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Cross River Rail

Environmental Impact Statement

Technical Report No. 1 – Transport

Part A

July 2011

Cross River Rail

TECHNICAL REPORT NO.1 – TRANSPORT PART A

JULY 2011

Contents

PART B

1 Summary

1.1 Introduction

1.1.1 The Project

This transport technical report presents an assessment of the likely transport and traffic effects of implementing Cross River Rail for the purpose of responding to the terms of reference for an environmental impact statement (EIS) of the Cross River Rail Project and to inform the business case.

Cross River Rail would provide a new north-south passenger rail line in Brisbane's inner city, extending from Bowen Hills in the north to Salisbury in the south via the Brisbane central business district (CBD).

The Project would comprise of two parallel tunnels, approximately 9.8 km in length extending from the Exhibition Loop at Spring Hill to Yeerongpilly, via the Brisbane CBD. The Project would include new underground rail stations at lower Albert Street, Woolloongabba and Boggo Road and new underground platforms at Roma Street. New surface stations would also be provided at Exhibition Station and Yeerongpilly, and upgrades would be provided to stations at Moorooka and Rocklea.

North of the portal at Spring Hill, the Project would include two additional tracks between Spring Hill and Mayne Rail Yard (railway yards) with the tracks on elevated structure within Mayne Rail Yard. South of the portal at Yeerongpilly, the Project would provide two additional surface tracks between Yeerongpilly and Rocklea and one additional surface track between Rocklea and Salisbury.

Cross River Rail would be integrated with the existing lines, operate with nine-car rolling-stock (by 2031) and allow 2.5 to 3 minute peak headways (up to 24 trains per hour each direction). Its implementation would also free up capacity to improve services on other lines and provide greater public transport accessibility to the southern end of the CBD, the Bowen Hills and Woolloongabba Urban Development Areas and the Yeerongpilly Transit Orientated Development (TOD).

1.1.2 Project need and objectives

Strong South East Queensland regional economic and population growth has resulted in growing rail and bus passenger demand to the CBD employment centres. A lack of adequate rail capacity through the CBD has put increasing pressure on rail services in the inner city and on passenger and train levels of service with existing demand close to the capacity of the inner rail network.

The detailed feasibility study for the Cross River Rail was an outcome of the 2008 Inner City Rail Capacity Study. The study reviewed options to increase heavy rail capacity in the inner city to accommodate the expected growth in rail patronage derived from the SEQ population growth and Brisbane CBD employment growth. Such growth has most recently been reported in the Draft Connecting SEQ 2031 (an Integrated Regional Transport Plan for South East Queensland).

The Project aims to improve commuter rail levels of service, improve CBD accessibility and provide rail capacity for growth with specific objectives being:

- to ensure the inner city rail infrastructure caters for patronage and service growth over the next 20 years
- to enable a transformation of passenger rail services in South East Queensland through new technology and standards delivering higher capacity and enhanced service quality
- to remove the conflicts between different rail service types and improve freight capacity
- to improve access to inner city attractors/generators and future inner city development
- to provide high quality strategic interchange facilities within the public transport network

- to ensure the project aligns with a longer term plan for the development of the transport network in South East Queensland
- to ensure the project represents value for money, taking account of project risk
- to support sustained economic growth of the region through improved access to employment and effective movement of freight
- to increase rail's mode share and reduce energy consumption and greenhouse gas emissions and manage traffic congestion.
- to integrate with and be a catalyst for urban redevelopment consistent with planning scheme intentions and opportunities
- to facilitate transit oriented development that incorporate the sustainable social and lifestyle benefits associated with proximity to high quality public transport
- to minimise impacts during construction and operation.

1.1.3 Scope of this report

This technical report describes, and documents the findings of the transport studies undertaken to assess the effects of the Project and the scenario without the Project on the transport system.

The following transport aspects of the Project have been assessed and presented in this report

- an overview of the methodology used for strategic patronage and traffic forecasting, station pedestrian simulation modelling, rail operations modelling and other methods used
- a description of the existing transport network as relevant to the Project
- an assessment of the existing travelling conditions and performance of services to and from the Brisbane CBD and throughout the South East Queensland rail as relevant to the Project.
- the need for the Project in terms of future conditions without Cross River Rail
- an assessment of rail alternatives to Cross River Rail including the extent to which these alternatives may support or delay the need for Cross River Rail
- key transport planning and operational characteristics and outcomes of the Project, in terms of passenger service improvements on the network
- the effects of the Project on other transport modes, including integration with other modes and station precinct plans
- the transport implications for impacts and mitigation measures of construction activities.

1.2 Methodology

1.2.1 Broad approach

The existing and future transport conditions within the study corridor, both with and without the Project were derived from a land use and transport model specifically developed for this Project and was called the Cross River Rail Project Model (CPM). Most of the analysis which forms the basis of the Project assessment, including the assessment of rail and bus patronage, station passenger usage, road network congestion and user benefit forecasts, were derived from this model.

However, three other integrated transport models were developed to assess the Project namely; a benchmark forecasting model, a station simulation (ClicSim) model and a rail operations model.

A separate assessment of the effects of the Project on freight movement by rail was undertaken.

The overarching method of assessing the transport effects of the Project involved a comparative analysis of effects with and without the Project.

1.2.2 Patronage forecasting

Patronage forecasting was undertaken using the Cross River Rail Project Model that is based on the Brisbane Strategic Transport Model Multi Modal (BSTM-MM). This transport model provides average weekday travel demand forecasts for the Brisbane Metropolitan Area up to and including the year 2031 for both public transport and road traffic trips.

Significant enhancements were made to the existing model to better predict public transport demand and user benefit, such as the inclusion of a public transport crowding component to increase confidence in the model outputs. Public transport patronage was modelled for years 2021 and 2031 (the years for which key model input data and demographic forecasts are available).

The demographic and transport assumptions upon which the Cross River Rail Project Model is based are taken from the Draft Connecting SEQ 2031 and are consistent with the current assumptions used on other Department of Transport and Main Roads (TMR) major projects. Growth in public transport fares, parking charges and road tolls, growth in the value of time and the strategic transport network improvements (rail, bus and road) are all based on Connecting SEQ 2031 and SEQIPP policies and programmes.

1.2.3 Rail operations modelling

Rail operation service plans for both the scenarios with and without Cross River Rail were developed by Systemwide to meet the rail demand forecasts. Service plans and operating strategies were developed to be consistent with the service planning policy and supporting measures identified, including measures to encourage peak spreading and establish simpler stopping patterns (Systemwide, December 2010).

The development of these service plans was an iterative process and service loadings were also tested as part of the service plan development process using the Train Load Predictor (TLP) model. The Train Load Predictor takes both an assumed future timetable and station by station demand figures (origin destination matrix) to produce an estimate of passenger loads and movements, on and between individual services within a rail timetable. A range of detailed key performance indicators (KPI), such as rail passenger crowding by service and on time reliability forecasts, were generated to enable the rigorous evaluation of passenger and operational impacts of different timetable options.

1.2.4 Station transport planning and access

A planning assessment framework including integrated land use, urban design and transport planning principles was used to determine optimal station locations. Future CBD public transport movement distribution from the Cross River Rail network model was also an input to this planning framework. Existing traffic data was used as a basis to assess station traffic access arrangements and impacts with the operational Project.

Station planning for modal integration, pedestrian and cycle accessibility was undertaken using opportunities and constraints analyses for key station precincts affected by the Project within the study corridor.

1.2.5 Rail freight demand and operations

Separate economic and operations analyses of the rail freight task were undertaken which assessed future rail freight demand, volumes and train movements on the network with and without the Project. Rail freight train paths were tested using the train operating model for consistency with passenger operations.

1.2.6 Construction traffic and rail network impacts

The proposed construction plans and worksite information for each of the new and upgraded stations and tunnel portal sites were used to undertake traffic impact assessments of construction traffic, in accordance the EIS Terms of Reference (ToR) section 3.1.6.

Impacts at the proposed worksites from construction traffic together with construction worker movements (including parking) were compared with existing traffic conditions and volumes to assess likely impacts and mitigation measures at each site. Construction spoil routes and estimated construction volumes were used to undertake intersection and pavement analysis along the major routes proposed to be taken by construction traffic. The cumulative impact of construction effects of the project in conjunction with other major projects being constructed within the same timeframe (2015 to 2020) were also investigated.

1.3 Existing transport network performance

1.3.1 Recent transport trends

National census statistics for the ten year period 1996-2006 for the Greater Brisbane Area show that the volume of commuting by public transport has increased on average by 3.8% per annum (45% over ten years), with rail increasing more rapidly than bus since 2001. Employment growth accounts for a large part of the growth in public transport commuting with an increase in public transport share from 12.5% in 1996 to 13.8% in 2006 also contributing to overall patronage growth. Most of this increase was on rail in the second half of the period. The rail patronage growth rate between 2001 and 2006 was reported at 6.9% per annum.

Census data also shows that public transport commuting to the CBD grew in volume by 4.1% per annum (50% in total) over the same ten year period (1996 to 2006). Employment growth in the CBD was 24%, accounting for only half of the growth in commuting by public transport. A significant increase in the public transport mode share from 41.5% to 50.2% was equally important in accounting for patronage growth. In the second half of the period (2001 to 2006), bus patronage to the CBD increased twice as fast as rail (5.8% per annum for bus as against 2.9% per annum for rail), the opposite of the Greater Brisbane trend, although the average growth rates for each mode over the full ten year period were similar. Growth in employment and growth in the public transport mode share were broadly equal in their contribution to the increase in public transport commuting to the central business district.

In 2006, the split of commuting to the CBD between the main public transport modes was 54% rail, 43% bus and 3% ferry. The split between public transport and car trips is in the order of 50:50 for commuting trips to the CBD.

Based on passenger load surveys for the period 2005 to 2009, Queensland Rail (QR) reports Brisbane average rail growth rates of 6.7% per annum for morning peak passenger boardings and 5% for evening peak period passenger alightings.

The Cross River Rail primary interest is in public transport travel to and from the CBD. According to the census, this grew (for commuters) by 4.1% per annum over the decade to 2006 but with higher growth of around 6.9% per annum in more recent years. Over the ten year period to 2006 public transport patronage growth exceeded growth in population and employment. This has been most marked for travel to and from the Brisbane CBD, for which the increase in employment accounts for only about half of the patronage growth, with an increase in the public transport mode share accounting for the other half.

Modelled growth in total daily person trips for the Greater Brisbane Area between 2006 and 2009, reveals overall growth at 6.4% (just over 2% per annum). Forecast growth in public transport trips over the same period however is much higher at 24.2% or 4.0% per annum, across Greater Brisbane.

Overall growth in daily vehicle traffic into the CBD and north and south across the Brisbane River was modelled as 6.4% for the period 2006 and 2009, with growth in vehicle traffic into the CBD in the peak period being somewhat lower. In contrast, the growth in public transport trips in the peak, which is significantly higher at 34%. These forecasts are consistent with the capacity constraints on the road network both into the CBD and across the Brisbane River.

1.3.2 Passenger rail network, services and capacity issues

The existing Queensland Rail suburban rail network comprises of more than 300 km of track and 144 stations. The network extends from the centre of Brisbane, south to Beenleigh and Varsity Lakes on the Gold Coast, north to Ferny Grove, Shorncliffe, Caboolture and Gympie, east to Cleveland and west to Ipswich and Rosewood.

Queensland Rail in partnership with TransLink Transit Authority provides 57 train services each weekday peak hour through the CBD. These rail services operate on the Suburban lines and Main (Interurban) lines generally dividing the rail network into two sectors.

Current rail operation involves inter-dependencies and crossing movement between the two sectors which constrains the rail network capacity as well as service reliability. The sharing of services and tracks between the Main Sector and Suburban Sector, especially between suburban lines to the north and western lines to the southwest mean that an incident in one sector has the potential to cause delays across both sectors. The lack of strict network sectorisation within the Brisbane network reduces schedule robustness, and allows knock-on delays across lines.

The Brisbane CBD rail network particularly between Central and Roma Street stations are constrained and are near capacity over much of the peak commuter periods. Capacity across the Brisbane River for the long-distance, commuter trains from the Gold Coast as well as suburban Beenleigh and Cleveland trains are limited to a single in-bound line across the Merivale Bridge.

Based on current passenger growth rates and the existing train operating patterns, the inner city rail network is approaching its capacity.

1.3.3 Bus transport demand and issues

Buses currently carry the majority of public transport trips in Brisbane. With around 285,700 daily bus users on an average weekday in the Brisbane Metropolitan Area (2009), this represents over 50% of total public transport trips across the Brisbane Metropolitan Area.

The Brisbane bus network is highly CBD-centred with over 500 bus services per hour entering the CBD in the morning peak (source Bus Access Capacity Inner City Study (BACICS), 2008). The two busways within the study corridor, the Inner Northern Busway and South East Busway, carry around two-thirds of these buses into the CBD. The South East Busway carries over 250 buses per hour inbound at its busiest point at Woolloongabba while the Inner Northern Busway carries over 90 buses per hour inbound at Roma Street in the morning peak.

Peak hour bus operations in Brisbane consist of a range of peak only routes which supplement the standard timetable and offer single seat express journeys into the CBD. From the south-east, most of these peak-only express services use the Captain Cook Bridge to enter the CBD rather than the inner South East Busway route via the Victoria Bridge.

Across inner Brisbane and the study corridor there is a general lack of dedicated bus-rail interchange infrastructure with two exceptions being at Roma Street Station and Park Road/Boggo Road station.

Bus layover space in the CBD is limited, with a range of on-street spaces used including Alice Street, William Street and Wickham Street as well as off street space at Woolloongabba (South East Busway), Petrie Terrace (Inner Northern Busway) and at Queen Street Bus Station.

1.3.4 Ferry services

Passenger ferries operate in inner Brisbane, from the University of Queensland (St Lucia) in the west and, via the CBD, to Bulimba and Hamilton in the east. Ferries cater for a very small component of trips within the South East Queensland Region with approximately 20,000 daily trips in 2009, this represents less than 2% of total daily (weekday) public transport trips.

In the study corridor itself the ferry network primarily provides access to the CBD with terminals at North Quay (around 900 m from Roma Street Station), South Bank (around 500 m from South Bank railway station), and the Riverside Centre (around 600 m from Central Station). Given the distances involved ferry-rail interchange is very limited.

1.3.5 Freight rail issues

Freight rail services use the Brisbane suburban rail network to access key freight destinations including Fisherman Islands (Port of Brisbane), Acacia Ridge Freight Terminal, and the North Coast line. Currently, there is no dedicated rail freight network in South East Queensland and as a result, passenger and freight rail services share network capacity with passenger services prioritised over freight in the peak hours. Efficiency and performance of non-peak passenger rail operations are often affected by the need to schedule freight trains in the times available between higher priority passenger train services.

There are around 344 freight services per week travelling through the Brisbane rail network along the narrow gauge lines. In addition to the freight services travelling along the narrow gauge lines, there are also 177 freight services per week operating along the existing dual gauge lines between Acacia Ridge and Port of Brisbane.

Freight services through the inner city use the Exhibition Loop to bypass the CBD and therefore do not pass through Roma Street, Central or Fortitude Valley stations. This is partially because the inner city stations were not designed to accommodate freight services, and largely because the freight services would cause operational difficulties in the heavily used inner city passenger corridor.

1.4 Future conditions without the Project

This section outlines the forecast changes in transport conditions and performance between the current (base) year of 2009 and the reported future modelled years – 2021 and 2031.

1.4.1 Future transport network (without Cross River Rail)

The public transport network and services as used in the patronage modelling will grow and evolve between 2009 and 2031 with a range of transport projects and service changes assumed. These assumptions are consistent with the draft Connecting SEQ 2031 (An Integrated Regional Transport Plan for South East Queensland) and the TransLink Transit Authority Strategic Plan 2010–2015.

Transport planning projects and policy assumptions include:

- new railway extensions and improvements including new Richlands branch line (2011), Richlands to Springfield extension (2016), Moreton Bay Rail Link (2016), and other capacity enhancements.
- a range of new busways are due to be completed by 2021 including the Eastern Busway to Coorparoo, Northern Busway to Chermside, and the extension of the South East Busway to Underwood.
- improved off-peak rail frequency introduced by 2021 allowing for ‘turn up and go’ frequencies of 15 minutes or less on most inner lines throughout the day and evening (seven days a week).
- increase in public transport fares above the Consumer Price Index (CPI) until 2014 in line with State Government policy, after which fares are assumed to increase in line with CPI.

- a range of road and motorway projects are completed since 2009 including Clem7 tunnel (now completed and operational) AirportLink toll tunnel (2012), Northern Link toll tunnel (2014), Gateway Bridge duplication (tolled - now completed and operational) and related Gateway Motorway upgrade (2011).

1.4.2 Future demand for travel

Weekday travel demand across Brisbane is forecast to grow significantly with 40% more motorised trips expected every day in 2031 compared to 2009. The greatest growth is expected to occur in public transport trips, with 97% more trips in 2031 compared to 2009, whereas vehicle trips are anticipated to grow at a slower rate, increasing 47% on 2009 volumes by 2031.

There is a steady increase in mode share for public transport forecast, from 8.1% of all weekday person trips in 2009 to 11.6% in 2031.

Travel to the Brisbane CBD is expected to be increasingly met by public transport modes, with minimal growth in vehicle trips expected, as shown in **Figure 1-1**. Rail, bus and ferry are all expected to cater for a greater number of trips, as well as a greater proportion of all trips to the CBD, between 2009 and 2031. Car travel to the CBD is expected to plateau at around 40,000 to 45,000 person trips in the morning peak period.

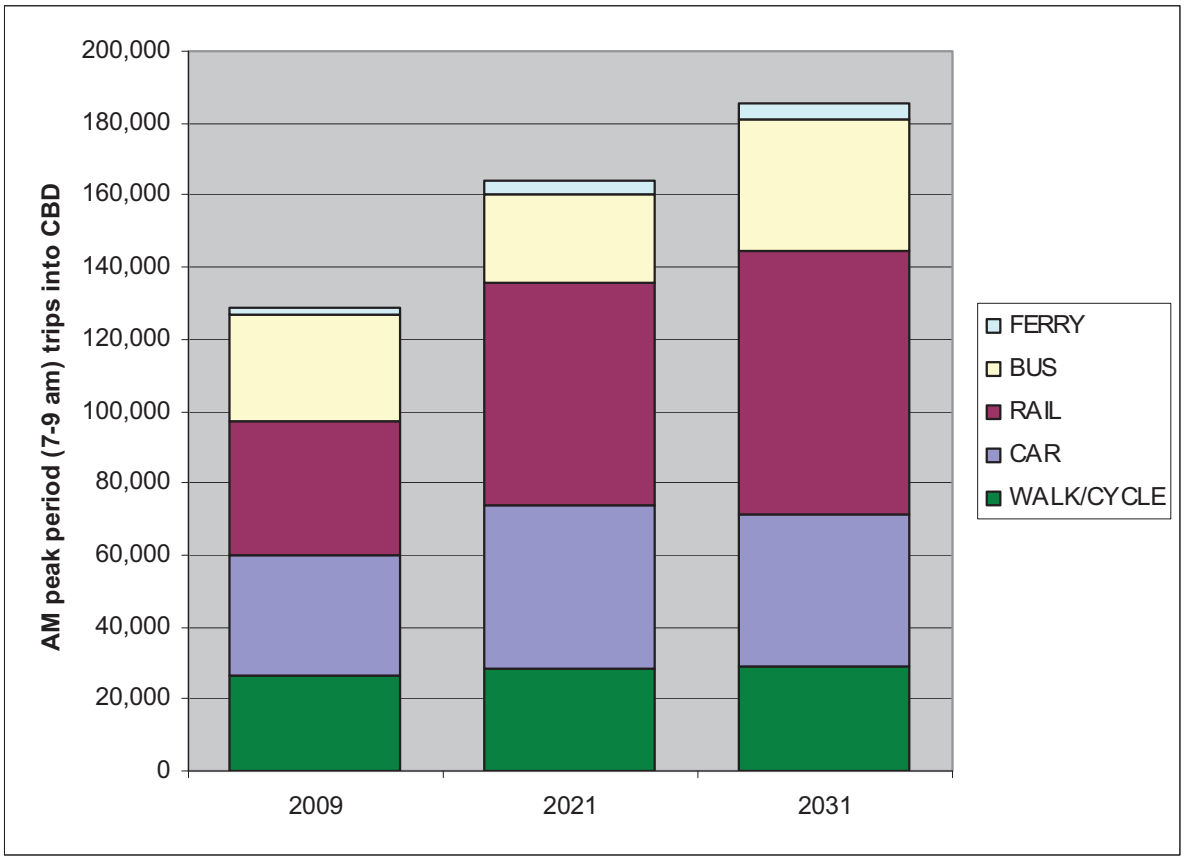


Figure 1-1 Forecast in travel demand to the Brisbane Central Business District

1.4.3 Growth in rail

As shown in **Table 1-1** rail trips are forecast to more than double from 2009 to 2031. By 2031 there are forecast to be more than half a million rail trips in the region, compared with around 250,000 today. Total passenger rail kilometres and passenger rail hours are also shown to be growing faster than rail patronage indicating that average rail trip lengths and journey times will get longer. Rail passenger, kilometres and hours are expected to grow faster in the morning peak than across the whole weekday.

Table 1-1 Forecast growth in rail usage in the Brisbane Metropolitan Area – average weekday (24 hours)

24 Hours	2009	2021		2031	
		Forecast	% growth	Forecast	% growth
Average rail passenger kilometre	5,178,200	9,645,100	86%	12,741,900	146%
Total rail passenger hours	124,400	226,200	82%	291,400	134%
Total rail patronage	243,200	421,900	73%	529,500	118%
Average rail trip length (km)	21.3	22.9		24.1	
Average rail trip time (mins)	30.7	32.2		33.0	

Source: Cross River Rail Project Model

Analysis of rail patronage growth on the suburban rail network shows that from 2009 to 2021 the morning peak period rail patronage is forecast to increase by 86% and by 2031 rail patronage would generally have more than doubled. The busiest sections of the rail network would carry over 50,000 passengers in the morning peak two-hour period.

Daily patronage is forecast to increase by a slightly greater percentage than for the morning peak period due to higher growth in rail travel during the off peak period. The busiest section of the rail network between Central Station and Fortitude Valley is forecast to carry around 53,000 rail passengers in the two-hour morning peak period and 200,000 during the whole day (by 2031).

The analysis also showed that Central station has a capacity of around 43,000 passengers in a two hour period. Forecast demand would reach this capacity by 2021 and be well in excess of this by 2031, with more passengers trying to use the station than can be comfortably accommodated. As such, forecast growth in passenger use of Central station is relatively low as passengers are discouraged from using this facility. Despite this constraint, the demand for passenger alightings in the CBD in the morning peak period is forecast to increase from 37,000 (in 2009) to almost 74,000 passengers without the Project by 2031, however with much of the growth occurring at other stations within the CBD, or outside the CBD itself.

Limited scope for additional services

By 2021 the demand for rail use would be close to the inner city network peak capacity.

Current infrastructure along with planned minor upgrades on the rail network in conjunction with changes in service patterns, would allow 5 more trains per hour to be added to the inner Brisbane network by 2031 compared to 2021 in the peak hour, with none to be added from the south (over the Merivale Bridge) This represents a 6% increase in the overall number of services in 2031 (compared to 2021) with no increase in services from the south, which would not be sufficient to meet the additional 25% overall rail patronage demand forecast, even with a shift in the demand profile to the shoulder peak and off peak periods.

Reduction in service reliability

The continued growth in demand for rail services would result in a significant reduction in service reliability and increase in overcrowding across the Brisbane rail network. By 2021. Nambour, Ferny Grove, Cleveland, Gold Coast and Ipswich corridors would experience a reduction in reliability of more than 10% compared to 2009. By 2031, the reduction in reliability on some of the major corridors, including Caboolture, Doomben, Shorncliffe and Airport would reach 50% compared to 2021. Services on the Beenleigh line would experience a further reduction in reliability of more than 20%. In fact, all lines approaching the CBD would be unable to achieve the current Queensland Rail benchmark of 92.4% on time reliability (at four minutes) during the morning peak period by 2031.

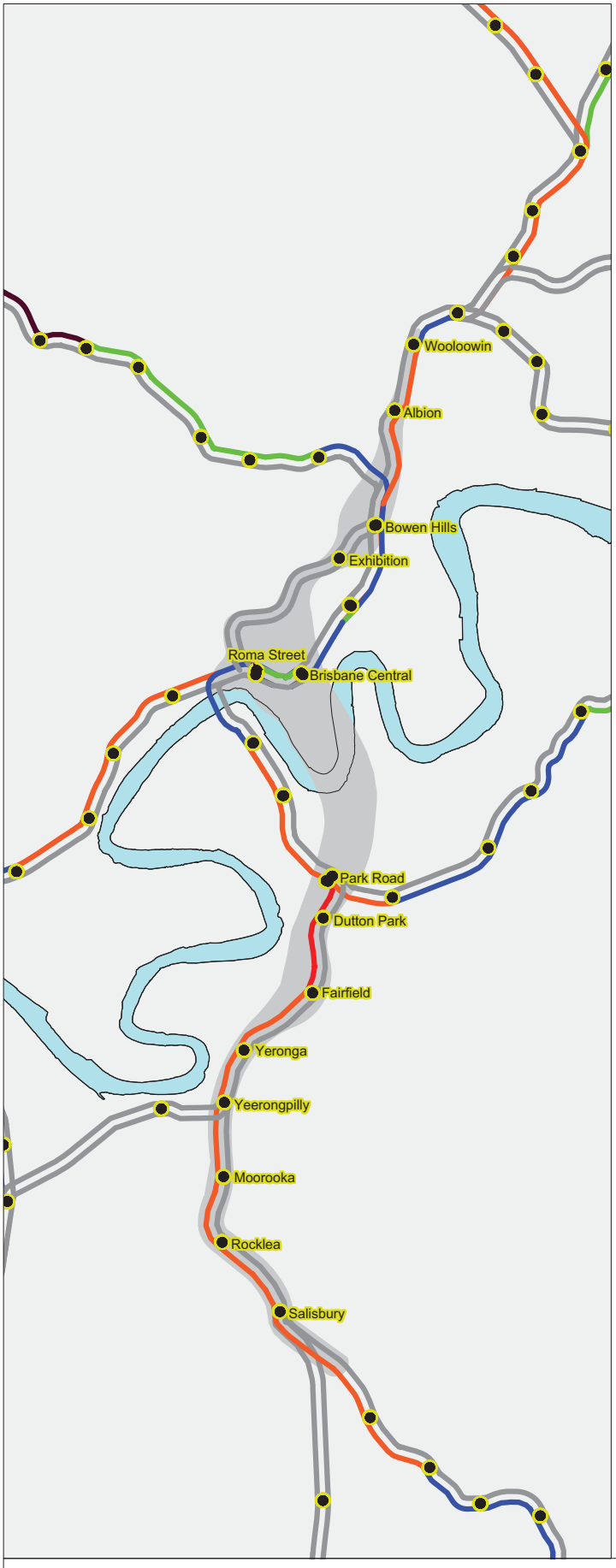
Higher train loadings and overcrowding

An assessment of level of service forecast without the Project measured in terms of passenger crowding was undertaken using the TLP model. Load factors (line loadings expressed as a proportion of seated capacity) in the morning peak period by rail segment by direction are presented in **Figure 1-2.**

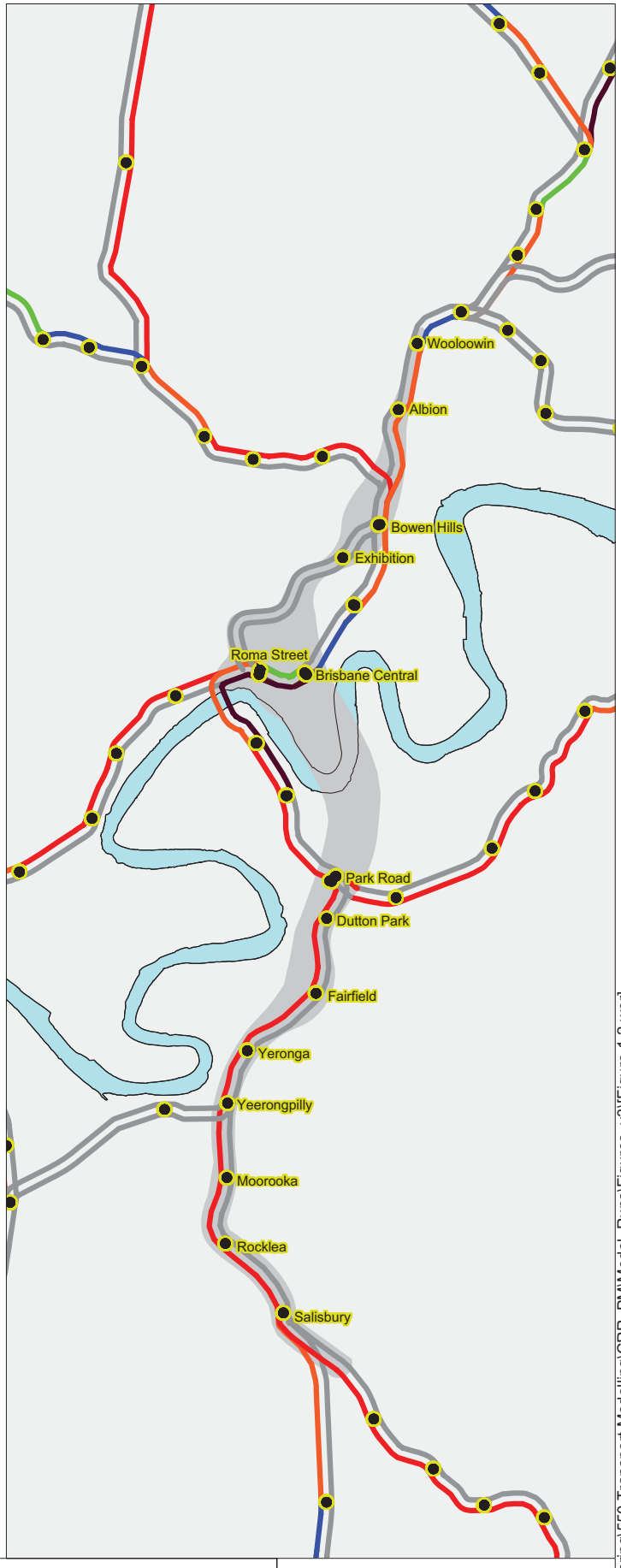
In 2021, load factors on all rail lines are forecast to increase substantially. Those services most impacted by the inner city capacity constraints, the Beenleigh and Gold Coast lines are forecast to have load factors of 150% approaching Park Road station (that is, 50% more passengers than the seated load capacity) on average across the entire two-hour AM peak period. By 2031, the forecast volume of passengers in excess of seated capacity is critical and all lines approaching the CBD would have passengers standing for more than 20 minutes from Central station and most lines would have a forecast load factor of greater than 150%. In 2031, all AM peak hour Gold Coast line (inbound) services would exceed 750 passengers, meaning passengers would experience high levels of congestion with many passengers inevitably being left behind. Overall, the level of crowding forecast for the rail network in peak periods in 2031, means a significant number of passengers would divert to already congested bus and road networks, or choose not to travel at all.

In addition, the modelling suggests that the existing arrangement of pedestrian infrastructure at Central Station would not have sufficient capacity to accommodate 2031 passenger volumes in the without project case.

Year 2021 - without Cross River Rail



Year 2031 - without Cross River Rail



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.50
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50
- Study Corridor
- Railway stations

Model ID: CPM_2021_013 (2021) CPM_2031_104 (2031)

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Figure 1-2

Morning peak period rail load factors 2021 to 2031 without Cross River Rail

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1.4.4 Bus and ferry services

Bus services

By 2021 extensions to the Northern and Eastern Busway would be operational with additional services using these key bus corridors.

TransLink's progressive rollout of the High Frequency Priority Network (HFPN) (also known as UrbanLink in the draft Connecting SEQ 2031 plan) would put more emphasis on simplifying and improving the bus network. This would involve more feeder routes to rail and busway hubs with an increasing need to transfer to another service, particularly from outer suburban areas, in the off peak. Bus services within 5 km of CBD would generally remain as 'one seat journeys'.

There would be a trend towards marginally shorter bus trip lengths and bus journey times between 2009 and 2031, due to more bus feeder routes to rail stations that would encourage bus-rail interchange (ie a change from current single seat bus journeys to the CBD to two-seat, two-mode journey patterns).

A substantial increase in demand on services would be seen on Ipswich Road, the South East Busway, the Captain Cook Bridge, the Northern Busway and Given Terrace (Paddington) and by 2021 overcrowding would occur on the South East Busway and the Captain Cook approaches to the CBD. This overcrowding is forecast to deteriorate further by 2031 despite the assumed provision of additional bus priority measures.

Ferry services

There are no major changes to ferry operations expected within the study corridor however moderate frequency improvements would continue to provide more regular services. By 2031, ferry patronage would more than double from 2009 volumes. Ferries would cater for only a small percentage of overall trips across the city – less than 1% of all motorised daily trips.

1.4.5 Rail freight

Without the Project, a dedicated freight track would not be available throughout the day from Salisbury to Park Road and the existing dual-gauge track would continue to be used by both express passenger rail (Gold Coast) services as well as freight trains from Acacia Ridge or the Western Lines (via Tennyson) to the Port of Brisbane. The continued presence of passenger rail operations would likely result in curfews on rail freight operation during the commuter peak periods and also prevent any increase in off peak frequency on the Gold Coast line. This would constrain the freight throughput between Salisbury and Tennyson between Tennyson and the Port of Brisbane.

As such there is a predicted shortfall in the number of rail paths available for freight in 2021 and 2031 without the project to meet projected freight demands. By 2021 only 14% of freight demand between Salisbury and Tennyson would be able to be transported by rail while around 70% of freight demand between Tennyson and the Port would be able to be transported by rail due to capacity constraints. By 2031, anticipated increases in off peak passenger rail frequency would mean very little anticipated freight demand on the North Coast line could be accommodated on rail (around 5%), while only 10% of freight demand between Salisbury and Tennyson and 60% of freight between Tennyson and the Port could be accommodated on rail. The unmet demand would need to be transported by road.

1.4.6 Need for the Project

The key conclusion of the analysis of the future transport network without the Project is that there would be declining levels of rail passenger and freight services. The outcomes which support the need for the Project include:

- Expected growth in rail network passenger use and peak commuter demand to the Brisbane CBD would reach the inner city rail capacity by about 2021. This is mainly due to the increasing long-distance traffic growth of commuters from southern suburbs using the Gold Coast line.
- The inner city rail infrastructure has not received major investment that is needed to unlock physical capacity constraints that would effectively accommodate the recent high levels of existing and forecast rail passenger and freight movement growth to the Brisbane CBD.
- Progressively poorer levels of rail service, including high levels of train crowding on the long-distance commuting trains and increasing train unreliability would continue without investment in the Project. Rail commuters would be forced to take off-peak trains, use alternative transport or change trip making decisions.
- The expected growth of the Brisbane CBD as an attractive destination, for jobs (which would double by 2031) and cultural and social activities, would put increasing pressure on the existing inner city rail network to service this demand, without a change to the train operating paradigms.

1.5 Alternatives to the Project

Two key alternatives to Cross River Rail have been investigated:

i. A minimal enhancement option

ii. Alternative alignment for Cross River Rail

1.5.1 Minimal enhancement

A minimal enhancement option has been investigated to examine if operational or minor infrastructure enhancements could maximise use of existing rail infrastructure and potentially defer the need for major rail network capacity enhancements. The minimal enhancement option is not considered a viable long term option to address project objectives, but rather it is seen as an important mechanism to defer major rail network improvements until the preferred solution can be funded and constructed.

A range of measures proposed in the Rail Access of Capacity Alternative Study (RACAS) (DTMR 2008) have been agreed among stakeholders and included in the minimal enhancement option as essential to achieve the theoretical CBD maximum capacity of 84 trains per hour (two-way) using existing infrastructure. This includes:

- Mayne stabling moves (removing conflicting crossing movements at Roma Street)
- Platform passenger management (improved information and on-platform assistance to reduce dwell times)
- Express Passenger Train (XPT) train paths – remove, relocate or re-time the southbound AM departure from June 2011
- Headway optimisiation on the Merivale Bridge.

Further to RACAS, the most significant measure included in the minimal enhancement option is improved timetabling and service planning including increased shoulder peak services. A key component of better utilising the infrastructure in the rail network is simplification of the current timetable. The current peak period timetables have many variations to routes and stopping patterns primarily to try to cater for variations in travel patterns but also in response to expected passenger load profiles ensuring services are not stopping when the train is full. This can, however, be confusing to passengers.

- The timetable restructure will reduce the overall number of routings and repeat regularly; provide consistent stopping patterns for express and all stops services; deliver an increase in services in the shoulder peak to encourage peak spreading; and achieve full sectorisation with the network divided into two independent sectors at all times.

The following network infrastructure improvements were also been identified as necessary to improve system performance and allow trains to be presented reliably to the inner city network paths. As such they have been included in the minimal enhancement option:

- Lawnton to Petrie third track (with Petrie fourth platform included)
- Coomera to Helensvale duplication
- Signalling upgrades from Ormeau to Beenleigh and duplication of single line sections on the Cleveland corridor to allow further service increases on these lines
- Cleveland stabling, to offset the need for a Park Road grade separation in the short term, without Cross River Rail. Services would move out of these stabling locations in the off-peak to remove a similar crossing move through Park Road junction in the afternoon peak.

The combination of above measures is expected to extend the life of the network to 2021 at which time implementation of Cross River Rail would be required. If investment in Cross River Rail is deferred beyond this time, other options to address overcrowding on key inner segments of the network would have to be considered.

Further measures considered

- While higher capacity (ie longer) rollingstock options were considered, they were rejected for this interim minimal enhancement option as longer trains would require major platform lengthening works to be undertaken over a number of years. Higher capacity trains with less seats were also rejected as this would involve several years lead in time to procure and manufacture the trains.

Next Generation Signalling was also considered but rejected for the minimal enhancement option, as it would not solve some capacity constraints at existing complex flat junctions (such as Park Road junction), it would take several years to develop, implement and test and comes at a significant cost ($500 million-plus).

1.5.2 Alternative alignment

The alternative alignment option outlined below is regarded as an option that seeks to improve inner city rail capacity by alleviating pressure on key network choke points. This option does not attempt to address the full range of Project objectives.

Under the alternative alignment option, long-distance southern corridor services (the Gold Coast line) would be rerouted via the Tennyson loop to connect with long-distance western corridor services (the Ipswich line). Grade separation would be required at the junction of the Tennyson loop with both the Gold Coast line at Yeerongpilly and the Ipswich line at Corinda.

Western line services would stop at Roma Street Station, and then enter a new tunnel via Central that would connect to the Exhibition Loop, whilst Gold Coast services would run straight onto the Exhibition Loop and connect to the new tunnel in a clockwise loop through Central (with a new platforms) and Roma Street stations.

The alternative alignment option would have operational complexity due to increased crossing conflicts which would lead to unreliability, delays and reduced line capacity.

Patronage forecasts for the alternative alignment have been compared to the without Project case in 2031 and shows an increase of over 4% in rail patronage to 551,900 total daily rail patronage in the Brisbane Metropolitan Area.

The alternative alignment option in 2031 would deliver 17% more alighting passengers in TransLink zone 1 compared to the without Project case (that is 118,300 passengers in total).

The alternative alignment option however would not provide relief to rail passenger crowding on the Gold Coast line south of Yeerongpilly and over the Merivale Bridge. A range of significant stakeholder issues arose throughout the development of the alternative option including:

- sustainability of combining the two strongest growth corridors (Gold Coast line and Ipswich line)
- impacts on passenger and freight services during construction may be considered to be unacceptable
- while increasing patronage to the Brisbane CBD this option has the inability to enhance access to trip attractors or generators within the inner city that are currently not serviced by rail, in particular the lack of a new station in the southern CBD.

1.6 Future conditions with the Project

Cross River Rail would provide much needed inner-city rail capacity to accommodate future rail patronage to and from the Brisbane CBD. It would allow increased public transport accessibility to the CBD from new and improved stations. The Project would support CBD population and employment growth by providing more effective and efficient transport services at reduced user costs compared with not investing in the Project.

1.6.1 Passenger rail network performance

Increase in services

The development of Cross River Rail allows for a fundamental transformation in rail capacity to and through the CBD. The new Cross River Rail tunnels would allow up to an additional 48 trains per hour (two-way) through the CBD, creating a combined total through-put of 132 trains per hour. This equates to a 57% increase in train numbers compared to the current infrastructure's maximum capacity of 84 trains per hour through the CBD. With such a step change in capacity, the Project would free up surface rail paths at existing bottlenecks such as the Park Road junction and Merivale Bridge, enabling additional passenger or freight services to be provided.

In 2021, an additional 13 peak hour trains from the Gold Coast, Beenleigh and Cleveland corridors compared to the without Project case would be accommodated creating a total of 36 trains per hour from the south-east. This is equivalent to an additional 57% in rail passenger capacity (number of six-car trains per hour) compared to the 23 trains in the 2021 without Project scenario.

By 2031, with the Project and the North West Transport Corridor in operation, together with a series of branch lines and extensions, more services would be added to the Brisbane rail network, especially from key regional centres such as Strathpine, Caloundra, Redcliffe from the north and Ripley, Flagstone Creek and Elanora from the south. The 2031 strategy with the Project would also allow for the introduction of nine-car trains on inter-city/outer suburban sectors and high capacity suburban multiple unit trains (HCSMUs) on suburban sectors increasing passenger throughput.

With the Project in operation in 2031, an additional 28 trains would be added to the Brisbane rail network during the morning peak compared to the situation without the Project. This represents a 33% increase in rail capacity (even higher when taking into account the use of new rollingstock) compared to the scenario without the Project.

Increase in rail patronage

Table 1-3 presents the average weekday travel and total person trip growth With and Without the Cross River Rail Project from 2009 to 2031. The total number of daily motorised trips forecast in the with Project case and the without Project case is similar. The public transport mode share is forecast to be higher With the project than Without the Project in both 2021 and 2031. By 2031, with the Project, 12.1% of trips are expected to be using public transport on an average weekday whereas without the project this is expected to be around 11.6%.

Total rail patronage is forecast to be higher with the Project compared to without that is around 8% higher in 2021 and over 12% higher in 2031. By 2031, the total number of weekday rail trips would be over double current levels.

Table 1-2 Average weekday trip changes with and without project in the Brisbane metropolitan area

24 Hour	2009	2021			2031		
		No CRR	With CRR	% change	No CRR	With CRR	% change
Total person trips by car	5,533,200	7,009,800	6,988,400	-0.31%	7,771,700	7,736,500	-0.45%
Public transport trips	546,00	824,200	841,800	2.13%	1,074,000	1,120,800	4.36%
Public Transport Mode share	8.15%	9.95%	10.16%		11.60%	12.10%	
Total rail patronage (24 hour)	243,200	421,900	454,200	7.66%	529,500	595,400	12.45%
Number of rail trips to CBD (am peak period)	37,100	61,600	72,800	18.24%	73,700	95,100	29.04%
Total vehicle trips	4,383,200	5,652,100	5,635,500.	-0.29%	6,460,200	6,431,500	-0.44%

Source: Cross River Rail Project Model

The forecast increase in rail trips to the CBD during the morning peak period due to the Project is even greater, 18% in 2021 rising to 29% by 2031. Cross River Rail allows rail passenger volumes to the CBD in the morning peak period to more than double between 2009 and 2031 and allow rail to fulfil a larger role in CBD-based travel. The busiest of section of Cross River Rail would be between Gabba and Albert Street Stations. In 2021 it is forecast that this section of the Project would carry almost 91,000 passengers per day and increasing to just over 124,000 passengers in 2031.

Key effects of the increase in rail patronage and rail travel behaviour in the morning peak would be:

- reduction, in the order of 50% in 2031, in the number of passengers using the existing surface rail network between Park Road and Roma Street

- in the 2031 (morning peak period) it is forecast that almost 23,000 passengers would travel by rail between Roma Street and Alderley via the North West Transport Corridor (NWTC). This has a significant effect in reducing the number of passengers using Cross River Rail between Roma Street and Ekka Stations
- boarding and alighting passengers at inner city and CBD stations would almost double at most stations by 2031. Daily usage of stations would also increase at a greater rate due to an increase in the number of off-peak rail trips made.
- significant growth in patronage to the CBD compared to the without Project scenario. With the Project, there are forecast to be 95,000 rail trips to the CBD during the 2031 morning peak period compared with 74,000 without the Project.
- an even distribution of passengers alighting rail services in the CBD between Roma Street, Central Station and Albert Street in 2031 providing relief to Central Station.
- a high number of rail to rail transfers at Roma Street Station occur between the Cross River Rail and surface platforms in both 2021 and 2031.
- South Brisbane and South Bank Stations are forecast to have less passenger activity with the Project operational compared to without. This is as passengers would transfer to Cross River Rail.

Increase in public transport mode share

Across the Brisbane Metropolitan Area, total rail patronage in 2031 is 65,000 more daily trips than without project, while total vehicle trips is around 30,000 less trips.

Figure 1-3 shows the changes to overall CBD travel demand in the morning peak with and without Cross River Rail for public transport modes. This shows rail capturing a larger share of trips to the CBD both with and without the Project and with bus and car reducing in significance as a mode of access to the CBD in the morning peak. By 2031, with Cross River Rail in operation, 59% of all trips to the CBD are forecast to be by rail.

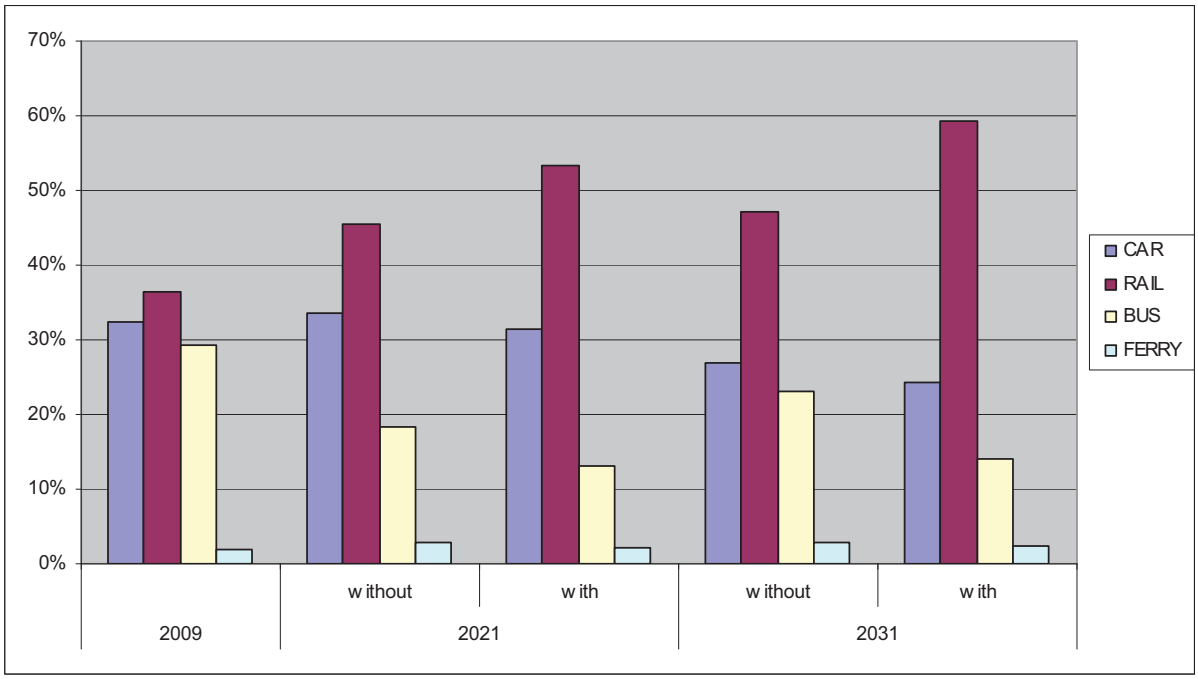


Figure 1-3 Forecast change in morning peak travel to the Brisbane Central Business District

Source: Cross River Rail Project Model

Analysis of cross river trips in the AM peak also, reveals a strong trend towards more rail trips and less bus and car trips. This shows that for all cross-river trips in the CBD (from the Go Between Bridge to the Story Bridge) rail will capture almost as many trips as car in 2031 (this includes major bypass roads not serving the CBD) with the Project. Without the project, however, rail captures less than half the number of trips as road.

Improvement in reliability

By 2021, Cross River Rail would bring punctuality improvements for Cleveland, Kuraby, Beenleigh and Gold Coast services travelling into the Brisbane CBD during the morning peak period. A 12% to 34% improvement of on time reliability is estimated. This improvement would occur because Cleveland and Kuraby services no longer would interact with Beenleigh and Gold Coast services on the suburban lines once Cross River Rail is operational.

In 2031, the Project would bring significant reliability benefits (39% to 57% improvement) for northern services (Caboolture, Redcliffe, Nambour and Kawana). This is because the additional services made possible with the Project reduces overcrowding and allows shorter dwell times at stations, especially in the inner city. In particular, a major improvement in reliability on the Caboolutre line is predicted, increasing from 39% to 96% of services 'on time' (within four minutes). In 2031 reliability improvements are also forecast for the Hillcrest, Gold Coast, Ferny Grove and Strathpine services during the morning peak period.

Improvement in travel time

A direct connection between the Sunshine Coast/Caboolture lines and the Gold Coast/Beenleigh lines would be provided by the Project, providing an up to ten-minute journey time reduction to Roma Street from the south. Up to five minutes of journey time reduction to Roma Street from the north in 2021 would also be realised due to efficiencies with sectorisation and new express running patterns for some services.

With Cross River Rail, a trip by train from Woolloongabba to the CBD would take only two minutes, from Ekka to Roma Street Stations would only take about two minutes and from Yeerongpilly to the CBD it would take about ten minutes; half the time it takes now.

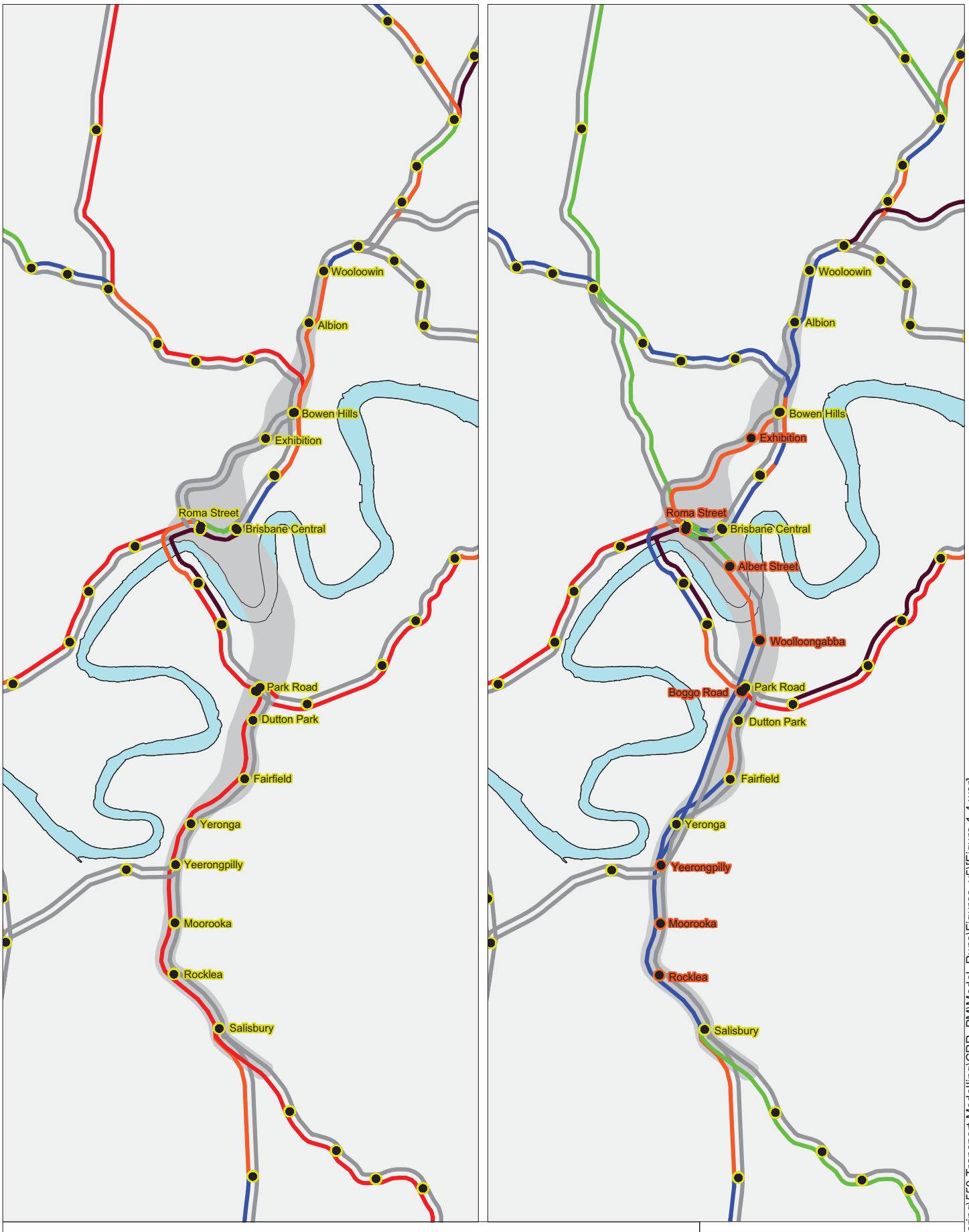
Under the 2031 With Project case, passenger travel times to the city would further improve for the North Coast line, with faster express running services utilising the more direct connection with the NWTC providing an up to 15 minute journey time reduction to Central Station from Nambour and Caloundra. As per 2021, journey times from the Gold Coast/Beenleigh would be up to 10 minutes quicker using the Cross River Rail tunnel approach to the CBD from the south.

Reduction in crowding

The introduction of Cross River Rail is forecast to reduce passenger crowding on numerous lines during peak periods providing significantly improved capacity to manage future growth in public transport demand.

In 2021, without the Project there would be significant crowding during the morning peak period on all rail approaches to the CBD. With the introduction of the Project in 2021, crowding would decrease significantly on the Beenleigh and Gold Coast, Ipswich and Cleveland lines as well as crowding relief on the northern lines between Northgate and Albion.

By 2031 without the Project, the degree and extent of over-crowding on all approaches to the CBD would worsen. With the introduction of the Project, significant crowing relief to a large portion of the network is forecast, including the Beenleigh and Gold Coast lines, the Ferny Grove line, the North Coast line through Wooloowin and Albion, the Cleveland line and on the Merivale Bridge. This is illustrated in **Figure 1-4**. Significant overloading at Park Road and Bowen Hills during the morning peak will be eliminated as the Project allows for much of this demand to be carried in the separate north-south corridor (that is the Cross River Rail tunnel and by 2031, the NWTC).



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.50
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

CRR railway stations

Model ID: CPM_2031_104 (without) CPM_2031_078 (with)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 1-4

2031 morning peak period rail load factors with and without Cross River Rail

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CRR JOINT VENTURE

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Furthermore, forecast reduction in overall passenger movements at Central Station in the morning peak with the Project would provide crowding relief within the station and the surrounding pedestrian precinct. In 2021, passenger numbers would be 35% lower and by 2031 16% lower in the AM peak. This is because Cross River Rail train services use Roma Street and Albert Street in the CBD, and not Central Station.

Improved transport accessibility in the CBD

Cross River Rail would provide significant accessibility improvements to the CBD south precinct and means that no part of the CBD would be more than a 15 minute walk from a train station with the vast majority of the CBD within a 10 minute walk of a rail station.

The new Cross River Rail station at Albert Street would provide direct rail accessibility improvements in the area immediately south of the current 'core' Central Station and Roma Street Station catchments to over 72,000 people by 2031, including 3,600 residents, 55,300 jobs and 13,500 students.

In summary, a Cross River Rail Station at Albert Street would provide a significant increase in core walk-up catchment population (employment) within the CBD, in the order of 65%. Queensland University of Technology (QUT) would also be provided with a CBD station within a comfortable walk distance of around 400 m to 500 m.

1.6.2 Freight rail improvements

The Project provides for a dedicated dual gauge freight track from Salisbury to Park Road, by providing additional passenger tracks through this corridor and removing passenger services from this line. This would provide the missing section of a dedicated freight route through the southern Brisbane rail network, from Acacia Ridge to the Port of Brisbane. This freight line would provide significant advantages for freight rail operations, including removing peak period curfews and allowing all projected 2031 freight demand to be accommodated on rail.

Table 1-4 provides a comparison of freight operability outcomes between without and with the Project. This shows the increased freight capability with the Project north of Tennyson, where by 2031, the available weekly train paths would increase from 201 to 326 freight trains.

Table 1-3 Forecast freight trains to meet demand not impacted by constraints outside the CRR scope

	Trains per week to match demand (both directions) – within CRR scope only					
	2021			2031		
	Demand	Without CRR	With CRR	Demand	Without CRR	With CRR
North Coast	264	264	264	322	16	322
Salisbury - Tennyson	172	24	172	209	24	209
Tennyson - Port (IM)	78	3	78	94	3	94
Tennyson - Port (Coal)	197	197	197	232	198	232
Tennyson to Port TOTAL	275	201	275	326	201	326

Source: SAHA, September 2010

Note: Demand paths assume current length consists

1.6.3 Bus and ferry

Bus services

Changes in overall modelled bus patronage and performance across the Brisbane metropolitan area are small with decreases of around 3% in overall bus passenger kilometres travelled with the Project in both 2021 and 2031. A marginal decrease in bus patronage is forecast in 2021, although by 2031 this reverts to marginal increase (1.7%) in overall bus patronage (1.4%) compared to the scenario without the Project.

By 2031 with the Project, forecast trip lengths by bus are shorter (-3.4%), and bus trip times are less (-6.7%). The change to shorter bus journeys is likely to be the result of greater levels of bus-rail interchange while increased use of the high frequency priority (HFP) bus network will continue to sustain bus patronage across the whole network, particularly in corridors without rail.

Changes in bus crowding have been assessed through changes in bus load factors. Bus load factors are a proportion of total bus passengers divided by total seated bus capacity. The forecast 2031 morning peak with/without Project bus load factors are illustrated in **Figure 1-5**. This clearly shows a significant benefit of the Project being the reduction in crowding on several bus routes including Ipswich Road, the South East Busway (including the Victoria Bridge and Captain Cook Bridge approaches to the CBD), Northern Busway/Gympie Road, and Kelvin Grove Road.

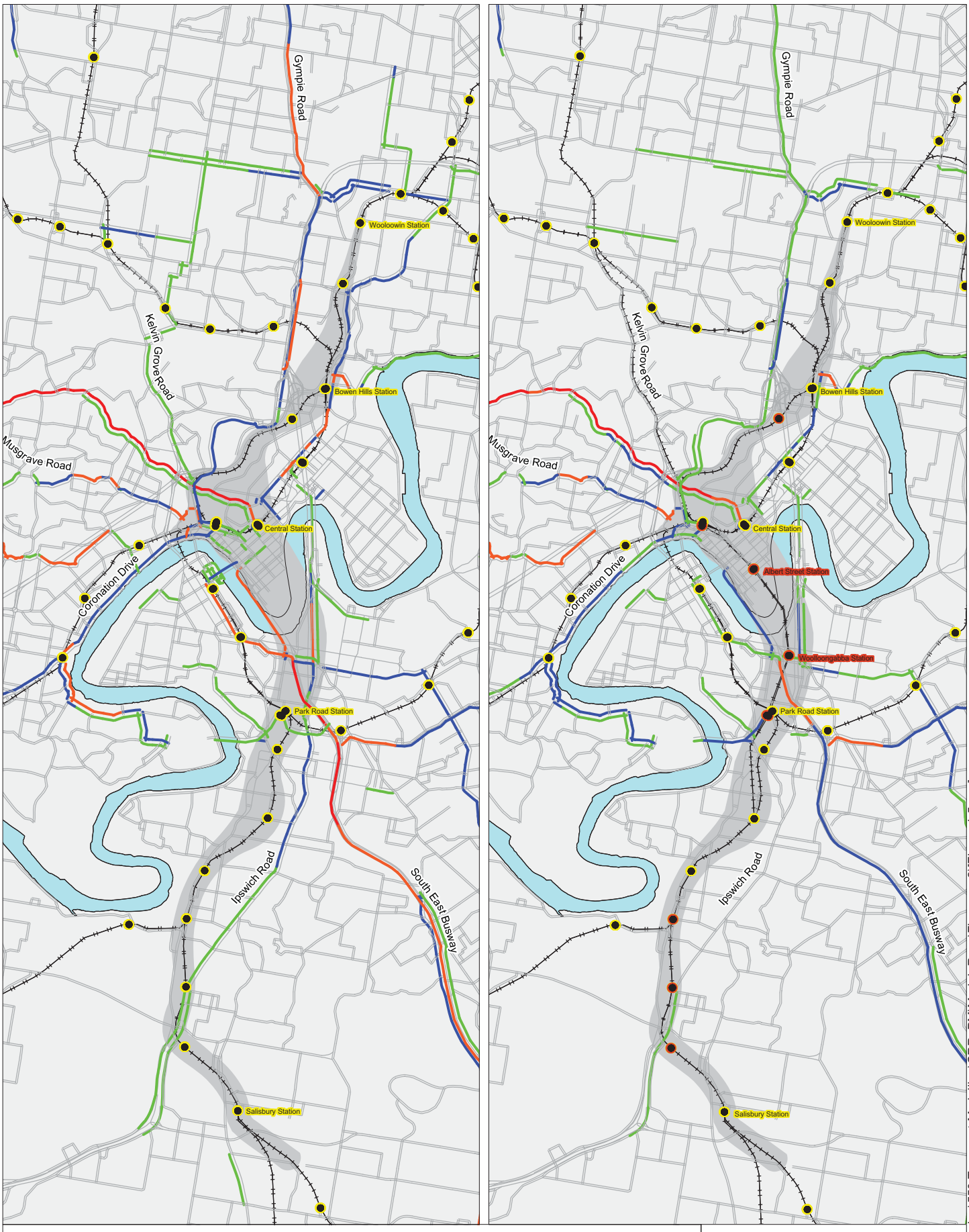
Ferry services

Overall changes in passenger ferry usage and performance in 2021 and 2031 with and without Cross River Rail would be very small with minor reductions in overall ferry patronage (around 3% less in 2021 and approximately 4% less in 2031). Such small changes indicate that ferry and rail trips are largely unconnected with little or no transfer between modes.

1.6.4 Road traffic impacts

There are forecast to be minor reductions in road network volumes and marginal improvements in performance with the Project in operation, compared to without the Project. In general there is forecast to be less than 1% difference in overall vehicle trips on the Greater Brisbane road network with Cross River Rail operational compared to without Cross River Rail in both 2021 and 2031 although by 2031 this would equate to around 30,000 less trips on the road network each weekday. The analysis shows a reduction in road traffic volumes of up to 3% within the north and south corridors to the CBD during the morning peak period in 2031.

Overall road network performance in 2021 and 2031 with the Project is expected to be marginally better than without the Project in the same year with notable cumulative benefits. By 2031, the reduction in private vehicle use associated with the Project is forecast to reach 275 million vehicle kilometres per annum which has been estimated to equate to 30,000 litres less fuel and 3,000 tonnes less carbon dioxide per annum



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.25
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway lines

Railway stations

CRR railway stations

Model ID: CPM_2031_104 (without) CPM_2031_078 (with)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 1-5

2031 morning peak period bus load factors with and without Cross River Rail

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1.7 Construction rail and traffic impacts

A construction traffic impact assessment has been prepared to address Section 3.1.6 of the Cross River Rail Terms of Reference. Construction traffic impacts are expected to arise in particular in relation to spoil haulage and materials delivery, both at the worksite and on routes leading to or from the worksites.

1.7.1 Rail services – assessment of construction effects

The construction of Cross River Rail would include both major surface and underground works. Much of the surface rail works would interface with the existing rail network, which would result in extensive sections of rail construction to be carried out whilst both passenger and freight rail services operate.

Underground works would have minimal impact on current operations. Of the Cross River Rail stations within the tunnel section of the Project only Roma Street has construction activities that would have an impact on the current rail network.

Surface rail works

The extent of surface works south of the Cross River Rail portal at Yeerongpilly and north of the portal at Victoria Park would be significant. Generally all passenger and freight rail services would continue to operate except when the Project takes possession of the tracks through targeted night time (outside of passenger rail operations), weekend and other longer period rail shut downs.

Exhibition Station and the Exhibition loop

Passenger rail services do not currently serve Exhibition Station except during the “Ekka”, held over 10 days each August, and the Camping and Caravan Show. Construction works are likely to result in Exhibition Station being closed for at least one Ekka. Construction work could be temporarily stopped at Exhibition Station when the Ekka is held.

Freight and other passenger rail operational movements could continue on the Exhibition loop during the construction period except during shut down periods. Diesel freight trains would be able to continue to operate when shut downs are limited to the removal of electrical power from the overhead electrical lines.

Roma Street Station

The construction of the major connection between the existing Roma Street Station subway and the new underground station would require acquisition of all of the staff carpark at the city end of the railway heritage building that occupies Platform 3. These connection works would also require the existing passenger toilets in the subway be relocated.

The major vertical shaft and works at the northern end of the station would require the demolition of the existing baggage handling facility and the rubbish disposal area on Platform 10. Works at Roma Street Station may also need the temporary diversion of trains to other platforms.

Rail maintenance

Cross River Rail construction works would not impact on the existing railway stabling and maintenance regime as all rail facilities and staff access points to maintenance facilities would generally be maintained throughout the construction period.

Emergency service and maintenance access to the rail corridor

Surface works would be carried out such that all existing emergency service and maintenance access points to the rail corridor would remain operational.

1.7.2 Spoil haulage impacts

The majority of Project construction work would occur off road, and the main traffic impact would be related to the haulage of spoil from tunnel portal and station worksites. Haulage routes have been determined which attempt to minimise the impact of truck operations from the proposed works. The impact of construction traffic, including spoil haulage and deliveries of plant and equipment, has been assessed in relation to peak hour traffic volumes in a traffic forecast year of 2016 (a typical construction year). Critical intersections on the haul road routes have been assessed using SIDRA modelling to determine the change which would result from the proposed construction traffic. The assessment showed that peak hour haulage operations would have minimal impact on base case peak traffic operation.

Spoil haulage would have to be managed appropriately to minimise any adverse impacts on the road network and the community. The haulage operations would need to be detailed in the contractors Construction Traffic Management Plan (CTMP), and would need to be based on detailed analysis that looks at any potential impact that the operations may have on the road users and the community.

The main issues for transporting materials from the sites would include:

- minimising truck traffic in local streets, by providing direct access to major roads, such as Ipswich Road, and specifying haulage routes on the major road network
- minimising the effect on residential communities, by using routes through residential areas only where there is no practical alternative and preferably not operating after hours on these routes
- minimising congestion effects
- minimising the effect on businesses and conflicts with pedestrians, by avoiding busy commercial areas if a suitable alternative exists
- avoiding conflicts with major events and peak holiday traffic.

With these mitigations in mind it is recommended that the suggested haul routes be re-visited following further discussion with Brisbane City Council (BCC) and the Department of Transport and Main Roads (TMR).

1.7.3 Impacts on road pavements

The impact of construction traffic in relation to existing Equivalent Standard Axles (ESA) has been assessed as a measure of contribution towards road pavement life span reduction. The assessment found that the contribution of Project traffic loadings would be less than a 5% increase to the existing for each of the specific network links examined, with the exception of three links, which would range between 11 to 15%. Given the relatively short duration of construction in the context of pavement design lifespan, this level of impact seems reasonable.

1.7.4 Impacts at worksites

Each worksite has been assessed to determine the potential impact of construction on pedestrians and cyclists, buses, parking, adjacent development and access, emergency services, special events and impact on general traffic operation. Specific mitigation measures have been proposed for each worksite where the impacts are considered to be significant. Overall, the impacts of construction are considered to be manageable, with a minimum of change to existing traffic conditions.

The worksite specific traffic impacts have been summarised into the table below.

Table 1-4 Worksite specific traffic impacts

Location	Impacts	Remedial measures
Mayne Rail Yard	Use of Abbotsford Road bus bay for construction vehicle access to Queensland Rail property gate Adjustment to internal Queensland Rail staff parking and provision of an additional 50 spaces for the Project workforce parking Adjustment to existing Queensland Rail truck turning and material set down areas Adjustment to existing level crossings within Mayne Yard Adjustment to emergency service access to Queensland Rail buildings and building evacuation routes Change to Queensland Rail staff pedestrian access routes between car parking and buildings Small increase in heavy vehicle volumes on site access and egress routes	Consultation with Queensland Rail on all proposed internal access modifications Close liaison with emergency service providers regarding changes to access
O'Connell Terrace	Staged construction activity within the O'Connell Terrace worksite (including short term closures to enable traffic switches to occur) as well as closure of Sneyd Street and detours via Wren Street. Potential pedestrian detours due to reconstruction of the rail overbridge. Suspension of eastbound cycle lane during construction. Detours for Queensland Rail Mayne Yard vehicles via Tufton Street and a temporary bridge to facilitate access to Lanham Street. Removal of some off-street car parking spaces in RNA showgrounds. Potential reconfiguration of RNA showgrounds car park. Potential suspension of existing on-street car parking in O'Connell Terrace east of Tufton Street. Potential closure of direct driveway access to RNA showgrounds east of rail overbridge where driveways occur within worksite area	Diversions (to enable traffic switches to occur) to be timed to occur at periods of low traffic. Communications Plan to be developed to advise motorists of delays and to avoid the area, as well as pedestrian detours. Detailed Construction Traffic Management plan to be developed; Considerate design to avoid cycle safety issues. Reconfiguration of existing RNA Showground parking to accommodate adjustment in parking provision. Special Events to be considered during development of the Construction Traffic Management Plan.
Northern Portal (Gregory Terrace)	Removal of four on street parking spaces adjacent to worksite driveway Construction traffic turn right directly off Gregory Terrace into worksite driveway Suspension of parking in worksite access driveway adjacent to Substation Closure of existing shared cycle pedestrian path on and off road at worksite Minor increase in traffic including volume of heavy vehicles in Gregory Terrace, between worksite and Bowen Bridge Road.	Provision of 'Keep Clear' markings for northbound Gregory Terrace at worksite driveway entrance Provision of alternative shared cycle pedestrian footpath past worksite

Location	Impacts	Remedial measures
Roma Street	Removal station masters carpark between platform 7 and 8 Closure of pedestrian access between Parkland Boulevard and Parkland Crescent Removal of existing roundabout in Parkland Boulevard Removal of some carparking spaces in College Crescent carpark and adjacent to Platform 10 due to kerb space modification Station evacuation plans likely to require adjustment Changes to the way westbound vehicles access the long distance platform from Parkland Boulevard Minor increase in heavy vehicle flows on the adjacent arterial and local road network; Potential for minor delays in Parkland Boulevard/Parkland Crescent.	Provide pedestrian detour through Roma Street Station Provide vehicle detour on Parkland Boulevard/Parkland Crescent
Albert Street	Removal of three on street parking spaces in Margaret Street, and four spaces in Mary Street. Adjustment to existing taxi stand in Alice Street, east of Albert Street Closure of footpaths in Albert and Mary Streets Removal of existing street furniture including bike racks and seats in Albert Street Staged construction across Alice Street resulting in closure of one or two lanes	Pedestrian detours implemented Taxi stand relocated if required Advanced signage and communications strategy Alternative bus routing (to avoid Alice Street east)
Woolloongabba	Minor Changes to access off slip lane off Vulture Street off ramp to facilitate a gated construction worksite entrance. Staged traffic management in the Woolloongabba spur of the South East Busway, including relocation of bus layover area potentially resulting in minor increase to running time for buses. New driveway access point from Ipswich Road northbound into worksite. Possible closure of existing pedestrian path on the southern side of Vulture Street off-ramp including connection with Leopard Street.	Communication strategy do be developed; and Detailed Construction Traffic Management Plan including details of staged traffic management in Vulture Street and South East Busway to be developed.
Boggo Road	Removal of on street parking in Peter Doherty Street and Boggo Road; Closure of footpaths between the Gaol and Ecoscience building, as well as both sides of Peter Doherty Street; Temporary diversion of pedestrian access between Boggo Road and the Busway; Staged construction traffic in Boggo Road; Closure of through access in Peter Doherty Street with detours via Boggo Road; Creation of a new right turn bay and phase at the intersection of Annerley Road and Peter Doherty Street; and Increase in heavy vehicle traffic in the Boggo Urban Village Precinct and minor increase in congestion at the Boggo Road/Annerley Road intersection.	Pedestrians detoured via Boggo Road to reach Annerley Road Pick up/set down and loading areas in Boggo Road relocated to the southern side of the Ecoscience building

Location	Impacts	Remedial measures
Worksite for the ventilation and emergency access building	Provision of new slip lane right turn/intersection adjustments at Fairfield Road one way northbound into Brougham Street. Removal on informal street and median parking in Brougham Street between Fairfield Road north and southbound (to facilitate truck U turn). Minor increase in heavy vehicle flows on Fairfield Road and Brougham Street. Closure of footpath on eastern side of Fairfield Road with diversion via side streets. Relocation of existing indented bus stop for southbound Fairfield Road north of Vernon Street. Change in access arrangements for five residences in Sunbeam Street and Railway Road, south of Sunbeam Street with vehicles detoured via Cross Street.	Pedestrian detours to be signposted including advance warning Existing southbound bus stop to be relocated approximately 150m to the north of Bledisloe Street.
Southern Portal	Closure of through access from Fairfield Road to Lucy Street, for non-construction vehicles Potential increase in volume of vehicles using School Road to travel between Ipswich Road and Fairfield Road Short term pedestrian and vehicle detours during the reconstruction of Wilkie Street	Communication Plan to be developed Local detours and diversions to be signposted
Clapham Rail Yards	Creation of a new driveway crossing and left in left out junction on Ipswich Road, south of Hamilton Road. Closure of Moorooka Station. Adjustment to kerbspace arrangements adjacent to Moorooka Station to pick up and set down passengers. Minor increase in the volume of heavy vehicles on Ipswich and Fairfield Roads.	Shuttle bus service to transport Moorooka Station passengers to adjacent stations..
Salisbury	Consolidate existing driveways from Lillian Avenue into a single entry point. Possible minor increase in the volume of heavy vehicles on Lillian Avenue and its intersection with Beaudesert Road.	Signalisation of Lillian Avenue and Beaudesert Road

1.7.5 Construction workforce parking

The identified construction workforce is expected to generate a peak parking demand of approximately 1,050 vehicles based on a conservative assumption that each member of the workforce would drive to the construction site. A total of 858 parking spaces are to be provided across the construction worksites catering for the majority of the peak workforce at a rate of one space per 1.2 workers. The majority of workforce car parking would be provided at the relevant construction sites with the exception of CBD worksites at which parking options would be restricted to public off-street car parks close to the construction sites. Some members of the workforce could be transported by shuttle bus from Yeerongpilly (where additional parking is proposed) to the worksites at Fairfield, Boggo Road and Woolloongabba, where parking is less than maximum workforce numbers due to site constraints.

In addition to provision for the workforce each construction site car park would also provide a small number of parking space for visitors and deliveries.

The proposed worksite parking arrangements including off street car parks along with existing (or proposed) on street parking controls and alternative transport (ie shuttle bus) are expected to be sufficient to avoid parking on the local streets. The contractor would be responsible for the management of car parking as specified within their Construction Traffic Management Plan. On street car parking conditions should be monitored on the streets surrounding all construction sites. If necessary, and following consultation with the community and BCC, enforcement could be achieved by extending or implementing local area traffic plans. This would be particularly relevant to the Yeerongpilly where it would be of particular benefit in the operational phase of the Project in any case.

Workforce parking and associated management for surrounding residential or commercial areas, addressing issues such as safety, access and amenity, will be fully addressed in the CTMPs prepared by the construction contractor.

1.7.6 Mitigation measures

Mitigation measures for construction works within the rail corridor

Construction works in the rail corridor would need to be staged into manageable, safe and reliable increments acceptable to Queensland Rail and so Queensland Rail must be part of the process to plan and agree the many operational interfaces between the new and existing rail infrastructure during the planning, demolition and construction phases. Much of the surface rail works would be carried out through rail shutdowns and track possessions conforming to Queensland Rail policy.

Specific rail passenger and operational mitigations measures would include:

- Rail network shutdowns are to be agreed with Queensland Rail through the Scheduled Closure Access System, prior to the commencement of works within the rail corridor, to minimise disruption to the rail network.
- Early and on-going notification is to be provided to Queensland Rail, rail passengers, rail freight operators and local communities of the timing and duration of rail shutdowns, likely disruptions to rail services and alternative arrangements to be implemented.
- Bus replacement services are to be provided where passenger rail operations are interrupted, such as during rail network shutdown periods or temporary closures of Exhibition, Yeerongpilly, Moorooka, Rocklea and Salisbury stations.
- Disruption to rail passenger services is to be avoided to the extent reasonable and practicable during major events, such as the Ekka (Exhibition Station), the Brisbane International tennis tournament (Yeerongpilly Station) and at Suncorp Stadium (Roma Street Station). Where disruptions are unavoidable, bus shuttle services are provided between appropriate stations to the major event venues, or to bypass the disrupted section in the network.
- Pedestrian access for Queensland Rail staff between Mayne Rail Yard and Bowen Hills Station is to be maintained.
- Road access to and within Mayne Rail Yard is maintained during construction works.
- To the extent reasonable and practicable, existing access to the rail corridor for maintenance and emergency service vehicles is to be maintained. Where necessary, alternative access arrangements are to be provided in consultation with Queensland Rail and other rail operators.
- Provision of temporary alternative passenger facilities including toilets at Roma Street and baggage handling facility at Roma Street where disrupted duration construction works.

Mitigation measures for construction works on the road network

Each construction worksite would have a Construction Traffic Management Plan prepared to implement measures that avoid where practicable, or minimise and mitigate, traffic problems arising during the construction phase. Prior to implementation of the Construction Traffic Management Plans they would be subject to a review by the relevant agencies (Brisbane City Council and TMR) followed by any necessary amendment by the contractor with final approval given by BCC, TMR and the police.

Road and traffic related mitigation measures that should be addressed in these plans include:

- Local communities and road users are to be notified of proposed changes to local traffic access arising from Project works. This includes, but is not limited to, the provision of clear signage identifying changed traffic conditions, and public advertisements (local and regional newspapers, Project website) describing the proposed changes, the duration of the changes, and possible alternative routes to avoid the impacts of the proposed changes.
- Project works in or near road corridors are to be screened with solid barriers to minimise distractions for motorists.
- Access to properties adjoining or near to Project works, is maintained. Where changes to property access are required, alternative access arrangements are to be identified in consultation with property owners and occupants.
- Access for delivery vehicles to local businesses near Project works is to be maintained. Where changes to access for delivery vehicles are required, alternative access arrangements are to be identified in consultation with local businesses. In particular, access for delivery vehicles is to be maintained to businesses
  - at O'Connell Terrace, Bowen Hills
  - at Roma Street, Albert Street, Alice Street and Mary Street in the Brisbane CBD
  - at Allen Street, Stanley Street and Vulture Street at Woolloongabba
  - at Boggo Road Urban Village off Annerley Road, Dutton Park
  - in the industrial area between Ipswich Road and Moolabin Creek at Moorooka
  - in the area between Fairfield Road and Clapham Rail Yard, Yeerongpilly.
- Two lanes of traffic are to be retained in each direction on Fairfield Road during peak periods.
- Access for emergency services vehicles is to be maintained for the duration of construction works to
  - Royal Brisbane and Women's Hospital (RBWH) via O'Connell Terrace
  - Princess Alexandra Hospital (PAH), via Cornwall Street
  - Mater Hospital, via Stanley Street.

Public and active transport mitigation measures proposed include:

- Traffic management measures are to be implemented near to Project works to minimise disruption and delays to bus services.
- Safe and functional access for pedestrians and cyclists is to be maintained near Project works, including for the elderly, children and people with mobility difficulties including vision and hearing impairments. This measure is to consider relevant Crime Prevention through Environmental Design (CPTED) principles.

- Safe and functional pedestrian and cycle access is to be maintained to public transport facilities near Project works. This measure would address the needs of children, elderly and people with mobility difficulties including vision and hearing impairments. In particular, access is to be maintained to
  - Exhibition Station, during Ekka events
  - Bowen Hills Station, including along O'Connell Terrace from the RBWH
  - Roma Street Station from Roma Street and from the Roma Street Parkland
  - Botanic Gardens, QUT and the parliamentary precinct
  - CBD streets including Albert Street, Mary Street, Margaret Street and Alice Street
  - Woolloongabba busway station
  - Park Road Station and Boggo Road busway station, particularly to/from the Boggo Road urban village
  - Yeerongpilly Station
  - Moorooka, Rocklea and Salisbury Stations
- Bus replacement services are to be provided when passenger rail operations are interrupted, eg during rail network shutdown periods or temporary closures of Exhibition, Yeerongpilly, Moorooka, Rocklea and Salisbury Stations.
- Safe pedestrian and cycle access is to be maintained near construction works to community facilities, such as schools, child care facilities, churches, aged care accommodation, open space, sport and recreation, health care and shopping facilities. This is to consider the particular needs of children, elderly and people with mobility difficulties, including vision and hearing impairments. In particular, access is to be maintained to
  - RNA Showgrounds
  - RBWH
  - Open space areas, such as Victoria Park, Roma Street Parkland, Botanic Gardens and Robinson Park
  - Schools near to Project works, such as Brisbane Girls Grammar School, St Josephs College, Brisbane Grammar School, Dutton Park State School, Nyanda State High School
  - Grosvenor Hall Child Care centre
  - Churches such as St Fabians Church at Yeerongpilly
- In areas of high pedestrian and cycle activity such as Roma Street and Albert Street work sites, articulated or dog trailer vehicles could present a hazard to road users, due to the swept paths and vehicles tracking across kerbs at intersections, as well as road users failing to observe the trailer component of the vehicle when crossing the road. CTMPs for these location should limit use of dog trailers.
- The design of driveways for Cross River Rail would take into consideration the potential for truck/pedestrian conflicts and the design of road narrowing would take into consideration cycle safety.
- Where pedestrian and cycle access to community facilities is changed, local access strategies are to be developed in consultation with local communities, community facility managers and relevant stakeholder groups, including Vision Australia.

- Safe, alternative access is to be provided for bikeways disturbed by construction works, including but not limited to
  - the bikeway in Victoria Park
  - the bikeway through Roma Street Parkland
  - off-road bikeway in Robinson Park at Fairfield
- Local communities, including but not limited to, residents, businesses, users of community facilities and public transport passengers, are to be notified about changes to pedestrian and cycle access near construction works, and public advertisements (local and regional newspapers, Project website) describing the proposed changes, the duration of the changes and possible alternative routes to avoid the impacts of the proposed changes.

2 Introduction

2.1 The Project and its transport objectives

Cross River Rail will provide a new underground river crossing to relieve the capacity constrained rail approaches to the Brisbane CBD. Cross River Rail will also provide new underground station capacity in the CBD (Roma Street and Albert Street), provide a new station at Woolloongabba and provide major station upgrades at Exhibition, Boggo Road and Yeerongpilly so providing rail access to new destinations and significantly improving services at existing stations. Cross River Rail is expected to deliver major improvements to rail services across the region, enhancing inner city access and helping to promote a more sustainable South East Queensland.

The key project objectives are:

- increased cross river rail capacity and increased service provision to the CBD (efficiency)
- passenger rail: improved CBD public transport accessibility (sustainability)
- freight rail: improved access to the rail network for freight (economy)
- enabling city growth (city building).

2.1.1 The Project

Project design

Whilst a detailed description of the Project is contained in Chapter 4 of the EIS (Project Description), key features from a transport perspective are presented in this section.

Cross River Rail provides a new north-south passenger rail line in Brisbane's inner city, extending from Bowen Hills in the north to Salisbury in the south via the Brisbane CBD.

The project comprises two parallel tunnels, each approximately 9.8 km in length extending from the Exhibition Loop at Victoria Park in Spring Hill to Yeerongpilly, via the Brisbane CBD, Woolloongabba and Dutton Park. The project includes new underground rail stations at lower Albert Street, Woolloongabba and Boggo Road and new underground platforms at Roma Street. New surface stations would also be provided at Exhibition Station and Yeerongpilly, with access improvements at Moorooka, Rocklea and Salisbury.

North of the portal at Spring Hill, the Project includes two additional tracks between Spring Hill and north of Mayne Rail Yards with the tracks on elevated structure within Mayne Rail Yard itself. South of the portal at Yeerongpilly, the Project provides two additional surface tracks between Yeerongpilly and Rocklea and one additional surface track between Rocklea and Salisbury.

Underground stations would generally be located at depths ranging from 20 m to 31 m, and would incorporate 220 m long platforms. Each underground station would also have air conditioning, platform screen doors for passenger comfort and safety, communication and information systems and safety and security measures such as closed circuit television (CCTV) monitoring.

Project construction

Construction of Cross River Rail would be conducted simultaneously from a number of construction worksites. The main worksites for construction of the mainline tunnels would be located at Yeerongpilly, Woolloongabba and Victoria Park in Spring Hill. Worksites would also be required at each of the underground stations to allow construction of the station cavern and station access points, and at each surface station. The northern surface works would be constructed from a worksite at Mayne Rail Yard and the southern surface works from worksites at Clapham Rail Yard and Salisbury.

The construction period is expected to be about 5.5 years and is proposed to commence in early 2015.

Project operation

During operation, the Project would cater for express passenger rail services connecting to the existing north-south rail lines linking the Gold Coast and the Sunshine Coast to the CBD. Passengers would be able to interchange with existing surface rail services at Yeerongpilly station, Boggo Road station (Park Road Station) and Roma Street Station. Passengers would also be able to interchange with the existing busway network at Boggo Road Station (Eastern Busway), Woolloongabba Station (South East Busway – Woolloongabba spur) and Roma Street Station (Northern Busway).

2.2 EIS Terms of Reference and transport requirements

This technical report addresses the relevant transport matters raised in the Terms of Reference for an Environmental Impact Statement issued by the Co-ordinator General in accordance with the Queensland State Development and Public Works Organisation Act 1971. Section 3.1 of those Terms of Reference deals specifically with traffic and transport matters and is reproduced in Appendix C.

The scope of the Transport investigations contained in this report meets the EIS terms of reference.

2.3 Scope of the transport investigation

The Transport assessment includes:

- an analysis of existing (2009/10) transport conditions within the study corridor with a particular emphasis on public transport
- an analysis of likely future trends in growth of population, employment and travel (including mode split) without the Project
- an analysis of likely future travel trends with the Project and comparisons back to the without Project case
- an assessment of the passenger and pedestrian throughput at all stations in the study corridor including the proposed new stations
- transport planning input into Cross River Rail station precinct plans
- assessment of traffic impacts of the operational Project for the purposes of the EIS
- assessment of transport user benefits of the Project
- analysis of the cumulative effects of other projects that could be under construction or operational at a similar time to Cross River Rail
- investigation and assessment of the effects of construction on road traffic.

2.4 Key transport stakeholders

Key transport stakeholders likely to be affected by the project have been consulted in the process of developing and assessing the project. The key transport stakeholders include:

- Brisbane City Council
- Queensland Rail
- TransLink Transit Authority
- Department of Transport and Main Roads.

2.5 Broad approach and report structure

Following this introduction, **Section 3** describes the methodology used for this assessment including the transport forecasting methodology. The transport forecasting methodology is the basis of the travel demand analysis. It presents the modelling tools, as well as land use patterns which generate movement demand and then travel trends that have framed the basis of assumptions into the future. The assumed future year transport network and operations are also presented.

Section 4 outlines the existing conditions of the traffic and transport networks and services within and around the study corridor. (The study corridor was determined by the Coordinator-General and extends from Wooloowin in the north to Salisbury in the south – refer **Section 2.2.1**). For each mode of transport, an overall assessment is presented of regional issues which affect the operations of that mode within the study corridor. This is followed by a description of the whole study corridor where required, and then a sub-corridor analysis.

The sub-corridors include:

- North section – Wooloowin to Exhibition
- Central section – Roma Street to Park Road
- Southern section – Dutton Park to Salisbury.

Where there are specific transport networks or performance issues related to stations, these are addressed within their relevant sub-corridor section above.

The analysis generally follows a north to south alignment.

The future base transport conditions (no Project) are described in **Section 5**. The effects of operating the project are presented in **Section 6** along with commentary on the cumulative effects of other projects. **Section 7** presents the assessment of construction road traffic impacts.

This transport technical report is supported by a series of appendices:

- Appendix A: Technical terms
- Appendix B: Acronyms and abbreviations
- Appendix C: Transport section extracted from the Terms of reference for an environmental impact statement, Cross River Rail, August 2010
- Appendix D: Transport network and rail service assumptions (without Project case)
- Appendix E: Without Project case patronage forecasts
- Appendix F: With Project case patronage forecasts.

2.6 Use of data

In order to describe existing transport conditions, develop and validate the transport forecasting model and analyse local traffic effects, a range of observed traffic and transport data was collected. Data was used in various assessments covering all modes of travel within the transport network. These included rail load counts, public transport ticketing data, public transport timetables road traffic pedestrians and cyclists, as described in subsequent sections of the report. This wide range of data that has been used in the assessment includes:

- census data from the Australian Bureau of Statistics (ABS)
- Population and Information Forecasting Unit (PIFU) data
- National Institute of Economic and Industry Research (NIEIR) employment forecasts data

- Brisbane City Council's Brisbane Urban Growth (BUG) model
- TransLink Transit Authority data including timetables and route and stop information
- rail passenger survey sourced from Queensland Rail
- modelled transport demands using the SKM-Aurecon CRR JV Project Model (a strategic transport model based on the BSTM-MM. This model is termed the Cross River Rail Patronage Forecast Model (CPM).

2.7 Limitations and disclaimer

This document is written solely for the purpose stated in the Contract between the Department of Transport and Main Roads ("TMR") and the SKM-Aurecon CRR Joint Venture (the "JV"), and for the sole and exclusive benefit of TMR whose remedies are set out in the Contract. This document is meant to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context.

All patronage forecasts were prepared using the Cross River Rail Project Model which is based on the BSTM-MM and data as supplied by TMR. Traffic Modelling and Forecasting is not a precise science and are only an indication of what might happen in the future, and is expressly not a representation as to a future matter, and may not ultimately be achieved. They rely upon complex set of data and assumptions and numerous factors which can influence actual patronage, many being beyond the control or reasonable foresight of the forecaster. The JV has in preparing the forecasts, followed normal methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care. However, no warranty is given or should be implied as to the accuracy of the forecasts. Unless expressly stated otherwise, TMR Data supplied by TMR ("TMR Data"), upon which the JV's forecasts are based, have not been verified by the JV.

Whilst the JV has reasonably reviewed the TMR Data, the JV disclaims and will not assume responsibility for the accuracy or completeness of the TMR Data. If the information and data is subsequently determined to be incorrect, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in the report may change.

Any traffic forecast or other information contained this report is an opinion based on reasonable investigation as to a future event and is inherently subject to uncertainties. Inevitably, some assumptions used to develop our report will not be realised and unanticipated events and circumstances may occur. Therefore the JV cannot provide any form of assurance that the forecasts documented in the report will be achieved.

To the extent permitted by law, the JV disclaims any liability to TMR and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

2.8 Assessment carried out by others

Further to **Section 1.1**, some content within this report has been developed by others and has not been independently verified or audited by the JV. The JV acknowledges the contribution made by the following entities; their work is referenced within this report:

- **AECOM** for traffic engineering assessment of the reference design and for the assessment of impacts on the rail network during construction
- **Saha International Limited (SAHA)** for Cross River Rail freight demand review
- **Systemwide Pty Ltd** for rail operations assessment.

