program of works and initiatives to accommodate growth and address inner-city capacity constraints in the existing rail system
BLTIP	<u>B</u> risbane <u>L</u> ong <u>T</u> erm <u>I</u> nfrastructure <u>P</u> lan 2012–2031	Intended to guide the prioritisation and alignment of Brisbane's infrastructure as the city grows, and to provide a reference for other levels of government and the private sector.
BQ	<u>B</u> uilding <u>Q</u> ueensland	
BRS	<u>b</u> usiness <u>r</u> ate <u>s</u> upplement	
BTC	<u>B</u> risbane <u>T</u> ransit <u>C</u> entre	
BSTM – MM	<u>B</u> risbane <u>S</u> trategic <u>T</u> ransport <u>M</u> odel – <u>M</u> ulti <u>M</u> odel	Used for strategic transport planning in Brisbane.



ACRONYMS AND ABBREVIATIONS		
CASA	<u>C</u> ivil <u>A</u> viation <u>S</u> afety <u>A</u> uthority	
CBA	<u>c</u> ost <u>b</u> enefit <u>a</u> nalysis	A structured technique for assessing the economic efficiency of resource allocation by quantifying in money terms, the costs and benefits of a range of alternative project options.
CBD	<u>c</u> entral <u>b</u> usiness <u>d</u> istrict	Central business district of Brisbane
CEO	<u>c</u> hief <u>e</u> xecutive <u>o</u> fficer	
CETS	<u>C</u> ivil <u>E</u> ngineering <u>T</u> rack <u>S</u> tandard	
CGE	<u>c</u> omputable <u>g</u> eneral <u>e</u> quilibrium	
CPI	<u>c</u> onsumer <u>p</u> rice <u>i</u> ndex	
CRR	<u>C</u> ross <u>R</u> iver <u>R</u> ail	
CRRDA	<u>C</u> ross <u>R</u> iver <u>R</u> ail <u>D</u> elivery <u>A</u> uthority	
CRRDA Act	<u>C</u> ross <u>R</u> iver <u>R</u> ail <u>D</u> elivery <u>A</u> uthority <u>A</u> ct 2016	
CSEQ	<u>C</u> onnecting <u>S</u> outh <u>E</u> ast <u>Q</u> ueensland 2031	
Cth	<u>C</u> ommonwealth	
DBOM	<u>d</u> esign, <u>b</u> uild, <u>o</u> perate and <u>m</u> aintain	Design, build, operating and maintain contract
D&C	<u>d</u> esign and <u>c</u> onstruct or alternatively <u>d</u> ocument and <u>c</u> onstruct	A form of project and contractual delivery method whereby the Contractor is responsible for the design and construction of an asset generally based on a performance specification prepared by the Principal
DCM	<u>d</u> esign, <u>c</u> onstruct and <u>m</u> aintain	Design, construct and maintain contract
DDA	<u>D</u> isability <u>D</u> iscrimination <u>A</u> ct	<i>Disability Discrimination Act 1992</i> (Commonwealth)
DMI	<u>d</u> river- <u>m</u> achine <u>i</u> nterface	The driver's cab console in <i>ERTMS</i> , or in <i>ATP</i> systems generally. See <i>HMI</i> .
DILGP	<u>D</u> epartment of <u>I</u> nfrastructure <u>L</u> ocal <u>G</u> overnment and <u>P</u> lanning	
DSAPT	<u>D</u> isability <u>S</u> tandard for <u>A</u> ccessible <u>P</u> ublic <u>T</u> ransport (Queensland Government) –	Standard developed to assist public transport operators and providers to meet their obligations under the DDA.
DUS	<u>D</u> enver <u>U</u> nion <u>S</u> tation	The Denver Union Station project in Colorado, USA
DUSPA	<u>D</u> enver <u>U</u> nion <u>S</u> tation <u>P</u> roject <u>A</u> uthority	
ED Act	<u>E</u> conomic <u>D</u> evelopment <u>A</u> ct 2012	
EIS	<u>e</u> nvironmental <u>i</u> mpact <u>s</u> tatement	
EOI	<u>e</u> xpression <u>o</u> f <u>i</u> nterest	



