4. Future transport conditions without the Project

This chapter outlines the forecast changes in transport conditions and performance between the base year of 2012 and the future modelled years – 2021 and 2031.

4.1 Modelled transport network and operation assumptions

Key assumptions incorporated into the BaT Project Model include growth in public transport fares, parking charges and road tolls, growth in the value of time as well as strategic transport network improvements. Details of these assumptions are contained in **section 2.2**.

The rail, bus and road network infrastructure for future years is based on current TMR and local government project commitments. A full description on key project inclusions and exclusions is shown in **section 2.2** but in summary, includes infrastructure projects currently under construction; infrastructure projects programmed in QTRIP; Queensland Rail (Transport Services Contract) funded projects and committed Brisbane City Council strategic road projects.

For this assessment, assumptions on key future rail transport projects include:

- by 2021, track duplication from Coomera to Helensvale; and rail stabling improvements
- by 2031, third track from Kuraby to Loganlea; track duplication from Beerburrum to Landsborough; and Clapham Yard stabling improvements.

Other key transport network planning projects within the Brisbane Statistical Division assumed to be completed:

- a range of new busways/ transitways by 2021, including the Old Cleveland Road transitway, Gympie Road transitway to Chermside and an extension of the South East Busway to Underwood
- several key motorway and arterial corridor projects by 2021 – the recent Pacific Motorway upgrade to 8 lanes through removing the transit lanes between Mains Road and the Gateway Motorway; Centenary Motorway upgrade to 6 lanes (Moggill Road to Toowong); Ipswich Motorway (Rocklea to Darra) upgrade to 6 lanes; Kingsford Smith Drive upgrade: Wynnum Road corridor improvements; and projects under construction such as the Legacy Way toll tunnel and the Gateway Motorway upgrade south of Deagon to 6 lanes.

For this assessment public transport service changes and policy assumptions incorporated in the modelling include:

- improved train and bus frequencies and modified rail and bus service plans over time. These have been developed consistent with TransLink service planning policy, supporting the transit infrastructure initiatives and including measures to encourage peak spreading of demand and establish simpler stopping patterns
- increase in public transport fares in line with the Consumer Price Index (CPI) beyond 2014.

4.1.1 Future rail service plans without the Project

Possible service plans for the future base case scenario without the Project were developed for 2021 based on the above service planning policies and infrastructure assumptions. In 2031, service plans developed for the scenario without the Project are aimed at meeting demand as much as possible using available capacity.

The proposed service plans without the Project for AM peak one hour in 2021 and 2031 are shown in **Figure 4-1** and **Figure 4-2** respectively.

Sectors have been assumed to be fundamentally similar to the current situation. The two sectors which are assumed to operate by 2021 in the base case (without the Project) are:

- **Suburbans sector** (shown as green on **Figure 4-1**), which would cater for half of the network including the Gold Coast, Beenleigh and Cleveland lines in the south, and the Ferny Grove, Shorncliffe, Airport and Doomben lines in the north.
- **Mains sector** (shown as pink on **Figure 4-1**), which encompasses Rosewood, Ipswich and Springfield services (in the west) and Kippa-Ring, Caboolture, Landsborough and Nambour services (in the north). The sector would have services travelling through the existing inner city via the Main lines.

Table 4-1 summarises the train service levels feasible for the peak hour, based on these service plans.

Table 4-1 Forecast morning peak one hour trains – without the Project

	2012	2021 without Project	2031 without Project
Trains from the south/ west	35	44	44
Trains from the north	35	39	41
Total	70	83	85

In 2021, the morning one hour peak (the busiest of the two peak periods), provides for 39 trains per hour on the northern approach to the CBD, with 20 trains per hour on the western approach and 24 trains per hour on the southern approach. In total, 83 train movements per hour are expected through the CBD (two-way) in the morning peak hour in 2021 (compared to 70 in 2014). In 2021, this total of 24 train movements in the morning peak hour period across the Merivale Bridge is considered to represent the maximum capacity of the southern part of the inner city rail network.

In 2031, peak hour train movements increase slightly to 41 trains per hour from the north but remain at capacity as 24 trains per hour from the south and 20 trains per hour from the west. This would provide the maximum possible total of 85 trains per hour through the CBD. Between 2021 and 2031 a change in rolling stock (known as New Generation Rolling Stock) is proposed. These new trains would have capacity for 480 seated passengers and a total capacity of 750 passengers.