3 Study methodology

3.1 Technical approach

The purpose of this section is to provide a review of the technical approach used for transport modelling and planning tasks to be carried out for the Cross River Rail project. Key tasks were split into several streams and the methodologies and specifications are described in this section following the definition of areas of interest:

- patronage and revenue modelling forecasting, to inform the design, business case and Environmental Impact Statement (EIS).
- rail operations assessment including a separate assessment of the effects of the Project on freight movement by rail was undertaken
- rail passenger simulation and station movement profiling, to inform the design.
- station planning and access, to inform the design and the EIS.
- the effects of the construction of Cross River Rail on the transport network.

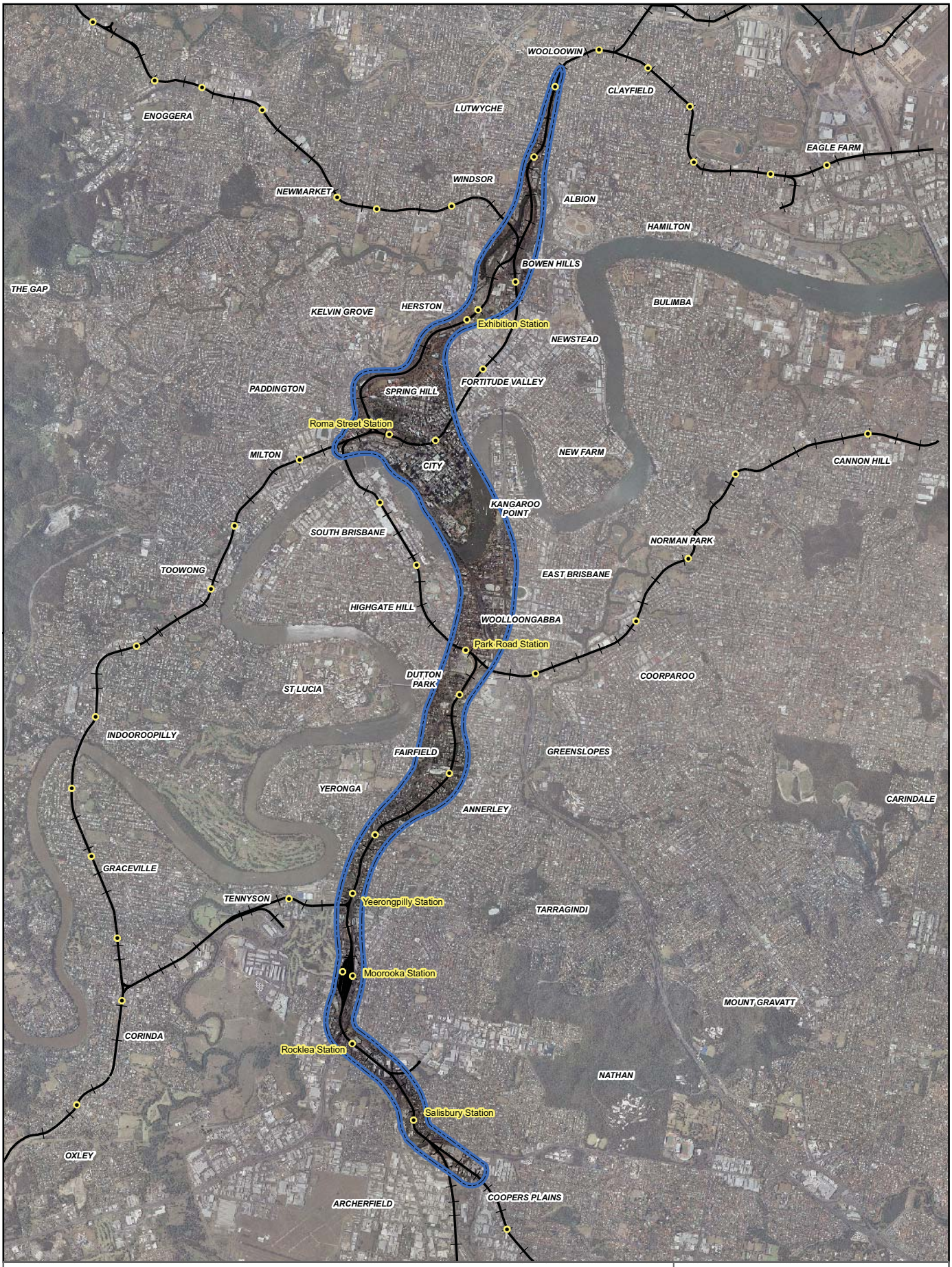
The overall method to assess the transport effects of the Project utilised a comparative analysis of effects with and without the Project.

3.2 Areas of interest

3.2.1 The study corridor

The traffic and transport assessment is focussed on the study corridor as determined by the Coordinator-General. The study corridor extends from Wooloowin in the north to Salisbury in the south and is shown in **Figure 3-1**. As necessary a sub-corridor analysis is carried out. The sub-corridors include:

- North section – Wooloowin to Exhibition
- Central section – Roma Street to Park Road
- Southern section – Dutton Park to Salisbury.



Study Corridor
Station
Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 3-1

Cross River Rail Study Corridor

0 1 2 3 4 km

1:75,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0119_CRR_Transport_Study_Corridor_TR_A4.mxd 06/07/2011 15:01

3.2.2 The Brisbane Central Business District (CBD)

For the purpose of this report the Brisbane Central Business District is defined as an area of extensive commercial, retail, finance and government activity located within an area that extends from Eagle Terrace (near William Jolly Bridge) to Kemp Place (near the Story Bridge) including all land to the south and east of Ann and Turbot Streets.

3.2.3 The Brisbane Metropolitan Area

The Brisbane Metropolitan Area is defined as Brisbane and the surrounding area extending to Caboolture in the north, Beenleigh in the south, Ipswich in the west and Redlands in the east. The Brisbane Metropolitan Area is also known as the Brisbane Statistical Division (BSD).

3.2.4 South East Queensland

The South East Queensland region covers 22,890 km^2, stretching 240 km from Noosa in the north to the Queensland-New South Wales border in the south, and 160 km west to Toowoomba (Department of Infrastructure and Planning, 2009). The South East Queensland region includes land covered by 11 city and regional local governments South East Queensland's population is heavily urbanised and is generally concentrated in Brisbane and Toowoomba and at the Gold and Sunshine Coast.

3.3 Transport modelling

A two stage approach was adopted for developing patronage forecasts for the Project. The benchmark forecasting tool provided robust preliminary patronage forecasts in order to provide early input to the engineering and design team for station sizing and other related tasks. Concurrently the CPM was developed. This section describes both forecasting tools and the key inputs to them:

- population and employment
- transport prices
- rail network and operations
- bus network
- road network.

3.3.1 Benchmark forecasting tool

This section reviews the approach applied to the benchmark forecasting tool and the relevant tasks of the development of this tool are outlined. Further details of the Benchmark Forecasting Tool can be found in the *Cross River Rail Benchmark Transport Model Report (*SKM-Aurecon CRR Joint Venture, March, 2010).

Underlying principles

The underlying principles of the development of the benchmark forecasting tools were:

- to make use of the existing models and studies namely
  - the BSTM-MM version 1.1
  - the Inner City Rail Capacity Study (ICRCS)
  - the draft Connecting SEQ 2031 Integrated Regional Transport Plan for South East Queensland (IRTP)
- to use the BSTM-MM V1.1 as the forecasting basis, but adjusting/applying its forecasts in order to make appropriate allowances for identified deficiencies

- Generally, to understand and, where possible, reconcile the following inputs and areas of the BSTM-MM model:
  - the base year(s) rail and bus travel demands
  - the future scenario characteristics in terms of
    - network scenarios (rail and bus) and in particular the Project strategy
    - land use and other input scenarios
  - the future year rail and bus travel demand forecasts.

For the benchmark forecasting tool the focus is on the with Project case and not the without Project case or any other scenario.

Additionally, the benchmark forecasting tool used the BSTM-MM to forecast rail station-to-station origin/destination matrices that were passed to the rail operation modellers and used incrementally to adjust the rail operation 2009 base – from which station demands would emerge for input to the rail passenger simulation and station movement task, informing station sizing and other related tasks.

3.3.2 Patronage forecasting and benefit forecasting process

The assessment of project benefits and the measurement of achievement against transport objectives required a comprehensive analytical basis. The development of the CPM was designed to provide the basis that formed a reliable means to forecast public transport patronage and service performance with sufficient detail to deliver results with confidence for the purpose of the EIS and the Project's business case.

The purpose of the transport model system is to provide forecasts of the impacts of future land use, economic and transport scenarios on travel demands in Brisbane, with a focus on the impacts of Cross River Rail options and alignments and related transport strategies. The model system is specifically designed to model rail passenger demands.

A simplified representation of the Cross River Rail patronage and benefit model process is shown by **Figure 3-2**. The overall structure of the Cross River Rail Project Model is illustrated in **Figure 3-3**. The BSTM-MM, is a part of the model system, and this sets the overall travel demand context for the Project, including the modelling of future transport and land-use scenarios. The BSTM-MM has been updated and enhanced specifically for this assessment.

The BSTM-MM was enhanced with a new set of sub-models and input data for the purpose of appraising the Project. This was designed to improve the accuracy of the forecasts of public transport passenger demands and to improve the capability of the models to address the impacts and benefits of the provision of increased rail capacity. The new model system, named the Cross River Rail Project Model comprises a comprehensive description of current public transport travel patterns derived from an origin destination survey in 2006 combined with count data for 2009. The BSTM-MM mode choice and public transport network models were further developed in the Cross River Rail Project Model, the latter refining the representation of CBD stations and specifically incorporating the effects of passenger crowding on public transport services. A more detailed zone system for the CBD was prepared to improve the model's ability to address the impacts of new stations.

The components of the model system are briefly described below. A summary description of the model validation process is also presented in the following text. A detailed description of the project model and its development is presented in the Transport Model Development Report (SKM-Aurecon CRR Joint Venture, June 2010).

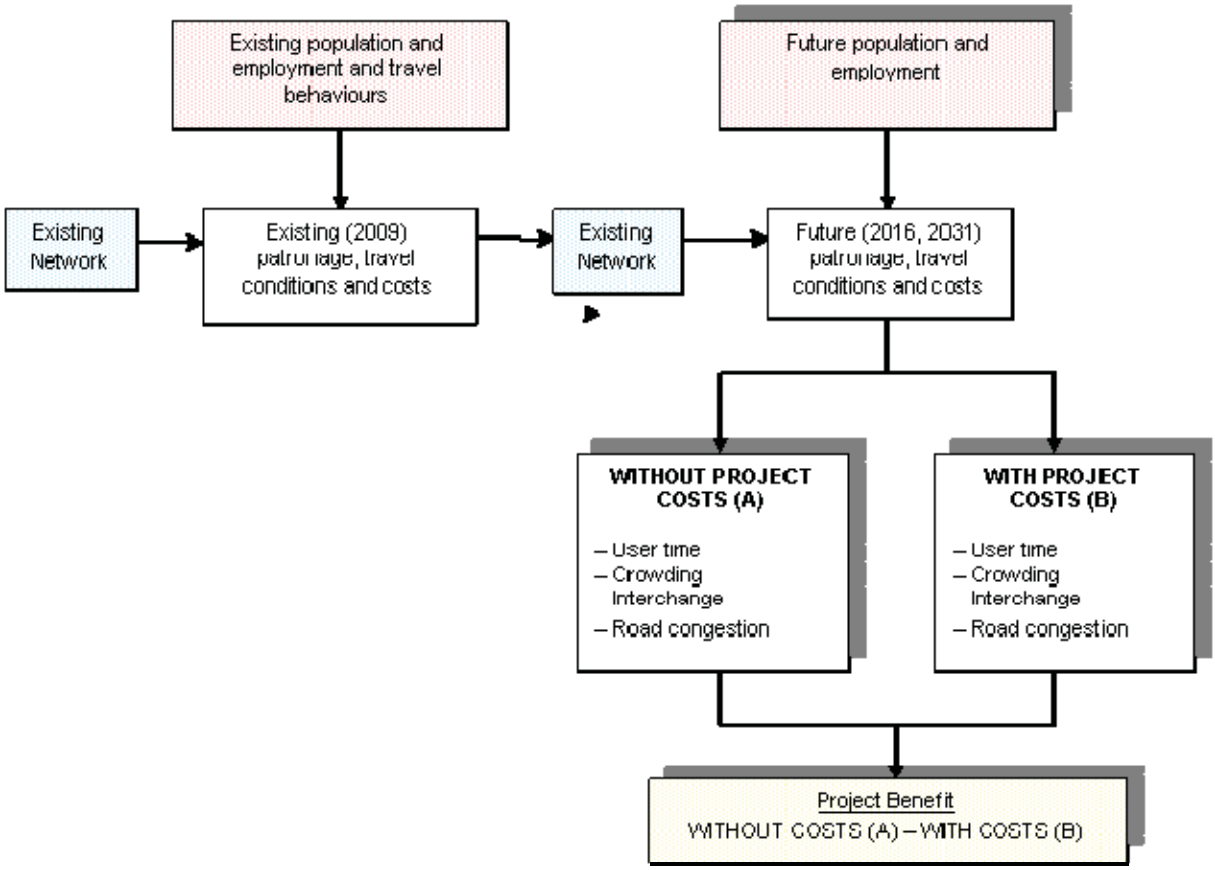


Figure 3-2 Representation of Cross River Rail patronage and benefit model process

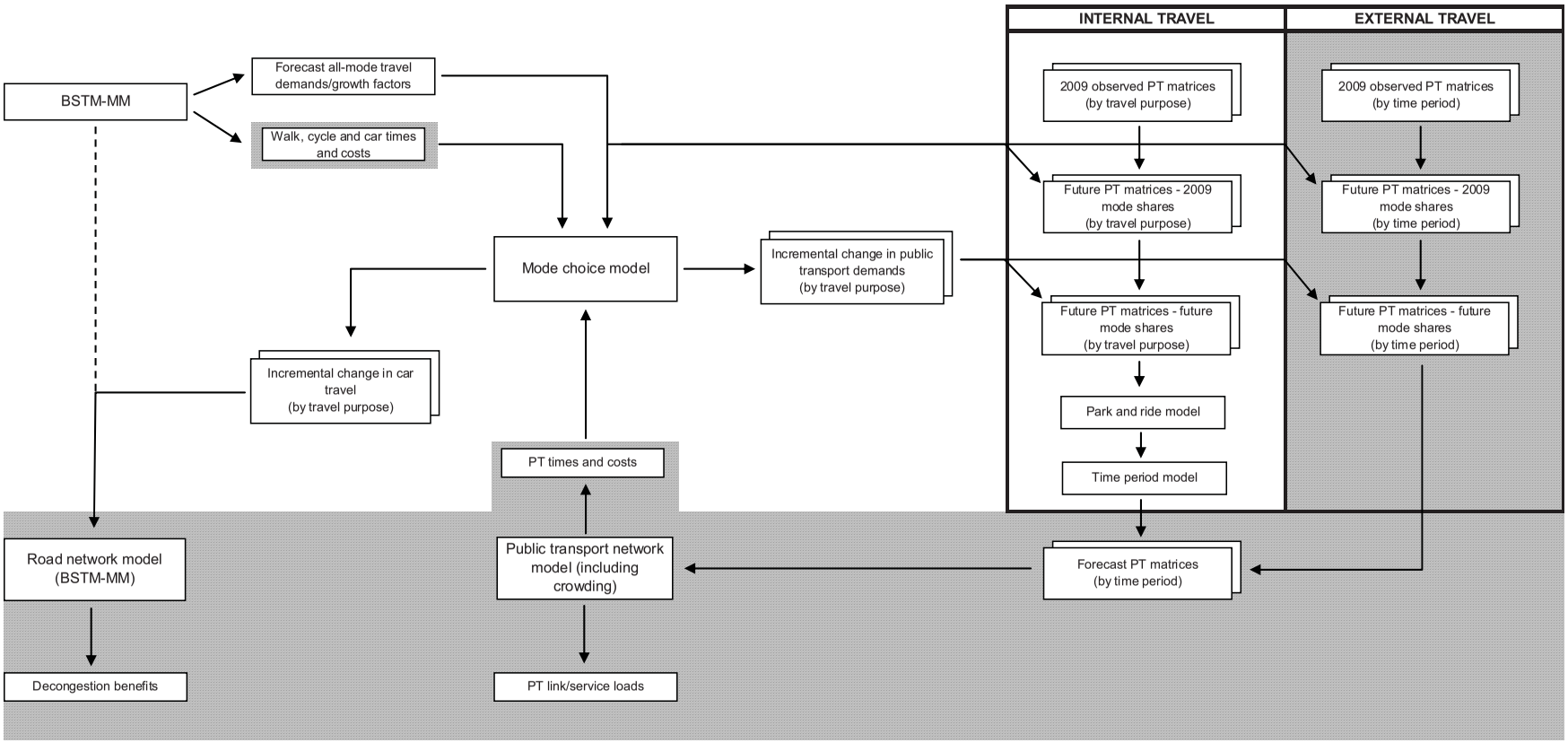


Figure 3-3 Cross River Rail patronage model process

The role of BSTM-MM

The role of BSTM-MM within the transport model system is illustrated in **Figure 3-3**. The forecasts of total (all mode) travel demands for a future scenario are made by BSTM-MM based on the land use economic and network inputs for that scenario. These daily trip matrices (for each purpose) are an input to the CPM.

The Cross River Rail Project Model includes a detailed representation of the characteristics of the public transport networks, but for other modes this information is provided by BSTM-MM. Thus the journey times and costs for the walk, cycle and car modes of transport are forecast by BSTM-MM and are an input to the Cross River Rail Project Model. The latter are a function of the forecast level of road congestion.

Additionally, Cross River Rail Project Model forecasts of reduced road usage (due to an improved public transport service) are fed back to the BSTM-MM highway network model, enabling the road network benefits of the traffic reductions arising from Cross River Rail to be quantified.

CPM – the zone system

The project would improve the accessibility of the rail network in the Brisbane CBD with a new rail alignment and, potentially, a new station. This would both affect the distribution of rail passengers between the CBD stations and the overall volume of rail passengers to/from the CBD. In order to improve the representation of these accessibility changes and thus the forecasting of the impacts on rail passengers, a more detailed zone system in the CBD has been designed. This increases the number of CBD zones to 30 (from the original 10 zones) in both BSTM-MM and Cross River Rail Project Model.

CPM – public transport demands

The sample of public transport trips obtained in the Brisbane household travel survey that was used to develop BSTM-MM was of the order of a few thousand trips. This is too small to ensure that the geographical variations in public transport patronage across the Brisbane metropolitan area are accurately reproduced by the model. Therefore the accuracy of the representation of public transport travel patterns has been substantially improved by incorporating a much larger observed sample of over 35,000 public transport trips in the Cross River Rail Project Model, derived from an intercept survey of passengers on all public transport in Brisbane (bus, rail and ferry) carried out by TransLink Transit Authority in 2006, controlled to 2009 public transport counts.

The outcome of this analysis is summarised in **Table 3-1**, indicating that just over half a million public transport trips are made on an average weekday (in 2009), 50% by bus, 47% by rail and the remainder by ferry.

This detailed information representing 2009 public transport travel patterns is at the heart of the Cross River Rail Project Model. Forecasts of the effects on public transport patronage of future scenarios and the project options have been made by adjusting these observed travel patterns.

Table 3-1 Public transport demands in the Brisbane Statistical Division (based on the 2006 survey) for an average weekday in 2009

Mode/Direction	Time period				
	AM peak 7.00 am to 9.00 am	Inter-peak 9.00 am to 4.00 pm	PM peak 4.00 pm to 6.00 pm	Off peak 6.00 pm to 7.00 am	Total Daily
Internal to internal Public Transport trips					
Bus	53,100	115,300	63,000	41,600	273,000
Ferry	2,600	5,700	2,700	2,600	13,500
Train	65,500	80,300	56,000	35, 000	236,800
External rail trips					
External – Internal	4,100	2,900	600	1,100	8,700
Internal – External	500	3,500	3,200	1,600	8,700
Combined Total	125,800	207,600	125,500	81,900	540,700

Cross River Rail Project Model public transport network model

The BSTM-MM public transport network model uses a data base of road and rail links, and public transport services running along these links, covering the model study area (the Brisbane Metropolitan Area, shown in **Figure 3-4**). Given a forecast of public transport travel patterns (passenger trips between every pair of zones), the network model assigns passenger demands to the best route through the network based on factors such as journey time, service headways and the need to interchange.

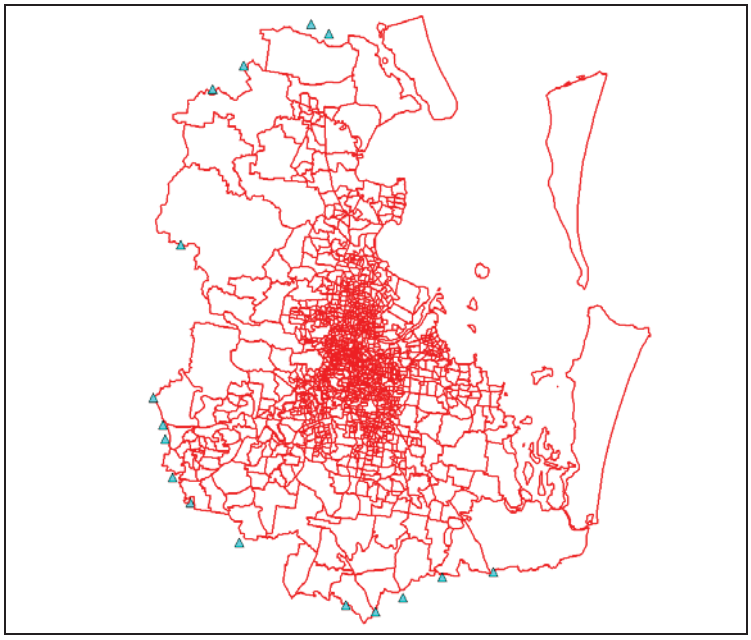


Figure 3-4 Model study area

Note: Blue triangles are external zones

For its application in the Cross River Rail Project Model, further enhancements to the model were incorporated, including enhancements to CBD zones and station representation. In these processes, for rail travel, the network model determines the optimum stations to use at the start and end of the journey and the degree of CBD zoning detail has been improved to represent accessibility to alternative stations more accurately. In addition, the representation of some inner city rail stations[1] has been extended with individual platforms being explicitly identified, as a means of monitoring interchange patterns.

The inclusion of public transport crowding

A major change to the public transport network model is the inclusion of the effects of passenger crowding. There are two reasons for making this change. The first is that the rapid growth of Brisbane will put pressure on public transport service capacity and the consequence is likely to be increased crowding on some services, which may affect both passengers' choice of services and the amount of public transport patronage. The second is that Cross River Rail is designed to increase rail capacity and thus reduce crowding and the associated passenger benefits need to be formally accounted for in the project evaluation.

In representing crowding the model adopts a philosophy that the experience of using crowded trains is disliked by passengers and that this can be represented by increasing the generalised cost weight on in-vehicle journey time above the normal value of 1.0, this additional weight being referred to as the "crowding weight".

The crowding weights incorporated in Cross River Rail Project Model, based on a review of international practice (refer Transport Model Development Report, SKM-Aurecon CRR JV, June 2010) are illustrated in **Figure 3-5**. An example curve for the most common current rolling stock is shown. The portion of the curve below seated capacity (the dotted line) is shaded black, with the coloured portion indicating the increasing multipliers to in-vehicle time with increased load.

[1] These are: Central, Roma Street, Fortitude Valley, Bowen Hills, South Brisbane, South Bank, Park Road.

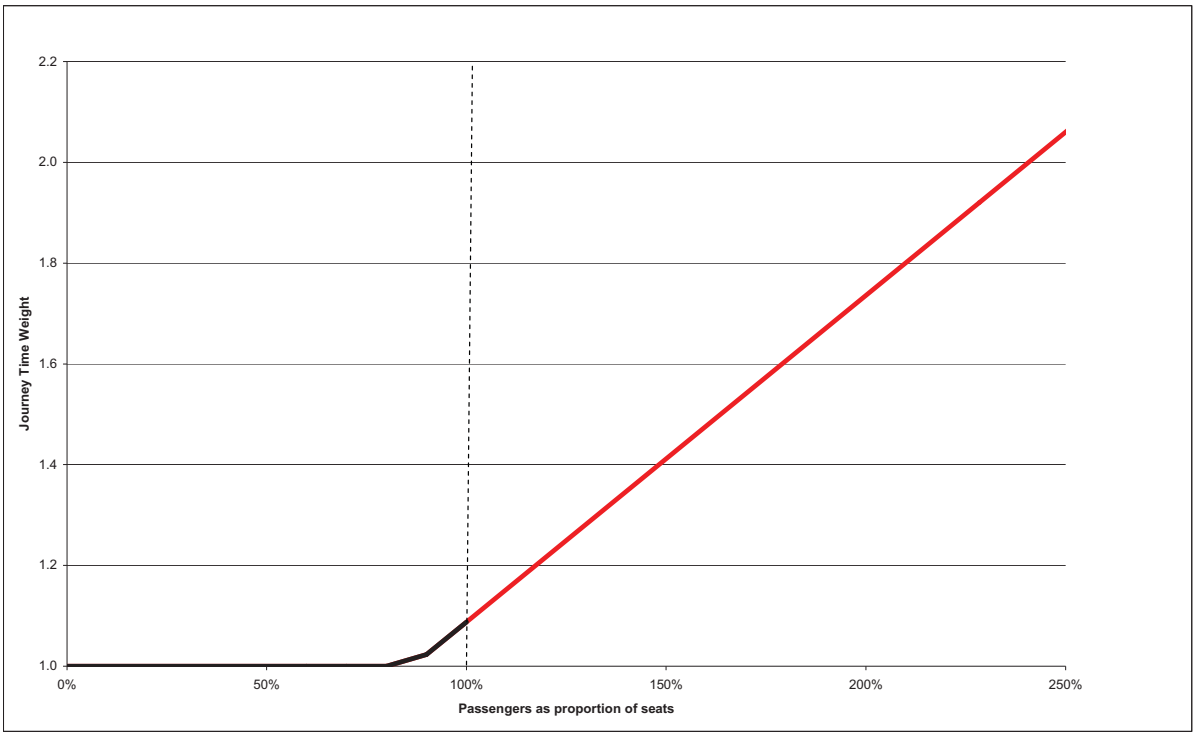


Figure 3-5 The public transport crowding weights in CPM[2]

While international research on the impact of crowding on buses is less well established, for consistency, the weighting attributable to rail travel was also adopted for bus crowding.

The park 'n' ride and kiss 'n' ride model

BSTM-MM distinguishes three public transport sub-modes according to the mode of station access (at the home end of the trip): park 'n' ride, kiss 'n' ride and walk/public transport access. The mode choice model forecasts the split of rail (and busway) trips between these sub-mode options, allowing for car parking capacities at and around stations.

The park 'n' ride and kiss 'n' ride options are identified using a special sub-model linked to the public transport network. For each zone of origin, this sub-model identifies the best local stations for passengers using park 'n' ride (and kiss 'n' ride), allowing for access and egress times as well as the rail level-of-service available at each station. In the standard version of BSTM-MM, all stations are considered accessible from each zone, but we have introduced restrictions on the choice to a limited feasible set of local stations, with the aim of ensuring that there are no unexpectedly unrealistic station choices introduced in future scenarios.

We have further modified the parameters of the kiss 'n' ride model to be more consistent with the park 'n ride model and international practice[3].

[2] Based on UK and Australian practice

[3] Station access times in this model were originally unweighted; we have added a weight of two to these times, the same as the P&R model and international practice.

Together with the inclusion of the crowded assignment, all assignment routeing parameters were tuned to better represent the routeing decisions evident in the observed public transport origin destination data. This included the weightings for walk access time, boarding penalties (by mode and station) and bus travel time functions.

Cross River Rail Project Model mode choice model

The model choice model and the public transport network model are the core of the Cross River Rail Project Model as illustrated in **Figure 3-3**.

Starting on the right hand side of **Figure 3-3**, the 2009 observed public transport travel patterns (trip matrices) derived from the 2009 public transport origin destination survey are growthed-up to the forecast year (assuming no mode share changes) based on the growth in all-model demands forecast by BSTM-MM[4].

Forecasts of changes in mode shares from the 2009 base due to future network changes (Cross River Rail, increased road congestion etc) are made in the CPM mode choice model. The consequent incremental effects on future public transport demands are added to the growthed-up public transport matrices, to give an overall forecast of public transport demands.

The time period model acts as an interface between the networks, which are for four separate time periods, and the mode choice model which is for 24 hours. (For each trip purpose, as required, this interface aggregates the network costs for each time period to 24 hours, and splits the 24-hour forecast trip demands between the four time periods.) In the Cross River Rail Project Model, the time period model for public transport journeys has been updated to reflect the most recent data (the 2006 public transport origin-destination surveys and the 2009 boarding counts).

The inputs to the mode choice model are walk, cycle and road times and costs from BSTM-MM and public transport times and costs, allowing for crowding, from the Cross River Rail Project Model public transport network model.

The Cross River Rail Project Model mode choice model also forecasts the changes in car mode shares[5] and the consequent incremental effects on future car demands are fed back to the BSTM-MM road network model to compute decongestion benefits.

External trips

The external origins and destinations of travel into and out of the model study area are aggregated to 15 cordon crossing points on the study area boundary. Of these two are most significant for rail (and Cross River Rail in particular), serving the Gold Coast and Sunshine Coast. The procedure for forecasting future external travel[6] and the impacts of Cross River Rail on these journeys is illustrated in **Figure 3-3**.

Current (2009) road traffic and rail passenger volumes were obtainable from existing information. Based on the Brisbane household survey and public transport origin destination survey (2006), these counts are attributed to origin and destination zones in the study area to create rail travel demand matrices for 2009 as input to the external model.

[4] The demands are by purpose, for 24 hours.

[5] In this case the change is measured relative to relative to the mode shares in the 2009 base case.

[6] Unlike other travel, external travel is disaggregated by time period in all procedures.

Modelled years

The following years were modelled for the purpose of patronage forecasting:

- 2009 – base year model
- 2021 – indicative of transport conditions around the proposed opening of Cross River Rail (late 2020)
- 2031 – the final forecast year for which all key inputs were available.

Model validation

Generally the fit to the observed data is good and can be described as follows below. A description of the validation is contained in the Transport Model Development Report (SKM-Aurecon CRR JV, June 2010):

- overall boardings and alightings match very well by mode, supporting the assignment routeing parameters
- the fit by individual rail station in inner Brisbane is good due in part to a more reliable distribution of trips across the CBD, and a better representation of the attractiveness of each station, particularly for transfer purposes
- the line loading patterns are broadly represented, and while the fit in the southern part of the network is very good, the lower sample sizes of the observed data in the northern network results in a worse fit, although the overall patterns are reproduced
- the fit to overall bus corridor boardings, while not as accurate as rail, is acceptable.

The implications of this validation are threefold:

a) The particularly good match to observed rail data in the peaks provides confidence in the ability of the model to provide reliable forecasts to use in both the system sizing and business case benefit calculations, particularly in relation to rail journeys to and from the CBD (and along the extended study corridor to Salisbury).

b) The broad (good) fit across the day provides further confidence that the benefits of the project can be reliably estimated.

c) If the model was to be used to assess specific bus corridors, further work would be required to improve the allocation to individual bus corridors/routes, including a more detailed analysis of observed data (most likely requiring further, specific, data collection).

3.3.3 Demographic and land use inputs and assumptions

Population and employment by traffic zone (demographic inputs to the model), are the most influential factors driving forecast transport demand. The density and distribution (by zone) assumptions are as important as absolute growth numbers and are critical to the outputs and transport outcomes of the project. Furthermore, their consistency with current government policy should not, nor has been, overlooked.

Table 3-2 presents future population assumptions and **Table 3-3** present the employment assumptions by statistical local area, the inner Brisbane area and the Brisbane Metropolitan Area respectively assumed for both the base and Project case.

Table 3-2 Future population assumptions

	2009	2021	2031
Inner Brisbane Statistical Local Area			
City - Inner	3,000	4,300	5,000
City - Remainder	5,000	5,500	6,000
Fortitude Valley	6,000	9,600	11,000
Spring Hill	5,000	5,700	6,000
Bowen Hills	2,000	6,400	8,000
Milton	2,000	2,600	3,000
South Brisbane	4,000	5,500	6,000
Kangaroo Point	6,000	7,200	9,000
Woolloongabba	4,000	6,200	13,000
Inner Brisbane total	38,000	53,000	66,000
Brisbane Metropolitan Area total	1,892,000	2,346,500	2,657,000

Source: TMR (Regional Plan Consistent V3)

Table 3-3 Future employment assumptions

	2009	2021	2031
Inner Brisbane Statistical Local Area			
City - Inner	87,000	108,100	114,000
City - Remainder	58,000	82,800	97,000
Fortitude Valley	20,000	25,400	31,000
Spring Hill	19,000	21,600	22,000
Bowen Hills	9,000	18,500	21,000
Milton	14,000	16,600	19,000
South Brisbane	21,000	37,500	44,000
Kangaroo Point	2,000	2,900	3,000
Woolloongabba	15,000	20,500	35,000
Inner Brisbane total	245,000	333,800	387,000
Brisbane Metropolitan Area total	**1,042,000**	**1,341,100**	**1,514,000**

Source: TMR (Regional Plan Consistent V3)

In consultation with TMR, the Regional Plan Consistent future year assumptions were adjusted in regards to the detailed distribution within the CBD (required with the refined zone system developed for the model) and the detailed distribution around Woolloongabba and Yeerongpilly (while maintaining the Statistical Local Area (SLA) targets detailed above). These latter adjustments reflected the latest information provided by ULDA and BCC.

Growth in public transport fare assumptions

The model operates in real terms, at 2009 prices and therefore the consumer price index is removed from all forecast growth in cost inputs.

Table 3-4 presents the assumed real fare growth index used in the model. The assume fare growth that takes into account the TransLink Transit Authority policy of fare increases above inflation over the four-year period from 2010 to 2014. This policy is in place to improve cost recovery in public transport operations. The total fare increase over this four year period will be 75%.

Table 3-4 Real fare growth index

Year	Growth	Index
2009	Base	100
2010	17.5%	118
2011	12.5%	132
2012	12.5%	149
2013	12.5%	167
2014	12.5%	188
2015-2031	0% (ie grows with CPI)	188

Source: TransLink Transit Authority

Growth in parking charges

The growth in parking charges is based on the assumptions contained in the modelling for the draft Connecting SEQ 2031 integrated regional transport plan for South East Queensland. Additionally, for 2031, with the large increase in employment density, parking charges in the suburbs of Woolloongabba and Fortitude Valley have been increase to CBD levels. That is all day parking charges increased from $6.40 and $15.82 to $25.50 (in 2009 terms) respectively. **Table 3-5** presents the assumed parking charge growth index (over CPI).

Table 3-5 Parking charge growth index

Year	Index
2009	100
2021	141
2031	187

Growth in road tolls

Growth in road tolls have been assumed to increase in line with the consumer price index (ie no change within the model).

Growth in value of time

Growth in value of time is modelled through real growth in earnings at 1.5% (assumed 4% less 2.5% CPI) based on the assumptions contained in the modelling for the draft Connecting SEQ 2031 integrated regional transport plan for South East Queensland.

3.3.4 Transport network and service assumptions with and without the project

Transport network assumptions are the second type of most influential model inputs.

Table 3-6 presents the public transport and road network assumptions for the base case in years 2021 and 2031. The network assumptions are based on the latest TMR advice (incorporating assumptions used for the draft Connecting SEQ 2031 and reviewed against SEQIPP).

Table 3-6 Public transport key project assumptions

Year	Type	Project
By 2021	Rail	Darra to Springfield railway - Stages 1 and 2 (Darra to Richlands) as well as stage 3 (Richlands to Springfield)
	Busway	Eastern Busway – Buranda to Main Avenue
	Busway	Northern Busway – Kedron to Chermside
	Rail	Lawnton to Petrie third track
	Rail	Moreton Bay Rail Link
	Rail	Keperra to Ferny Grove duplication
	Road	AirportLink Toll Road
	Road	Gateway bridge duplication, and Gateway South Upgrade to six and eight lanes
	Road	Clem7 Toll Road
	Road	Northern Link Toll Road
	Road	Brisbane Urban Corridor upgrade to six lanes
	Road	Kingsford Smith Drive upgrade to six lanes and Breakfast Creek Road upgrade to six lanes
	Bus	UQ to Toowong and Indooroopilly bus priority
	Road	Airport Drive upgrade to six lanes
	Road/Bus	Pacific Morotway upgrade to eight lanes including T2 lanes (Springwood busway station to Hyperdome)
	Road/Bus	Old Cleveland Road upgrade to six lanes including bus lanes (Coorparoo to Carindale)
	Road/Bus	Old Cleveland Road upgrade to six lanes including T2 lanes (Carindale to Capalaba)
	Road/Bus	Finucane Road/Shore Road upgrade to six lanes including T2 lanes (Capalaba to Cleveland)
	Busway	South East Busway Extension - Eight Mile Plains to Underwood, bus lanes to Springwood
	Rail	Sandgate to Shorncliffe duplication
	Road	Ipswich motorway upgrade (Rocklea to Darra) six lanes
	Road/Bus	Centenary Motoway upgrade to eight lane (inc T2) - Ipswich Motorway to Toowong roundabout)
	Road	Logan Mwy upgrade to six lanes (Ipswich Motorway to Gateway Motorway)
	Road	Port of Brisbane Motorway upgrade to four lanes
	Road	Ipswich Motorway upgrade to six lanes (Dinmore to Darra)
	Road	Pacific Motorway upgrade to eight lanes including T2 lanes (Gateway Motorway to Springwood)

Year	Type	Project
By 2031	Rail	Ipswich to Springfield rail - Ipswich to Yamanto, Yamanto to Ripley TC, Ripley to Springfield
	Rail	NWTC rail (Strathpine to Alderley in base case; Strathpine to Roma Street in with Project case)
	Rail	Salisbury to Flagstone rail
	Rail	Manly to Thorneside duplication, Ormiston to Cleveland duplication, Birkdale to Wellington Point duplication
	Road	North-south motorway
	Road	Stafford Road six lanes
	Road	Riverside Expressway eight lanes
	Road	Gateway Motorway upgrade to six lanes (Bruce Highway to Nudgee Road)
	Road	Centenary Motorway upgrade to four lanes (south of Logan Motorway)
	Road	Gateway Motorway Extension south to Southern Infrastructure Corridor
	Road	Mt Lindsey Highway upgrade to four and six lanes (Browns Plains to Jimboomba)
	Road/bus	Mains Road upgrade to six lanes including bus lanes

3.3.5 Rail service planning methodology

Rail operation service plans for both the with and without Project cases have been developed by Systemwide Pty Ltd. to meet the rail demand forecasts. Service plans and operating strategies for both with and without Project cases have been developed to be consistent with the service planning policy and supporting measures identified, including measures to encourage peak spreading and establish simpler stopping patterns (Systemwide, December 2010).

The development of these service plans is an iterative process and service loadings are also tested as part of the service plan development process using the Train Load Predictor (TLP) model. TLP takes both a RailSys timetable and station by station demand figures (Origin-Destination (OD) matrix) to produce an estimate of passenger loads and movements, on and between individual services within a rail timetable. It also automatically generates a range of detailed KPIs to enable the rigorous evaluation of passenger and operational impacts of different timetable options.

Rail simulation methodology

To compare the on-time reliability (OTR) for the with and without Project cases, RailSys dynamic simulation models were developed for 2009 (for calibration), 2016 and 2031 scenarios with 2021 interpolated between these years. The modelling process includes the following steps:

- develop and calibrate a base RailSys model of the current operation for the time period of September – mid December 2009 (Systemwide, December 2010).
- new timetables, additional infrastructure upgrades and revised rollingstock consists were then incorporated into the based model for both with and without Project cases.
- rerun the models with updated perturbations data and extract the OTR results.
- compare the Project case OTR results against without Project case OTR results and summarise the reliability benefits for each scenario.

It should be noted that due to uncertainty around future operational practices, as well as the known areas where calibration could be improved, the project mainly used the RailSys models to compare the relative change of reliability between the two scenarios in each year, rather than to provide an absolute estimate.

Rolling stock capacities

Passenger forecasts for 2021 have been based on using six-car train sets, as currently operated by Queensland Rail. For 2031, modelling has assumed that nine-car services can be operated on Cross River Rail infrastructure (including stations) as well as stop at stations north of Petrie and south of Kuraby. Rail modelling for 2031 (both with and without Cross River Rail) also assumes that High Capacity Suburban Multiple Unit (HCSMU) trains can be operated within some of the short distance rail corridors. HCSMU trains have more doors, less seats and higher carrying capacity than current six-car trains used on the network.

Assumptions for train capacity are based on current Queensland Rail rollingstock and assumed future potential rollingstock configurations, including

- current six-car electric multiple unit (EMU)/suburban multiple unit (SMU) sets: 472 seated passengers (750 design capacity including a comfortable number of standees)
- current six-car interurban multiple unit (IMU) sets: 434 seated passengers (750 design capacity including a comfortable number of standees)
- future nine-car equivalent train sets (Cross River Rail case only): seated capacity for 651 passenger and design capacity of 1,125
- future UrbanLink metro-style high capacity suburban multiple unit (HCSMU) sets: design capacity of 900 passengers, including 350 seated passengers and 550 standing passengers

Rail passenger level of service

Rail passenger level of service has been measured by two criteria for the purpose of this assessment. These are related to passenger loading standards and on time reliability.

The passenger loading level of service is related to two criteria (Systemwide, December 2010):

- That a passenger is not standing for more than 20 minutes
- That a train load of 750 passengers is not exceeded for six-car set. This has been averaged to the equivalent to a load factor of over 1.5 over a two-hour morning peak period.
- The level of service relating to on time reliability is measured by the current Queensland Rail benchmark of 92.4% on time reliability at four minutes during the morning peak period. (That is 92.4% of services arrive within four minutes of the timetabled time.)

Passenger fleet and stabling requirements assessment methodology

Analysis was undertaken (Systemwide, December 2010) to assess the potential rolling stock fleet size requirements and associated stabling requirements for the forecast years of 2021 and 2031 for the with Project case.

Indicative operational timetables covering the start of operations to 10.00 am were developed in RailSys. These timetables were then imported into the Train Load Predictor, which then exported them into an Excel spreadsheet model. Using this model, stabling balances were rationalised into five minute bins throughout the morning.

The number of stabling berths required overnight gives the number of rolling stock consists required to operate the timetable in question. An Excel model using cycle times was also developed and the numbers generated using these methods were compared to that of the RailSys timetable.

The total overnight stabling requirement across the metropolitan network then gives the total number of trains required to operate this indicative timetable. Assuming a spares allocation of 10% of the operational fleet, the total rolling stock fleet size required is calculated.

Possible stabling locations for the housing of these spare sets are discussed later in this document.

Rail service assumptions

The existing (2009) train operating plan for the morning peak hour is shown in **Figure 3-6**. It can be seen that 30 trains per hour operate northbound through the CBD stations and 27 southbound.

The following inner city network service plans present AM peak hour train operating assumptions for the following scenarios:

- **Figure 3-7** AM peak 2021 without Cross River Rail
- **Figure 3-8** AM peak 2021 with Cross River Rail
- **Figure 3-9** AM peak 2031 without Cross River Rail
- **Figure 3-10** AM peak 2031 with Cross River Rail.

Table 3-7 summarises CBD station peak hour train frequencies assumed under each morning peak scenario. Other period assumptions and operating plans (shoulder, inter peak, etc) are presented in the Rail Operations Report (Systemwide, December 2010).

Table 3-7 Summary of morning peak hour train operation assumptions through CBD stations

	Trains from the south (inc western line)	Trains from the north	Total – 2 way
2009	30	27	57
2021 without CRR	40	39	79
2021 with CRR	55	47	102
2031 without CRR	42	42	84
2031 with CRR	57	55	112

Note: The peak hour capacity of a single track at two-minute headways is 30 trains. However, the maximum train capacity through the CBD is constrained by dwell times at stations and signalling headways. The maximum capacity through the CBD without the Project is assumed to be 19 trains per hour on the Main Lines and 23 trains per hour on the Suburban Lines (each way) giving a total two-way capacity of 84 trains per hour.

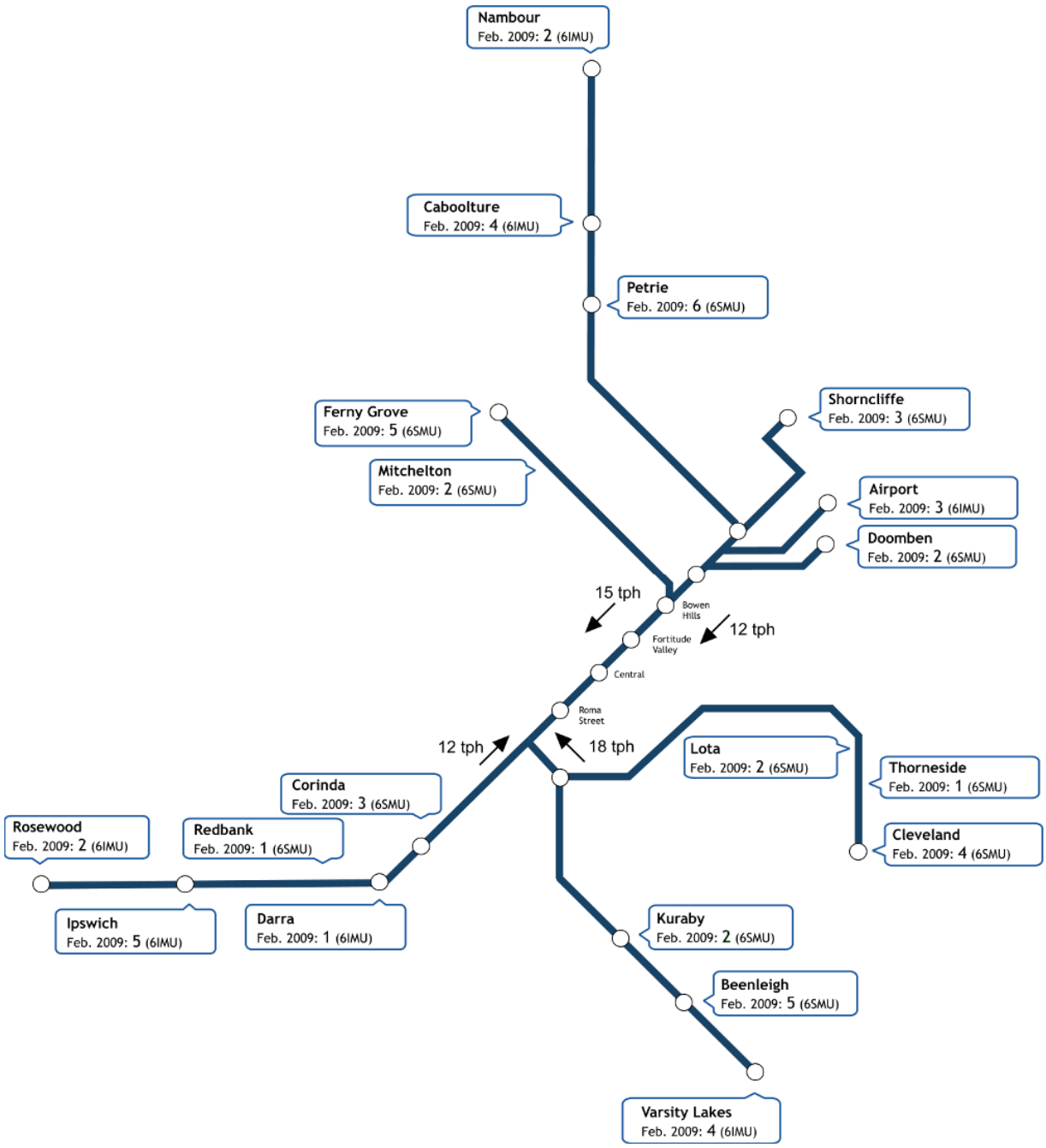


Figure 3-6 2009 AM Peak Hour Rail Service Levels

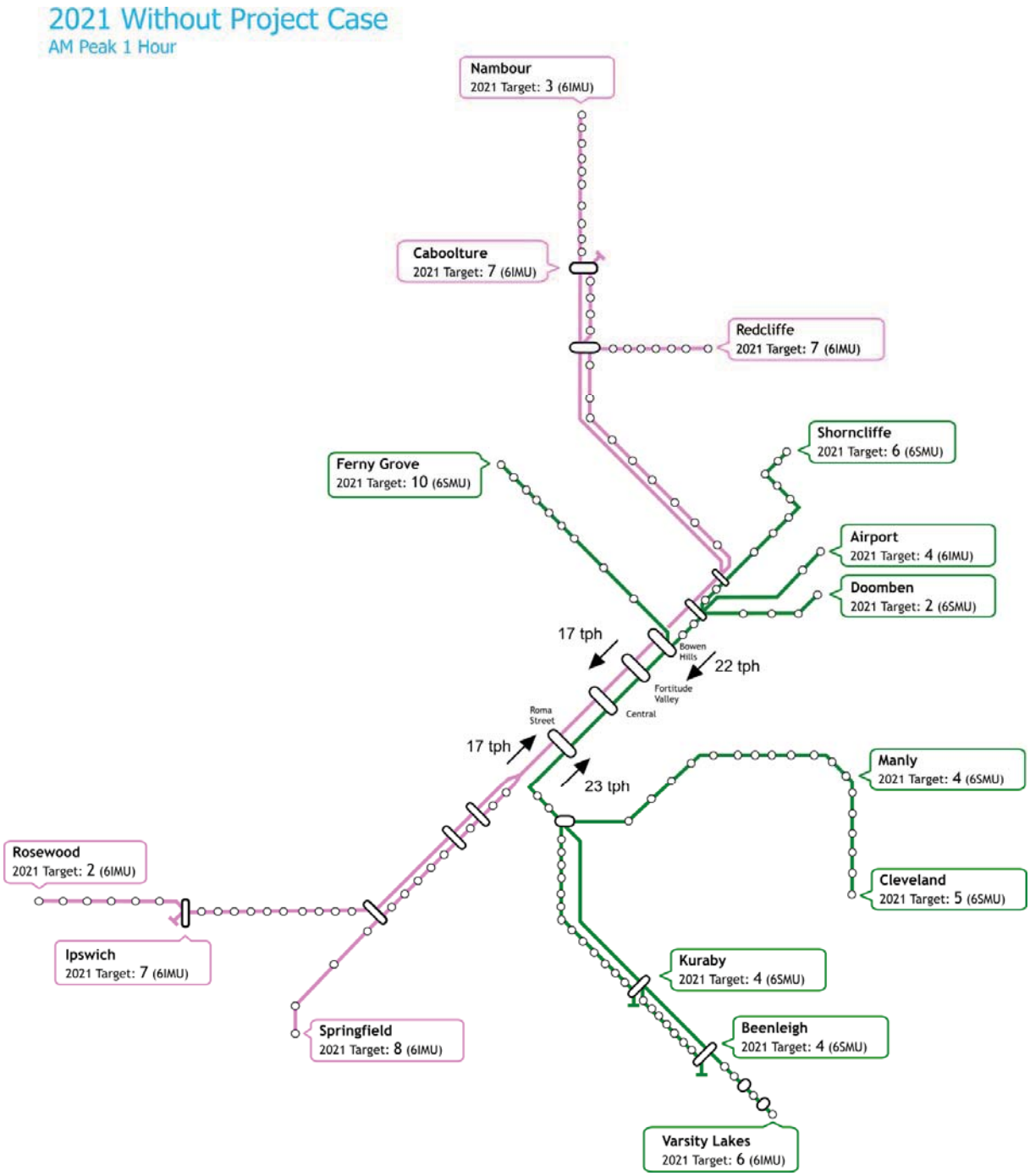


Figure 3-7 2021 without Cross River Rail AM peak one-hour service plans

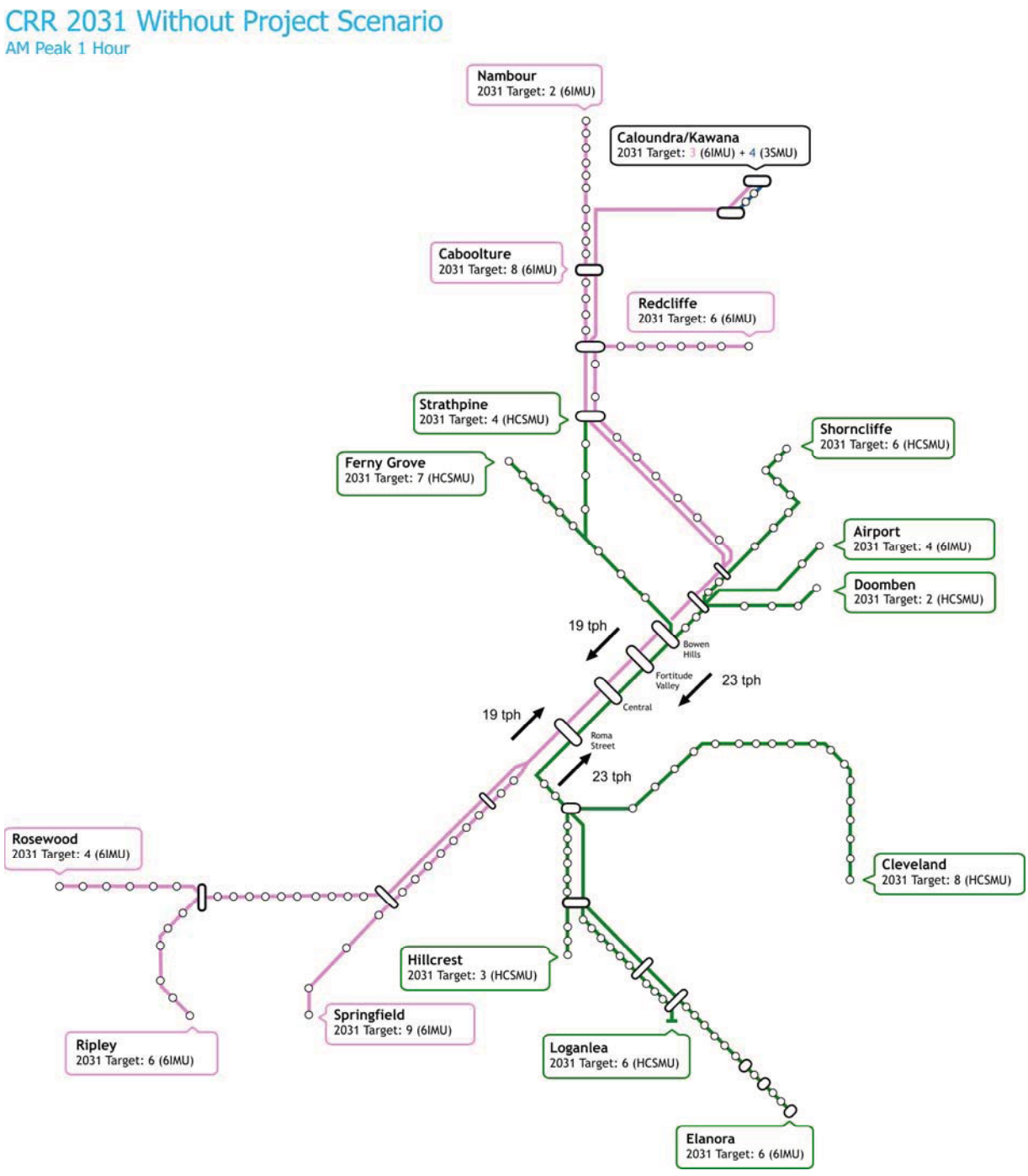


Figure 3-8 2031 without Cross River Rail AM peak one-hour service plans

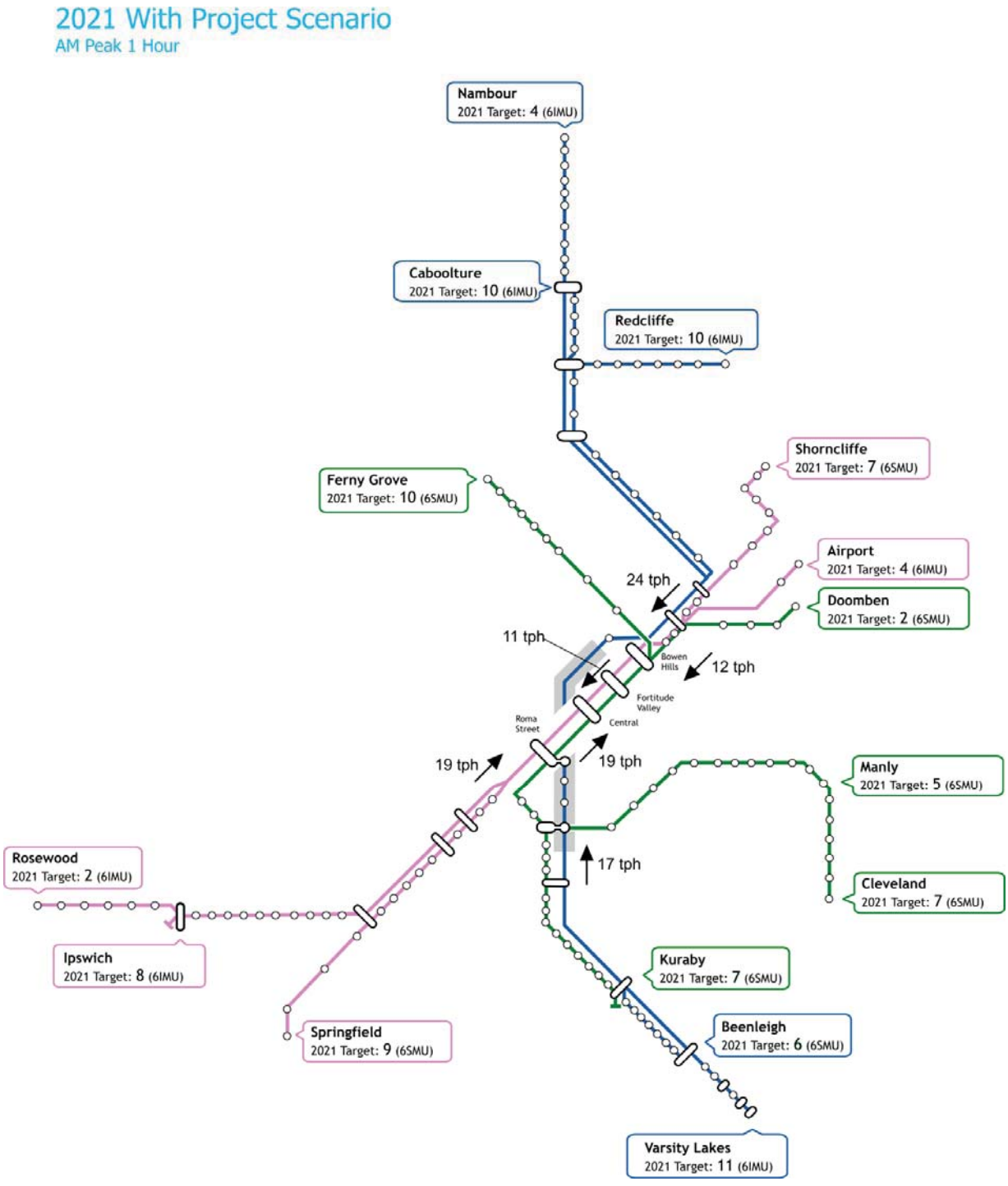


Figure 3-9 2021 with Cross River Rail AM peak one-hour service plans

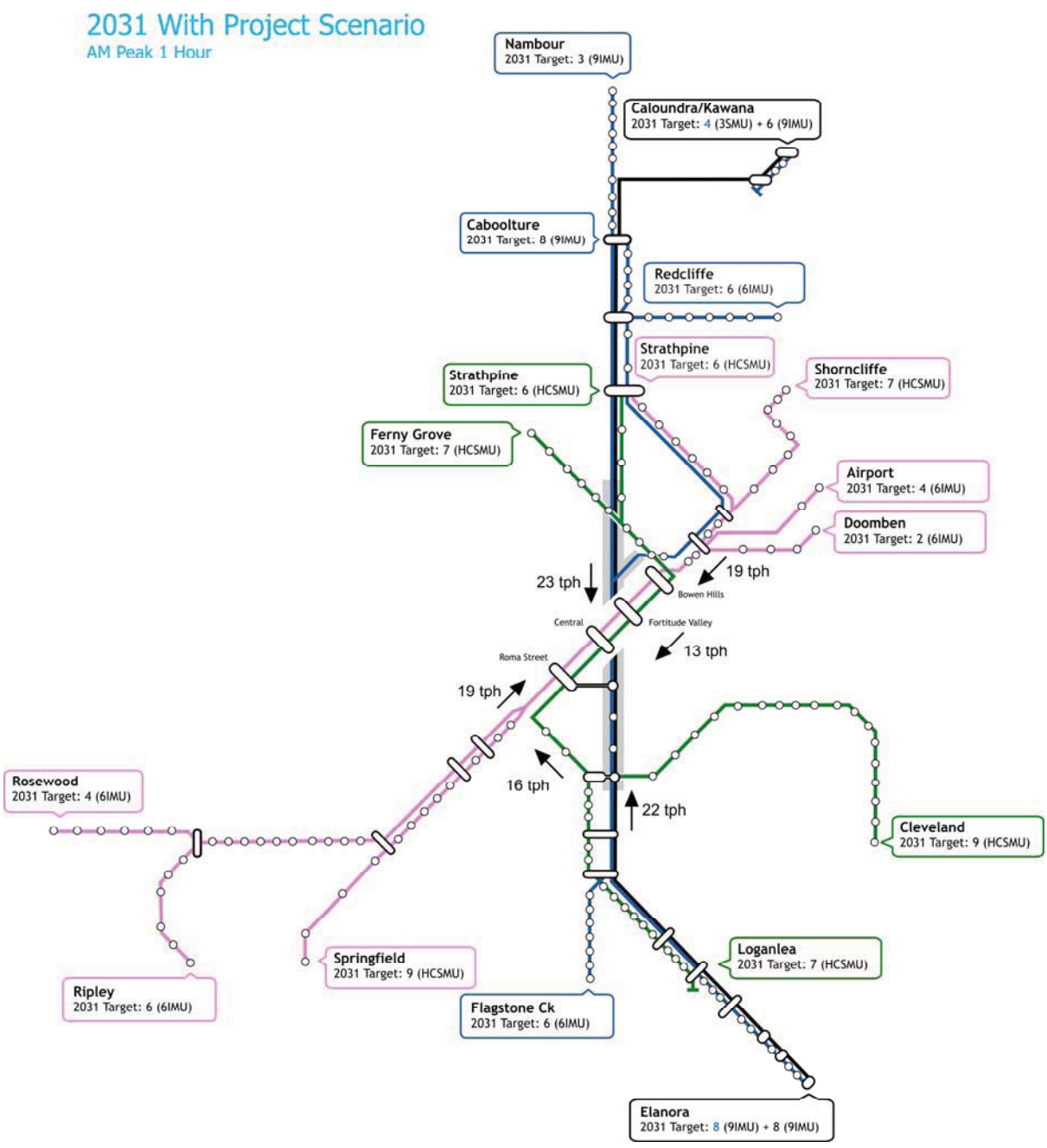


Figure 3-10 2031 with Cross River Rail AM peak one-hour service plans

Bus service assumptions

TransLink Transit Authority and TMR advised on the bus service assumptions that have been used for future years. The future bus services are consistent with the bus strategy as described in the draft Connecting SEQ 2031, consisting of a High Frequency Priority (HFP) trunk network with suburban feeder services to major bus and rail interchange locations.

Bus service assumptions are consistent between the with Project case and without Project case for each year.

3.3.6 Exclusions to the assessment

The model development and the range of assumptions provided a comprehensive basis to assess both patronage and benefits between the with and without Project cases. There are some future policy issues which have not been modelled and therefore have been excluded from the analysis of future conditions. While they are likely to change over time, they are not likely to be material to an assessment of need and of project benefit. Any risks that can be raised as a result of their exclusion can be managed within a sensitivity analysis.

Those policy issues excluded from the base analysis and model runs include:

- changes in ownership of the services (eg privatisation of rail and bus services into the future)
- changes in the use of fossil fuel and energy in the transport sector (it is assumed that no significant change in the price of oil will effect travel behaviour over the next 30 years)
- behavioural change in transport use and trip making
- road pricing (network and CBD cordon pricing) has not been allowed for
- the model does not forecast freight movement on the network.

3.4 Rail freight demand and operations

The section presents the methodology employed to forecast the future demand for rail freight on the network, the forecast rail freight volumes and an assessment of the required rail freight paths carried out by SAHA (SAHA, September 2010)

3.4.1 Rail freight demand

Desk top analysis of existing freight data sources was undertaken. The review focused on the following documents:

- SEQ Intermodal freight terminal strategy, Queensland Transport
- Rail Strategy for SEQ, Queensland Department of Transport and Main Roads
- Freight Strategy for SEQ, Queensland Transport and Main Roads
- SEQ Regional freight network strategy 2007–2012, Queensland Transport and Main Roads
- MPB Inner City Rail Capacity Study (ICRCS), Freight Operations Supporting Material
- Freight Network Integration Issues and Opportunities, Western Downs Regional Organisations of Councils
- Australia Trade Coast Freight Study
- Port of Brisbane: Container Origin & Destination Study
- Melbourne to Brisbane Inland Rail Alignment Study, ARTC
- SEQ Freight Intermodal Terminal Study, Stage 2 – Additional Site Needs Investigation (2005)
- QR Annual Report 2008-09.

An overview of key rail freight markets within Brisbane/South East Queensland, noting the relevance to the Project, was carried out. Freight estimates and demand scenarios were developed to be considered in future year operational analysis based on growth rates and other key assumptions such as the use of longer trains. Medium and high growth scenarios were developed that are presented in **Table 3-8**. Following discussions with Queensland Rail the medium growth rates were used for the

freight analysis and it should be that the medium growth rate was consistent with those used in the ICRCS.

Table 3-8 Freight demand scenarios

Growth scenario	Network Segment	Freight type	Growth rates and other key assumptions
Medium growth	North Coast line	Intermodal	3% growth pa[7]
		Bulk	1% growth pa
	Western line	Intermodal	1% growth pa[8]
		Bulk	Grain – volumes remain constant Coal – 5% growth pa with an assumed upper limit of 10 mt per annum for exports through the Port of Brisbane[9]
	Intra-urban IMEX	Acacia Ridge – BMT	Rail mode share remains stable at 10% of all container movements through the Port of Brisbane
	Interstate freight	Inland Rail – Acacia Ridge	N/A – No inland rail route, interstate freight movements continue into Acacia Ridge via the existing standard gauge link to the south of the terminal
High growth	North Coast line	Intermodal	5% growth pa
		Bulk	3% growth pa
	Western line	Intermodal	3% growth pa
		Bulk	Grain – volumes remain constant Coal – 10% growth pa, with an assumed upper limit of 10 mt per annum for exports through the Port of Brisbane
	Intra-urban IMEX	Acacia Ridge – BMT	Rail mode share for container movements through the Port of Brisbane increases from 10% in 2010 to 20% by 2020 and remains constant thereafter
	Interstate freight	Inland Rail – Acacia Ridge	Assumed development of the inland rail route by 2025, using freight demand estimates from the Inland Rail Route Study[10]

Notes:

7. *This growth rate is consistent with the freight forecasts identified in the AusLink Green Paper, the National Transport Commission Information Bulletin 'Facts on Freight Growth' and the AusLink Brisbane – Cairns Corridor Study.*
8. *A growth rate of 1% per annum was assumed in both medium and high growth scenarios for the ICRCS. A growth rate of 3% per annum has been adopted as an upper limit for the purposes of this paper.*
9. *Based on the assumption that the coal terminal at the port of Brisbane is upgraded to a capacity of 10 MTPA, as noted in the DTMR (2010) Rail Strategy for South East Queensland. As previously noted, more substantial exploitation of the Surat Basin to increase volumes above this level is considered to be contingent on the development of the Surat Basin Railway ('Southern Missing Link') connecting to the Moura Line, allowing exports through the Port of Gladstone. The Melbourne-Brisbane Inland Rail Alignment Study (ARTC, July 2010) assumed that coal exports through the Port of Brisbane could increase to 15 MTPA if the inland rail route is developed. This scenario has not been considered within this paper on the basis that volumes above 10 MTPA may require infrastructure enhancements elsewhere on the coal supply chain.*
10. *See freight estimates contained in Appendix B of ARTC (2010), Melbourne – Brisbane Inland Rail Alignment Study Final Report July 2010. Freight estimates adopted in this paper are based on intercaptial freight movements between Melbourne and Brisbane. The Melbourne-Brisbane Inland Rail Alignment Study assumed a low level of market contestability for freight from Northern NSW, ie limited potential for freight currently exported through the Port of Newcastle and Port Botany to be diverted to the Port of Brisbane as a result of the inland rail route being developed. Estimates for intercapital freight movements along the east coast incorporate a minor allowance for 'land-bridging' ie the movement of freight between ports by land as a substitute for sea transport. This practice has declined in recent years with the increasing availability of ships making calls at all three major east coast ports.*

3.4.2 Rail freight paths

A pragmatic approach to assessing the impact of the forecasted freight demand on the operations of the Without and With Project cases was carried out by Systemwide (Systemwide, December 2010).

The proposed 2021 and 2031 off-peak operations have been modelled using RailSys and the number of available freight paths offered by these proposed operations assessed. These freight paths were assessed taking into account restrictions on freight operations during the passenger peak hours, the operating hours of passenger services, and the current 'peakiness' and time sensitivity of freight operations.

Based on the assessment of paths available in different periods of the day, weekly freight path availability throughout the network has been calculated by multiplying the number of available paths for each period of passenger operations by the number of instances of each period of passenger operations throughout the week. This has then been compared against the 2026 medium growth freight forecast from the ICRCS for consistency.

As the intention of the analysis is not to develop a full, detailed freight timetable, defining scope is important. Some of the assumptions that were made in the analysis are detailed below.

Peak freight curfew

Freight operational hours are currently restricted by a passenger-peak freight curfew, not allowing freight services access to the passenger network during the AM or PM peak hours, with restricted access during the shoulder period. It is assumed that this restriction will continue to be in place in 2021 and 2031, preventing freight operations for approximately four hours of each weekday.

Network boundaries

Assessment was undertaken on the passenger network bounded by Rosewood, Salisbury, Nambour and Lindum (Lytton junction).

Assumed network infrastructure

The network infrastructure in place for the analysis is assumed to be that required for the operation of the 2021 and 2031 passenger services. Additional infrastructure will be recommended if required freight service levels cannot be met. The existing dual gauge line between Park Road and the Port (alongside the Cleveland line) would preferably be a priority freight line rather than used for express passenger services.

Hours of passenger and freight operation

Passenger services have been assumed to operate between 4.00 am and 2.00 am on weekdays, between 5.00 am and 2.00 am on Saturdays, and between 6.00 am and midnight on Sundays.

Freight services are assumed to operate 24 hours a day, seven days a week, except during the passenger AM and PM peak hours on weekdays if tracks are unavailable.

Freight time-sensitivity

The peak freight periods are 4.00 am to 7.00 am, and 6.00 pm to 9.00pm. It is expected that the evening departures are more flexible in terms of a departure window, whereas the morning arrivals are required due to distribution during the day.

The future demand for freight services will be distributed through the day and week as is current, eg livestock and intermodal services will still be time-sensitive.

Adjustments to the off-peak timetable

As timetabling outputs for the Project are not expected to be detailed operational timetables, and are likely to change significantly before implementation by Queensland Rail, major changes to off-peak passenger timetables to accommodate freight movements that occur today amongst similar passenger operations will not be undertaken as part of this analysis. These will be assumed to be operable, as they are today.

Operations on the Merivale Bridge

As agreed previously in the ICRCS (Queensland Transport, 2008), the Merivale bridge has not been assumed as a fundamental rail freight route. The analysis assumes this route used only opportunistically when train paths are available for freight traffic. The primary route for all freight to and from Acacia Ridge from the North Coast would be via Corinda and Tennyson.

External constraints

Coal services are assumed to be constrained by the Toowoomba range, and can only enter or exit the study network on an hourly basis each way. By 2031, operations will approach this limit to supply the 0.74 coal trains per hour expected between Park Road and Yeerongpilly without encroaching on the peak curfews on the western line.

Freight consist lengths

All freight consists were assumed to be the same length as are currently operated. Extensions to these lengths have previously been considered and remain an option if available capacity does not meet forecast requirements.

3.5 Rail passenger (pedestrian) assessment

The purpose of this section is to define the tasks required to model pedestrian movements within Cross River Rail stations and other stations within the study corridor.

Rail passenger simulation modelling was used for the major new underground stations to assess the proposed station designs at a high level to indicate areas where potential capacity limitations needed to be addressed. The results of the modelling were used to inform the engineering design of the stations. Comprehensive details of the methodology are provided in the Station Pedestrian Analysis Report (SKM-Aurecon CRR JV, September 2010),

Stations located within the study corridor but which would not be served by Cross River Rail have been assessed using a simpler spreadsheet method. This method is reported in **Section 3.5.2**.

3.5.1 Major stations assessment – rail passenger simulation

The rail passenger simulation methodology used for major stations (including all new Cross River Rail underground stations) allowed for the following outputs:

- congestion levels by location by year – weighted measures of congestion for each station area for each forecast year. Identification of congestion ‘hot spots’ and capacity deficiencies
- Fruin levels of service (Fruin, 1977) – for specific station areas by year
- internal OD matrices – for each station, the movement volumes between points of entry to the station (platform-platform and platform-exit).

Emergency evacuation modelling and microscopic pedestrian flow modelling that could be carried out through a pedestrian simulation model was not included.

Software – ClicSim overview

The ClicSim software package forecasts pedestrian flows and levels of service within each station. ClicSim simulates passenger and train movements across the entire rail system. It tracks the position of each passenger in time and space as they move through stations and travel on trains. The simulation can be interrogated to produce rich outputs such as train loadings, transfer movements, station levels of service and passenger travel times.

At the time of writing, the latest version of ClicSim is 2.0.0. This includes several enhancements over the previous version (1.9.2), which was used by SKM and the Victorian Department of Transport to model the Melbourne rail network. The enhancements provide more rigorous error-checking, improvements to usability and a richer set of station network elements.

ClicSim operation and input file formats are described in the ClicSim User Guide (SKM, 2009).

Inputs

ClicSim requires three main inputs for each scenario as shown in the following table.

Table 3-9 ClicSim model inputs

Input	Description	Source
Rail network	Central Brisbane rail network	TransLink web site
Station networks	Internal pedestrian networks within each central Brisbane station	Station plans provided by TransLink
Timetable	Stopping patterns of all trains during the simulated time period in the central Brisbane area	Systemwide
Passenger demand	Station-to-station origin destination matrices of passenger trips	Systemwide

Outputs

A wide range of diagnostic outputs is available from ClicSim. For the purposes of the Cross River Rail project, the most relevant outputs provided are:

- occupancy and level of service – minute-by-minute snapshots of the number of pedestrians in each area of a station, providing an indication of congestion levels
- passenger station movements – a breakdown of entry and exit points and travel times for each pedestrian using a station.

In addition, several other outputs, such as boardings, alightings and transfers were used for validation checks to ensure that passenger demands have been correctly specified.

Limitations

ClicSim has been designed as a rapid-response modelling tool. It uses average travel times, queue rates and densities to determine the dwell times of pedestrians in each area of the station. It does not model the individual trajectories of pedestrians and pedestrian-to-pedestrian interactions (as is done in a microscopic pedestrian model). If more detailed outputs are required, then a microscopic pedestrian model could be used, although this would take much longer to set up and apply.

The path-finding algorithm within ClicSim currently assumes that passengers travelling through a station will use the quickest path between a given origin and destination. This means that all pedestrians travelling between two points in the station will be modelled to use the same path. In most

instances, this is a valid assumption; there is often only a single direct path between, say, a platform and an exit.

In more complex stations, passengers may have a choice of paths, particularly if there are several sets of escalators distributed along platforms. In these cases, some care will be needed in platform coding to ensure that the model realistically distributes passengers among available escalators.

3.5.2 Minor stations assessment

The adequacy of the pedestrian infrastructure at stations in the study corridor not proposed to be served by Cross River Rail have been assessed in the with and without Project cases. The assessment is based on that a minimum pedestrian level of service D (based on Fruin's definition of pedestrian level of service) should be achieved at each station. The required pedestrian width is then compared to what is provided within the existing infrastructure. As the stairs and walkways are the critical components of pedestrian infrastructure at suburban stations these components have been assessed.

3.6 Station transport planning and access

This section presents the principles behind the station transport planning and access tasks. Delivering an acceptable and successful Cross River Rail solution means supporting integrated transport and land use outcomes for the inner city, by ensuring stations and station precincts are configured to maximise safe and efficient access to them. Integrated, intermodal station access planning is therefore essential to a successful Cross River Rail project.

There are numerous land use and transport drivers that influence the design and operation of the various stations along Cross River Rail, including competing access mode needs.

Maximising accessibility to and within the station precinct and incorporate world's best practice passenger experience factors and design principles means maximising the investment in public transport infrastructure and maximising opportunities for land use integration and land value capture.

As such, station transport planning and access tasks have strong interactions with:

- land use planners
- urban designers
- architects
- patronage modellers
- station designers/engineers
- EIS team.

The overall tasks from the station access planning stream that have informed the reference design were:

- Station interchange planning principles
- Station precinct opportunities and constraints assessment
- Station location assessment
- Station precinct planning.

3.6.1 Station interchange planning principles

A review of a range of recent and relevant standards, policies and guidelines was carried out in order to inform the development of future deliverables including station precinct plans and station location criteria. The material reviewed included best practice relating to:

- station location and access – including number of station access points and spacing between, location of station access points, relative to, in response to or in anticipation of land use/ development needs and opportunities
- interchange and access mode planning – including determining an appropriate hierarchy of access modes and relative importance of each, determining what makes access and interchange around stations 'good' in the eyes of a passenger, what makes interchange easy or comfortable
- bus planning at stations including location and nature of stops, requirements/triggers for dedicated infrastructure provision, bus service planning methodologies for major stations, bus priority measures/triggers, bus operational/management issues around stations etc
- pedestrian factors including extent of infrastructure provision, level of service planning, security/ safety issues, and physical road layout/design considerations, legibility/wayfinding, etc
- cycle issues including appropriate level of access and priority for cyclists within precinct, number, type and relative location of cycle infrastructure (parking, showers, lockers etc) relative to station function
- taxi/private drop-off – quantity/type of facilities required, location relative to other competing modes etc, drop off versus pickup, taxi versus private car (combined/separated facilities etc), potential need for taxi driver facilities, signage and enforcement issues etc
- park 'n' ride – determining best practice guidelines of how to deal with private parking (on street and off) including active versus passive provision, management/pricing etc
- other access and activities – including private charter bus/minibus access, coach (intercity) access, school bus access, commercial vehicle loading etc.

Documents and previous work included in this review included:

- London Underground guidelines
- Hong Kong guidelines
- Transport for London interchange best practice guidelines
- Sydney Metro
- Cross River Rail project definition report (ie to understand CRR objectives/aspirations etc)
- input from experienced practitioners.

Further information is contained in the Station Interchange Planning Principles report for Cross River Rail (SKM-Aurecon CRR JV, May 2010).

3.6.2 Station precinct transport opportunities and constraints assessment

This task involved:

- examining existing transport provision and interchange conditions at candidate station locations (new or significantly altered stations only – namely Park Road, Woolloongabba, 'CBD south', Central and Roma Street, Exhibition, Bowen Hills).
- analysing existing transport plans/policies
- examining future land use plans.

A high level analysis of existing transport provision within the 'interchange zone/station precinct' was undertaken that involved mostly desktop studies supplemented by peak period site visits in order to appreciate current transport performance and issues. These were not audits but high level analyses to gain a better understanding of the existing:

- rail and bus services (based on current timetables)
- interchange facilities
- pedestrian facilities
- bus facilities
- park 'n' ride – on and off road parking provision including traffic areas (controlled on-street parking zones)
- cycle facilities – parking and on/off road routes
- taxi facilities
- kiss 'n' ride facilities
- loading provision
- road network – hierarchy/volumes/constraints
- land use/development opportunities within the station catchment.

Future transport plans were analysed to gain an understanding of relevant policies and aspirations for Cross River Rail. These plans included:

- Draft Connecting SEQ 2031 (An integrated regional transport plan for South East Queensland)
- South East Queensland Infrastructure Plan and Program
- TransLink Transit Authority – Transport Network Plan 2018
- Brisbane City Council – Transport Plan for Brisbane and Road Action Plan.

Future land use plans were also examined as an input to the analysis of station precinct catchment opportunities. Such documents included:

- SEQ Regional Plan
- BCC planning documents (City Plan, CBD Masterplan, Neighbourhood Plans, Local Area Plans)
- ULDA (Bowen Hills UDA)
- RNA Showgrounds Master Plan
- Development opportunities and developer contributions should be explored.

Further information is contained in the Station Precinct Opportunities and Constraints report for Cross River Rail (SKM-Aurecon CRR JV, May 2010).

3.6.3 Station location assessment

As part of the early design process the transport planning team assisted in the determination of preferred station locations through:

- development of station location assessment criteria
- the analysis of potential station locations against the above criteria.

There were two differing types of station assessment processes in this task. The CBD station location options were more significantly varied in nature whereas the 'fringe' stations (Woolloongabba, Park Road, Exhibition and Bowen Hills) were more defined in location with minor location variations.

As such more fundamental differences in station accessibility were identified for the CBD station options. For the fringe stations, marginal (but important) accessibility and interchange benefits were identified for different discrete station/station access location options.

The BSTM-MM (benchmark forecast) data outputs were used to examine changes in population and employment density within the CBD up to 2031 to assess changes in the catchments' trip generating potential.

A set of value drivers were developed, that included input from all disciplines, and applied to assist in determining preferred station locations for CBD stations.

Further information can be found on the Value Drivers for CBD Station Location Assessment – Transport Planning Inputs, report (SKM-Aurecon CRR JV, May 2010). Transport planning inputs to other station locations can be found in the Precinct Planning, Land Use and Urban Design Report (AECOM-Hasell, October 2010).

3.6.4 Station precinct planning

Preliminary intermodal station access criteria/standards were developed to inform the progressive design development by the engineering and design team.

The development of the intermodal station precinct plans were developed in close collaboration with the engineering and design team, based on the application of the best practice principles and other complementary intermodal integration strategies.

Determining the right mix of infrastructure and services within each precinct was determined through:

- analysis of benchmark forecasts – which provided patronage numbers by access mode and period of day (morning peak, evening peak, off peak) for each station; access routes to/from stations to trip origins/destinations; and the quantum and nature of interchange between all modes within each station precinct.
- discussion with key service delivery stakeholders including TransLink Transit Authority and BCC
- ongoing design development including the technical feasibility of solutions, in terms of land take, constructability and cost.

Further information can be found in SKM-Aurecon CRR JV's Station Precinct Planning – Transport report (August 2010) and the Precinct Planning, Land Use and Urban Design Report (AECOM-Hasell, October 2010).

3.6.5 Operational traffic (road impact) assessment

Assessment of the operational traffic impacts of the Cross River Rail project on the regional road network was carried out and involved the following:

- differences in traffic volumes for the with and without Project cases in 2021 and 2031 for the whole of the model area (Brisbane Metropolitan Area). This was to highlight any overall trends in numbers of trips by car and overall mode split across Brisbane as a result of the project.
- changes in traffic volumes and level of service at selected links along five screenlines and a CBD cordon within the study area. This was to indentify any key differences in vehicle volumes with the Project compared to without on specific links within and across the study area.

- analysis of any changes in traffic volumes on State Controlled Roads within or immediately surrounding the study corridor in the AM peak and over 24 hours to determine whether the project leads to an increase of 5% or more in traffic on these key road links and hence trigger the requirement for more detailed analysis of impacts and mitigation measures in line with TMR's Guidelines for the Assessment of the Road Impacts of Development.

In line with the ToR (section 3.1,5), an assessment of the operational impacts of the project was undertaken in general accordance with TMR's Guidelines for Assessment of Road Impacts of Development (2006). As such the underlying principles of this assessment as listed below were addressed individually in **Section 6** of this report with respect to the modelled strategic network impacts identified above:

- whether the development compromises the intention for MTR to provide and maintain a safe and efficient State Controlled Road (SCR) network
- whether the development will generate a high proportion of additional traffic which would justify development contributions
- whether the development generates an increase in traffic on SCR of less than 5% of current daily traffic, and therefore the road impacts can be considered insignificant
- if there are road impacts and potential mitigation measures, what intervention levels would be required for planning and investment purposes
- whether the development is consistent with TMR's plans and hence not cause significant impacts to the road system
- whether the development is inconsistent with TMR's plans in terms of scale and intensity of use, and hence, conditions of development approval may be set including for mitigation works or contributions
- if mitigation measures are required they do not have to be infrastructure solutions and could include transport modal choice, traffic management, alternative route selection or alternative staging of development
- whether there are any roadworks associated with a direct connection between the development site and the SCR network and whether the project address the specific road impacts on the SCR network
- whether the development requires the use of bring forward methodology to mitigate its impacts as identified in the Road Impact Assessment (RIA) – the use of bring forward methodology may not be acceptable to TMR and other mitigation measures may be required.

In addition to the assessment of impacts at the strategic regional road level outlined above, local traffic impacts were assessed through analysis of:

- modelled park 'n' ride and kiss and ride demands to railway stations within the corridor with the Project relative to without the Project (% differences) broken down to vehicle trips per minute in peak periods. A qualitative assessment of the expected impacts of any additional trips related to Cross River Rail relative to the available road, parking and loading infrastructure was then undertaken.
- modelled impacts of permanent road capacity changes in the CBD. In line with discussions with Brisbane City Council, changes to road network capacity in the CBD to accommodate widened footways and additional pedestrian crossings were assessed using a combination of SIDRA and TRANSYT traffic modelling software. The methodology used to determine the changes in traffic demands and assess their impacts is outlined below.
- Modelled changes to road and intersection performance around Salisbury and Rocklea as a result of the closure of an open level crossing, diverted traffic and the proposed signalisation of two intersections, namely Beaudesert Road/Lillian Avenue and Muriel Avenue/Gladstone Street.

A detailed traffic engineering assessment of the permanent road capacity changes was undertaken by AECOM (AECOM, October 2010) around two key CBD stations, namely Albert Street and Roma Street. For each of these stations the following activities were undertaken:

- Detector loop counts of effected intersections in the CBD were supplied by BCC as a basis for the design work. However examination of the 12-hour data supplied shows that approximately 40% of the detector loops at both the Albert Street and Roma Street sites were inoperable. As such additional 15-minute manual surveys were undertaken.
- Examination of the current and historical data available suggests that traffic conditions in the CBD are very dynamic and variable with short peaks in volume recorded at different times within the peak periods, with varying daily profiles at each intersection. The data available for some intersections suggests that flows may have dropped overall since 2008; however the limited data available makes it difficult to define a definitive trend in this regard.
- Intersection signal phasing and coordination plans were also obtained from BCC for inclusion in the base traffic models. The coordination plans show the CBD signals to be running on fixed time plans for each peak and inter-peak period of the day.
- The proportion of turning movements at each intersection was estimated by undertaking 15-minute, lane-by-lane traffic surveys for each traffic movement at the same time as the detector loop recordings. The traffic surveys of relevant intersections were undertaken in sequence at each precinct on Tuesdays and Wednesdays. The sample counts included pedestrians crossing at each intersection with an estimate of direction, and also included classification of traffic into cars, buses, heavy commercial vehicles and cyclists. Indicative queue lengths and delays were also noted on a lane by lane basis and it was noted that congestion levels at the sites observed were generally low to medium with traffic queues typically clearing each cycle.
- The Cross River Rail Patronage Forecast Model (CPM) was used to determine annual traffic growth rates for the period 2009 to 2031 for the CBD – these were found to be 0.6% and 0.8% for the AM (and PM) peak period for the With and Without (or do-minimum) scenarios respectively. 24-hour daily annual growth rates for the period 2009 to 2031 of 1.0% and 1.1% for the with and without Project cases were also provided. To be conservative and allow for a degree of traffic redistribution, the higher 24-hour highway (general road traffic) growth rates were adopted for the design analysis and applied to the available historical and sample survey traffic data.
- Growth rates for public transport (PT) of 2.6% with the Project and 2.4% without the Project were also provided which were used as a proxy to represent the growth of pedestrian traffic in the CBD.
- The proposed intersection layouts around Albert Street station were tested in SIDRA version 5.0 for 2010, 2021 (with and without Cross River Rail, AM and PM peaks) and 2031 (with and without Cross River Rail in both the AM and PM peaks. SIDRA was used as a comparative tool to assess the concept designs and the impacts the project will have on traffic operations at key intersections including degree of saturation, delay, queues and Level of Service changes. The intersections around Albert Street are closely spaced and the signals operate on fixed plans which are co-ordinated across the CBD. Although SIDRA takes some account of signal coordination such as the extent of vehicle platooning, it considers intersections in isolation and does not model network operations therefore the results must be viewed with some caution.

- The proposed intersection layouts around Roma Street station were tested in TRANSYT for 2010, 2021 (with and without Cross River Rail, AM and PM peaks) and 2031 (with and without Cross River Rail in both the AM and PM peaks. TRANSYT is a traffic network modelling software package capable of providing optimised signal phasing for closely associated intersections. TRANSYT modelling was developed for Roma Street to assist in the design of future year signal phasing arrangements and to provide analysis of network performance including changes in degree of saturation, delay, queues, Level of Service and journey time. Base year (2010) modelling was produced using existing traffic flow, network and signal data. These models were then calibrated using surveyed queue length and journey time data to ensure the accuracy of the model forecasts. The Roma Street TRANSYT model extends from the Makerston Street intersection in the west to the Parklands Boulevard intersection in the east and includes the George Street/Herschel Street intersection to the south.
- Neither SIDRA nor TRANSYT are able to represent the redistribution of traffic within a network due to changes in intersection or link capacity. It is considered that the predominant factors in establishing traffic levels in the CBD are the level of development and associated parking provision, public transport availability and public parking availability, regulation and pricing. It is recognised that there a large proportion of vehicle trips on CBD roads are through trips whose origin and destination is outside the CBD. It is expected that any minor traffic distribution resulting from changes to intersections to provide better for pedestrians will be accommodated in the dynamic CBD and city frame traffic environment. As the 'captive market' of CBD destined traffic increases through intensification of land use it may be expected that there will be some generally beneficial reallocation of through traffic to alternate routes.

The following basic assumptions have been made in assessing the Albert Street intersections in SIDRA:

- The existing phasing sequence has been assumed for all future year models both with and without the Project, (unless stated otherwise).
- The current cycle time has been assumed for all future year models, both with and without Cross River Rail. Intersections on Albert Street typically have a cycle time of 90 seconds while those on Roma Street are a mix of 90 second and 120 seconds.
- SIDRA has been set to optimise green times that satisfy to practical degree of saturation for critical movements (as defined by SIDRA).
- The percentage volume of heavy vehicles (HV) for future years has been calculated on an averaged existing intersection count form sample counts in the CBD. A 5% proportion of HVs has been assumed as a typical figure with a higher figure of 10% being adopted on Elizabeth Street due to the higher observed proportion of buses and other large vehicles. Typically the proportion of HVs on Albert Street was observed to be considerably lower or zero. The application of this figure across all movements at an intersection is considered to provide a conservative basis for analysis.
- An additional 5% peaking of traffic volumes has been allowed for in the SIDRA models as a conservative approach to allow for the dynamic nature of traffic flows within and through the CBD.

The following basic assumptions have been made in assessing the Roma Street intersections in TRANSYT:

- All traffic volumes used in Transyt were converted to Passenger Car Units (PCUs). This ensures the variation in acceleration and physical length of vehicle types is accounted for in the model calculations.
- The surveyed intersection turning counts were balanced across the network using a manual process to ensure all downstream exit flows were equal to upstream inflows.