ACRONYMS AND ABBREVIATIONS		
EP Act	<u>E</u> nvironmental <u>P</u> rotection <u>A</u> ct 1994	
EPBC Act	<u>E</u> nvironmental <u>P</u> rotection and <u>B</u> iodiversity <u>C</u> onservation <u>A</u> ct 1999	
ETCS	<u>E</u> uropean <u>T</u> rain <u>C</u> ontrol <u>S</u> ystem	The train control and protection layer of <i>ERTMS</i> : see <a href="http://www.ertms.net/home.aspx">http://www.ertms.net/home.aspx</a> for details.
ETCS L2	<u>E</u> uropean <u>T</u> rain <u>C</u> ontrol <u>S</u> ystem <u>L</u> evel <u>2</u>	Level 2 is a variant of <i>ETCS</i> which does not require lineside signals but otherwise retains conventional signal interlocking and train detection. <i>Movement authorities</i> are transmitted direct to the train via GSM-R, with fixed, track-mounted balises used for position fixing.
FLS	<u>f</u> ire <u>l</u> ife <u>s</u> afety	
FTE	<u>f</u> ull-time <u>e</u> quivalent	
FTN	<u>f</u> ixed <u>t</u> elecommunications <u>n</u> etwork	
GCCC	<u>G</u> old <u>C</u> oast <u>C</u> ity <u>C</u> ouncil	
GOA	<u>g</u> rade <u>o</u> f <u>a</u> utomation	
GSP	<u>g</u> ross <u>s</u> tate <u>p</u> roduct	
GST	<u>g</u> oods and <u>s</u> ervices <u>t</u> ax	
ICRCS	<u>I</u> nn <u>e</u> r <u>C</u> ity <u>R</u> ail <u>C</u> apacity <u>S</u> tudy	Released in October 2008. Identified that the limited capacity of the inner-city rail network significantly constrains the number of additional trains that can be introduced on the rail lines servicing the region.
IS	<u>i</u> nfrastructure <u>s</u> ustainability	
ITALICS	<u>I</u> ntegrated <u>T</u> ransport and <u>L</u> and Use – <u>I</u> nn <u>e</u> r <u>C</u> ity <u>S</u> trategy, 2009	Considered capacity constraints faced by rail and bus and the difficulties faced with increased demand in and through the Brisbane CBD.
km	<u>k</u> ilometre	
km/h	<u>k</u> ilometres per <u>h</u> our	
KPI	<u>k</u> ey <u>p</u> erformance <u>i</u> ndicator	
LGA	<u>l</u> ocal <u>g</u> overnment <u>a</u> rea	
MCA	<u>m</u> ulti- <u>c</u> riteria <u>a</u> nalysis	
m <sup>2</sup>	square metres	
NGR	<u>n</u> ew <u>g</u> eneration <u>r</u> ollingstock	
NPC	<u>N</u> et <u>P</u> resent <u>C</u> ost	The sum of the values on a given date of a series of future cash flows, discounted to reflect the time value of money and other factors such as investment risk of a series of outgoing cash flows.
NPV	<u>N</u> et <u>P</u> resent <u>V</u> alue	
NPV/I	<u>N</u> et <u>P</u> resent <u>V</u> alue per dollar <u>I</u> nvested	
NSW	<u>N</u> ew <u>S</u> outh <u>W</u> ales	