The assessment of the operational performance of the without Project rail network and service provision scenario to cater for forecast future demand for rail travel is described in **section 4.4**.

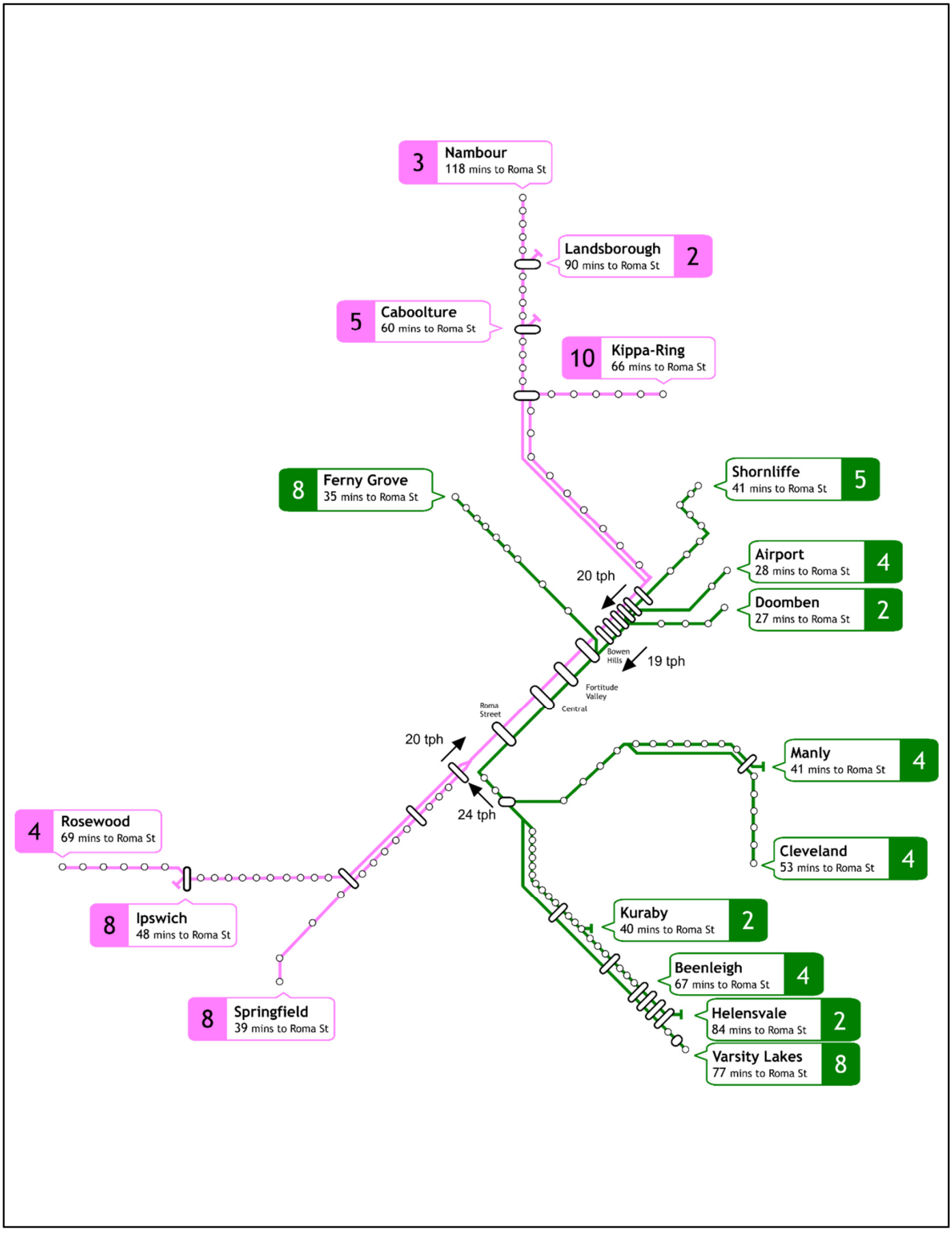

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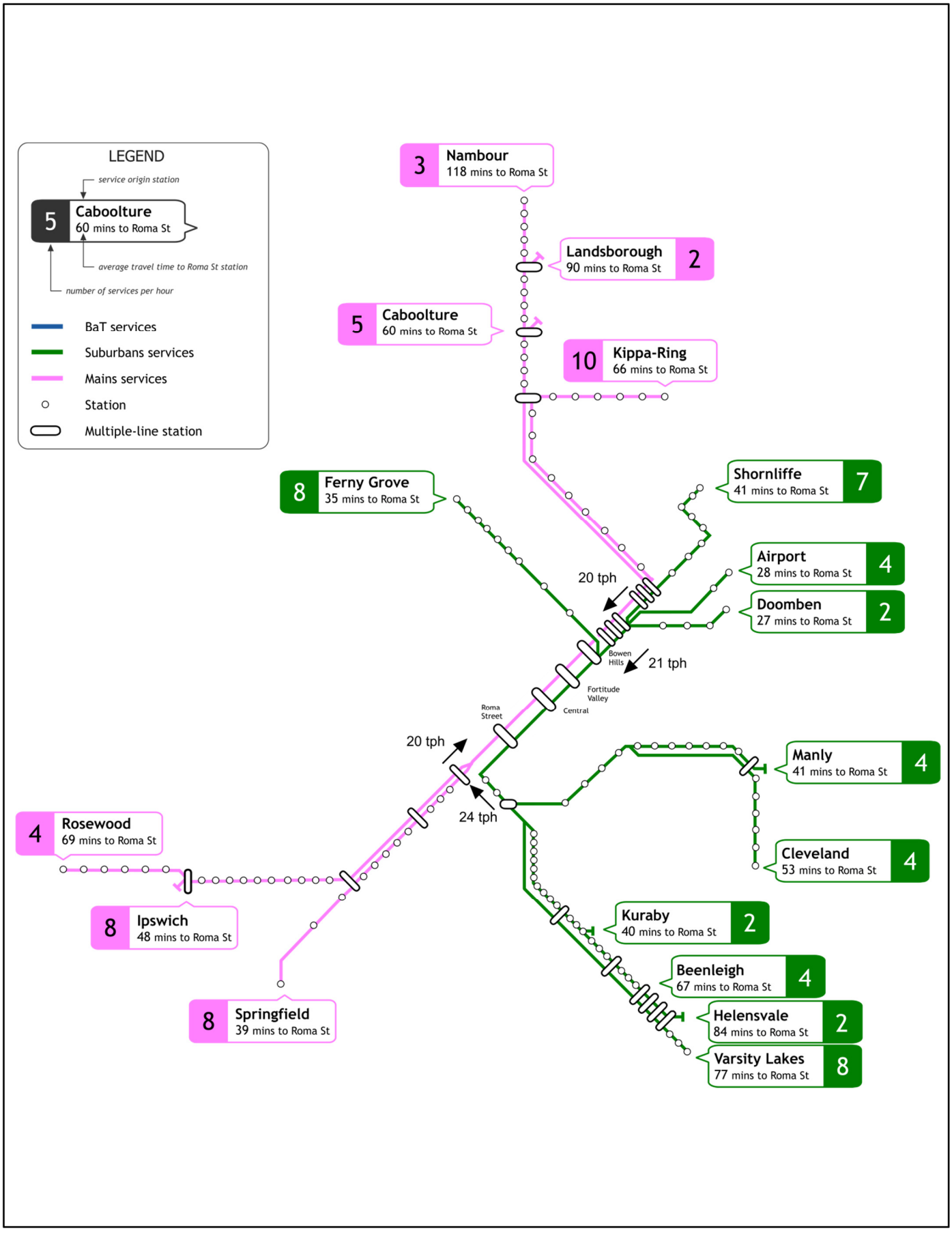
FIGURE 4-1

Overview of 2021 rail service plan – morning one-hour peak without the Project



BUS AND TRAIN PROJECT
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FIGURE 4-2

Overview of 2031 rail service plan – morning peak one hour without the Project

Future bus operations without the Project

The two main growth markets for buses within the primary metropolitan service area are inner-city distribution and suburban commuting. As the South East Busway and Victoria Bridge are already at-capacity, limited growth in services would be possible on these parts of the network in the without Project case. Accordingly, to accommodate some growth in inner-city distributor services without the Project, it would be necessary to remove some bus services from the Victoria Bridge to make space for new distributor routes. On this basis, the proposed without Project strategy would be to divert selected north-side services to terminate within the Parliament precinct instead of at the Cultural Centre. These services would no longer use the Victoria Bridge which would allow for some growth of inner-city distributor services.