- Phasing plans for the signalised intersections in the network have been provided by BCC and phase splits and offsets have been determined directly from these for the AM and PM peak existing networks. In the 2016 and 2032 do-minimum scenarios these existing timings were retained and only adjusted when approaches became oversaturated. In this situation the phase splits were adjusted by the minimum amount possible to bring all approaches within capacity and avoid potential diversion effects.
- For the proposed with project scenarios in 2021 and 2031, the phasing plan for the intersection of George and Herschel Streets was modified from five to three phases to account for the removal of the bus contra-flow on George Street
- TRANSYT was used to optimise the phase splits and offsets for the proposed network (with Project), maintaining the existing network cycle times of 90 seconds in the AM peak and 120 seconds in the PM peak.
- Saturation flows applied to the network have been based on those defined within the current Austroads Guide to Traffic Management, Part 3: Traffic Studies and Analysis, 2009. An Environmental Class B has been assumed for the study area, due to ample lane widths and turning radii. Lane type has then been assigned according to the movements permitted on the lane only, as pedestrian interference has been accounted for separately
- To account for the delay to turning traffic that occurs as a result of parallel running pedestrian movements at signalised intersections, TRANSYT start lags were used to hold the effected movements for a set period from the start of the phase. The extent of these turning movement delays is highly dependant upon the volume of pedestrians crossing. As such three categories of crossing were defined and the amount of additional delay to the turning movement calculated separately

Further information can be found in the Traffic Engineering Design Report, (AECOM, October 2010). An assessment of the impacts of the proposed closure of the Beaudesert Road Service Road Open Level Crossing was also undertaken. For this assessment the following methodology was used:

- Two-hour concurrent classified traffic volume surveys (using automated video based technology) and travel time surveys (using the floating car method) were undertaken for both peak periods, in December 2010
- Traffic signal plans and cycle times were obtained from TMR and BCC as relevant and a traffic model was developed using TRANSYT software for the Beaudesert Road corridor and calibrated to a 2010 base year
- 2016 (although used to represent 2021 opening year) and 2031 models were developed for both do-minimum and with Project scenarios.
- The with Project scenarios involved manually reassigning diverted local traffic from the closed service road onto Beaudesert Road via new signalised intersections.
- Both do-minimum and with project scenarios involved ‘growthing up’ background 2010 traffic volumes by 0.9% per annum from 2010 to 2016 and 2% per annum from 2016 to 2031. This is based on strategic transport model growth assumptions for the region.

Further information can be found in the Traffic Engineering Design Supplementary Report – Road Works in Rocklea Area, (AECOM, March 2011).

3.6.6 Pedestrian assessment

Pedestrian assessments were undertaken through:

- analysis of changes in boardings and alightings at stations (as outlined in **Section 3.5**) and the impact of such on pedestrian level of service within the station
- analysis of pedestrian access routes surrounding new stations or new station entrances including Exhibition, Roma Street. Albert Street and Woolloongabba where known pedestrian pinchpoints exist
- analysis of proposed pedestrian crossing facilities at Boggo Road and Yeerongpilly station to ensure an appropriate level of infrastructure is provided
- a more detailed analysis of footpath and crossing level of service within the Albert Street station precinct to justify and confirm design interventions required. Further details of the assumptions used in this analysis are outlined below.

A pedestrian Level of Service Assessment was undertaken around the proposed Albert Street Station based on Level of Service definitions developed by John J. Fruin, (Fruin, 1987). This assessment was undertaken for both the without Project and with Cross River Rail scenarios for Albert Street and its approaches (28 footpath links in total).

For the With project scenario the midblock pedestrian volumes for 2031 were derived by:

- growing the corrected baseline counts using the BSTM derived public transport growth rate as a proxy for pedestrian activity growth
- reducing growth baseline counts by 30% to reflect the reduction in foot traffic from Central Station (ie redistribution due to Cross River Rail
- adding distributed BSTM link volumes for Cross River Rail pedestrian traffic only. Using link volumes supplied from the BSTM, movement paths were manually plotted on the basis of likely footpath splits (ie which side of the road) and logical shortest length paths. 19% of the two hour modelled pedestrian volume was used to derive the peak 15-minute volume which represents the peaking of train services and the likely maximum discharge rate at the station.
- a peaking factor was applied to the pedestrian volumes to account for platooning of pedestrians as they move off from traffic signals. The peaking factor used the proportion of the 90 second CBD standard cycle time assigned to pedestrian green time at the upstream intersection. This provides an indicative representation of pedestrian platooning and is considered to provide a more realistic design case than average volumes which an even spread of arrivals. For movements leaving the station the peaking factor is set to one as pedestrian flow is a function of maximum escalator capacity and can be considered to be essentially constant across a traffic cycle.

A similar process was used to determine the number of pedestrians using each traffic signal crossing for use in the SIDRA intersection analysis and to check on the suitability of standing area provision at traffic signals. The accumulation of pedestrians on a corner for design purposes with parallel crossing signal phasing was assumed to consist of all of the dominant flow arrivals in the cycle time plus half of the perpendicular pedestrian crossing arrivals.

Pedestrian Level of Service was defined using the following table. Levels of Service A to C were considered good with LOS D acceptable for short periods during peak times. LOS E and F were considered unacceptable for day to day operations but potentially acceptable for event conditions, subject to appropriate control and management measures being in place.

Table 3-10 Fruin Level of Service categories for walkways, stairs and queuing areas

Colour code	Level of Service (LOS)	Walkways (m^2 per person)	Stairs (m^2 per person)	Queuing (m^2 per person)
	A	>3.25	>1.86	>1.21
	B	2.32-3.25	1.39-1.86	0.93-1.21
	C	1.39-2.32	0.93-1.39	0.65-0.93
	D	0.93-1.39	0.65-0.93	0.28-0.65
	E	0.46-0.93	0.37-0.65	0.19-0.28
	F	<0.46	<0.37	<0.19

Source: Fruin JJ, 1977

3.6.7 Construction road traffic impact assessment

The methodology for the construction road traffic impact assessment is presented in **Chapter 7** of this report.

4 Description of the existing transport network and its performance

This chapter starts by outlining the current transport policies at all levels of government and the transport network and operations ownership and responsibilities in South East Queensland. Trends in travel growth, mode share, pricing and fares and parking are also presented.

The existing (2009) conditions of the traffic and transport networks and services within and around the study corridor relating to passenger rail, freight rail, bus, ferry, active transport and road traffic are then described.

4.1 Current transport policies, responsibilities and trends

Australian (Federal) transport policy

The Department of Infrastructure and Transport administers policy and programmes relating to transport, for the Federal Government. The Department provides policy advice to the Minister for Infrastructure and Transport, conducts research and analysis, provides safety information and advice and performs regulatory functions.

The Department's core purpose including its overarching policy goals is:

- providing funding for transport infrastructure
- promoting safe and secure transport solutions
- providing a framework for competition between and within transport modes
- promoting a transport system that is accessible, sustainable and environmentally responsible.

Queensland (State) transport policy

The South East Queensland Regional Plan (Department of Infrastructure and Planning, 2009) is the Queensland Government's statutory planning document for the South East Queensland region. The plan proposes that a major contribution to supporting sustainable population growth is investment in rail, including Cross River Rail.

The draft Integrated Regional Transport Plan for South East Queensland - called *Connecting SEQ 2031* (Department of Transport and Main Roads, 2010) provides the framework for the integrated planning, design and delivery of transport and land use across the region, consistent with the broader South East Queensland Regional Plan. Connecting SEQ 2031 proposes a target of 14% of all trips across South East Queensland by public transport by 2031 – an increase from 7% in 2010. In Brisbane, public transport mode share is expected to increase more significantly, from 10% to 20% of all trips by 2031. Connecting SEQ 2031 places strong emphasis on rail supporting the region's continued growth with Cross River Rail a key component of the future SEQ rail network.

The 2010 South East Queensland Infrastructure Plan and Programme, or SEQIPP, (Department of Infrastructure and Planning, 2010) is a $126 billion investment plan and programme for the region over the next 21 years. Cross River Rail is seen as a key enabling project at the heart of the rail improvement programme to support growth.

The Rail Network Strategy (Department of Transport and Main Roads, 2009) is a whole of state rail strategy and policy guideline which provides a series of objectives for investment in the rail network, including efficiency, managing congestion and safety.

The TransLink Network Plan (TransLink, 2010) is an eight-year plan and one year programme of works and improvements to the public transport network in South East Queensland. At present this plan only identifies short term rail and bus improvements including service frequency enhancements.

Brisbane City Council

BCC has developed the Transport Plan for Brisbane (2008 to 2026) (BCC, 2008) which performs the function of an Integrated Local Transport Plan, under the region's Integrated Regional Transport Plan.

The plan recognises that the city's economic growth and the lifestyle of its residents depend upon an efficient transport system. The transport plan includes investment in public transport, walking and cycling with an efficient road network. The transport plan responds to and references:

- South East Queensland Regional Plan and Infrastructure Plan and Program
- TransApex transport policy (a ring road/bypass strategy for inner Brisbane)
- Brisbane's draft City Shape Implementation Strategy
- City Centre Master Plan
- TransLink Transit Authority Network Plan.

The plan focuses on transport corridors, which are the major arterial routes through the city. The plan:

- defines the specific transport projects Council will make in an area
- directs planning work to major road corridors and the roads that feed into them
- considers how to manage travel demand in those corridors, looking at a range of projects to manage congestion, such as additional road space, more public transport, walking and cycling facilities and/or improved signal coordination.

The Transport Plan for Brisbane also sets mode share targets for the transport system. The plan suggests that by 2026, public transport should be catering for around 13% of all trips in Brisbane (24 hours), however it proposes that 75% of all motorised trips to the CBD in peak hours should be on public transport.

4.1.2 Ownership and responsibilities of the transport system

Australian (Federal) Government

The primary responsibility for road and rail infrastructure is with the States, however the Australian (Federal) Government has an overall role in the safety and efficiency of transport systems. The Government also funds transport projects directly through its Nation Building Program. The Australian Government is investing $37 billion on road and rail infrastructure throughout the Nation Building Program over the six-year period from 2008-09 to 2013-14. The Department is delivering this investment through a range of road and rail programs and projects across the National Land Transport Network. The network is based on national and inter-regional land transport corridors that are of critical importance to national and regional growth.

Queensland (State) Government

State Transport policy is managed by the Department of Transport and Main Roads that was formed in April 2009 with the merger of the former Queensland Transport and Department of Main Roads.

The Department of Transport and Main Roads aims to move and connect people, places, goods and services safely, efficiently and effectively across Queensland. The Department of Transport and Main Roads plans, manages and oversees the delivery of an integrated transport system for road, rail, air and sea that supports sustainable economic, social and environmental outcomes in Queensland.

The Department works closely with Queensland Rail, port authorities, TransLink Transit Authority, other state and federal government departments, local governments, industry and the community to ensure a coordinated, consultative and integrated approach to addressing and resolving transport and road challenges.

The Department is responsible for the operation and maintenance of the State Controlled road network in Queensland.

The TransLink Transit Authority is a statutory authority of the Queensland Government charged with meeting the public transport needs of South East Queensland. TransLink provides public transport information and oversees services provided by bus, train and ferry operators in the region and aims to improve and expand public transport services.

Queensland Rail (QR) is the state owned passenger transport operator and passenger rail network owner following the separation of passenger services from the coal and freight businesses on 1 July 2010.

QR run more than 260,000 scheduled services and carries 62 million passengers a year on 8000 km of track and service the population centres of South East Queensland and connects the regions of the state.

QR operates passenger rail services on the suburban rail network across much of South East Queensland. This network extends from the centre of Brisbane south to Varsity Lakes on the Gold Coast, north to Gympie, east to Cleveland and west to Rosewood (west of Ipswich) and covers approximately 300 km of track and encompassing 144 stations.

The QR Traveltrain rail network plays an important role in connecting regional Queensland. These services extend along the Queensland coastline from Brisbane to Cairns and west to Charleville, Longreach and Mount Isa.

QR National is the entity created following the separation of the Queensland Rail's freight, network and services businesses from Queensland Rail passenger services. QR National has a significant focus on coal and mineral haulage across Queensland, New South Wales and Western Australia. QR National's freight haulage operations span the entire east coast of Australia, and west to Perth.

Brisbane City Council (Local Government)

BCC is the responsible local authority for the maintenance and operations of all roads, footpaths and bikeways within the study corridor with the exception of the State Controlled Road network. BCC also operates most of the buses within the Council boundary through its commercial arm, Brisbane Transport and also manages scheduled passenger ferry services on the Brisbane River on behalf of TransLink.

4.1.3 Trends in public transport growth to the central business district

This section presents a broad overview of trends of the economy and population in South East Queensland and trip making, particularly public transport trips, to the Brisbane CBD.

Population, employment and economic trends

The economic and demographic trends since 1996/7 are illustrated in **Figure 4-1**. Gross state product (real) has increased by 5% per annum whilst petrol price trends have been variable but overall are close to the gross state product trend. Population has grown at 2.1% per annum.

The growth in employment over this period was higher than population, at 2.7% per annum.

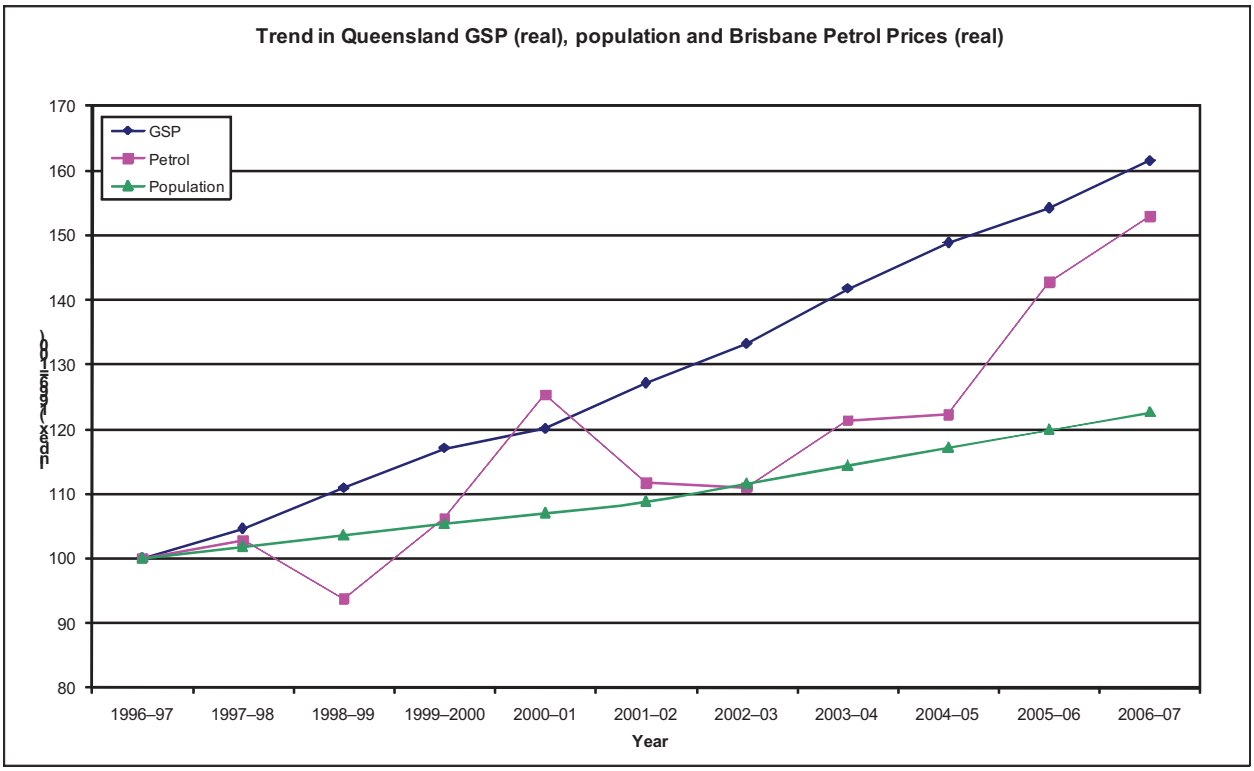


Figure 4-1 Economic and demographic trends

Source: ABS, 2010

Table 4-1 presents the current (2009) population and employment for the Brisbane Metropolitan Area. The Brisbane Metropolitan Area accounts for about two-thirds of the South East Queensland region's population. Brisbane City's population share of the region is currently 45% of the total. Brisbane City also dominates as the major employment and education centre for the region.

Table 4-1 Existing (2009) population and employment

Parameter	Brisbane Metropolitan Area	Central Business District
Total persons	1,891,600	15,500
Area (km²)	4,700	4
Density (persons/km²)	400	3,900
Total households	718,300	6,400
Total employment	1,041,500	170,600
Total enrolments (primary, secondary and tertiary)	505,300	34,900

Source: Cross River Rail Project Model

Table 4-2 presents growth in population and employment for the period 2006 to 2009 for the Greater Brisbane Area. This shows growth of almost 6% for population and 8.5% for employment.

Table 4-2 Growth in total population and employment for the Greater Brisbane Area, 2006 to 2009

	2006	2009	Growth
Population	1,786,300	1,891,600	5.9%
Employment	960,200	1,041,500	8.5%

Source: Census Data, PIFU and NIER projections

The census of population: commuting patterns

National census statistics for the 10 year period 1996-2006 for the Greater Brisbane Area (**Figure 4-2**) show that the volume of commuting by public transport has increased on average by 3.8% per annum (45% over 10 years), with rail increasing more rapidly than bus since 2001 (6.1% per annum for rail, 3.6% per annum for bus).

Employment increased by 31% over the 10 year period, which accounts for a large part of the growth in public transport commuting. Additionally, the public transport share increased a little over the 10 year period, from 12.5% in 1996 to 13.8% in 2006. Most of this increase was on rail in the second half of the period (the rail patronage growth rate between 2001 and 2006 was 6.9% per annum).

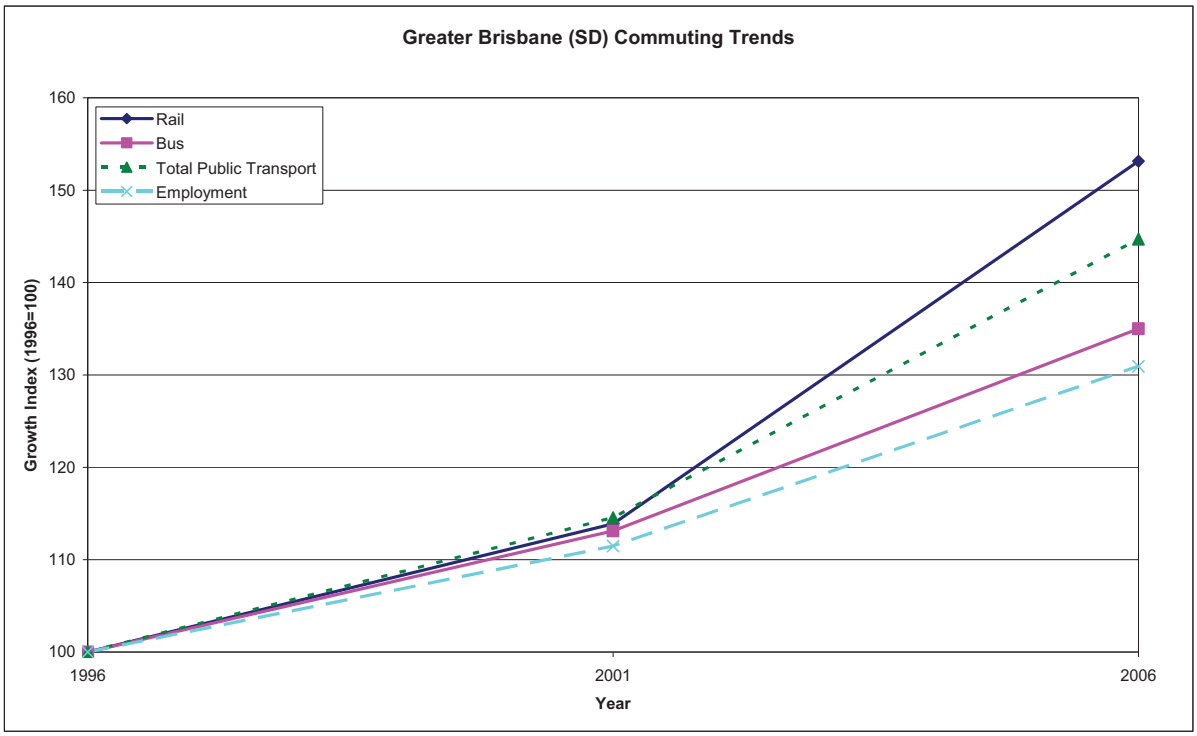


Figure 4-2 Greater Brisbane commuting trends from the census

Source: ABS, 2010

Public transport and rail in particular, is focused on travel to and from the Brisbane central business district (**Figure 4-3**)[1]. Public transport commuting to Brisbane central business district[2] grew in volume by 4.1% per annum (50% over the 10 year period). Employment growth in the central business district[3] was 24%, accounting for only half of the growth in commuting by public transport, the significant increase in the public transport share from 41.5% to 50.2% being equally important in accounting for patronage growth.

In the second half of the period, bus patronage increased twice as fast as rail (5.8% per annum for bus as against 2.9% per annum for rail), the opposite of the Greater Brisbane trend, although the average growth rates for each mode over the full 10 year period were similar.

Growth in employment and growth in the public transport mode share were broadly equal in their contribution to the increase in public transport commuting to the central business district.

For reference, in 2006, the split of commuting to the central business district between the main public transport modes was 54% rail, 43% bus and 3% ferry. The split between public transport and car trips is in the order of 50:50 for commuting trips to the central business district.

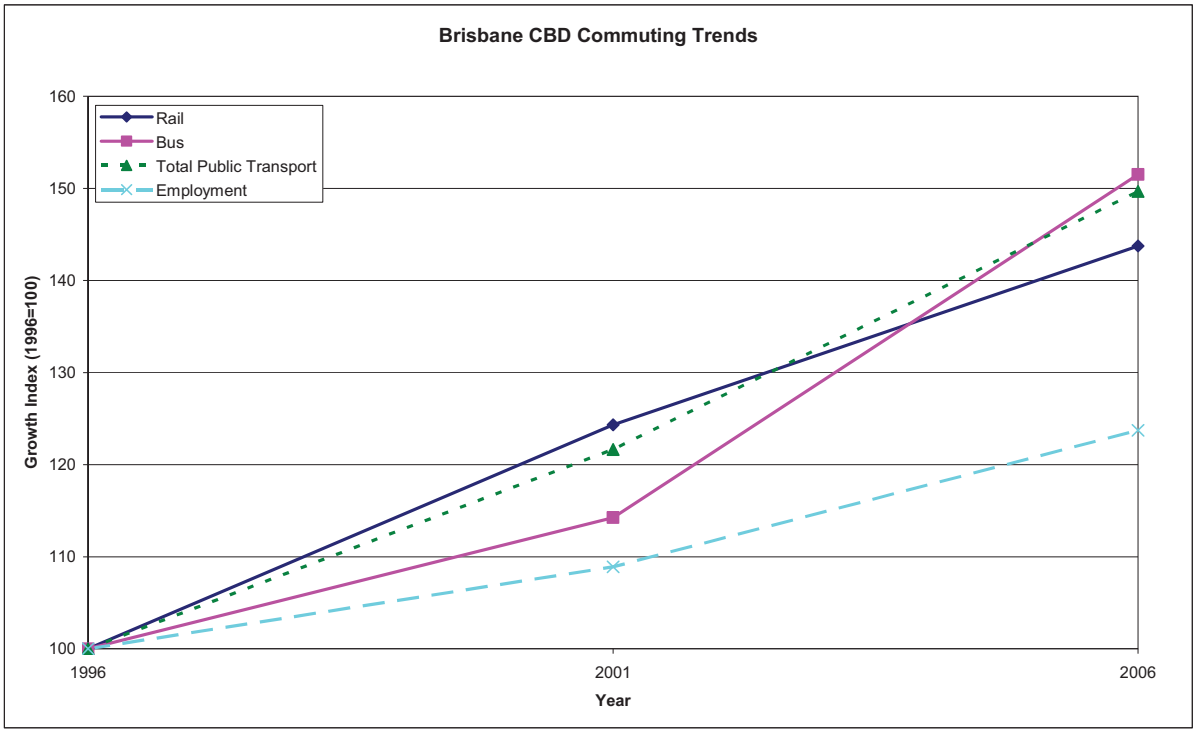


Figure 4-3 Commuting trends for Brisbane central business district employment from the census

Source: ABS, 2010

[1] In 2006, according to the census, nearly 80% of rail and over 50% of bus commuting trips were to/from the CBD.

[2] This is the wider CBD, including also Spring Hill, Fortitude Valley and South Brisbane, and accounting for just under 20% of all Brisbane employment.

[3] CBD employment growth over the 10 year period (24%) was lower than the employment growth for Brisbane as a whole (31%).

Other public transport trends

Based on the QR passenger load surveys for the period 2005 to 2009, Brisbane average rail growth rates of 6.7% per annum for morning peak boardings and 5% per annum for evening peak alightings have been achieved.

Implications of these trends for Cross River Rail

The Cross River Rail primary interest is in public transport travel to and from the Brisbane CBD. According to the census, this grew (for commuters) by 4.1% per annum over the decade to 2006. More generally, there is consistent evidence that the growth rates for public transport travel demand have been high – in the range of 3.8% to 6.9% per annum, depending on mode, period, geographic area and data source.

Over the 10 year period 1996-2006 public transport patronage growth rates have exceeded the growth in economic activity (population and employment). This has been most marked for travel to and from Brisbane CBD, for which the increase in employment accounts for about half of the patronage growth, with an increase in the public transport mode share accounting for the other half.

Factors which may have influenced the mode share include increasing road congestion, the new fare system, improvements to public transport services (principally the busways) and changing commuting patterns associated with the growing metropolitan area.

4.1.4 Existing mode shares

The modelled growth in total daily person-trips for the Greater Brisbane Area, by mode between 2006 and 2009, is detailed in **Table 4-3** below. Overall growth is estimated at 6.4% (just over 2% per annum between 2006 and 2009). Forecast growth in public transport trips is much higher at 24.2% which accords well with TransLink's reported patronage growth of approximately 23%[4].

Table 4-3 Growth in total daily demands for the Greater Brisbane Area, 2006 to 2009

Mode	2006		2009		Growth
	Person trips	Mode share	Person trips	Mode share	
Car driver	3,695,000	58.6%	3,908,100	58.3%	5.8%
Car passenger	1,456,500	23.1%	1,515,100	22.6%	4.0%
Public transport	484,500	7.7%	601,600	9.0%	24.2%
Walk and cycle	664,400	10.5%	676,600	10.1%	1.8%
Total	6,300,500		6,701,400		6.4%

Source: SKM-Aurecon CRR JV Benchmark Forecasting Model_BSTM-MMC

As detailed vehicle counts were not assembled for 2009, the modelled growth in screenline totals between 2006 and 2009 has been assessed. The growth in car driver demands of 5.8% translates to an overall growth in daily vehicle traffic across all screenlines of 6.4% as demonstrated in **Table 4-4**. Growth in vehicle traffic into the central business district in the peak period is somewhat lower, contrasted against the growth in public transport trips, which is significantly higher at 34%. These forecasts are consistent with the capacity constraints on the road network both into the central business district and across the Brisbane River.

[4] Translink Transit Authority Annual Report, 2008-09.

Table 4-4 Growth in screenline volumes, 2006 to 2009

Mode	Vehicle traffic		PT Passengers	
	AM Peak	Daily	AM Peak	Daily
CBD circle – inbound	-2.6%	2.5%	34.1%	13.6%
Brisbane River – northbound	1.9%	4.6%		19.2%
Brisbane River – southbound	5.3%	4.6%		26.3%
All screenlines	6.1%	6.4%		

Source: SKM-Aurecon CRR JV Benchmark Forecasting Model_BSTM-MMC

4.1.5 Pricing and fares

Public Transport in South East Queensland is managed and coordinated by the TransLink Transit Authority. TransLink have developed a consistent region-wide zone and fare structure which covers 23 zones. The Brisbane CBD is the heart of the network and is zone 1. The network extends as far north as Gympie, south to Coolangatta and west to Helidon (west of Ipswich). Fare zones covering Brisbane are illustrated in **Figure 4-4**.

Fares are calculated at either an adult or concession rate and based on the number of zones you travel through during your journey. Fares also vary between paper and electronic (go card) payment methods, with an off peak discount applied for electronic (go card) transactions only. The current (2011) adult paper fare within one zone is $3.90, while the equivalent peak fare on go card is $2.65 and the off peak go card fare is $2.26. The current (2011) adult go card fares within five zones (for example Strathpine, Moggill or Kuraby to the Brisbane CBD) are $4.72 (peak) and $4.02 (off peak). Concession fares are half the equivalent adult fare.

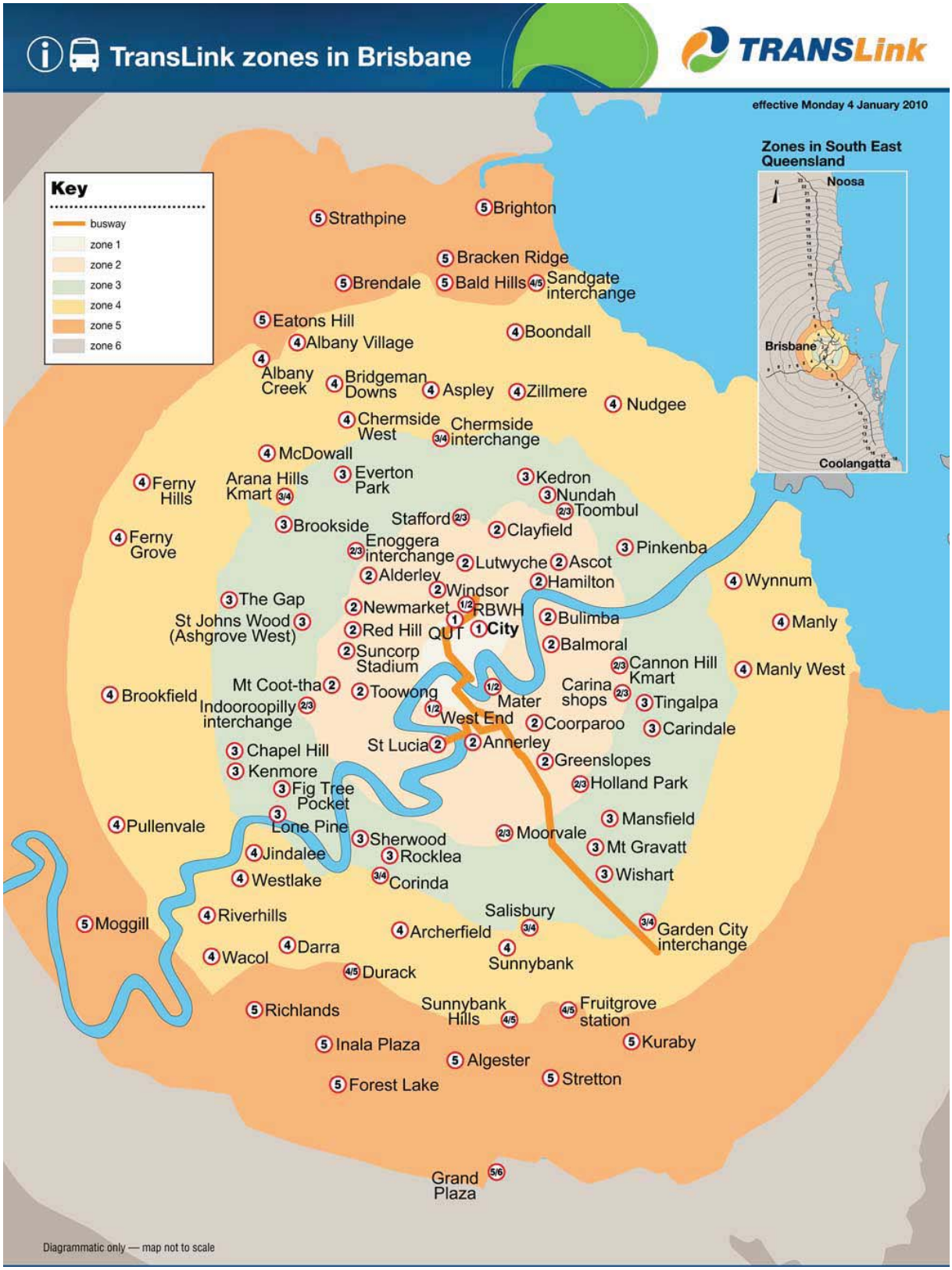


Figure 4-4 Fare zones in Brisbane

Source: www.translink.com.au, 2010

4.1.6 Road pricing

The current State Government and BCC transport policy does not support distance or cordon based road pricing as a policy position. The current private transport cost base including taxation arrangements and route-specific tolls are expected to remain unchanged for the foreseeable future.

Future policy settings and assumed planning changes into the future for the purpose of investigating Cross River Rail were presented in **Section 3** of this report.

4.1.7 Parking in the study corridor

Access, parking and servicing for new development

Parking for new development within the Study Corridor is set by Brisbane City Council (BCC) Code A7.3 of the Transport, Access, Parking and Servicing Code of the Brisbane City Plan (Brisbane City Council, 2000) states:

> *On-site car parking numbers for development in the City Centre or City Frame[5] do not exceed 1 car space for every 200 m² of gross floor area for any development other than multi-unit or single unit dwelling or Short Term Accommodation.*

Parking must be provided, designed and located to ensure it is convenient and safe. However the policy states that parking in the City Centre must achieve a balance between controlling congestion and providing sufficient short term shopping and business parking to keep the City Centre viable. Long term parking within the City Centre is strongly discouraged, particularly in the case of purpose built car parks. Note that parking rates in the City Centre and Frame are maximum rates (that is parking is capped to a maximum of one space per 200 m² for any development other than dwellings) and as such no parking may be provided in these developments.

Outside of the City Centre and City Frame, minimum parking rates apply which are generally intended to cater for user car parking needs within the development.

Car parking for multi-unit dwellings depends on the size and mix of units. The policy suggests the following parking rates:

Table 4-5 BCC parking rates

Dwelling unit size (number of bedrooms)	Average vehicle spaces per dwelling unit
1	0.5
2	1
3	1.5
4 and above	2
AND 1 visitor space for every 20 dwelling units	

As such, despite maximum parking rates and discouragement of long term commercial/retail parking, the continued intensification and development of the CBD is expected to continue to generate vehicle trips onto the CBD road network, in particular loading and servicing trips.

[5] On 10 May 2011 Council resolved to amend the Transport, Access, Parking and Servicing code to increase parking rates for the City Frame

Off street parking prices in central Brisbane

A 2010 Colliers International survey of global city centre parking charges found that Brisbane was the ranked 15th in the world in terms of most expensive unreserved monthly parking rates and equal 23rd for daily parking rates. Compared to other Australian cities, Brisbane is on par with Melbourne as the second most expensive city for daily parking charges (after Sydney) at around $35 per day (Colliers International, 2010).

On street parking controls

Within large parts of the study corridor, on street parking and loading is controlled under traffic areas as listed in **Table 4-6**. The extent of these traffic areas is shown in **Figure 4-5**.

Table 4-6 Traffic areas and parking restrictions within the study corridor

Traffic area name	Suburbs included	Parking restrictions
Brisbane Central Traffic Area	Bowen Hills, Fortitude Valley, Spring Hill, Kelvin Grove, Newstead, Kangaroo Point (north), South Brisbane, West End (north), Woolloongabba (west)	Maximum two-hour parking 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 12.00 Noon Saturday Resident permits excepted
Gabba Traffic Area	Woolloongabba (east), Kangaroo Point (south), East Brisbane,	Maximum two-hour parking 7.00 am to 7.00 pm Monday to Friday Maximum 15 minute parking on event days from 7.00 am to 10.00 pm Resident permits excepted
Dutton Park Traffic Area	Highgate Hill (south), Dutton park, Buranda (west) Fairfield (north)	Maximum two-hour parking 7.00 am to 7.00 pm Monday to Friday (excluding public holidays) Resident permits excepted
Queensland Tennis Centre Parking Control Area	Tennyson, Yeronga (south), Yeerongpilly	Maximum one hour parking 7.00 am to 10.00 pm on event days only
Lang Park Traffic Area	Milton, Petrie Terrace, Red Hill	15 minute parking only (residents excepted) from midday to 10pm on event days only

On street parking in central Brisbane

The Brisbane Central Traffic Area is a regulated parking area covering the CBD and nearby suburbs, for example, Fortitude Valley, West End, South Brisbane, Spring Hill and Newstead. Within the Brisbane Central Traffic Area a two hour parking limit applies, except as signed or where meters operate, and as permitted by the road rules.

Short term (one hour and two hour) on-street parking bays in the CBD are charged at up to $4 per hour during weekdays (7.00 am to 7.00 pm). Where four hour or longer parking is available (such as in the city frame area) a fee of $2.50 per hour applies, up to a maximum daily charge of $10 on weekdays ($6 on weekends).

Parking restrictions apply Monday to Friday 7.00 am to 6.00 pm and Saturday 7.00 am to 12 noon.

Figure 4-5 Brisbane Central Traffic Area map

Source: BCC (www.brisbane.qld.gov.au)

The Gabba Traffic Area

A two-hour (2P) parking limit applies in The Gabba Traffic Area from 7.00 am to 7.00 pm Monday to Friday on all unsigned roads. During events at The Gabba, a 15-minute parking limit applies on all unsigned roads from 7.00 am to 10.00 pm on the day of the event.

Dutton Park Traffic Area

The Dutton Park Traffic area operates between 7.00 am and 7.00 pm, Monday to Friday (excluding public holidays):

- a two-hour parking limit applies to all unsigned roads within the area
- a four-hour parking limit applies to disability parking bays
- bays and 30-minute parking zones are provided near business precincts.

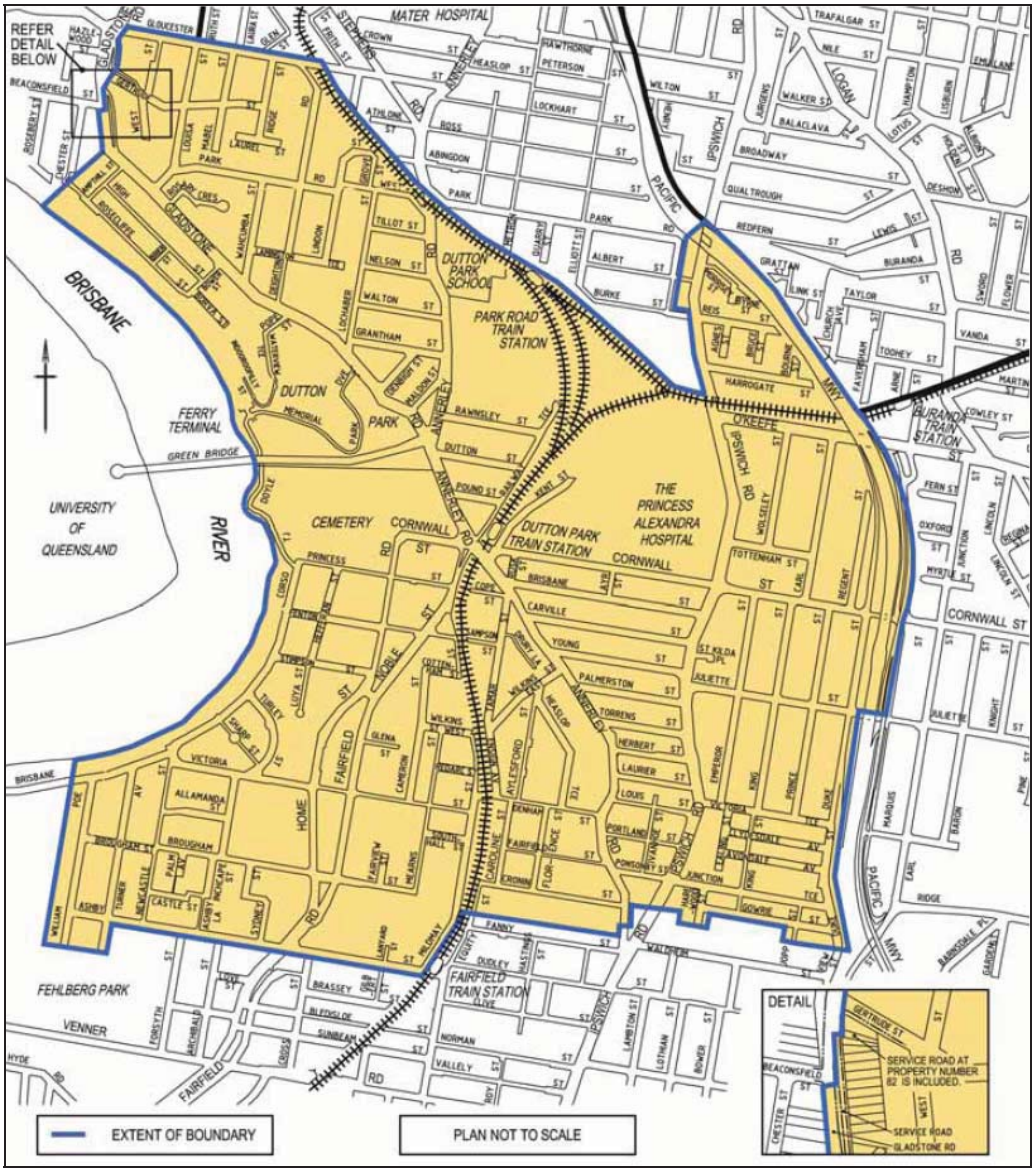


Figure 4-6 Dutton Park Traffic Area map

Source: BCC (www.brisbane.qld.gov.au)

Queensland Tennis Centre Parking Area

The Queensland Tennis Centre Parking area operates during major events only, such as the Brisbane International. During such events, parking on the streets shaded pink in **Figure 4-7** is restricted between the hours of 7.00 am and 10.00 pm to one hour only (with residents excepted by permit).

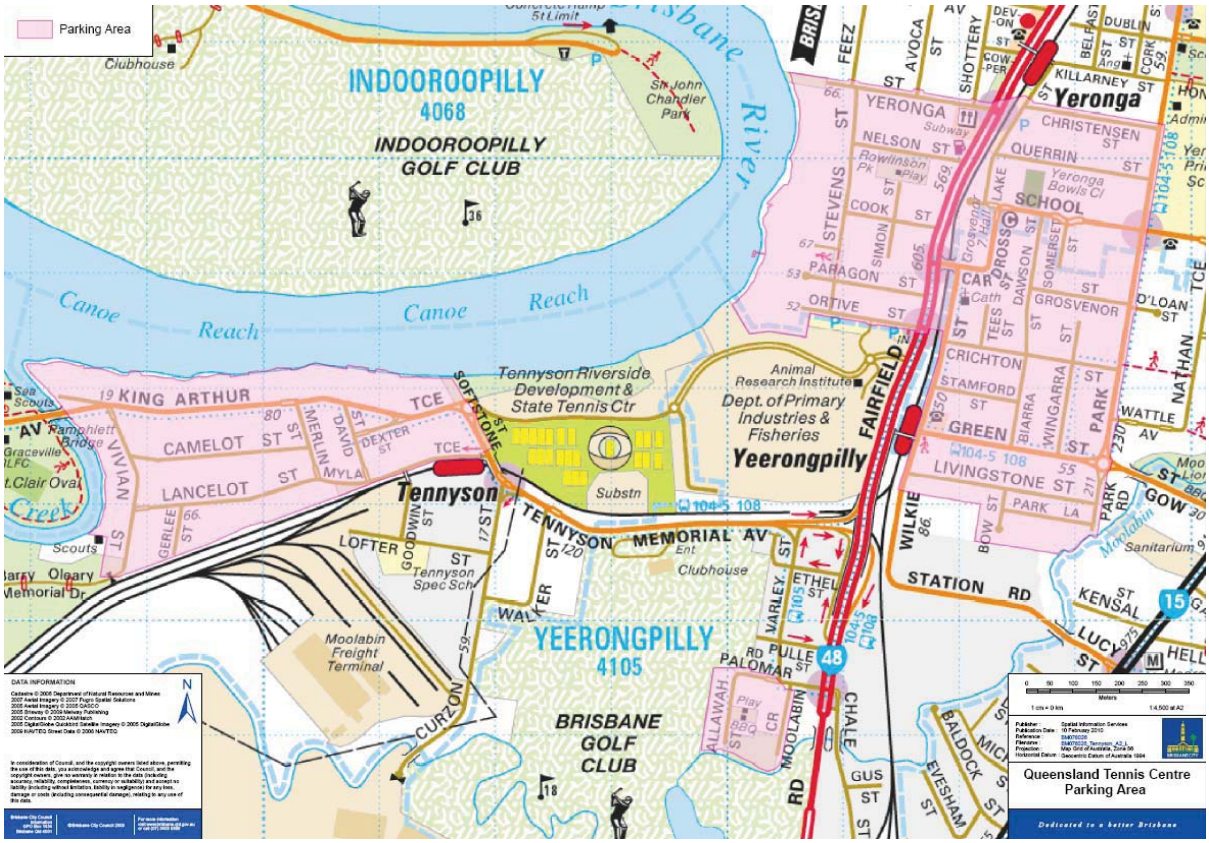


Figure 4-7 Queensland Tennis Centre Parking Area map

Source: BCC (www.brisbane.qld.gov.au)

Lang Park Traffic Area

The Lang Park Traffic Area covers part of the study corridor near Roma Street. This parking control zone applies between midday and 10pm on event days only.

4.2 Existing regional public transport networks

4.2.1 Passenger rail – the regional rail network and rail infrastructure

The existing South East Queensland rail network is a large suburban railway network by world standards. It comprises more than 300 km of track and includes 144 stations. The network (**Figure 4-8**) extends from the centre of Brisbane, south to Beenleigh and Varsity Lakes on the Gold Coast, north to Ferny Grove, Shorncliffe, Caboolture and Gympie, east to Cleveland and west to Ipswich and Rosewood.

Queensland Rail in partnership with TransLink Transit Authority provides 57 train services each weekday peak hour through the CBD. These rail services operate on suburban lines and main lines forming two largely independent sectors, namely:

- Main sector: Services operating on the main lines, including Nambour, Caboolture, Ipswich and Rosewood lines
- Suburban sector: Services operating on the suburban lines, including Shorncliffe, Airport, Doomben, Ferny Grove, Cleveland, Beenleigh and Gold Coast lines.

The current operation suggests that inter-dependencies between the two sectors still remain which constrains the rail network capacity as well as service reliability. The sharing of services and tracks between main sector and suburban sector, especially between suburban lines to the north and western lines to the south-west (Shorncliffe services are currently connected to Ipswich services during the morning peak period) mean that an incident in one sector has the potential to cause delays across both sectors.

Generally, passenger rail services in Brisbane are medium to long-distance commuter services, with heavy use during the morning and evening peaks.

As illustrated in **Figure 4-9**, the existing (2009) timetable allows 57 trains per hour into the CBD during the morning peak one-hour[6] period. These services include:

- 15 services operating on the main lines from the north. These 15 services include: two express services from Nambour (Sunshine Coast), four semi-express services from Caboolture, six services from Petrie and three services from Shorncliffe.
- 12 services operating on the suburban lines from the north. These 12 services include: three services from the Airport, two services from Doomben, five services from Ferny Grove and two services from Mitchelton.
- 12 services operating on the main lines from the west. These 12 services include two express services from Rosewood, five services from Ipswich, three services from Corinda, one service from Redbank and one service from Darra.
- 18 services operating on the suburban lines from Beenleigh, the Gold Coast and Cleveland. These 18 services include four express services from the Gold Coast, five services from Beenleigh, two services from Kuraby, four services from Cleveland, one service from Thorneside and two services from Lota. These services all use the Merivale Bridge.

[6] Arriving at Central Station between 7.30 am and 8.30 am during weekdays

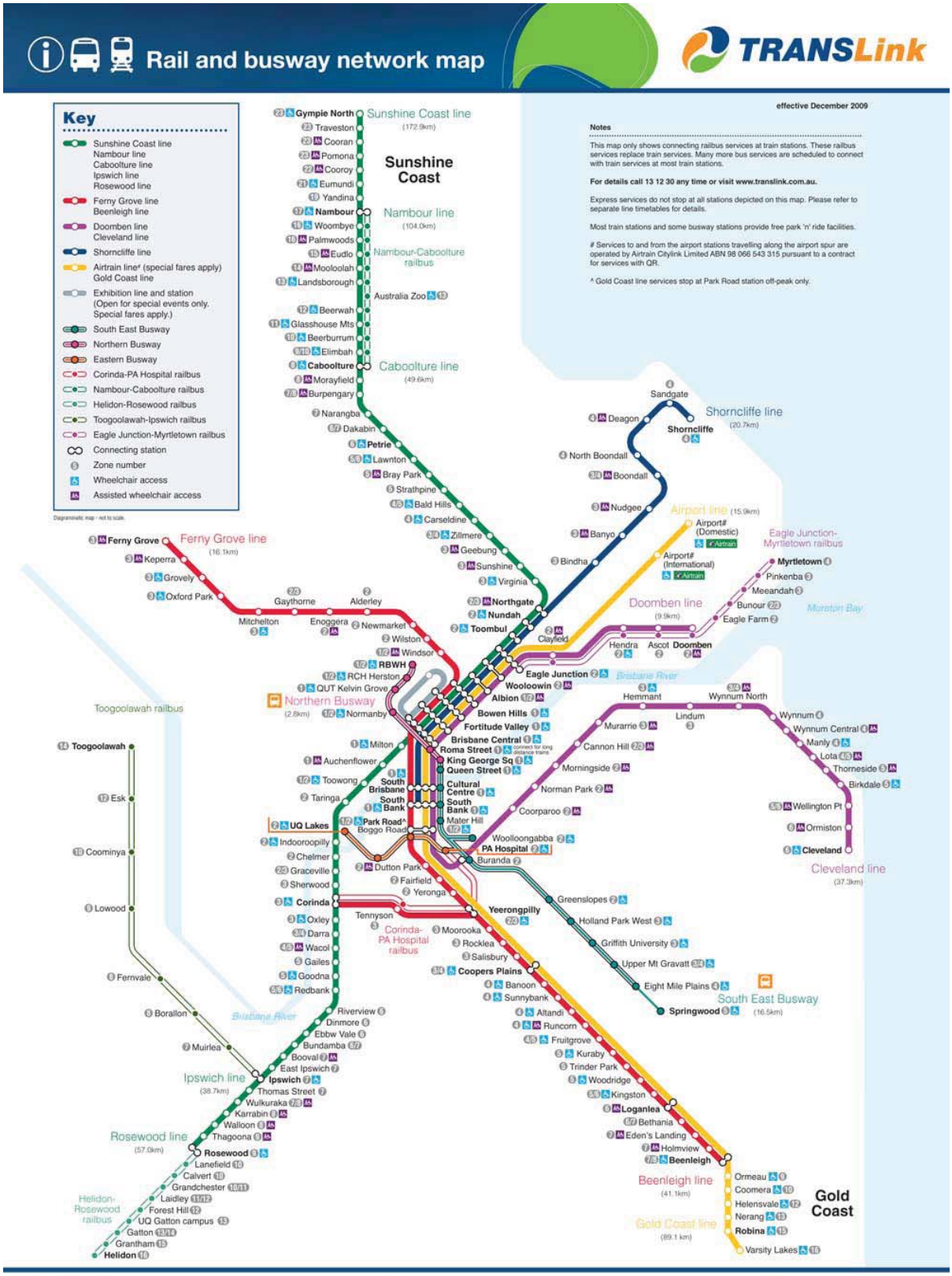


Figure 4-8 South East Queensland rail network

Source: www.translink.com.au, 2010

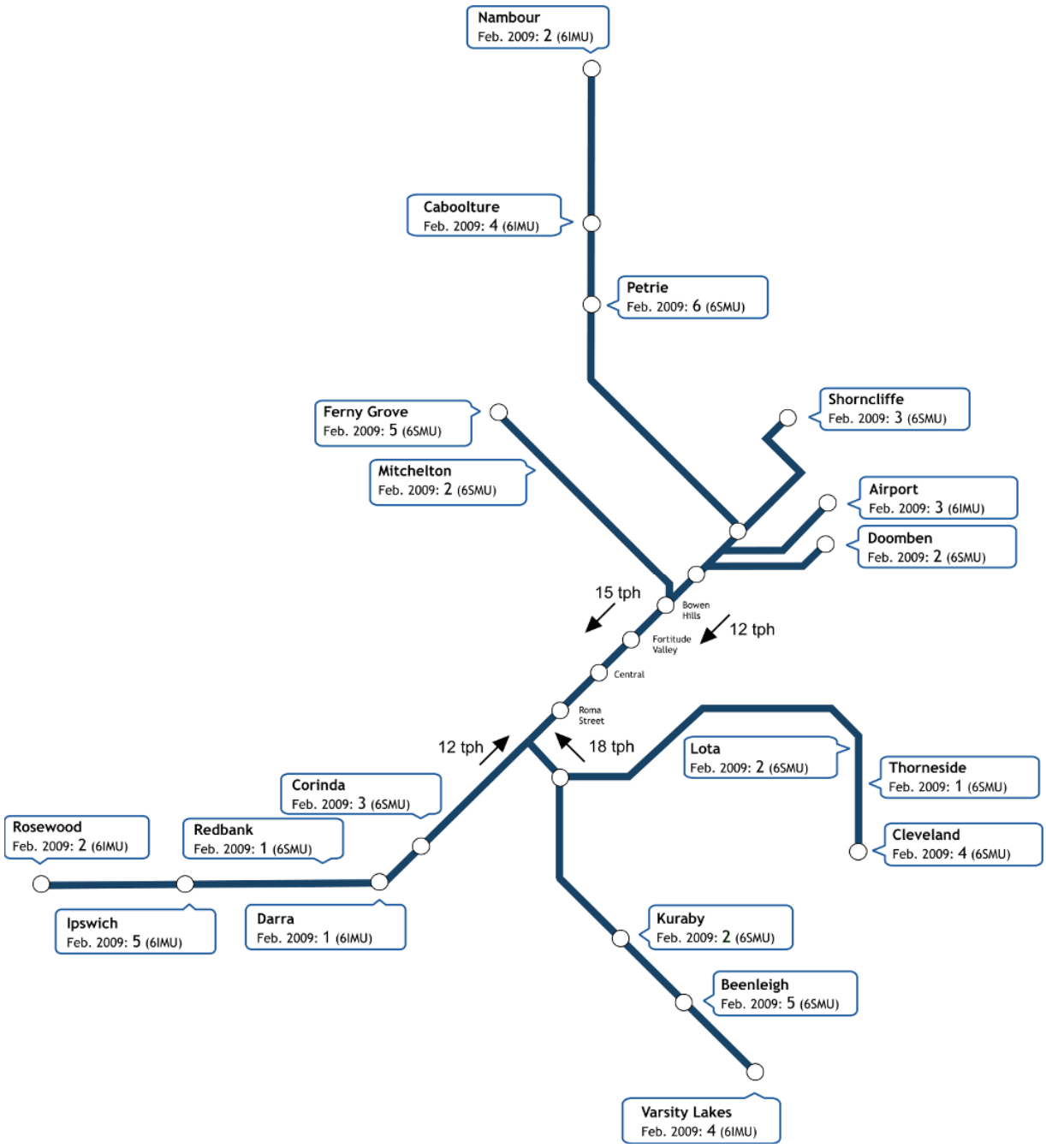


Figure 4-9 Brisbane 2009 morning peak hour (towards Brisbane CBD) Rail Service Levels

Source: Systemwide, December 2010

The current service plans on the passenger rail network are complex with a mixture of all stops, express and semi-express as well as multiple commencing or termination points on some lines. This requires passengers to have a detailed knowledge of the timetable for the most efficient travel around the network, and discourages interchanges. The wide range of stopping patterns can also reduce overall network capacity and efficiency.

The lack of strict sectorisation within the network reduces schedule robustness, and allows knock-on delays across lines. This can sometimes result in long-distance rollingstock being used for short-distance services and vice-versa, potentially reducing capacity on services to the CBD which in turn results in passenger on longer-distance commuter services not being guaranteed access to appropriate on-board facilities.

The current operations mean that inter-dependencies between the two sectors (ie the main sector and the suburban sector) constrain the rail network capacity as well as service reliability. The sharing of services and tracks between main sector and suburban sector, especially between suburban lines to the north and western lines to the south-west mean that an incident in one sector has the potential to cause delays across both sectors. For example, Shorncliffe services are currently connected to Ipswich services during the morning peak period, requiring trains to crossover from the suburban lines to the main lines and potentially delaying other services on both sectors.

At the heart of the network, the Brisbane CBD rail configuration presents finite capacity. Between Roma Street and Bowen Hills, the railway is comprised of only two pairs of tracks with a combined maximum capacity of 42 trains per hour, in each direction (84 trains per hour in total). The main lines have a theoretical maximum capacity of 19 trains per hour (each direction) while the suburban lines have a higher capacity of 23 trains per hour, per direction due to dual platform faces at Central Station allowing one train to approach the station while another (in the same direction) is at the station or preparing to depart.

As well as the inner city tunnels and stations, the approach routes to the inner city railway lines and station are also constrained which limits capacity into the inner city itself. For example, services from Milton (on the four-track western line) and Park Road (that is Beenleigh, Gold Coast and Cleveland trains on the three-track southern line) must merge together to access the CBD via only four tracks to the south-west of Roma Street Station. This limits the ability to fully exploit the capacity potential on these approach corridors individually.

Capacity across the Brisbane River in particular is constrained as long-distance express trains from the Gold Coast as well as suburban trains from Beenleigh and Cleveland must all use a single in-bound track across the Merivale Bridge. Of the 18 trains per hour approaching Roma Street from the south (over the Merivale Bridge) in the morning peak, four trains per hour are longer distance express trains from the Gold Coast. This capacity constraint on the bridge and access into Roma Street station restricts growth on these services. Cross River Rail would provide additional capacity into the CBD for this growing commuter market.

These key rail capacity constraints in the inner city rail network are shown in **Figure 4–10**.

Based on current passenger growth rates and the existing train operating regimes, the inner city rail network and in particular the approach from the south is approaching its capacity. If additional line capacity is not provided or operations changed to allow higher frequent services, peak period service performance on the passenger rail network would decline. This could lead to a greater dependence on other modes to access the CBD and spreading of the commuter peak period. These outcomes could slow the growth of the CBD and affect the city's competitiveness in the medium to long term.

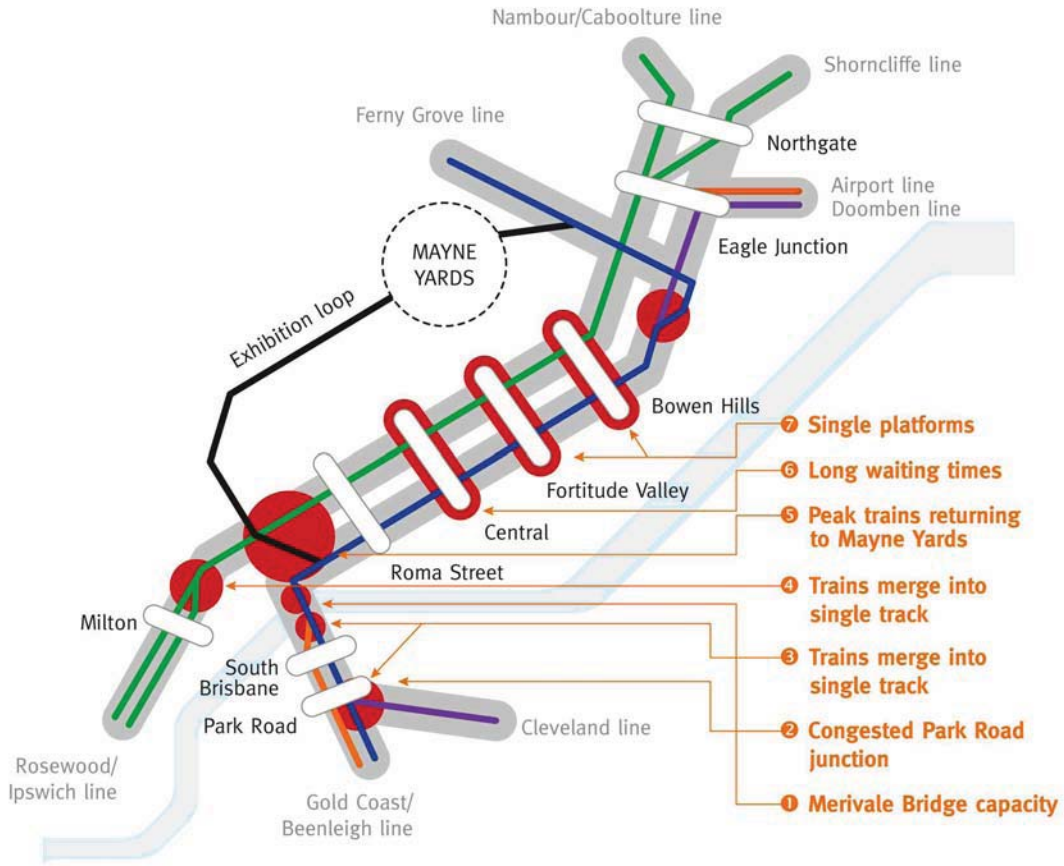


Figure 4-10 Capacity Constraints in the Brisbane Inner-City rail network

Completed rail studies and projects

Whilst some of the capacity constraints within the rail network could be resolved without building a new rail alignment, a number of previous studies have indicated that continued growth in demand for rail services means that the inner city rail network will reach capacity by around 2016 (without any investment or changes to operations) with one new two-track corridor required to service the Gold Coast/Beenleigh and Cleveland Lines[7]. The new inner city rail corridor identified was later defined as Cross River Rail[8] and was included in the 2008 and 2010 update of South East Queensland Infrastructure Plan and Program (SEQIPP).

[7] Inner City Rail Capacity Study Pre-Feasibility Report, Queensland Transport 2008

[8] A new north-south rail line in Brisbane's inner city including a tunnel under the Brisbane River and new underground inner city train stations.

Recently completed rail projects[9] all aim to improve the reliability and strengthen the capacity, by removing some of the rail network capacity constraints, of the Brisbane rail network. These projects include:

- Beerwah rail crossing grade separation
- Caboolture to Beerburrum realignment and duplication
- Mitchelton to Keperra rail line track duplication
- Salisbury to Kuraby additional track, alignment and station upgrades
- Ormeau to Coomera track duplication
- Helensvale to Robina track duplication

However none of these projects address inner city capacity constraints.

4.2.2 Regional freight rail

Freight services currently pass through the Brisbane rail network to destinations including Fisherman Islands (Port of Brisbane), Acacia Ridge Freight Terminal, and to regions serviced by the North Coast line (refer to **Figure 4-11).** Currently, there is no dedicated rail freight network in South East Queensland and as a result, passenger and freight rail services share network capacity with passenger services prioritised over freight (passenger services share freight lines in the passenger peak and freight traffic use train paths on the passenger network in the off-peak[10]). Efficiency and performance of non-peak operations are often affected by the need to schedule freight trains in the times available between higher priority passenger train services.

According to the Inner City Rail Capacity Study analysis, the current freight peak periods are between 4.00 am and 7.00 am arriving at terminal and 6.00 pm and 9.00 pm departure to match current logistics trends. There is more flexibility for afternoon and evening departures depending on the length of journey but freight arrivals typically must arrive at the beginning of the day to meet distribution needs.

There are around 344 freight services per week (**Figure 4-11**) travelling through the Brisbane rail network along the narrow gauge lines, including:

- 120 coal services travelling along the western corridor, between Rosewood and Port of Brisbane (Fisherman Islands) via Corinda and Yeerongpilly
- 16 grain services travelling along the western corridor, between Rosewood and Port of Brisbane (Fisherman Islands) via Corinda and Yeerongpilly
- 146 intermodal freight services travelling along the North Coast line, between Nambour and intermodal freight terminals, such as Acacia Ridge and Port of Brisbane
- 62 intermodal freight services travelling along the western corridor, between Rosewood and Port of Brisbane or Acacia Ridge Terminal.

In addition to the freight services travelling along the narrow gauge lines, there are also 177 freight services, 59 of which are travelling along the standard gauge line between Melbourne and Brisbane, per week operating along the existing dual gauge lines between Acacia Ridge and Port of Brisbane.

[9] SEQIPP 2010 – 2031, Department of Infrastructure and Planning

[10] Currently, freight trains do not operate during peak periods within the Brisbane metropolitan rail network

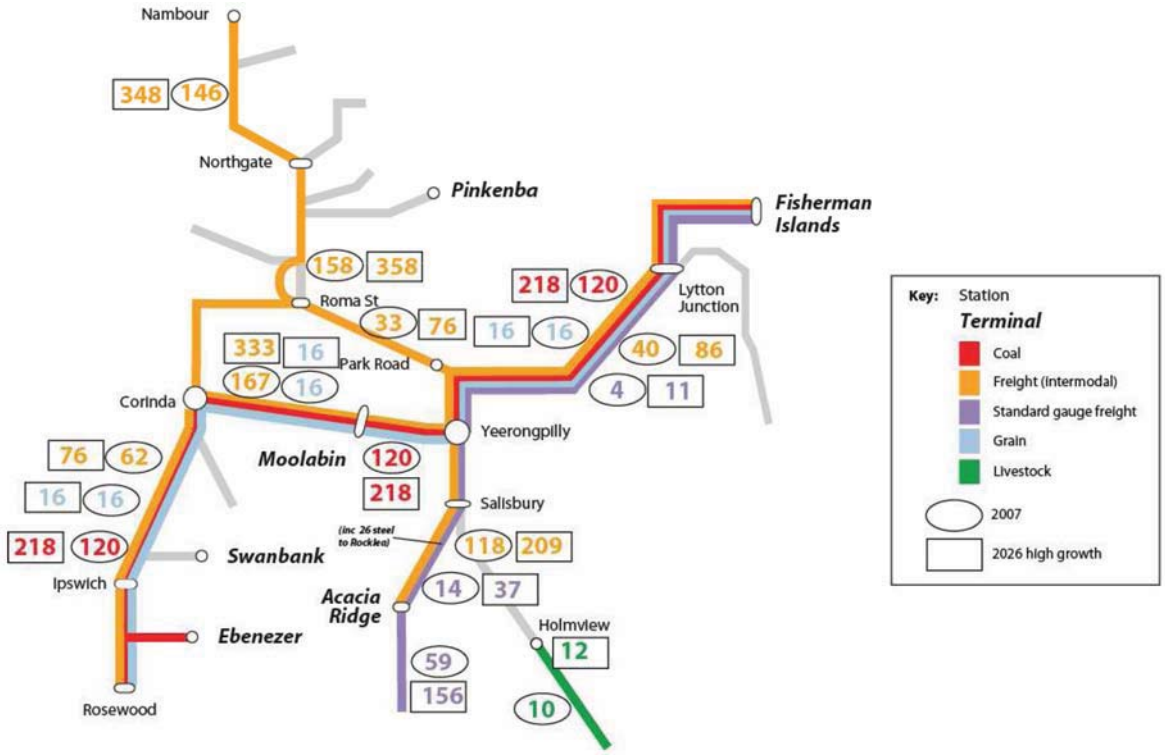


Figure 4-11 Brisbane Freight Rail Network

Source: Inner City Capacity Study Pre-Feasibility Study Report, 2008

Freight services through the inner city have traditionally approached the city on the passenger network before taking an alternative route via the Exhibition loop. This is partially because the inner city stations were not designed to accommodate freight services, and largely because the freight services would cause operational difficulties in the heavily used inner city corridor.

More information about freight services on individual lines and constraints to freight movement are discussed in **Section 4.4**

4.2.3 Bus

With around 285,000 bus users on an average weekday in the Brisbane metropolitan area, buses cater for approximately 50% of total public transport trips across the Brisbane metropolitan area.

The Brisbane bus network is highly CBD-centred with over 500 bus services per hour entering the CBD in the morning peak. The two busways within the study corridor, the Inner Northern Busway and South East Busway, carry around two-thirds of these buses into the CBD. The South East Busway carries over 250 buses per hour inbound at its busiest point at Woolloongabba while the Inner Northern Busway carries over 90 buses per hour inbound at Roma Street in the morning peak.

Peak hour bus operations in Brisbane consist of a range of peak only routes which supplement the standard timetable and offer single-seat express journeys into the CBD. From the south-east, most of these peak-only express services use the Captain Cook Bridge to enter the CBD itself rather than the inner South East Busway route via the Victoria Bridge.

Across inner Brisbane and the study corridor there is a general lack of dedicated bus-rail interchange infrastructure with two exceptions being Roma Street and Park Road, as shown in **Figure 4-12**. There is also limited on-street bus priority in the CBD with key exceptions being the Adelaide Street bus mall and approach lanes, Edward Street southbound bus lane, and the Ann Street westbound bus lane (Boundary Street to George Street). Buses in the CBD however use almost every road, and are consequently susceptible to traffic congestion in peak periods, resulting in poor journey time reliability on many routes.

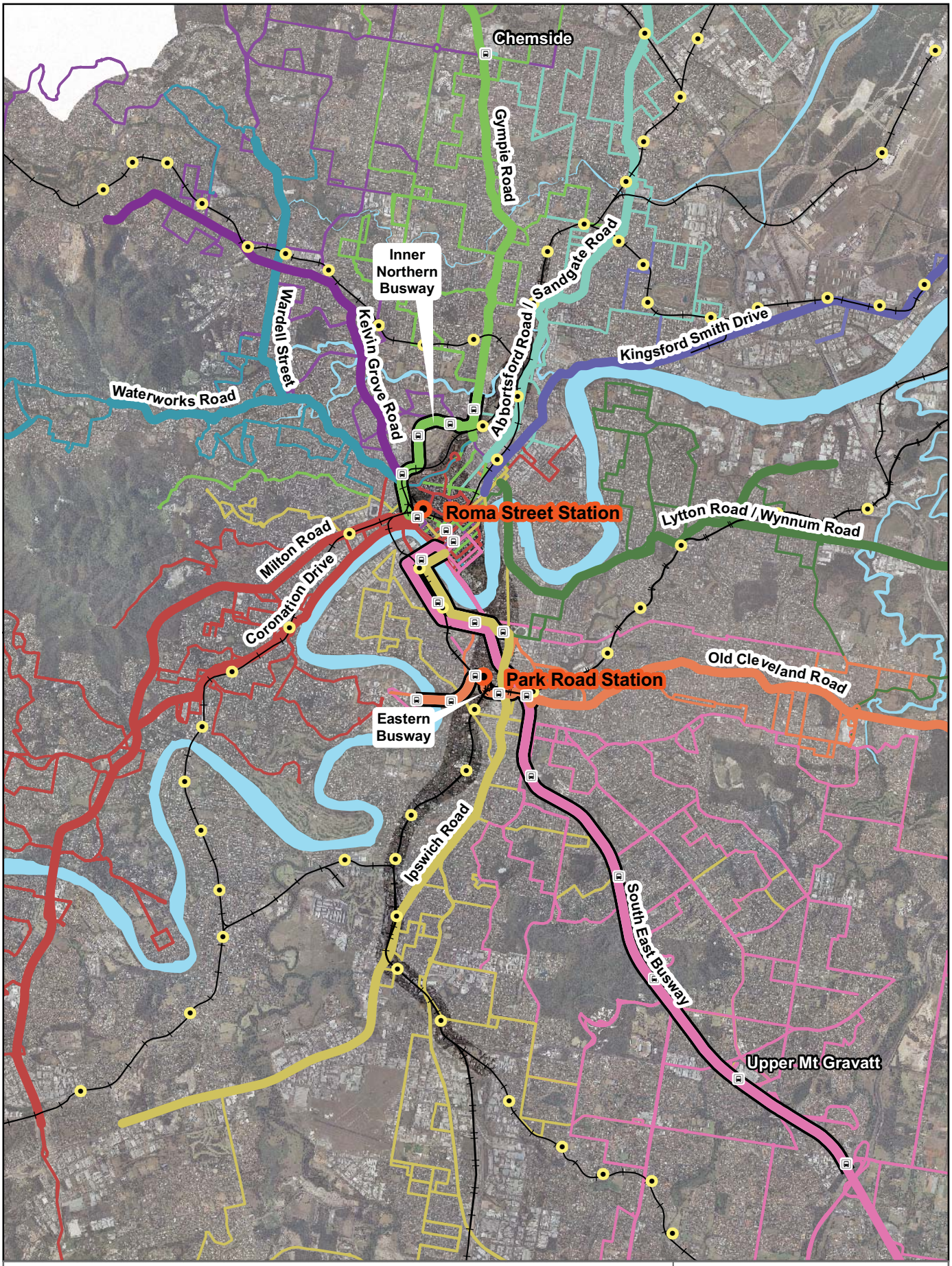
Bus layover space in the CBD is also limited, with a range of on-street spaces already dedicated for buses including sections of Alice Street, William Street and Wickham Street as well as off street space at Woolloongabba (South East Busway), Petrie Terrace (Inner Northern Busway) and at the Queen Street Bus Station. This is now limiting the ability of TransLink to provide for more terminating bus services in the CBD.

Particular congestion and operational constraints are also now apparent on the South East Busway, including:

- bus queuing and delays around the Melbourne Street (South Brisbane) tunnel portal caused by interaction with on-street surface traffic
- congestion within the Cultural Centre Busway Station which causes buses to queue over the Victoria Bridge – this is a major bus hub and termination point for high frequency services from the north and west
- bus congestion at the Allen Street busway exit (onto the Captain Cook Bridge) at Woolloongabba, caused by general traffic congestion on the bridge - a major CBD approach route from the south.

Overall the bus network is currently experiencing high levels of demand with congestion occurring on several routes causing delays and reliability concerns. Some bus corridors, such as the South East Busway could now be considered saturated in peak times.

Further detail about bus services and operations within the study corridor are provided in **Section 4.5**.



LEGEND

- Study Corridor
- Bus-Rail Interchange
- Station
- Track
- Busway
- South East Busway
- Ipswich Road
- Kelvin Grove Road
- Kingsford Smith Drive
- Lytton Road / Wynnum Road
- Northern Busway / Gympie Road
- Milton Road / Coronation Drive
- Abbortsford Road / Sandgate Road
- Waterworks Road / Wardell Street
- Old Cleveland Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-12

Key Brisbane Bus Corridors and Interchanges

0 0.5 1 1.5 2 2.5 3 km

1:100,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\VAurecon\205555_CRR\G022_CCR_Trans_Regional_bus_A4_TR_ver93.mxd 06/07/2011 15:02

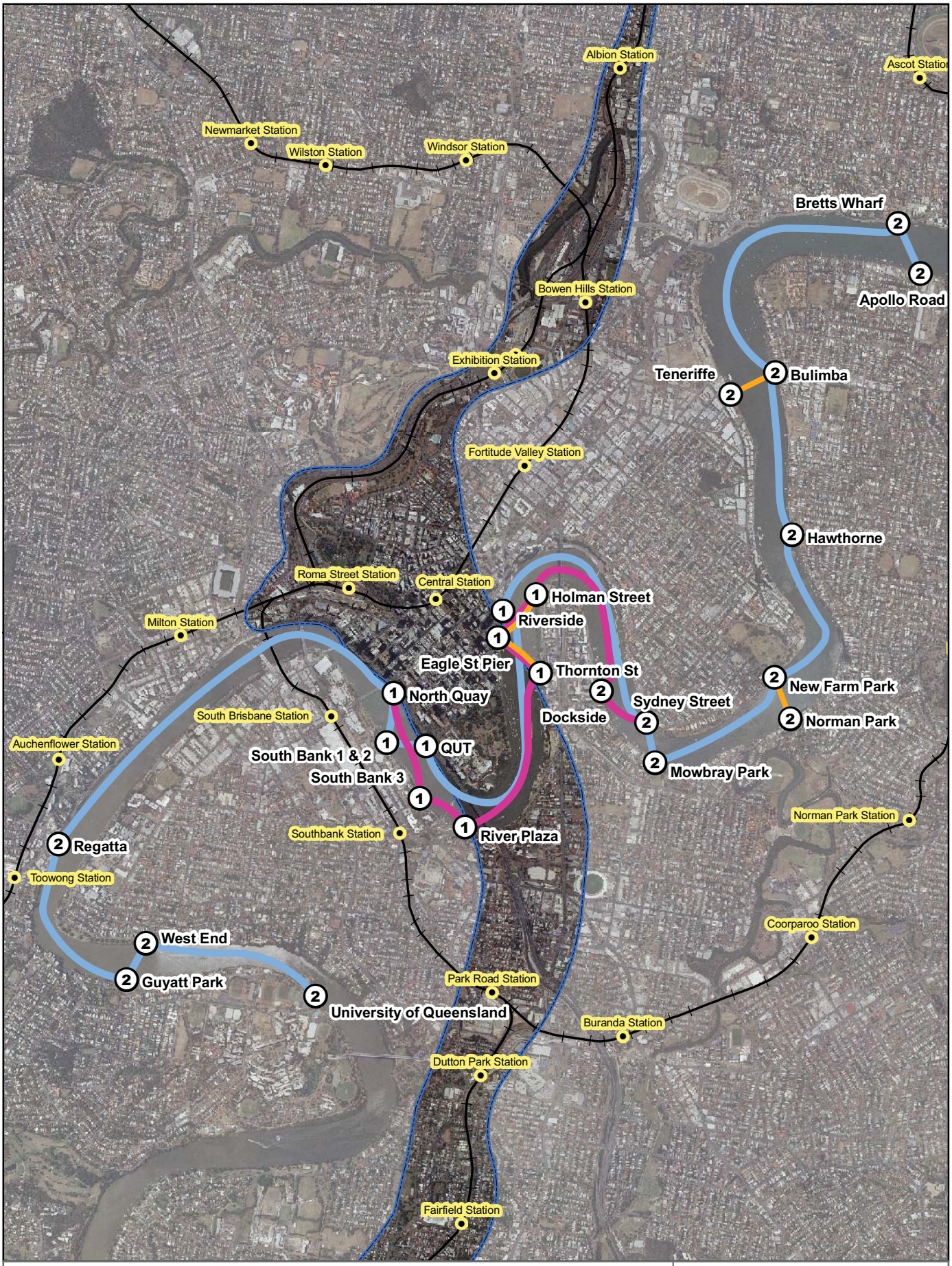
4.2.4 Ferry

Passenger ferries cater for a very small component of trips within the South East Queensland Region. With approx 13,000 daily trips in 2009, this represents less than 3% of total daily (weekday) public transport trips.

Passenger ferries operate in inner Brisbane, from the University of Queensland (St Lucia) in the west, to Bulimba and Hamilton in the east.

In the study corridor itself the ferry network primarily provides access to the CBD with key terminals at North Quay (around 900 m from Roma Street station), South Bank (around 500 m from South Bank railway station), and Riverside Centre (around 600 m from Central Station). Given the distances involved ferry-rail interchange is very limited.

Scheduled TransLink ferry routes and termini are shown in **Figure 4-13**.



LEGEND

- Study Corridor
- Station
- Track

Brisbane Ferry Routes

- Citycat
- Inner City Ferry
- Cross River Ferry

Brisbane Ferry Stops

Zone

- 1 1
- 2 2

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-13

Brisbane Ferry Routes and Terminals

0 250 500 750 1,000 1,250 Meters

1:40,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G023_CCR_Trans_Regional_ferry_A4_TR_ver93.mxd 06/07/2011 15:03

4.3 Passenger rail operations and performance

The study corridor extends north to Wooloowin and south to Salisbury. The corridor can be separated into three sections: northern section, central section and southern section. Passenger rail operations are explained in each geographic section below, following a network wide commentary on patronage.

4.3.1 Rail patronage

The number of passengers using the rail system during the morning and evening peak periods out of the daily 24-hour total of 243,200 passengers is shown in **Table 4-7**. This table also illustrates that about 50% of rail passengers use the rail system during the peak periods – that is four hours of a 24 hour day.

Table 4-7 2009 peak period rail users

Period	Rail users
AM two-hour peak (7.00 am to 9.00 am)	67,000
PM two hour peak (4.00 pm to 6.00 pm)	58,400
Daily	243,200

Source: Cross River Rail Project Model

The number of boarding and alighting passengers at inner city rail stations in the 2009 two hour morning peak period number about 56,500. Of these 43,800 board or alight at a CBD station. Central Station dominates for alighting passengers with over 30,000 passengers (80% of the alightings that occur in the CBD). Central Station is the principal destination for rail passengers to and from the CBD.

Inner city stations[11] cater for less than 10% of boarding passengers as the majority of passengers board trains outside the inner city in the morning peak period. About 29,800 passengers board trains to the north of the inner city whilst 35,800 (almost 50%) of passengers board trains to the south and/or west of the CBD (including the Ipswich line).

4.3.2 Passenger rail services in the northern study corridor

Rail services operating on the northern section of the study corridor include:

- services to and from the Sunshine Coast and Caboolture and (some) Shorncliffe trains operating on the main lines
- services to and from Airport, Doomben Ferny Gove and (some) Shorncliffe trains operating on the suburban lines.

Train frequencies and stopping patterns for the northern section are summarised in **Table 4-8**. As shown there is a minimum of two trains per hour from each destination with services combining to create higher frequencies at many inner stations. Off peak, a typical half hourly service pattern can be expected from Caboolture, Shorncliffe, Airport, Doomben and Ferry Grove with less frequent services (approximately every two hours) from the Sunshine Coast (Nambour).

[11] Inner city stations are Bowen Hills, Fortitude Valley, Central, Roma Street, South Brisbane and South Bank stations

Table 4-8 Northern section peak direction service levels and stopping patterns during morning Peak

Origin	Stopping Pattern	Trains per hour
Nambour	Running all stations to Caboolture and then express between Caboolture and Bowen Hills	2
Caboolture	Running semi-express between Caboolture and Eagle Junction and then express to Bowen Hills	4
Petrie	Running semi-express between Petrie and Eagle Junction and then express to Bowen Hills	2
Petrie	Running all stations between Petrie and Bowen Hills	4
Airport	Running all stations between Domestic Airport and Eagle Junction and then express to Bowen Hills	3
Doomben	Running all stations between Doomben and Bowen Hills	2
Shorncliffe	Running all stations between Shorncliffe and Bowen Hills	1
Shorncliffe	Running semi-express between Shorncliffe and Eagle Junction and then express to Bowen Hills	2
Ferny Grove	Running a mix of express and all stations between Ferny Grove and Bowen Hills	5
Mitchelton	Running all stations between Mitchelton and Bowen Hills	2
		27

The main constraints within and beyond the northern section of the study corridor affecting performance within the study corridor include:

- single track sections on some of the northern branch lines including Shorncliffe, Ferny Grove, Doomben and Airport, together with irregular service gaps which causes irregular crossing points
- north coast express services and slower Caboolture services having to share the same two railway tracks north of Petrie
- inbound trains from the suburban lines having to cross to the main lines between Eagle Junction and Northgate
- outbound trains to Doomben, Airport and Shorncliffe lines crossing the path of inbound trains
- limited overnight stabling facilities and station platform capacity.

4.3.3 Passenger rail services in the central study corridor

All services from northern and southern study corridors merge onto the Central study corridor and all of these services stop at all four stations from Bowen Hills to Roma Street (inclusive). The Brisbane CBD rail network configuration however has finite capacity. Between Roma Street and Bowen Hills, the railway is comprised of only two pairs of tracks with a combined maximum capacity of 42 trains per hour, in each direction (84 trains per hour in total). The main lines have a theoretical maximum capacity of 19 trains per hour (each direction) while the suburban lines have a higher capacity of 23 trains per hour, per direction due to dual platform faces at Central allowing one train to approach the station while another (in the same direction) is at the station or preparing to depart.

The frequency of services (by line) stopping within the study corridor during the morning peak hour are summarised in **Table 4-9**.

Table 4-9 Central section peak direction service levels and stopping patterns during morning Peak

Line	Trains per hour
Sunshine Coast line	2
Caboolture (including Petrie) line	10
Airport line	3
Doomben line	2
Shorncliffe line	3
Ferny Grove (including Mitchelton) line	7
Beenleigh (inc Kuraby) line	7
Gold Coast line	4
Cleveland (inc Lota and Thorneside) line	7
Ipswich (inc Rosewood, Darra and Redbank) line	12
	57

As well as the inner city tunnels and stations, the approach routes to the inner city railway lines and station are also constrained which limits capacity into the inner city itself. For example, services from Milton (on the four-track western line) and Park Road (that is Beenleigh, Gold Coast and Cleveland trains on the three-track southern line) must merge together to access the CBD via only four tracks to the south-west of Roma Street station. This limits the ability to fully exploit the capacity potential on these approach corridors individually.

Capacity across the Brisbane River in particular is constrained as long-distance express trains from the Gold Coast as well as suburban trains from Beenleigh and Cleveland must all use a single in-bound track across the Merivale Bridge. Of the 18 trains per hour approaching Roma Street from the south (over the Merivale Bridge) in the morning peak, four trains per hour are longer distance express trains from the Gold Coast. This capacity constraint on the bridge and access into Roma Street station restricts growth on these services. Cross River Rail would provide additional capacity into the CBD for this growing commuter market.

In summary the main constraints on the rail network within the Central Section of the study corridor include:

- single platform faces at Fortitude Valley and Bowen Hills. This limits the maximum number of trains to 26 trains per hour (assuming 2 minutes headway and 20 seconds dwell time)
- trains blocking both the suburban and main lines trying to access Mayne yard. Delays in accessing the yard could cause these tracks to become blocked
- the existing CBD area routes inbound to Roma Street are limited to one from Milton (Western line) and one from Park Road (Beenleigh, Gold Coast and Cleveland) requiring services from these corridors to merge together to access the CBD area from the south of the CBD.
- long dwell times in the CBD area, such as Central, also constrain the ability to maximise the signalling capacity within the CBD area
- crew changes at Bowen Hills and the need for trains terminating at Roma Street and Bowen Hills to reach Mayne Yard for stabling.

Based on current passenger growth rates and the existing train operating regimes, the inner city rail network and in particular the approach from the south is approaching its capacity. If additional line capacity is not provided or operations changed to allow higher frequent services, peak period service performance on the passenger rail network would decline. This could lead to a greater dependence on other modes to access the CBD and spreading of the commuter peak period. These outcomes could slow the growth of the CBD and affect the city's competitiveness in the medium to long term.

4.3.4 Passenger rail services in the southern study corridor

Rail services operating on the southern section of the study corridor include:

- services to and from Gold Coast and Beenleigh lines and Cleveland line operating on the suburban lines (ie from the south)
- services to and from Ipswich and Rosewood line operating on the main lines (from the west)
- train numbers and stopping patterns for the southern section are summarised in **Table 4-10**.

Table 4-10 Southern section peak direction service levels and stopping patterns during morning Peak

Origin	Stopping pattern	Trains per hour
Beenleigh	Running all stations to Sunnybank and then express to Park Road and then all stations to Roma Street	2
Beenleigh	Running all stations to Roma Street	3
Kuraby	Running all stations to Roma Street	2
Gold Coast	Running all stations to Beenleigh and then express to South Bank and then all stations to Roma Street	4
Cleveland	Running all stations between Cleveland and Manly and then express to Park Road and then all stations to Roma Street	1
Cleveland	Running all stations to Roma Street	3
Lota/ Thorneside	Running all stations to Roma Street	3
Darra/ Redbank	Running all stations to Roma Street	2
Ipswich	Running semi express between Ipswich and Roma Street	3
Ipswich	Running all stations between Ipswich and Roma Street	2
Corinda	Running all stations to Roma Street	3
Rosewood	Running all stations between Rosewood and Goodna and then semi express to Roma Street	2
		30

The main constraints within the southern section of the study corridor include:

- single track section on Gold Coast line between Coomera and Helensvale
- single track section on Cleveland line between Manly and Cleveland
- Gold Coast express services and slower Beenleigh services having to share the single inbound track between Beenleigh and Salisbury
- scheduling constraints – inbound Cleveland services conflicts with outbound Beenleigh and Gold Coast line at Park Road for example
- limited overnight stabling facilities and station platform capacity.

Most of the capacity constraints discussed in the previous section could be resolved without building a new alignment, however, these will only delay the need for a new alignment as eventually the track capacity limits will be reached. A number of previous studies have indicated that continued growth in demand for rail services mean that the inner city rail network would reach capacity by 2016 (without investment) and that one new two-track corridor would be required to service the Gold Coast/Beenleigh and Cleveland Lines. The new inner city rail corridor identified was later defined as Cross River Rail and was included in the 2008 and 2010 update of South East Queensland Infrastructure Plan and Program (Department of Infrastructure and Planning, 2010).

It is also understood that a new inner city rail corridor can offset the cost and disadvantages of poor reliability, junction grade separation and single track duplication etc.

4.3.5 Level of service - on time reliability

This section provides a summary of the reliability of the passenger rail network during the morning peak period and is based on time reliability data collected from Queensland Rail and compiled, analysed and reported by Systemwide (Systemwide, December 2010). Further details on definitions and assumptions related to reliability assessment can be found in this report.

Table 4-11 presents the average on time reliability results for inbound services arriving at Central Station from start of operation till 10.00 am during a normal weekday and so includes the morning peak period.

Table 4-11 On time reliability results for the inbound direction measured at Central Station

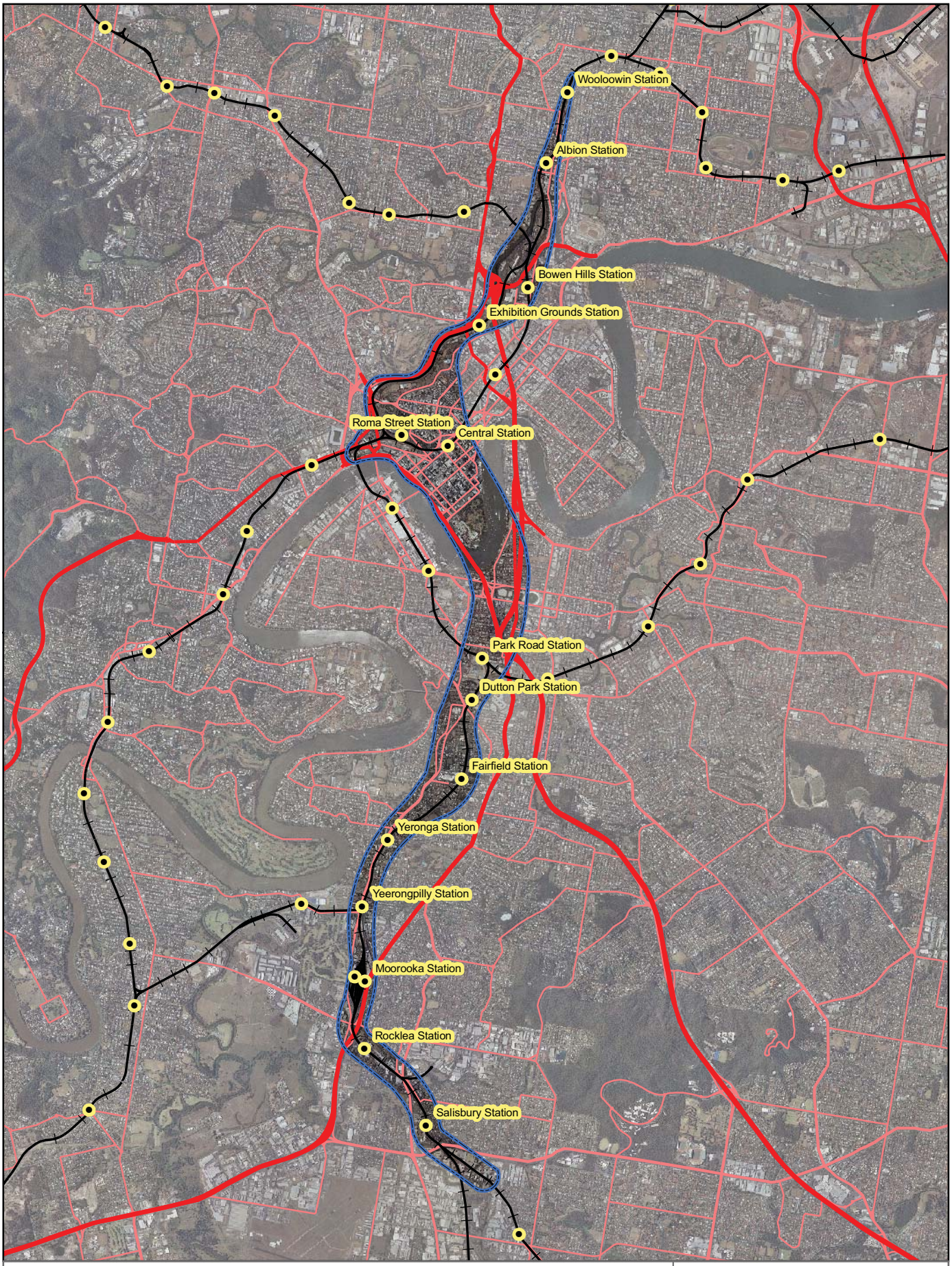
Reliability measured at CBD/Central	Two minutes	Four minutes	Six minutes
Nambour	83.1%	90.1%	91.7%
Caboolture	84.6%	94.8%	96.7%
Shorncliffe	82.5%	93.9%	96.1%
Airport	84.4%	94.2%	96.7%
Doomben	84.9%	95.1%	96.8%
Ferny Grove	87.6%	95.9%	97.3%
Cleveland	79.4%	93.1%	95.9%
Robina	81.9%	93.3%	95.8%
Beenleigh	84.2%	93.1%	95.3%
Rosewood	90.1%	95.6%	97.5%
Ipswich	86.4%	94.7%	96.5%

Source: Systemwide, December 2010

The Queensland Rail on time reliability benchmark is currently that 92.4% of trains should arrive within four minutes of the timetable. Based on this reliability benchmark of four minutes, all lines with the exception of the Nambour line, achieve an average on time reliability of more than 92.4% for services arriving at Central Station from start of the operation till 10.00am during a normal weekday.