ACRONYMS AND ABBREVIATIONS		
PA	<u>P</u> rincess <u>A</u> lexandra	Princess Alexandra Hospital
PAF	<u>P</u> roject <u>A</u> ssessment <u>E</u> ramework	The foundation framework for ensuring that project management is undertaken effectively across the Queensland Public Sector, and delivers value for money to the government from its significant investment in project activity.
PDA	<u>p</u> riority <u>d</u> evelopment <u>a</u> rea	
PN	<u>P</u> acific <u>N</u> ational	A train operator owned by Asciano, which operates freight services throughout Australia, including on the <i>Queensland Rail</i> network.
PPP	<u>p</u> ublic <u>p</u> riate <u>p</u> artnership	PPP delivery model where the private sector delivers the project including traffic demand risk. In general terms any number of a range of relational contract arrangements between the public and private sectors. Often used more specifically to describe an arrangement that includes long-term private sector involvement in public sector infrastructure through equity risk i.e. either partly or fully funded by the private sector.
PV	<u>p</u> resent <u>v</u> alue	
QAS	<u>Q</u> ueensland <u>A</u> mbulance <u>S</u> ervice	
QFES	<u>Q</u> ueensland <u>F</u> ire and <u>E</u> mergency <u>S</u> ervices	
Qld	<u>Q</u> ueensland	The State of Queensland within the Commonwealth of Australia
QPP	<u>Q</u> ueensland <u>P</u> rocurement <u>P</u> olicy	
QR		QR Limited: the former Queensland Government owned company, separated into <i>Queensland Rail</i> and <i>QR National</i> in 2010.
QTRIP	<u>Q</u> ueensland <u>T</u> ransport and <u>R</u> oads <u>I</u> nterestment <u>P</u> rogram	Queensland Transport and Roads Investment Program 2015–16 to 2018–19.  Outlines the commitment to delivering an integrated, safe and efficient transport system and details the current transport and road projects the Queensland Government plans to deliver over the next four years.
QUT	<u>Q</u> ueensland <u>U</u> niversity of <u>T</u> echnology	
QWB	<u>Q</u> ueen's <u>W</u> harf <u>B</u> risbane	
RACAS	<u>R</u> ail <u>A</u> ssessment of <u>C</u> apacity <u>A</u> lternatives <u>S</u> tudy	Commissioned in 2008 by the then Queensland Transport and TransLink Transit Authority. S ought to identify and investigate the feasibility, impact, cost and capacity benefit of operating policy options and any associated infrastructure measures to improve rail capacity.
RBC	<u>r</u> adio <u>b</u> lock <u>c</u> entre	In an <i>ETCS</i> Level 2 and Level 3 system, a centralised processor unit which receives route data from signal interlockings and train position information via <i>GSM-R</i> radio, and which issues <i>movement authorities</i> to trains.
RBWH	<u>R</u> oyal <u>B</u> risbane and <u>W</u> omen's <u>H</u> ospital	





ACRONYMS AND ABBREVIATIONS		
RfPC EMP	<u>R</u> es <u>e</u> quest for <u>P</u> roject <u>C</u> hange <u>D</u> raft <u>O</u> utline <u>E</u> nvironmental <u>M</u> anagement <u>P</u> lan	
RFP	<u>r</u> es <u>e</u> quest for <u>p</u> ro <u>p</u> osal	
RSNL	<u>R</u> ail <u>S</u> afety <u>N</u> ational <u>L</u> aw (South Australia) Act 2012	
RTD	<u>R</u> egional <u>T</u> ransportation <u>D</u> istrict	A United States Government Agency
SCMP	<u>s</u> afety <u>c</u> hange <u>m</u> anagement <u>p</u> lan	
SDPWO	<u>S</u> tate <u>D</u> evelopment and <u>P</u> ublic <u>W</u> orks <u>O</u> rganisation Act 1971	
SEQ	<u>S</u> outh <u>E</u> ast <u>Q</u> ueensland	
SEQCI	<u>S</u> outh <u>E</u> ast <u>Q</u> ueensland <u>C</u> apacity <u>I</u> mprovement Project (2014)	
SEQRP	<u>S</u> outh <u>E</u> ast <u>Q</u> ueensland <u>R</u> egional <u>P</u> lan 2009–2031	
SIE	<u>s</u> ocial <u>i</u> mpact <u>e</u> valuation	
SIP	<u>S</u> tate <u>I</u> nfrastructure <u>P</u> lan	
TBM	<u>t</u> unnel <u>b</u> oring <u>m</u> achine	
TMR	Queensland Department of <u>T</u> ransport and <u>M</u> ain <u>R</u> oads	
TMS	<u>t</u> raffic <u>m</u> anagement <u>s</u> ystem	The system provided to the Network Controller to control and monitor the rail network.
TOC	<u>t</u> arget <u>o</u> utturn <u>c</u> ost	
Tph	<u>t</u> ra <u>i</u> ns <u>p</u> er <u>h</u> our	
UK	<u>U</u> nited <u>K</u> ingdom	
UN	<u>U</u> nited <u>N</u> ations	
UQ	The <u>U</u> niversity of <u>Q</u> ueensland	
US	<u>U</u> nited <u>S</u> tates of America	
VOC	<u>v</u> ehicle <u>o</u> perating <u>c</u> osts	
WEBs	<u>W</u> ider <u>E</u> conomic <u>B</u> enefits	





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