All other growth in metropolitan scale commuter services would need to be achieved by growing the volume of peak period 'Rockets' using the Captain Cook Bridge. This would place considerable pressure on the Allen Street intersection, the Captain Cook Bridge, the northbound Riverside Expressway exit ramps and kerb-space along accessible streets within the city centre. There is no room for additional peak 'Rocket' services to be added to Elizabeth Street. Consequently, growth of services would need to be directed to Margaret Street and Alice Street. This would significantly increase the number of bus services in these streets, offering a sub-standard service where buses are delayed in congestion.

Table 4-2 describes the key assumptions that have been made for the without the Project scenario bus operational plan.

Table 4-2 Key project-level bus operations assumptions without the Project

Topic	Assumption
Infrastructure and network improvements by 2020	Infrastructure considered necessary to enable the CBD bus network to operate in 2020: • Widening of the Melbourne Street busway tunnel portal • Banning of the right turn for general traffic from North Quay onto the Victoria Bridge • Amending the Platform Screen Doors at King George Square busway station Infrastructure assumed to be in place by 2020 to facilitate the efficient operation of the bus network includes the following: • Gympie Road Transitway (Kedron to Chermside) • Old Cleveland Road Transitway (Coorparoo to Carindale) • Chermside Bus Station and layover • Depot improvements • Fleet expansions Mary Street bus/ pedestrian link, between George Street and William Street. This is necessary for on-street CBD distribution bus routes to be able to serve on-street related to a Southern CBD bus corridor as identified for investigation within Council's CBD masterplan. Queen's Wharf Road – It is assumed that Queen's Wharf Road will be available for buses to lay-over and to access to QSBS.
Network Design	Capacity constraints such as RBWH and Buranda Busway stations have been considered at a high level only. Further network modelling, design and interchange/ wayfinding strategies will be required to ensure these locations do not become system bottlenecks

Topic	Assumption
Fleet	Performance characteristics have been assumed per the current fleet of 12.5m, 14.5m, and 18m vehicles
Bus capacity	As per current operational practices for existing fleet, 65 seated and standing passengers per bus has been used as the maximum load.
Layover	Additional hold-up areas and layover space close to the city centre will be essential to enable a reliable and operationally efficient network.
Bus station boardings	It is assumed that inner-city bus stations will be pre-paid only, with off-board validation and with passengers being able to board via any door of the vehicle. The policies and systems necessary for this are currently under investigation by TransLink

4.2 Future transport demand without the Project

Forecast growth in weekday travel demand across Brisbane is shown in **Table 4-3**. The highest percentage growth forecast is expected to occur in public transport trips, with over double the number of trips forecast for 2031, compared to 2012. Vehicle trips are anticipated to grow at a slower rate, increasing by 42 per cent between 2012 and 2031.

A change in mode share to public transport from car trips is forecast from seven per cent of all weekday person trips in 2012 to 10.8 per cent in 2031.

Table 4-3 Growth in travel demand in the Brisbane Statistical Division without the Project

Parameter	2012	2021	2031
Total person trips by all modes	7,165,000	8,890,000	10,348,000
Total person trips by car	5,860,700	7,099,900	8,148,300
Percentage growth in person trips by car (on 2012)	-	21%	39%
Public transport person trips	503,000	836,100	1,115,600
Percentage growth in public transport trips (on 2012)	-	66%	122%
Public transport mode share (of all motorised person trips)	7.0%	9.4%	10.8%
Total rail patronage (24 hour)	214,500	395,500	558,000
Percentage growth in rail patronage (on 2012)	-	84%	160%
Total bus patronage (24 hour)	248,800	381,300	496,600
Percentage growth in bus patronage (on 2012)		53%	100%
Total vehicle trips*	4,695,000	5,755,800	6,680,100
Percentage growth in vehicle trips (on 2012)	-	23%	42%
Pedestrian and cycle trips	801,300	954,000	1,084,100
Percentage growth in pedestrian and cycle trips (on 2012)		19%	35%
Pedestrian and cycle mode share	11.2%	10.7%	10.5%

** Note: Weekday travel. Includes commercial vehicle trips*

Source: BaT Project Model

Travel to the Brisbane CBD and inner Brisbane is expected to be increasingly met by public transport modes, with minimal growth in vehicle trips, as shown in **Figure 4-3**.