4.3.6 Station activity in the study corridor

Stations in the study corridor are shown in **Figure 4-14**. A description of each station, its location, context and current level of activity can be found in the following section.



LEGEND

- Study Corridor
- Station
- Track
- Highway/Motorway/Major Alternate
- Other Roads

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-14

Railway Stations in Study Corridor

0 1 2 3 km

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CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G076_CCR_Stations_within_Bnd_A4_ver93.mxd 06/07/2011 15:05

Wooloowin Station

Wooloowin Station is situated between Bridge Street and Hudson Road, in a predominantly low density residential part of Wooloowin, some 5.6 km north of Central Station (refer to **Figure 4-15**).

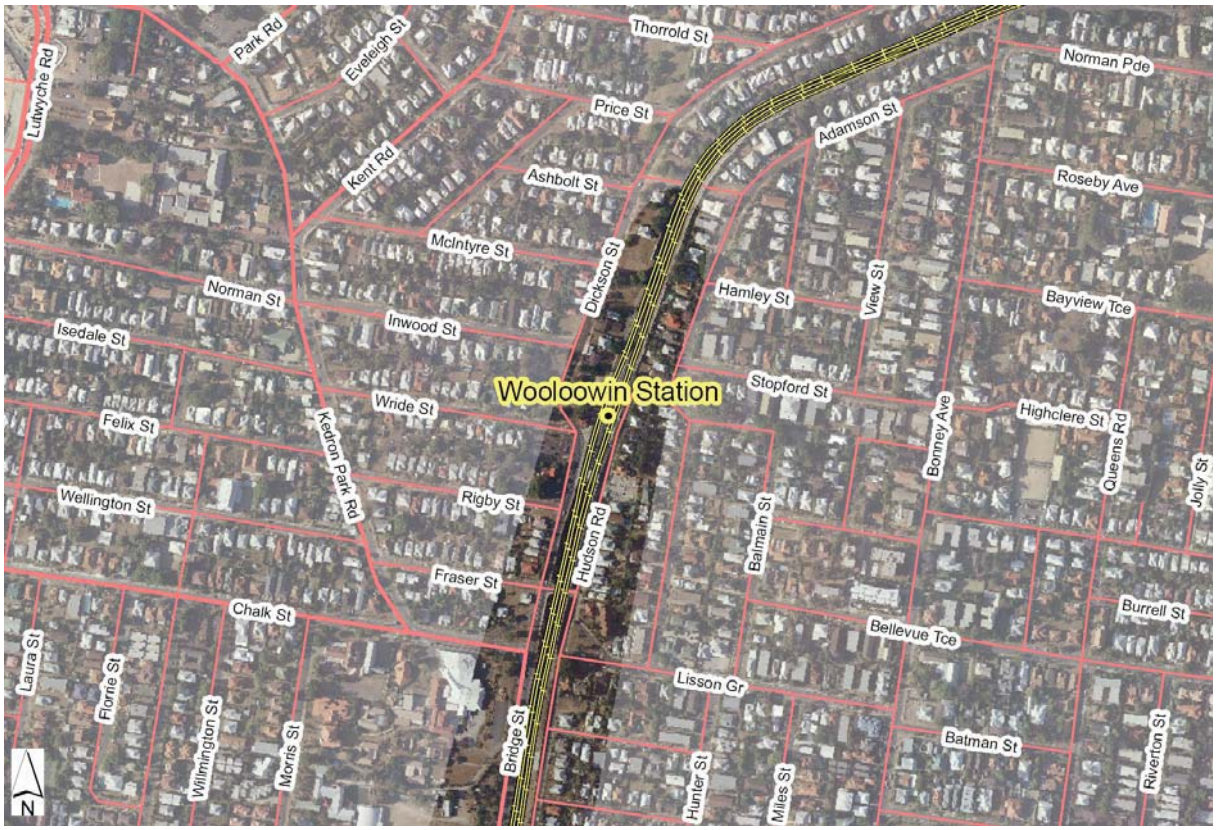

Figure 4-15 Wooloowin Station and surrounds

Wooloowin Station is located on the main north coast railway line and is served by the Caboolture, Shorncliffe and Doomben line trains. Airport Line and Sunshine Coast (Nambour) line trains pass through but do not stop at the station. Furthermore, peak hour express trains from Caboolture pass through but do not stop at this station. During the morning peak hour, there are eight trains in total stopping at Wooloowin Station in the peak direction having originated at Petrie/Caboolture, Shorncliffe and Doomben. Off-peak, six trains per hour (two Caboolture trains, two Shorncliffe trains and two Doomben trains) serve Wooloowin in each direction.

This station has four railway tracks and four platforms connected by a pedestrian bridge and station concourse at the southern side of station. The station ticket office is located on the concourse bridge above platform two and three and includes other facilities such as bike racks and toilets. All four platforms are approximately 150 m in length, with tactile indicators present only on platform four.

Existing station activity is summarised in **Table 4-12** below. Overall boardings and alightings are relatively low with around 600 passenger movements in each peak period (7.00 am – 9.00 am or 4.00 pm – 6.00 pm). The station operates a typical residential movement pattern with a large proportion of station activity relating to boardings in the morning peak and alightings in the evening peak, with the majority of trips related to inner city employment (journey to work) trips. Rail loading data provided in **Section 4.3.7** shows that in the morning peak period (7.00 am – 9.00 am) southbound trains are carrying 110% of their seated capacity, showing that there are numerous standees for a large part of the morning peak, although with some spare capacity particularly in the end carriages. Observations of platform activity show that passengers are able to board southbound trains at Wooloowin in the morning peak period and that trains are not at crush capacity.

Table 4-12 Existing (2009) boardings and alightings

Time Period	Boardings	Alightings	Total
Daily	1,100	1,300	2,400
AM (7.00 to 9.00 am)	500	100	600
PM (4.00 to 6.00 pm)	100	500	600

Source: Cross River Rail Project Model

Table 4-13 shows that walk access is by far the dominant mode of access in the morning peak representing around 70% of station boardings. Park 'n' ride was second with almost 30% of station boarders accessing the station by this mode. A description of pedestrian, cycle, vehicle and bus access to the station is provided separately in **Section 4.5** to **Section 4.8** below.

Table 4-13 Mode of access at Wooloowin Station (AM peak)

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	1%	<100	0%	<100	1%
Car	200	29%	<100	4%	200	25%
Rail	<100	1%	<100	3%	<100	1%
Walk/cycle	400	70%	100	93%	500	74%
Total	500	100%	100	100%	600	100%

Source: Cross River Rail Project Model

Albion station

The location of Albion station is illustrated in **Figure 4-16**. It is located 700 m east of Lutwyche Road between Mawarra Street and Hudson Road in the suburb of Albion, some 4.5 km north of Central Station.

Figure 4-16 Albion station and surrounds

Albion Station includes four platforms and four railway tracks. All platforms are approximately 150 m in length and arranged as an island and two side platforms. Platform number two and three (island platform) are accessed by two pedestrian bridges connecting to all other platforms and the surrounding streets – one pedestrian bridge is at the northern end and one at the southern end of the platforms. Platform one and platforms four are side platforms with direct access to adjacent streets. The station office is located on platform number one.

Albion Station is served by the Caboolture, Shorncliffe and Doomben line. During the morning peak hour, there are eight trains in total stopping at Albion Station in the peak direction having originated at Petrie/Caboolture, Shorncliffe and Doomben. Off-peak, six trains per hour (two Caboolture trains, two Shorncliffe trains and two Doomben trains) serve Albion in each direction.

Rail loading data provided in **Section 4.3.7** reveals that in the morning peak period (7.00 am – 9.00 am) southbound trains are carrying 114% of their seated capacity, showing that there are standing passengers for a large part of the morning peak, although with some spare capacity particularly in the end carriages. Observations of platform activity show that passengers are able to board southbound trains at Albion in the morning peak period and that trains are not at crush capacity. Existing station activity (boardings and alightings) is shown in **Table 4-14.**

Table 4-14 Existing (2009) boardings and alightings at Albion station

Time Period	Boardings	Alightings	Total
Daily	2,500	2,500	5,000
AM (7.00 to 9.00 am)	1,000	300	1,300
PM (4.00 to 6.00 pm)	500	900	1,400

Source: Cross River Rail Project Model

Table 4-15 shows that walk access is by far the dominant mode of access in the morning peak representing 63% of station boardings. Park 'n' ride was second with around 36% of station boarders accessing the station by this mode. Bus access is negligible. A description of pedestrian, cycle, vehicle and bus access to the station is provided separately in **Section 4.5** to **Section 4.8** below.

Table 4-15 Mode of access at Albion station (AM peak)

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	0%	<100	0%
Car	400	36%	<100	3%	400	28%
Rail	<100	1%	<100	2%	<100	1%
Walk/cycle	600	63%	300	94%	1000	71%
Total	1000	100%	300	100%	1300	100%

Source: Cross River Rail Project Model

Bowen Hills Station

Figure 4-17 Bowen Hills Railway station location

Bowen Hills Station lies in the inner city suburb of Bowen Hills, some 2.7 km north of Central Station. Bowen Hills Station is approximately 250 m west of the existing Queensland Rail's Mayne Yard (rail depot) and 700 m north-east of the Brisbane Exhibition Grounds as shown on **Figure 4-17**.

Bowen Hill station comprises of two island platforms with four platform faces serving four railway tracks. The station is accessible by two pedestrian overpasses – one to the south which includes lift access and one to the north featuring stairs only.

Bowen Hills Station is also one of only four railway stations (Fortitude Valley, Brisbane Central, Roma Street and Bowen Hills) in Brisbane which is served by all suburban passenger lines. During the morning peak hour, there are 57 trains in total stopping at Bowen Hills Station.

Bowen Hills Station is one of the busiest stations in the City network (after Central, Roma Street, Fortitude Valley, South Bank and South Brisbane stations) with over 10,000 daily entry and exits. **Table 4-16** presents the existing rail boardings and alightings by time period at Bowen Hills Station. In the morning peak period the majority of station activity is alighting movements while in the evening peak the reverse is true. This table also shows that the combined four hours of the morning and evening peak periods account for around 50% of the daily passenger activity.

Table 4-16 Existing (2009) Bowen Hills Railway station person train usage

Time Period	Boardings	Alightings	Total
Daily	5,900	6,800	12,700
AM (7-9 am)	800	2,800	3,600
PM (4-6 pm)	2,200	1,000	3,200

Source: Cross River Rail Project Model

The existing mode share for access and egress by time period to Bowen Hills Railway Station is presented in **Table 4-17**. It shows that walk access is the dominant mode of access with car and bus being minor modes of access. Rail is also shown as being a major form of access highlighting the role of the station as a rail-rail interchange. A key operational issue at the station is the narrow width of the western island platform (platforms 3 and 4) which is less than 4 m wide at its northern end, well below the 8 m minimum QR require and is often overcrowded in peak times.

Table 4-17 Bowen Hills Railway station Existing (2009) mode of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	2%	<100	2%
Car	<100	11%	<100	0%	<100	2%
Rail	300	40%	300	12%	700	18%
Walk/cycle	400	49%	2400	86%	2800	77%
Total	800	100%	2800	100%	3600	100%

Source: Cross River Rail Project Model

Exhibition station

Exhibition station, approximately 3.4 km north-east of Central Station, lies in the Royal National Agricultural and Industrial Association of Queensland (RNA) Showground precinct which is bordered by Bowen Bridge Road, O'Connell Terrace, St Paul's Terrace and Gregory Terrace at Bowen Hills. The location is shown on **Figure 4-18**.

Exhibition station is located on the Exhibition Railway Loop and is currently only serving passengers during special events such as the Royal Queensland Show (the Ekka). As such, there is no weekday patronage data or mode of access data to report.

During normal operations trains travelling on the Exhibition Loop include:

- empty trains to and from the stabling (Mayne Rail Yard) and these empty trains do not stop at Exhibition Station
- freight trains accessing the Normanby marshalling yard and travelling across Brisbane avoiding the heavily used passenger lines between Bowen Hills and Roma Street Stations
- long-distance passenger services using Exhibition Loop to arrive at and depart from Roma Street Station.

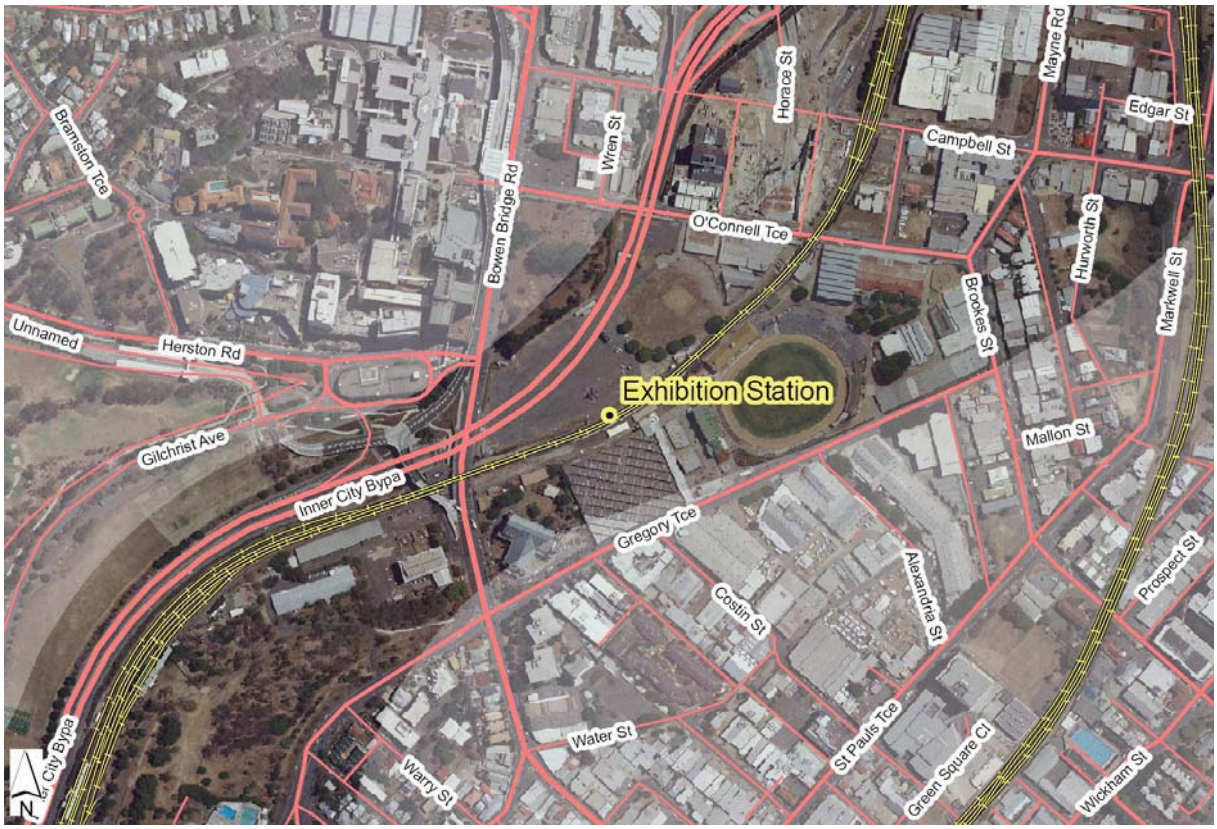

Figure 4-18 Exhibition station location

Central Station

Central Station lies in the northern area of the Brisbane Central Business District (CBD) approximately 200 m north-west of the Brisbane General Post Office (refer to **Figure 4-19**). The station precinct is dominated by the station, the Queensland Railway Centre (high rise offices), the Sofitel and Grand Central hotels and the surrounding multi lane roads of Ann Street, Turbot Street, Creek Street and Edward Street.

Central Station is the hub of the South East Queensland Rail network. It serves all suburban and interurban railway lines via six platforms arranged as three double sided islands. Each island has escalator, stairs and lift access to the main station concourse above as well as stair access down to a pedestrian subway link to ANZAC Square.

Central Station concourse area houses a range of facilities that passengers can utilise such as a newsagent, cafes, a hotel, entertainment ticket sales, McDonald's restaurant, hairdresser, ATMs, and a Queensland Rail Travel Centre.

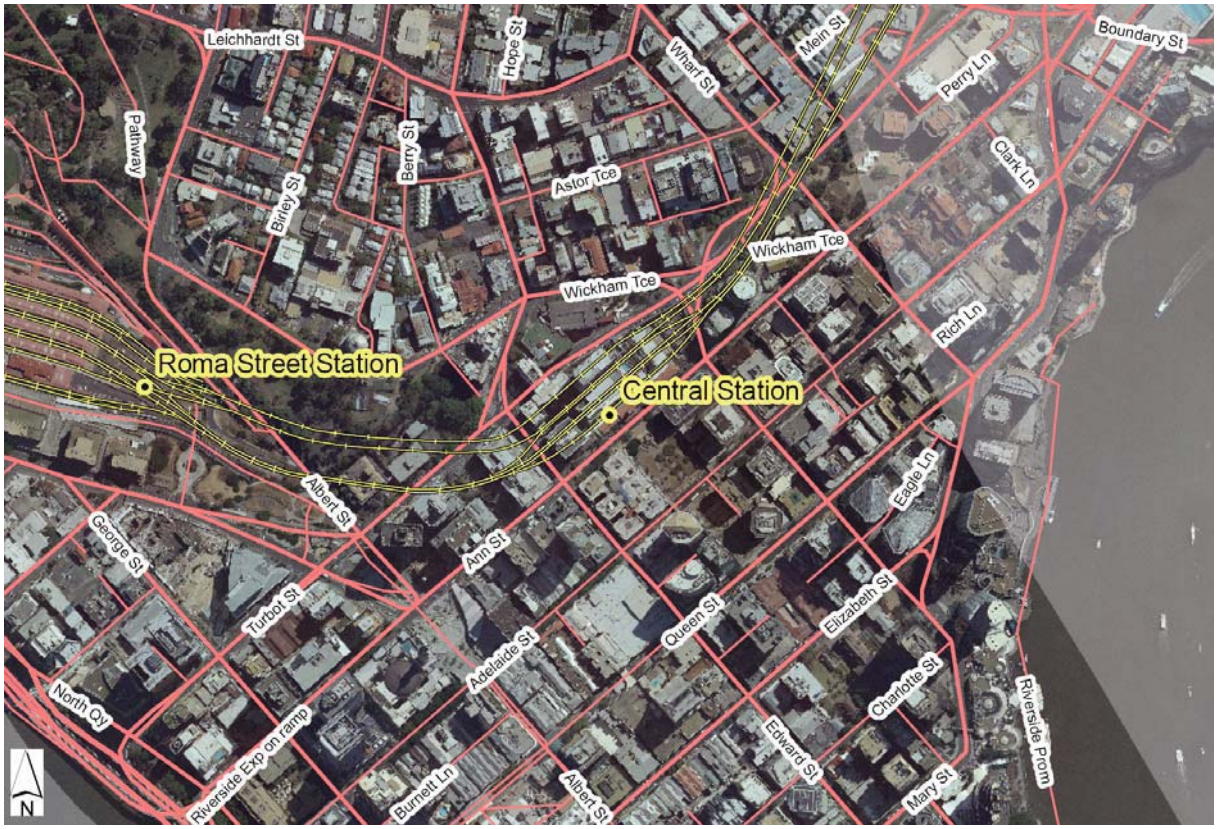

Figure 4-19 Central Station location

Central Station is the busiest on the QR City network. During the morning peak hour, there are 57 trains in total stopping at Central Station as shown in **Table 4-18**.

Table 4-18 Rail service provision at Central Station in the morning peak hour

Line	Trains per hour
Sunshine Coast line	2
Caboolture (including Petrie) line	10
Airport line	3
Doomben line	2
Shorncliffe line	3
Ferny Grove (including Mitchelton) line	7
Beenleigh (inc Kuraby) line	7
Gold Coast line	4
Cleveland (inc Lota) line	7
Ipswich (inc Rosewood, Darra and Redbank) line	12
	57

Table 4-19 presents the existing (2009) rail boardings and alightings by time period at Central Station. There are over 100,000 passenger movements (boardings, alightings and transfers) on a typical weekday with. This table shows that the peak periods dominant passenger activity at Central Station. The combined four hours of the morning and evening peak periods account for almost 60% of the daily passenger activity. **Table 4-19** also illustrates that more passenger activity occurs in the morning peak period than the evening peak period.

It also shows that there is a strong tidal flow nature of passenger movements at Central Station with very heavy alightings in the morning peak (and few boardings) whereas in the evening peak there are large numbers of boardings and few alightings. Central Station experiences relatively short and intense peak flows with congestion on platforms and at access stairs a noticeable issue at such times.

Table 4-19 Existing (2009) Central Station person train usage

Time Period	Boardings	Alightings	Total
Daily	54,000	50,300	104,300
AM (7.00 to 9.00 am)	4,400	30,100	34,500
PM (4.00 to 6.00 pm)	23,800	2,400	26,200

Source: Cross River Rail Project Model

The existing mode share for access during the evening peak period at Central Station is presented in **Table 4-20**. This shows that walk access is by far the dominant mode of access with car and bus based modes being minor modes of access. Central Station has very little interchange – either bus-rail or rail-rail.

Table 4-20 Central Station existing (2009) modes of access – 2009[12]

Access mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	800	17%	1,000	3%	1,800	5%
Car	<100	1%	<100	0%	<100	0%
Rail	2,200	51%	2,200	7%	4,500	13%
Walk/cycle	1,300	31%	26,900	89%	28,200	82%
Total	4,400	100%	30,100	100%	34,500	100%

Source: Cross River Rail Project Model

Roma Street Station

The Roma Street Station is part of the Roma Street Transit Centre, a multi-modal transport hub comprised of the Roma Street Station, Roma Street Busway Station and Roma Street Intercity Coach Station as well as a range of food, hotel, office and retail uses (refer to **Figure 4-20**). The transit centre was constructed in the early 1980s and lies in the north-western part of the Brisbane Central Business District (CBD) serving a growing inner city precinct within the CBD.

[12] The existing mode of access data used in the report was predicted based on 2007 Origin Destination Survey, which may not represent the current interchange behaviour.

Figure 4-20 Roma Street station location

Roma Street Station serves all suburban and interurban passenger railway services (a total of 57 services per hour in the morning peak) via six in-service platforms (platforms 4 to 9). Each platform is accessible by stairs, lifts and escalators off a central pedestrian subway.

In addition to the above suburban rail services, Roma Street is also served by interstate and long distance rail services including:

- daily railway services to Sydney are provided by CountryLink NSW. Services arrive at 6.30 am (5.30 am during Eastern Daylight Time) and leave at 7.30 am (6.30 am during Eastern Daylight Time) daily from platform 2
- long distance services to Queensland destinations are provided by Queensland Rail which all depart from platform 10 – this includes daily Tilt Train services to Rockhampton, as well as weekly services to Cairns, Longreach and Roma.

Roma Street Station is the second busiest on the QR City network with almost 40,000 passenger movements (boardings, alightings and transfers) on a typical weekday. This is less than half the number currently using Central Station. **Table 4-21** presents the existing (2009) rail boardings and alightings by time period at Roma Street Station. This table shows that the peak periods dominate passenger activity at Roma Street with around 50% of daily activity in the peak four hours. The morning peak period is also observed to be marginally busier than the evening peak period and that there are significantly more alighters than boarders in the morning peak with the reverse true in the evening peak.

Table 4-21 Existing (2009) Roma Street station person train usage

Time Period	Boardings	Alightings	Total
Daily	17,800	18,700	36,500
AM (7.00 to 9.00 am)	1,700	7,600	9,300
PM (4.00 to 6.00 pm)	6,500	2,400	8,900

Source: Cross River Rail Project Model

The existing mode share for access during the evening peak at Roma Street Station is presented in **Table 4-22** below. This shows that Roma Street Station has an important interchange function with around 50% of boarding passengers transferring from another rail service and a further 31% of boarding passengers transferring from a bus service. Walk access however is the minor form of boarding access in the morning peak with only 15% of passengers using this mode. Alighting movement at Roma Street Station in the morning peak, however is overwhelmingly pedestrian-orientated with around 75% of alighters walking from the station to the surrounding precinct, 14% transferring to bus and a further 12% transferring to other rail services.

Table 4-22 Roma Street station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	500	31%	1100	14%	1,600	17%
Car	<100	2%	<100	0%	<100	0%
Rail	900	53%	900	12%	1,800	19%
Walk/cycle	300	15%	5,600	74%	5,900	63%
Total	1,700	100%	7,600	100%	9,300	100%

Source: Cross River Rail Project Model

Specific issues at this station include crowding at the main ticket gate line within the subway. Another key problem exists at the station exits approaching Roma Street itself, where the exit closest to the northern end of George Street is a narrow set of double doors with narrow stairs, a narrow footway and no formal pedestrian crossing (see **Figure 4-21)**.

Figure 4-21 Roma Street station entrance facing Roma Street/George Street intersection

Park Road Station

Park Road Station is located in the inner suburb of Dutton Park approximately 5 km south of Central Station. Dutton Park Station is located only 800 m to the south (refer to **Figure 4-22**).

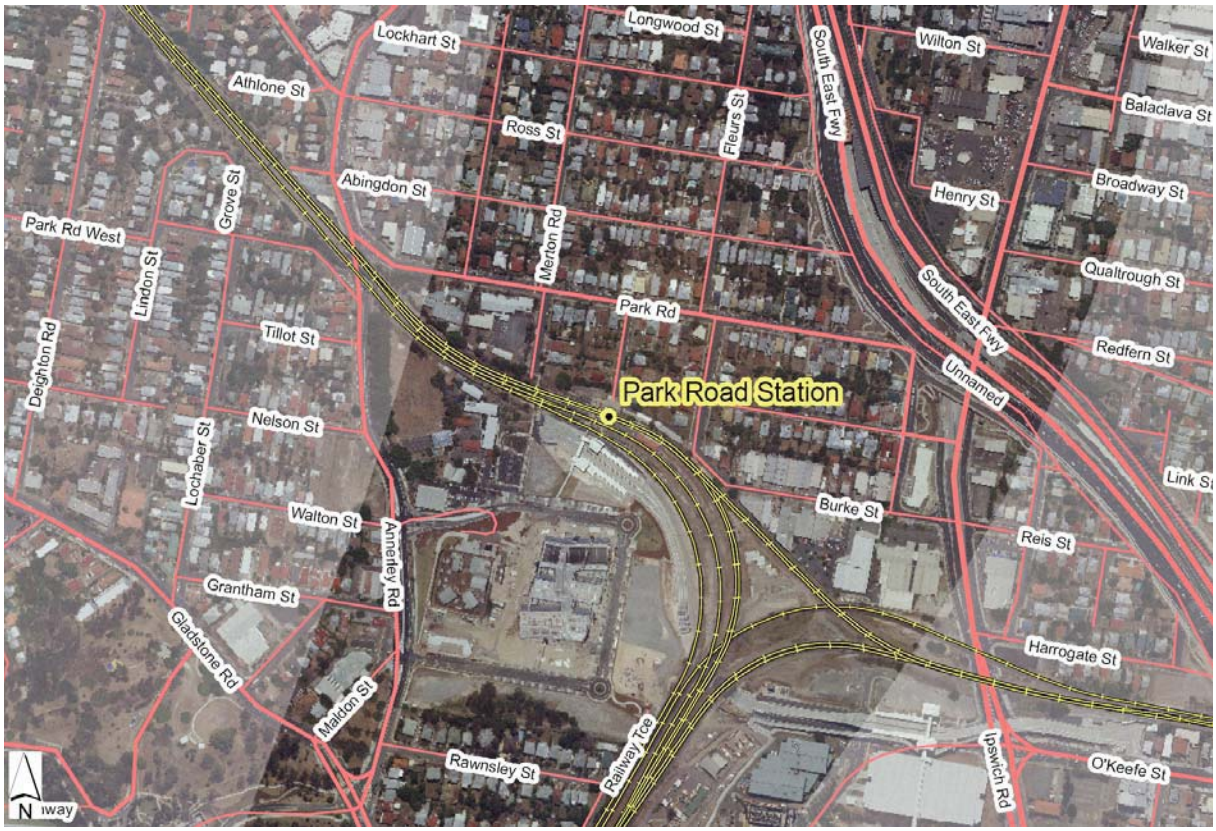

Figure 4-22 Park Road station location and surrounds

Park Road station serves a wide range of suburban and interurban railway lines via four platforms. Each platform has stair and lift access to a pedestrian over bridge which also links roads and footpath networks on both the north and south sides of the station.

The Beenleigh, Cleveland and Gold Coast lines all stop at Park Road station however only off peak Gold Coast services call at the station. The Beenleigh and Cleveland lines both have regular all stops services, approximately every half an hour, all day every day with more regular service (including some semi-express) in peak hours. In the morning peak hour, between 7.00 am and 8.00 am, seven services arrive from the Cleveland Corridor and six stopping trains from the Beenleigh corridor giving a total of 13 trains per hour stopping at Park Road, heading inbound to the CBD. In the off-peak, two trains per hour each from Cleveland, Beenleigh and Gold Coast stop at Park Road giving a combined total of six trains per hour in each direction.

Park Road Station has over 3,000 boardings and alightings on a typical weekday in 2009. **Table 4-23** illustrates station activity by time period. This shows that the morning peak period is slightly busier than the evening peak period and that boardings and alightings are closely matched in the morning peak – that is there as many boardings and there are alightings, which is indicative of the range of attractors and destinations within the surrounding catchment as well as the various interchange opportunities (rail-rail and rail-bus) available at Park Road. This does not carry through to the evening peak, potentially due to peak spreading of alighting trips into other time periods (eg school travel occurring before this period and late-working commuters travelling after this time period).

Table 4-23 Existing (2009) Park Road station person train usage

Time Period	Boardings	Alightings	Total
Daily	2,100	1,800	3,900
AM (7.00 to 9.00 am)	600	600	1,200
PM (4.00 to 6.00 pm)	600	300	900

Source: Cross River Rail Project Model

The existing mode share for access to Park Road Station during the evening peak period is presented in **Table 4-24**. This shows a high proportion of rail passengers accessing the station by walking or cycling (51%), however given the limited cycle parking facilities at the station the vast majority of these are expected to be pedestrian trips. There is some limited park and ride and kiss 'n' ride access to the station at around 17% while bus access to the station in the morning peak is low at around 4%. However morning alightings shows a significant number of passengers transferring to bus (around 30%), a further 25% transferring to another rail service and a large proportion (43%) walking to surrounding trip attractors including the PA Hospital (1.1 km), the University of Queensland (1.5 km) and local businesses.

Table 4-24 Park Road station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	4%	200	31%	200	18%
Car	<100	17%	<100	1%	100	8%
Rail	200	27%	200	25%	300	26%
Walk/cycle	300	51%	300	43%	600	47%
Total	600	100%	600	100%	1200	100%

Source: Cross River Rail Project Model

There were no observed crowding issues on the platforms or access walkways on a typical weekday morning peak.

Dutton Park Station

Dutton Park Station is located under Annerley Road, on the Beenleigh Railway Line, 5.9 km south of Central Station – see **Figure 4-23**. The station consists of two side platforms, one for northbound and one for southbound travel. The northbound platform is 160 m long and is accessed by an elevated ramp and stair structure from the eastern side of Annerley Road. The southbound platform is 150 m long and is accessed by a ramp from Kent Street. Station facilities (ticket office and amenities) are located on the northbound platform. To the west of the northbound platform is a third, dual gauge railroad used by express passenger trains (to and from the Gold Coast and Sydney) as well as freight trains to the north and east (including the Port of Brisbane).

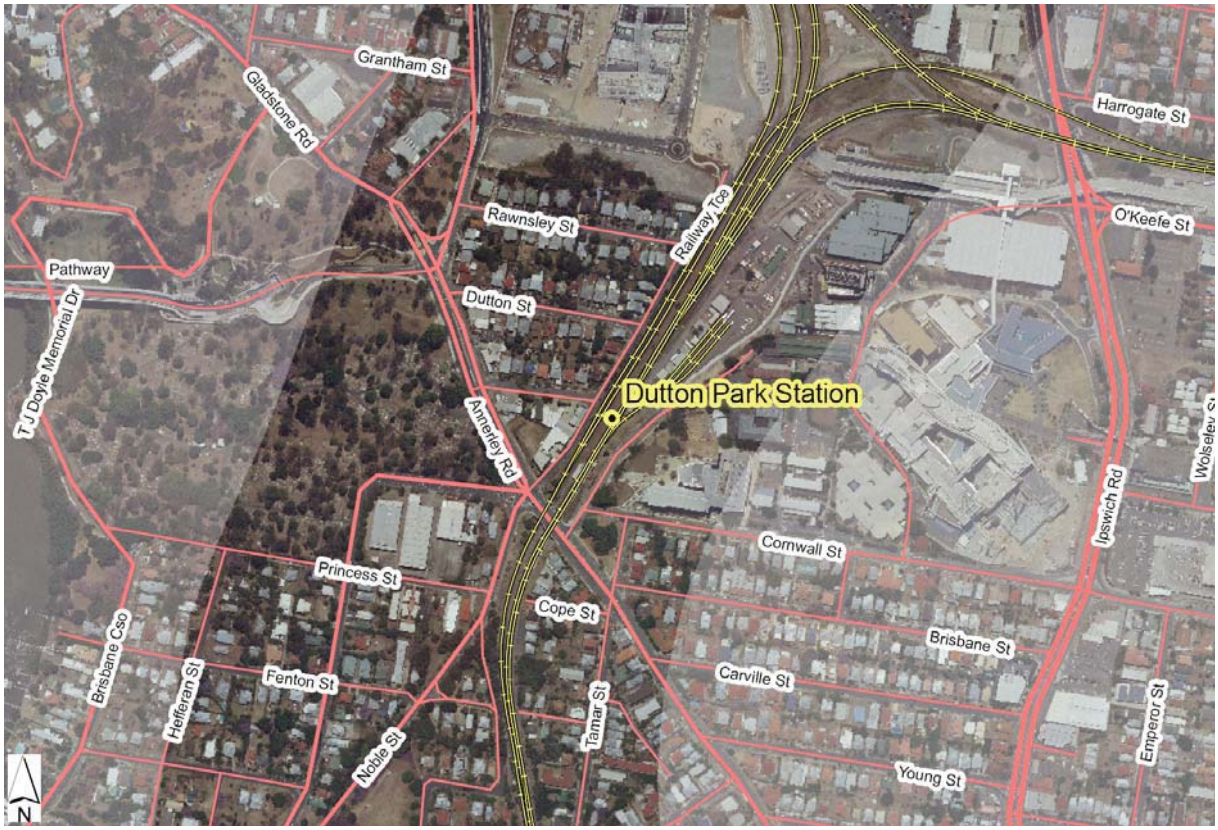

Figure 4-23 Dutton Road station location and surrounds

In the peak one-hour (peak direction) there are up to five inbound services to the city, however off-peak, only two services per hour in each direction are provided. Train services generally commence at 5.15 am at Dutton Park Station with the last service at 12:15 am (later on Friday and Saturday nights).

Dutton Park Station has relatively low levels of passenger use, with around 1,000 boardings and alightings as shown in **Table 4-25**. Activity in the morning peak is higher than the evening peak with morning activity mostly boarding movements, with the reverse true in the evening peak.

Table 4-25 Existing (2009) Dutton Park station person train usage

Time Period	Boardings	Alightings	Total
Daily	500	500	1,000
AM (7.00 to 9.00 am)	300	100	400
PM (4.00 to 6.00 pm)	<100	100	100

Source: Cross River Rail Project Model

Table 4-26 illustrates the modes of access and egress at Dutton Park Station. This shows that the majority of morning peak boarders (70%) arrive on foot with around 30% by car. Alighters in the morning peak are virtually all walking to their final destination (some 99%) with 1% travelling onward by car.

Table 4-26 Dutton Park station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	0%	<100	0%
Car	<100	30%	<100	1%	<100	20%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	200	70%	100	99%	300	80%
Total	300	100%	100	100%	400	100%

Fairfield Station

Fairfield Station is located some 7.1 km south of Central Station between Midmay Street and Equity Street running and situated approximately 80 m away from the Fairfield Gardens shopping centre as illustrated in **Figure 4-24**. This station consists of two platforms and three tracks. Platform one is located parallel to Equity Street and has a direct access from the street as well a pedestrian bridge, while platform two is located parallel to Midmay Street and accessed via a pedestrian bridge. The station office is located on platform two. There are no passenger lifts.

Figure 4-24 Fairfield Station location and surrounds

In the peak one hour (peak direction) there are up to five inbound services to the city, however off peak, only two services per hour in each direction are provided.

Fairfield Station has relatively low levels of passenger use, with around 1,100 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-27**. Activity in the morning peak is higher than the evening peak with morning activity mostly consisting of boarding movements, with the reverse true in the evening peak.

Table 4-27 Existing (2009) Fairfield Station person train usage

Time Period	Boardings	Alightings	Total
Daily	600	500	1100
AM (7.00 to 9.00 am)	500	100	600
PM (4.00 to 6.00 pm)	<100	200	200

Source: Cross River Rail Project Model

Table 4-28 below illustrates the modes of access and egress at Fairfield Station. This shows that the majority of morning peak boarders (86%) arrive on foot with around 14% by car. Alighters in the morning peak are virtually all walking to their final destination (some 95%) with 5% travelling onward by bus or car.

Table 4-28 Fairfield Station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	4%	<100	1%
Car	<100	14%	<100	1%	<100	11%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	400	86%	100	95%	500	88%
Total	500	100%	100	100%	600	100%

Source: Cross River Rail Project Model

Yeronga Station

Yeronga Station is located between Fairfield Road and Lake Street as shown in **Figure 4-25**. This station consists of two side platforms with three tracks. The third track is a dual gauge express/freight track running parallel to Fairfield Road bypassing the station. Platform one can be accessed by ramp or stairs but platform two can only be accessed by a footbridge linking the platform to the rest of the station to the east and over Fairfield Road to the west. Both the platforms are approximately 150 m in length with the station ticket office located on platform two.

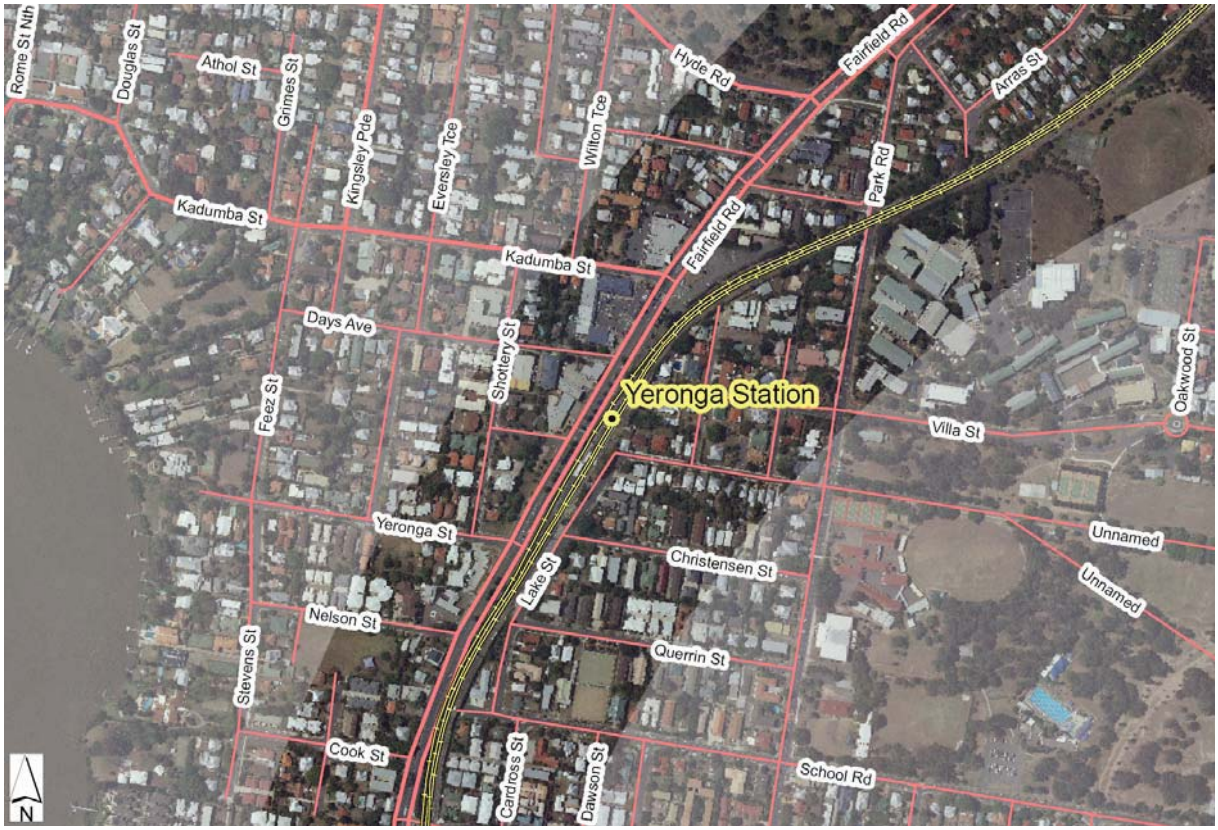

Figure 4-25 Yeronga station location and surrounds

Yeronga Station is served by the Beenleigh Line and there are currently five all stations inbound services stopping at Yeronga station during the morning peak, including three Beenleigh and two Kuraby services. Off-peak, only two services per hour in each direction are provided.

Yeronga Station has relatively low levels of passenger use, with around 2,000 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-29**. Activity in the morning peak is higher than the evening peak with morning activity mostly consisting of boarding movements, with the reverse true in the evening peak.

Table 4-29 Existing (2009) Yeronga station person train usage

Time Period	Boardings	Alightings	Total
Daily	1,000	900	2,000
AM (7-9 am)	500	200	700
PM (4-6 pm)	100	300	400

Source: Cross River Rail Project Model

Table 4-30 illustrates the modes of access and egress at Yeronga Station. This shows that the majority of morning peak boarders (57%) arrive on foot with a significant proportion (43%) by car. Alighters in the morning peak are virtually all walking to their final destination (some 94%) with 6% travelling onward by car.

Table 4-30 Yeronga station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	0%	<100	0%
Car	200	43%	<100	6%	200	34%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	300	57%	200	94%	500	66%
Total	500	100%	200	100%	700	100%

Source: Cross River Rail Project Model

Yeerongpilly Station

Yeerongpilly Station is located between Fairfield Road and Wilkie Street as shown in **Figure 4-26**. It is located approximately 9.3 route km south of Central Station on the Beenleigh line. There are two platforms arranged in an island configuration at this station with two main tracks for passenger and four additional tracks for freight and express trains. The station ticket office is located on the island platform.

Figure 4-26 Yeerongpilly Station location and surrounds

Yeerongpilly Station is served by the Beenleigh Line and there are currently seven inbound services stopping at Yeerongpilly Station during the morning peak, including two Beenleigh express, three Beenleigh all stations and two Kuraby all stations services. Off peak, only two services per hour in each direction are provided.

Yeerongpilly Station has relatively low levels of passenger use, with around 1,500 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-31**. Activity in the morning peak is higher than the evening peak with morning activity mostly consisting of boarding movements, with the reverse true in the evening peak.

Table 4-31 Existing (2009) Yeerongpilly Station person train usage

Time Period	Boardings	Alightings	Total
Daily	600	900	1,500
AM (7.00 to 9.00 am)	400	300	700
PM (4.00 to 6.00 pm)	<100	200	300

Source: Cross River Rail Project Model

Table 4-32 below illustrates the modes of access and egress at Yeerongpilly Station . This shows that the majority of morning peak boarders (80%) arrive on foot with a significant proportion (20%) by car. Alighters in the morning peak are virtually all walking to their final destination (some 99%) with only 1% travelling onwards by car. Bus access is negligible.

Table 4-32 Yeerongpilly Station Existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	0%	<100	0%
Car	<100	20%	<100	1%	<100	11%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	300	80%	300	99%	600	89%
Total	400	100%	300	100%	700	100%

Source: Cross River Rail Project Model

Moorooka Station

Moorooka Station is located between Ipswich Road and Fairfield Road as shown in **Figure 4-27**. It is approximately 10.5 km from Central Station. The station consists of two platforms in an island configuration with an approximate length of 150 m. The station office is located on the island platform which is served by two passenger rail tracks with additional rail tracks to the west and through the adjacent Clapham Rail Yard served by express and freight trains.

Figure 4-27 Moorooka Station location and surrounds

Moorooka Station is served by the Beenleigh Line and there are currently five inbound services stopping at Moorooka Station during the morning peak, three Beenleigh all stations and two Kuraby all stations services. Off-peak, only two services per hour in each direction are provided.

Moorooka has relatively low levels of passenger use, with around 1,400 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-33**. Activity in the morning peak is higher than the evening peak with morning activity mostly consisting of boarding movements, with the reverse true in the evening peak.

Table 4-33 Existing (2009) Moorooka Station person train usage

Time Period	Boardings	Alightings	Total
Daily	800	600	1,400
AM (7.00 to 9.00 am)	300	100	400
PM (4.00 to 6.00 pm)	100	100	200

Source: Cross River Rail Project Model

Table 4-34 illustrates the modes of access and egress at Moorooka Station . This shows that the around half of morning peak boarders (48%) arrive on foot with a significant proportion (31%) by bus and a further 17% by car. Alighters in the morning peak are virtually all walking to their final destination (some 84%) with only 3% travelling onwards by car or bus and a further 13% transferring to another rail service.

Table 4-34 Moorooka Station existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	100	31%	<100	1%	100	25%
Car	<100	17%	<100	2%	<100	14%
Rail	<100	4%	<100	13%	<100	5%
Walk/cycle	200	48%	<100	84%	200	55%
Total	300	100%	<100	100%	400	100%

Source: Cross River Rail Project Model

Rocklea Station

Rocklea Station is located 11.6 km from Central Station on the Beenleigh Line, in close proximity to the Ipswich Motorway and Beaudesert Road (see **Figure 4-28** below).

Figure 4-28 Rocklea Station location and surrounds

The railway within the vicinity of the station is of three-track configuration, with a pair of suburban lines and a single dual gauge track for freight and express passenger trains. The station consists of two side platforms – ticket facilities, toilets etc are located on the northbound platform. Overbridges link the platforms to each other and the surrounding catchment.

Rocklea Station is on the Beenleigh Line and there are currently five inbound services stopping at Rocklea Station during the morning peak. Off-peak, only two services per hour in each direction are provided.

Rocklea Station has relatively low levels of passenger use, with around 1,100 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-35**. Activity in the morning peak is higher than the evening peak with morning activity mostly consisting of alighting movements, with the reverse true in the evening peak.

Table 4-35 Existing (2009) Rocklea Station person train usage

Time Period	Boardings	Alightings	Total
Daily	600	500	1100
AM (7.00 to 9.00 am)	100	200	300
PM (4.00 to 6.00 pm)	200	100	300

Source: Cross River Rail Project Model

Table 4-36 below illustrates the modes of access and egress at Rocklea Station. This shows that the majority of morning peak boarders (70%) arrive on foot with a significant proportion (30%) by car. Alighters in the morning peak are all walking to their final destination with no recorded onward travel by bus or car.

Table 4-36 Rocklea Station Existing (2009) modes of access

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	0%	<100	0%	<100	0%
Car	<100	30%	<100	0%	<100	10%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	<100	70%	200	100%	300	90%
Total	<100	100%	200	100%	300	100%

Source: Cross River Rail Project Model

Salisbury Station

Salisbury Station is located 13 km from Central Station on the Beenleigh Line, close to and east of Beausdesert Road as shown in **Figure 4-29**.

The railway within the vicinity of the station is of three-track configuration, with a pair of suburban lines and a single dual gauge express track for freight, express trains and/or standard gauge (interstate) trains. station consists of two platforms in an island configuration with ticket facilities, toilets etc all located within the island.

Salisbury Station is on the Beenleigh Line and there are currently five inbound services stopping at Rocklea Station during the morning peak. Off peak, only two services per hour in each direction are provided.

Salisbury Station has relatively low levels of passenger use, with around 1,100 boardings and alightings on a typical weekday in 2009 as shown in **Table 4-37**. Most morning peak activity consists of alighting movements, with the reverse true in the evening peak.

Figure 4-29 **Salisbury station location and surrounds**

Table 4-37 **Existing (2009) Salisbury station person train usage**

Time Period	Boardings	Alightings	Total
Daily	600	500	1100
AM (7.00 to 9.00 am)	100	200	300
PM (4.00 to 6.00 pm)	200	100	300

Source: Cross River Rail Project Model

Table 4-38 below illustrates the modes of access and egress at Salisbury Station. This shows that the majority of morning peak boarders (48%) arrive on foot with a significant proportion (37%) by car. Alighters in the morning peak mostly walked to their final destination (58%) with a further 38% continuing by bus.

Table 4-38 **Salisbury station Existing (2009) modes of access**

Access Mode	Boardings		Alightings		Total	
	Passengers	Proportion	Passengers	Proportion	Passengers	Proportion
Bus	<100	15%	<100	38%	<100	20%
Car	<100	37%	<100	4%	<100	29%
Rail	<100	0%	<100	0%	<100	0%
Walk/cycle	<100	48%	<100	58%	100	51%
Total	200	100%	<100	100%	200	100%

Source: Cross River Rail Project Model

4.3.7 Line activity in the study corridor

Line loadings

Modelled train loadings on the existing passenger network (expressed as a percentage of seated train capacity) are reported in **Table 4-39**. This assessment shows that during the morning and evening peak periods significant crowding is now prevalent on inner city sections of the rail network with numerous line segments experiencing passenger demands close to, or exceeding seated capacity, for the whole two-hour peak period[13]. Train loads are generally heavier in the morning peak (in the peak direction) than the evening peak (in the peak direction). This is because education and work-based trips coincide in the morning peak period (7.00 am to 9.00 am), whereas education based trips are predominantly undertaken before the start of the evening peak period (4.00 pm to 6.00 pm).

Table 4-39 Existing line loadings (2009) between stations within the study corridor

Time period	Northbound	Southbound	Two-Way
Wooloowin-Albion			
Daily	18%	19%	18%
AM (7.00 to 9.00 am)	22%	110%	77%
PM (4.00 to 6.00 pm)	51%	16%	37%
Albion-Bowen Hills			
Daily	19%	18%	19%
AM (7.00 to 9.00 am)	22%	114%	80%
PM (4.00 to 6.00 pm)	53%	16%	38%
Bowen Hills-Fortitude Valley			
Daily	13%	14%	13%
AM (7.00 to 9.00 am)	14%	101%	56%
PM (4.00 to 6.00 pm)	48%	12%	30%
Fortitude Valley-Central			
Daily	13%	14%	14%
AM (7.00 to 9.00 am)	23%	95%	57%
PM (4.00 to 6.00 pm)	44%	15%	30%
Central Station-Roma Street			
Daily	10%	12%	11%
AM (7.00 to 9.00 am)	68%	34%	52%
PM (4.00 to 6.00 pm)	14%	36%	24%
Roma Street-South Brisbane			
Daily	13%	13%	13%
AM (7.00 to 9.00 am)	72%	53%	66%
PM (4.00 to 6.00 pm)	17%	38%	31%

[13] A load factor of 100% means that all seats are occupied on average for the two-hour time period and would mean that the average number of passengers matches the available number of seats over 2 hours. It does not attempt to provide an indication of the passenger load on any individual train service within that two hour period.

Time period	Northbound	Southbound	Two-Way
South Brisbane-South Bank			
Daily	14%	14%	14%
AM (7.00 to 9.00 am)	43%	25%	37%
PM (4.00 to 6.00 pm)	18%	45%	35%
South Bank-Park Road			
Daily	45%	16%	24%
AM (7.00 to 9.00 am)	48%	16%	38%
PM (4.00 to 6.00 pm)	21%	52%	41%
Park Road-Dutton Park			
Daily	18%	16%	17%
AM (7.00 to 9.00 am)	98%	33%	76%
PM (4.00 to 6.00 pm)	24%	50%	40%
Dutton Park-Fairfield			
Daily	18%	16%	17%
AM (7.00 to 9.00 am)	96%	31%	74%
PM (4.00 to 6.00 pm)	24%	50%	40%
Fairfield-Yeronga			
Daily	18%	16%	17%
AM (7.00 to 9.00 am)	92%	31%	72%
PM (4.00 to 6.00 pm)	24%	48%	39%
Yeronga-Yeerongpilly			
Daily	17%	15%	16%
AM (7.00 to 9.00 am)	87%	28%	68%
PM (4.00 to 6.00 pm)	23%	46%	38%
Yeerongpilly-Moorooka			
Daily	17%	16%	16%
AM (7.00 to 9.00 am)	93%	25%	70%
PM (4.00 to 6.00 pm)	26%	45%	38%
Moorooka-Rocklea			
Daily	17%	16%	16%
AM (7.00 to 9.00 am)	90%	29%	72%
PM (4.00 to 6.00 pm)	26%	45%	38%
Rocklea-Salisbury			
Daily	17%	16%	16%
AM (7.00 to 9.00 am)	92%	29%	72%
PM (4.00 to 6.00 pm)	25%	45%	38%

Source: Cross River Rail Project Model

Note: Line loading is expressed as a percentage of seated capacity

4.3.8 Level of service – load factor

This section provides an assessment of load factors across the network in peak periods. Load factors express the demand (patronage) of individual train services relative to the capacity of that train - either seated capacity or 'design load' - that is seated capacity plus a reasonable number of standees. This is distinct from the line loading assessment above which provided demand as a percentage of seated capacity averaged over the whole two-hour period.

The capacity provided by peak rail services is heavily concentrated on the main corridors into the Brisbane inner city area (from northern section to central section and from southern section to central section).

In the morning two-hour peak period, trains from Beenleigh and the Gold Coast are operating at or near their seated capacity (around 98%) approaching Park Road Station. Rail modelling shows that three out of seven peak hour services on the Beenleigh line currently exceed the design load for Queensland Rail rollingstock (that is more than 750 passengers at any point or passengers standing for more than 20 minutes). On the Gold Coast line, all four services in the morning peak hour exceed the design load.

In the morning two-hour peak period trains from the Sunshine Coast, Caboolture, Airport, Doomben and Shorncliffe lines are operating at or above their full seated capacity (around 114% of seated capacity approaching Bowen Hills southbound). On the Caboolture line, eight out of 10 services in the peak hour currently exceed the Queensland Rail design load.

It is predicted that Brisbane inner city rail network will reach the maximum capacity by around 2016. It should be noted that various restrictions exist outside of the CBD, but even if these are all removed the maximum CBD capacity using the current rollingstock and signalling system is still 19 trains per hour in each direction on the main lines and 23 trains per hour in each direction on suburban lines.

4.4 Freight rail operations and performance

4.4.1 Overview of the rail freight network

The review of rail freight demand tasks have been completed by SAHA (SAHA, September 2010) the review of constraints on the rail freight network has been completed by Systemwide (Systemwide, December 2010).

Rail freight movements through Brisbane and South East Queensland have been grouped into the following market segments:

- North Coast line
- Western line
- Interstate freight
- 'Intra-urban freight'.

North Coast line

The North Coast line consists mainly of non-bulk (intermodal or containerised) rail freight transported between Acacia Ridge (and to a lesser extent Brisbane Multi-modal Terminal) and various destinations in North Queensland. Intermodal freight is mainly transported north from Brisbane to markets in Central Queensland, with a lesser volume of specific commodities such as refrigerated meat moving south for export via the Port of Brisbane. Bulk freight mainly consists of fuel and bitumen transported north from refining facilities located in the Australia Trade Coast region to central Queensland, and

cement which is transported from quarries in central and northern Queensland to the Brisbane/South East Queensland market[14].

North Coast line freight movements are important in the context of inner city rail capacity as virtually all of this freight is transported through the inner city via the Exhibition Loop. The vast majority of North Coast line freight is transported to and from Acacia Ridge (intermodal freight) and the Australia Trade Coast (fuel and bitumen) via Corinda and the Tennyson loop. Movement of freight directly across the Merivale Bridge is not considered to be a viable alternative to current transport arrangements given the importance of this route to passenger trains[15]

Estimates suggest that 2.8 million tonnes of freight is transported along the North Coast line each year (see **Table 4-40**).

Table 4-40 Existing estimates of freight flows between SEQ and North Queensland[16]

Mode	Million tonnes per annum			Mode share (%)
	Inbound	Outbound	Total	
Road	2.6	2.1	4.7	63
Rail	1.4	1.4	2.8	37
Total	4.0	3.5	7.5	

Western line

The Western line extends from Corinda through Rosewood to Toowoomba and regions further west of South East Queensland. Significant amounts of bulk freight are transported along this line from locations west of Toowoomba to the Port of Brisbane for export. Coal in particular has increased significantly in recent years as a result of strong export demand and new/expanded mining activities in the Surat Basin. Coal exports through the Port of Brisbane are shown in **Table 4-41**. Each week there are 120 coal train movements to and from the port via the Western line[17].

Table 4-41 Coal exports through the Port of Brisbane[18]

Year	Million tonnes per annum	% change on previous year
2009 - 2010	6.3	-0.5
2008 - 2009	6.3	15.1
2007 - 2008	5.5	30.2
2006 - 2007	4.2	1.6
2005 - 2006	4.2	12.2
2004 - 2005	3.7	

Given the non-time sensitive nature of coal, much of the rail throughput is transported in non-peak periods when rail capacity is more readily available.

Grain movements west of Toowoomba are much lower compared to coal (approximately 1 Million tonnes per annum) and are highly seasonal.

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[14] Queensland Transport (2007) South East Queensland Regional Freight Network Strategy 2007-2012.

[15] Queensland Transport (2008) Inner City Rail Capacity Study.

[16] Queensland Transport (2008) SEQ Freight Intermodal Terminal Study.

[17] Queensland Transport (2007) South East Queensland Regional Freight Network Strategy 2007-2012.

[18] Port of Brisbane Corporation, Trade reports from 2005/06 to 2009/10.

Coal and grain trains operating on the Western line use the Tennyson loop then the southern lines between Yeerongpilly and Park Road in order to access the Port of Brisbane. Future capacity constraints on this corridor could impact on these freight movements.

Some non-bulk freight is also transported along the Western line however this is relatively small and currently in the region of 600,000 tonnes per annum[19]. In order to access Acacia Ridge, intermodal trains operating on the Western line use the Tennyson loop then the southern lines between Yeerongpilly and Salisbury.

Interstate freight

Interstate freight, consists of intermodal freight transported between South East Queensland and other Australian states via Acacia Ridge and the Brisbane Multi-modal Terminal (BMT). At present interstate freight train operations are confined to the network south of Park Road.

Acacia Ridge[20] plays a key role in the Queensland Freight Network and supports the movement of interstate and intra-regional freight. The terminal has dual gauge rail lines servicing the interstate corridor and the BMT. Current terminal throughput is understood to be in the range of 380,000 twenty-foot equivalent units (TEUs) per annum. The terminal has a total capacity of 500,000 TEUs per annum. However, as a result of infrastructure and operational enhancements, it is expected that this could be increased to around 850,000 TEUs per annum[21].

'Intra-urban freight'

'Intra-urban freight' currently represents a small market segment and a very small amount of intra-urban freight is transported by rail within South East Queensland. Freight trains operate between Acacia Ridge and the Brisbane Multi-modal Terminal, but almost all of this freight arrives from, or is destined for, locations outside South East Queensland (ie interstate and intrastate). Rail currently caters for around 13% of import-export (IMEX) container movements through the Port of Brisbane. Freight trains operating between Acacia Ridge and BMT move through the inner city corridor between Yeerongpilly and Park Road.

The vast majority of freight movements between Acacia Ridge and BMT relate to exports from outside South East Queensland. At present virtually all intra-urban IMEX movements are transported by road.

4.4.2 Weekly freight train movements

Figure 4-30 shows estimates of weekly freight train for 2007. This illustrates that in 2007:

- 120 two-way coal trains per week between the west and the Port of Brisbane via Yeerongpilly and Park Road
- 78 two-way weekly freight trains accessing the Brisbane inner city rail network from the west
- 33 two-way freight (intermodal) trains per week between Roma Street and Park Road and so passing over the Merivale Bridge
- a total of 158 two-way weekly freight trains accessing the Brisbane inner city rail network from the north
- 132 two-way weekly freight trains accessing the Brisbane inner city rail network from the west.

[19] Queensland Transport (2007) South East Queensland Regional Freight Network Strategy 2007-2012.

[20] Acacia Ridge is also supported by smaller terminals located at Moolabin and Clapham.

[21] Queensland Transport (2008) Report on the findings of the SEQ Intermodal Freight Terminal Study

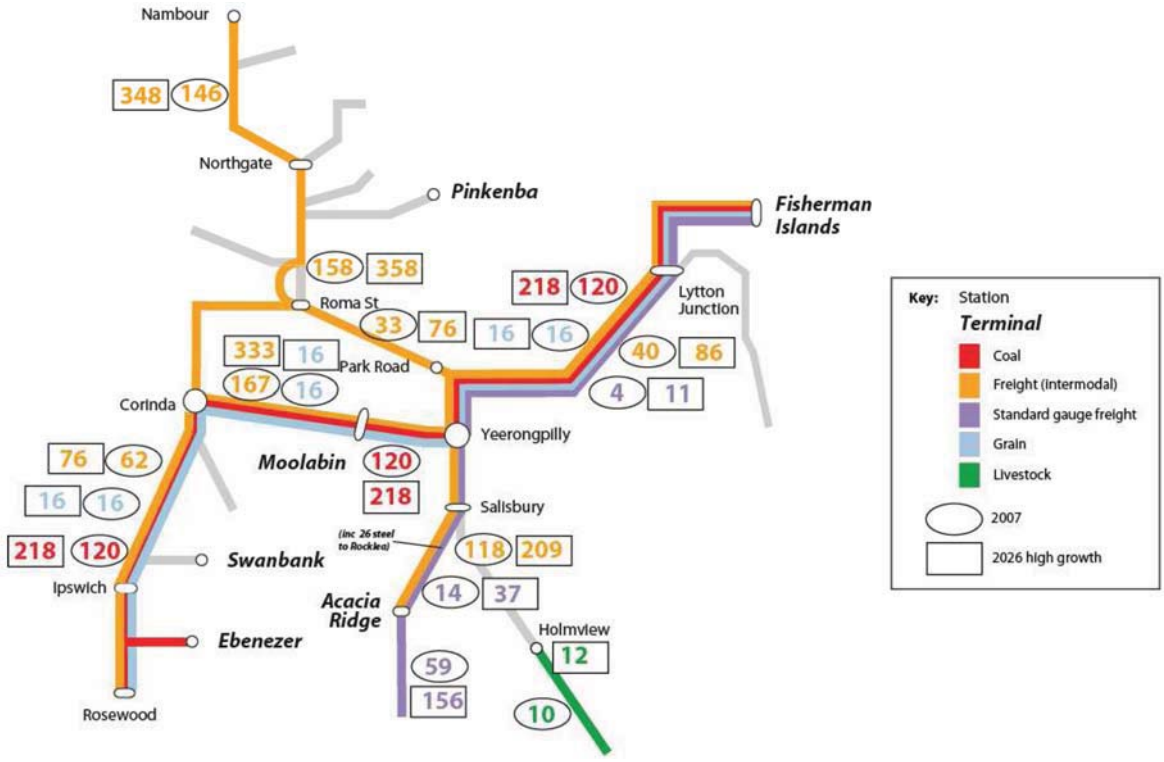


Figure 4-30 Existing estimates of weekly train movements within SEQ rail network[22] (two-way flows)

4.4.3 Constraints to rail freight operations

Passenger and freight rail services share network capacity, with passenger services prioritised over freight. Currently freight trains do not operate during peak periods within the Brisbane metropolitan rail network. Efficiency and performance of non-peak passenger rail operations are often affected by the need to schedule freight trains in the times available between higher priority passenger train services.

Key generators of freight rail services are Fisherman Islands (Port of Brisbane), Acacia Ridge Freight Terminal, and regions serviced by the North Coast line. The current freight peak periods are between 4.00 am and 7.00 am arriving at the terminals, and between 6.00 pm and 9.00 pm for departures to match current logistics trends. There is more flexibility for afternoon and evening departures depending on the length of journey but freight arrivals typically must arrive at the beginning of the day to meet distribution needs.

A series of specific conflicts exists that affect the operation of freight trains. These include network conflicts and conflicts with the operation of passenger trains around the inner city. The capacity for freight movements from one side of the city to the other is determined by these key freight capacity constraints within the inner city area. Specific performance issues are:

- peak freight curfew – freight operational hours are currently restricted by a passenger-peak freight curfew, not allowing freight services access to the passenger network during the morning or evening peak hours, with restricted access during the shoulder period. This prevents freight operations for approximately four hours of the day on large parts of the network.

[22] Queensland Transport (2008) Inner City Rail Capacity Study. Note that figure contains estimates for 2026 – see Section 3 for further information relating to future freight demand.

- operations on the Merivale Bridge – passenger train operations have priority on the Merivale Bridge. This route is only used opportunistically when train paths are available for freight traffic. The primary route for all freight to and from Acacia Ridge from the North Coast is via Corinda and the Tennyson loop.
- network constraints such as
  - freight services arriving from the North Coast must cross the path of passenger services heading to the north at Bowen Hills junction
  - non-freight services entering and exiting Mayne Rail Yard cause flat junction conflicts with the freight services on the Exhibition loop tracks
  - the area around Normanby Yard has many potential crossing and merging conflicts, especially with passenger services finishing at Roma Street and heading to Mayne Rail Yard
  - junction conflicts between freight and passenger services at the Milton and Roma Street Junction
  - passenger and freight trains sharing the single bi-directional dual gauge track between Salisbury and Park Road, preventing freight trains from operating on this part of the network in peak commuting hours, and limiting the number of both freight and express passenger (ie Gold Coast) services in the off peak to approximately current levels.

It should be noted that one of the most complicated sections of the inner city rail network (in terms of freight operation) is the area between College Road, Roma Street station, and the junction west of Roma Street. Flat junction conflicts exist between freight services and passenger services moving between Roma Street and Mayne Rail Yard, and all passenger movements south of Roma Street. Freight services travelling via the Merivale Bridge must travel across all four tracks at grade.

Freight conflict locations in the inner city are shown in **Figure 4-31**.

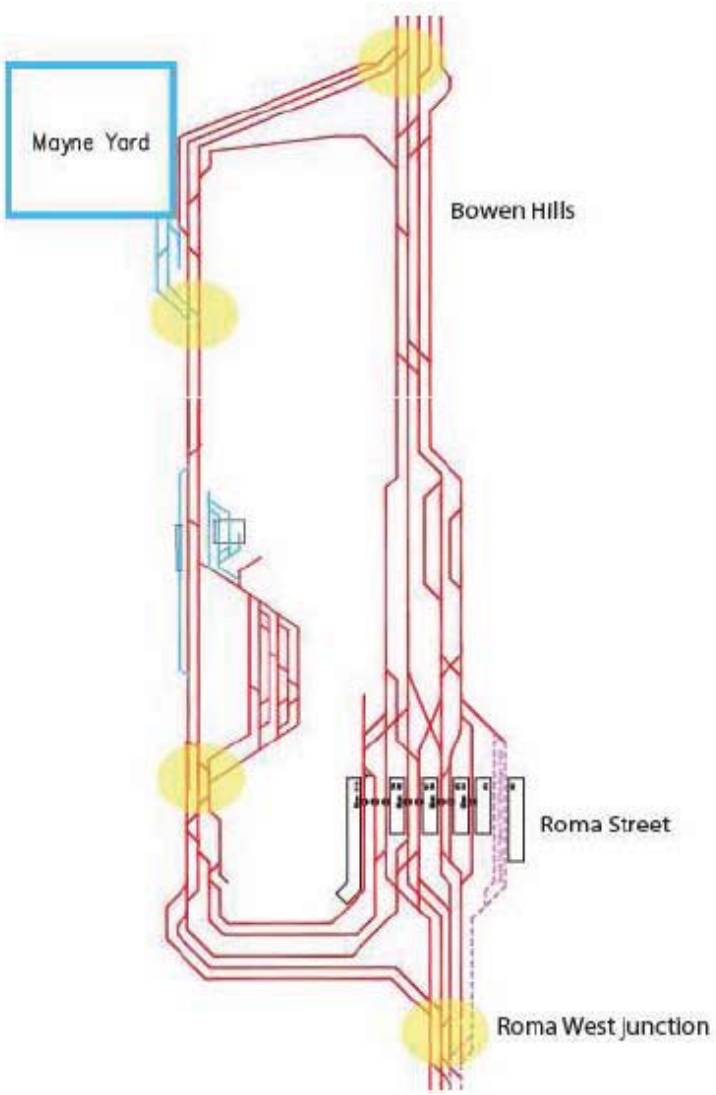


Figure 4-31 The Inner City layout and conflict locations

Source: Inner City Rail Capacity Study (Queensland Transport, 2008)

4.5 Bus operations and performance

For the purposes of this investigation, bus operations within the study corridor have been broken up into three geographic areas: north, central and south.

4.5.1 Current bus operations – north

Across the northern part of the study corridor, bus services are principally grouped on Bowen Bridge Road/Lutwyche Road to the west and Abbotsford RoadSandgate Road to the east of the railway. There are no dedicated bus-rail interchange facilities in this part of the study corridor.

On the Lutwyche Road corridor, approximately 50 buses per hour operate in the peak direction in 2009-2010. Off-peak, there are around 18 buses per hour (each direction) on the Lutwyche Road corridor (south of Lutwyche) including the corridor's only high frequency bus route, the 333 which operates at least every 15 minutes, 6.00 am to 11.00 pm seven days a week.

On Sandgate Road, a combination of limited stops and all stops buses combine to create peak frequency of 12 buses per hour in the peak direction. Off-peak, approximately seven buses per hour operate in each direction.

The inner Northern Busway currently links the CBD and Cultural Centre to the Royal Brisbane and Women's Hospital (RBWH) Busway Stations via QUT and the Royal Children's Hospital (RCH) Busway Station. This is the first stage of the Northern Busway which is ultimately destined for Bracken Ridge via Windsor, Lutwyche, Kedron, Chermside, Aspley and Carseldine.

Travel speeds on both Lutwyche Road and Sandgate Road are variable due to lack of bus priority and heavy background traffic conditions. The Northern Busway (RBWH to Kedron) is currently under construction in the Lutwyche Road corridor, along with the Airport Link toll road and both are due for completion in mid-2012. Planning is underway for the Kedron to Bracken Ridge section of the Northern Busway. These initiatives are intended to address growing patronage and relieve surface traffic congestion in this corridor. The Northern Busway is expected to be the bus spine for north Brisbane and serve a complimentary catchment to the passenger rail network.

Wooloowin Station bus services and facilities

There are no bus services within 500 m of Wooloowin Station. The 321 service operates an infrequent service on Kedron Park Road which is outside the study corridor, more than 500 m to the north-west. The 320 service (Chermside to City via Eagle Junction) operates along Bonney Avenue with the nearest stops over 600 m to the east of the station which is outside the study corridor.

Bus facilities at Wooloowin are considered to be non-existent. Bus rail interchange in this area is likely to occur at Toombul or Eagle Junction to the north, or at stations to the south, including Bowen Hills, Fortitude Valley and Central.

Albion station bus services and facilities

Bus stops at Albion are located on Sandgate Road near the Lever Street intersection as shown in **Figure 4-32**. Inbound bus stop are located on Sandgate Road approximately 220 m east of the station servicing inbound bus routes 306, 320 and 322. The outbound bus stop is located on Sandgate Road approximately 200 m east of the station servicing outbound buses route 306, 320 and 322. There are no bus stops immediately west of the station.

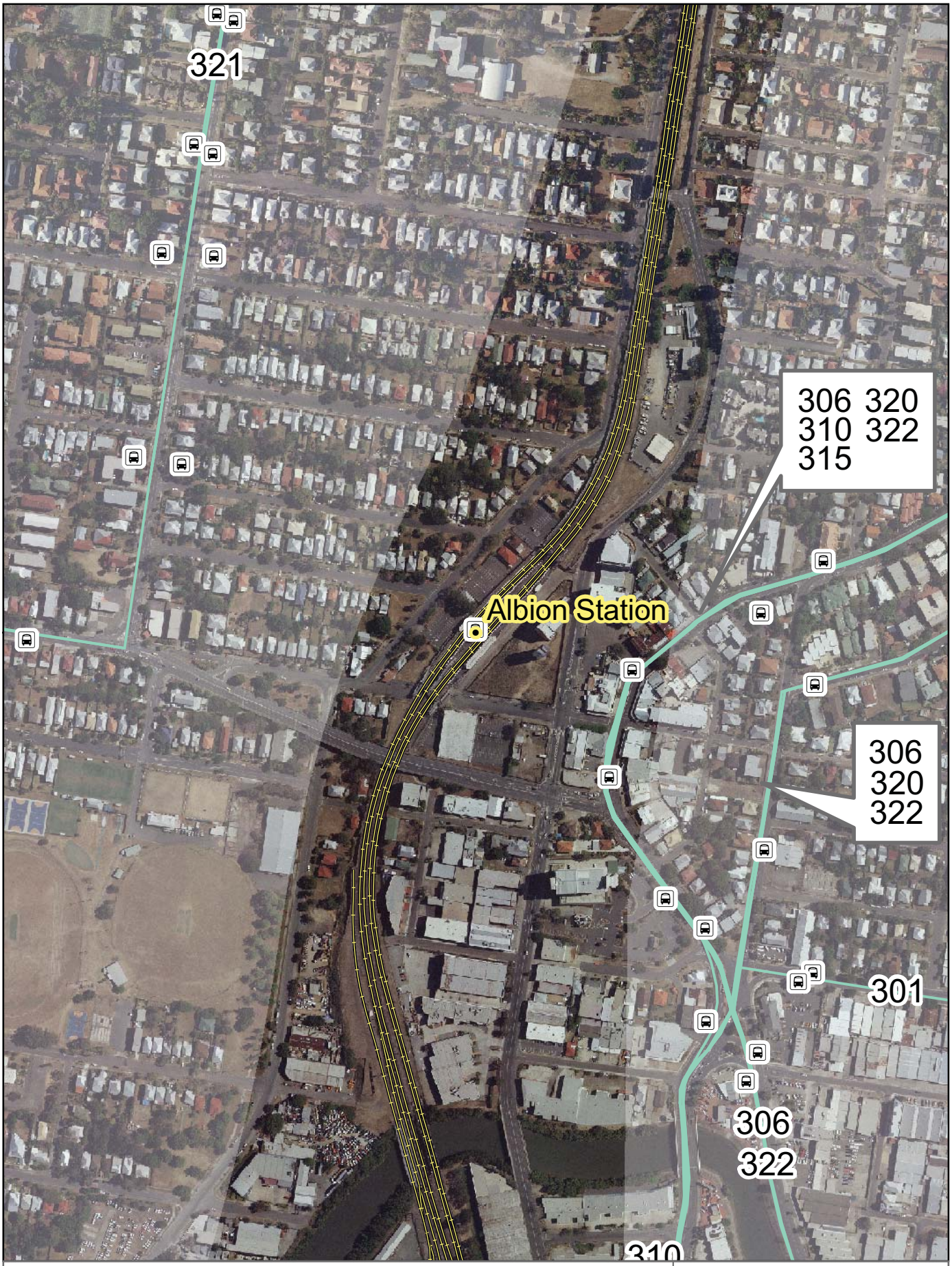
As shown in **Table 4-42**, there are up to eight buses per hour in peak times (peak direction) dropping back to five per hour each direction in the off-peak.

Two further bus routes, the 310 and 315 are limited stops buses which travel along Sandgate Road within 150 m of Albion station but do not stop at Albion. The nearest bus stop for these services is approximately 1 km to the north-east, on Sandgate Road, approaching Oriel Road which is outside the study corridor.

Table 4-42 Bus services per hour in the vicinity of Albion station

Bus Services	Peak direction (one-way)	Monday – Friday off-peak (one-way)	Saturday	Sunday
306/322 (combined service between Toombul to City via valley)	4	3	2	1
320 (Chermside to City via Eagle Junction)	4	2	Approx hourly	6 services in total
Total buses per hour	8	5	Up to 4	Up to 2

Source: TransLink website, 2010 (www.translink.com.au)



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-32

Bus Stops and Routes around Albion Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G034_CCR_Trans_current_bus_Albion_Station_A4_ver93.mxd 06/07/2011 15:06

Bowen Hills Station bus services and facilities

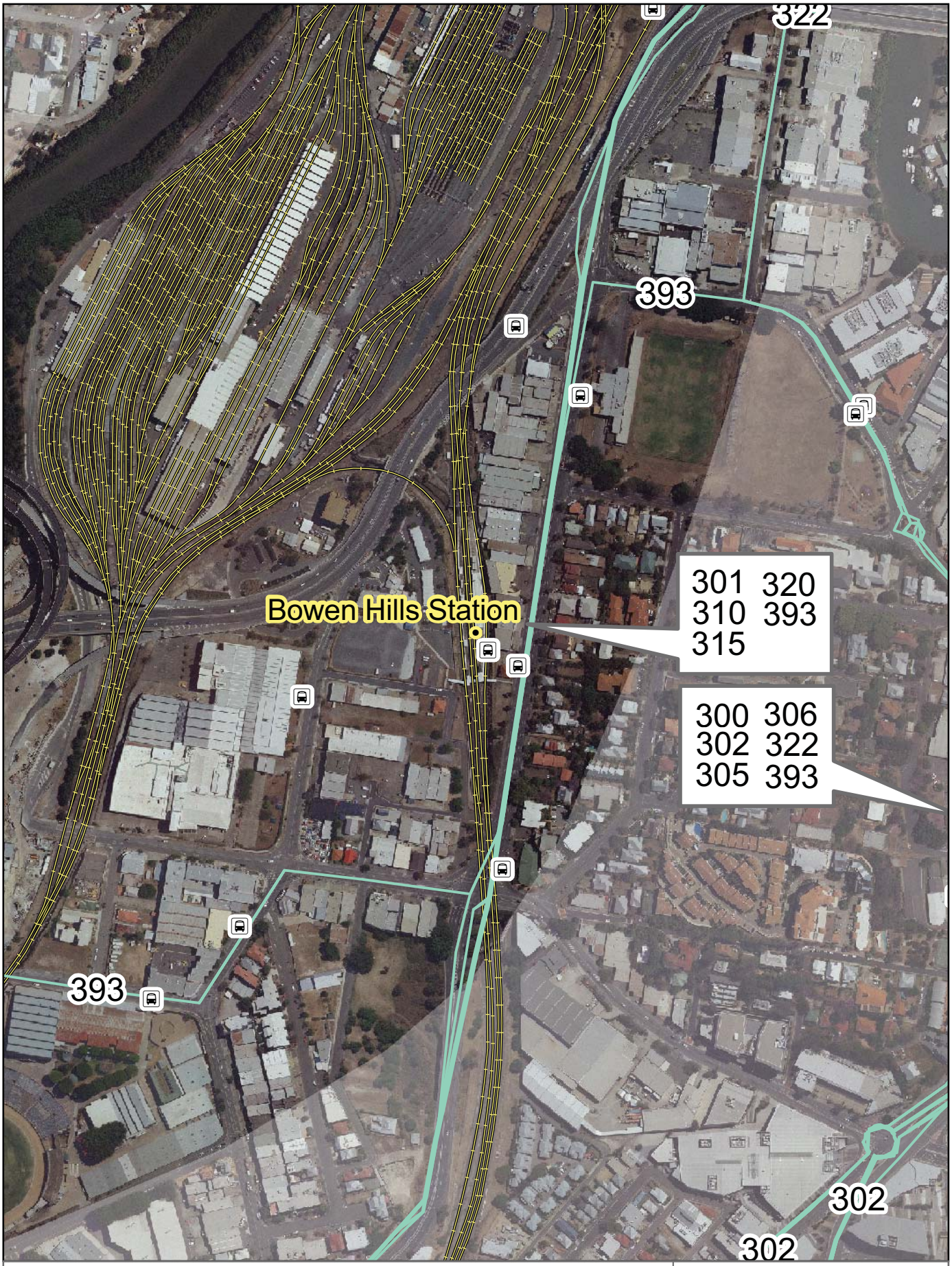
Six bus routes serve Bowen Hills Station via bus stops on Abbotsford Road. An outbound (northbound) bus stop is located adjacent to the station's southern entrance while an inbound (southbound) bus stop is located adjacent to Perry Park, 200 m from the northern entrance. A second inbound bus stop is located on Abbotsford Road approximately 100 m north of the intersection with Montpellier Street however this stop only serves route 301 and 320. Refer to **Figure 4 34** for these bus routes and stops including details of the following bus routes:

- Route 393 operates from Normanby to Teneriffe Ferry Terminal. It serves Bowen Hills residential area located east of the station, with the nearest bus stop located at Abbotsford Road It operates during the weekday, with a 15 to 20 minute frequency during the peak periods
- Route 320 operates between Queen Street Mall/Edward Street and Chermside Interchange via Albion. It operates daily with a 15 to 30 minute frequency during the peak periods
- Route 310, N310 and 315 operate between Sandgate and City (Queen Street). The 310/315 operates a combined frequency of every 15 minutes in peak times, 30 minutes off peak (weekdays) and hourly on weekends. Route N310 operates hourly outbound only on Friday and Saturday nights between 1.00 am to 5.00 am
- Route 301 operates between Toombul Interchange and Cultural Centre Busway Station. It operates daily with a 30 minute frequency during the peak periods.

In the peak periods, there up to 11 buses per hour in each direction.

The existing bus stop facilities on Abbotsford Road are considered to be poor with the outbound bus stop on a narrow footpath with limited seating space as seen **Figure 4-33**. Only minimal interchange was observed between bus and rail however in the morning peak, interchange between rail and northbound bus at the Abbotsford Road bus stop immediately adjacent to the station entrance was observed.

Figure 4-33 Abbotsford Road outbound bus stop



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-34

Bus Stops and Routes around Bowen Hills Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G035_CCR_Trans_current_bus_Bowen_Hills_Station_A4_ver93.mxd 06/07/2011 15:07

Exhibition Station bus services and facilities

Bus is an important public transport mode in the Exhibition Station precinct given the lack of regular passenger rail services from the current Exhibition Station. Key surrounding bus stops and bus routes are shown in **Figure 4 35**.

Exhibition Station is located within 500 m of both the Royal Children's Hospital (RCH) and Royal Brisbane and Women's Hospital (RBWH) Busway Stations on the Northern Busway.

The Northern Busway currently links the CBD and Cultural Centre to the RBWH via QUT and the RCH. This is the first stage of the Northern Busway which is ultimately destined for Bracken Ridge via Windsor, Lutwyche, Kedron, Chermside and Aspley. Construction of the extension of the Northern Busway from RBWH to Kedron began in 2008 and is due to be completed in 2012. Planning is underway for the Kedron to Bracken Ridge section of the Northern Busway.

Apart from the above bus stations, buses and bus stops are also located on Bowen Bridge Road (immediately north of Gregory Terrace) and O'Connell Terrace.

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-35

Bus Stops and Routes around Exhibition Station

0 50 100 150 200 m

1:5,500 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G036_CCR_Trans_current_bus_Exhibition_Station_A4_ver93.mxd 06/07/2011 15:07

4.5.2 Current bus operations – Central

Central Brisbane is the hub of the Brisbane bus network and the principal destination for bus commuters in Brisbane. A wide range of bus operating patterns service the inner city including all stops inner suburban buses, limited stops buses from middle-outer suburban locations and express-running, peak-only 'rocket' type services.

In 2008, around 530 buses were entering the inner city in the morning peak one hour. Over 300 of these buses come from the south, entering the city via the Victoria Bridge (South East Busway) or the Captain Cook Bridge.

Constraints to capacity exist because of both road and busway constraints (particularly from the south and/or east where access to the city is via one of only three bridges (Victoria, Captain Cook or Story Bridges). Constraints also exist in terms of on street stopping space and layover as reported in the Bus Access Capacity-Inner City Study (BACICS), 2008.

The key inner city bus termination and interchange locations are:

- Roma Street – busway station fully integrated with the railway station allowing for bus-rail and bus-bus interchange
- King George Square (KGS) Busway Station – bus-bus interchange and termination for some bus services from the west
- Queen Street Bus Station (QSBS) – principally a termination destination from the south and west with bus-bus interchange opportunities
- Cultural Centre Busway Station – a principal bus termination destination from the north with significant bus-bus and bus-rail interchange opportunities at nearby South Brisbane rail station
- Adelaide Street – provides bus-bus and bus-rail interchange opportunities near Central Station
- Elizabeth Street – principally a bus termination destination from the south with some potential for bus-bus interchange.

While bus access to the inner city including the CBD are very good overall, there are parts of the CBD south of Elizabeth Street which experience infrequent and irregular bus services, particularly during the off peak periods. For example the popular City Loop service provides a good level of service (every 10 to15 minutes) during work hours Monday to Friday however it does not serve the precinct outside of this time. Furthermore, while there are a range of routes serving the southern CBD operated by Veolia Transport from the east of Brisbane (Redlands area), these operate during morning and evening peak periods (in the peak direction), Monday to Friday only.

Roma Street station bus services and facilities

Bus routes and stops in the vicinity of Roma Street can be found in **Figure 4-36**. As illustrated, the Roma Street Busway Station is located adjacent to and part of the Roma Street Station. This busway station is comprised of two busway platforms (Platform 1 outbound and Platform 2 inbound) accessed directly off the main pedestrian subway to the rail platforms.

From Roma Street Busway Station, key outbound services include:

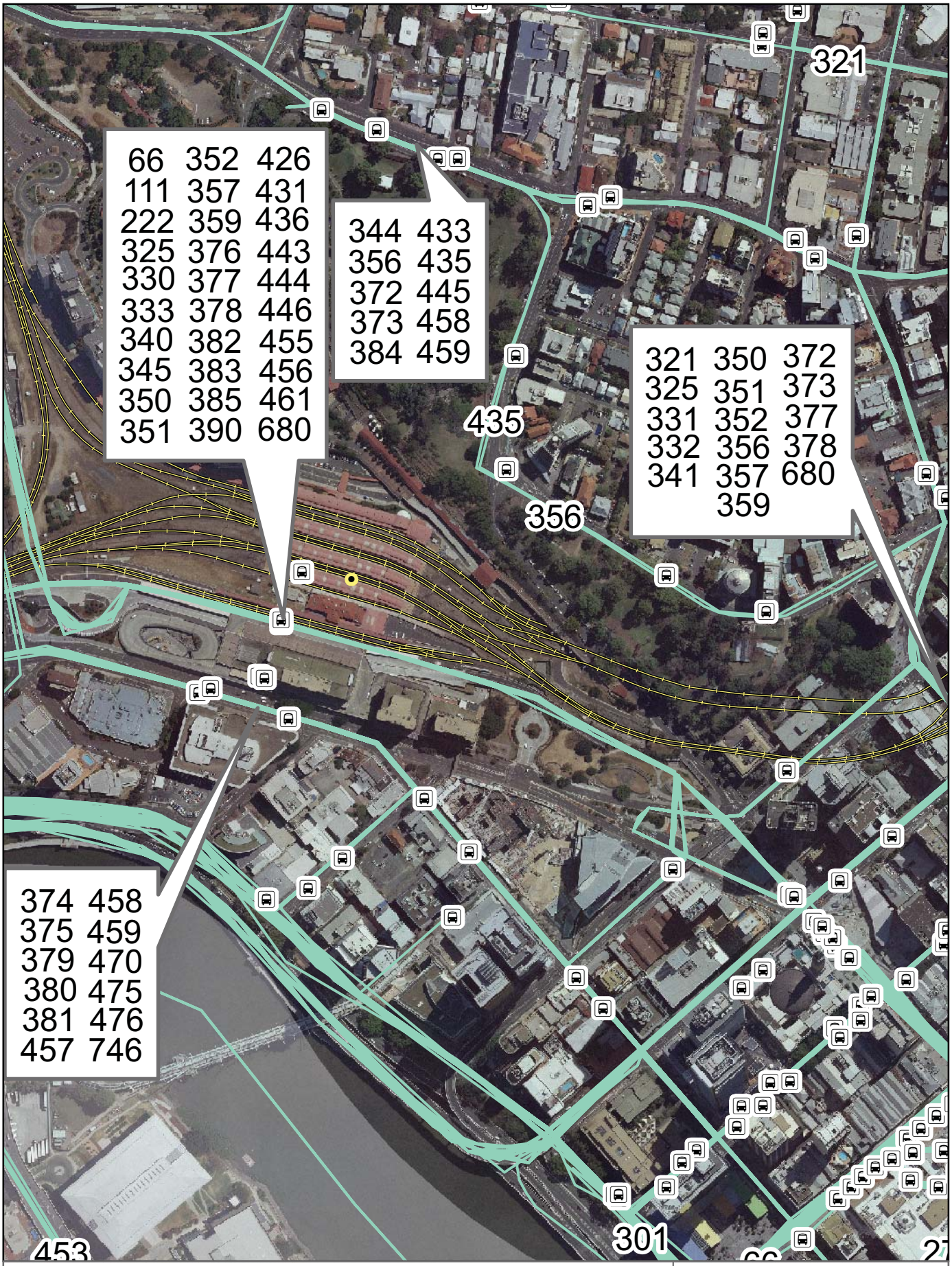
- Western bus services along Coronation Drive or Milton Road (eg P88, 444 and 455 to Indooroopilly, Kenmore and Moggill)
- North-west bus services along Caxton Street/La Trobe Terrace (eg 385 to The Gap via Paddington)
- Northern services along Kelvin Grove Road (eg 345 to Aspley) and Northern Busway/Gympie Road (eg 333 to Chermside, 330 to Bracken Ridge and 340 to Carseldine).

Inbound services from Roma Street travel to either KGS, or QSBS approximately 200 m beyond KGS station or to on-street stops within the CBD. The majority of services that stop at KGS, then pass through QSBS (without stopping) and continue to Cultural Centre Busway Station where the majority of services from Roma Street terminate. The key exceptions are route 66 (to Woolloongabba) route 222 (to Carindale) and route 111 (to Eight Mile Plains).

The completion of the Inner Northern Busway through Roma Street station in 2007 has significantly enhanced bus-rail integration and interchange opportunities within Brisbane, with both high frequency bus services and rail services serving the same station. Seamless transfer is now possible between both modes, making many more public transport journey combinations more attractive.

Moderate levels of interchange were observed in the morning peak site visit (possibly 15% of train alightees transferring to a busway service), however the 2009 passenger survey suggests this is less than 10%. Over time, it is expected that bus-rail interchange will become more significant as the number and attractiveness of key busway services increase. For example as the Northern Busway to Chermside and Eastern Busway to Carindale is constructed, and bus journey times from Roma Street reduce, then additional interchange between bus and rail services could be expected.