Rail is expected to cater for a greater number of trips, as well as a greater proportion of all trips to the CBD, by 2031 compared to 2012, primarily due to the demographic growth profile forecast for the region. Growth in bus trips to the CBD would be constrained. Car travel to the CBD is expected to plateau at around 40,000 person trips in the morning peak period as illustrated in **Figure 4-3**.

This change in mode share is due to a number of factors, including minimal changes in road capacity, as well as minimal increases in likely car parking availability in the CBD. Consequently, as the CBD continues to grow and provide more employment opportunities, the public transport mode share would increase. Restrictive car parking ratios mean that new commercial development will be reliant on public transport to cater for employee trips with less than one in ten workers in new office buildings in the CBD likely to have access to on-site car parking. This will lead to changes in mode share for journeys to work in the CBD over the coming decades.

Figure 4-3 illustrates a growth of 50 per cent in public transport travel from 2012 to 2031.

Figure 4-3 Morning peak period travel demand into the Brisbane CBD without the Project

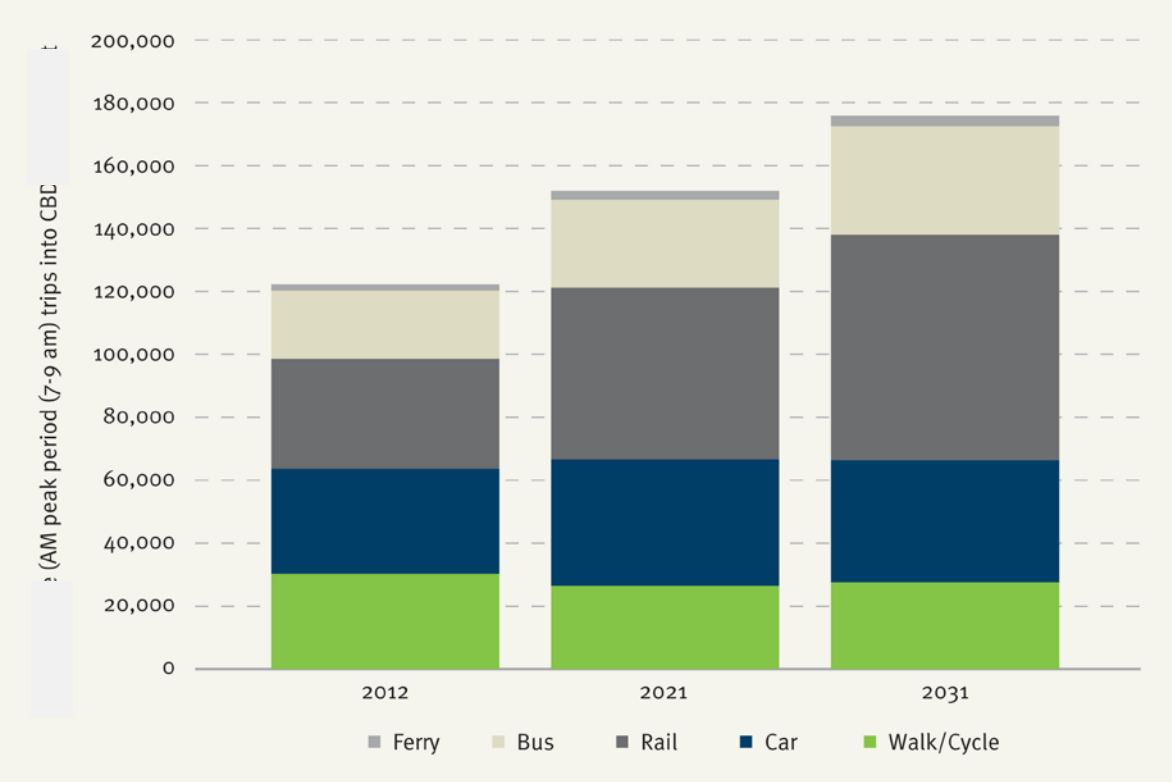


Table 4-4 shows the forecast growth in rail patronage in the region. Both peak period and daily rail trips are forecast to increase by more than double between 2012 and 2031. By 2031, over half a million daily rail trips are expected in the Brisbane metropolitan area. **Table 4-5** identifies forecast growth in bus travel between 2012 and 2031. Growth is also strong, with around twice as many peak period and daily bus trips forecast.