Additional bus stops for local buses are located on Roma Street itself, approximately 100 m west of the station. These cater for local services (including the interchange between rail and on-street bus). Observations in peak hours did not reveal any major bus-bus or bus-rail interchange at this location however the outbound bus stop on the southern side of Roma Street was observed to be heavily used in the evening peak with passengers crowding the footway.



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-36

Bus Stops and Routes around Roma Street Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G037_CCR_Trans_current_bus_Roma_St_Station_A4_ver93.mxd 06/07/2011 15:08

Central Station bus services and facilities

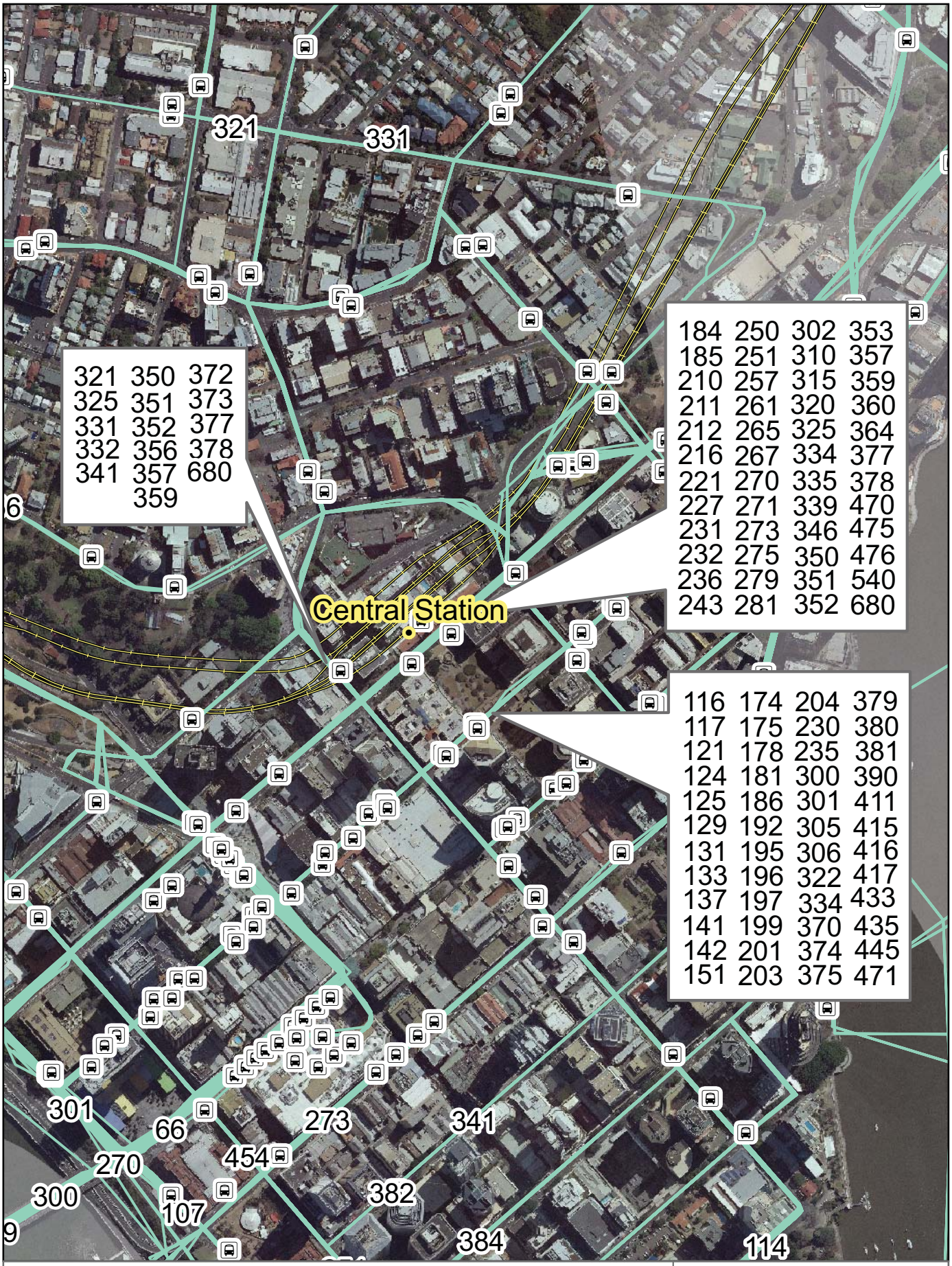
Central Station does not provide any dedicated opportunities for integrated interchange with the bus network with passengers who wish to transfer to bus required to use the on road bus stops on Ann Street, Edward Street, Creek Street or Adelaide Street (refer to **Figure 4-38**). The busway network does not serve Central Station directly and the Adelaide Street bus mall is approximately 150 m south of the station. As shown in the station activity mode of access tables in **Section 2.5.1**, only 3% of station boarders accessed the station by bus.

Nevertheless, there are currently two locations for interchange between rail and bus, in the vicinity of Central Station. The first is the anti-clockwise city loop bus stop on Ann Street immediately opposite the station (principally serving the Government and QUT precincts) and was observed to be crowded in the morning peak as seen in **Figure 4-37**. The second is the clockwise City Loop bus stop located on Adelaide Street at ANZAC Square however this bus stop is more than 150 m from the station and so does not provide a good level of interchange with Central Station due to the walk distance between modes.

The city centre free loop stops at several key CBD destinations including Queen Street Mall, City Botanic Gardens, Riverside Centre, QUT and KGS. The City Loop operates every 15 minutes between 7.00 am and 6.00 pm in each direction. The passenger demand for the city centre free loop is currently observed to be high in the peak periods with buses operating at capacity. The service covers the areas of the CBD that are currently not well served by rail.

Other bus-rail interchange opportunities existing with the QSBS and KGS Busway Station. QSBS is located in the Queen Street mall under the Myer Centre approximately 430 m south of Central Station. It is a terminus for many routes using the South East Busway. The station currently services 38 routes via 16 bus bays. KGS Busway Station is located beneath the KGS approximately 300 m from Central Station. Because of the close proximity of KGS Busway Station and QSBS, bus services that stop at QSBS bypass the KGS Busway Station and vice versa As such a wide range of bus services can be accessed from these two stations.

Figure 4-37 Rail-bus passengers at Ann Street bus stop



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-38

Bus Stops and Routes around Central Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G038_CCR_Trans_current_bus_Central_Station_A4_ver93.mxd 06/07/2011 15:09

Woolloongabba area bus services and facilities

The suburb of Woolloongabba includes significant bus infrastructure and is a key part of the south-east Brisbane bus network. The South East Busway passes through the suburb, catering for high frequency bus services from the south-east most of which do not stop in Woolloongabba. A spur off the South East Busway includes the Woolloongabba Busway Station, which caters for numerous buses travelling along the Ipswich Road, Logan Road and Stanley Street corridors to the south and east of the busway station.

The suburb is served by a wide range of buses including:

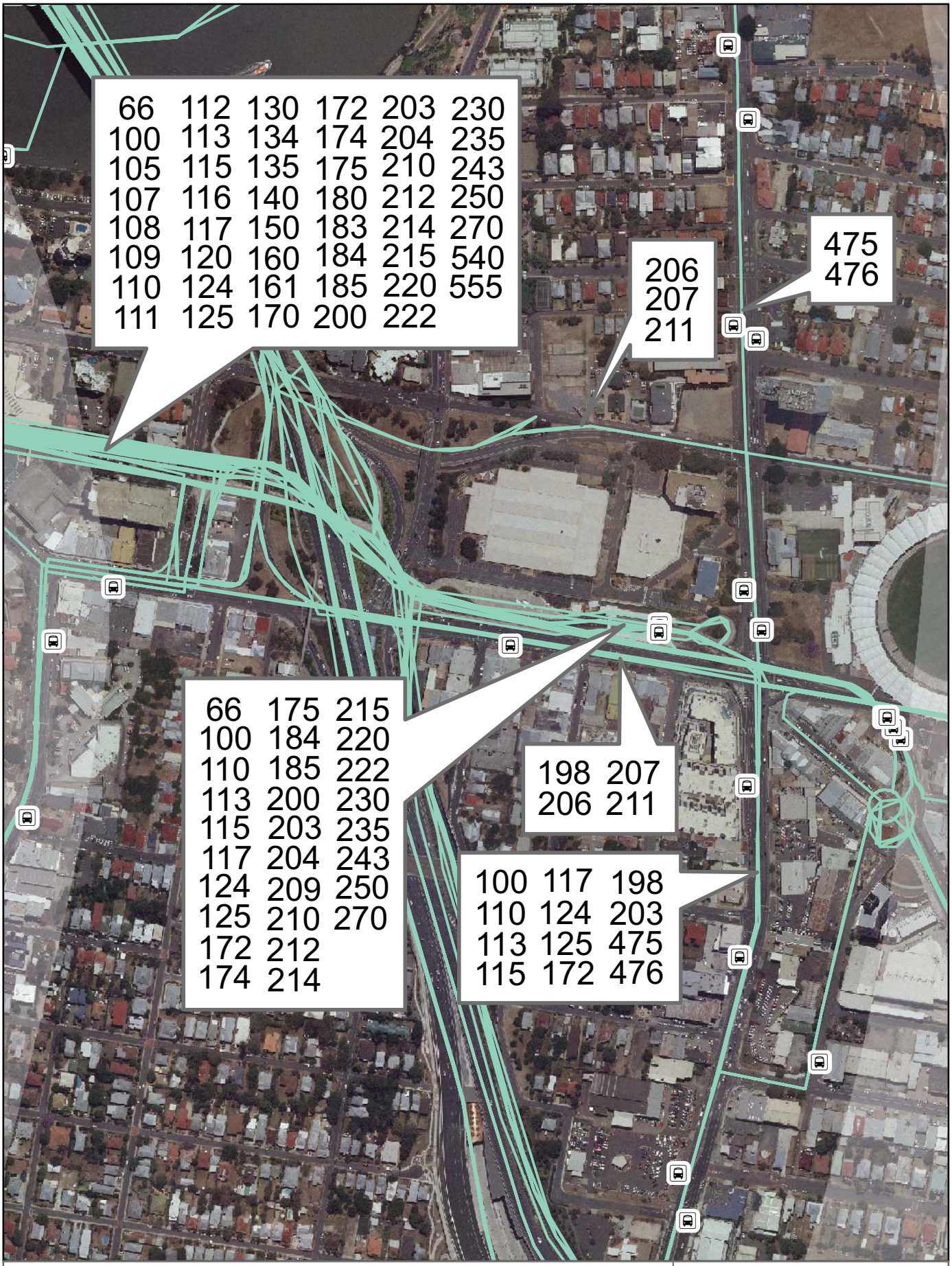
- high frequency and local services operating on the Woolloongabba spur of the South East Busway and serving Woolloongabba Busway Station (eg 66, 200, 220)
- high frequency services via the mainline South East Busway but not travelling through or stopping at Woolloongabba Busway Station (eg 111, 130, 140, 150, 555)
- services travelling along and stopping on Ipswich Road/Main Street to the east of the busway station (eg 475, 476).

A map of bus stops in the area is shown in **Figure 4-39**.

Woolloongabba Busway Station accommodates over 110 stopping bus services per hour (two-way) in the peak hours (75 of these being inbound) operating 24 different routes from the CBD (and University of Queensland) to destinations as far afield as Wynnum, Carindale, Garden City (Upper Mt Gravatt), and Forest Lake. Furthermore a range of non-stop buses pass through the Woolloongabba Busway spur and on the South East Busway itself, some 200 m west of the station.

The busway in the vicinity of Woolloongabba Busway Station was observed to be operating at very high frequencies in the morning peak with several buses every minute. Immediately to the west of the busway station is the intersection of the Woolloongabba Busway spur and the mainline South East Busway, carrying hundreds of buses per hour in the peaks. In total, over 350 bus movements were estimated in the Woolloongabba area (on the busway) during each morning peak hour (two-way), with around 275 of these being inbound trips. A busway bottle-neck is created where the two busways merge under the Pacific Motorway at Woolloongabba with bus queuing observed. Some 200 m further west of this junction is another intersection (Allen Street) where a large number of peak only buses exit the busway to join the M3 (Pacific Motorway) to enter the CBD via the Captain Cook Bridge – this exit onto a congested Motorway on-ramp causes some queuing of buses onto the busway with consequential bus congestion within the busway itself (sometimes preventing buses on the mainline busway from getting past the buses trying to exit the busway). At this point, of the busway, TransLink Transit Authority estimates that there are 15,000 passengers in the morning peak hour (two-way).

Overall, Woolloongabba is very well served by stopping buses however there are a significant majority of bus movements through Woolloongabba which do not involve a stop, thereby limiting accessibility to the suburb particularly from the south.



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-39

Bus Stops and Routes around Woolloongabba Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G039_CCR_Trans_current_bus_Gabba_Station_A4_ver93.mxd 06/07/2011 15:10

During events at the Gabba Stadium, special event shuttle buses are used (refer to **Figure 4-40**). Over 100 buses travel to the following destinations from the assigned departure points for one hour from the end of the game:

- Brisbane City and Roma Street Station shuttles depart Stanley Street (corner Logan Road)
- Carindale shuttles depart Woolloongabba Busway Station (platform 2)
- Eight Mile Plains shuttles depart Woolloongabba Busway Station (platform 1)
- Chermside shuttles depart stop 9, Main Street (corner Vulture Street).

Due to the large numbers of buses and people crossing roads to access buses after the stadium, Stanley Street and Vulture Street (immediately surrounding the stadium) are closed for up to one hour after each major event. Ipswich Road operates under traffic control to ensure priority for pedestrians crossing towards the busway station, and South Bank Station.

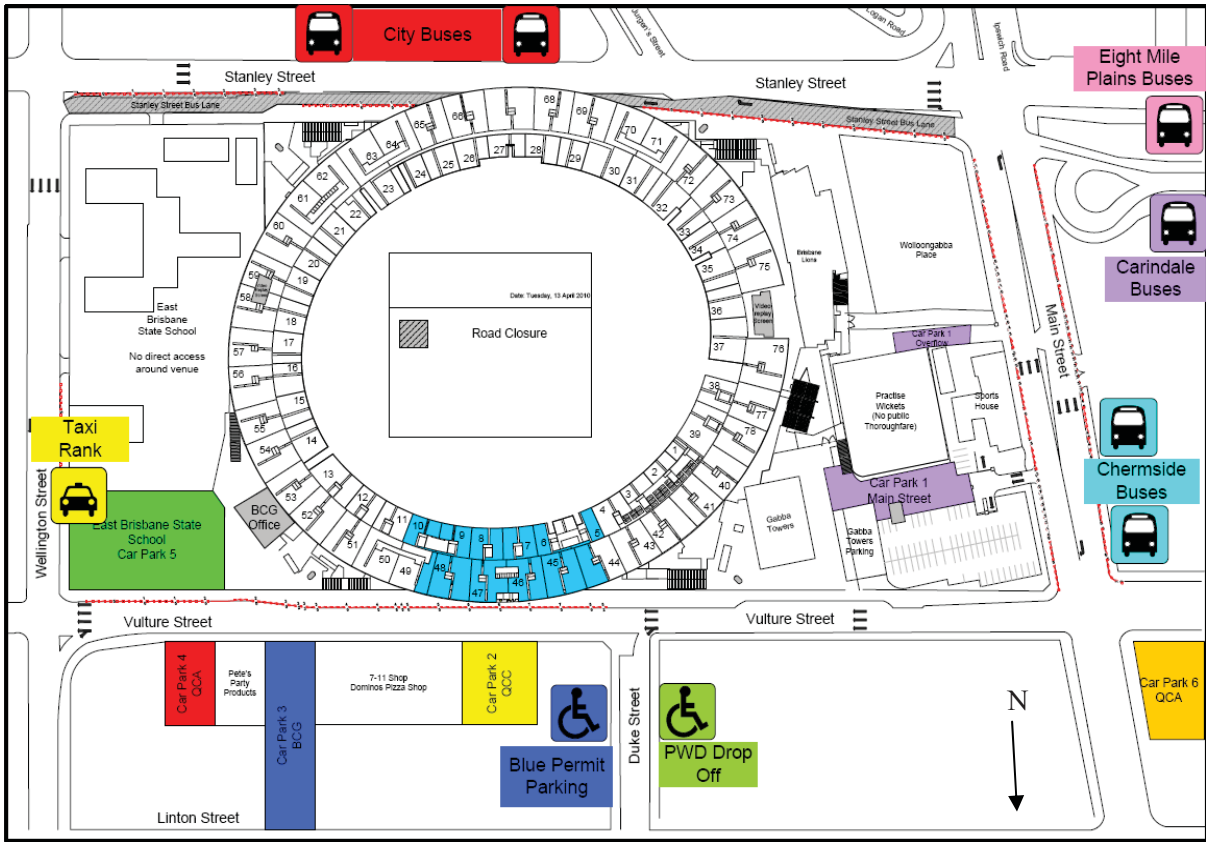


Figure 4-40 Woolloongabba Event Transport Management Plan

Source: The Gabba Events Transport Management Plan, Stadiums Queensland

Park Road Station bus services and facilities

The key bus facility in the vicinity of Park Road station is the Eastern Busway and the Boggo Road Busway Station located immediately adjacent to the Park Road train station, and which is integrated into one interchange with a common over bridge and station access points (refer to **Figure 4-41**). Key services operating from the Boggo Road Busway Station include the:

- 109 (City to University of Queensland)
- 139 (Sunnybank to University of Queensland)
- 169 (Eight Mile Plains to University of Queensland)
- 209 (Carindale to University of Queensland).

These services combine to provide up to 37 bus services per hour to the University of Queensland (some 2 km to the west) in the morning peak and six services per hour in the morning peak to the Princess Alexandra Hospital approximately 600 m west from Park Road station. It is worth noting that walk access from Park Road railway station to the Princess Alexandra Hospital is currently an indirect 900 m walk due to the presence of railway infrastructure and as such a bus transfer via the busway provides a more attractive access option from Park Road Station.

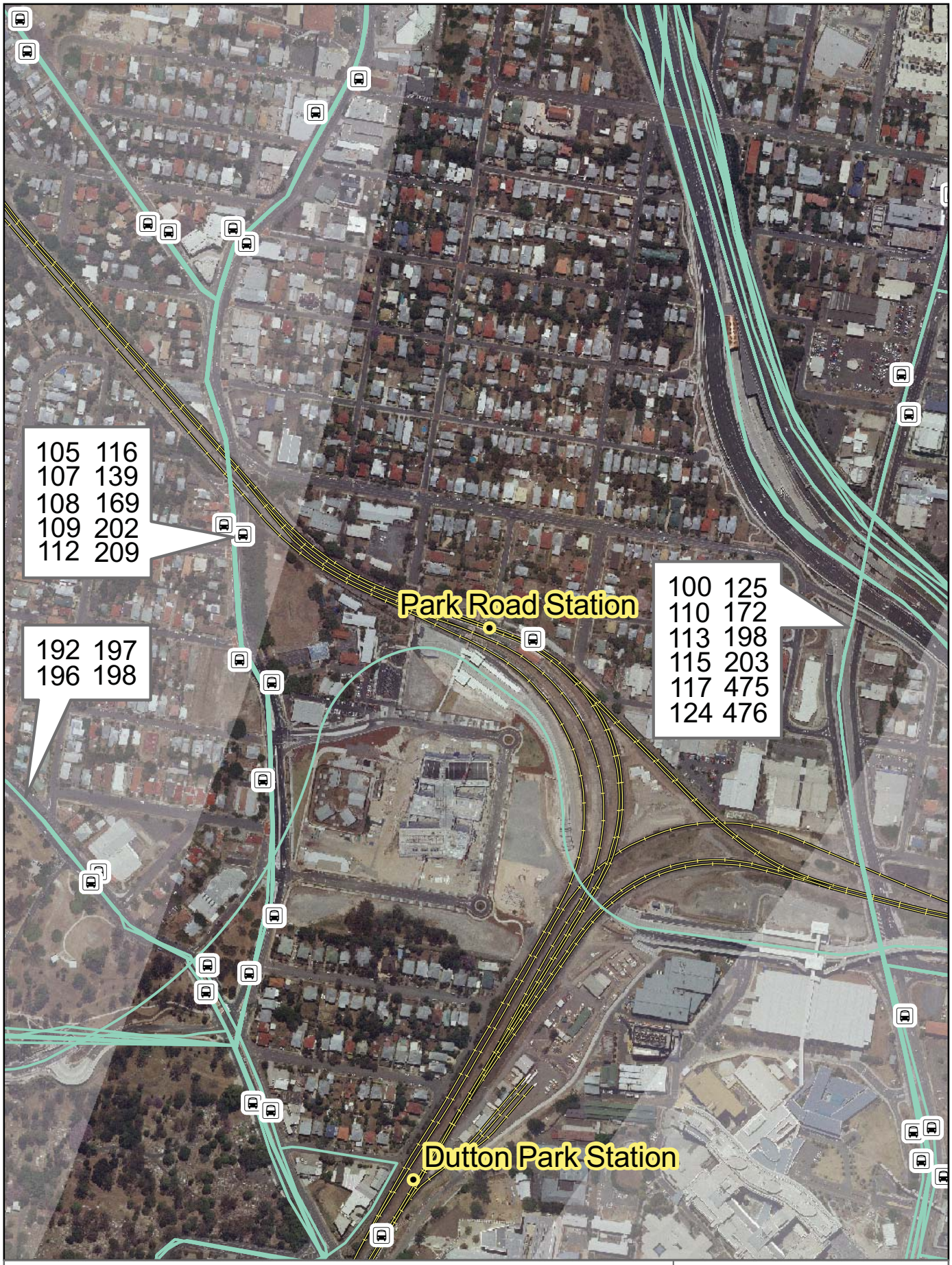
In addition to busway services, several on-street bus services travel along Annerley Road, approximately 250 m west of Park Road station which combine to create a frequency of up to 10 buses an hour inbound in the morning peak. This is comprised of the following bus routes:

- 105, 107, 108 (all services from Yeronga/Fairfield to city)
- 112 (Mt Gravatt to City)
- 202 (Carindale to City).

Some 400 m to the east of Park Road station is Ipswich Road where several more bus services can be found, which combine to create an morning inbound peak frequency of up to 15 buses per hour. This is comprised of the following bus routes:

- 113 (Mt Gravatt to City)
- 117 (Acacia Ridge to City)
- 124 (Sunnybank to City)
- 125 (Garden City to City via Salisbury)
- 172 (Garden City to City via Mt Gravatt)
- 203 (Carindale to City).

Overall, the Park Road precinct is very well served by existing bus services. Whilst current (2009) origin-destination survey results do not show any rail-bus interchange this was undertaken before the opening of the Boggo Road/Eastern Busway and station and is therefore not representative of the new range of journey options from Park Road Boggo Road Stations.



LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-41

Bus Stops and Routes around Park Road Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G040_CCR_Trans_current_bus_Park_Rd_Station_A4_ver93.mxd 06/07/2011 15:11

4.5.3 Current bus operations – south

In the southern part of the study corridor, bus services are principally centred on Fairfield Road, including routes 196/197 to Fairfield and route 105 to Indooroopilly via Yeerongpilly.

Dutton Park Station bus services and facilities

Dutton Park is well served by buses on several routes with stops on Annerley Road (200 m north and 55 m south of station), Noble Street, Fairfield Road and Cornwall Street providing informal bus-rail interchange opportunity although very little was observed on site (refer to **Figure 4-42**).

Bus stops located on Cornwall Street serve inbound and outbound services for bus routes 198 and 202. Route 198 undertakes a loop between PA hospital, Brisbane State High School, West End, Highgate Hill and Dutton Park. Route 202 operates between the City and Carindale via Dutton Park, Stones Corner and Carina Heights.

A bus stop on Annerley Road 60 m south of station serves routes 112 and 116 outbound between the City and Mt Gravatt or Moorooka. A bus stop on Nobel Street is located 90 m south of station. This bus stop is sheltered and serves bus routes 105, 107, 108, 196 and 197 for outbound passengers.

Two more bus stops are located on Annerley Road 200 m north of the station for inbound and outbound services. The outbound bus stop is serviced by bus routes 105, 107, 108, 112, 116, 192, 196, 197, 198 and 202 with bus routes 192, 196 and 197 servicing the inbound bus stop. Formal pedestrian crossings are available at Annerley Road/Noble Street and Annerley Road/Gladstone Road intersections located north and south of the bus stops on Annerley Road.

As shown in **Table 4-43** below, there are up to 17 buses per hour in peak times (peak direction) dropping back to eight per hour in the off peak (weekdays) and around four per hour on Sundays.

Table 4-43 Bus Services in the vicinity of Dutton Park Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
105 (Indooroopilly to City)	1	1	Hourly each direction	4 services total
107 (Yeronga to City) – Mon-Fri peak hours only	2	0	0	0
108 (Indooroopilly to City) – Mon-Fri peak hours only	2	0	0	0
112 (Mt Gravatt to City)	2	1	Hourly each direction	4 services total
196/197 (Fairfield to New Farm via City) – 197 operates Mon-Fri only	5	4	Half hourly each direction	Half hourly each direction
198 (West End-Dutton Park-West End loop)	3	1	Hourly (one way loop)	Hourly (one way loop)
202 (Carindale to City)	2	1	Hourly each direction	4 services total
Total buses per hour	17	8	Up to 6	Up to 4

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-42

Bus Stops and Routes around Dutton Park Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G041_CCR_Trans_current_bus_Dutton_Pk_Station_A4_ver93.mxd 06/07/2011 15:11

Fairfield Station bus services and facilities

The key bus stops in the vicinity of Fairfield Station are located on and near Fairfield Road approximately 400 m west of Fairfield Station (refer to **Figure 4-43**).

One bus stop is located within the Fairfield Gardens shopping centre carpark near the Brougham Street/Gardens access intersection. This bus stop is sheltered with seating for six passengers. Route 196 and 197 (terminating services) use this bus stop and travel between Fairfield and New Farm via the City. Other bus stops are located near the Fairfield Road/Ashby Road intersection and on Ashby Road west. Route 105, 107 and 108 serve these bus stops (refer to **Table 4-44**).

Table 4-44 Bus Services in the vicinity of Fairfield Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
105 (Indooroopilly to City)	1	1	Hourly each direction	4 services total
107 (Yeronga to City) – Mon-Fri peak hours only	2	0	0	0
108 (Indooroopilly to City) – Mon-Fri peak hours only	2	0	0	0
196/197 (Fairfield to New Farm via City) – 197 operates Mon-Fri only	5	4	Half hourly each direction	Half hourly each direction
Total	10	5	3	Up to 3

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-43

Bus Stops and Routes around Fairfield Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G042_CCR_Trans_current_bus_Fairfield_Station_A4_ver93.mxd 06/07/2011 15:12

Yeronga Station bus services and facilities

The nearest bus stops to Yeronga Station are located on Kadumba Street 200 m west of the station and Park Road some 250 m east of the station (refer to **Figure 4-44**).

Bus stops on Park Road serve routes 105 and 108. The bus stop on Kadumba Street serves outbound route 105 (on the Yeronga Loop part of its outbound journey).

As shown in **Table 4-45**, route 105 operates a standard hourly service throughout the week with only four services on Sundays, in each direction, and route 108 is a peak supplement service operating Monday-Friday peak periods only.

Table 4-45 Bus Services in the vicinity of Yeronga Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
105 (Indooroopilly to City)	1	1	Hourly each direction	4 services total
108 (Indooroopilly to City) – Mon-Fri peak hours only	2	0	0	0
Total	3	1	1	Up to 1

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-44

Bus Stops and Routes around Yeronga Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G043_CCR_Trans_current_bus_Yeronga_Station_A4_ver93.mxd 06/07/2011 15:13

Yeerongpilly Station bus services and facilities

Bus stops in the vicinity of Yeerongpilly Station are located on Fairfield Road, Wilkie Street and Green Street. Bus stops on Wilkie Street are located within 50 m of the train station and bus stops on Green Street around 150 m from the station (refer to **Figure 4-45**).

Bus routes 104, 105 and 108 serve Yeerongpilly Station via one or more of these stops. Route 104 generally runs hourly between Corinda and the PAH on weekdays only stopping at Wilkie Street. Route 105 and 108 runs between Indooroopilly to City serving both Fairfield Road and Wilkie Street bus stops. Route 105 operates hourly Monday to Saturday (less frequent on Sundays) while route 108 operates weekday peak hours only (refer to **Table 4-46**).

Table 4-46 Bus Services in the vicinity of Yeerongpilly Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
104 (Buranda to PA Hospital) – Mon-Fri only	2	1	0	0
105 (Indooroopilly to City)	1	1	Hourly each direction	4 services total
108 (Indooroopilly to City) – Mon-Fri peak hours only	2	0	0	0
Total	5	2	1	Up to 1

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Railway Station
- Railway Line

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-45

Bus Stops and Routes around Yeerongpilly Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G044_CCR_Trans_current_bus_Yeerongpilly_Station_A4_ver93.mxd 06/07/2011 15:37

Moorooka Station bus services and facilities

An outbound bus stop on Ipswich Road (approximately 110 m south of Moorooka Station) serves routes 100 and 116. The corresponding inbound bus stop is located 170 m north of the station north of Unwin Street (refer to **Figure 4-46**).

Route 100 operates a typically hourly service (each way) between the City and Forest Lake via Moorooka and Oxley. Route 116 operates a typically hourly service Monday to Saturday between the City and Rocklea via Dutton Park and Tarragindi (refer to **Table 4-47**).

Table 4-47 Bus Services in the vicinity of Moorooka Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
100 (Forest Lake to City)	5	1	Hourly each direction	Hourly each direction
116 (Rocklea to City) – Mon-Sat only	2	1	Hourly each direction	0
Total	7	2	2	1

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-46

Bus Stops and Routes around Moorooka Station

0 50 100 150 200 m

1:5,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G045_CCR_Trans_current_bus_Moorooka_Station_A4_ver93.mxd 06/07/2011 15:14

Rocklea Station bus services and facilities

There is one bus route directly servicing Rocklea Station, namely route 116 (refer to **Figure 4-47**). This service operates a loop through Rocklea, with inbound services commencing from Rocklea Station at a bus stop located on Brooke Street, approximately 50 m from the station entrance. Terminating services generally service this bus stop then continue past the station around the loop before returning to the Brooke Street stop where they wait to recommence service. A bus shelter is provided along with timetable.

Route 116 runs hourly from 6.00 am to 6.00 pm Monday to Friday and hourly from 8.00 am to 5.00 pm on Saturdays (refer to **Table 4-48**). There is no service on Sundays or Public Holidays.

Table 4-48 Bus Services in the vicinity of Rocklea Station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
116 (Rocklea to City) – Mon-Sat only	1 per hour commencing	1 per hour commencing and 1 per hour terminating	Hourly	–

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-47

Bus Stops and Routes around Rocklea Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G046_CCR_Trans_current_bus_Rocklea_Station_A4_ver93.mxd 06/07/2011 15:15

Salisbury Station bus services and facilities

Bus services at or near Salisbury Station can be separated into two groups according to their stopping location. That is, either on the eastern side (Fairlie Terrace) or western side (Beaudesert Road) of the station (refer to **Figure 4-48**).

Routes 125, 598 and 599 serve a pair of bus stops on Lillian Avenue, approximately 120 m north-east of the station. Both of these bus stops have timetable information and shelters. Route 598/599 is known as the Great Circle Line and provides a connection to Garden City, Carindale, Indooroopilly, Mitchelton and Chermside. Route 598/599 runs Monday to Saturday only, between 6.00 am and 6.00 pm. On Sundays, therefore, only route 125 operates from these stops, running at hourly frequencies in each direction between 9.00 am and 7.00 pm.

Routes 110, 115, 117 and 540 serve a pair of bus stops on Beaudesert Road, approximately 300 m west of the station. Both of these bus stops have indented bus lay-bys, timetable information and shelters. Route 540 is a commuter peak hour (peak direction) only service, Monday to Friday. Route 115 and 117 also operate Monday to Friday only. As such, on weekends these bus stops are only serviced by route 110, generally at half hourly frequencies on Saturdays (8.00 am to 11.00 pm) and hourly frequencies on Sundays (9.00 am to 9.00 pm) (refer to **Table 4-49**).

Table 4-49 Bus Services in the vicinity of Salisbury station

Bus services	Peak direction (one-way)	Monday – Friday Off-peak (one-way)	Saturday	Sunday
110 (Inala to City)	2	1	Half hourly each direction	Hourly each direction
115 (Calamvale to City) – Mon-Fri only	1	1	-	-
117 (Acacia Ridge to City) – Mon to Fri only	2	1	-	-
125 (Garden City to City)	2	2	Hourly each direction	Hourly each direction
540 (Beaudesert to City) – Mon to Fri peak hours only	2	-	-	-
598/599 (Great Circle Line) – Mon to Sat only	2	2	Half hourly each direction	-
Total buses per hour (each way)	11	7	5	2

Source: TransLink website, 2010 (www.translink.com.au)

LEGEND

- Study Corridor
- Bus Stop
- Bus Route
- Station
- Track

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-48

Bus Stops and Routes around Salisbury Station

0 50 100 150 200 250 m

1:6,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G047_CCR_Trans_current_bus_Salisbury_Station_A4_ver93.mxd 06/07/2011 15:16

4.6 Ferry operations and performance

4.6.1 Ferry services – north

There are no ferry services in the northern part of the study corridor.

4.6.2 Ferry services – central

Ferry services operate in the central part of the study corridor where the Brisbane River traverses the study corridor. These are shown in **Figure 4-49**.

Ferry services consist of two service types:

- CityCat (high capacity catamaran ferries accommodating up to 162 passengers and travelling up to 25 knots or 46 km/h)
- City Ferry (single hull ferries accommodating between 54 and 80 passengers and travelling up to 12 knots or 22 km/h).

CityCats operate between Apollo Road (Bulimba north) and the University of Queensland at St Lucia, generally every 15 minutes in each direction throughout the day (Monday to Sunday). City Ferries operate cross river and inner city distributor type ferry services within the study corridor generally every 10 minutes in each direction. See **Table 4-50**.

Table 4-50 Ferry services in the Inner City

Bus Services	Peak Direction (One Way)	Monday – Friday Off Peak (One Way)	Saturday	Sunday
CityCat	9	4	4	4
Cross River Ferry/inner City Ferry (Holman to Eagle Street to Thornton Street)	6	4-6	4-6	4-6
Total ferries per hour (each way)	15	Up to 10	Up to 10	Up to 10

Source: TransLink website, 2010 (www.translink.com.au)

The main ferry terminals within the study area are Riverside and the adjacent Eagle Street (the main terminals for the eastern part of the CBD), QUT (for the southern CBD) and North Quay (for the north-western part of the CBD. See **Figure 4-49** below.

The ferry terminal nearest to Central Station is Riverside, located on Eagle Street some 550 m to the south-east of Central Station. There is little observed or modelled interchange function between ferry and rail.

4.6.3 Ferry services – south

There are no ferry services in the southern part of the study corridor.

LEGEND

- Study Corridor
- Station
- Track

Brisbane Ferry Routes

- Citycat
- Inner City Ferry
- Cross River Ferry

Brisbane Ferry Stops

Zone

1 1

2 2

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-49

Ferry Routes and Terminals (Central Section)

0 100 200 300 400 500 m

1:15,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G025_CCR_Trans_existing_ferry_A4_ver93.mxd 06/07/2011 15:17

4.7 Pedestrian and bicycle facilities

This section describes the regional and local pedestrian and cycle network within the study corridor. Existing pedestrian links have been mapped where they intersect with the rail network to enable a description of the wider cross corridor pedestrian connectivity to be made. A more detailed description of pedestrian access and connectivity at stations is also included based on site visit observations.

4.7.1 Pedestrian and cycle networks – north

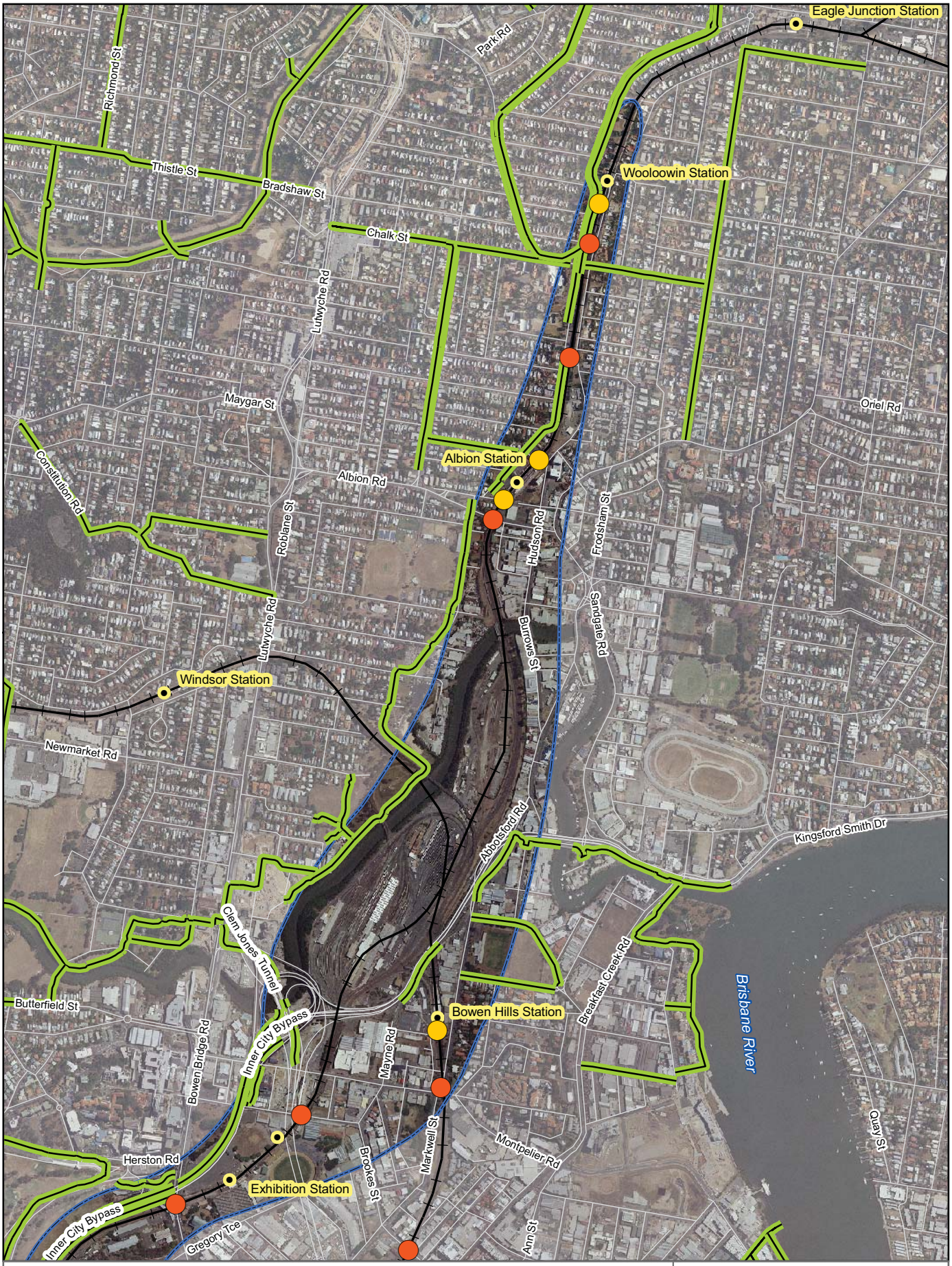
Pedestrian access is provided across the study corridor at regular intervals including at road crossings in this part of the study corridor as well as by way of dedicated pedestrian access bridges at all stations. A list of all pedestrian crossings along with a qualitative description is provided in **Table 4-51**.

Table 4-51 Pedestrian access across the railway in the northern study corridor

Location/description	Crossing type and width	Comments
Wooloowin Station footbridge	3 m footbridge with station concourse attached	Pedestrian bridge connecting Wooloowin Station with Bridge Street to the west and Hudson Street to the east station office also located on the bridge.
Fraser Street (south of Wooloowin Station)	10 m road over rail bridge with footways on both sides	Narrow footpaths of around 1.4 m to 1.5 m width exist on both sides of the bridge. No cycle lanes.
Bridge Street (north of Albion Station)	11 m road over rail bridge with footways on both sides	Narrow footpaths of around 1.5 m average width exist on both sides of the bridge. No cycle lanes.
Albion Station footbridge	2 m pedestrian over rail bridge	Connecting Albion Station with Mawarra Street and Hudson Street west and east, also the bridge connects car park on the western side of the station
Albion Station footbridge	2 m pedestrian over rail bridge	Connecting Albion Station with Albion Road on west and east, also the bridge connects car park on both sides
Albion Overpass (south of Albion Station)	18 m road over rail bridge with two narrow footways	Footpath exist on both sides, footpath on the northern side is slightly narrower than the footpath on southern side - footpaths range between 1.6 m and 2 m with an average of around 1.8 m
Inner City Bypass (north of Bowen Hills Station)	22 m road over rail bridge and adjoining 3 m footbridge over rail	Separate footbridge adjacent to ICB road bridge
Bowen Hills Sation footbridge	2 m wide (approx) wide pedestrian over rail bridge	Footbridge connects Abbotsford Road and Hudd Street across Bowen Hills Station at the northern end of platforms
Bowen Hills Station footbridge	2.5 m wide (approx) pedestrian over rail bridge	Footbridge connect Abbotsford Road and Hudd Street across Bowen Hills Station at the southern end of platforms
Abbotsford Road/Campbell Street/ Montpelier Street/ Markwell Street intersection (south of Bowen Hills Station)	Rail in 40 m long tunnel under this four-way intersection	Footpaths and pedestrian crossings exist on all four sides of this intersection. No cycle lanes exist.
O'Connell Terrace (east of Exhibition Station)	14 m road over rail bridge with 2 m wide footway on northern side	A narrow footpath exists on north side only. A signalised intersection with Lanham Street provides alternative access from the southern footway to the northern footway if approaching from the west only. A bicycle lane exists on the northern side (eastbound direction) only.
Bowen Bridge Road (west of Exhibition Station)	27 m road over rail bridge with two wide footways	3 m to 3.5 m wide footways are provided on both sides of bridge. No cycle lanes

As well as the above crossing points for pedestrians and cyclists, there are a number of existing on-road marked cycleways parallel to and across the railway corridor as illustrated in **Table 4-51**. This includes a well used north-south on-road cycle link running adjacent to the North Coast railway line between Eagle Junction and Albion before following Enoggera Creek towards the Royal Brisbane and Women's Hospital at Herston. This bicycle route connects to Chermside via Kedron to the north of the study corridor with links at Kedron Brook towards Nudgee in the east and Mitchelton in the west. To the south this bike path provides a continuous link to City via Herston (Victoria Park) and QUT Kelvin Grove. Other existing designated bicycle routes include the ICB, which is unattractive to all but the most experienced cyclists, as well as a range of minor local links.

Further details of station related pedestrian and cycle access and facilities in the northern study corridor is provided below.



LEGEND

- Study Corridor
- Existing Bikeway

Rail Crossings

- Ped/Cycle
- Vehicles and Ped/Cycle

- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-50

Existing Pedestrian and Cycle Network (Northern Section)

0 0.25 0.5 0.75 1 km

1:17,500 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G026_CCR_Trans_Ped_Cycle_A4_aerial_TR_ver93.mxd 06/07/2011 15:17

Wooloowin Station pedestrian and cycle facilities

A pedestrian bridge is located at the southern end of the station providing access to all four platforms. Direct access from Bridge Street is available to platform number four, while all other platforms including platform one are accessed by pedestrian bridge, with no direct access from Hudson Road (to the east) to platform one.

No lifts are provided in this station, although ramps exist and are estimated to be non-DDA compliant (greater than one in 20 gradient) which may present difficulties for non-motorised wheel chair access to platforms. Tactile ground surface indicators (for visually impaired passengers) are present only on platform number four.

A signalised pedestrian crossing is located on Bridge Street near the south-western entrance to the station which provides a link across Bridge Street to the park and ride car parks. There is another available pedestrian crossing 200 m south of the station at the intersection of Bridge Street and Chalk Street. Footpaths on Bridge Street and Hudson Road are in good condition.

On road cycle lanes are located on Bridge Street, Chalk Street and Kedron Park Road located west of the station. Bicycle lanes start 400 m south of Bridge Street to the south of the station. Six bike racks are provided at Wooloowin Station with one utilised at the time of site visits, however informal bike parking were also spotted including bikes locked to fences. Formal bicycle lockers are conveniently located on the pedestrian bridge west of the station office.

Albion station pedestrian and cycle facilities

Two pedestrian bridges are located at Albion Station – one at the northern end of the platforms and one at the southern end. The northern pedestrian bridge connects Hudson Road and Mawarra Street including with stairs to all four platforms and the western car park on Mawarra Street. The southern pedestrian bridge provides access to Albion Road east and Albion Road west, with connections to the car park on Mawarra Street, the car park on Albion Road and all four platforms. Wheel chair access is provided only on the southern bridge for all four platforms by way of ramps. No lifts are provided in the station. The existing ramps are steep and not likely to be DDA-compliant and may therefore be difficult for non motorised mobility impaired passengers to access the station platforms.

Mawarra Street immediately west of the station is a local street with no formal pedestrian crossing provided. Hudson Road immediately east of the station has two pedestrian crossings – one crossing is located close to the north-east station entrance near the northern pedestrian bridge and is signalised. The second pedestrian crossing is located near the south-east station entrance between Albion Road intersection and Albion Road Overpass intersection. This pedestrian crossing is a zebra crossing.

Mawarra Street is a designated ‘BCC on-road cycle route’ however no formal cycle markings exist on site. There are no designated cycle paths on the east of the station (such as Hudson Road and Sandgate Road). Two secure cycle lockers are located near the platform one entrance for bicycle users. No bike racks were spotted at the time of visit and no informal bicycle parking was observed.

Bowen Hills Station pedestrian and cycle facilities

Pedestrians access to Bowen Hills Station is from Abbotsford Road to the east of the station, Hudd Street and Mayne Rail Yard to the west of the station via the existing pedestrian paths and bridges. Abbotsford Road, the main north-south arterial road immediately west of the station, is an unattractive pedestrian environment due to the road width (six traffic lanes), high traffic volumes, vehicle speeds (60 km/h speed limit) and associated noise and vehicle emissions. Safety at night is a major concern to and from Bowen Hills Station, given the current industrial land uses, lack of night activity and low levels of street lighting leading to a lack of passive surveillance.

There are two pedestrian bridges linking the four platforms to the surrounding pedestrian and road network – one at the southern end of the station which includes lifts and stairs, and one northern end of the station, which includes stairs only. The northern access provides access for QR staff (including train drivers) to and from the Queensland Rail Mayne Yard Operations Centre. The northern entrance also leads to a narrow, unattractive walkway between industrial buildings to Abbotsford Road in the east. In general there is a lack of footpath provision and continuity to and from Bowen Hills Station. Where they exist, walkway spaces are often narrow, dark and difficult to navigate. It was estimated that from morning peak site observations that approximately one-third of passengers exited the station via the northern pedestrian footbridge and two-thrids exited the station via the southern pedestrian footbridge.

Site observations also concluded that there was a strong demand to the residential precinct east of the station with around two-thirds of alighting passengers in the morning peak heading east from the station and the majority of these observed to cross Abbotsford Road. The majority of alighting passengers heading to the western side of Bowen Hills Station chose to exit via Hudd Street using the southern exit. The vast majority of these were observed to be walking south-west towards RBWH.

The observations undertaken at Bowen Hills Station highlighted some localised issues with current pedestrian network around the station:

- The main north-south traffic artery in the vicinity of the station (Abbotsford Road) is an unattractive pedestrian environment due to high traffic volumes, vehicle speeds and associated noise and vehicle fumes.
- Very narrow footway widths adjacent to the station's south-eastern entrance onto Abbotsford Road (less than 3 m) which when obstacles such a posts and bus stops are taken into account leaves a very narrow effective footway width adjacent to heavy and fast flowing vehicular traffic.
- Pedestrian delays at major intersections, including Abbotsford Road and Folkestone Street intersection, can be as long as 120 seconds. Pedestrians are often not willing to wait this long leading to pedestrian safety issues. The long pedestrian delays may reduce the walk-up catchment to the east.
- In the vicinity of the southern station exit the lack of direct, convenient pedestrian crossing raises safety issues as numerous pedestrians cross Abbotsford Road in an east-west direction.
- Poor pedestrian accessibility, safety and visibility particularly at the northern entrance as shown in **Figure 4-51**. Safety at night is a major concern to and from Bowen Hills Station, given the lack of night time activity and lack of passive surveillance from the existing land use.

Figure 4-51 Bowen Hills Station Abbotsford Road northern exit

The cycle network in the vicinity of Bowen Hills Station is highlighted on **Figure 4-50**. Furthermore, the South East Queensland Principal Cycle Network Plan – or PCNP (QT, 2007) – identifies existing and proposed principle cycle routes through the Bowen Hills Station Precinct. The only existing principal route of relevance is the cycleway on the western side of Enoggera Creek, some 500 m to 1000 m away from the station. And while the ICB hard shoulder is considered a constructed on-road cycle facility in BCC Cycle Maps, it features as a 'future' principal route in the PCNP. This may be because it does not meet minimum standards for a principal cycle route. In general, the existing Bowen Hills Station is not considered to be connected to South East Queensland Principal Cycle Network.

It should be noted that although the topography is generally flat, barriers to the cycling in the area include discontinuous cycle routes and high traffic volumes on the surrounding streets, create a fairly hostile cycling environment. This combined with the low level of land use density and trip destinations, results in a low level of cycle activity to Bowen Hills Station. There were few cyclists observed around Bowen Hills Station and cycling as a mode of access and egress to the station is low, with 10 cyclists in one hour observed down Abbotsford Road in the morning peak. As a result, the cycle parking is currently under-utilised (see **Figure 4-52**).

Figure 4-52 Cycle parking at Bowen Hills Station

Exhibition Station pedestrian and cycle facilities

Exhibition Station is located within the RNA Showgrounds precinct. The pedestrian movement in the vicinity of Exhibition Station is dependent on whether the precinct is in event or non-event mode.

There was minimal pedestrian activity observed within the Exhibition Station precinct during non-event time. Pedestrian activity is typically generated by the Royal Brisbane and Women's Hospital (RBWH) to the west of the precinct with the major east-west movements along Butterfield Street and Herston Road and the major north-south movement occurring on Bowen Bridge Road. O'Connell Terrace links Bowen Bridge Road to eastern land uses in Bowen Hills (such as the railway station) and Fortitude Valley. Following the recent completion of construction activity related to the Clem7 tunnel and associated pedestrian improvements, the quality of this pedestrian connection has improved.

During non-event times, footpath widths are generally sufficient for the pedestrian demand. However, the railway and Bowen Bridge Road are barriers to pedestrian movement between RNA Showgrounds, on the eastern side of the railway and RBWH on the western side. Key pedestrian infrastructure issues to note include:

- excessive pedestrian delays at traffic signals/low pedestrian priority in general, particularly on Bowen Bridge Road
- long city blocks running north-south (eg Bowen Bridge Road) with few mid block crossings resulting in formal crossings at several hundred metres apart. This results in difficulties for pedestrians to access the station or RNA Showgrounds from the hospital precinct
- there is a road underpass under Bowen Bridge Road, 200 m to the south-west of the existing Exhibition Station although this is understood to be gated at present
- no strong pedestrian spine provided between Fortitude Valley and Bowen Hills through the RNA Showground and hospital precinct
- solid barriers exist along major pedestrian desire lines – Gregory Terrace and O'Connell Terrace – which are not pedestrian-friendly.

During major events such as the Royal Queensland Show, the station serves only the RNA showgrounds – people exiting a train at the Exhibition Station must have or purchase a ticket to enter the showgrounds. There is no general exit to surrounding land uses with the whole site gated.

Generally there is a low level of cycle activity dispersed throughout the Exhibition Station precinct. The generally flat topography of the cycle network around Exhibition Station indicates that it would be suitable for cyclists. The hospital precinct is the main cycle attractor.

The cycle network in the vicinity of Exhibition Station as shown in **Figure 4-50** includes:

- on-road bikeway along the ICB linking Exhibition Station with Bowen Hills Station and ends at the southern end of Victoria Park
- off-road bikeway along Gilchrist Avenue along the northern side of the Exhibition Loop railway linking Victoria Park and QUT Kelvin Grove Campus with RBWH and Exhibition Station
- a combination of on-road and off-road bikeways, linking Exhibition station with Albion Station and further north along Herston Road, Hetherington Street, Butterfield Street, Downey Street, Noble Street Bridge and McDonald Street
- a combination of on-road and off-road bikeways along the eastern side of the existing railway line linking Gilchrist Avenue cycleway to an off-road connection to Roma Street and onto the Brisbane CBD and Goodwill Bridge.

In addition, the RBWH Cycle Centre (**Figure 4-53**) end-of-trip facility is located under the RBWH Busway Station, adjacent to Bowen Bridge Road and within walk catchment of the existing Exhibition Station. The facility provides 750 secure bike-parking spaces, more than 900 lockers and 20 male and

20 female showers, as well as ironing facilities, hairdryers, a towel service and a clothes drying room. It was provided as part of the construction of the Royal Children's Hospital to Windsor section of the Northern Busway.

Very few numbers of cyclists were observed around the eastern side of Exhibition Station due to discontinuous cycle routes, heavily trafficked routes and limited cycle facility provision. There were only a few cyclists observed around the western side of Exhibition station, where the RBWH Cycle Centre is located. Based on the latest statistics, 85% of cyclists using RBWH Cycle Centre are RBWH staff.

It should be noted that the hospital precinct is strategically located at the confluence of a large number of existing and future principal cycle routes identified in the South East Queensland Principal Cycle Network Plan. It is therefore considered that RBWH Cycle Centre would continue to provide a significant opportunity for an integrated cycle-rail interchange within the wider station precinct.

Figure 4-53 RBWH Cycle station

4.7.2 Pedestrian and cycle networks – central

Pedestrian and cycle facilities in the central part of the study corridor are centred on the Brisbane CBD including both leisure and commuter based trips. In the Brisbane CBD, the footpath network generally follows the road network which is characterised by a grid pattern, with east-west roads spaced approximately 100 m apart and north-south roads spaced approximately 220 m apart. This road and footpath network pattern results in frequent intersections across the CBD in a north-south direction, but long city blocks running in an east-west direction with few mid-block crossings. In some parts of the city, mid block links create additional pedestrian only paths through these long city locks – examples include the Brisbane Arcade between Queen Street and Adelaide Street and Post Office Lane between Elizabeth Street and Queen Street. The walking environment along the footpath network in the CBD ranges from generous and wide to narrow and cluttered.

BCC pedestrian counts suggest that the top five intersections for pedestrian movements in the city centre are clustered around Central Station. These five represent 45% of the total morning peak city centre pedestrian movements. The intersection of Edward and Adelaide Street recorded the highest pedestrian movements, explained by its strategic location proximate to Central Station, Queen Street and KGS Busway Stations, Adelaide Street bus stops and Queen Street Mall.

The BCC data also identifies pedestrian activity and traffic incidents. This reveals that nearly half (43%) of all pedestrian incidents occurred along three streets – Adelaide Street (19%), Ann Street

(14%) and Edward Street (10%). These streets carry the highest level of pedestrian traffic and form key connections between the city centre and the major public transport hubs of Central Station, Adelaide bus stops and KGS Busway Station.

Key active transport links in the central study corridor are shown in **Figure 4-54**. This includes a range of rail corridor crossings which are detailed in **Table 4-52**.

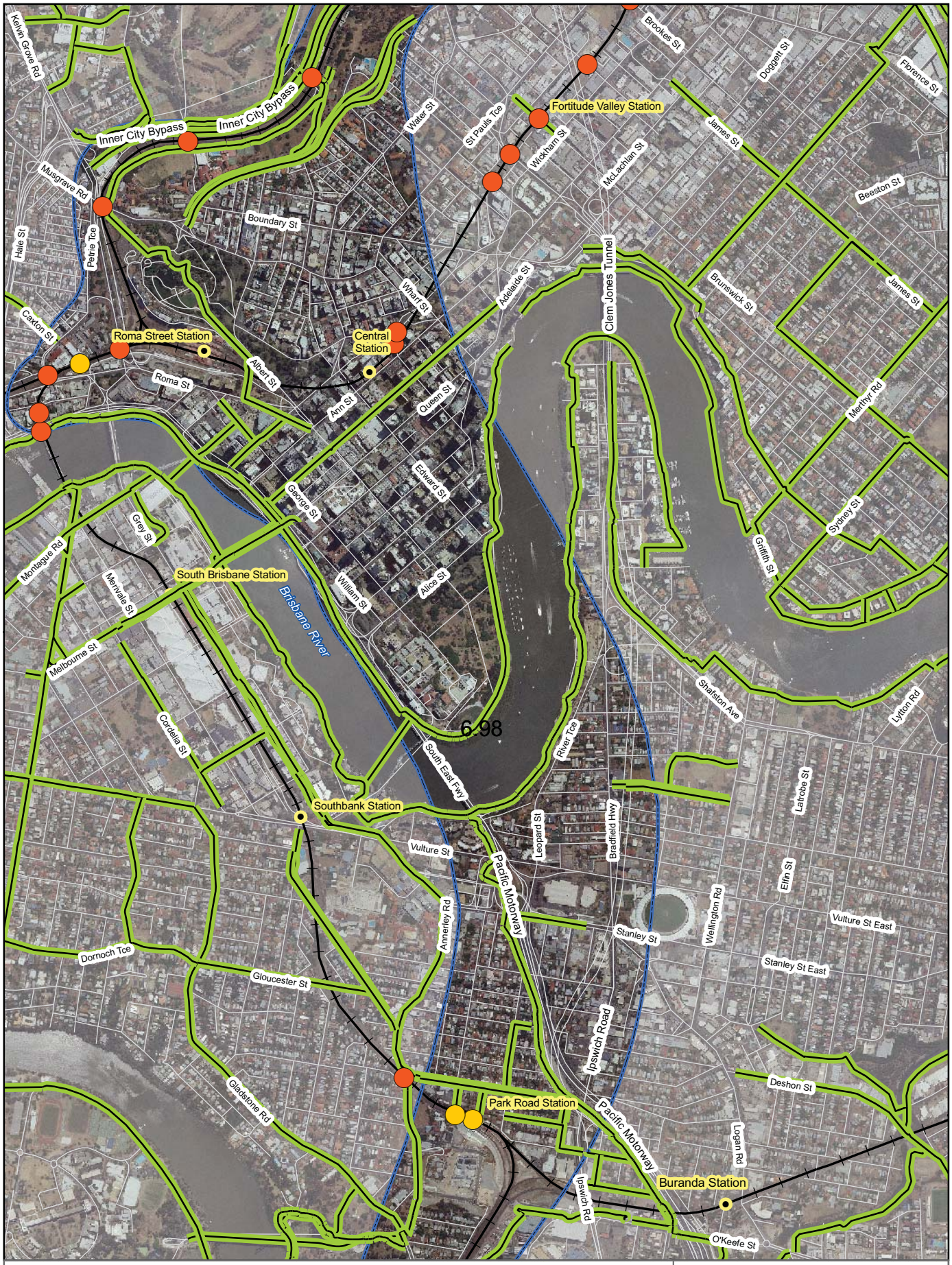
Table 4-52 Pedestrian access across rail in the central study corridor

Location/description	Crossing type and width	Comments
Victoria Park land bridge	22 m to 27 m pedestrian/ cycle over rail bridge	This bridge is a well used 'green bridge' for pedestrians and cyclists linking Spring Hill with Herston over the Exhibition Railway lines and the ICB motorway.
Brisbane Grammar School pedestrian bridge	1.5 m pedestrian over rail bridge	This is a narrow footbridge over a long section of railway yards and the ICB adjacent to Brisbane Grammar School linking the school with playing fields to the north
College Road (north of Roma Street station)	30 m wide road over rail (and cycleway) bridge	This bridge spans both the exhibition railway line and the 4 m wide shared use Normanby Link path. The bridge itself includes six traffic lanes and two footways each 3 m+ in width. There are no formal cycle lane on College Road
Countess Street (west of Roma Street Station)	Rail over road bridge with 23 m wide road underneath	This rail over road bridge spans five traffic lanes and footpaths on each side of the carriageway. There are no cycle lanes on Countess Street.
Caxton Street Link (west of Roma Street Station)	8 m wide pedestrian over rail bridge	This is a new pedestrian bridge over the Inner Northern Busway and the western and southern railway lines, west of Roma Street Station providing a link from Caxton Street and the Suncorp Stadium precinct to Roma Street and the Transit Centre precinct
Bicentennial Pedestrian/cycle way (north of South Brisbane Station)	Pedestrian/cycleway underneath Merivale (rail) Bridge	This is a major shared use path for both cyclists and pedestrian which runs parallel to the river connecting the CBD with western suburbs including the University of Queensland
Annerley Road (north of Park Road Station)	Two rail over road bridges	Four general traffic lanes, two cycle lanes exist under this rail bridge along with footpaths on both sides of the carriageway
Merton Road pedestrian bridge (north of Park Road Station)	2 m wide pedestrian over rail bridge	This bridge is only for pedestrian and cyclist use connects Merton Road to the north with Boggo Road to the south
Park Road Station pedestrian bridge	2 m wide pedestrian over rail bridge	This pedestrian bridge across the railway line connects Park Road bus and train station with Quarry Street to the north and Boggo Road to the south

Figure 4-54 also highlights key cycle and pedestrian only routes in the central part of the study corridor including:

- routes through the City Botanic Gardens
- Bicentennial bikeway (under the Riverside Expressway)
- the Normanby and Victoria Park bikeways (including the Victoria Park landbridge)
- the Riverside bikeway and boardwalk parallel to Eagle Street
- the Goodwill Bridge
- the Kurilpa Bridge
- South East Bikeway (cycles only).

Data from BCC suggests that within the central study corridor there are currently heavy cycling movements in Roma Street, Adelaide Street (fed primarily from the Bicentennial Bikeway, which extends to Newstead in the north-west and Toowong in the south-west) and Edward Street south.



LEGEND

- Study Corridor
- Existing Bikeway

Rail Crossings

- Ped/Cycle
- Vehicles and Ped/Cycle

- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-54

Existing Pedestrian and Cycle Network (Central Section)

0 0.25 0.5 0.75 1 km

1:21,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G027_CCR_Trans_Ped_Cycle_A4_aerial_TR_ver93.mxd 06/07/2011 15:18

Roma Street station pedestrian and cycle facilities

Walking is a major means of access to Roma Street Station with approximately 75% of passengers accessing the rail network at Roma Street via a walk trip Observations during the morning peak revealed some significant issues with the current pedestrian network and access arrangements around the station.

It was estimated, from site observations that over 90% of passengers alighting from Roma Street station were bound for destinations to the south of the station. With some interchange observed to the immediately adjacent busway station (approximately 15%), The remaining alightees used one of three alternative exits from the station building as illustrated in **Figure 4-55**. Some 30% exited towards the signalised crossing of Roma Street via ramp and stairs; 25% exited straight ahead via stairs and across Roma Street where there are no formal crossing facilities; and a further 20% travelled up to level 1 (via escalators or lift) to the food court and through to the overhead walkway across Roma Street. Of the 75% exiting the station onto/ near Roma Street, it appeared that the vast majority (around 60%) were headed towards George Street – a key pedestrian link to CBD trip attractors.

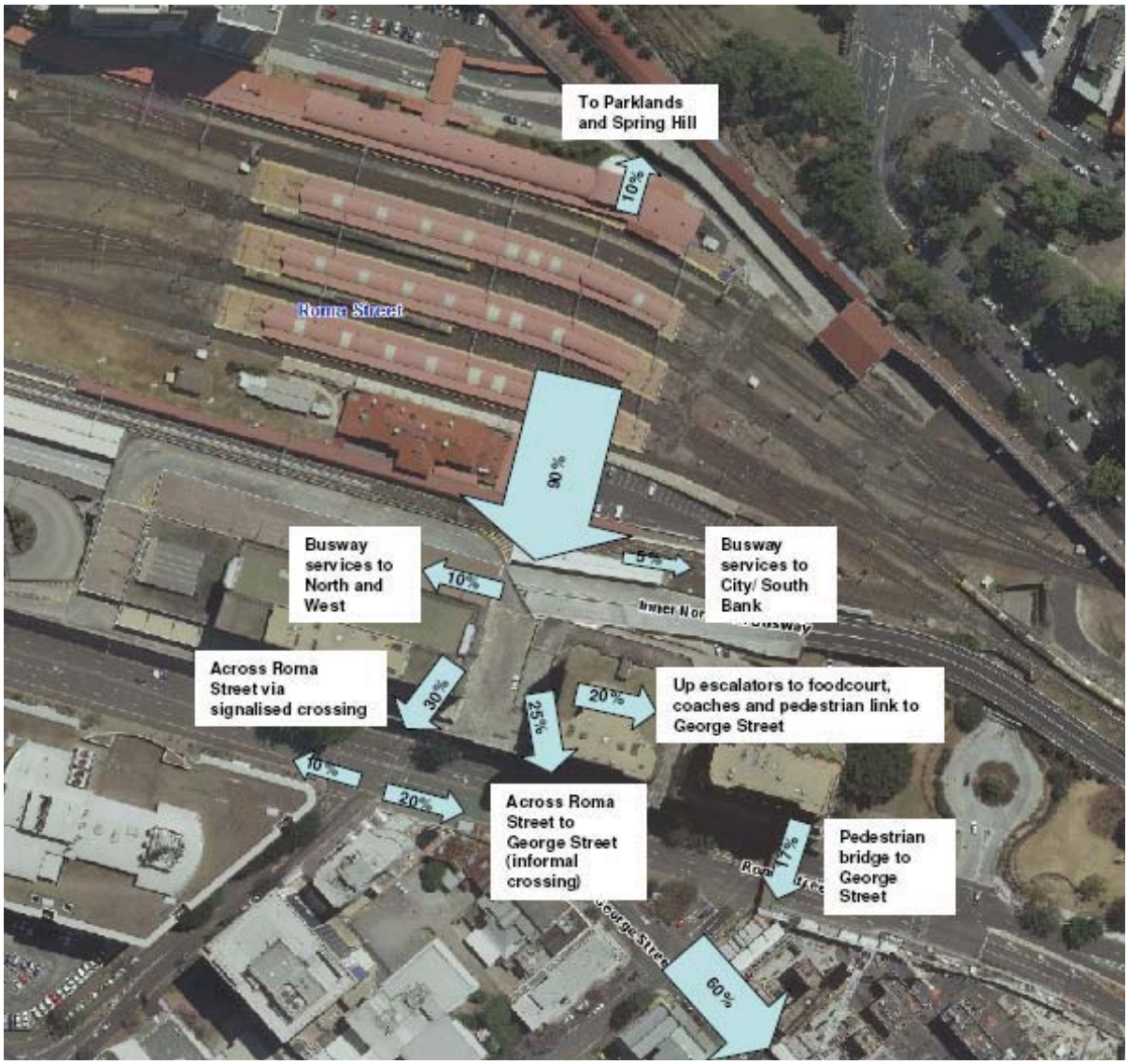


Figure 4-55 Existing (2009) morning peak pedestrian egress proportions from Roma Street Station

Source: ©AAMHatch 2009, supplied by Transport and Main Roads

The key access routes to Roma Street Railway Station therefore are along George Street and along/across Roma Street to the south-east (refer to **Figure 4-56**). A further description of access routes is outlined below:

- To the south George Street is a key link from the station to the major employment areas to the south of the station including the legal and administration precinct. Access to George Street is possible only by crossing Roma Street by one of three means – an at-grade signalised crossing at Makerston Street, jaywalking 'mid-block', or by utilising the existing overbridge.
- Roma Street is the main access route to the west of the station (including the areas around Petrie Terrace and Caxton Street) as well as land uses immediately east of the station including around King George Square. While lightly used in general, this route is heavily used when events are held at Suncorp Stadium. This route is relatively unattractive as it is flanked by car parks, busy roads and rail/busway bridges, with no shelter/shade and with narrow footways (less than 2 m effective width in sections).
- To the east of the station, along Roma Street itself, there were few observed pedestrians. This could be attributed to the relatively poor quality of the walking environment between the station and Albert Street/KGS (via Roma Street). The route has very limited street activity; it is flanked by building 'rear ends' and blank facades and suffers from a lack of shelter/shade.
- To the north, the key issue identified was the lack of clear, direct access to Spring Hill despite its proximity.

The key pedestrian access issues observed at Roma Street frontage of the station:

- lack of clear, direct, safe and legible pedestrian route from the station entrance and George Street, a key route and desire line for pedestrians
- significant barriers at the station entrances (to Roma Street) including narrow doorways and stairs, indirect routing, poor orientation location of landscaping and kiosks etc.
- significant barriers immediately beyond the station entrances (to Roma Street), namely the level difference between the station concourse level and the street level (approx 1 m), lack of a direct DDA compliant route and relatively narrow pavement width/limited waiting space and several obstructions including post boxes and telephone boxes
- significant traffic barrier formed by Roma Street itself and the lack of direct crossing facilities. The existing signalised crossing is not on the key pedestrian desire line and requires pedestrians to undertake a 50 m to 60 m detour if walking towards George Street. The existing overbridge is not well signposted from within the station, requires two level changes (up escalators, and then down stairs) and indirect routing.
- high levels of jaywalking immediately in front of station were observed as a result of the above route deficiencies
- a key barrier is the intersection of George Street and Herschel Street. In the morning peak large numbers of pedestrians gather on the north-western corner of the intersection and are subject to long delays at the intersection due to the complicated signal phasing arrangement. The signals provides two bus only right turn phases in each cycle, irrespective of whether there is a bus in the approaching bus lane. The bus right turn is in direct conflict with the aforementioned pedestrian crossing and any time allocated to the bus phase results in further delays for pedestrians. This leads to pedestrian frustration and jaywalking. When the pedestrian phase is finally activated the timing is very short, at some 10 seconds of green time and a further 10 seconds of clearance time. The heavy left turn vehicle flow from George Street into Herschel Street is in direct conflict with the path of the pedestrians crossing during the short green time leading to both driver and pedestrian frustration. The current intersection layout and signal timings inevitably causes delays, congestion and potential road safety concerns for all road user – ie both George Street left turning traffic, buses on George Street and pedestrians on the western side of George Street.

Figure 4-56 People crossing Roma Street in front of the Roma Street Transit Centre

The major arterial roads surrounding Roma Street Station have varying degrees of provision for cyclists. For example, Roma Street in front of and west of the station has no on-road provision, however east of the station there is a short section of marked on-road cycle lanes.

In George Street, BCC has recently completed a high quality two-way segregated cycleway (Copenhagen Lane) running between Herschel Street and Turbot Street providing access to Tank Street and the Kurilpa Pedestrian/Cycle Bridge.

Roma Street can also be accessed from the Bicentennial Bikeway (under the Riverside Expressway) at Herschel Street, some 150 m from the station.

Another key cycle facility in the vicinity of the station is the Normanby cycle link through Roma Street Parklands to the north. This is a heavily used route into the CBD from the northern suburbs, connecting cycleways and routes from Kelvin Grove Road through to Bowen Bridge Road. This route passes the station to the north and east, joining Roma Street some 100 m to the east of the station.

No dedicated bicycle parking was observed at Roma Street station, limiting bicycle parking to light poles and fencing. Nevertheless, the BCC-run KGS cycle centre is approximately 400 m to the south-east and a City Cycle bike hire station has been recently installed outside the station entrance on Roma Street.

Brisbane City Council data suggests that there are currently heavy cycling movements in Roma Street, as well as along Adelaide Street, fed primarily from the Bicentennial Bikeway, which extends to Newstead in the north-west and Toowong in the south-west. However, there are very few cyclists observed accessing Roma Street Station in the morning peak.

Central Station pedestrian and cycle facilities

Central Station is the busiest on the QR City network with almost 90,000 passenger movements (boardings, alightings and transfers) on a typical weekday walking is the primary mode of access and egress to Central Station accounting for over 90% of trips to and from the station.

Central Station is surrounded on all four sides by multi-lane roads, namely Ann Street, Edward Street, Creek Street, and Turbot Street that passengers must traverse to access the station. However, a dense network of footpaths and subways connects the station with its surrounding catchment.

It was estimated from morning peak site observations (**Figure 4-57**) that approximately 40% of pedestrians exited the station via the subway and 60% via the concourse and surface level links. It was also observed that only around 10% of station alighters exited to the north of the station (towards Spring Hill) in the morning peak.

Of the 60% of alighting passenger that exited the station via the upper concourse level more than half were destined for the Ann Street/Edward Street exit (the notional front door of the station) with approximately one-third to the Ann Street/Creek Street exit. Of the 40% of alighting passengers that exit the Central Station via the subway, the vast majority were CBD bound. Pedestrian counts indicated that almost 8,000 pedestrians use the subway's ANZAC Square entrance during the two hour morning peak period. The subway was observed to be operating at an acceptable level of service (ie no significant crowding or conflicts) during the morning peak.

Figure 4-57 Central Station morning peak egress Ann Street/Edward Street intersection

The observations undertaken at Central Station together with BCC pedestrian data highlighted some localised issues with current pedestrian network around the station:

- Nearly half of the pedestrian incidents occurred within close proximity to Central Station, along Adelaide Street, Ann Street and Edward Street.
- Top five intersections for pedestrian movements in the city centre are clustered around Central Station.
- There are sub-standard pedestrian facilities and poor sight lines on Creek Street between Turbot and Ann Streets east of Central Station. There are perceived dangers with pedestrian and vehicle conflict and pedestrians were observed undertaking risky crossings or walking on the road pavement due to lack of formal footpaths or back of kerbside waiting and movement space.
- The effective footpath widths around Central Station were found to be among the narrowest in the CBD (less than 3 m). This is a cause for concern as these correspond to the routes with the highest level of pedestrian activity.
- Although the CBD has high pedestrian crossing demands at most signalised intersections, there is only one scramble crossing (all pedestrian phase) observed in the area, at the Adelaide Street/Edward Street intersection.

- The Central Station footbridge that provides a link from the entrance at the corner of Ann Street and Creek Street to Wickham Terrace is under utilised. The footbridge is narrow, unattractive and the access points are not easily visible (**Figure 4-58**). Pedestrians instead choose to walk along Creek Street even though this link has no formalised pedestrian facilities.
- There are poor pedestrian crossing facilities at the Wickham Terrace entrance to the station – the area is dominated by roads and carpark access ramps while the uncontrolled crossing of Wickham Terrace provides poor sightlines to oncoming northbound traffic.
- There is insufficient storage space on the traffic island at the intersection of Creek Street and Ann Street to service current morning peak demands, which results in pedestrian overspill.

Figure 4-58 Footbridge across railway tracks east of Central Station

There is currently minimal provision for cyclists at Central Station.

The major arterial roads surrounding Central Station are identified as high difficulty roads for cyclists and none of the streets that surround the station are designated as cycle routes. The roads that surround the station (Creek Street, Ann Street, Turbot Street and Edward Street) have an absence of dedicated cyclists' priority lanes with high volumes of pedestrians, buses and general traffic. Edward Street and Creek Street have very steep gradients and Ann Street and Turbot Street have speed limits of 60 km/h (whereas the rest of the CBD has a 40 km/h speed limit). Bus lanes on Edward Street and Ann Street permit use by cyclists but are too narrow to allow buses and cyclists to share the lane.

These features create an unattractive environment for cyclists to access the station or the CBD in general. As such, few commuters were observed to cycle to Central Station and interchange to rail. BCC cycle data suggests that the majority of cyclists are concentrated on a few key routes into the City and city frame.

There was no observed bicycle parking facilities provided at Central Station with some bicycles locked to light poles and fencing in the vicinity of the station (**Figure 4-59**). However the KGS Cycle Centre, or cycle2city (C2C) located approximately 315 m west of Central Station on Ann Street is a major cycle facility in the CBD. Cycle2city provides member access to 420 secure bike lockers and end of trip facilities such as toilets, showers, and lockers. The facility is open weekdays 6.00 am to 8.00 pm Monday to Friday.

Figure 4-59 Ramp entering King George Square Cycle Centre

Source: www.cycle2city.com.au

Woolloongabba area pedestrian and cycle facilities

While there is no current railway station in Woolloongabba, the Woolloongabba Busway Station is the current public transport focal point for the suburb and a generator of significant walk trips. It is also in the vicinity of this busway station that the future Woolloongabba Cross River Rail station will be located.

Woolloongabba Busway Station is surrounded on all four sides by heavily trafficked arterial roads, namely Stanley Street, Vulture Street, Ipswich Road and the Pacific Motorway (M3). With no grade separated crossings (except for under and over the M3), all trips to the surrounding precincts involve crossing one of these wide heavily trafficked roads at signals (refer to **Figure 4-60**).

Figure 4-60 Road infrastructure surrounding the Woolloongabba precinct

To the south, an existing mid block pedestrian crossing provides good access from the busway station to the Stanley Street retail strip albeit there are six lanes of traffic to cross (including a service road).

To the east, access to the Logan Road commercial precinct is by way of a three stage crossing of Ipswich Road/Main Street and Stanley Street traversing 14 lanes of traffic, making for an intimidating walk trip. There is also a lack of pedestrian signal on the southern side of Ipswich Road/Vulture Street intersection. Before and after major events, this requires traffic controllers to stop traffic to allow pedestrians to cross safely. The alternative is to navigate around all three other sides of the intersection.

To the west there is no footpath on the northern side of Stanley Street, west of Leopard Street/ southbound M3 on-ramp. This means all pedestrians heading west from the busway/Woolloongabba precinct must cross to the south side of Stanley Street and to get to Stanley Street west and the Mater Hospital precinct.

Walking routes during Gabba Stadium events are severely constrained. As such Police must close Vulture Street, Stanley Street and marshal pedestrian and vehicle activity on Ipswich Road to safely accommodate large numbers of pedestrians as well as event shuttle buses.

The surrounding network of arterial roads is relatively hostile to cyclists and there were no observed cycle lanes or off-road paths on any other immediately surrounding roads or streets, with the exception of a short section of on street cycle lane on Stanley Street between the Pacific Motorway and the service lane opposite the busway station (see **Figure 4-61)**.

Also of importance is the presence of the South East Bikeway (on the western side of the Pacific Motorway) which is a good quality, well used cycle link between the southern suburbs and the CBD (via the Goodwill Bridge). This would be expected to cater for CBD bound cycle trips with an added opportunity to provide good cycle links to the Gabba Precinct from both north and south.

However, the access to the bikeway via Stanley and Vulture Streets through Woolloongabba is poor due to lack of dedicated cycle provision. There were few observed cyclists during the site visit undertaken in the morning peak hour. There was no observed cycle parking on street or at the busway station.

Figure 4-61 Existing (2009) short section of cycle lane on Stanley Street (looking west)

Park Road Station pedestrian and cycle facilities

All four Park Road Station platforms and two busway platforms are connected by way of lifts and stairs to a common pedestrian overbridge which provides connections to Boggo Road in the south and Quarry Street in the north. However the wider pedestrian network through the station precinct is somewhat disjointed and disconnected and is severely constrained by the presence of three major railways – ie the South Coast line, the Cleveland line and the Port of Brisbane freight railway line.

To the west of the station is a second pedestrian overbridge 70 m to the west of the main station access bridge linking Merton Road and Boggo Road (adjacent to Dutton Park School).

To the north of the station, pedestrian access is predominantly by way of footpaths alongside residential streets. This area of the station catchment is predominantly low density. The station itself is at the end of Quarry Street a small cul-de sac with no through vehicle connection and provides a somewhat hidden 'front entrance' to the station.

To the east, access to the station is via an off road pedestrian path between Quarry Street and Elliott Street, which is narrow and unattractive with little natural surveillance and poor quality footway as illustrated in **Figure 4-62**. At present there is no direct pedestrian or cycle access between the station and the major employment generating Prince Alfred Hospital, only 500 m south-east due to the presence of the railways and lack of crossings.

Access to the south is available via the station's pedestrian overbridge and through the Boggo Road redevelopment precinct.

Figure 4-62 Pedestrian link from Quarry Street to Elliott Street

There is a range of cycle routes and paths around the station. To the west of the station, cycle provision already exists along Annerley Road in the form of formal cycle lanes. At the top of Annerley Road (southern end) these cycle lanes connect to the Eleanor Schonell (Green) Bridge across to the University of Queensland.

To the south-east of the station, a new cycle way (opened August 2009) exists adjacent to the Eastern (Boggo Road) Busway, in the vicinity of the Prince Alexandra Hospital (see **Figure 4-63)**. This cycleway ends just north of Dutton Park Railway station with no dedicated facilities between this cycleway and the Eleanor Schonell cycleway on the opposite side of Annerley Road, towards the University of Queensland.

Figure 4-63 Existing (2009) off road cycleway between O'Keefe Street/ PAH and Dutton park railway station

To the north of the station, yellow Bicycle Awareness Zone (BAZ) markings are present on the Park Road carriageway, between Annerley Road in the west and Ipswich Road in the east. At the Ipswich Road end of Park Road, there is a direct link to the South East Bikeway.

To the south of the station there is a critical missing link in what is a strategic cycle way between the University of Queensland and the South East Bikeway (which parallels the M3/Pacific Motorway). There is also a lack of cycle parking at the station which limits current cycle trips as a mode of access to the station.

4.7.3 Pedestrian and cycle networks – south

The pedestrian and cycle network in the southern part of the study corridor is comprised of a range of local crossing points of the corridor, mostly co-located with local road crossings. There are also several designated local cycle routes as shown in **Figure 4-64**. The local pedestrian and cycle crossing points are further described in **Table 4-53**. This shows that there are several substandard railway crossings across the corridor with the railway forming a barrier to pedestrian and cycle connectivity in some areas.

Table 4-53 Pedestrian access across rail in the southern study corridor

Location/description	Crossing type and width	Comments
Venner Road (north of Yeronga)	11.5 m road over rail bridge	A narrow (approx 1.6 m wide) footpath exist on the northern side of Venner Road only, no cycle lanes exist on the bridge
Park Road (north of Yeronga Station)	Rail over road bridges	Approx 15 m wide road corridor under rail bridges includes two traffic lanes and two footpaths separated from the road carriageway. No cycle lanes exist.
Yeronga Station pedestrian bridge	1.8 m wide pedestrian over rail and road bridge	Pedestrian bridges connect Fairfield Road to the west and Lake Street to the east with Yeronga station
Cardross Street (north of Yeerongpilly Station)	10 m wide road over rail bridge	Narrow footway (less than 2 m) on northern side of bridge only. No bike lane exists
Yeerongpilly Station pedestrian bridge	2 m wide pedestrian over rail bridge	Pedestrian bridge connecting Yerongpilly station with Fairfield Road to the west with Wilkie Street to the east

Location/description	Crossing type and width	Comments
Muriel Avenue (north of Rocklea Station)	Rail over road bridges	1.5 m footpath present on southern side of Muriel Avenue with a separate 1.5 m to 2.3 m wide footway on the northern side. No cycle lanes of Muriel Avenue.
Rocklea Station pedestrian bridge	A 1.5 m to 1.75 m wide pedestrian over rail bridge	Pedestrian bridge which connects Rocklea Station with Brooke Street to the south and Railway Parade footpath to the north.
Beaudesert Road (north of Salisbury Station)	16 m road over rail bride	No footpath or bicycle lane on Beaudesert Road Bridge - pedestrians and inexperienced cyclists use the open level crossing underneath this bridge
Beaudesert Road Service Road (north of Salisbury Station)	Open level crossing	Pedestrian crossing is separated from general traffic and includes ramp facility at southern end
Salisbury Station pedestrian bridge	Less than 2 m wide pedestrian over rail bridge	Pedestrian bridge connecting Salisbury Station with Dollis Street to the west and Olivia Avenue to the east.

Dutton Park Station pedestrian and cycle facilities

Pedestrian access to Dutton Park station platforms are via ramps from the Annerley Road Bridge with a width of approximately 1.8 m. A second accesses exists for platform one from Kent Street. A zebra crossing is provided on Kent Street and a signalised pedestrian crossing on Cornwall Street at a distance of 110 m from the platform one entrance. The only wheel chair access is via the ramps for both platforms, with no lifts are provided at this station.

The major pedestrian constraint at present is the width of footway on the eastern side of Annerley Road, where the northbound platform access ramp joins the footway. At this point, the footway is less than 2 m wide. This footway is the main route for cyclists currently doing an east-west manoeuvre between the University of Queensland and the PAH/South East Bikeway, as well as catering for walk trips to the station.

To the north, the residential catchment is accessed directly from the eastern side of Annerley Road with good access to the station.

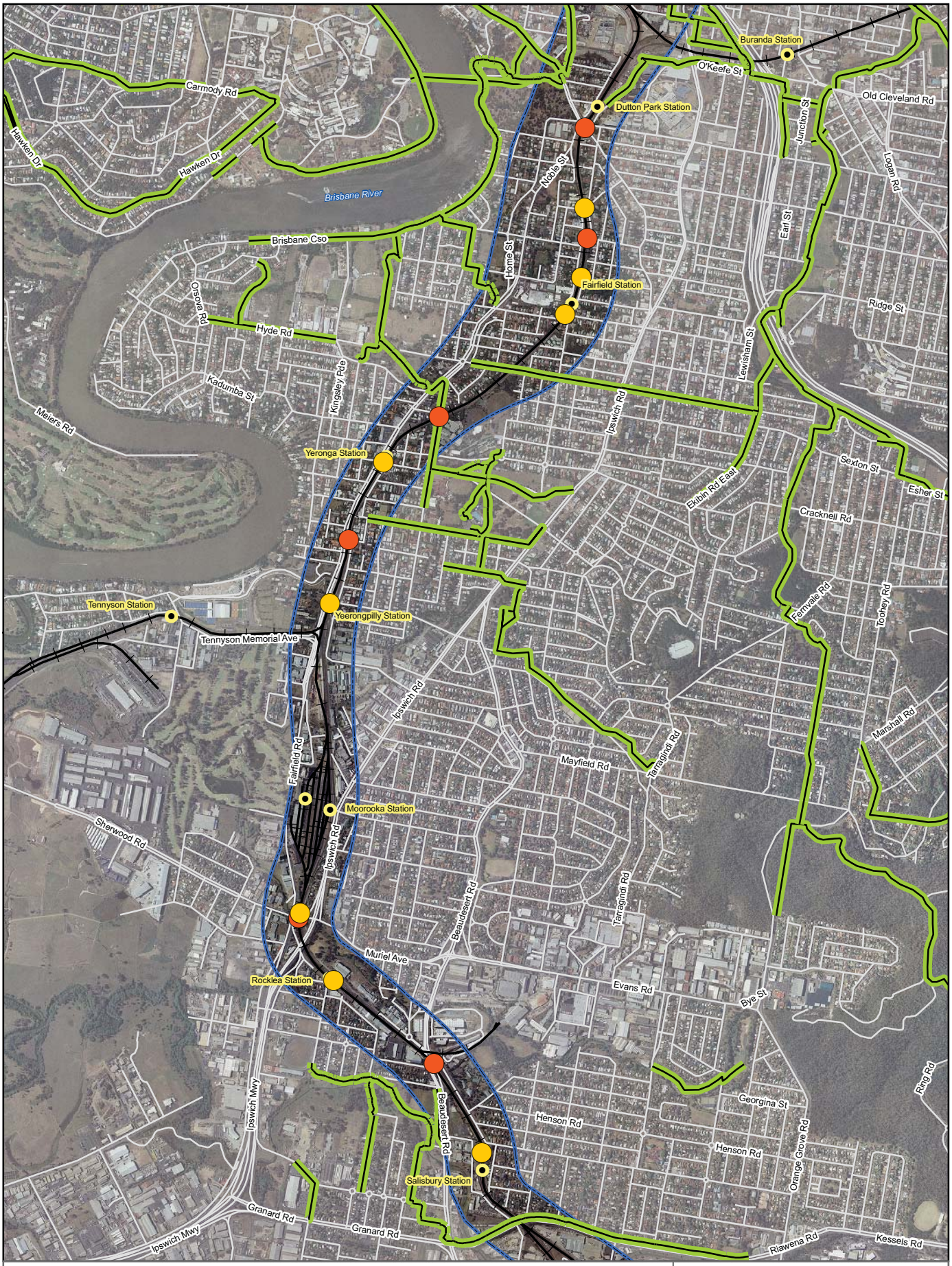
To the south-east, access to the station is via Annerley Road, with good formal direct road crossing opportunities around 130 m and 350 m to the south.

To the south-west, access to the station is more difficult, with a three stage pedestrian crossing at Annerley Road and Noble Street. This then leads to a narrow footway (less than 2 m wide) along the western side of Noble Street where the residential catchment is located.

Dutton Park is also at the crossroads of several cycle routes, namely:

- an existing cycle route between Annerley Road/Gladstone Road and the University of Queensland via the Eleanor Schonell Bridge
- a strategic cycle route between Dutton Park station at Annerley Road and the PAH/Boggo Road precinct and onwards to the South East Bikeway via a Bridge over Ipswich Road.

The key issue for cycling in this area is the missing links in the cycle network, particularly between the intersection of Annerley Road/Gladstone Road and the intersection of Annerley Road/Rusk Street/ Cornwall Street. The Annerley Road bridge over the railway line is a particular pinch point where the PAH/South East Bikeway link meets Annerley Road. The lack of safe, direct convenient crossing from the west side of Annerley Road/ Gladstone Road intersection (ie from Eleanor Schonell Bridge) to the eastern side of the railway line is considered the most important strategic missing link.



LEGEND

- Study Corridor
- Existing Bikeway
- **Rail Crossings**
  - Ped/Cycle
  - Vehicles and Ped/Cycle
- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-64

Existing Pedestrian and Cycle Network (Southern Section)

0 0.25 0.5 0.75 1 km

1:30,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G028_CCR_Trans_Ped_Cycle_A4_aerial_TR_ver93.mxd 06/07/2011 15:19

Fairfield Station pedestrian and cycle facilities

A pedestrian bridge at this station connects both the platforms but there are no lift facilities serving either platform. There is only one ramp connecting platform one to the street but not to or from the pedestrian bridge restricting wheel chair access to platform two

In addition to the station pedestrian bridge another pedestrian/cycle bridge is located 230 m north of the station connecting Midmay Street and Cronin Street/Equity Street.

Footpaths on the side streets adjacent to the station appear to be adequate and in good condition however there are no formal pedestrian crossings available close to the station. Nevertheless, the streets are local access in function and speed humps are provided on Equity Street to reduce the speed on the down hill grade before nearing the station.

Four secured cycle parking lockers and six bicycle racks are located on platform one. The cycle racks were not utilised at the time of site visit and no informal cycle parking was spotted during the time of site visit.

A local cycle route in the vicinity of the station starts from Yeronga Park connecting University of Queensland and the City along the riverside bikeway facility. This route is located 430 m west of the station and can be accessed via Ashby Street. On road bike lanes are also located on Venner Road to the south of the station, connecting eastern and southern suburbs with Fairfield Station

Yeronga station pedestrian and cycle facilities

Pedestrian access to the station is via a footbridge connecting both platforms and to Lake Street in the east and Fairfield Road in the west. Wheelchair access is possible to platform one via a ramp located on Lake Street but not to platform two from either Lake Street or from Fairfield Road. The width of the pedestrian bridge is approximately 1.8 m which is constrained. The existing footpaths on Fairfield Road and Lake Street appear appropriate; however there is no footpath on the eastern side of Fairfield Road from the south. A footbridge over Fairfield Road is effectively an extension of the rail footbridge however this bridge is narrow with low side walls and no anti-throw screens in place. Few people were spotted using the footbridge but many were crossing Fairfield Road illegally. There is no lift or ramp to provide DDA compliant access to this footbridge. Signalised pedestrian crossings are located at the intersection of Fairfield Road/Cowper Street to the south and the intersection of Fairfield Road/Kadumba Street to the north of the Fairfield Road station entrance. No formal pedestrian crossings are located on Lake Street however this is a local access street.