Table 4-4 Growth in rail travel in the Brisbane Statistical Division area without the Project

Time period	2012	2021		2031	
	Rail users	Rail users	Growth	Rail users	Growth
AM two hour peak (7.00am-9.00am)	59,500	104,900	76%	148,600	150%
PM two hour peak (4.00pm-6.00pm)	54,300	98,900	82%	143,600	165%
Daily	214,500	395,500	84%	558,000	160%

Source: BaT Project Model

Table 4-5 Growth in bus travel in the Brisbane Statistical Division without the Project

Time period	2012	2021		2031	
	Bus users	Bus users	Growth	Bus users	Growth
AM two hour peak (7.00am-9.00am)	58,000	88,800	76%	114,400	97%
PM two hour peak (4.00pm-6.00pm)	49,500	70,800	43%	91,300	84%
Daily	248,700	381,300	53%	496,600	100%

Source: BaT Project Model

4.3 Inner city bus and rail station passenger activity without the Project

4.3.1 CBD bus and rail station passenger activity

The significant increase in rail and bus patronage forecast across the metropolitan area that would result in increased peak period passengers using the inner city rail and bus stations is illustrated in **Table 4-6**.

By 2031, total passenger movements (boarding and alighting, including transfers) at key stations in the CBD and CBD fringe is estimated to almost double, growing by 88 per cent from 2012. The growth is stronger for rail movements, 137 per cent, compared to bus, with a growth of 38 per cent.

Table 4-6 AM peak two hour CBD and CBD fringe station activity without the Project

Mode	2012	2021		2031	
	Passengers	Passengers	% change from 2012	Passengers	% change from 2012
Rail	53,100	93,100	75%	125,800	137%
Bus	51,500	55,800	8%	71,300	38%
Rail and bus	104,600	148,900	42%	197,100	88%

Source: BaT Project Model

The forecast passenger activity (boardings, alightings and transfers) at rail stations and busway stations in the CBD without the Project for 2012 and 2031 is provided in **Table 4-7**. Across the CBD passenger activities at stations and bus stops would increase by over 80 per cent from 2012 to 2031. Increase in rail activity would more than double to over 88,000 boarding, alighting and transfer

movements at Roma Street Station and Central Station in the 2031 two hour morning peak period. Total bus passenger activity would increase by 38 per cent to over 50,000 boarding, alighting and transfer movements by 2031. The amount of bus passenger activity on the CBD streets would increase from 16,900 to 29,600 boarding, alighting and transfer movements by 2031.

Table 4-7 Forecast AM peak two hour period CBD station passenger activity without the Project

Station	2012	2021		2031	
		Without Project	% change from 2012	Without Project	% change from 2012
Roma Street rail	12,600	23,100	83%	42,500	237%
Roma Street bus	5,300	6,500	23%	8,900	68%
Roma Street total	*17,900*	*29,600*	*65%*	*51,400*	*187%*
Central - rail	27,400	46,100	68%	45,700	67%
QSBS - bus	4,300	3,000	-30%	4,300	0%
KGS - bus	10,300	7,300	-29%	8,100	-21%
CBD streets - bus	16,900	23,800	41%	29,600	75%
CBD Total Rail	40,000	69,200	73%	88,200	121%
CBD Total Bus	36,800	40,600	10%	50,900	38%
CBD Total	76,800	109,800	43%	139,100	81%

Source: BaT Project Model

Central Station

At Central Station, the existing arrangement of pedestrian infrastructure would not have sufficient capacity to accommodate forecast passenger volumes without the Project.

Central Station has an estimated capacity of around 43,000 passengers (boardings and alightings combined) in a two-hour period based upon the capacity of the existing pedestrian infrastructure including stairs, escalators and platform waiting space. This capacity limitation was factored into the Project Model.