No bicycle lockers are located at the station and no illegal cycle parking was noted at the time of visit. BAZ signs were observed on School Road and on Park Road providing local cycle facilities. More strategic cycle connections exist from the south-east to north-west connecting the TAFE with the University of Queensland via Hyde Road, Fairfield Park and Brisbane Corso.

Yeerongpilly Station pedestrian and cycle facilities

A 75 m long pedestrian overbridge is the only means of access to the station from Fairfield Road and Wilkie Street with an approximate minimum width of 2 m. Lifts and stairs link the footbridge to the island platform, serving both northbound and southbound trains, as well as the western side of Wilkie Street and the western side of Fairfield Road, via a new extension to the footbridge and new western lift and stair access (refer to **Figure 4-65**).

Formal pedestrian crossing facilities are located on both roads adjacent to the station, including a zebra crossing on Wilkie Street near the entrance to the pedestrian bridge and a signalised pedestrian crossing on Fairfield Road at its intersection with King Arthur Terrace some 150 m north of the station. The footpath on the eastern (railway) side of Fairfield Road has recently been widened between the

pedestrian crossing but then narrows to less than 2 m north of that. The footpath on the Wilkie Street appears to be of an appropriate standard.

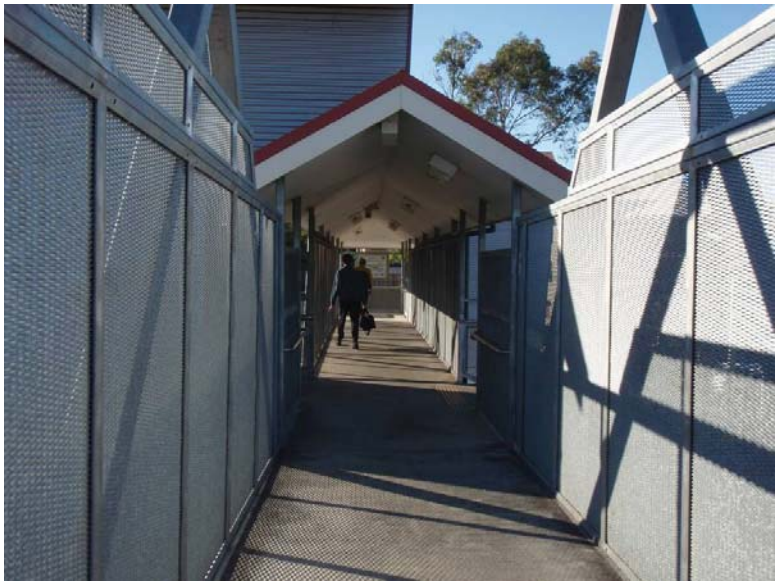


Figure 4-65 Existing (2009) pedestrian access bridge to Yeerongpilly Station.

Four secured cycle lockers were located on Wilkie Street side adjacent to the lift. No informal cycle parking was noted during site visit. On road cycle lane exists on King Arthur Terrace to the west of the station connecting the Queensland Tennis Centre and Yeerongpilly TOD area to Fairfield Road and the station. No formal cycle lanes exists on Wilkie Street however traffic volumes are low and conditions for cycling are relatively good.

Moorooka Station pedestrian and cycle facilities

Moorooka Station can only be accessed by a narrow footbridge to or from the east (Ipswich Road) due to the presence of the Clapham Railway Yards on the western side of the station, through which there is no pedestrian access. The approximate width of the footbridge is 1.2 m and it is accessible by stairs only (no ramps or lifts).

At the station entrance, where the footbridge access stairs meet Ipswich Road, the footpath is very narrow with a width that varies from 1 m to 2 m. This could cause pedestrian safety hazard the close proximity of heavy traffic at the main station entrance and the lack of safety fencing. A signalised pedestrian crossing is located only 15 m north of the station entrance on Ipswich Road which facilitates good east-west crossings from the station to the eastern station catchment as well as to the southbound bus stop on Ipswich Road.

No formal secure lockers were identified at this station during the site visit and no cycle lanes exist on or near Ipswich Road.

Rocklea Station pedestrian and cycle facilities

The main entrance to Rocklea Station is from Brooke Street, on the south-western side of the station. Pedestrian access to this entrance is via the small park 'n' ride facility. On the north-eastern side, access to the station is via a footpath parallel to the southbound rail track linking the southbound platform at its southern end to the northern end of Railway Parade – a distance of around 250 m. This is a long, narrow and exposed pathway in a somewhat hostile environment, surrounded by railway and industrial uses.

A footbridge links the two platforms with the surrounding street network and there are no lifts or ramps linking the footbridge to the platforms or surrounding streets.

There are two cycle lockers located on the western side of the station, within the park 'n' ride facility. There was one bicycle chained to a fence/post adjacent to the lockers indicating demand for additional cycle parking. There are no marked cycle routes on the approaches to the station

Salisbury Station pedestrian and cycle facilities

Pedestrian access to Salisbury Station is available via a central pedestrian overbridge which links the surrounding streets to the island platform.

On the western side of the station, access to the overbridge is via a footpath from Dollis Street. There is a footpath along the western side of Dollis Street but currently no crossing facility exists between the station access and the western footpath. From Dollis Street access to the western residential catchment (on the western side of Beaudesert Road) is via Lillian Avenue and a footpath through Kookaburra Park towards Colvin Street. However pedestrians must cross Beaudesert Road, and there are no pedestrian crossing facilities on this desire line near the intersection of Beaudesert Road and Lillian Avenue. Therefore, to cross using a formal crossing, pedestrians must use the Granard Road intersection, some 600 m south, which is a substantial detour from the desire line. Alternatively residents from this catchment could use Rocklea Station instead.

To the east, access to the station is via two footpaths leading to the station footbridge, one connecting to Fairlie Terrace and one connecting to Olivia Avenue. There is a zebra crossing of Fairlie Avenue in the vicinity of the station access path. There are no major pedestrian access barriers on the eastern side of the station.

There are 14 cycle lockers located on the eastern side of the station, adjacent to the park 'n' ride facility and there were two bicycles chained to a fence post adjacent to the lockers indicating demand for additional cycle parking. There are no marked cycle routes on the immediate approaches to the station.

Approximately 400 m south of the station, along the northern side of Riawena Road (a part of the Brisbane Urban Corridor route), a shared path exists. This is part of a Strategic Cycle Route. However this shared path varies between about 3 m in width to 4.5 m and is considered sub-standard in sections. There is no direct connection between this cycle route and Salisbury Station itself despite the proximity.

Beaudesert Road is designated a future Strategic Cycle Route in the Principal Cycle Network Plan (PCNP) for South East Queensland, however, no dedicated cycle provision currently exists.

4.8 The regional, arterial and local road network

4.8.1 Regional road network and performance

The Brisbane regional road network is characterised by a range of radial and orbital arterial and motorway routes including:

- the M1 (Gateway Motorway) – a north-south bypass on the eastern edge of the Brisbane Metropolitan area
- the M3/M7/A3 (Pacific Motorway/Clem Jones Tunnel/Gympie Road) - a key north-south route through inner Brisbane
- the M5/ICB/Kingsford Smith Drive – an east-west route linking the western suburbs to the north-eastern suburbs and airport via inner north Brisbane
- the M2/M6 route (Logan Motorway) forming an east-west bypass of Brisbane on the southern edge of the metropolitan area.

The major arterial roads are shown in **Figure 4-66**.

Over four million car and light vehicle trips and approximately 370,000 commercial vehicle (freight) trips occur within the Brisbane metropolitan area on an average weekday (2009).

Level of service (LOS) is a key measure of the performance of the regional and urban road network. It can be measured at a mid-block point or at an intersection, and provides an assessment of the operation as performance of the road network in terms of conditions experienced by drivers.

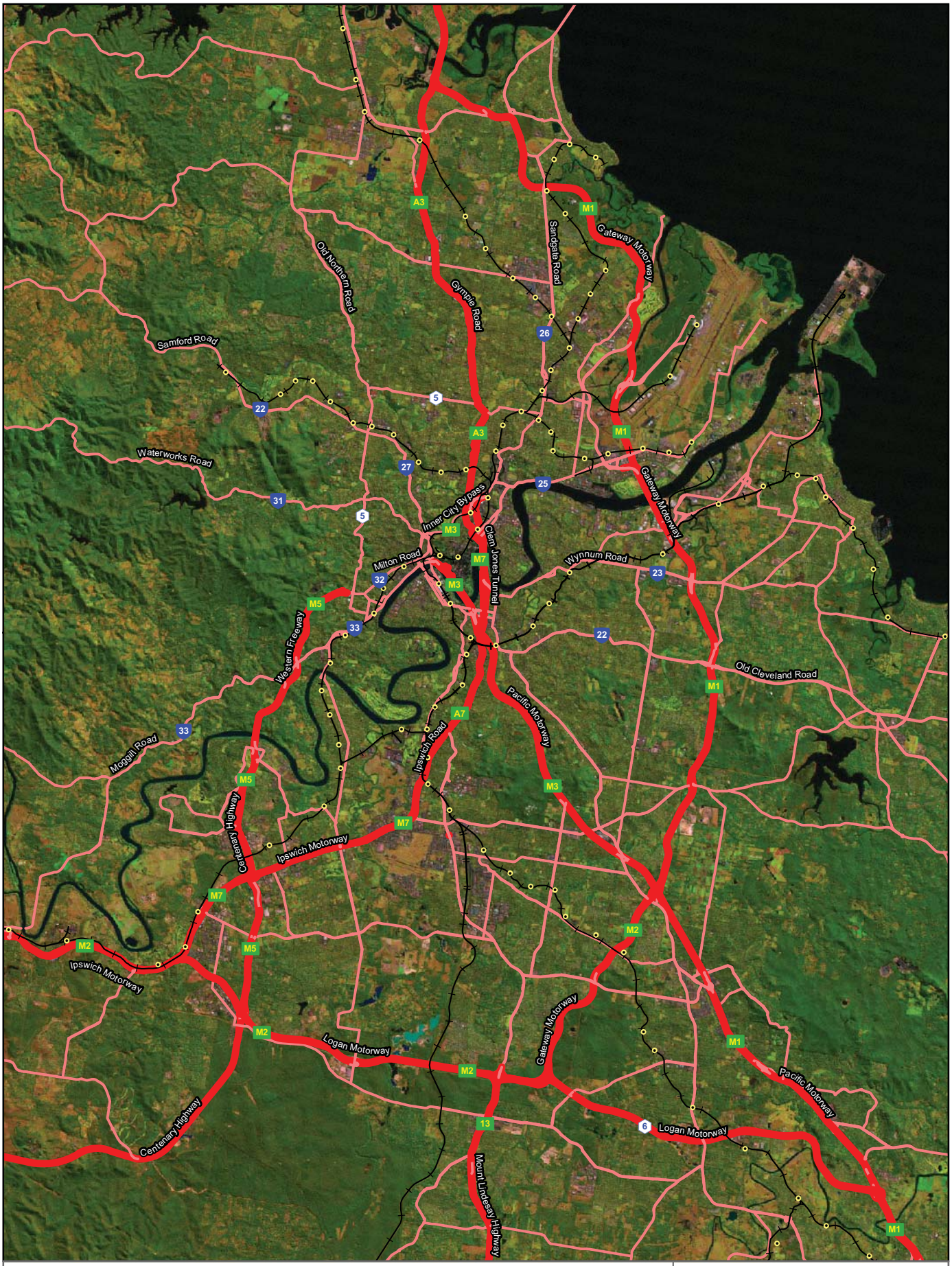
The LOS for roads within each sub-area of the study corridor has been determined for existing conditions for the base year 2009 using travel speed (as estimated from the Cross River Rail Project model) as the defining measure for urban and suburban arterial roads with interrupted flow using Austroads (2009) definitions. As travel speeds decrease from the optimum free-flow condition, the LOS to road users deteriorates. The LOS range is from A (very good) to E (congested) and F (very congested).

This assessment shows that in the morning peak, the radial road network centred on the CBD is heavily constrained with several key road corridors experiencing congested conditions (LOS E or F) with significant delays and low average travel speeds including sections of:

- Riverside Expressway (both directions)
- Pacific Motorway (Captain Cook Bridge) inbound
- Sandgate Road/Abbotsford Road (north of the Inner City Bypass)
- Lutwyche Road/Bowen Bridge Road
- Story Bridge (inbound/northbound)
- Coronation Drive and Milton Road (inbound)
- Ipswich Road and the Ipswich Motorway.

More details on individual routes within the northern, central and southern sections of the study corridor including maps are discussed in the section below.

Also of note is that recent investment in road capacity around the CBD, such as the Clem7 Motorway and Go Between Bridge (part of BCC's TransApex strategy) are aimed at providing alternative routes to avoid may of the above congested roads. However there are no State or Local Government proposals for major road capacity upgrades into and through the CBD itself. As such the capacity of the these roads is considered fixed and the ability of the regional and arterial network to satisfactorily cater for further growth in travel demand by private vehicles to Brisbane's CBD during the peak periods is therefore severely constrained.



LEGEND

- Station
- Track

Road Network

- Motorway/ Major Arterial Road
- Other Roads

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-66

Existing Brisbane Regional Road Network

0 1 2 3 4 5 6 7 km

1:200,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G071_CCR_Regional_Roads_A4_TR_ver93.mxd 06/07/2011 15:20

Northern road network and performance

The major road network in the northern part of the study corridor includes:

- Sandgate Road/Abbotsford Road
- The Inner City Bypass
- Bowen Bridge Road/Lutwyche Road
- Clem Jones Tunnel (Clem7).

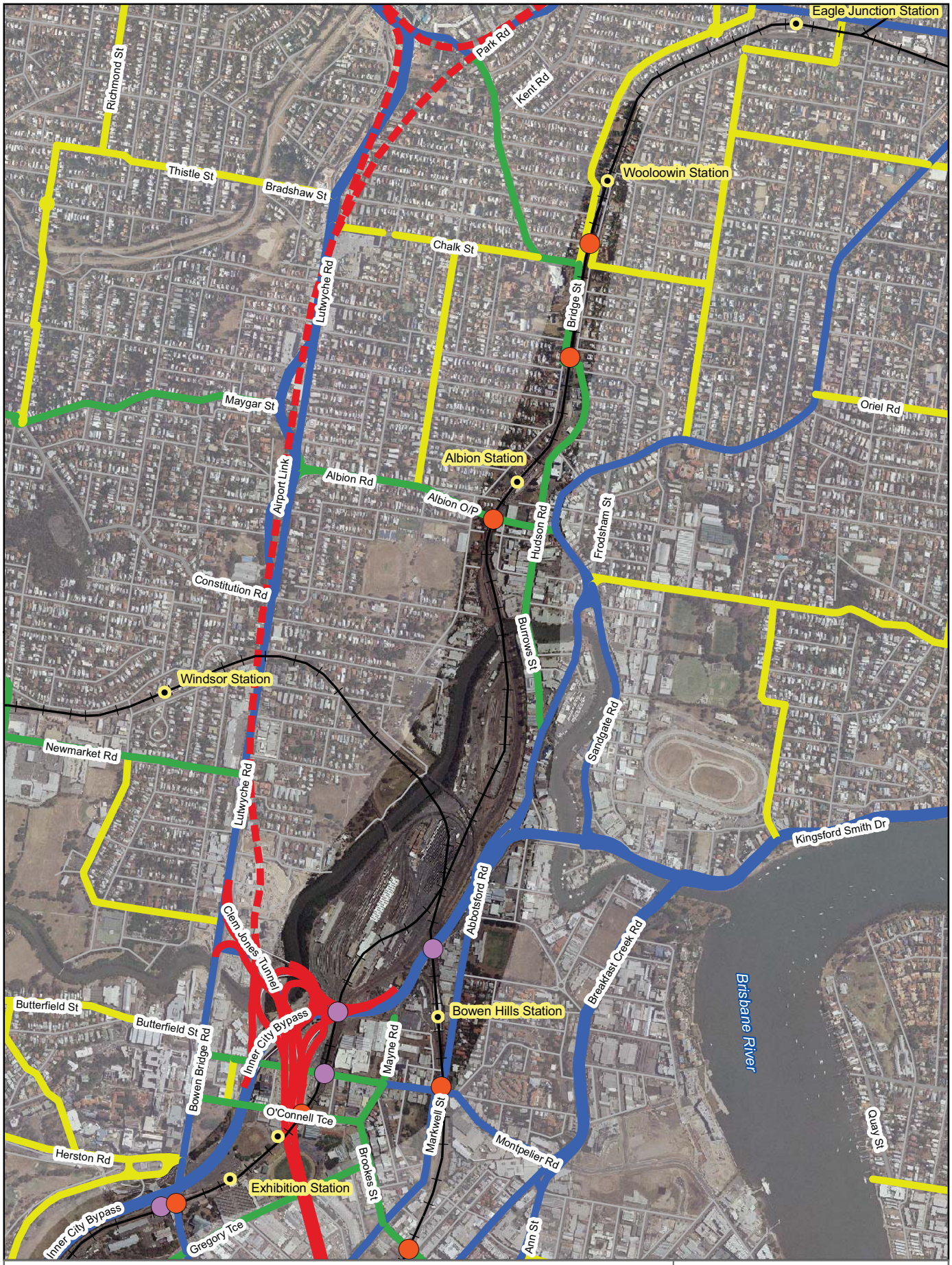
Lutwyche Road and the ICB are both designated 'Priority 2' freight routes under the South East Queensland Regional Freight Network Strategy (2007-2012).

The northern corridor road network including the road hierarchy and all road crossings of the rail corridor are shown in **Figure 4-67**.

Outputs from the 2009 SKM-Aurecon project model show that In the morning peak, numerous key roads experience Level of Service (LOS) of E or worse for inbound traffic. LOS E represents volume over capacity of 0.9 or worse. This means that more than 90% of available road capacity is being used which generally translate to unstable flows, congestion and delays. Roads experiencing a LOS of E or worse in the morning peak in 2009 include:

- Kedron Park Road/Bridge Street/Hudson Road
- Sandgate Road/Abbotsford Road (north of the ICB)
- Lutwyche Road/Bowen Bridge Road.

The Level of Service for all roads in the northern part of the study corridor is shown in **Figure 4-68**. This also shows that most lower order roads are operating a good Level of Service.



LEGEND

- Study Corridor

Rail Crossings

- Vehicle Only
- Vehicle and Ped/Cycle
- Station
- Track

Road Hierarchy

- Motorway Route
- Future Transport Corridor
- Arterial Route
- Suburban Route
- District Access Route
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-67

Existing Road Network (Northern Section)

0 0.25 0.5 0.75 km

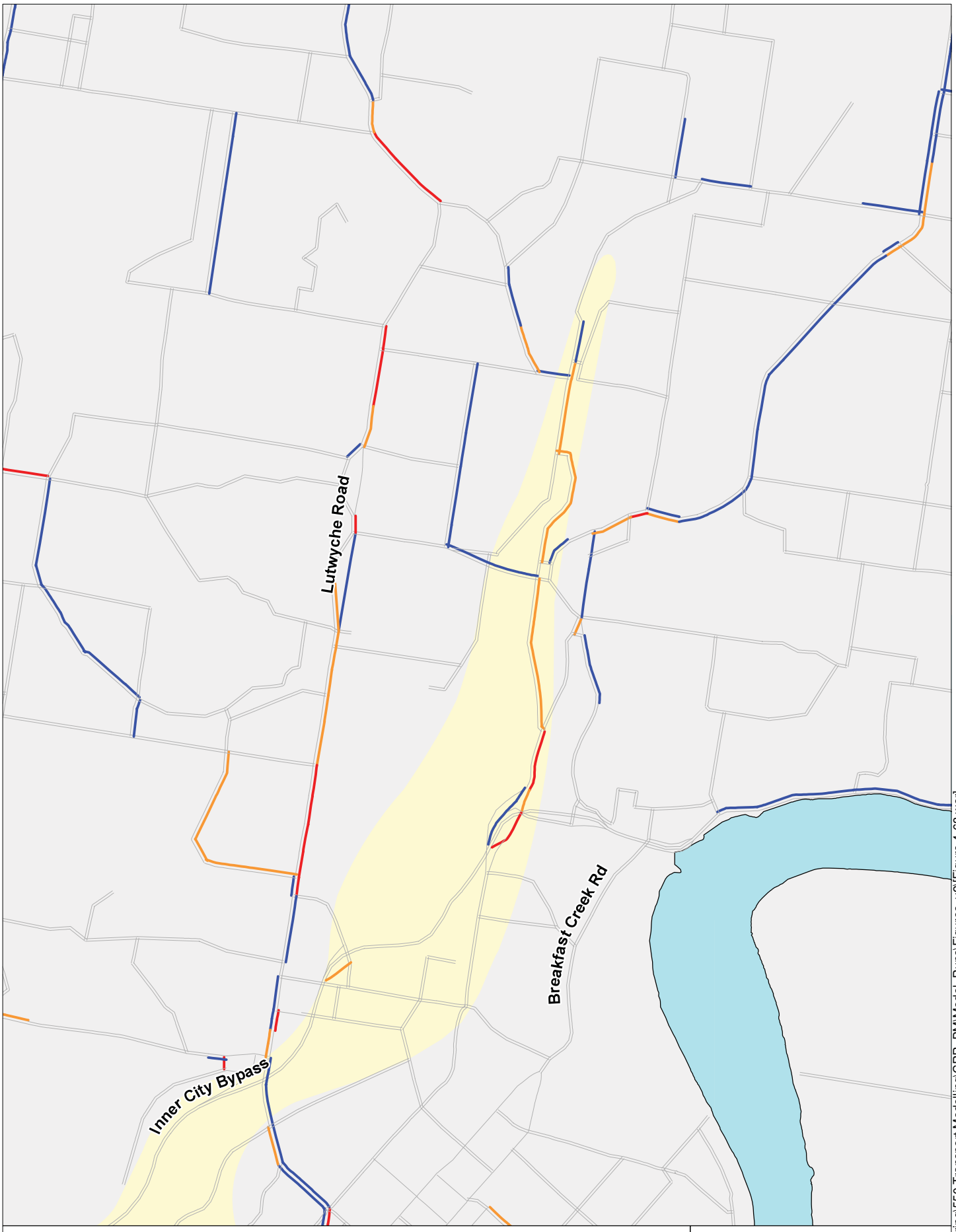
1:17,500 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G030_CCR_Trans_road_network_North_A4_TR_ver93.mxd 06/07/2011 15:21



LEGEND

AM peak (2 hrs) v/c ratio

- > 1.00
- 0.90 to 1.00
- 0.75 to 0.89
- < 0.75

Study Corridor

Model ID: CRR_2009_020

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-68

Road traffic volume over capacity - North
2009 morning peak period

N

CrossRiverRail

SKM aurecon

CRR JOINT VENTURE

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Central road network and performance

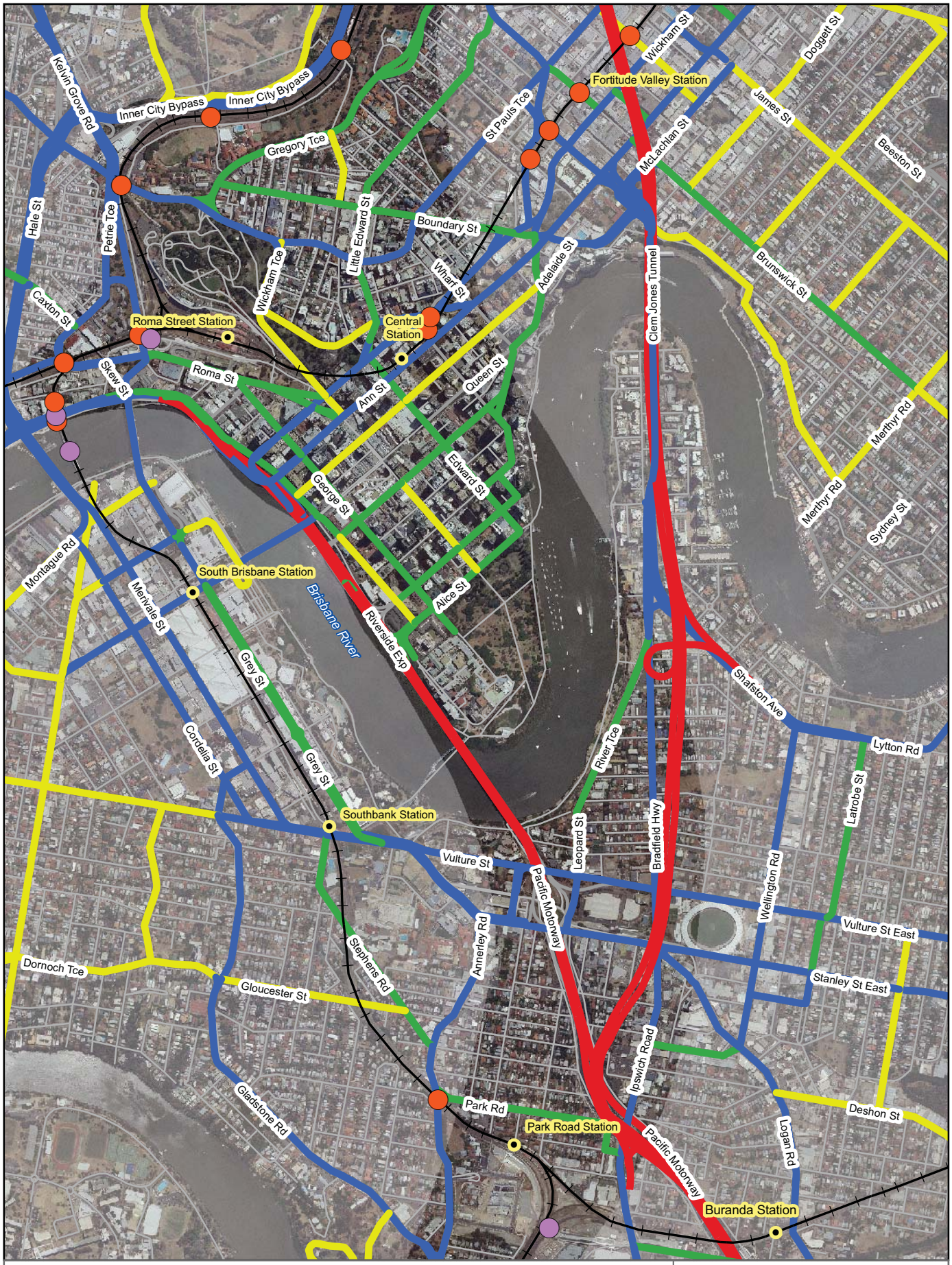
The central study corridor road network is surrounded by key arterial roads such as the ICB and Pacific Motorway. It is also comprised of major city centre through-routes such as Ann Street and Turbot Street and major southern arterial roads such as Ipswich Road/Main Street. These roads are shown in **Figure 4-69**.

The road network within the Brisbane CBD itself is characterised by a grid pattern with east-west roads spaced approximately 100 m apart and north-south roads spaced approximately 220 m apart. This road network pattern results in frequent intersections across the CBD in a north-south direction but long city blocks running in an east-west direction.

Outputs from the 2009 SKM-Aurecon project model show that in the morning peak period (7 am to 9 am) numerous key roads experience Level of Service (LOS) of E or worse for inbound traffic. LOS E represents volume over capacity of 0.9 or higher. This means that more than 90% of available road capacity is being used which generally translates to unstable flows, congestion and delays. Key rotes with a Level of Service E or worse include:

- The Riverside Expressway (both directions)
- The Pacific Motorway (Captain Cook Bridge) inbound
- The Story Bridge (inbound/northbound)
- Coronation Drive (inbound).

The performance of the central road network in the morning peak in 2009 is shown in **Figure 4-70**.



LEGEND

- Study Corridor

Rail Crossings

- Vehicle Only
- Vehicle and Ped/Cycle
- Station
- Track

Road Hierarchy

- Motorway Route
- Future Transport Corridor
- Arterial Route
- Suburban Route
- District Access Route
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-69

Existing Road Network (Central Section)

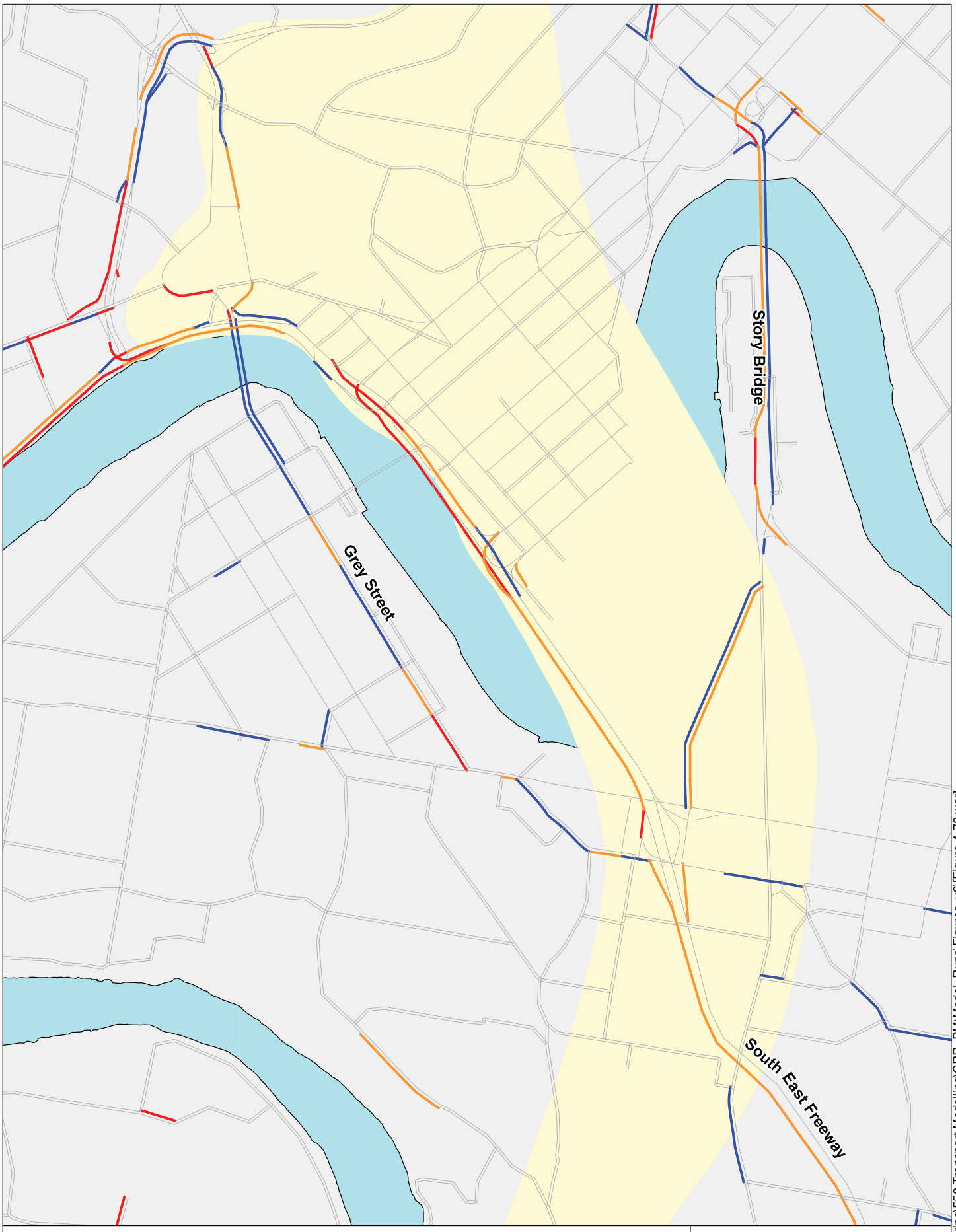
0 0.25 0.5 0.75 km N

1:20,000 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G031_CCR_Trans_road_network_Central_A4_TR_ver93.mxd 06/07/2011 15:21



LEGEND

AM peak (2 hrs) v/c ratio

- > 1.00
- 0.90 to 1.00
- 0.75 to 0.89
- < 0.75

Study Corridor

Model ID: CRR_2009_020

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-70

Road traffic volume over capacity - Central 2009 morning peak period

N

CrossRiverRail

SKM aurecon

CRR JOINT VENTURE

G:\Cross River Rail\500 Engineering\550 Transport Modelling\CRR_PM\Model_Runs\Figures_v2\[Figure 4-70.wor]

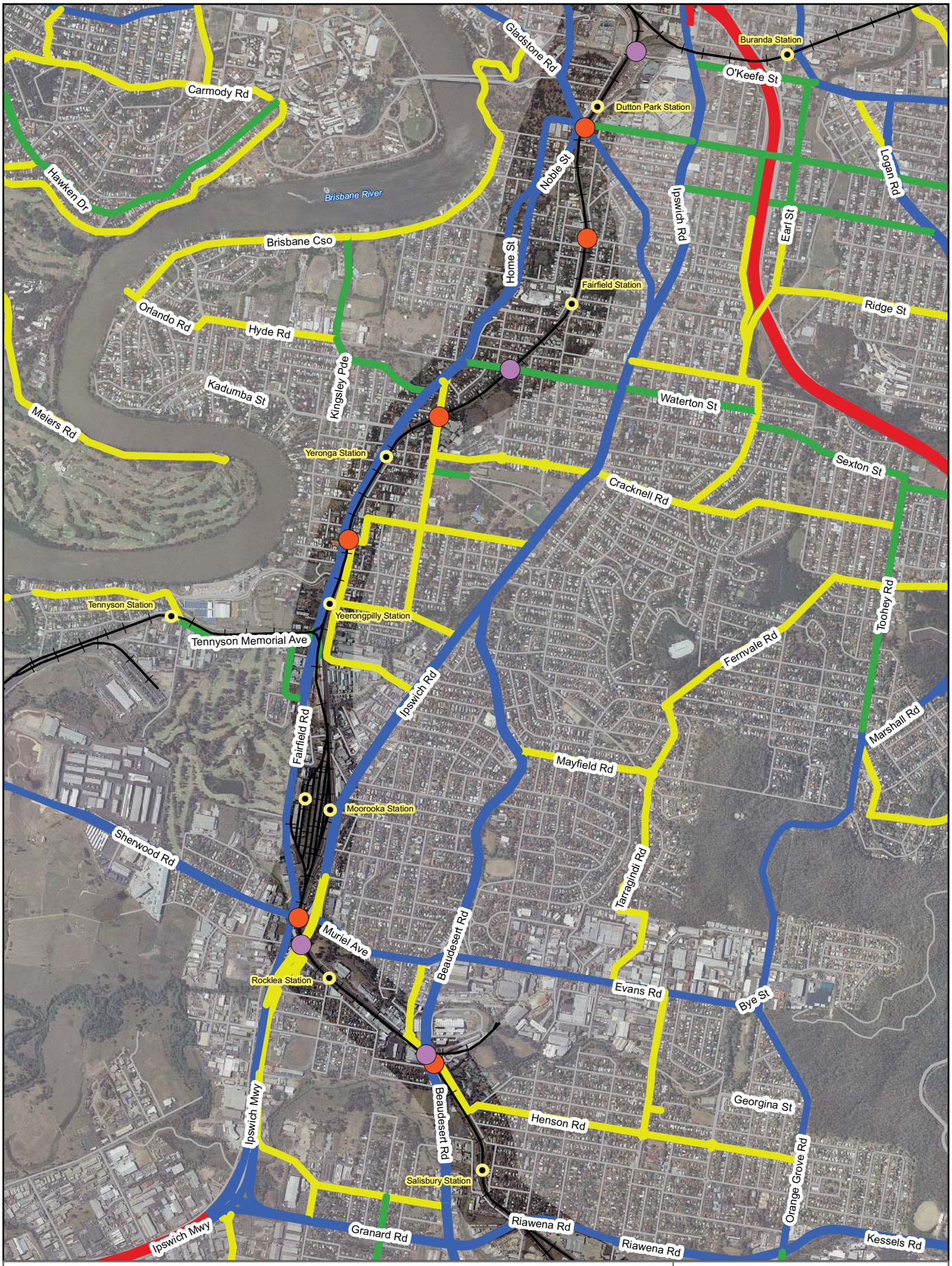
Southern road network and performance

The road network in the southern part of the study corridor centres around Fairfield Road, the key north-south arterial road and a range of east-west links across the corridor including Venner Road and Muriel Road/Sherwood Road.

Riawena Road and Granard Road form part of the Brisbane Urban Corridor, a major arterial route which runs east-west across the southern edge of the study corridor and is a Priority 1 freight route according to the SEQ Regional Freight Network Strategy 2007-2012.

A map of the roads and their function within the southern corridor is shown in **Figure 4-71**.

The performance of the southern corridor road network in the morning peak period (7.00 am to 9.00 am) is illustrated in **Figure 4-72**. This shows that within the study corridor itself there are no roads experiencing Level of Service (LOS) of E or worse. Outside of the study corridor, roads experiencing a LOS of E or worse in 2009 include parts of Ipswich Road and the Ipswich Motorway, the Pacific Motorway and parts of Beaudesert Road.



LEGEND

- Study Corridor

Rail Crossings

- Vehicle Only Crossing
- Vehicle and Ped/Cycle Crossing
- Station
- Track

Road Hierarchy

- Motorway Route
- Future Transport Corridor
- Arterial Route
- Suburban Route
- District Access Route
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 4-71

Existing Road Network (Southern Section)

0 0.25 0.5 0.75 1 km

1:30,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G032_CCR_Trans_road_network_South_A4_TR_ver93.mxd 06/07/2011 15:22

LEGEND

AM peak (2 hrs) v/c ratio

- > 1.00
- 0.90 to 1.00
- 0.75 to 0.89
- < 0.75

Study Corridor

Model ID: CRR_2009_020

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-72

Road traffic volume over capacity - South 2009 morning peak period

N

CrossRiverRail

SKM aurecon

CRR JOINT VENTURE

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4.8.2 Road access and parking at stations – north

Details of traffic and parking at each station within the northern study corridor is outlined below.

Wooloowin Station vehicle access and parking facilities

Wooloowin is surrounded by lower order local and suburban roads. There is very little commercial activity with the surrounding streets dominated by single detached dwellings. As such, background on street parking and loading demand is considered to be low.

A total of 190 off-street car parking bays are available for commuters at Wooloowin, located west of the station between Inwood Street and Rigby Street. During a typical weekday the car parks were observed to be over 90% utilised. According to the 2009 TransLink park 'n' ride survey over 190 cars parked on surrounding streets were assumed to be informal park and ride. This includes 40 on Dickson St, 40 on Rigby Street, 44 on Wride Street and 26 on Inwood Street to the west of the station as well as 19 on Hudson Street and 9 on Adamson Street to the east of the station.

Informal parking was also identified at 11 Dickson Street with approximately 10 cars parked on this empty private allotment during the site visit.

A 15 m section of 2P (two hour) parking exists on the eastern side of Dickson Street immediately adjacent to the western entrance which caters for the neighbouring business and kiss 'n' ride pick-up. Adjacent to this is a short of loading zone with a taxi call box catering for kiss 'n' ride drop off and taxi activity.

Albion Station vehicle access and parking facilities

Albion Station is located close to a range of major arterial and district access roads and adjacent to the Albion commercial centre. As such there is a strong demand for on street parking and loading in the vicinity of the station.

Designated commuter car parking is located both east and west of the station with a total of around 300 formal park and ride spaces available. Three separate car parks are located on Mawarra Street (to the west) and two car parks on east of station which includes two level secure parking (south-east of station near entrance to platform one). This south side secure parking is accessed by Albion Road east (no through road) via Hudson Road and it was observed that commuters also parked on street on Albion Road east.

On a typical weekday site visit, virtually all formal car parking bays were occupied, with only one or two bays available on Mawarra Street car park. Around 95% of the secure two level car parking bays were occupied; and the disabled parking on the upper level was occupied.

The 2009 TransLink park 'n' ride survey found that almost 160 informal park and ride commuters are parked on surrounding streets including 48 cars on Mawarra Street, 21 on Bale Street, 14 on Grove Street, 11 on Wakefield Street,12 on McDonald Street, and 20 on or under Albion Road west, all to the west of the station. A further 11 cars were parked on Hudson Street and 18 on Albion Road east, to the east of the station.

Kiss 'n' ride is possible on both sides of station's southern entrance on Albion Road east and west.

Bowen Hills Station vehicle access and parking facilities

The Bowen Hills Station precinct is surrounded by the ICB (to the north and west) and the arterial roads of Abbotsford Road, Kingsford Smith Drive and Breakfast Creek Road to the east.

Abbotsford Road is a six-lane radial arterial road with three lanes in each direction and with signalised pedestrian crossings facilities provided to the north of the station at the intersection of Abbotsford Road and Folkestone Street (approximatley 70 m north-east of the stations northern entrance) and to the south of the station at the intersection or Abbotsford Road/Campbell Street/Montpelier Street, some 190 m away.

The Inner City Bypass (ICB) is a BCC arterial road that provides a vital east-west link around the city fringe – joining the Pacific Motorway at Milton (to the west) with Kingsford Smith Drive in Hamilton to the east. The ICB passes over the existing railway line north of Bowen Hills Station with two lanes in each direction from Campbell Street to Kingsford Smith Drive.

The existing low density environment does not generally support the provision of dedicated taxi related facilities. As such there are no formal arrangements currently provided for taxis.

There is no formal kiss n' ride facility dedicated to Bowen Hills Station. Kiss 'n' ride activity could take place kerbside to the west side of the station on, for example Hudd Street and Jamison Street.

The TransLink survey did not report any formal or informal park and ride parking at Bowen Hills Station and there is no formal commuter park 'n' ride facility at the station. The surrounding streets are within the Brisbane Central Traffic Area which is generally time limited to two-hour parking. While several individual streets within the study area are exempt (not time limited), allowing for all day on-street parking, these appeared to operate as employee parking for surrounding businesses. QR operates a carpark for staff only on a site immediately to the north-west of the station.

The on-street parking spaces were well used at the time of site visits, but it was considered likely that this parking is being used by employees of surrounding businesses rather than commuters, given that park 'n' ride access to the rail network from the north is generally easier and more convenient at a location further away from the CBD.

Exhibition station vehicle access and parking facilities

Exhibition station precinct is surrounded by the key arterial roads of the ICB, and Bowen Bridge Road. The following are the key sub-arterials within the station precinct:

- O'Connell Terrace
- Gregory Terrace
- Butterfield Street
- Herston Road.

As described above, the ICB is a key Brisbane transport corridor that provides a vital east-west link around the city fringe.

Bowen Bridge Road is a six-lane arterial road with signalised pedestrian crossings facilities provided at the intersection of Bowen Bridge Road and Gregory Terrace, Herston Road, O'Connell Terrace and Butterfield Street.

As Exhibition Station is only operational during the Royal Queensland Show there are no formal arrangements currently provided for taxis or kiss 'n' ride within the station precinct. As such, the 2009 TransLink park 'n' ride survey did not reveal any formal or informal park 'n' ride demand at this station.

Nevertheless, the RNA showgrounds can provide parking for up to 3,000 cars on site (except during the Royal Queensland Show). During shows and exhibitions there is a charge of $10 per day, with restrictions for the duration of the Royal Queensland Show. The parking is located next to the Exhibition Station on the western side of the railway line. This car parking is generally used by commuters who work in the surrounding precinct, in particular the hospitals.

Vehicles can access RNA Showground parking via Campbell Street, Wren Street and O'Connell Terrace. There is limited on-street parking on surrounding streets with a two-hour time limit applicable across the precinct (with some exceptions).

4.8.3 Road access and parking at stations – central

Details of traffic and parking at each station within the central study corridor is outlined below.

Roma Street Station vehicle access and parking facilities

Positioned at the north-western edge of the Brisbane CBD, Roma Street Station is served by good road access. As a major interchange station there is a range of access modes provided including taxi and private car.

There are several taxi facilities provided at/around Roma Street Station, including:

- ground level taxi rank with space for at least two taxis adjacent to the Roma Street entrance to the transit centre. However this facility provides a poor passenger waiting environment, being within the ground level of the Transit centre carpark. No taxis or passengers were observed using this facility in the morning peak (**Figure 4-73).**
- taxi rank at the rear (north side) of the long distance inter-city platform 10 to the north of the station. This is a more attractive, open taxi facility with dedicated space for approximately eight taxis with a waiting area provided under cover. This facility is expected to be used predominantly when a long distance train is in service from the adjacent platform 10.
- the coach terminal on level 3 of the transit centre has dedicated taxi facilities with space for at least four taxis, which appear to be well used as this facility provides convenient interchange for people accessing coach services, is well lit with weather protection. At least two taxis were observed during the morning peak hour (see **Figure 4-74**).
- short term waiting and loading bays exist on Roma Street itself, in front of both the Telstra Tower and the Holiday Inn hotel.

Figure 4-73 Taxi waiting area at Roma Street Station

Figure 4-74 Taxi rank at Roma Street Coach Station

Kiss ‘n’ ride facilities are provided at the northern and southern ends of the station complex. A short term drop-off facility is located within the ground floor of the multi-level carpark fronting Roma Street, adjacent to the first of the above-mentioned taxi facilities. This principally serves passengers using the suburban and Sydney trains as well as the intercity coaches and has capacity for at least four cars.

Another drop-of and pick-up facility is provided adjacent to Platform 10 on the north side of the station. This principally serves long distance Queensland trains (such as the Tilt Trains to Rockhampton and Cairns, Sprit of the Outback to Longreach and Westlander to Roma). Capacity is provided for approximately 30 cars in this carpark with parking limited to two hours.

While there were two kiss ‘n’ ride (short term pick up and drop off) facilities within the station complex, they were not well used at the time of site observations (AM peak). This is partly due to the fact that Roma Street Station has substantially more alighting passenger movements than boarding movements in the morning peak and that passenger drop offs are associated primarily with long distance trips rather than weekday commuting trips.

Given the relative infrequency of long distance trains, using platform 10, the kiss ‘n’ ride facility to the north of the station is only used sporadically. Also, given the spread of long distance bus services throughout the day, the kiss ‘n’ ride facility to the south would not be likely to coincide with the morning peak.

There is no dedicated park ‘n’ ride facility at Roma Street Station however there is a large multi-storey public carpark immediately adjacent to and integrated with the station. This is principally parking for tenants of transit centre office buildings as well as offering paid parking for CBD commuters. Such parking is intended to cater for commuter driving trips rather than driving as part of a public transport journey and therefore is not considered park and ride parking.

Furthermore, the Brisbane CBD falls under the Brisbane Central Traffic Area parking restriction controlling and limiting the availability of all day commuter on-street parking.

As such, there is currently severely limited catchment for private vehicle trips and park ‘n’ ride is a negligible part of the access mode requirements for the station.

Central Station vehicle access and parking facilities

Central Station is located between the busy CBD through-routes of Ann Street and Turbot Street.

There are currently no taxi ranks dedicated for railway station use. Consequently, rail passengers wishing to transfer must exit the station precinct and utilise on-street taxi facilities. On-street taxi ranks that rail passengers could choose to use if they are prepared to walk are located on:

- Ann Street, directly outside the Grand Central Hotel in the Central Station sub-precinct
- off Turbot Street at the Sofitel Hotel (four bays), although passenger access from Central Station to these ranks is indirect and is not signed
- Creek Street, servicing the CBD east and the financial precinct around Eagle Street (16 bays north and south of Queen Street and five bays south of Elizabeth Street). All except the taxi rank south of Elizabeth Street are well used during the day. These taxi ranks are over 200 m from the railway station and do not provide good interchange with Central Station.
- Albert Street, between Elizabeth Street and Charlotte Street, servicing the CBD centre and CBD south. These ranks were observed to be well used during the day and in the evenings. These taxi ranks are over 200 m from the railway station and do not provide good interchange facilities.

There is a general lack of way-finding information signage directing Central Station passengers to the nearby taxi ranks within the station precinct. When the demand is present, the majority of interchanging rail-taxi passengers were observed to 'hail-down' taxis on the street network within close proximity to the station.

Kiss 'n' ride bays or passenger loading bays are not provided at Central Station. There are two short term passenger loading bays on Ann Street on the opposite side of Central Station primarily servicing the Rendezvous Hotel that rail passengers could potentially use.

Rail passengers are also likely to use kerbside locations on the surrounding streets for any kiss 'n' ride activities.

Given the lack of dedicated kiss 'n' ride facilities, no observations were made of kiss 'n' ride operational issues. The mode of access data presented above confirms that kiss 'n' ride is a minor mode of access to Central Station.

There is no formal park 'n' ride facility at Central Station. However, off street public car parking is provided adjacent the station at:

- corner of Edward Street and Turbot Street (access from Wickham Terrace, Turbot Street or Creek Street)
- Secure Parking on Adelaide Street
- Kings Parking on Adelaide Street.

On street parking within the Brisbane CBD falls under the Brisbane Central Traffic Area parking restriction. This is an on-street parking control to limit the availability of all day commuter on-street parking. As such, there is currently severely limited catchment for private vehicle trips.

The mode of access data presented above confirms that park 'n' ride is a minor mode of access to Central Station. Central Station is predominantly a destination station (with negligible demand for park 'n' ride trips).

Albert Street area vehicle access and parking area

Within the lower part of the CBD, taxis provide access to the wider CBD. Dedicated taxi pick-up and set-down facilities located within the CBD south precinct include:

- Albert Street, between Elizabeth Street and Charlotte Street
- Felix Street, outside the Waterfront Place
- Edward Street, outside the Stamford Plaza
- Alice Street, adjacent the Royal on the Park
- Gardens Point Road at QUT.

While there are a large number of private parking facilities within the precinct, there are no formal park 'n' ride facilities in CBD south. This is due to the destination based nature of trips in the CBD and the cost of land, limiting low intensity uses such as parking.

Public on-street car parking in the CBD is limited and restricted due to the Brisbane Central Traffic Area that limits on street parking to two hours 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 12.00 pm on Saturday unless signed.

Public off-street car parking is in strong demand within the CBD with weekday parking fees observed to be around $25 per day.

Woolloongabba area vehicle access and parking facilities

Woolloongabba is surrounded and dissected by major road links including the M3 (Pacific Motorway) to the west, Ipswich Road (A7) running north-south through the study area as well as Vulture Street and Stanley Street running east-west through the study area.

Stanley Street runs westbound through the study area and is the key access road to the M3 (Pacific Motorway) inbound. As such it suffers from heavy morning inbound traffic, queuing to get onto the motorway.

Vulture Street runs eastbound through the study area and is a key motorway distributor route. As such it suffers from heavy outbound traffic in the evening peak.

There is a taxi zone located on Stanley Street (south side). Busway passengers must cross Stanley Street at the signalised pedestrian crossing to access the busway station. However there was no observed taxi use during the morning peak hour.

After major events at the Gabba Stadium, a temporary taxi rank is setup in Vulture Street which is closed to general traffic for one hour after major events.

No formal park 'n' ride exists at Woolloongabba Busway Station. Informally, some park 'n' ride may occur on some non-time-limited on-street parking zones within the study area (such as Hubert Street). Short term parking is also located on Stanley Street (southern side) which could function as passenger drop off or pickup (kiss 'n' ride).

Furthermore, short term parking within the Goprint and Dental Hospital site could function as kiss 'n' ride (albeit informally).

However given the lack of dedicated kiss 'n' ride facilities, no observations were made of kiss 'n' ride operational issues. Likewise, given the lack of dedicated park 'n' ride facilities, no observations were made of park 'n' ride operational issues

Park Road Station vehicle access and parking facilities

Park Road Station is located around 200 m from the nearest arterial road, Annerley Road and is surrounded by local access streets

No dedicated taxi facilities were identified on site. As such there was a lack of observed taxi activity during morning peak hours, and there is no known operational issues associated with taxi provision at Park Road Station.

The area is not considered sufficiently developed at this point in time to warrant dedicated taxi facilities, being mostly low density residential. However with an increasing mix of commercial development in the Boggo Road precinct, then facilities on the southern side may be warranted, in the future.

Kiss 'n' ride (drop off and pickup) was observed on Quarry Street in the morning peak although no dedicated facilities exist – people were being dropped off at the end of the cul-de-sac which forms the entrance to the station via platform 1 and the pedestrian overbridge.

Some kiss 'n' ride may be occurring from the dedicated off-road facility at Dutton Park State School on the southern side of the station.

A 28-bay park and ride facility currently exists at Park Road Station (refer to **Figure 4-75**). It was observed that this was full by 7.30 am on the day of the site visit. The facility is free to use.

All streets to the north of the station are part of the Brisbane Central Traffic area, where parking is limited to two hours from 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 12 midday on Saturdays, unless otherwise signed.

Streets to the south of the station are included within the Dutton Park Traffic Area, where parking is limited to two hours (unless otherwise signed) between 7.00 am and 7.00 pm, Monday to Friday. However, some limited all day (no time limit) parking does exist and is used by park 'n' ride commuters.

The 2009 TransLink park 'n' ride survey also found some low levels of on street informal park and ride parking in surrounding streets including three on Park Road itself and eight on Quarry Street.

Figure 4-75 Park 'n' ride facility at Park Road Station

4.8.4 Road access and parking at stations – south

Details of traffic and parking at each station within the southern study corridor is outlined as follows.

Dutton Park Station vehicle access and parking facilities

Dutton Park Station has good access to the surrounding road network including the adjacent Annerley Road, classified as an arterial road, and Cornwall Street a suburban access route. The station is adjacent to the Princess Alexandra Hospital (PAH) with high demands for on-street parking managed through timed parking controls.

A taxi bay (with space for two taxis) and taxi call box is located on Cornwall Street, approximately 50 m from the station entrance. A taxi was observed waiting in this bay at the time of site visit, which is off-peak on a weekday morning, see **Figure 4-76**.

There is no formal park 'n' ride facility at Dutton Park station and the station is located in the Dutton Park traffic area limiting parking on surrounding streets.

Figure 4-76 Taxi facility at Dutton Park Station

Fairfield Station vehicle access and parking facilities

Fairfield Station is located in a predominantly low density residential area and accessible via local access roads. The station is located at the rear (western side) of Fairfield Gardens shopping centre although loading and parking for this commercial precinct is located off-street. As such there is little background demand for parking and loading from existing land uses and low traffic volumes on immediately surrounding streets.

Fairfield Station has a small formal commuter car parking with seven bays located on the western side of Equity Street adjacent to the eastern entrance to Fairfield Station. All bays were all occupied during the time of site visit.

The 2009 TransLink park 'n' ride survey found that up to 60 park and ride cars were parked on surrounding streets including 26 on Lagonda Street, 15 on Dudley Street, 11 on Clive Street and five on Equity Street. Parking restrictions limit parking availability on Equity Street

To the west of the station, car parking is restricted on Midmay Street adjacent to the station entrance and at the rear of Fairfield Gardens, limiting parking opportunities on this street. There is no restriction for drop off and pick up on Midmay Street and this functions as a part-time informal kiss 'n' ride drop off zone.

Yeronga Station vehicle access and parking facilities

Yeronga Station is located parallel to and east of Fairfield Road, classified as an arterial road, which has low density frontage retail and commercial uses with off street parking and loading. East of the station is the unclassified local access street, Lake Street, which is fronted by predominantly low-medium density residential uses. As such background parking and loading demand is low with high traffic volumes on Fairfield Road meaning the station is easily accessible to the wider south Brisbane road network.

Commuter carparks at Yeronga Station are located on Lake Street (40 spaces) and on Fairfield Road (24 spaces). At the time of site visit the Lake Street carpark was fully occupied and the Fairfield Road at 95% of capacity.

The 2009 TransLink park 'n' ride survey revealed that over 160 park and ride commuter cars were parked on surrounding streets. This includes nine on Cardross Street, 29 on Christensen Street, four on Killarney Street, five on Lake Street, 44 on Querrin St and 15 on School Road, to the east of the station, as well as 17 on Cowper Street, 10 on Devon Street and 27 on Shottery Street to the west of Fairfield Road, west of the station.

There is no formal kiss 'n' ride or taxi facilities at Yeronga station with any drop off and pick up likely to occur on Lake Street which is residential, low trafficked environment. There are no drop off bays on the Fairfield Road side of the station with any drop off likely to occur on side roads.

Yeerongpilly Station vehicle access and parking facilities

Yeerongpilly Station is also located parallel and east of Fairfield Road, and is also accessible from Ipswich Road to the east via Green Street and Gow Street (district access routes). The surrounding land uses are predominantly low to medium residential with low on street parking demand.

Two formal park 'n' ride carparks are available at Wilkie Street, adjacent to Yeerongpilly Station with capacity for 24 cars in total – 13 to the north of the station and 11 to the south of the station (both located on the western side of Wilkie Street). Approximately 85% of the car park was full during the site visit at 9.00 am.

The 2009 TransLink park 'n' ride survey shows that demand for on-street (informal) park 'n' ride parking exceeded 90 cars with 21 on Green Street, 19 on Livingstone Street, nine on Stamford Street and 31 on Wilkie Street all to the east of the station. No on-street parking was available on Fairfield Road and no on-street park and ride parking was reported to the west of the station.

There is no dedicated kiss 'n' ride or taxi bay at Yeerongpilly, however, informal opportunities exist on Wilkie Street.

On street parking, formal park 'n' ride parking and bus stop bays are shown in **Figure 4-77**.

Figure 4-77 Parking on Wilkie Street, Yeerongpilly

Moorooka Station vehicle access and parking facilities

Moorooka Station is located immediately adjacent to Ipswich Road, a busy arterial road and priority two freight route. The station is located in a predominantly industrial area with numerous car yards on Ipswich Road creating demand for on street parking in the vicinity of the station.

Currently no formal park and ride parking bays are available at this station. Informal kiss 'n' ride is available on Ipswich Road itself where short term parking opportunities exist close to the station entrance.

Unrestricted parking also exists on the western side of Ipswich Road, south of Moorooka Station . These bays were around 60% full at the time of inspection at 4.30 pm.

Rocklea Station vehicle access and parking facilities

Rocklea Station is bordered in the west by Ipswich Road/Ipswich Motorway, a major Arterial Road, in the east by Beaudesert Road, a major arterial road and to the north, Muriel Avenue, another arterial road.

Beaudesert Road has around 28,000 vehicles per day in 2009, while Ipswich Motorway has almost 70,000 vehicles per day in 2009. However direct vehicle access to the station is provided from the west via the local residential streets including Brook Street and Pegg Road.

A formal park 'n' ride facility exists on the western side of the station, off Brooke Street. This has capacity for 40 cars and was around 50% capacity at the time of site visit (10.00 am on a weekday). There did not appear to be any on-street informal overspill park 'n' ride parking in the vicinity of Brooke Street and this is confirmed by the 2009 TransLink park 'n' ride survey.

Informal vehicle access to the station is possible (via a 250 m walk) on the eastern side of the station, at the northern end of Railway Parade. On-street parking was observed in this area however it is likely to be related to employee parking for adjacent industrial uses rather than commuter parking.

There is no dedicated kiss 'n' ride facility or private drop off at this station. The station's park 'n' ride facility however would be expected to accommodate any expected kiss 'n' ride access to this station.

There are no on-street parking controls in the vicinity of the station – that is no resident only parking, or dedicated on street loading zones.

Salisbury Station vehicle access and parking facilities

The Salisbury Station precinct is bordered in the west by Beaudesert Road, a major Arterial Road while Granard Road/Riawena Drive, borders the station precinct to the south. This is another major Arterial, Road, and a component of the Brisbane Urban Corridor a strategic freight link across inner south Brisbane – between the Ipswich Motorway and the Gateway Motorway. Beaudesert Road carried almost 28,000 vehicles per day in 2009 while Riawena Drive/Granard Road carried almost 39,000 vehicles per day.

Vehicle access to the station itself is provided from both the east and the west. A formal park 'n' ride facility exists on the eastern side of the station on the corner of Lillian Avenue East and Olivia Avenue. This has capacity for 21 cars and was full at the time of site visit (10.30 am weekday). An additional off-street park 'n' ride facility was observed immediately west of the formal facility and appeared to serve a further 25 to 30 cars.

On the western side of the station, parking on the eastern side of Dollis Street provides an informal off-street park 'n' ride opportunity for around 10 vehicles although many of these spaces could be used by employees of adjacent industrial land uses.

There did not appear to be any significant on-street informal overspill park 'n' ride parking with the 2009 TransLink park 'n' ride survey reporting 28 on street park 'n' ride vehicles – three on Lillian Avenue east (near Olivia Avenue), 19 on Olivia Avenue and six on Nicholson Avenue. There are no on-street parking controls in the vicinity of the station preventing all day on-street parking – that is no resident only parking or dedicated on street loading zones.

There is no dedicated kiss 'n' ride facility/private drop off at this station.

5 Future base transport conditions

This section outlines the forecast changes in transport conditions and performance between the current (base) year of 2009 and the future modelled years – 2021 and 2031.

5.1 Future demand for travel

Forecast growth in weekday travel demand across Brisbane is shown in **Table 5-1**.

The greatest percentage growth forecast is expected to occur in public transport trips, with almost double the trips forecast for 2031 compared to 2009. Vehicle trips are anticipated to grow at a slower rate, increasing by 47% between 2009 and 2031.

A change in mode share for public transport from 8.1% of all weekday person trips in 2009 to 11.6% in 2031 is forecast.

Table 5-1 Forecast growth in weekday travel demand in the Brisbane metropolitan area without Cross River Rail

Parameter	2009	2021	2031
Total person trips by all motorised modes (car and public transport)	6,700,600	8,283,800	9,259,900
Total person trips by car	5,533,200	7,009,800	7,771,700
% growth in person trips by car (on 2009)	-	27%	40%
Public transport person trips	546,000	824,200	1,074,000
% growth in public transport trips (on 2009)	-	51%	97%
Public transport mode share (of all person trips)	8.15%	9.95%	11.60%
Total rail patronage (24 hr)	243,200	421,900	529,500
% growth in rail patronage (on 2009)	-	73%	118%
Number of rail trips to CBD (morning peak period)	37,100	61,600	73,700
% growth in rail trips to CBD (on 2009)	-	66%	99%
Total vehicle trips (1)	4,383,200	5,652,100	6,460,200
% growth in vehicle trips (on 2009)	-	29%	47%

Source: Cross River Rail Project Model

Travel to the CBD is expected to be increasingly met by public transport modes, with minimal growth in vehicle trips expected, as shown in **Figure 5-1**. Rail, bus and ferry are all expected to cater for a greater number of trips, as well as a greater proportion of all trips to the CBD, between 2009 and 2031. Car travel to the CBD is expected to plateau at around 40,000 to 45,000 person trips in the morning peak period.

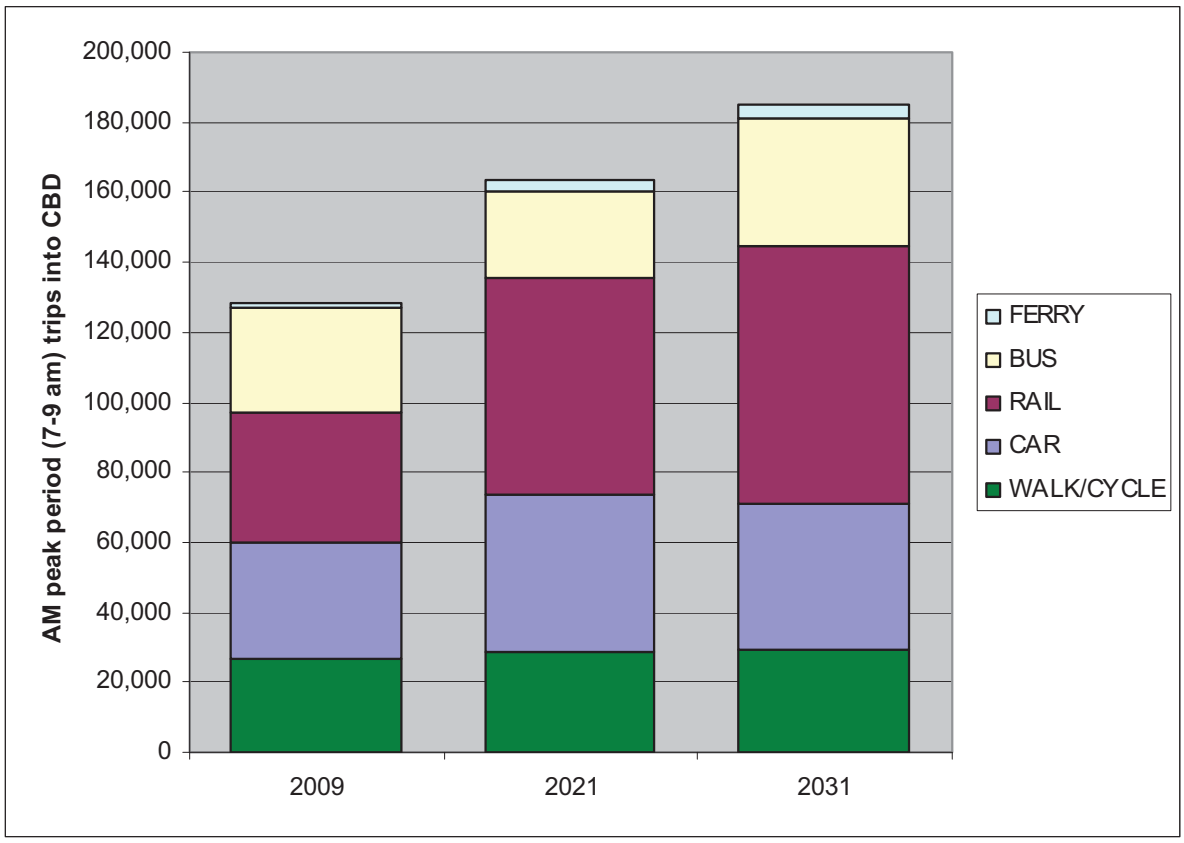


Figure 5-1 Forecast morning peak period travel demand (person trips) into the Brisbane CBD without Cross River Rail

5.2 Future transport network description

The public transport network and services will grow and evolve between 2009 and 2031 with a range of transport projects and service changes assumed. These assumptions have been agreed through the Cross River Rail Transport Advisory Group (TAG) and Cross River Rail Planning Advisory Group (PAG) and incorporated in the Cross River Rail patronage model used to assess the project. These assumptions are consistent with the draft Connecting SEQ 2031 Integrated Regional Transport Plan for South East Queensland and the TransLink Transit Authority Strategic Plan 2010–2015.

Transport planning projects and policy assumptions include:

- new railway extensions and improvements including new Richland's branch line (2011), Richland's to Springfield extension (2016), Moreton Bay Rail Link (2016), and other capacity enhancements – further details on rail capacity changes can be found in **Section 5.3.2**
- a range of new busways are due to be completed including the Eastern Busway to Coorparoo by 2016, Northern Busway to Chermside by 2016, and the extension of the South East Busway to Underwood by 2021
- improved off peak rail frequency is introduced by 2021 allowing for "turn up and go" frequencies of 15 minutes or less on most lines throughout the day and evening (seven days a week)
- increase in public transport fares above the Consumer Price Index (CPI) up until 2014 in line with State Government policy, after which fares are assumed to increase in line with CPI

- key motorway projects including the recently completed Clem7 toll tunnel, Airport Link toll tunnel (2012), Northern Link toll tunnel (2014), Gateway Bridge duplication (tolled) and Gateway Motorway upgrade (2010).

Further details of transport projects are included in **Appendix D**.

5.3 Passenger rail network and performance

5.3.1 Passenger rail network planning

Demand

The 2021 and 2031 passenger rail demands for a rail network without Cross River Rail were determined using passenger demand forecasts from Cross River Rail Project Model. Daily patronage forecast outputs from the Project model are provided in four different time periods:

- two hour morning peak period of 7.00 am to 9.00 am
- day time off peak period of 9.00 am to 4.00 pm
- two hour evening peak period of 4.00 pm to 6.00 pm
- evening off peak period of 6.00 pm to 7.00 am.

For the two hour morning peak period an assumption was made regarding the distribution of trips across this period. The analysis assumes the measures identified will achieve an overall flattening of passenger demand profile to achieve a shift from the current 67%/ 33% split in the number of people travelling in peak / shoulder hours to a 60% / 40% split[1] by 2021 and a 50% / 50% split by 2031. This aligns with the rail operations service plan policy. These demands have been used to test and refine the 2021 and 2031 service plans without Cross River Rail.

Service planning assumptions

Rail operation service plans have been developed in an attempt to meet the above modelled demands as far as possible using available capacity. Service plans and operating strategies for the future base case scenarios have been developed to be consistent with the service planning policy and supporting measures identified, including measures to encourage peak spreading and establish simpler stopping patterns.

Sectors/ sectorisation

Sectors are assumed to coincide with the recent Queensland Rail 2011 City Network timetable update. These are fundamentally the same as the current sectors, with:

- the Nambour and Caboolture lines connecting to the Ipswich and Springfield lines via the inner city Mains
- the Gold Coast, Beenleigh and Cleveland lines connecting to the Ferny Grove, Shorncliffe, Airport and Doomben lines.

[1] The 2009 split in the number of people travelling in the peak / shoulder hours is 67% / 33%

The exception is that Shorncliffe services would no longer be connected to Ipswich services therefore removing the crossing required by outbound Shorncliffe services. The two sectors to be achieved by 2021 (and shown in **Figure 5-2** and **Figure 5-3**) are represented as green lines (Suburban Lines sector) and pink lines (Main Lines sector):

a) **Suburban sector (Green**) This sector would cater for half of the network containing the Gold Coast, Beenleigh and Cleveland lines in the south, and the Ferny Grove, Shorncliffe, Airport and Doomben lines in the north. This sector would remove the requirement to have permanent flat-junction crossing moves in day to day operations. In this sector, Gold Coast services would be connected to Airport services (as existing), Beenleigh services would be connected to Ferny Grove services (as existing), Cleveland and Manly services would be connected to Doomben and Shorncliffe services, with one Cleveland or Manly service turning back in Mayne Yard using the Ferny Grove flyover.

b) **Main sector (Pink)** This sector encompasses Rosewood, Ipswich and Springfield services (in the west) and Petrie, Caboolture and Nambour services (in the north). The sector would have services travelling through the existing inner city via the Main Lines. This sectorisation would remove the requirements for flat-junction crossing conflicts between Northgate and Bowen Hills.

Wherever possible, this sectorisation connects Springfield services with Petrie services and Caboolture/Nambour services with Rosewood/Ipswich services, so that suburban rollingstock with fewer seats (but greater capacity) could be operated on the shorter lines and inter-urban style rollingstock (more seats and less capacity) could be operated on the longer lines.

Rolling stock

Passenger forecasting for 2021 have been based on using six-car train sets, as currently operated by Queensland Rail. For 2031, modelling has assumed that nine-car services can be operated on Cross River Rail infrastructure (including stations) as well as stop at stations north of Petrie and south of Kuraby. 2031 rail modelling (both with and without CRR) also assumes that High Capacity Suburban Multiple Unit (HCSMU) trains can be operated within some of the short distance rail corridors. HCSMU trains have more doors, less seats and higher carrying capacity than current 6-car trains used on the network.

Assumptions for train capacity are based on current Queensland Rail rollingstock and assumed future potential rollingstock configurations, include:

- current six-car electric multiple unit (EMU) / suburban multiple unit (SMU) sets : 472 seated passengers (750 design capacity including a comfortable number of standees)
- current six-car interurban multiple unit (IMU) sets : 434 seated passengers (750 design capacity including a comfortable number of standees)
- future nine-car equivalent train sets (CRR case only): seated capacity for 651 passenger and design capacity of 1,125
- future UrbanLink “metro-style” high capacity suburban multiple unit (HCSMU) sets: design capacity of 900 passengers, including 350 seated passengers and 550 standing passengers.

5.3.2 Rail network infrastructure changes

Currently committed and funded rail infrastructure as listed in **Table 5-2** has been assumed to be in place by 2021, either with or without the Project. The assumed additional rail infrastructure for 2031 either with or without the Project is also listed. These assumptions are based on the latest policies and strategies contained in the draft Connecting SEQ 2031 and SEQIPP.

Table 5-2 Committed and assumed other rail infrastructure in 2021 and 2031

Corridor	2021 committed rail infrastructure	2031 assumed rail infrastructure
Cleveland	3rd platform at Manly	-
Ferny Grove	Ferny Grove to Keperra duplication	-
Gold Coast/Beenleigh	4th platform at Kuraby. Coomera to Helensvale duplication (excluding bridge section).	Varsity Lakes to Elanora (Gold Coast Line) extension. Salisbury to Flagstone Creek branch line.
Caboolture/ North Coast	Lawnton to Petrie triplication. 4th platform at Petrie	Moreton Bay Rail Link (Petrie to Redcliffe branch line) Beerwah to Caloundra branch line
Western	Duplicated extension to Springfield. Corinda to Darra 3rd track.	Ipswich to Ripley branch line
North West Transport Corridor	-	New rail tracks utilising the North West Transport Corridor from Strathpine to Alderley. Dual track extension from Alderley to Roma Street in tunnel (assumed for the Cross River Rail case only).

5.3.3 2021 Passenger rail network operations

The proposed without Project case service plans for 2021 are outlined in **Figure 5-2** (peak 1 hour) and **Figure 5-3** (off peak). **Figure 5-2** shows that the morning 1 hour peak (the busiest of the two peak periods), provides for 39 trains per hour on the northern approach to the CBD, with 17 trains per hour on the western approach and 23 trains per hour on the southern approach. In total, 79 train movements per hour are expected through the CBD (2-way) in the morning peak hour in 2021 (compared to 57 in 2009). Service plans provided by Systemwide (Systemwide, December 2010).

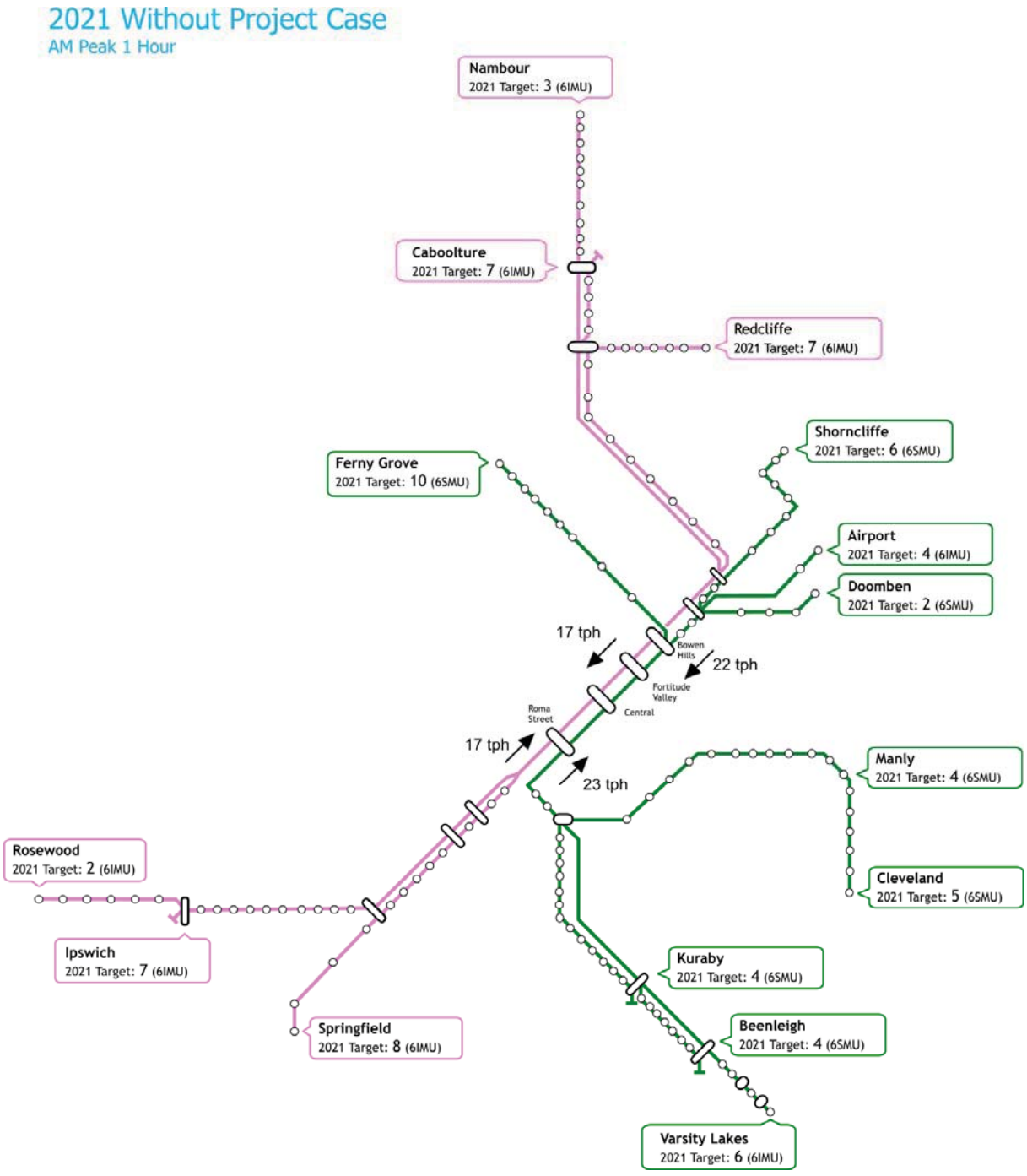


Figure 5-2 Overview of 2021 service plans – morning one hour peak

In a typical weekday off peak hour in 2021, the train frequencies would drop back to 38 trains per hour (two-way) through the CBD. The proposed off peak timetable would provide train frequencies from Petrie (Redcliffe) , Shorncliffe, Ferny Grove, Darra, Kuraby and Manly of 4 trains per hour an increase from two trains per hour under the 2009 timetable.

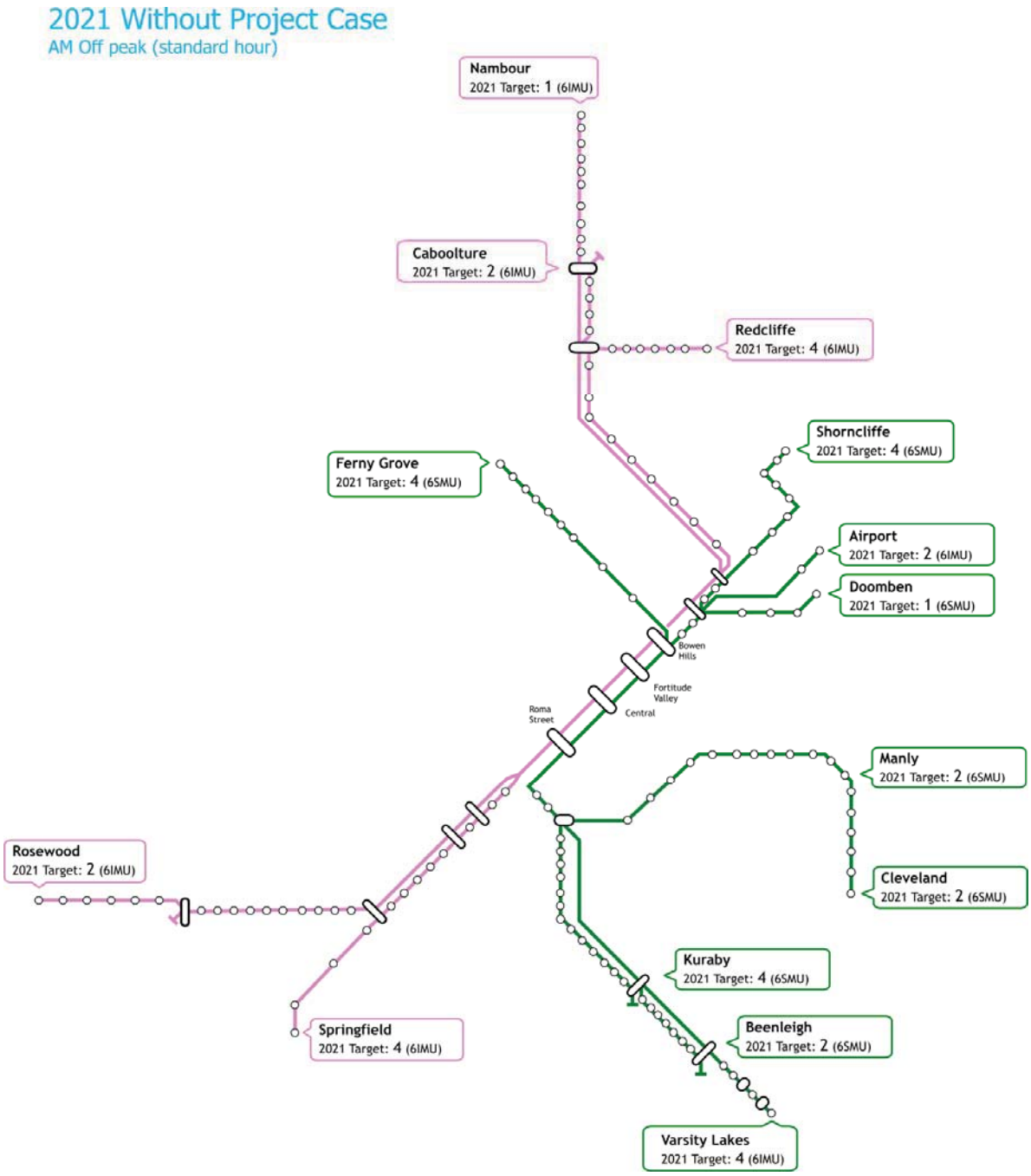


Figure 5-3 Overview of 2021 service plans – off peak (per hour)

Demand forecasts suggest that the rail patronage to the CBD in the morning peak would be forecast to increase by 66% by 2021 compared to 2009 (from 37,100 to 61,600) in the morning peak 2 hours without the Project. Detailed analysis suggests that even with rationalised service plans, spreading peak demands and strict network sectorisation, unresolved capacity constraints at existing bottlenecks such as Park Road junction and Merivale Bridge would mean the inner city rail network would reach its maximum capacity in the peaks before 2021.

5.3.4 2031 rail network operations

In 2031, service plans were developed in an attempt to meet demand as much as possible using available capacity (shown in **Figure 5-4** and **Figure 5-5**). In 2031, peak 1 hour train movements would reach 42 trains per hour from the north (up from 39 in 2021), 19 trains per hour from the west (up from 17 in 2021) and 23 trains per hour from the south (same as in 2021). This would provide a total of 84 trains per hour through the CBD, only 5 more than in 2021.

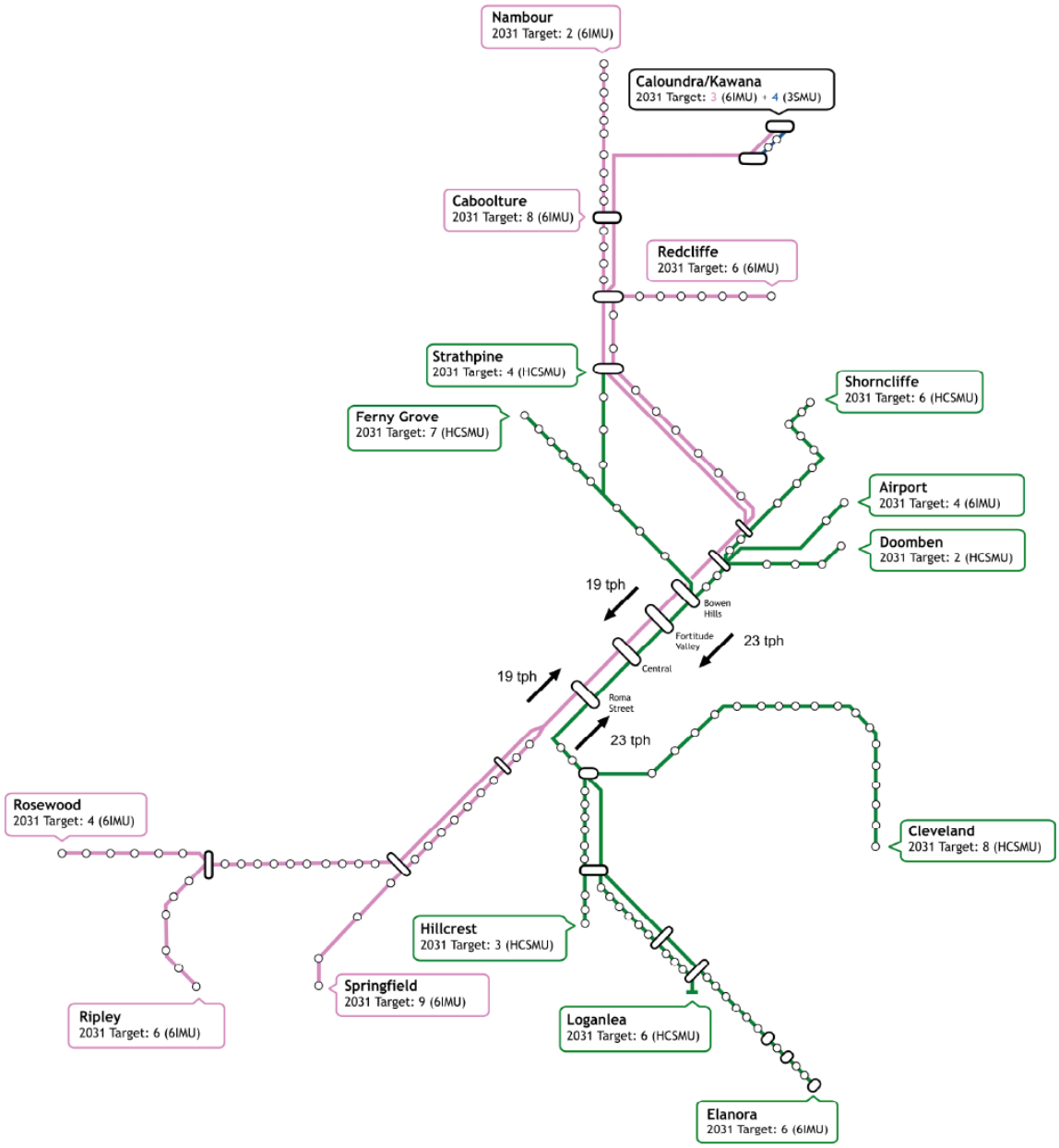


Figure 5-4 Overview of 2031 service plans – morning peak 1 hour

By 2031, a total of 84 train movements in the morning peak hour would be facilitated, which is considered to represent the maximum capacity of the inner city rail network. It must be noted that the assumed 2031 network without Cross River Rail includes all future rail projects such as new branch lines as per Connecting SEQ 2031 and SEQIPP, *EXCEPT* Cross River Rail.

However, the assessment of the performance of such a network concludes that this approach would be unrealistic due to crowding and reliability problems encountered and/or unacceptable impacts on freight.

In a typical off peak hour in 2031, the number of train movements would reduce to 57 trains per hour, which is 68% of the morning peak one hour train frequencies. This would provide additional off peak train services each hour from Caboolture/ Petrie, Ipswich/ Darra, Gold Coast/ Beenleigh and Cleveland compared to 2021.

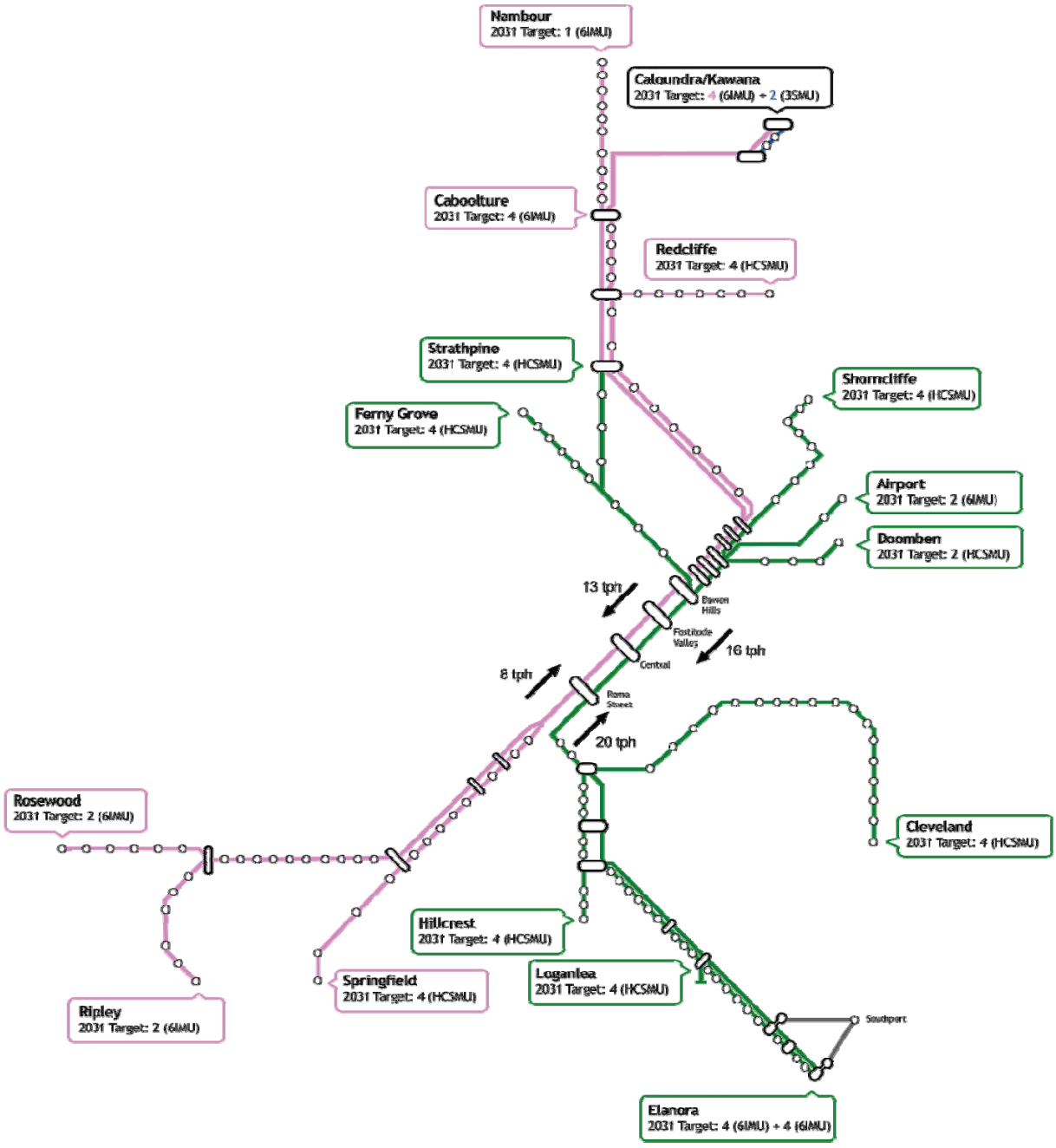


Figure 5-5 Overview of 2031 service plans – off peak

The Cross River Rail Project Model forecasts suggest that the rail patronage growth to the CBD in the morning peak period would increase by around 20% from 2021 to 2031 (from 61,600 to 73,700 during the morning peak 2 hour period) without Cross River Rail.

5.3.5 Performance of the regional rail network including patronage

The analysis suggests that even with the assumed additional infrastructure upgrades elsewhere in the network in conjunction with changes in stopping patterns and network connections, an additional 17 more trains could be added to the Brisbane network by 2031 compared to 2021 in the peak one hour. However of these, only 3.5 would be from the south, using the Merivale Bridge due to major constraints on that link. The 3.5 additional services from the south in 2031, compared to 2021, are not expected to be sufficient to meet the additional rail patronage demand even with a shift in demand profile to the shoulder peak and off peak period. This would have a significant impact on passenger rail operations and performance by 2031.

Table 5-3 and **Table 5-4** illustrate the changes in overall Brisbane rail usage forecast between 2009 and 2031. This shows that total passenger rail kilometres and passenger rail hours are growing faster than rail patronage indicating that average rail trip lengths and journey times will get longer. Rail passenger, kilometres and hours are also expected to grow faster in the morning peak than across the whole weekday.

Table 5-3 Forecast growth in rail usage in the Brisbane metropolitan area– average weekday (24 hours) without Cross River Rail

24 Hours	2009	2021		2031	
		Forecast	% growth	Forecast	% growth
Average rail passenger kilometre	5,178,200	9,645,100	86%	12,741,900	146%
Total rail passenger hours	124,400	226,200	82%	291,400	134%
Total rail patronage	243,200	421,900	73%	529,500	118%
Average rail trip length (km)	21.3	22.9		24.1	
Average rail trip time (min)	30.7	32.2		33.0	

Source: Cross River Rail Project Model

Table 5-4 Forecast growth in rail usage in the Brisbane metropolitan area – average weekday morning peak period without Cross River Rail

AM peak	2009	2021		2031	
		Forecast	% growth	Forecast	% growth
Average rail passenger kilometre	1,318,600	2,292,100	74%	3,404,600	158%
Total rail passenger hours	34,000	57,300	69%	82,300	142%
Total rail patronage	67,000	108,300	62%	141,900	112%
Average rail trip length (km)	19.7	21.2		24.0	
Average rail trip time (min)	30.4	31.7		34.8	
Average rail trip speed (kph)	38.8	40.0		41.4	

Source: Cross River Rail Project Model

Journey times

As noted in **Table 5-4** average rail speed is forecast to increase slightly over time without the Project due to an increase in the number of longer distance express services although for individual lines the average speed would largely remain the same between 2009 and 2031. This is shown in **Table 5-5**.

Table 5-5 Forecast rail journey times (minutes) without Cross River Rail

Origin	2009	2021*	2031
		Forecast	Forecast
Nambour	106	107	111
Caboolture	60	52	57
Beenleigh	60	56	55
Robina	77	85	84
Rosewood	76	71	72
Ipswich	52	49	51
Airport	25	25	25
Shorncliffe	38	38	39
Doomben	21	23	25
Ferny Grove	29	31	32

Source: Systemwide, December 2010 (*Note: 2021 journey time based on 2016 modelling journey time due to limited changes)

Rail patronage and CBD station throughput

Table 5-6 shows the forecast growth in rail patronage in the region. Both peak period and daily rail trips are forecast to more than double between 2009 and 2031. By 2031, over half a million daily rail trips are expected in the Brisbane metropolitan area. However it should be noted that overall demand for rail, particularly in 2031, is suppressed by crowded conditions in peak periods.

Table 5-6 Forecast growth in rail usage in the Brisbane metropolitan area without Cross River Rail

Period	2009	2021		2031	
		Forecast	% growth	Forecast	% growth
AM 2hr peak(7am-9am)	67,000	108,300	62%	141,900	112%
PM 2hr peak(4pm-6pm)	58,400	104,400	79%	131,700	126%
Daily	243,200	421,900	73%	529,500	118%

Source: Cross River Rail Project Model

Table 5-7 presents the forecast number of boarding and alighting passenger at a selection of stations. This shows that the forecast morning peak period boarding and alighting passengers at inner city and CBD stations would almost double at most stations by 2031. Daily usage of stations would increase at a greater rate due to an increase in the number of off-peak rail trips made.

Central station has a capacity of almost 43,000 passengers in a two hour period. This capacity is reached by around 2016 and exceeded in 2021 and 2031. This is likely to be the reason for accelerated growth in patronage at Roma Street. Despite this the number of alighting passengers to the CBD is forecast to increase from 57,000 to 75,000 passengers without the Cross River Rail project.

Significant growth in station activity is also forecast for Boggo Road and Yeerongpilly.

Table 5-7 Forecast growth in total boardings and alightings at stations without Cross River Rail

	2009	2021	%growth	2031	%growth
Morning peak period					
Bowen Hills	3,600	6,700	86%	7,600	111%
Fortitude Valley	4,700	7,000	49%	10,800	130%
Roma Street	9,300	15,300	65%	26,700	187%
Central	34,500	47,300	37%	49,300	43%
South Bank	5,300	9,700	83%	9,900	87%
South Brisbane	2,800	5,900	111%	9,900	254%
Boggo Road	1,200	3,800	217%	5,100	325%
Yeerongpilly	700	1,300	86%	2,000	186%
Average weekday (24 hour)					
Bowen Hills	12,700	25,900	104%	32,100	153%
Roma Street	16,800	28,600	70%	40,700	142%
Fortitude Valley	36,500	62,200	70%	94,600	159%
Central	104,300	152,500	46%	177,600	70%
South Bank	22,900	62,800	174%	44,400	94%
South Brisbane	7,400	18,400	149%	25,800	249%
Boggo Road	3,900	11,600	197%	17,300	344%
Yeerongpilly	1,500	3,500	133%	5,800	287%

Source: Cross River Rail Project Model
Note:
1. Passenger boardings and alightings include transfers between all modes including rail to rail.

Line loadings

The forecast growth in rail patronage on the inner city rail network is illustrated in **Table 5-8**. This shows that from 2009 to 2021 the morning peak period rail patronage in the inner city is forecast to increase by around 50% and by 2031 rail patronage would generally have more than doubled. The busiest sections of the rail network would carry over 50,000 passengers in the morning peak two hour period by 2031 (compared to 25,000-30,000 in 2009).

Daily patronage is forecast to increase by a slightly greater percentage than for the morning peak period due to growth in rail travel during the off peak period. The busiest section of the rail network between Central Station and Fortitude Valley is forecast to carry almost 200,000 rail passengers during the whole day.

By 2021 the demand for rail use would be close to the inner city network peak capacity. **Table 5-6** shows that forecast AM peak patronage levels would increase by about 62% by 2021 compared with 2009.

Analysis of patronage (line loadings) across the whole weekday (see **Appendix E**,) shows that higher growth in patronage is expected to occur in the contra peak directions (where there is generally greater spare capacity) compared to the peak direction growth. For example, Roma Street to South Brisbane (southbound/ outbound) in the morning peak period is expected to grow by around 180% between 2009 and 2031, whereas South Brisbane to Roma Street (northbound/ inbound) in the morning peak is forecast to grow by around 90% over the same period. Most other parts of the rail network within the study corridor are expected to grow by around 100% (ie double their current patronage) by 2031.

Table 5-8 Forecast growth in rail patronage without Cross River Rail

	2009	2021	%growth	2031	%growth
Morning peak period					
Fortitude Valley to Bowen Hills	27,400	40,600	48%	52,600	92%
Central to Fortitude Valley	28,000	41,900	50%	53,400	91%
Roma Street to Central	25,300	41,400	64%	51,100	102%
South Brisbane to Roma Street	15,100	25,400	68%	32,500	115%
South Bank to South Brisbane	17,600	29,300	66%	39,100	122%
Boggo Road to South Bank	17,700	29,300	66%	37,800	114%
Dutton Park to Park Road	11,200	17,600	57%	23,800	113%
Average weekday (24 hour)					
Fortitude Valley to Bowen Hills	98,800	154,000	56%	192,800	95%
Central to Fortitude Valley	99,800	158,400	59%	194,200	95%
Roma Street to Central	82,900	144,600	74%	181,000	118%
South Brisbane to Roma Street	49,000	92,900	90%	118,100	141%
South Bank to South Brisbane	55,800	105,000	88%	135,500	143%
Boggo Road to South Bank	66,200	126,700	91%	141,000	113%
Dutton Park to Park Road	41,600	84,200	102%	99,100	138%

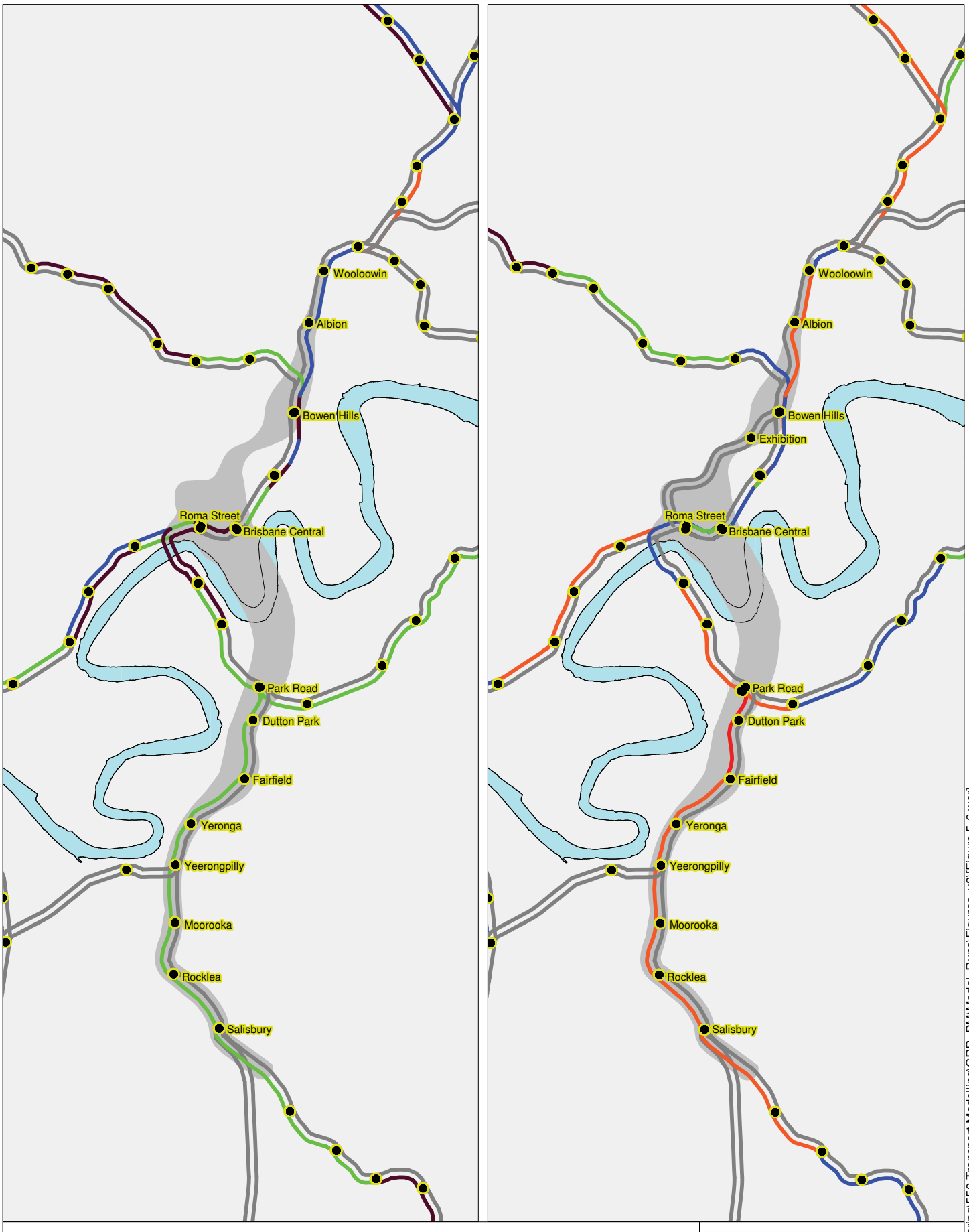
Source: Cross River Rail Project Model

Level of service – load factors

Load factors (line loadings expressed as a proportion of seated capacity) in the morning peak period by rail segment by direction are tabulated in Appendix E and are illustrated in the **Figure 5-6** and **Figure 5-7**. In the morning peak this shows a typical commuter peak trip pattern with each line becoming increasingly more crowded as it approaches the principal morning peak destination area, namely the Brisbane CBD. As shown, loadings in 2031 are higher than in 2021, on all key approaches to the CBD

In 2021, key routes into the city, including the Nambour Line, Shorncliffe Line, Beenleigh / Gold Coast Lines would all have passenger standing further than 20 minutes from Central Station over and average of the two hour morning peak period. No lines are forecast to have an average load factor of 1.5 or greater over the morning peak period.

By 2031, the volume of passengers in excess of seated capacity is more severe with all approaches to the CBD having passengers standing for more than 20 minutes from Central Station and most lines have a load factor of greater than 1.5.



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.50
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

Model ID: CPM_2009_003 (2009) CPM_2021_013 (2021)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-6

Morning peak period rail load factors 2009 to 2021 without Cross River Rail

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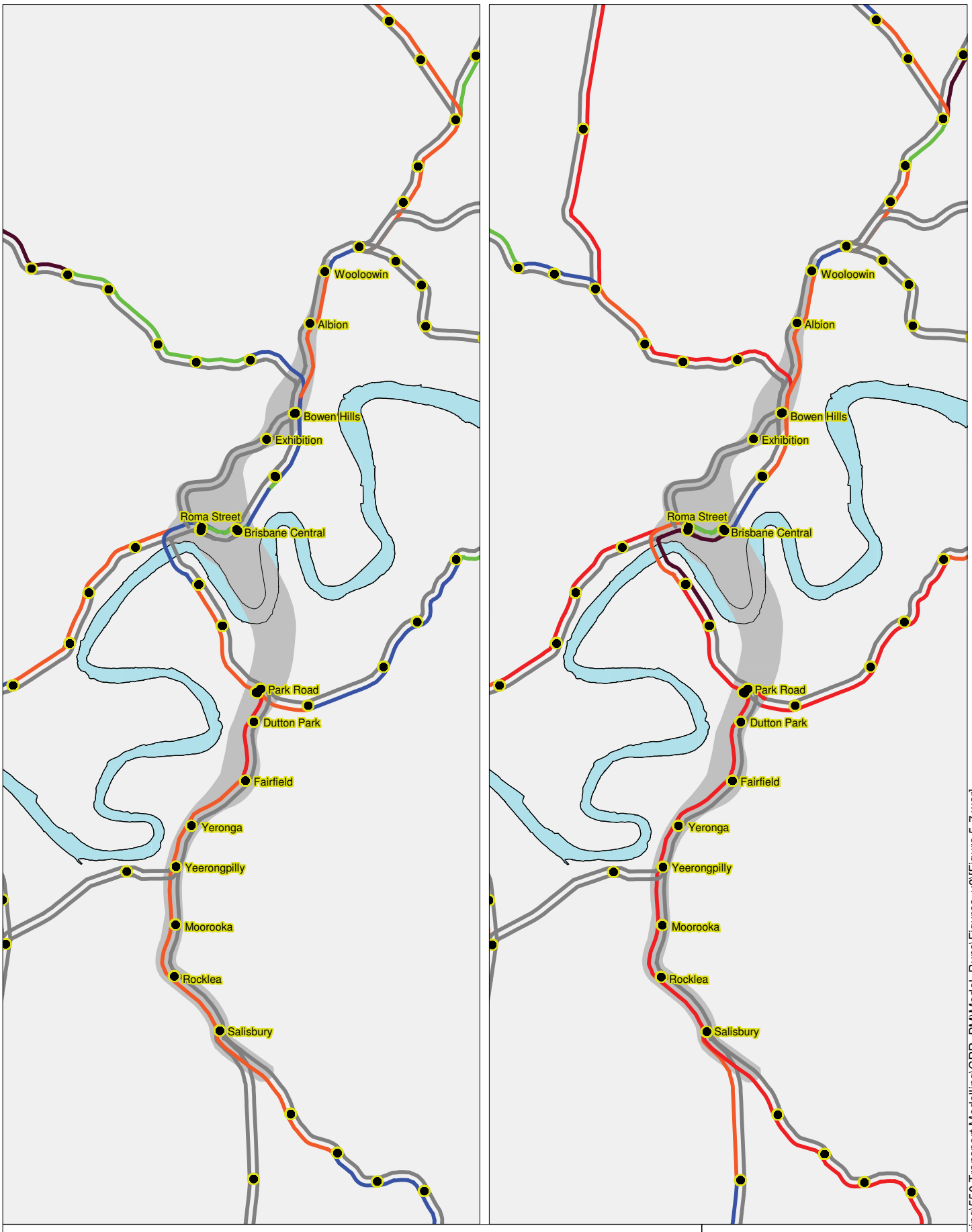

LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.50
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

Model ID: CPM_2021_013 (2021) CPM_2031_104 (2031)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-7

Morning peak period rail load factors 2021 to 2031 without Cross River Rail

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Level of service – loadings on individual services

Loadings on individual services were estimated using the Train Load Predictor (TLP) (Systemwide, December 2010). Analysis was undertaken for 2016 and 2031 Without Project Case rail timetables. The analysis for 2021 is based on linear interpolation of patronage growth between 2016 and 2031.

Key findings for the 2021 Without Project Case scenario are:

- Seven of the eight Kuraby services (on the Beenleigh/ Gold Coast line) over the peak two hours in the morning would be overloaded at Park Road (**Figure 5-8**) in the Without Project case. The rolling hour average load shows that crowded conditions would be experienced for one hour. Additional services cannot be provided due to capacity constraints elsewhere on the network such as the Merivale Bridge.

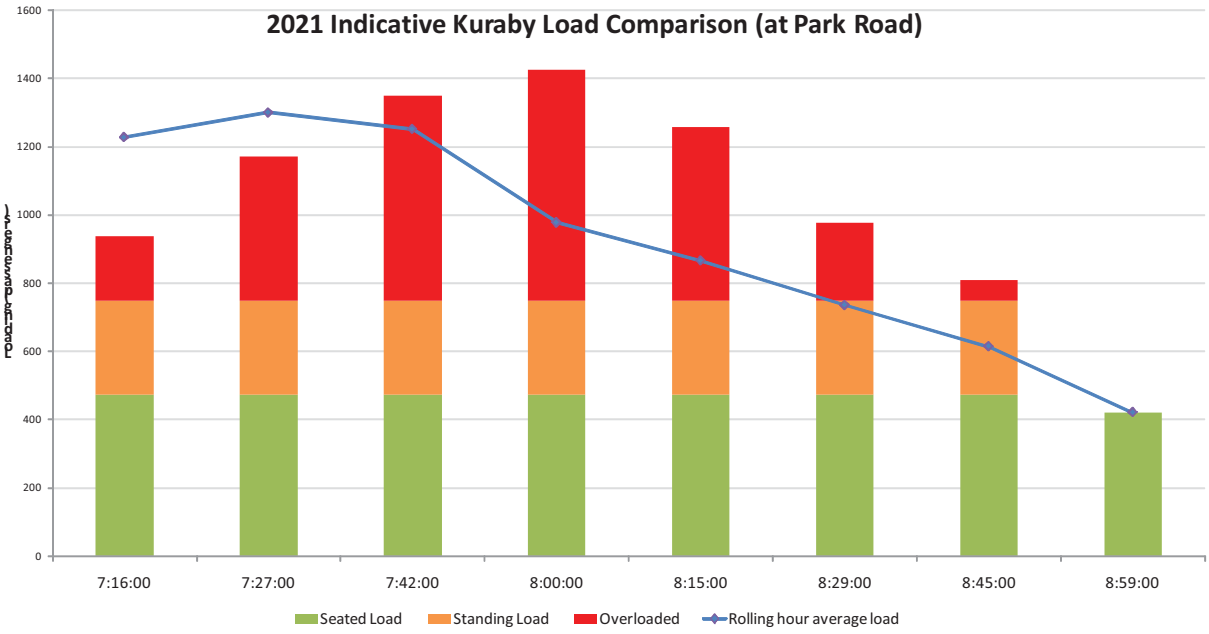


Figure 5-8 2021 Without Project case Kuraby service load forecast at Park Road across the AM Peak 2 hours (based on linear interpolation of patronage growth between 2016 and 2031)

Source: Systemwide, December 2010

- Around five services on the Cleveland line are forecast to be overloaded during the morning peak period in 2021. (The overloaded services would be those that start from Cleveland. Services with spare capacity would be those that start from Manly.)
- Loadings on the Northern Suburban corridors in the Without Project case operate within capacity.
- Nambour and Petrie services would be significantly overcrowded (**Figure 5-9**) during the peak of the peak, with the rolling average load line indicating that overcrowded conditions would be experienced for an hour.

Without Cross River Rail, train crowding will increase from 13,200 daily hours (2009) to 48,400 daily hours in 2021, an increase of 267% in 12 years.

Key findings of the 2031 Without Project Case timetable include:

- By 2031, the forecast volume of passengers in excess of seated capacity is critical with train crowding forecast to increase to 67,900 daily hours.

- Loadings on the Gold Coast services would be significantly higher than 2021 with all services having at least standees south of Coomera. Most Gold Coast services would have uncomfortable levels of standing for over an hour.

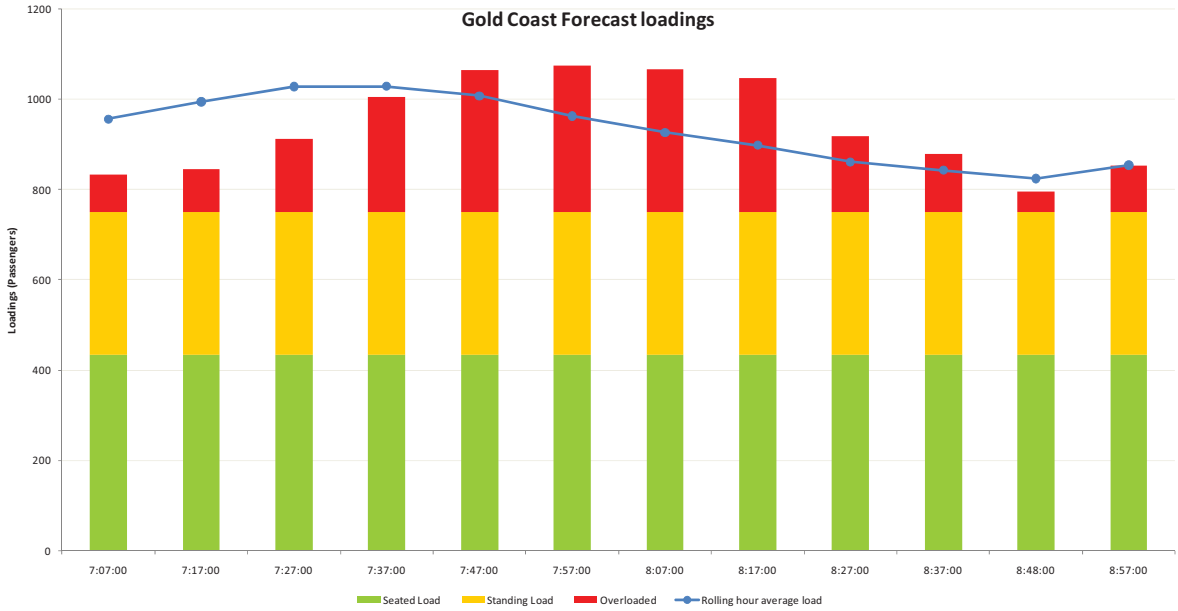


Figure 5-9 2031 Without Project case Gold Coast line service load forecast at Park Road across the AM Peak 2 hours

Source: Systemwide, December 2010

- Many Loganlea services would have standees at least from Coopers Plains, with some further south than this in 2031. Similarly, Flagstone Creek services would have standees from south of Acacia Ridge. In both cases, this would mean that passengers would be standing for longer than 25 – 30 minutes (**Figure 5-10**).

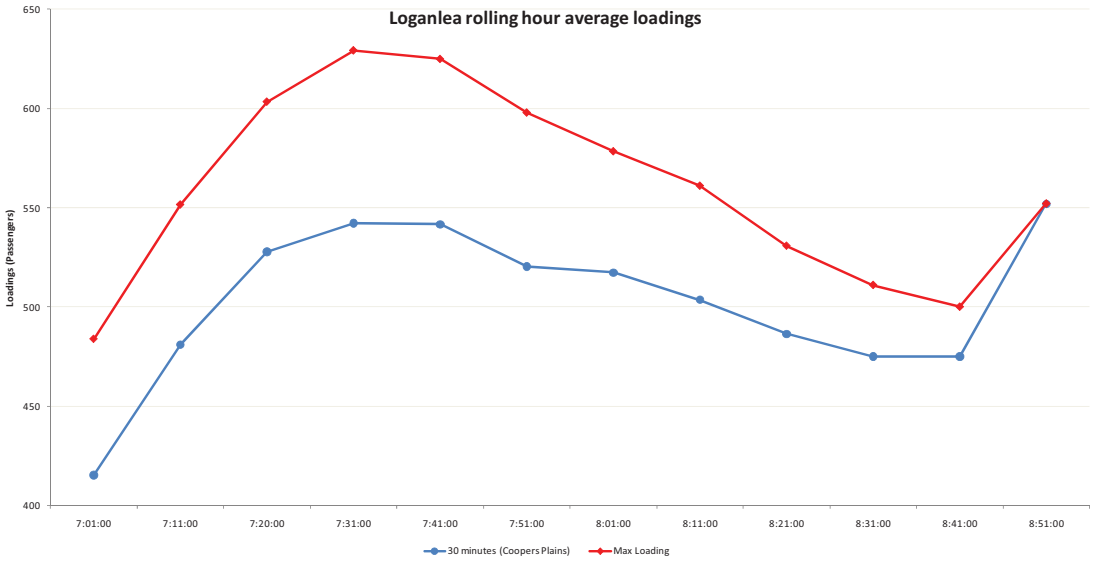


Figure 5-10 2031 Without Project forecast rolling hour average loadings across the AM 2 hour peak (maximum loading and at Coopers Plains): Loganlea services

Source: Systemwide, December 2010

- Doomben and Airport services are not forecast to be heavily loaded in the 2031 Without Project scenario.
- Neither Ferny Grove nor Strathpine services would be particularly heavily loaded, with no overcrowding forecasted in 2031 without the Project.
- Sunshine Coast (Nambour and Kawana) services would generally have heavier loads than the Caboolture services, due to their shorter running time to the inner city. Sunshine Coast corridor services would have significantly high rolling hour average loadings.
- Services on the Western corridor are forecast to experience significant overcrowding in the 2031 Without Project scenario. Both Rosewood and South Ripley services are forecast to have rolling hour average loads above 700 passengers for much of the morning peak 2 hours, with Springfield services forecast to have a rolling hour average load above 500 for much of the morning peak 2 hours.
- Overall, the level of crowding forecast for the rail network in peak periods in 2031, means a significant number of passengers would divert to already congested bus and road networks, or choose not to travel at all.

Level of service – service reliability

As the number of services operating on a corridor approaches the limit of available capacity, the punctuality of services is expected to decline gradually (although this relationship is also complicated by the impact of crowding on individual services). The rate of this decline accelerates as punctuality falls, due to the increasing complexity involved in compensating for out of order running and increasing influence of knock-on delays.

Without Cross River Rail in place, service levels would not increase at a sufficient rate to keep pace with growth in demand. This means that overcrowding would steadily increase, lengthening dwell times, which would drive delays. As the network would be operating at capacity, there would be no recovery to absorb these delays.

Rail dynamic simulations were conducted by Systemwide for both 2009 and 2031 for the Without Project case and indicatively for 2021. These forecasts showed that the on-time reliability weighted network average would deteriorate to 80% in 2021 without the project and to 65% in 2031. This compares to around 94% of trains currently (2009) arriving within four minutes of the timetable.

On time reliability results are shown in **Table 5-9** for each line in 2009 and 2031. The results indicate that without the Project, the continued growth in demand for rail services would result in significant reduction in service reliability across the Brisbane rail network. By 2031, the reduction in reliability on some of the major corridors, including Nambour, Caboolture, Doomben Shorncliffe and Airport will mean 40-60% worsening in on time reliability (compared to 2009). Ferny Grove, Cleveland and Beenleigh lines will experience a 20-30% worsening in on time reliability. No lines approaching the CBD would be able to achieve the current Queensland Rail benchmark of 92.4% on time reliability (at 4 minutes) during the morning peak period by 2031.

Table 5-9 2009 and 2031 Without Project Case forecast on time reliability at 4 minutes for inbound services per line (measured at Central/CBD from start of operation to 10:00 am).

Reliability measured at CBD/Central	Reliability at 4 minutes (%)		
Line	2009	2031 Without Project Case	
	Current OTR	Forecast	Change in OTR (compared to 2009)
Nambour	90.09%	41.30%	-48.79%
Caboolture	94.78%	38.71%	-56.07%
Shorncliffe	93.86%	40.08%	-53.78%
Airport	94.23%	38.73%	-55.50%
Doomben	95.06%	54.99%	-40.07%
Ferny Grove	95.88%	73.88%	-22.00%
Cleveland	93.11%	65.85%	-27.26%
Robina	93.26%	77.65%	-15.61%
Beenleigh	93.11%	61.55% (Loganlea)	-31.56%
Rosewood	95.58%	88.26%	-7.32%
Ipswich	94.72%	N/A	N/A
Springfield	N/A	82.48%	N/A
Kuraby	N/A	N/A	N/A
Kawana	N/A	52.87%	N/A
Hillcrest	N/A	80.84%	N/A
Redcliffe	N/A	56.83%	N/A
Strathpine via NWTC	N/A	76.32%	N/A

Source: Systemwide, December 2010

Rollingstock requirement

The 2021 and 2031 Without Project rolling stock requirements have been calculated by Systemwide (Systemwide, December 2010). The breakdown of rolling stock requirements to support the 2021 and 2031 Without Project timetables are given below in **Table 5-10**.

Table 5-10 Forecast 2021 Without Project rolling stock requirements

Without Project rolling stock requirement (spreadsheet methodology)	3-car sets required	
Corridor	**2021 Without Project**	**2031 Without Project**
Western corridor requirement	58	71
Southern corridor requirement	98	116
Northern corridor requirement	123	152
TOTAL 3-CAR SETS (operations)	279	339
Spares (10% allocation)	28	34
TOTAL 3-CAR SETS (operations)	307	373
Existing rolling stock fleet size (end 2012)	215	215
ADDITIONAL ROLLING STOCK PROCUREMENT (operations inc. spares)	52	158
Possible ICE and EMU retirement allocation	95	95
TOTAL ADDITIONAL ROLLINGSTOCK PROCUREMENT (operations inc. spares including retirements)	147	253

Source: Systemwide, December 2010

Network boardings and alightings

Table 5-11 and **Figure 5-11** outline forecast changes in rail passenger boardings and alightings across the network. This shows substantial growth in alightings outside of Zone 1, highlighting the increasing decentralisation of employment outside of the CBD and an increased rate of take up of public transport for “contra peak” journeys – that is against the traditional peak flow of “inbound” to the Brisbane CBD in the morning peak and “outbound” from the Brisbane CBD in the PM peak. It also shows that there would be substantially more alightings than boardings in Zone 1 in all years, with the reverse true in all other zones, for the morning peak period.

Table 5-11 TransLink network zone rail passenger boardings and alightings (morning peak period – 7.00am to 9.00 am)

TransLink Zone	2009	2021		2031	
		Forecast	**% change**	**Forecast**	**% change**
Zone 1 Boarding	18,400	22,700	23%	31,000	68%
Zone 1 Alighting	91,500	116,200	27%	148,200	62%
Zone 2 Boarding	36,100	50,000	39%	66,200	83%
Zone 2 Alighting	18,100	33,200	83%	48,200	166%
Zone 3 Boarding	20,600	28,300	37%	37,900	84%
Zone 3 Alighting	9,200	16,000	74%	23,400	154%
Zone 4+ Boarding	65,500	109,100	67%	161,000	146%
Zone 4+ Alighting	21,800	44,600	105%	76,300	250%
Total	281,200	420,100	49%	592,200	111%

Source: Cross River Rail Project Model.

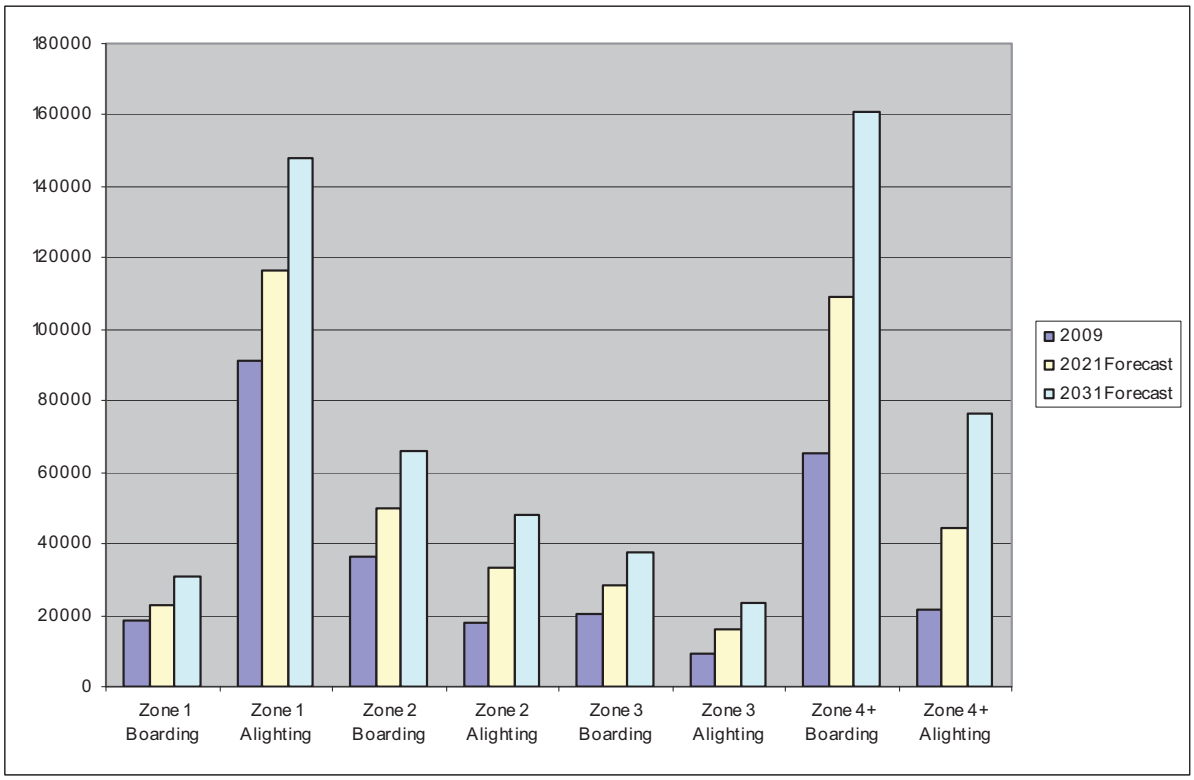


Figure 5-11 TransLink Zone rail passenger boardings and alightings – morning peak period (7.00 am to 9.00 am)

Station activity

Changes in station activity within the study corridor across future years are shown in **Figure 5-12**. This shows that in the morning peak period, there is expected to be substantial background growth in boardings and alightings at several stations including Wooloowin, Albion, Roma Street, Park Road and Salisbury, with negative growth anticipated for Dutton Park, Fairfield, Yeronga, Moorooka and Rocklea. Tables showing morning and 24 hour volume and percentage changes in station activity can be found in **Appendix E**.

Changes to station activity in the southern study corridor is expected to be the result of changes to rail stopping patterns with express Gold Coast trains stopping at Salisbury and Yeerongpilly from 2021 onwards. This then makes these stations more attractive than adjacent stations such as Rocklea, and Yeronga, leading to reductions in patronage at these stations. By 2031 a new branch line (Hillcrest/ Flagstone) joins the network at Salisbury with a further 3 to 4 trains per hour calling at Salisbury station leading to further increases in patronage and station activity at this station relative to both 2009 and 2021.

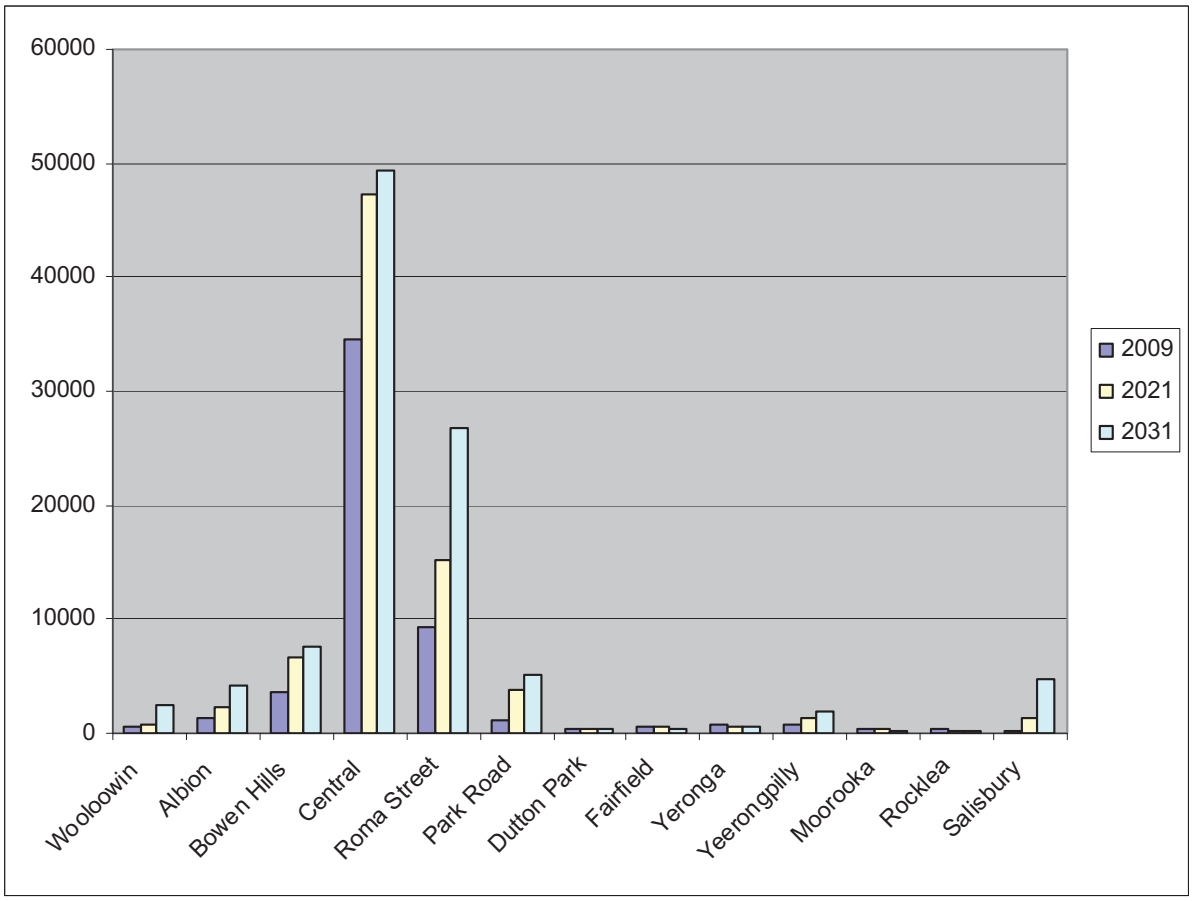


Figure 5-12 Changes in station boarding and alighting totals morning peak (7.00am to 9.00am)

Interchange

Table 5-12 represent rail to rail transfers in the morning peak period. This shows substantial additional growth in rail to rail interchange.

Table 5-12 Rail to rail transfers (morning peak period – 7 am-9 am)

AM Peak	2009	2021		2031	
Area		Forecast	% change	Forecast	% change
CBD	3,100	3,500	13%	5,900	90%
Study corridor (north area)	3,600	4,300	19%	7,000	94%

Source: Cross River Rail Project Model
Note:
1. CBD is Central and Roma Street stations. Study corridor (north area) is Central, Roma Street, Bowen Hills, and Park Road.

5.3.6 Future rail station performance – North

Forecast rail passengers boardings and alightings for each station in the northern part of the study corridor across future years for the Without Project Case are reported below along with a breakdown in forecast access modes to each station.

An analysis of the station performance in terms of forecast pedestrian level of service on the key components on the pedestrian infrastructure such as stairs and walkways is also provided for each of the suburban stations in the northern part of the study corridor.

Wooloowin

Boardings and alightings at Wooloowin station are expected to grow marginally between 2009 and 2021. However rapid growth in boardings and alightings of over 300% over the 10 year period between 2021 and 2031 is forecast. **Table 5-13** highlights that walking would continue to be the principle mode of access to Wooloowin in the morning peak with over 70% of passenger arriving on foot with a significant increase in rail to rail transfers. Travel to Wooloowin by car would remain at less than 200 person trips in the morning peak (with no major change over time) although as a proportion of total station activity, car access diminishes in importance.

Rail to rail transfers are forecast to significantly increase between 2021 and 2031. This would be due to the proposed major changes in rail operating patterns such as sectorisation and the North West Transport corridor being introduced.

Table 5-13 Wooloowin - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	70%	400	93%	100	73%	400	92%	100	61%	1,100	24%	200
Rail	1%	<50	3%	<50	1%	<50	5%	<50	29%	500	75%	500
Bus	1%	<50	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50
Car	29%	200	4%	<50	25%	100	3%	<50	10%	200	1%	<50
Total	100%	600	100%	200	100%	600	100%	200	100%	1,800	100%	700
Total (boardings + alightings)	800				800				2,500			

Source: Cross River Rail Project Model

The adequacy of the pedestrian infrastructure at Wooloowin without the Project being implemented has been assessed to determine if the infrastructure could adequately cater for the forecast increase in passenger demand. A minimum pedestrian level of service D (based on Fruin's definition of pedestrian level of service) should be achieved at the station. The station capacity analysis for 2031, shown in **Table 5-14**, shows that the minimum width requirements to achieve the required level of service of D are 1.2 metres and 1.4 metres for walkways and stairs respectively. This confirms that the existing infrastructure is adequate to cater for the increased passenger activity in 2031. As the stairs and walkways are the critical components of pedestrian infrastructure at suburban stations it assumed that the pedestrian level of service on the platforms would also be adequate (ie level of service of D or better).

Table 5-14 Minimum width requirement for level of service D in 2031 at Wooloowin (morning peak period)

Walkways (m)	Stairs (m)
1.2	1.4

Albion

Passenger boardings and alightings at Albion station are forecast to grow significantly from around 1,500 boardings and alightings in 2009 to over 4,300 in 2031. This is a forecast growth of over 200% over 22 years.

The forecast modes of access to Albion station is illustrated in **Table 5-15**. Around 65-70% of passengers boarding trains at Albion in the morning peak are forecast to arrive on foot in all years, with a diminishing proportion arriving by car, over time from 35% in 2009 to 14% in 2031. Access to the station by train (ie rail to rail transfer) would increase significantly from 1% of boardings in 2009 to 16% of boardings in 2031. Access by bus is and will continue to be negligible at no more than 1% of morning passenger boardings.

Table 5-15 Albion - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	64%	700	95%	300	73%	1,000	89%	700	69%	2,000	64%	900
Rail	1%	<50	2%	<50	5%	100	9%	100	16%	500	34%	500
Bus	0%	<50	0%	<50	0%	<50	0%	<50	1%	<50	0%	<50
Car	35%	400	3%	<50	22%	300	2%	<50	14%	400	1%	<50
Total	100%	1,100	100%	400	100%	1,500	100%	800	100%	2,900	100%	1,400
Total (boardings + alightings)	1,500				2,300				4,300			

Source: Cross River Rail Project Model

The adequacy of the pedestrian infrastructure at Albion station has been assessed to determine if the infrastructure could adequately cater for the forecast increase in passenger demand. A minimum pedestrian level of service D (based on Fruin's definition of pedestrian level of service) should be achieved at the station. The station capacity analysis for 2031, shown in **Table 5-16**, shows that the minimum width requirements to achieve the required level of service of D are 1.6 metres and 2.0 metres for walkways and stairs respectively. This confirms that the existing infrastructure is adequate to cater for the increased passenger activity in 2031. As the stairs and walkways are the critical components of pedestrian infrastructure at suburban stations it assumed that the pedestrian level of service on the platforms would also be adequate (ie level of service of D or better).

Table 5-16 Minimum width requirement for level of service D in 2031 at Albion (morning peak period)

Walkways (m)	Stairs (m)
1.6	2.0

Bowen Hills

Passenger access and egress at Bowen Hills station is forecast to grow substantially from around 3,700 morning 2 hour peak period passenger boardings and alightings in 2009 to 7,700 in 2031. This is equivalent to growth of over 110% over 22 years. A significant increase in the number and proportion of trips to and from the station on foot is forecast between 2009 and 2031 principally due to the redevelopment of the land within the station catchment as planned by the Bowen Hills Urban Development area.

Bowen Hills is a major rail to rail transfer destination although this will diminish as a proportion of total passenger boardings from 38% in 2009 to 24% in 2031. Conversely bus access will become more dominant as a mode of access from 0% arriving to the station by bus in 2009 to 10% in 2031.

Table 5-17 Bowen Hills - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	50%	400	86%	2,400	72%	1,400	90%	4,300	62%	1,300	82%	4,500
Rail	38%	300	11%	300	22%	400	8%	400	24%	500	9%	500
Bus	0%	<50	4%	100	0%	<50	2%	100	10%	200	9%	500
Car	13%	100	0%	<50	6%	100	0%	<50	5%	100	0%	<50
Total	100%	900	100%	2,800	100%	1,900	100%	4,900	100%	2,100	100%	5,600
Total (boardings + alightings)	3,700				6,800				7,700			

Source: Cross River Rail Project Model

An assessment of the adequacy of the pedestrian infrastructure at Bowen Hills in 2031 has been carried out using the ClicSim pedestrian simulation software. This uses the modelled internal origin-destination (OD)[2] matrix of passenger demand within the existing Bowen Hills Station during the morning peak is shown in **Table 5-17**.

Table 5-18 Bowen Hills morning peak 2031 matrix (Without Project case)

Destination / Origin	Bowen Hills Station Entrance	Platform 1	Platform 2	Platform 3	Platform 4	Total
Platform 1	1,239	320	275	143	247	2,224
Platform 2	1,100	0	75	0	25	1,200
Platform 3	1,762	167	155	93	0	2,177
Platform 4	1,283	0	585	0	529	2,397
Bowen Hills Station Entrance	0	644	135	554	147	1,480
Total	5,384	1,131	1,225	790	948	9,478

Source: Cross River Rail Project Model

The pedestrian modelling analysis suggests that without the Project, Bowen Hills Station provides sufficient capacity to accommodate forecast pedestrian movement (with an average level of service B or better for all walkable areas within the station). The morning peak model suggests that there may be intermittent congestion on and around the southern platform stairs, corresponding to the heavier use of the southern exits (50% of total entries and 65% total exits). However, the modelled congestion levels on the stairs are within an acceptable range (an average level of service of B, occasionally peaking at LOS D).

Exhibition

Exhibition station is currently only used for the Ekka event held at the RNA showgrounds station. The assumed future year rail service plans presented in **Section 5.3.4** do not propose to use the Exhibition loop or station for passenger rail services. Consequently there is no forecast patronage or station activity for a typical weekday.

[2] The origin and destination of each passenger were taken as the point of entry and point of exit from the station.

5.3.7 Future rail station performance – Central

Forecast passenger boardings and alightings for each rail station in the central part of the study corridor for the Without Project case in the future years are reported below along with a breakdown in access modes to each station.

An analysis of station performance in terms of the forecast pedestrian level of service on platforms and other station pedestrian infrastructure such as stairs, escalators, walkways and platforms is provided for each station in the central part of the study corridor.

Central Station

Growth at Central Station in the morning peak is expected to be relatively slow, due to expected congestion and station capacity constraints beyond 2021. Over the period to 2021 growth in the number of passengers using Central Station is forecast to be almost 54% to around 47,000 passengers. The practical operating capacity of Central Station is thought to around 43,000 passengers in a 2 hour peak period and consequently growth in the number of rail passengers using this station beyond 2021 is low (refer to **Table 5-19**).

Walking is currently the key mode of egress for passengers alighting at the station, with around 90% walking to their final destination and this is not forecast to change to 2031. A significant proportion of boarding passengers have transferred from another rail service (between 40 and 50%) however the overall numbers of boarding passengers is dwarfed by the number alighting – representing around 10-15% of the number alighting – in the morning peak period. Onward travel from Central Station by bus in the morning peak is relatively small, less than 10% of alightings.

Table 5-19 Central Station – forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	30%	1,300	89%	26,800	54%	2,600	96%	40,700	45%	2,600	92%	40,300
Rail	51%	2,200	7%	2,200	33%	1,600	4%	1,600	50%	2,900	7%	2,900
Bus	19%	800	4%	1,100	10%	500	1%	300	3%	200	1%	400
Car	0%	<50	0%	<50	2%	100	0%	<50	2%	100	0%	<50
Total	100%	4,400	100%	30,200	100%	4,800	100%	42,600	100%	5,800	100%	43,600
Total (boardings + alightings)	34,600				47,400				49,400			

Source: Cross River Rail Project Model

An assessment of the adequacy of the pedestrian infrastructure at Central Station in 2031 has been carried out using the ClicSim pedestrian simulation software. The modelled internal origin-destination (OD) matrix of passenger demand within the existing Central Station during the morning peak is in **Table 5-20**.

Table 5-20 Central station morning peak 2031 matrix (without Project case)

Destination Origin	Central Station Entrance	Platform 1	Platform 2	Platform 3	Platform 4	Platform 5	Platform 6	Total
Platform 1	3,503	865	460	0	0	824	0	5,652
Platform 2	3,277	597	164	0	0	542	2	4,582
Platform 3	4,164	0	0	225	466	62	637	5,554
Platform 4	4,733	0	0	374	263	88	700	6,158
Platform 5	17,349	1,556	1,378	0	0	3,938	0	24,221
Platform 6	8,789	13	2	353	232	0	429	9,818
Central Station Entrance	0	140	118	329	367	767	705	2,426
Total	41,815	3,171	2,122	1,281	1,328	6,221	2,473	58,411

Source: Cross River Rail Project Model

The pedestrian modelling for the without Project Case in 2031 is illustrated in **Figure 5-13** and suggests that:

- the platform 5 and 6 stairs and escalators are forecast to be heavily used and prolonged queuing occurs at the bottom of the escalators (level of service F) during the morning peak. This is due to exceptionally large pedestrian flows on platform 5 and 6. These two platforms account for over 60% of total activity at the station. This is equivalent to over 42,000 passengers.
- the platform 3 and 4 stairs and escalators are also heavily used with extended periods of congestion and queuing at the bottom of the escalators (an average level of service F is maintained during the busiest 15 minutes)
- the platform 1 and 2 stairs and escalators are moderately used and they provide sufficient capacity to accommodate forecast movements (level of service A)
- platforms 3, 4, 5 and 6 all show significant congested areas in the centre of the platforms and near the stairs and escalators
- the stairs from platforms 5 and 6 to the subway level are also heavily used, with an average LOS C during the busiest 15-minute period
- the escalators and stairs limit the pedestrian flows to concourse level, possibly masking future congestion issues on the concourse and around the ticket gates.

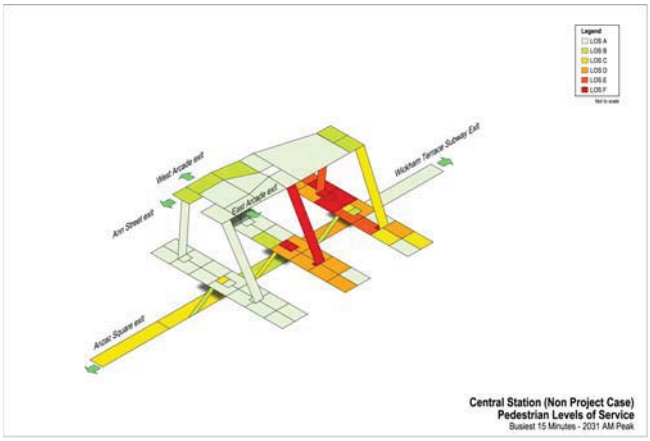


Figure 5-13 Central station pedestrian level of service in 2031 (AM Peak Without Project Case)

In summary, the modelling suggests that the existing arrangement of pedestrian infrastructure at Central Station would not have sufficient capacity to accommodate 2031 passenger volumes in the without Project case.

Roma Street

There is forecast to be significant growth in boardings and alightings at Roma Street between 2009 and 2031 as illustrated in **Table 5-21**. Overall station activity is forecast to almost triple from 9,000 to around 27,000 passenger movements during that 22 year period. This is partly expected to be the result of crowding at Central Station, making Roma Street more attractive for access and interchange. This forecast passenger growth is also partly due to increased development in the Roma Street precinct. Walk-based passenger alightings are forecast to increase substantially, from around 5,600 in 2009 to almost 18,000 trips by 2031. Rail to rail boardings (ie transfers from other rail services) increases from only 900 in 2009 to over 3,000 in 2031 potentially due to the introduction of sectorisation into the future year rail service plans.

Table 5-21 Roma Street - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	18%	300	74%	5,600	17%	500	78%	9,500	14%	600	81%	17,900
Rail	53%	900	12%	900	63%	1,900	16%	1,900	68%	3,000	14%	3,000
Bus	29%	500	14%	1,100	20%	600	7%	800	18%	800	6%	1,300
Car	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50
Total	100%	1,700	100%	7,600	100%	3,100	100%	12,300	100%	4,500	100%	22,300
Total (boardings + alightings)	9,300				15,400				26,800			

Source: Cross River Rail Project Model

An assessment of the adequacy of the pedestrian infrastructure at Roma Street station in 2031 has been carried out using the ClicSim pedestrian simulation software. The modelled internal origin-destination (OD) matrix of passenger demand within the existing Roma Street station during the morning peak period is presented in **Table 5-22**.

Table 5-22 Roma Street morning peak 2031 matrix (Without Project case)

Destination / Origin	Roma Street Station Entrance	Platform 4	Platform 5	Platform 6	Platform 8	Platform 9	Total
Platform 4	194	0	0	0	0	0	194
Platform 5	2,222	0	3	1	59	0	2,285
Platform 6	5,712	0	0	51	1,302	352	7,417
Platform 8	5,244	17	730	0	598	0	6,589
Platform 9	9,182	111	1382	110	86	35	10,906
Roma Street Station Entrance	0	33	362	146	522	234	1,297
Total	22,554	161	2,477	308	2,567	621	28,688

Source: Cross River Rail Project Model

The pedestrian modelling analysis suggests that in the Without Project Case, Roma Street Station provides sufficient capacity to accommodate forecast pedestrian movement (with an average level of service A for most walkable areas within the station). The morning peak period model suggests that the main area of congestion will be around the platform 8 and 9 stairs and escalators that connect to the existing subway. These stairs and escalators are forecast to have a level of service of D. This is caused by the large number of passengers alighting at the station from platforms 8 and 9 (accounting for 64% of the total number of passengers) in the morning peak.

The modelled levels of service at Roma Street during the busiest 15-minutes of the 2031 morning peak are shown in **Figure 5-14**.

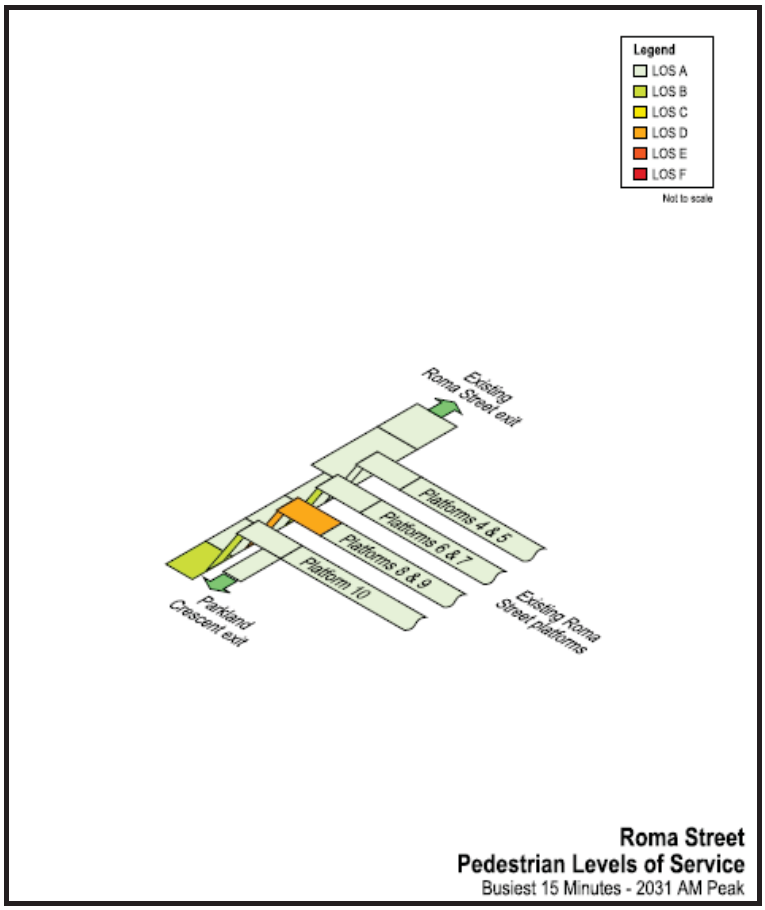


Figure 5-14 Roma Street pedestrian level of service in 2031 (AM Peak Without Project Case)

Park Road

Park Road is forecast to experience significant growth in rail passenger boardings and alightings with overall station activity more than quadrupling from 1,300 in 2009 to around 5,200 passenger movements in 2031 (refer to **Table 5-23**). This is expected to be caused by the increased services using Park Road from 13 inbound services in the morning peak hour in 2009 to 23 in 2031 as well as ongoing development of the Boggo Road Urban Village adjacent to the station. Walk-based boardings and alightings are the largest mode of access at around 50 to 60% of boardings and around 40% of alightings. Access by bus is forecast to have a larger mode of access with around 30-40% of alighting passengers transferring to bus in 2021 and 2031. Rail to rail transfer are forecast to continue to be an important activity at Boggo Road station, and is expected to grow in numbers although as a proportion of boarding total trips it reduces.

Table 5-23 Park Road - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	50%	300	43%	300	32%	600	35%	700	54%	1,300	44%	1,200
Rail	33%	200	29%	200	21%	400	20%	400	25%	600	22%	600
Bus	0%	<50	29%	200	42%	800	45%	900	17%	400	33%	900
Car	17%	100	0%	<50	5%	100	0%	<50	4%	100	0%	<50
Total	100%	600	100%	700	100%	2,000	100%	2,000	100%	2,500	100%	2,700
Total (boardings + alightings)	1,300				4,000				5,200			

Source: Cross River Rail Project Model

An assessment of the adequacy of the pedestrian infrastructure at Park Road station in 2031 has been carried out using the ClicSim pedestrian simulation software. The modelled internal origin-destination (OD) matrix of passenger demand within the existing Park Road station during the morning peak period is presented in **Table 5-24**.

Table 5-24 Park Road morning peak 2031 matrix (Without Project case)

Destination Origin	Park Road Station Entrance	Platform 1	Platform 2	Platform 3	Platform 4	Total
Platform 1	1,726	2	0	0	0	1,728
Platform 2	567	83	0	7	0	657
Platform 3	293	84	1	1	1	380
Platform 4	185	87	0	5	0	277
Park Road Station Entrance	0	449	504	568	332	1,853
Park Road Station Entrance	2,771	705	505	581	333	4,895

Source: Cross River Rail Project Model

The modelled levels of service at Park Road during the busiest 15-minutes of the 2031 morning peak are shown in **Figure 5-15**. This suggests that in the Without Project Case, Park Road station provides sufficient capacity to accommodate forecast pedestrian movements (with an average level of service B or above for all walkable areas within the station). The morning peak model suggests that there may be congestion occurring occasionally on and around platform 3 and 4 stair. However, the modelled congestion levels are all within acceptable levels that peak at a pedestrian level of service of D).

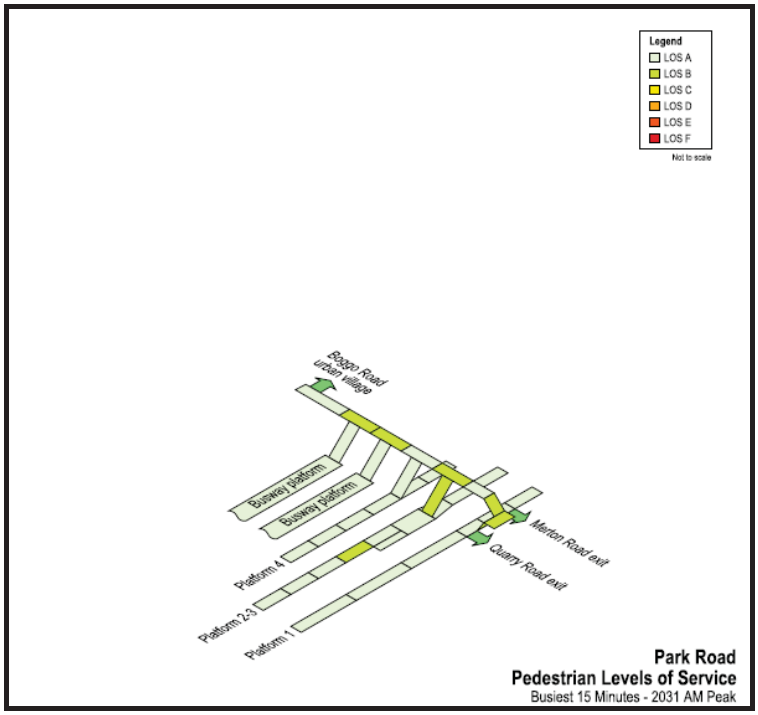


Figure 5-15 Park Road pedestrian level of service in 2031 (AM Peak Without Project Case)

5.3.8 Future rail station performance – South

Forecast rail passenger boardings and alightings for each station in the southern part of the study corridor across future years for the Without Project Case are reported below along with a breakdown in forecast access modes to each station.

An analysis of the station performance in terms of forecast pedestrian level of service on the key components on the pedestrian infrastructure such as stairs and walkways is also provided for each of the suburban stations in the southern part of the study corridor.

Dutton Park

Forecast rail passenger boarding and alighting activity is presented in **Table 5-25.** This shows that little change is forecast to occur in passenger activity at Dutton Park over the next 20 years. Overall morning peak activity is forecast to reduce slightly from over 500 movements to around 400 movements. In particular, boardings in the morning peak reduce substantially from around 300 to 100 boardings. This is expected to be due to increased services at Park Road attracting passengers to use that station instead. Rail and bus access to Dutton park station remains negligible, with car access to the station expected to remain at around ten boardings.

Table 5-25 Dutton Park - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	96%	300	100%	100	13%	<50	87%	200	89%	100	98%	200
Rail	0%	<50	0%	<50	0%	<50	0%	<50	3%	<50	1%	<50
Bus	0%	<50	0%	<50	24%	<50	13%	<50	0%	<50	0%	<50
Car	4%	<50	0%	<50	63%	100	0%	<50	8%	<50	0%	<50
Total	100%	300	100%	200	100%	200	100%	300	100%	100	100%	300
Total (boardings + alightings)	500				500				400			

Source: Cross River Rail Project Model

The adequacy of the pedestrian infrastructure at Dutton Park for the Without Project Case has been assessed to determine if the infrastructure could adequately cater for the forecast increase in passenger demand. This result of the capacity analysis is presented in **Table 5-26** and shows that in 2031, the minimum width required to achieve the required pedestrian level of service D are 0.7 metres for both walkways and stairs. These requirements are well within existing infrastructure widths. The capacity of the platform is adequate as well based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-26 Minimum width requirement for level of service D in 2031 at Dutton Park (morning peak period)

Walkways (m)	Stairs (m)
0.7	0.7

Fairfield

Total forecast rail passenger boardings and alightings at Fairfield station are presented in **Table 5-27** and are expected to remain at around 500 movements in the morning peak period. Walking would remain as the overwhelmingly dominant mode of access in the morning peak with around 90% of passengers arriving on foot. Rail and bus access to the station is negligible while car access to the station is expected to remain steady at around 10% of mode of access for passenger boardings.

Table 5-27 Fairfield - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	92%	400	96%	100	84%	400	78%	<50	88%	300	91%	<50
Rail	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50	2%	<50
Bus	0%	<50	4%	<50	2%	<50	20%	<50	0%	<50	2%	<50
Car	8%	<50	0%	<50	14%	100	3%	<50	12%	<50	5%	<50
Total	100%	500	100%	200	100%	600	100%	100	100%	400	100%	<50
Total (boardings + alightings)	700				700				400			

Source: Cross River Rail Project Model

The adequacy of the pedestrian infrastructure at Fairfield for the Without Project Case has been assessed to determine if the infrastructure could adequately cater for the forecast increase in passenger demand. The result of the capacity analysis is presented in **Table 5-28** and shows that in 2031, the minimum width required to achieve the required pedestrian level of service D are 0.8 metres for both walkways and stairs. These requirements are well within the existing infrastructure widths. The capacity of the platform is adequate based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-28 Minimum width requirement for level of service D in 2031 at Fairfield (morning peak period)

Walkways (m)	Stairs (m)
0.7	0.7

Yeronga

Total forecast rail passenger boardings and alightings at Yeronga are present in **Table 5-29** and are expected to remain at around 700 movements in the morning peak period with some fluctuation between 600 and 800 expected in future years as train operating patterns change. Walking, as a mode of access would remain the dominant mode of access in the morning peak with around 60% of passengers arriving on foot. Rail and bus access to the station is negligible while car access to the station is expected to remain a significant proportion of boardings at around 40%, or 200 passengers arriving by car in the morning peak period.

Table 5-29 Yeronga - forecast number of passengers and mode of access (morning peak period))

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	66%	300	101%	200	55%	300	78%	100	54%	200	91%	100
Rail	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50
Bus	0%	<50	0%	<50	2%	<50	11%	<50	1%	<50	3%	<50
Car	34%	200	-1%	<50	43%	200	11%	<50	45%	200	5%	<50
Total	100%	600	100%	200	100%	500	100%	100	100%	500	100%	200
Total (boardings + alightings)	800				600				700			

Source: Cross River Rail Project Model

A station capacity analysis at Yeronga station, shows that in 2031, the minimum width requirements to achieve a required pedestrian level of service D are 0.7 metres and 0.8 metres for walkways and stairs respectively. The result of the capacity analysis is presented in **Table 5-30**. These requirements are well within the existing infrastructure widths. The capacity of the platform would also be adequate based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-30 Minimum width requirement for level of service D in 2031 at Yeronga (morning peak period)

Walkways (m)	Stairs (m)
0.7	0.8

Yeerongpilly

Total boardings and alightings at Yeerongpilly are expected to nearly triple from under 700 movement in 2009 to over 2,000 in 2031 without Cross River Rail as train operating patterns change to serve this developing precinct (refer to **Table 5-31**). While walking is currently the overwhelmingly dominant mode of access, rail access and transfer will constitute a larger share of station activity in 2021 and beyond. By2031 around 17%% of morning peak period rail passenger boardings would have transferred from another rail service. Bus is forecast to remain as a minor mode of access to Yeerongpilly rail station with car reducing in significance as a mode of access from 25% in 2009 to 17% in 2031.

Table 5-31 Yeerongpilly - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	75%	300	100%	300	71%	500	83%	500	67%	400	93%	1,300
Rail	0%	<50	0%	<50	14%	100	17%	100	17%	100	7%	100
Bus	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50
Car	25%	100	0%	<50	14%	100	0%	<50	17%	100	0%	<50
Total	100%	400	100%	400	100%	700	100%	700	100%	700	100%	1,400
Total (boardings + alightings)	800				1,400				2,100			

Source: Cross River Rail Project Model

A station capacity analysis at Yeerongpilly station shows that in 2031, the minimum width requirements to achieve the required pedestrian level of service D are 1.1 metres and 1.3 metres for walkways and stairs respectively. The result of the capacity analysis is presented in **Table 5-32**. This confirms that the existing infrastructure is adequate to cater for the passenger activity even in 2031. The capacity of the platform is adequate as well based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-32 Minimum width requirement for level of service D in 2031 at Yeerongpilly (morning peak period)

Walkways (m)	Stairs (m)
1.1	1.3

Moorooka

Total forecast rail passenger boardings and alightings at Moorooka are illustrated in **Table 5-33** and are expected to reduce slightly from around 500 movements in the morning peak period in 2009 to around 400 in 2031. This is expected to be the result of more attractive rail frequencies offered at Yeerongpilly and Salisbury with passengers choosing to use one of these alternative stations.

Walking is forecast to remain the dominant mode of access with bus diminishing in importance and car increasing in importance (as a proportion of total access boardings). The mix of boardings and alightings is also expected to change over time with less boardings and more alightings in the morning peak, potentially as a result of increased employment opportunities in the area.

Table 5-33 Moorooka - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	51%	200	86%	100	73%	200	75%	100	57%	100	80%	100
Rail	7%	<50	14%	<50	0%	<50	0%	<50	0%	<50	0%	<50
Bus	28%	100	0%	<50	7%	<50	23%	<50	3%	<50	18%	<50
Car	14%	<50	0%	<50	20%	100	1%	<50	40%	100	2%	<50
Total	100%	400	100%	100	100%	300	100%	100	100%	200	100%	200
Total (boardings + alightings)	500				400				400			

Source: Cross River Rail Project Model

A station capacity analysis at Moorooka Station for 2031 is shown in **Table 5-34**. The minimum width requirements to achieve the required level of service D are 0.7 metres and 0.7 metres for walkways and stairs respectively. This confirms that the existing infrastructure is adequate to cater for the passenger activity even in 2031. The capacity of the platform is adequate as well based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-34 Minimum width requirement for level of service D in 2031 at Moorooka (morning peak period)

Walkways (m)	Stairs (m)
0.7	0.7

Rocklea

Forecast AM peak period rail passenger boardings and alightings at Rocklea are presented in **Table** 5-35 and are expected to reduce slightly over time from around 400 movements in the morning peak period in 2009 to about 300 in 2031. This is expected to be the result of more attractive rail frequencies offered at Yeerongpilly and Salisbury with passengers choosing to use one of these alternative stations. Rocklea has more alightings than boardings in the morning peak, reflecting the mixture of industrial and residential uses within the station catchment.

Walking is forecast to remain the overwhelmingly dominant mode of egress for alighting passengers in the morning peak, however boardings passengers are split between walking and car access. As overall boarding movements reduce, car access as a proportion becomes higher, rising from 28% of boardings to 66% (although the absolute volumes stay at around 30 passenger trips.).

Table 5-35 Rocklea - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	72%	100	100%	200	59%	<50	99%	100	34%	<50	97%	200
Rail	0%	<50	0%	<50	0%	<50	0%	<50	0%	<50	1%	<50
Bus	0%	<50	0%	<50	1%	<50	0%	<50	0%	<50	2%	<50
Car	28%	<50	0%	<50	41%	<50	1%	<50	66%	<50	1%	<50
Total	100%	100	100%	300	100%	100	100%	200	100%	100	100%	200
Total (boardings + alightings)	400				300				300			

Source: Cross River Rail Project Model

A station capacity analysis at Rocklea station (**Table 5-36**) shows that in 2031, the minimum width requirements to achieve the required level of service D are 0.7 metres and 0.8 metres for walkways and stairs respectively. This confirms that the existing infrastructure is adequate to cater for the passenger activity even in 2031. The capacity of the platform is adequate as well based on the assumption that the walkways and stairs are the critical sections of a suburban railway station.

Table 5-36 Minimum width requirement for level of service D in 2031 at Rocklea (morning peak period)

Walkways (m)	Stairs (m)
0.7	0.8

Salisbury

Forecast total rail passenger boardings and alightings at Salisbury station (**Table 5-37**) are expected to increase twenty-fold from a low base of around 300 passenger movements in 2009 to 4,800 passenger movement in 2031 without Cross River Rail. By 2021, 12 inbound trains per hour are proposed to serve Salisbury Station in the morning peak, and by 2031 15 inbound trains are expected to serve the station.

While walking is currently the dominant mode of access and egress from the station, rail access and transfer is forecast to constitute a largest share of station activity. By 2031 almost 1,800 rail to rail transfer trips are forecast which is likely to be the result of the introduction of the Hillcrest branch line some time after 2021. Access to the station by bus is expected to increase by 2031, while car access is forecast to reduce to only 2% of boardings by 2031. Absolute numbers of passengers arriving to the station by car is forecast to continue to be less than 100 in 2031.

Table 5-37 Salisbury forecast - forecast number of passengers and mode of access (morning peak period)

AM peak	2009				2021				2031			
Mode	Boardings		Alightings		Boardings		Alightings		Boardings		Alightings	
Walk/cycle	58%	100	61%	<50	43%	400	28%	100	21%	600	9%	200
Rail	10%	<50	3%	<50	24%	200	47%	200	67%	1,800	87%	1,800
Bus	5%	<50	35%	<50	26%	200	24%	100	9%	300	3%	100
Car	27%	<50	1%	<50	7%	100	1%	<50	2%	100	0%	<50
Total	100%	200	100%	100	100%	900	100%	500	100%	2,700	100%	2,100
Total (boardings + alightings)	300				1,400				4,800			

Source: Cross River Rail Project Model

A station capacity analysis for Salisbury station (**Table 5-38**) shows that in 2021, the minimum width requirements to achieve the required pedestrian level of service D are 1.1 metres and 1.3 metres for walkways and stairs respectively. This confirms that the existing infrastructure is adequate to cater for the passenger activity in 2021. The capacity of the platform is adequate as well based on the assumption that the walkways and stairs are the critical sections of a suburban railway station. In 2031, the station would not be able to achieve a level of service D or better even without Cross River Rail.

Table 5-38 Minimum width requirement for level of service D in 2031 at Salisbury (morning peak period)

2031	
Walkways (m)	Stairs (m)
1.7	2.2

5.4 Freight rail operations and performance

The demand for freight rail and the performance of freight rail operations for the Without Project case are assessed in this section by the methodology outlined in **Chapter 3** of this report. The forecasted rail freight volumes and train movements, the demand, is presented followed by an assessment of the freight rail operability outcomes of the rail network without the Project.

5.4.1 Rail freight volumes and train movements

Table 5-39 shows freight volume estimates by line and market segment. Baseline freight volumes for 2010 were estimated using data from the Inner City Rail Capacity Study. (This source data is consistent with the findings of the desk top study on freight demand carried out for this assessment – refer **Section 3.4** of this report).

For Western Line[3], and North Coast Line[4] intermodal freight movements, medium growth rates of 2% and 4% per annum were used to adjust 2007 estimates to 2010 values. Estimates for bulk freight transported on the Western Line in 2010 were modified to reflect export movements through the Port of Brisbane.

[3] The Western Line extends from Corinda through Rosewood to Toowoomba and regions further west of South East Queensland.

[4] The North Coast Line is to destination north of Brisbane and South East Queensland that is accessed via the Exhibition Loop in the Inner City.

Table 5-39 Estimates of 2010 freight volumes and assumptions relating to train consists

Network Segment	Freight type	2010 Freight Volumes (mtpa)	Current length of train consists (m)
North Coast Line	Intermodal	2.6	650
	Bulk	0.6	650
Western Line	Intermodal	0.7	650
	Bulk	7.3	650
Intra-urban import-export	Acacia Ridge – BMT	1.1	650
Interstate freight	Inland Rail – Acacia Ridge	N/A - assumed start date 2025	1,500

Table 5-40 shows forecast annual freight volumes for the medium growth scenario that has been used for this assessment. This growth scenario excludes consideration of a northern intermodal terminal and the potential development of the Inland Rail Route. For all market segments with the exception of Western Line Bulk[5], future freight volume estimates were derived on a 'bottom up' basis using adjusted 2010 freight train movements.

Estimates of import-export freight were derived from long term forecasts for containerised trade reported in the ATC Freight Study[6]. Acacia Ridge – BMT estimates were derived as a percentage of overall freight movements through the Port of Brisbane. Estimates relating to the establishment of a future northern IMT were based on long term estimates of the number of container movements to the northern areas of Brisbane and South East Queensland. These estimates were derived through analysis of road freight movements from the Port of Brisbane Container Origin and Destination Study[7].

Regional intermodal freight estimates are based on an average container weight of 15 tonnes. Weight estimates for intra-urban IMEX freight have been estimated using average container weights reported in the Port of Brisbane Container Origin and Destination Study.

Bulk freight estimates assume no back loading. North Coast Line Intermodal estimates assume a 10% backload on return journeys in light of commodities transported from North Queensland to the Port of Brisbane for export. No back loading was assumed for regional intermodal movements on the Western Line.

[5] A number of variations were found between Western Line freight train movements shown in **Table 5-39** and data relating to the ICRCS. In particular estimates of Western Line Intermodal trains shown in Table 5-39 do not appear to match estimates in ICRCS source data. Difficulties were also encountered in reconciling the number of bulk train movements shown in Table 5-39 with estimates of freight volumes documented in other sources. Freight volume estimates for the Western Line Bulk are therefore based on data from Port of Brisbane Trade Reports. Train movements for this market segment are based on Table 5-39 Average train lengths and the number of train movements on the Western Line should be reviewed with QR Network prior to the completion of the CRR Project evaluation.

[6] See PSA Consulting (2008) Australia Trade Coast Freight Study (p81). Effective annual growth rates were derived from expected trade increases between 2006/07 and 2025/26. The following growth rates were used to extend forecasts to 2031: 5.1% (Full Imports), 4.7% (Empty Imports), 1.5% (Full Exports) and 7.7% (Empty Exports).

[7] See Sd+D (2007) Port of Brisbane Container Origin and Destination Study. Analysis assumes that current container distribution patterns will continue over time.

Table 5-40 Estimates of future freight demand (million tonnes per annum)

Growth Scenario	Network Segment	Freight Type	Year			
			2016	2021	2026	2031
Medium Growth	North Coast Line	Intermodal	3.1	3.6	4.2	4.9
		Bulk	0.6	0.6	0.7	0.7
	Western Line	Intermodal	0.7	0.8	0.8	0.8
		Bulk	7.3	11.0	11.0	11.0
	Intra-urban IMEX	Northern IMT - BMT	N/A	N/A	N/A	N/A
		Acacia Ridge – BMT	1.4	1.7	2.1	2.5
	Interstate freight	Inland Rail – Acacia Ridge	N/A	N/A	N/A	N/A
	Total – Medium Scenario		**13.2**	**17.7**	**18.7**	**19.9**

Table 5-41 shows forecast weekly for the medium growth scenarios based on use of existing consists.

Table 5-41 Forecast weekly freight train movements based on current consists (two way combined)

Growth Scenario	Network Segment	Freight Type	Year			
			2016	2021	2026	2031
Medium Growth	North Coast Line	Intermodal	158	184	213	247
		Bulk	27	28	30	31
	Western Line	Intermodal	70	73	77	81
		Bulk	177	206	206	206
	Intra-urban IMEX	Acacia Ridge – BMT	55	70	90	118
	Interstate freight	Inland Rail – Acacia Ridge	-	-	-	-
	Total – Medium Scenario		**487**	**562**	**617**	**684**

The North Coast Line and Western Line freight forecasts for 2026 were compared against those developed for the equivalent year (2026) in the Inner City Rail Capacity Study and were found to be broadly consistent, despite the slightly different methodologies applied in the freight forecast estimation process and previously noted issues with Western Line estimates. This comparison is shown in **Table 5-42**. For the purpose of the comparison, intra-urban import-export freight and interstate freight (based on the Inland Rail Route) were excluded as they were not considered in the Inner City Rail Capacity Study.

Table 5-42 Comparison of North Coast Line and Western Line Freight Forecasts (2026)

Network Segment	Scenario	ICRCS (2008)	SAHA (2010)
North Coast Line	Medium	249	243
Western Line	Medium	283	284

5.4.2 Freight rail operability without the Project

The rail network was assessed to understand freight rail operability without the Project. Indicative freight timetables for five to six hour periods were generated for the forecast years of 2021 and 2031. The potential throughputs in these periods were apportioned to the different time periods of the day (for example, the interpeak, off-peak, and peak periods), which were then apportioned to an entire week to understand the potential weekly freight paths available.

These indicative five to six hour timetables did not assume any service flighting, assumed that current consist lengths would be maintained, and that the current hours of operation would be maintained. Hence, the potential paths forecast are an underestimate of the potential throughput, but allow consistent comparison.

The 2021 and 2031 Without Project case does not have freight infrastructure on the Southern corridor to separate freight and passenger rail operations. This is because a dedicated freight track is not provided throughout the day from Salisbury to the Port of Brisbane without the Project. This reduces the operability of freight in the southern corridor as a peak curfew must be maintained.

In addition, coal services would not be able to use the narrow-gauge network between Lindum and Yeerongpilly restricting coal movements as either the Murarrie passing loop must be extended to accommodate coal freight consists, or passing must be done at the port. There is also less northern passenger rail infrastructure (compared to the With Project case) to assist freight.

The increase in off-peak passenger frequencies severely restricts the ability to operate freight across much of the network. In the 2031 off-peak service levels are significantly higher than the current day and 2021. For the Without Project case it would not be possible to advance a freight train into the suburban area from the north during the day due to increased passenger off-peak service frequencies between Strathpine and Bowen Hills. Therefore northern intermodal freight is required to be prohibited during all the hours of passenger operation.

5.4.3 Average freight movements

The forecast 'freight movements per week' results from the above analysis are shown in **Table 5-43** for the North Coast and freight services operating between Salisbury and the Port of Brisbane. Assumptions have been made as part of this analysis (Systemwide, December 2010), and detailed freight timetables have not been created. Hence, the difference between scenarios is more descriptive than the exact forecast trains per hour.

Table 5-43 Forecast freight trains to meet demand not impacted by constraints outside the Cross River Rail scope

	Trains per week (both directions) - CRR scope only					
	2021			2031		
	Demand	Without Project	% demand met	Demand	Without Project	% demand met
North Coast	264	264	100%	322	16	5%
Salisbury - Tennyson	172	24	14%	209	24	11%
Tennyson - Port (IM)	78	3	4%	94	3	3%
Tennyson - Port (Coal)	197	197	100%	232	198	85%
Tennyson to Port TOTAL	275	201	73%	326	201	62%

Note: Demand paths assume current length consists

Whilst some forecast paths are below the demand requirement, this analysis provides an underestimation of the number of possible paths. Rail freight capacity could only be increased to meet demand with a range of changes such as:

- lower off-peak frequencies pre-morning peak and post-evening peak
- lower off-peak frequencies on weekends
- increased capacity of freight services (length or carrying capacity)
- flighting
- less restrictions on freight operating hours.

However, as currently modelled, significant demand for rail freight would be unable to be met by the rail network without the Project, with the excess demand expected to be accommodated by the road network resulting in a reduction in economic competitiveness and additional road congestion.

5.4.4 Rail freight outcomes – 2021

As shown in **Table 5-43**, by 2021 the majority of freight demand between Salisbury and Tennyson would not be able to be transported by rail (some 76%) while around 27% of total freight demand (IM + coal) between Tennyson and the Port would not be able to be transport by rail.

Southern corridor

As the Without Project case infrastructure does not includes new express passenger rail tracks north of Salisbury, express passenger rail services must share the freight network at Yeerongpilly which means that freight operations could only occur outside peaks. This would impact upon intermodal and standard-gauge only freight throughputs more heavily than coal freight services, as they are more time sensitive and / or need to operate on the dual-gauge tracks that are being used for passenger services. This means that there are approximately 20 hours a week in which rail freight cannot operate, which would cater for a significant number of possible freight services.

Northern/North Coast corridor

The North Coast Line is no more or less constrained in the 2016 Without Project scenario than in the 2016 With Project scenario, except for slightly less ability to pass freight services near Mayne Yard. Northern infrastructure does not change north of Mayne Yard, and with the same off-peak service plans, freight operability does not change.

5.4.5 Rail freight outcomes – 2031

The frequency of rail passenger services across the network in the 2031 Without Project scenario is prohibitive to operating narrow-gauge freight in both the south and the north of the network.

The following sections discuss the impact on each key section of the network.

Southern corridor

2031 Without Project case southern operations would deteriorate compared to 2021 Without Project operations. By 2031, almost 90% of freight demand between Salisbury and Tennyson and 43% of freight between Tennyson and the Port could not be accommodated on rail.

Northern/North Coast corridor

By 2031, very little anticipated freight demand on the North Coast Line could be accommodate on rail as the North Coast. The exclusion of the North West Transport Corridor (between the Ferny Grove line and Roma Street station) in the Without Project case results in all North Coast passenger services operating on the existing passenger network between Strathpine and Bowen Hills. Consequently, freight services cannot operate during the peak period of passenger operations, as passenger services are expected to operate at 20 trains per hour. North Coast freight services are generally intermodal services, which operate primarily during the hours of passenger operations due to terminal operating hours.

Therefore, unless passengers services were operated at a lower frequency than the assumed service plans it would only be possible to accommodate rail freight before and after passenger rail operations. This would provide a very small window across the week for rail freight. This highlighted in Error! Reference source not found. with only 16 rail freight services per week possible between Wooloowin and Roma Street.

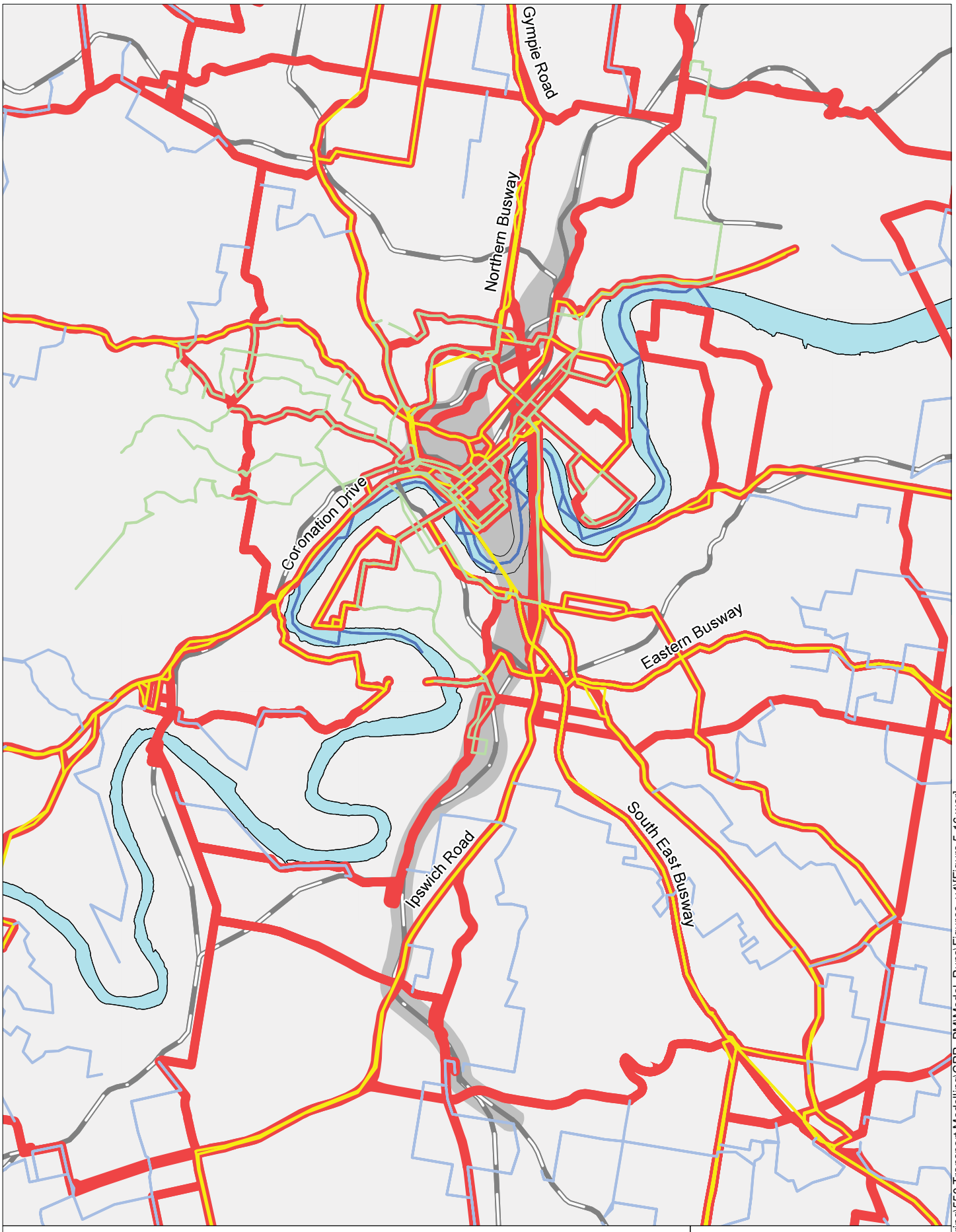
5.5 Bus operations and performance

5.5.1 Future bus operations

Between 2009 and 2021 extensions to the Northern Busway and Eastern Busway are planned to be operational with additional services using these key bus corridors. On the Northern Busway a major interchange would be provided at The Royal Brisbane and Women's Hospital (now operational) while on the Eastern Busway intermodal interchanges would be provided at Buranda and Park Road (Boggo Road busway station).

TransLink's progressive rollout of the high frequency priority network (HFPN), termed UrbanLink in the draft Connecting SEQ 2031 Integrated Regional Transport Plan, would put more emphasis on simplifying and improving the bus network. This would involve more feeder routes to rail and busway hubs with an increasing need to transfer to another service, particularly from outer suburban areas, in the off peak. The strategy would trend towards marginally shorter bus trip lengths and bus journey times between 2009 and 2031, due to introduction of more bus feeder routes to rail stations that would encourage bus-rail interchange (that is a change from current single seat bus journeys to the CBD to two-seat, two-mode journey patterns). Bus services within 5 km of CBD are planned to generally remain as single seat journeys (that is with no need for interchanging).

The 2031 bus network is shown in **Figure 5-16**. This illustrates the key HFP network and supplementary feeder routes, as well as peak only express route. The HFP network represents a simplification of the current network and a consolidation of some routes on key corridors to create higher frequency trunk services. For example Fairfield Road/ Annerley Road, Main Street/ Story Bridge and Gregory Terrace are all expected to see greater numbers of direct trunk-style bus routes.



LEGEND

Bus Services

- HFP
- Peak Express
- 5km Feed
- Feeder
- Ferry
- Rail
- Study Corridor

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-16

Overview of 2031 bus and ferry network

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CrossRiverRail

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Future bus performance in the region

Forecast demands for bus services are shown in **Table 5-44**. This shows a large proportional increase in bus patronage (over 96%) from 2009 to 2031, with bus (and Public Transport in general) growing faster than overall motorised trips. With around 550 buses per hour entering the CBD in the morning peak hour in 2009, such growth would require over 1,000 buses to enter the CBD by 2031 (assuming similar occupancy rate).

Table 5-44 Forecast trips by bus in the Brisbane metropolitan area without Cross River Rail

24H	2009	2021		2031	
		Forecast	% change*	Forecast	% change*
Public transport trips	546,100	824,200	50.9%	1,074,000	96.7%
Total bus patronage	**285,700**	**393,500**	**37.7%**	**560,800**	**96.3%**
% bus trips (motorised trips)	4.70%	5.02%	NA	6.34%	NA
Total bus passenger kilometres	3,252,100	4,080,400	25.5%	5,632,000	73.2%
Total bus passenger hours	139,700	162,100	16.0%	245,100	75.4%
Average bus trip length (km)	11.38	10.37	-8.9%	10.04	-11.8%
Average bus trip time (minutes)	29.34	24.72	-15.7%	26.23	-10.6%

Source: Cross River Rail Project Model

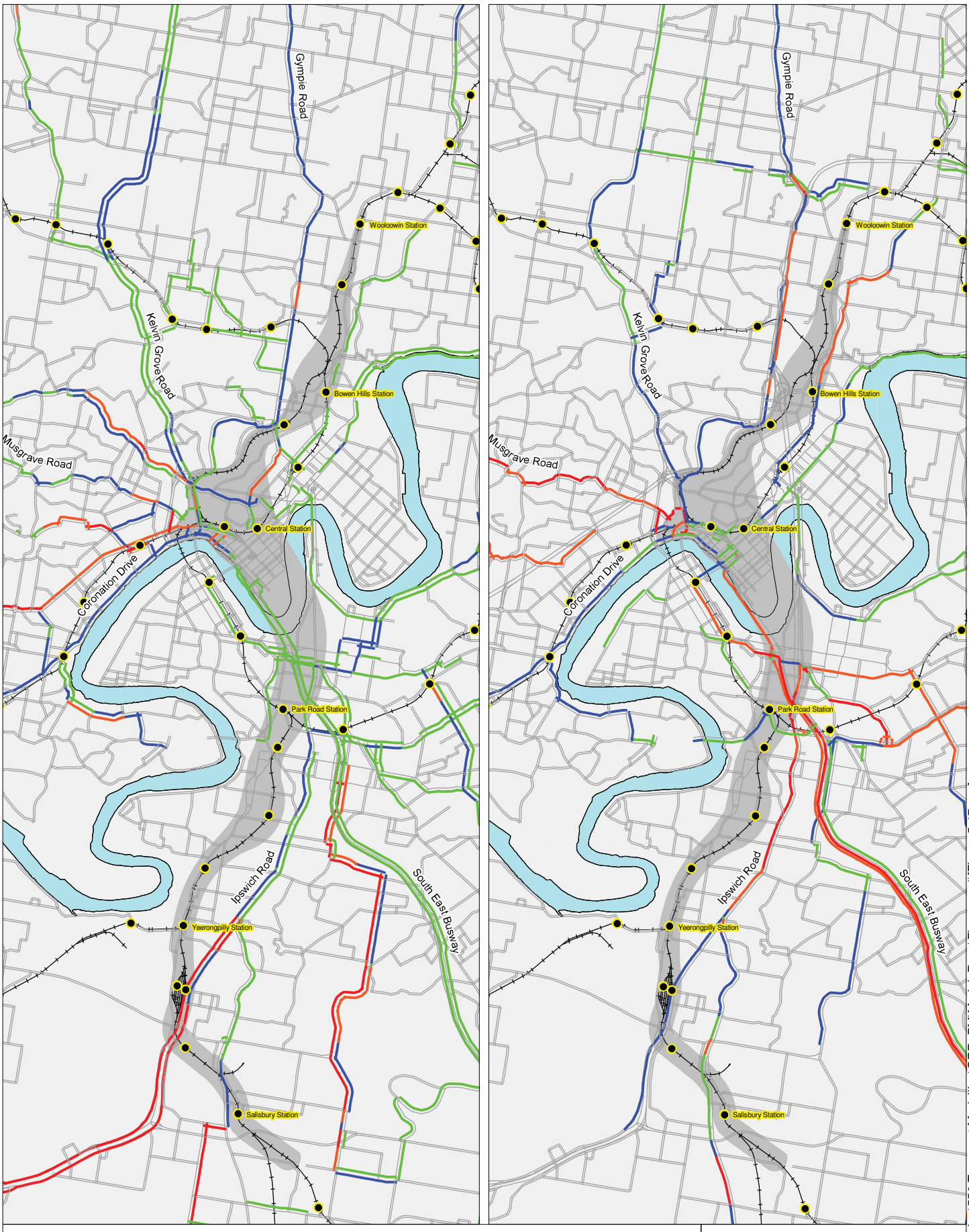
Note:
**% change on 2009 volumes*

There is a trend towards marginally shorter bus trip lengths and bus journey times between 2009 and 2031, possibly related to more bus-rail interchange (ie a change from current single seat bus journeys to the CBD to 2-seat, 2-mode journey patterns).

Volume over capacity on the bus network within and surrounding the study corridor is illustrated in **Figure 5-17** and **Figure 5-18** for 2009 through to 2031.

A substantial increase in demand on services is forecast for Ipswich Road, the South-East Busway, the Captain Cook Bridge, the Northern Busway and Given Terrace (Paddington) without the Project. There would be some relief shown on the Ipswich Motorway which is expected to be the result of the opening of the Springfield railway line by 2013, taking demand away from bus route 100 in particular.

By 2021, overcrowding would be likely on the South East Busway and the Captain Cook Bridge bus services approaching the CBD. This overcrowding is forecast to deteriorate further by 2031. Between 2021 and 2031, even with provision of additional bus capacity, crowding is forecast to worsen on the northern corridor (Northern Busway), Waterworks Road (through Red Hill) and St Pauls Terrace.



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.25
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

Railway lines

Model ID: CPM_2009_003 (2009) CPM_2021_013 (2021)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-17

Morning peak period bus load factors 2009 to 2021 without Cross River Rail

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CrossRiverRail

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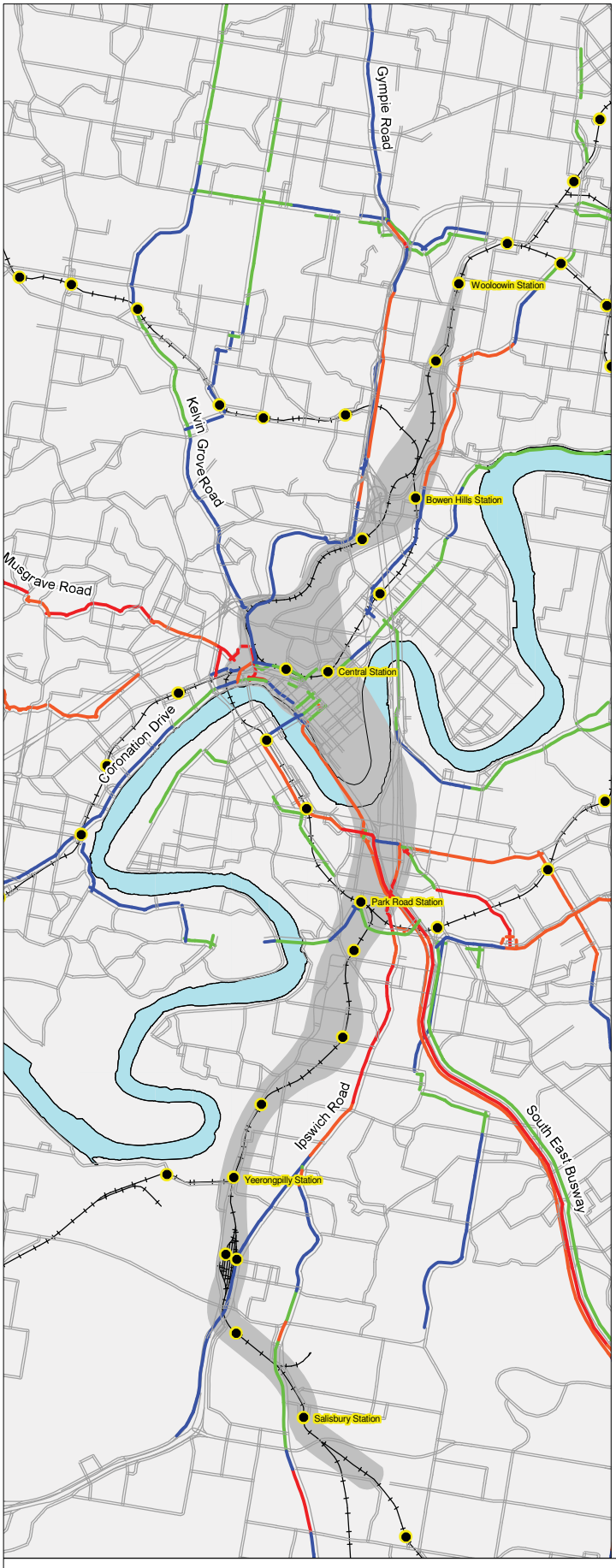
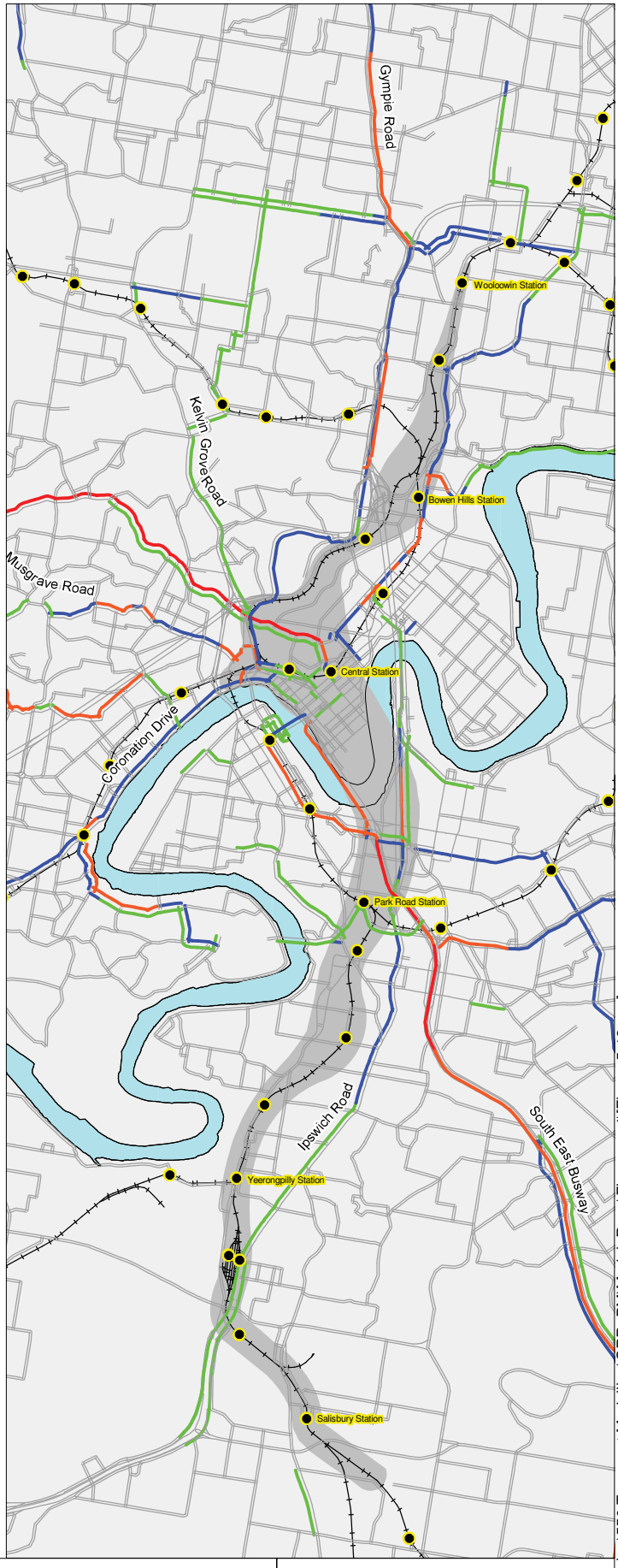
Year 2021 - without Cross River Rail



Year 2031 - without Cross River Rail



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.25
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

Railway lines

Model ID: CPM_2021_013 (2021) CPM_2031_104 (2031)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-18

Morning peak period bus load factors 2021 to 2031 without Cross River Rail

N

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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5.5.2 Future bus operations at rail stations – North

Wooloowin

There are no forecast changes to bus services in the vicinity of Wooloowin station in future years. Bus as a mode of access to Wooloowin station remains negligible with no forecast demands to or from bus in the morning peak. This is reflected in a lack of nearby bus routes which is not expected to change in future years.

Albion

There are no major changes anticipated for bus services near Albion Station into the future and buses will continue to play a negligible role in providing access to and from the station under current plans. At most 1% of morning rail passenger boardings are forecast to be use bus as an access mode by 2031.

Bowen Hills

Bus services on Abbotsford Road immediately adjacent to Bowen Hills station are expected to grow significantly between 2009 and 2031 from around 25 buses per hour in the morning peak to over 60. As such, bus as an access mode will become more important representing up to 10% of boarding and alightings in 2031, compared to less than 4% of alightings and 0% of boardings in 2009.

Exhibition

Buses would continue to play a major role in providing access to the Exhibition station precinct into the future without Cross River Rail as there is not expected to be any regular rail serviced from this station. Bus access will principally be provided via the RBWH Busway Station on the Northern Busway, approximately 400m west of the current event-only station.

5.5.3 Future bus operations at rail stations – Central

Central Station

In the CBD, buses would continue to use current key access routes such as Adelaide Street, where no increase in bus numbers are proposed from 2009 to 2031, due to capacity constraints, with around 120 buses per hour in the morning peak, or 1 in each direction, for each minute of the peak. Buses are not expected to be a significant mode of egress for alighting rail passengers in the morning peak diminishing from the current 4% of alighting rail passengers to around 1% by 2031.

Roma Street

Bus services in the Roma Street precinct would continue to operate principally from the Inner Northern Busway with no major increases in frequency proposed (from the current 100 inbound services per hour in the morning peak) due to platform capacity constraints on the busway. As such an increase in bus services is forecast on Roma Street itself, from around 30 per hour in 2009 to 60 per hour by 2031 (inbound). Bus to rail interchange transfers are forecast to increase from 1,500 in 2009 to over 2,100 in 2031 although with substantially more passengers using the station the proportion using bus as a mode of access or egress actually reduces.

Park Road

Bus operations within the Park Road/ Boggo Road precinct will continue to be dominated by busway services operating complimentary east-west and cross town services interchanging with the station. Frequency on the busway is expected to increase significantly from around 35 westbound (towards UQ) services in the morning peak hour in 2009 to over 60 per hour in 2031. Bus access and egress is expected to increase in absolute and proportionate terms as interchange between modes becomes more critical in the network over time.

5.5.4 Future bus operations at rail stations – South

Dutton Park

At Dutton Park, bus operations are expected to remain similar to 2009 with no major changes proposed. Bus access and interchange, likewise remain negligible at Dutton Park, with less than 1% of trips to or from the station in the morning peak, by bus in 2031.

Fairfield

Bus operations around Fairfield Station are expected to remain similar to 2009 with no major changes proposed to the Fairfield Road services. Bus access and interchange, likewise remain negligible at Yeronga.

A new High Frequency Priority (HFP) north-south bus route along Fairfield Road is forecast to be in operation by 2031. As such, up to 4 buses per hour per direction could be expected by 2031, with new, more direct links from the station to Indooroopilly in the west. However this is only forecast to lead to minor levels of bus to rail interchange by 2031, with around 1% to 2% of boarding rail passengers arriving by bus in the morning peak.

Yeerongpilly

The same HFP route proposed to serve Yeronga is also expected to serve Yeerongpilly, via bus stops on Fairfield Road with up to 4 services per hour per direction in the morning peak by 2031. However there is no forecast change in bus-rail interchange with less than 1% of rail passenger boardings predicted to transfer from bus by 2031.

Moorooka

A doubling of bus frequency is proposed along Ipswich Road at Moorooka by 2031 from around 6 per hour inbound in the morning peak in 2009 to around 12 per hour in 2031. However these are expected to be longer distance buses from Forest Lake with bus-rail interchange at the station forecast to remain minor.

Rocklea

Very few changes are expected to bus operations at Rocklea, with buses continuing to provide a negligible mode of access and egress in the morning peak period (less than 2% of passengers arriving by bus by 2031).

Salisbury

Bus operations around Salisbury station are expected to change marginally with the biggest changes being increase in frequency on Beaudesert Road 200m to the west of the station, from around 7 per hour in the morning peak to 14 per hour by 2031. Bus-rail interchange (both access and egress) in the morning peak is expected to increase both in terms of absolute numbers and as a proportion of total boardings and alightings. For example, passengers arriving by bus are forecast to increase from 9 people (5%) in 2009 to 253 people (9%) by 2031.

5.6 Ferry operations and performance

There are no major changes to ferry operations expected within the study corridor however moderate frequency improvements continue to provide more regular services.

By 2031, ferry patronage has more than doubled (141% of 2009 volumes) however ferries still cater for only a small percentage of overall trips across the city – less than 1% of all motorised daily trips (refer to **Table 5-45**).

There is a trend towards slightly longer trips with average trip lengths and average trip times increasing between 2009 and 2031 which reflects proposed minor extensions to the CityCat network downstream to North Shore Hamilton.

Table 5-45 Forecast ferry trips in the Brisbane metropolitan area without Cross River Rail

24H	2009	2021		2031	
		Forecast	% change*	Forecast	% change*
Public transport trips	546,100	824,200	50.9%	1,074,000	96.67%
Total ferry patronage	12,800	28,700	124.2%	30,900	141.41%
% ferry trips (motorised trips)	0.21%	0.37%	NA	0.35%	0.14%
Total ferry passenger kilometres	48,500	130,800	169.7%	133,300	174.85%
Total ferry passenger hours	3,100	7,900	154.8%	8,100	161.29%
Average ferry trip length (km)	3.79	4.56	20.3%	4.31	13.96%
Average ferry trip time (minutes)	14.74	16.55	12.3%	15.64	6.10%

Source: Cross River Rail Project Model

Note:
**growth = growth on 2009 volumes*

There is no projected development of any ferry to rail interchanges and transfer between these modes is expected to remain negligible over future years.

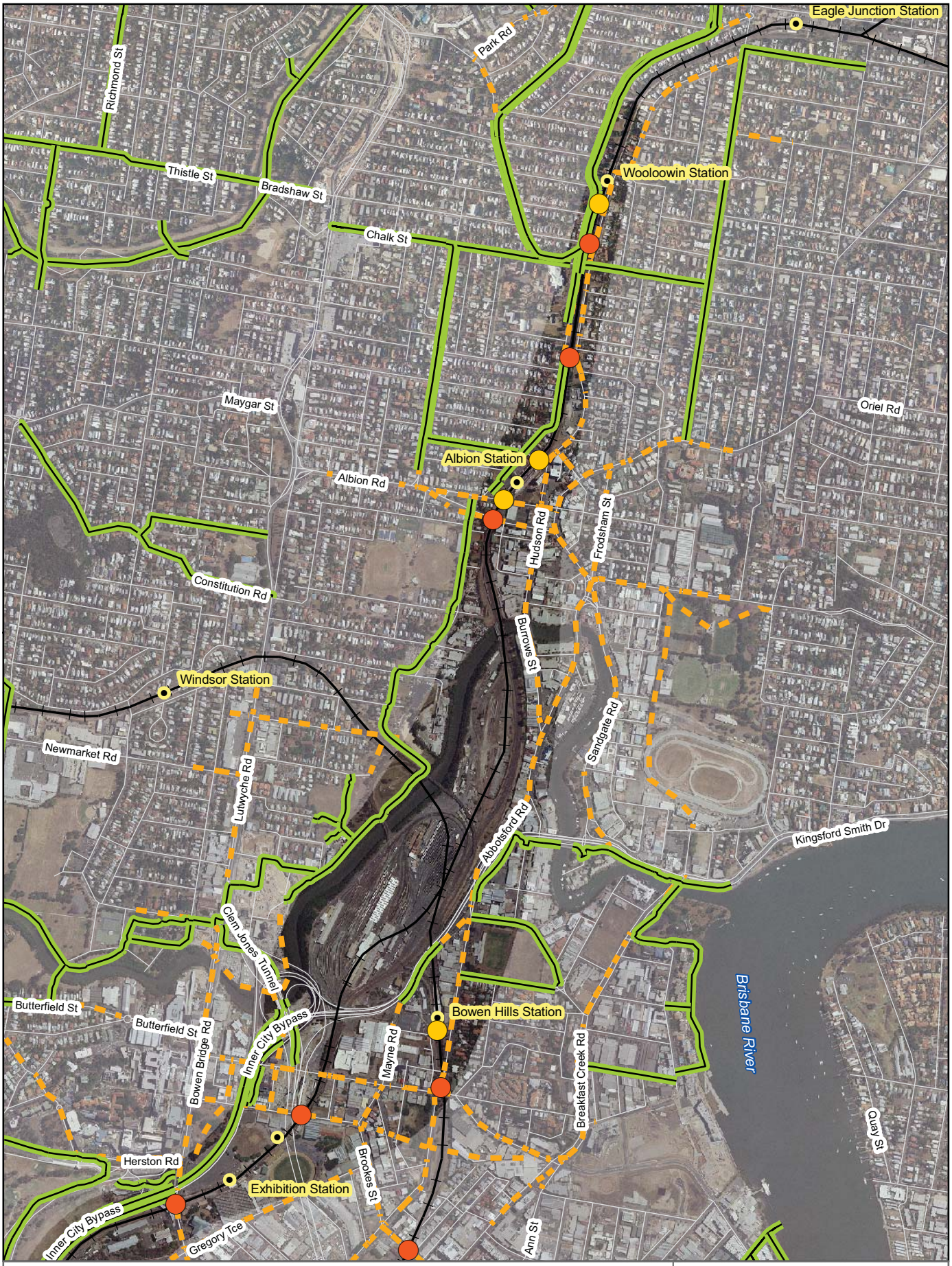
5.7 Pedestrian and bicycle

Overall boarding and alighting activity by station by mode is outlined in **Section 5-3**.

Changes to the pedestrian and cycle networks around stations within the study corridor is outlined further in following three sections.

5.7.1 Future pedestrian and cycle operations at rail stations – North

The future pedestrian and cycle network within the northern part of the study corridor is shown in **Figure 5-19**.



LEGEND

Rail Crossings - Existing

- Ped/Cycle
- Vehicles and Ped/Cycle
- Existing Bikeway
- Future Local Bikeway
- Future Principal Bikeway
- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-19

Future Pedestrian/Cycle facilities (Northern Section)

0 0.25 0.5 0.75 1 km

1:17,500 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G077_CCR_Trans_Future_Ped_Cycle_North_A4_aerial_TR_ver93.mxd 07/07/2011 14:34

Wooloowin

Around Wooloowin station there are a range of potential local cycle links as well as a principal cycle link to the north-west, to Kedron Brook and Gympie Road. This would provide improved connectivity to the station from the north in particular.

Albion

Albion is at the cross roads of a range of future local and principal cycle links. Potential local improvements include new pedestrian connections to the east of the station in conjunction with the Mill development.

Bowen Hills

A wide range of future local pedestrian upgrades are envisaged as part of ongoing development around the station, under the Bowen Hills Urban Development Area (UDA) plan, as shown in **Figure 5-20**. This includes potential new road (including pedestrian links) to the south-west of the station, as well as new plazas and shared zones. Possible future cycle links include facilities on Abbotsford Road and O'Connell Terrace.

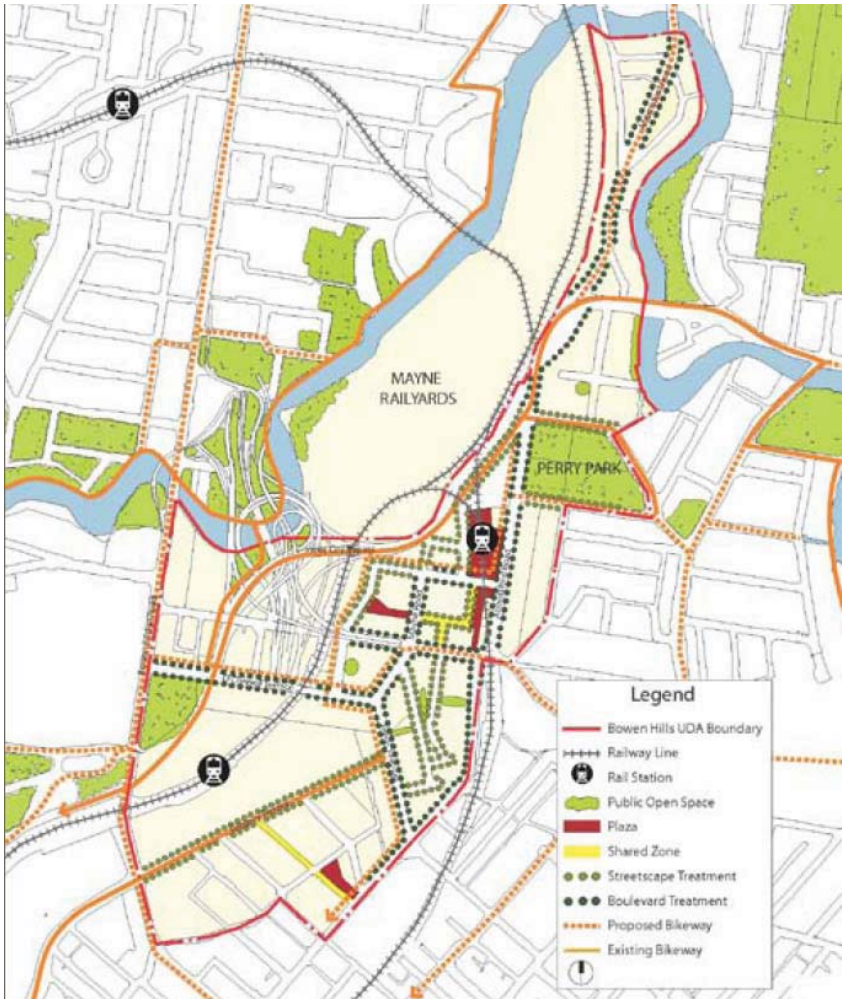


Figure 5-20 Future proposed pedestrian links around Bowen Hills station

Exhibition

Major changes to access are proposed as part of the RNA redevelopment surrounding Exhibition station including new internal pedestrian and cycle links open most of the year (except during the Royal Queensland Show – the "Ekka"). These proposed changes are illustrated in **Figure 5-21**.

The most strategic new link proposed runs from Bowen Park near the RBWH in the north-west corner of the site to St Paul's Terrace in the south-eastern corner, across Gregory Terrace. A new pedestrian spine is also proposed in the north-east linking the site to the corner of O'Connell Terrace and Brooke Street and onwards to Bowen Hills station. Additional external cycle links are also proposed including enhance cycle infrastructure on O'Connell Terrace, Bowen Bridge Road and Gregory Terrace.

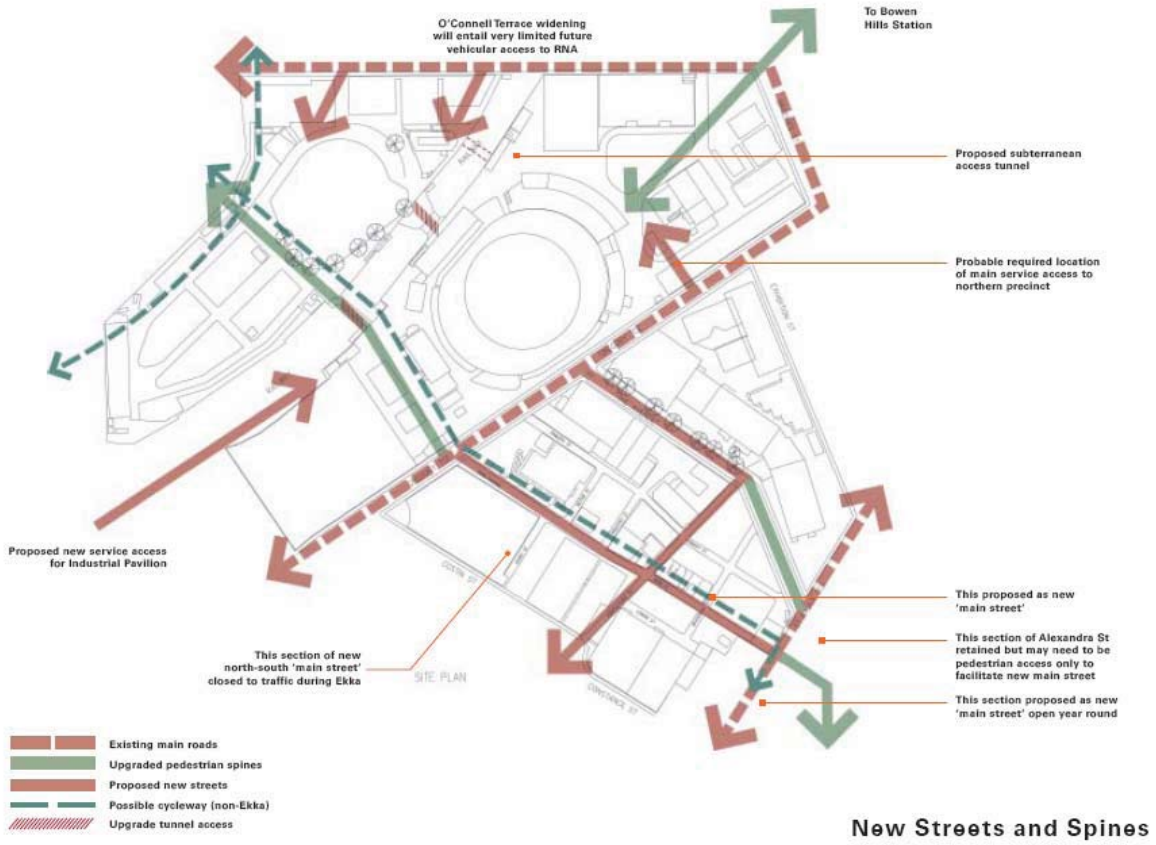


Figure 5-21 Future planned pedestrian and cycle links around Exhibition Station

5.7.2 Future pedestrian and cycle operations at rail stations – Central

Potential future pedestrian and cycle network changes in the central part of the study corridor are shown in **Figure 5-22**.

Key changes to the pedestrian and cycle links in the central study corridor envisaged on current strategic planning documents include:

- a future new bridge over the Brisbane River linking lower Edward Street to Kangaroo Point
- enhanced cycle infrastructure on Ann Street
- enhanced cycle infrastructure on William Jolly Bridge
- new cycle infrastructure on Main Street/ Ipswich Road.

None of the above are currently committed projects with funding and the implementation dates are as yet unknown.

In addition to the above major new infrastructure changes, the most significant change in cycle operations in the central study corridor is likely to result from the CityCycle bicycle hire scheme. Stage one opened in late 2010 with stage 2 planned for 2011. When complete, the scheme will offer up to 2,000 bicycles from over 150 stations from Newstead to West End and Toowong.

LEGEND

Rail Crossings - Existing

- Ped/Cycle
- Vehicles and Ped/Cycle
- Existing Bikeway
- Future Local Bikeway
- Future Principal Bikeway
- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-22

Future Pedestrian/Cycle facilities (Central Section)

0 0.25 0.5 0.75 1 km

1:20,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G077_CCR_Trans_Future_Ped_Cycle_Central_A4_aerial_TR_ver93.mxd 07/07/2011 14:33

Brisbane Central

No major changes to pedestrian infrastructure are proposed around Central station with only minor changes to footpaths and crossing timings anticipated. Possible future cycle improvements along Ann Street and Edward Street are proposed in the Principal Cycle Network Plan for South Eats Queensland but the form and likely implementation timing of these proposals is as-yet unknown.

Roma Street

Possible local changes to pedestrian and cycle access exist as part of Brisbane City Council's Roma Street Boulevard project – one of 12 key demonstration projects in Brisbane City Council's City Centre Master Plan (2006). This scheme could involve reduction in traffic lane capacity and improved pedestrian walking environment such as widened footways and additional crossing opportunities.

Woolloongabba

The Woolloongabba area is destined for significant change and redevelopment with numerous changes to pedestrian and cycle links proposed, including (refer to **Figure 5-23**):

- new pedestrian and cycle connections along the northern side of Stanley Street extending under the Pacific Motorway to the west of the site
- new cycle connections north-south on the eastern side of the current Leopard Street.
- new signalised intersection with Vulture Street mid way between Leopard Street and Main Street providing an opportunity for mid-block crossing by pedestrians.

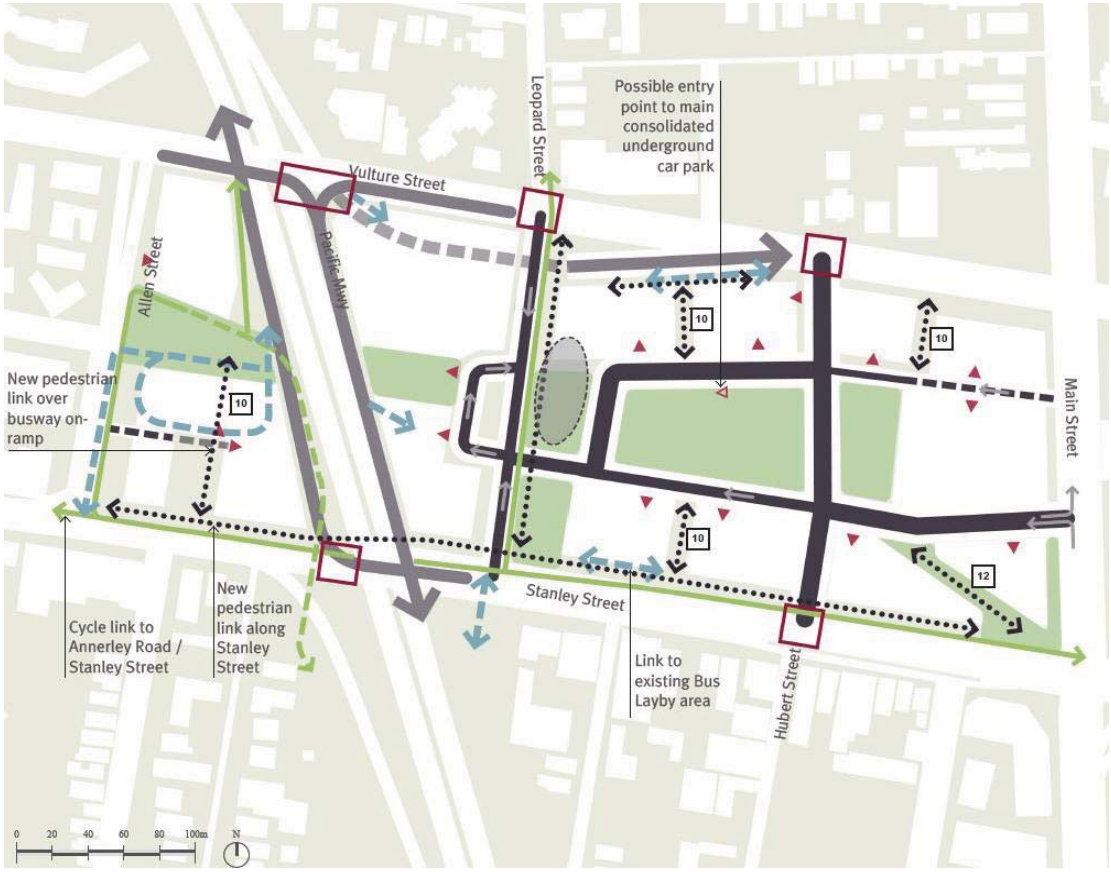


Figure 5-23 Proposed access plans as part of Woolloongabba UDA Development Scheme

(Source ULDA, 2011)

Park Road/ Boggo Road

There are no further changes to pedestrian access envisaged around Park Road Station, as part of the Boggo Road Urban Village or through other plans or projects. The road network and crossings now completed and in operation to the south of the station are not likely to change in the future.

5.7.3 Future pedestrian and cycle operations at rail stations – South

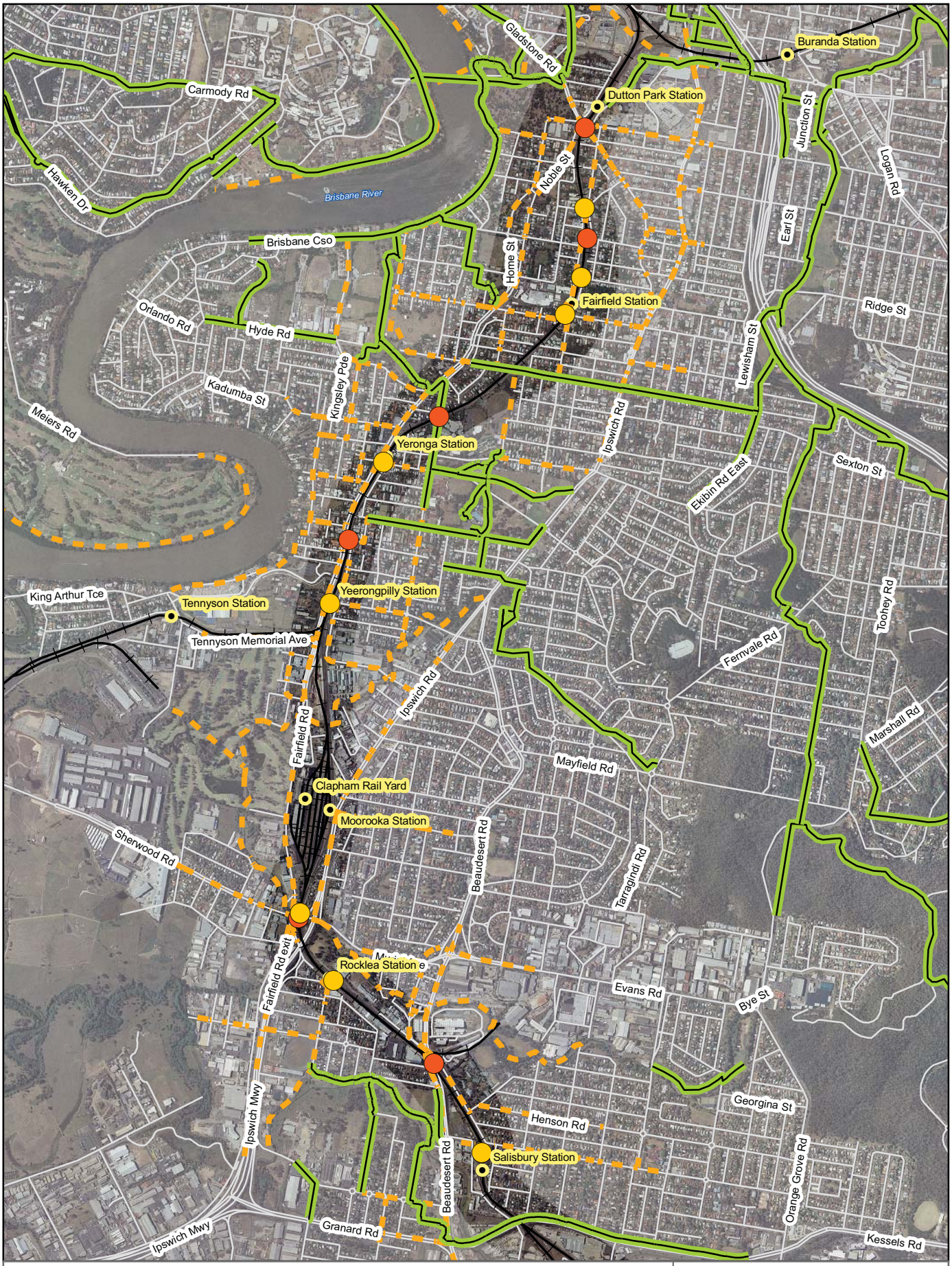
Key changes within this part of the study corridor include:

- a proposed principal cycle route along Fairfield Road
- a proposed principal cycle route along Ipswich Road and Beaudesert Road
- a range of local cycle links.

Possible future changes to the pedestrian and cycle network in the southern part of the study corridor are shown in **Figure 5-24**.

There are currently no major changes proposed at the following station precincts:

- Dutton Park
- Fairfield
- Yeronga
- Moorooka
- Rocklea
- Salisbury.



LEGEND

Rail Crossings - Existing

- Ped/Cycle
- Vehicles and Ped/Cycle
- Existing Bikeway
- Future Local Bikeway
- Future Principal Bikeway
- Station
- Track
- Road

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-24

Future Pedestrian/Cycle facilities (Southern Section)

0 0.25 0.5 0.75 1 km

1:30,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G077_CCR_Trans_Future_Ped_Cycle_South_A4_aerial_TR_ver93.mxd 06/07/2011 15:24

Yeerongpilly

At Yeerongpilly station a new pedestrian bridge has recently been constructed over Fairfield Road to the west of the station linking directly into the station footbridge.

To the west of Fairfield Road, is a major new redevelopment area on the site of the former Animal Research Institute, which is being master-planned by the Department of Infrastructure and Planning. A concept plan of development for this "Transit Oriented Development" or TOD was released in October 2010.

As illustrated in **Figure 5-25,** this includes a range of new pedestrian and cycle paths through the TOD site including a pedestrianised east-west spine (dashed red line).

Figure 5-25 Yeerongpilly TOD – Concept Plan of Development, Department of Infrastructure and Planning

5.8 Regional, arterial and local road network

5.8.1 Regional road network and performance

Growth and change in vehicle trips across the Brisbane area are reported in **Table 5-46**. This shows a forecast overall increase in daily vehicle trips of approximately 47% by 2031, with growth in commercial vehicles slightly lower.

Table 5-46 Forecast changes in vehicle trips in Brisbane metropolitan area without Cross River Rail

24H	2009	2021	2031
Total person trips by all motorised modes (car and public transport)	6,700,600	8,283,782	9,259,900
Total person trips by car	5,533,200	7,009,803	7,771,700
Car/light vehicle trips	4,015,600	5,237,458	5,937,200
Commercial vehicle trips	367,600	414,672	523,000
Total vehicle trips	4,383,200	5,652,130	6,460,200
% growth in vehicle trips compared to 2009	-	29%	47%

Source: Cross River Rail Project Model

Between 2009 and 2021, a range of new road projects have or are forecast to open, including Clem7, AirportLink and NorthernLink – see **Figure 5-26**. These regional road network changes lead to reductions in traffic on some routes such as the Story Bridge, Milton Road, Kingsford Smith Drive, Lutwyche Road and Sandgate Road and increases on other routes including the Pacific Motorway, Western Freeway, Gympie Road and Stafford Road. This is illustrated in **Figure 5-27**.

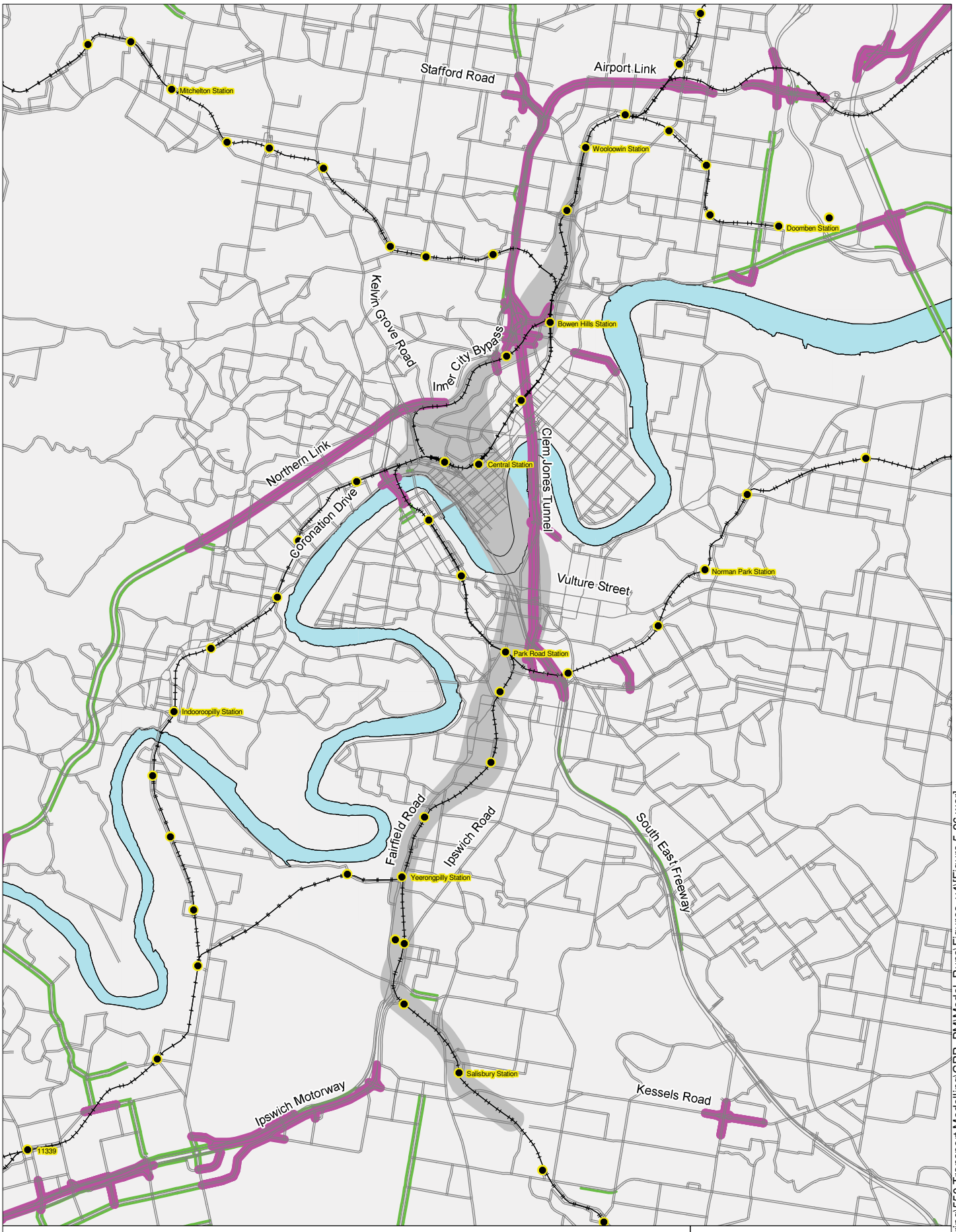
The performance of the road network in peak hour despite the above projects is expected to worsen between 2009 and 2021, with volume/over capacity ratio in excess of 0.9 on larger parts of the Pacific Motorway, Ipswich Motorway, Gympie Road, Old Northern Road and Beaudesert Road as shown in **Figure 5-28**.

Between 2021 and 2031, there are smaller changes to the road network as illustrated in **Figure 5-29**. Volumes on the regional road network have increased on several routes within the study corridor including the Pacific Motorway, Clem7 tunnel, Ipswich Road, Fairfield Road, The Inner City Bypass and AirportLink as shown in **Figure 5-30**.

Road conditions have further worsened in the morning peak period between 2021 and 2031 particularly on the Gateway Motorway southbound, Ipswich Road northbound and the Clem Jones Tunnel northbound as seen in **Figure 5-31**.

Traffic volumes on the inner city river crossings of the Go Between Bridge, William Jolly Bridge, Victoria Bridge, the Captain Cook Bridge, the Clem Jones tunnel and the Story Bridge are forecast to increase from a combined two way average AM peak volume of 46,000 vehicles in 2009 to 60,000 in 2021. By 2031 the traffic volume using these river crossings is forecast to reach approximately 69,000 vehicles per day.

This equates to an increase in demand of 30% over the 12 years between 2009 and 2021 (or around 2.5% per annum) but only 15% in the 10 years from 2021 to 2031 (or 1.5% per annum) indicating growth in vehicle trips slowing as congestion worsens. As such there would be increasing congestion pressures on the road traffic network feeding the CBD, particularly from the south.



LEGEND

- New links
- Number of lanes change
- Railway network
- Railway stations
- Study Corridor

Model ID: CPM_2009_003 (2009) CPM_2021_013 (2021)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-26

Changes to Brisbane road network 2009 to 2021

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CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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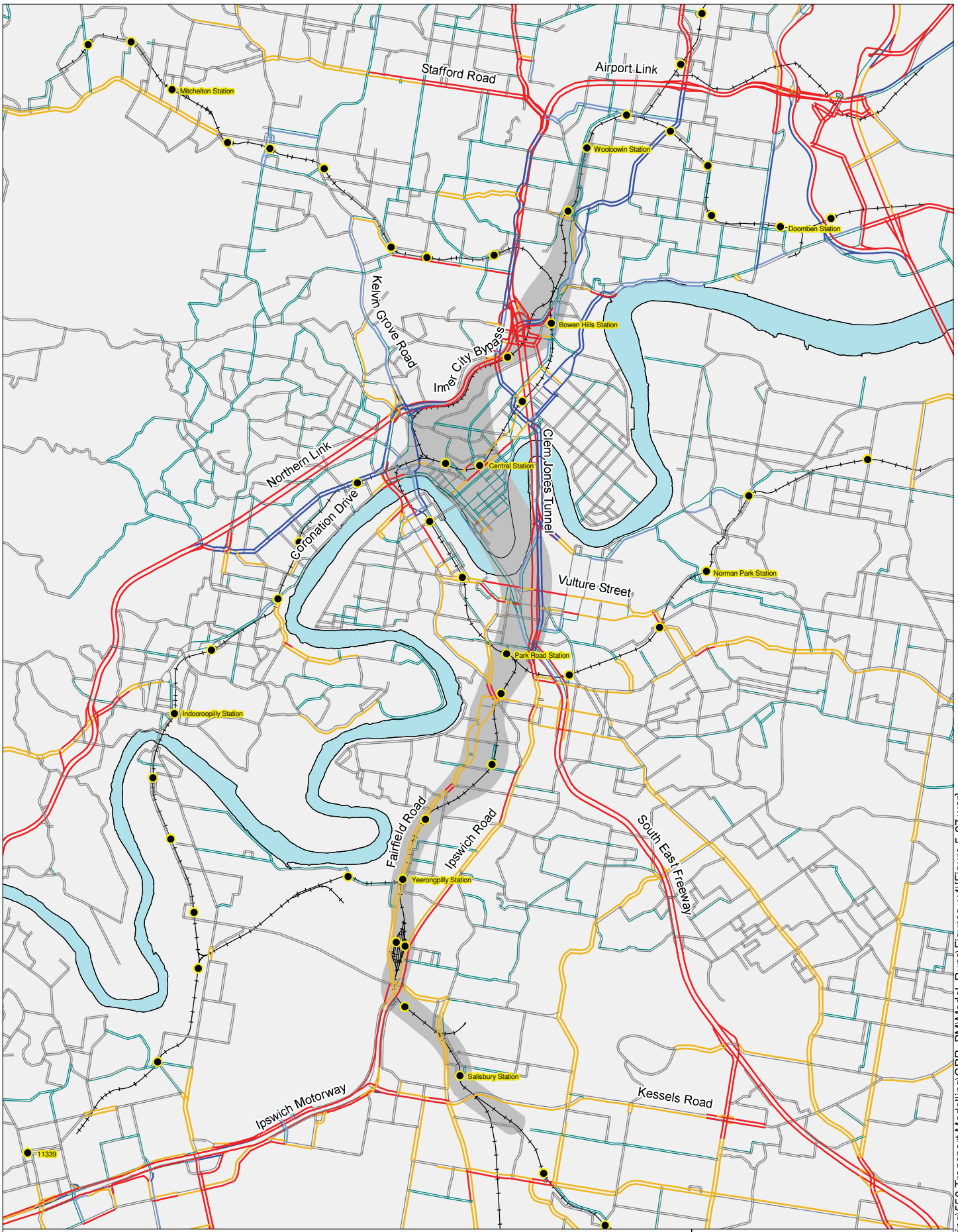

LEGEND

24hr vehicle volume difference

- > 5,000
- 2,500 to 5,000
- 0 to 2,500
- -2,500 to 0
- -5,000 to -2,500
- < -5,000

Study Corridor

Railway stations

Railway lines

Model ID: CRR_2009_020X (2009) CRR_2021_001X (2021)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-27

Forecast growth in vehicle travel demand in Brisbane - 2009 to 2021

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CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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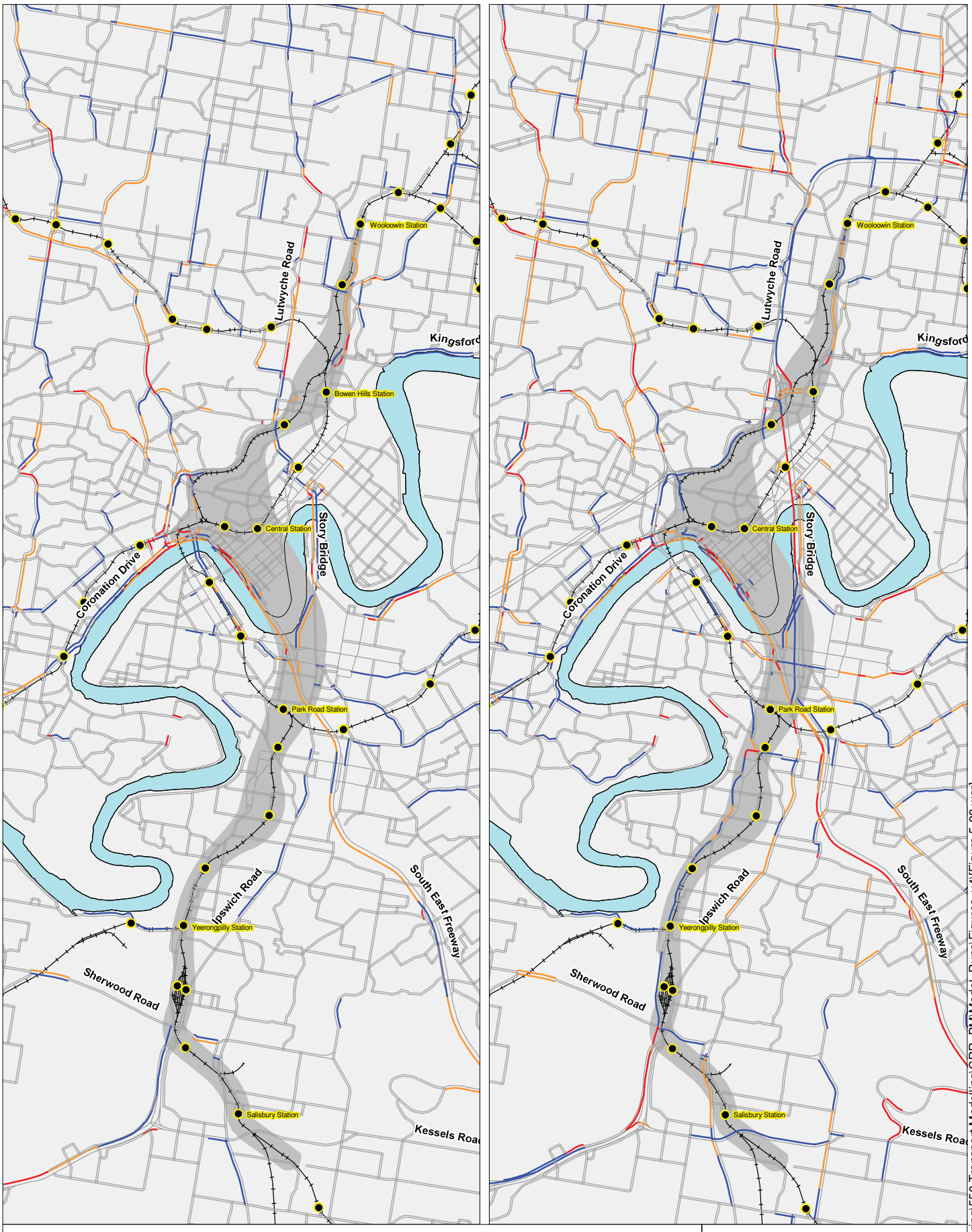

LEGEND

AM peak (2 hrs) v/c ratio

- > 1.00
- 0.90 to 1.00
- 0.75 to 0.89
- < 0.75

Study Corridor

Railway stations

Railway lines

Model ID: CRR_2009_020X (2009) CRR_2021_001X (2021)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-28

Forecast change in road traffic volume over capacity 2009 to 2021 morning peak period

N

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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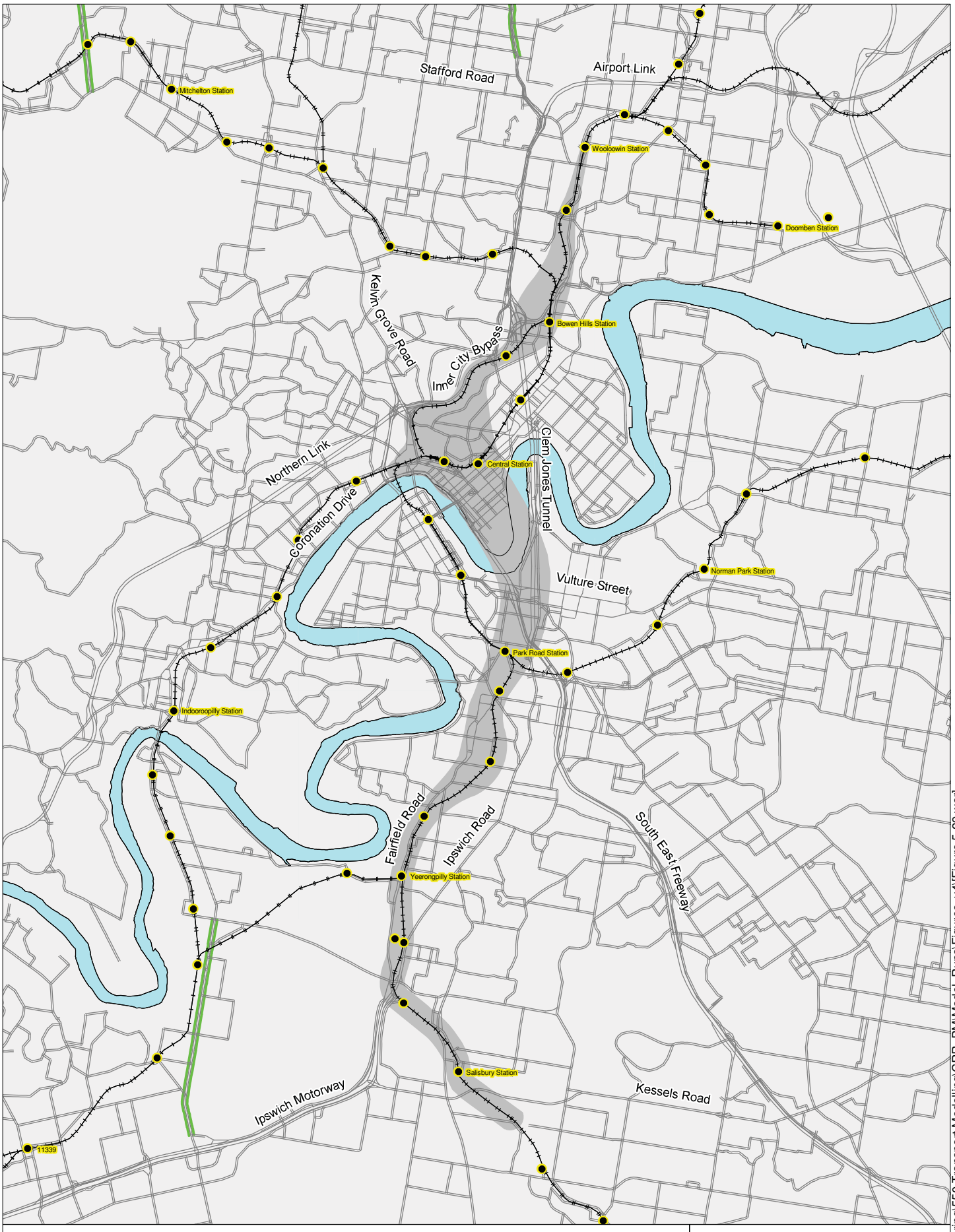

LEGEND

- New links
- Number of lanes change
- Rail network
- Railway stations
- Study Corridor

Model ID: CPM_2021_013 (2021) CPM_2031_104 (2031)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-29

Changes to Brisbane road network 2021 to 2031

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CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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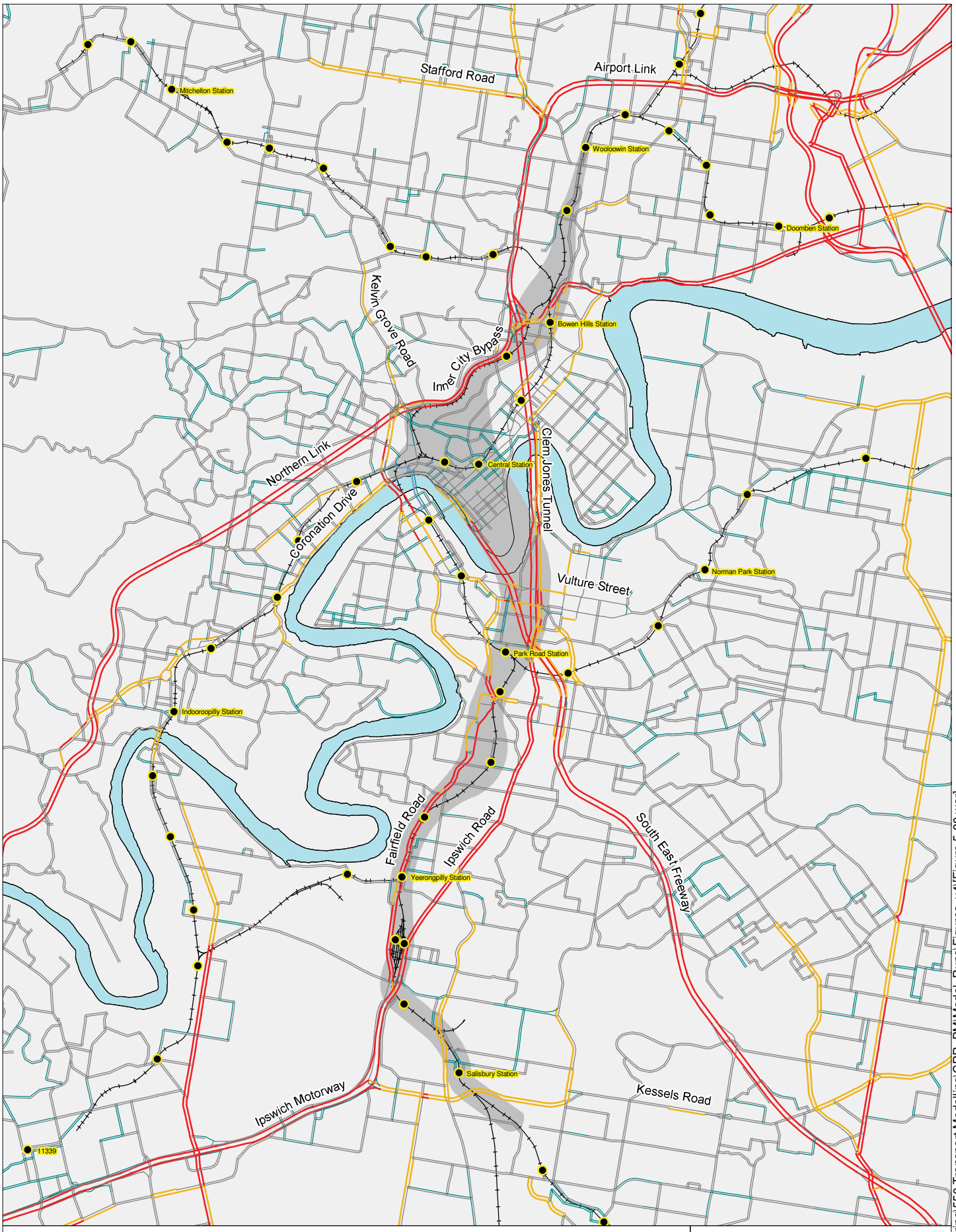

LEGEND

24hr vehicle volume difference

- > 5,000
- 2,500 to 5,000
- 0 to 2,500
- -2,500 to 0
- -5,000 to -2,500
- < -5,000

Study Corridor

Railway stations

Railway lines

Model ID: CRR_2021_001X (2021) CRR_2031_012X (2031)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-30

Forecast growth in vehicle travel demand in Brisbane - 2021 to 2031

N

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

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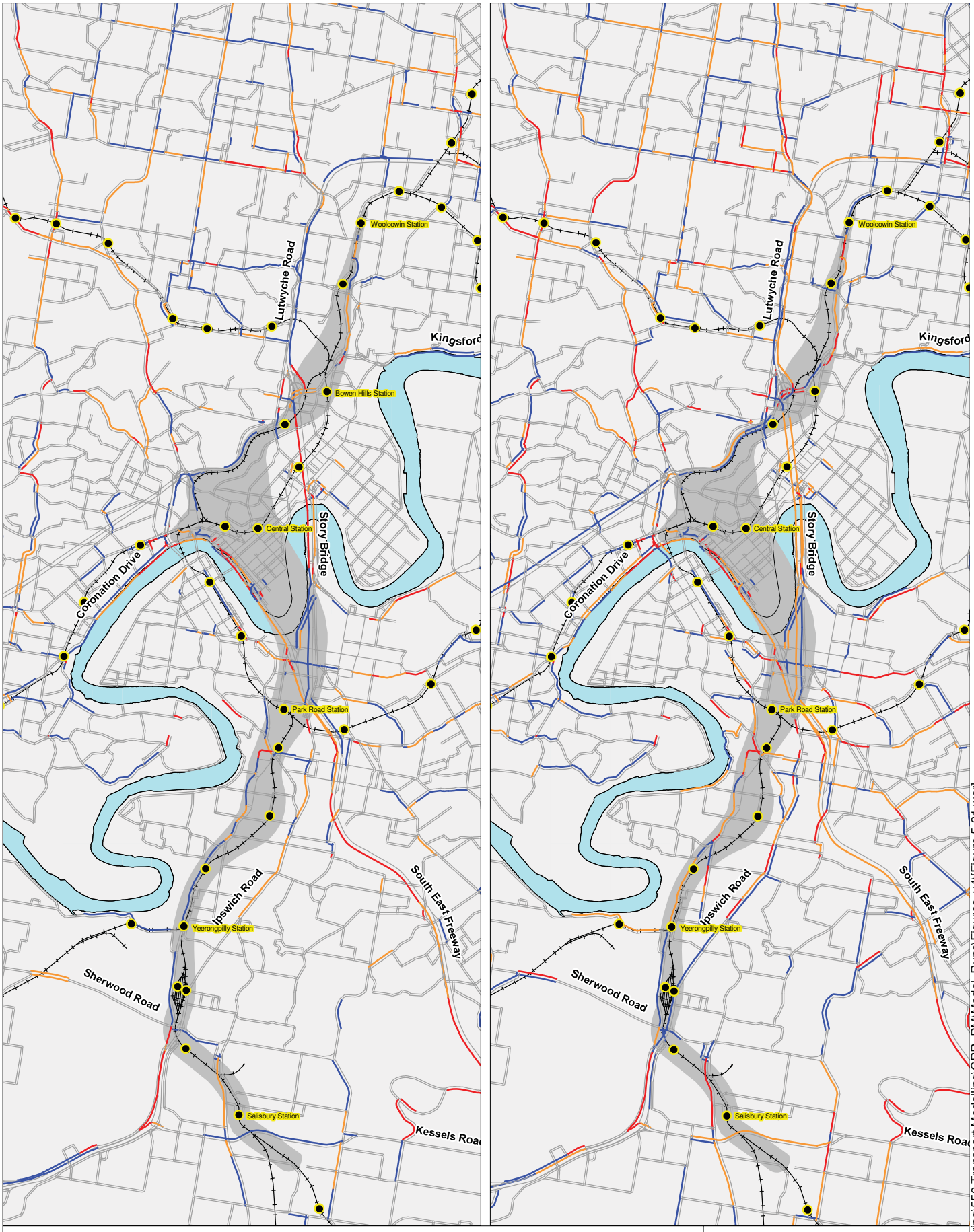
Year 2021 - without Cross River Rail

Year 2031 - without Cross River Rail



LEGEND

AM peak (2 hrs) v/c ratio

- > 1.00
- 0.90 to 1.00
- 0.75 to 0.89
- < 0.75

Study Corridor

Railway stations

Railway lines

Model ID: CRR_2021_001X (2021) CRR_2031_012X (2031)

CROSS RIVER RAIL
TRANSPORT TECHNICAL REPORT

Figure 5-31

Forecast change in road traffic volume over capacity 2021 to 2031 morning peak period

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

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5.9 Alternative rail operational options or network upgrades

The purpose of this section is to present an assessment of alternative rail operational configurations or network upgrades and the extent to which these alternatives may support or delay the need for the Project.

An assessment of such alternative rail operational configurations or network upgrades has been completed with the Project objectives and service requirements serving as key evaluation criteria. The Project objectives are to

- increase the capacity of existing public transport networks right across south east Queensland (SEQ) (addressing the service challenge)
- improve access to the inner city and provide more public transport choices (addressing the access challenge)
- promote a sustainable SEQ by reducing traffic congestion and pollution, supporting economic growth and helping the region develop in a way that maintains our lifestyle.

5.9.1 Background to the development of alternative options

Alternative rail options for the expansion of the South East Queensland suburban rail network could include:

- infrastructure to permit termination of heavy rail services at the edge of the inner city area and transitioning people to a different transport mode such as bus, light rail or metro
- expanding infrastructure to cater for growth in through-routing heavy rail services
- rail loop infrastructure.

A variety of heavy rail route options were identified and assessed throughout the prefeasibility and detailed feasibility stage of Cross River Rail. Together these two stages examined over 100 heavy rail options that consisted of a variety of through running and alternative heavy rail options.

The assessment of these broad options was carried out through the Inner City Rail Capacity Study. During this study 70 possible network concepts were identified and evaluated. A shortlisting process resulted in the top ten options being selected and evaluated in a multi-criteria analysis. After the multi-criteria analysis three preferred options were identified and taken forward to the detailed feasibility phase for the Project that examined potential heavy rail options under four streams of investigation:

- Inner City Rail Capacity Study options – this involved a review of the options from the Inner City Rail Capacity Study. This review generated an additional three options, providing a total of six options that were evaluated.
- straight line path – this involved development and refinement of the 2016 Inner City Rail Capacity Study option. The aim of this pathway was to refine the prefeasibility options in order to improve affordability and operational effectiveness. 15 options were identified and evaluated.
- challenge path – this involved an investigation of potential alternative options, outside of the constraints of the prefeasibility study. The aim of this pathway to determine if there were any alternative feasible heavy rail options to solve the inner city capacity problem. 20 options were identified and evaluated.
- rail loop option – this involved an investigation into a potential rail loop system. The aim of this study was to examine if a rail loop system would provide better affordability and operational effectiveness then the existing through running rail system.

These investigations were documented in the CRR EIS, **Chapter 3 Project Development**.

The assessment of this range of strategic heavy rail options led to the identification of two scenarios:

- the Cross River Rail Project alignment
- an alternative option that is regarded as a 'lower cost' alternative to the Project that seeks to improve inner city rail capacity by alleviating pressure on key network choke points

Additionally, potential non-asset alternatives were investigated and assessed as part of the detailed option analysis, leading to the identification of a further option. This Minimal Enhancement option is comprised of a range of operational initiatives (with some potential minor infrastructure enhancements) designed to derive additional performance and capacity from the existing system.

This following sections present an assessment of the minimal enhancement option and the alternative alignment option.

5.9.2 Minimal enhancement option

A Minimal Enhancement Option has been investigated to examine if operational or minor infrastructure enhancements could maximise use of existing rail infrastructure and potentially defer the need for major rail network capacity enhancements. The Minimal Enhancement Option is not considered a viable long term option to address project objectives, but rather it is seen as an important mechanism to defer major rail network improvements until the preferred solution can be funded and constructed.

The Minimal Enhancement Option was developed through analysis of previous studies, and key transport planning objectives:

Rail Assessment of Capacity Alternatives Study (RACAS)

A range of measures proposed in RACAS (DTMR 2008) have been agreed among stakeholders and included in the development of the Minimal Enhancement Option as essential to achieve the theoretical CBD maximum capacity of 84 trains per hour (2 way). This includes:

- Mayne stabling moves (removing conflicting crossing movements at Roma Street)
- platform passenger management (improved information and on-platform assistance to reduce dwell times)
- XPT train paths – remove, relocate or re-time the southbound AM departure from June 2011
- headway optimisiation on the Merivale Bridge.

The following network infrastructure improvements were also been identified as necessary to improve system performance and allow trains to be presented reliably to the inner city network paths. As such they have been included in the Minimal Enhancement Option:

- Lawnton to Petrie third track (with Petrie 4th platform included)
- Coomera to Helensvale duplication
- signalling upgrades from Ormeau to Beenleigh and duplication of single line sections on the Cleveland corridor to allow further service increases on these lines
- Cleveland stabling, to offset the need for a Park Road grade separation in the short term, without Cross River Rail. Services would move out of these stabling locations in the off-peak to remove a similar crossing move through Park Road junction in the afternoon peak.

Subsequent to RACAS, the development of further Minimal Enhancement Option elements included consideration of key objectives and measures such as to:

- increase the line capacity of existing tracks (eg signalling enhancements and consistent stopping patterns)

- increase the passenger capacity of existing lines (including higher capacity trains and platform extensions
- increase the use of infrastructure throughout the day by spreading demands.

Each potential solution to achieve the above objectives is further discussed below.

Improved timetabling and service planning

A key component of better utilising the infrastructure in the rail network is simplification of the current timetable. The current peak period timetables have many variations to routes and stopping patterns primarily to try to cater for variations in travel patterns but also in response to expected passenger load profiles ensuring services are not stopping when the train is full. This can however be confusing to passengers.

Queensland Rail and TransLink are currently undertaking a major restructure of the entire rail timetable for implementation in 2011. This will seek to:

- reduce the overall number of routings and repeat regularly
- provide consistent stopping patterns for express and all stops services - For the Ipswich line this is likely to involve replacing 12 difference peak period stopping patterns with just 4.
- ensure express services are dedicated to longer distance routes only
- remove express running on shorter services
- allow for all stops services sweeping behind express services on common lines.

The timetable restructure will also achieve full sectorisation with the network divided into 2 independent sectors at all times.

Increased shoulder peak services

The new timetables being developed above by TransLink and Queensland Rail would allow for additional services in the shoulder peak periods, where infrastructure capacity is more readily available. The provision of extended peak services has minimal impact on track capacity for passenger services and has lower rollingstock requirements than adding new peak hour services – for example operating a longer peak period provides more opportunities for rollingstock to operate a second peak direction service. This approach is intended to induce behaviour change over time, by providing a consistently high level of service for a longer period of time; passengers may be encouraged to travel earlier or later than they currently do.

Higher capacity rollingstock

Connecting SEQ2031 proposes higher capacity rollingstock on the network with proposed UrbanLink high frequency “metro-style” services on shorter routes with ExpressLink and intercity CoastLink services on longer routes.

Ultimately, UrbanLink “metro-style” rollingstock would be expected to provide capacity for around 1200 passenger per 6-carriage train compared to 928 for the current fleet, through removal of some seats and greater standing space. Such trains would then be dedicated to shorter routes. Higher capacity on longer distance trains would be achieved through longer trains (9 car sets).

However such changes to the network to accommodate longer trains require major platform lengthening works to be undertaken over a number of years and as such this is considered a longer term option, post CRR. As such, new longer or reconfigured rollingstock are not part of the Minimal Enhancement Option.

Next generation signalling

Railway systems around the world are moving away from line-side (track-side) signalling towards next generation of signalling which uses in-cab communication systems to display the "proceed' authority to the train driver.

An initial assessment of the Next Generation Signalling (European Train Control System or ETCS Level 2) could increase train throughput from 23 to 26 trains per hour (each direction) on the Suburban Lines and 19 to 22 trains per hour (each direction) on the Main Lines – a 14% increase in capacity overall.

However Next Generation Signalling would not allow more than 23 trains per hour through the complex Park Road junction, it would take several years to develop, implement and test and comes at a significant cost ($500m +). While Next Generation Signalling would offer significant benefits for the wider rail network in the longer term, it would have little or no impact on the key capacity problems to be addressed by Cross River Rail. As such, it is not considered a short term solution and not part of the Minimal Enhancement Option.

Conclusion

The preferred Minimal Enhancement Option therefore includes:

- removing some peak Mayne Stabling movements
- dwell time management (active platform management)
- alternative train path for the southbound XPT to Sydney in the AM peak
- headway optimisation on the Merivale bridge
- improved timetabling and service planning including increased shoulder peak services.

Rail operational modelling concluded that the combination of these measures is expected to extend the life of the network to around 2020 at which time implementation of Cross River Rail would be required. However, if investment in Cross River Rail is deferred beyond this time, the next option to consider would be the reconfiguration of rollingstock seating for shorter distance lines to address chronic overcrowding on key inner segments of the network.

5.9.3 Alternative option

The Alternative Option outlined below is regarded as an option that seeks to improve inner city rail capacity by alleviating pressure on key network choke points. This option does not attempt to address the full range of project objectives.

Alternative option – rail operations

The Alternative Option seeks to unlock inner city capacity by alleviating pressure on the following three existing network capacity choke points:

- Merivale Bridge – all services from the south currently merge together between Park Road and South Brisbane to operate as one corridor across the Merivale Bridge, restricting peak growth in this corridor
- Merivale Junction – all western corridor services currently merge together at this junction to operate on a single corridor through the inner city, restricting peak growth in this corridor
- existing inner city stations – the capacity of existing inner city stations is limited and is expected to start impacting on service growth by the time service levels reach 23 trains per hour in either direction on the suburban lines, or 19tph in either direction on the main lines.

To address these constraints, long-distance Southern corridor services (the Gold Coast Line) are rerouted via the Tennyson loop to connect with long-distance Western corridor services (the Ipswich Line). Grade separation is required at the junction of the Tennyson loop with both the Gold Coast Line at Yeerongpilly and the Ipswich line at Corinda.

The Gold Coast services would operate on a new pair of tracks through the Roma West junction on the western side, and diverge on the other side of this junction. Western services stop at Roma Street station, and then enter a new tunnel via Central that connects to the Exhibition Loop, whilst Gold Coast services run straight onto the Exhibition Loop and connect to the new tunnel in a clockwise loop through Central (with a new platforms at Central North in addition to the existing platforms) and Roma Street stations. An indicative layout of the new loop through Central Station is shown in **Figure 5-32.**

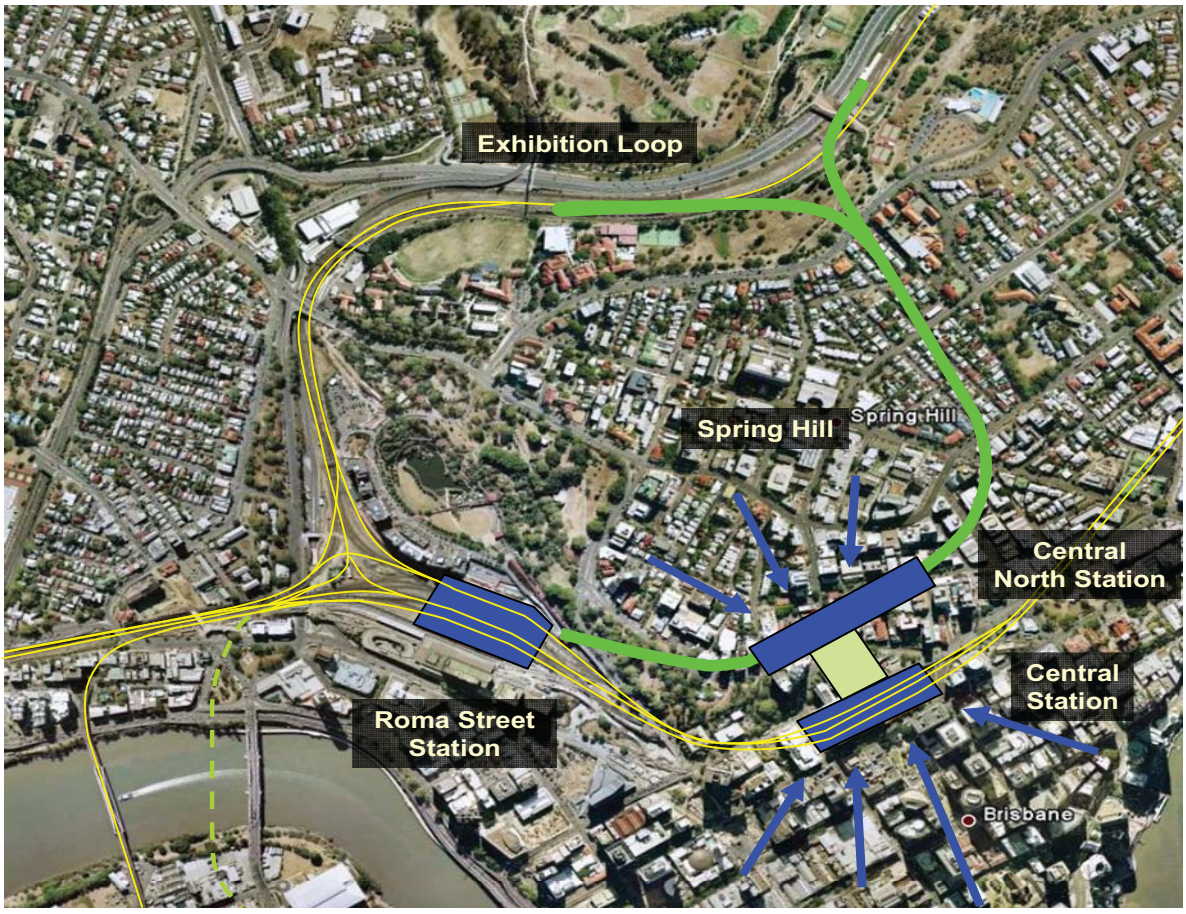


Figure 5-32 Alternative alignment in Brisbane CBD

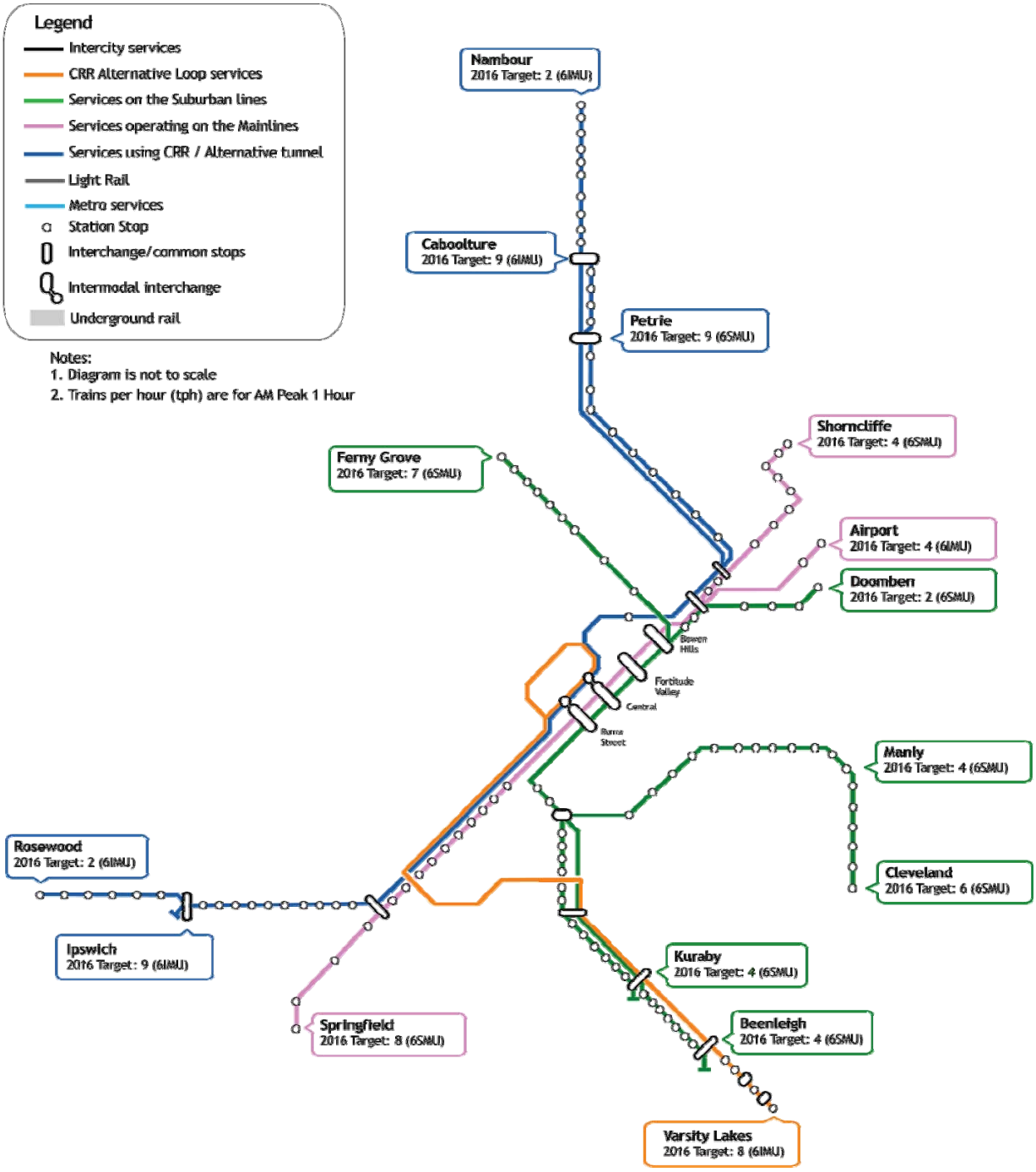
Service plans were developed for this option using 2016 demand forecasts from the Inner City Rail Capacity Study, a rolling hour average load service planning principle, and current morning peak two hour demand profile. These service plans are shown in **Figure 5-33**.

Sectorisation in the Alternative Option does is similar to the Without Project case. It is important to note that:

- Beenleigh services continue to be routed through the Park Road junction and across the Merivale bridge
- Gold Coast services loop back on themselves in the inner city and thus no longer form a through connection to another line.

Off-peak operations also change significantly, and the arrangement results in an unbalanced off-peak operation, requiring many services to turn back in stabling. (Systemwide, December 2010).

The alternative alignment option has operational complexity due to increased crossing conflicts which lead to unreliability, delays and reduced line capacity.



Alternative option – patronage forecast

The Cross River Rail Project Model was used to produce patronage forecasts for the alternative alignment option for 2031. These forecasts were compared to the Without Project case. Compared to the Without Project case in 2031 the alternative option shows an increase of over 4% to 551,900 total daily rail patronage in the Brisbane Metropolitan Area.

Table 5-47 presents a summary of comparative forecasts with the Without Project case for the morning and evening peak periods in 2031.

Table 5-47 Forecast rail usage in the Brisbane Metropolitan Area of the alternative option compared with the Without Project case – average morning weekday peak period 2031

AM peak	2031		
	Without Project case	Alternative alignment	% change
Total rail passenger kilometre	3,404,600	3,774,700	10.9%
Total rail passenger hours	82,300	89,100	8.3%
Total rail patronage	141,900	158,600	11.8%
Average rail trip length (km)	24.0	23.8	-0.8%
Average rail trip time (min)	34.8	33.7	-3.1%
Average rail trip speed (km/h)	41.36	42.4	2.4%

The tables shows that total passenger kilometres, hours and patronage would all be between 5% - 10% greater for the Alternative Option compared to the Without Project case, although the average trip length (both in kilometres and minutes) would not change by any significant margin.

Table 5-48 Boardings and Alightings by TransLink Zone number – average morning weekday peak period 2031

TransLink Transit Authority Zone	2031		
	No CRR	Alternative alignment	% change
1 - Boarding	18,200	21,000	15.38%
1 - Alighting	101,200	118,300	16.90%
2 - Boarding	28,800	35,100	21.88%
2 - Alighting	20,500	21,800	6.34%
3 - Boarding	17,100	16,100	-5.85%
3 - Alighting	10,200	8,000	-21.57%
>3 - Boarding	108,000	111,400	3.15%
>3 - Alighting	40,200	35,400	-11.94%

The alternative alignment option in 2031, compared to the Without Project case, delivers 17% more passengers to the Brisbane inner city (around 118,300 rail passenger alightings in the TTA zone 1 in the two hour morning peak period) (refer to **Table 5-48**).

However, the alternative alignment option does alter rail patronage and change the distribution of passenger alighting within the CBD as follows in 2031:

- Over 30% additional rail passengers being delivered to the CBD in the alternative alignment compared to the Without Project case. This is a total of almost 77,000 total passenger alightings at Roma Street and Central Station (includes new station infrastructure at Central).
- Almost no change in final rail passenger alighting at Roma Street Station (18,300 compared with 17,900 morning peak period passengers).
- A great increase in the number of passengers at Central Station due to the additional station infrastructure of 58,000 final alighting rail passengers compared to 40,000 passengers in Without Project case in 2031. This number of passengers would increase the pressure on pedestrian infrastructure around Central Station.
- The alternative alignment option does not enhance access to trip attractors or generators within the inner city that are currently not serviced by rail, in particular the lack of a new station in the heart of the Brisbane CBD.

The alternative alignment option does provide relief to rail passenger crowding on the Gold Coast Line due south of Yeerongpilly and over the Merivale Bridge. This is illustrated in **Figure 5-34** that clearly shows relief to crowding south of Salisbury and from Salisbury to Yeerongpilly during the 2031 morning peak period. North of Yeerongpilly some passengers would be standing despite the crowding relief.

Alternative alignment option – stakeholder issues

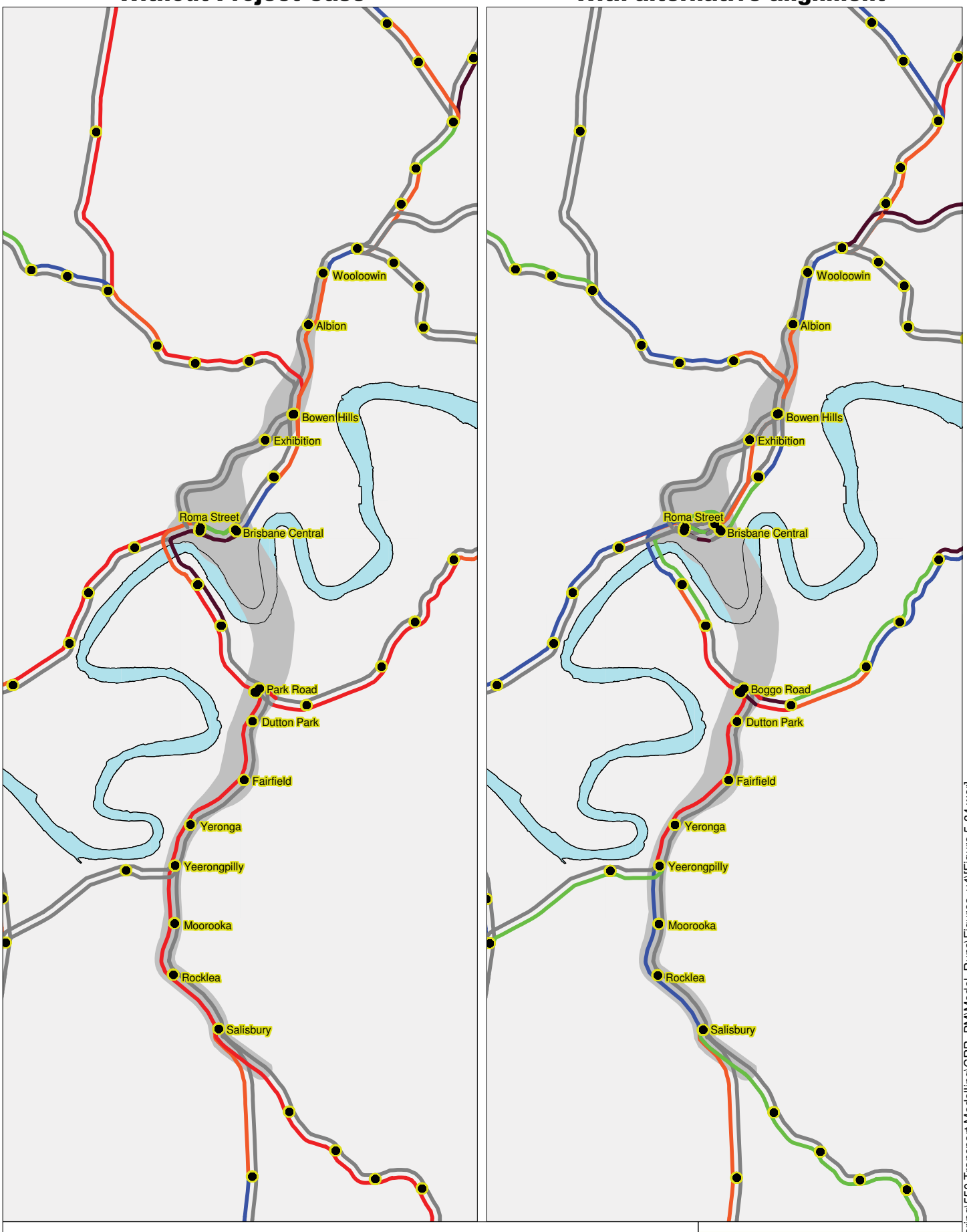
A range of significant stakeholder issues arose throughout the development of the Alternative Option. Most notable of these issues are:

- Queensland Rail and TransLink Transit Authority have questioned the viability of the option in terms of delivering any real network performance benefits
- sustainability of combining the two strongest growth corridors (Gold Coast line and Ipswich line) into one
- impacts on passenger and freight services during construction may be considered to be unacceptable.

Alternative alignment option – conclusion

The analysis of the Alternative Option, as outlined above, has highlighted a number of significant issues associated with the option. Key issues include:

- operational complexity (increased crossing conflicts which lead to unreliability, delays and reduced line capacity)
- while increasing patronage to the Brisbane CBD during this option has the inability to enhance access to trip attractors or generators within the inner city that are currently not serviced by rail, in particular the lack of a new station in the heart of the Brisbane CBD
- potential constructability and property resumption issues.



LEGEND

AM peak (2 hrs) seat load factor (v/c ratio)

- > 1.50
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- < 0.50

Study Corridor

Railway stations

Model ID: CPM_2031_104 (Without) CPM_2031_095 (2031AA)

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TRANSPORT TECHNICAL REPORT

Figure 5-34

2031 morning peak period rail load factors for the without Project Case and the alternative alignment option

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CrossRiverRail

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