Forecast demand would exceed this capacity by 2021 unless measures are put in place to 'cap' the usage of the station. Consequently, forecast growth in passenger use of Central Station is relatively low. A 'cap' on its use could occur through passengers avoiding use of Central Station in busy times by altering travel times, diverting to Roma Street Station or other modes. If required, for safety reasons for example, Queensland Rail could also manage the number of passengers that use the station.

Bus and rail station passenger activity at CBD fringe bus and rail station

The demand for passenger activity in the CBD fringe bus and rail stations of South Bank, South Brisbane, Cultural Centre, Mater Hill and Fortitude Valley would also significantly increase without the Project. **Table 4-8** illustrates this growth that would be due to more passengers walking into the CBD from these fringe stations and accessing new development within the CBD fringe area itself.

Table 4-8 CBD and CBD fringe station passenger activity (AM peak two hour period)

Station	2012	2021		2031	
		Without Project	% change from 2012	Without Project	% change from 2012
CBD					
Rail	40,000	69,200	73%	88,200	121%
Bus	36,800	40,600	10%	50,900	38%
CBD total	76,800	*109,800*	43%	*139,100*	81%
South Bank					
Rail	5,000	8,900	78%	13,400	168%
Bus	4,400	4,800	9%	6,500	48%
South Bank total	*9,400*	*13,700*	46%	*19,900*	112%
South Brisbane (rail)	3,100	6,500	110%	11,300	265%
Cultural Centre (bus)	6,500	5,800	-11%	7,300	12%
Mater Hill (bus)	3,800	4,600	21%	6,600	74%
Fortitude Valley (rail)	5,000	8,500	70%	12,900	158%
Total rail	53,100	93,100	75%	125,800	137%
Total bus	51,500	55,800	8%	71,300	38%
Total	104,600	148,900	42%	197,100	88%

Source: BaT Project Model

4.4 Future rail network performance without the Project

4.4.1 Forecast growth in rail use

Table 4-9 and **Table 4-10** show the forecast significant increase in use of the rail network 2012 and 2031 for daily and peak period trips respectively.

Over this period, total passenger rail kilometres and passenger rail hours would increase faster than rail patronage, indicating that longer average rail trip lengths and journey times are anticipated. Growth in daily, peak period and inter-peak use of the passenger rail network is strong. These increases in rail passengers, distance and time are expected to grow faster in the morning peak than across the overall weekday by 2031. The 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.

Table 4-9 Growth in daily rail usage in the Brisbane Statistical Division without the Project

Parameters for average weekday (24 hours)	2012	2021		2031	
		Forecast	% change from 2012	Forecast	% change from 2012
Rail passenger kilometres	4,462,400	8,581,400	92%	12,899,800	189%
Total rail passenger hours	110,700	212,900	92%	312,600	182%
Total rail patronage	214,500	395,500	84%	558,000	160%
Average rail trip length (km)	20.8	21.7	4%	23.1	11%
Average rail trip time (mins)	30.9	32.3	4%	33.6	9%

Parameters for average weekday (24 hours)	2012	2021		2031	
		Forecast	% change from 2012	Forecast	% change from 2012
Average rail trip speed (kph)	40.3	40.3	0%	41.3	2%

Source: BaT Project Model. Average weekday

Table 4-10 Growth in AM peak period rail usage in the Brisbane Statistical Division without the Project

Parameters for average weekday AM peak (7.00am to 9.00am)	2012	2021		2031	
		Forecast	% change from 2012	Forecast	% change from 2012
Rail passenger kilometres	1,192,300	2,239,400	88%	3,373,200	183%
Total rail passenger hours	30,000	55,200	84%	81,200	171%
Total rail patronage	59,500	104,900	76%	148,600	150%
Average rail trip length (km)	20.0	21.3	6%	22.7	13%
Average rail trip time (mins)	30.2	31.6	5%	32.8	9%
Average rail trip speed (kph)	39.8	40.6	2%	41.5	4%

Source: BaT Project Model

Demand for peak hour services

The Merivale Bridge that provides access to the CBD stations for trains from the south has a capacity of 24 trains per hour. **Table 4.11** provides a comparison of the demand for rail services from the south compared with the capacity. There is demand for an additional four services in 2021, rising to nine additional services in 2031. This exceeds the capacity of the Merivale Bridge.

Table 4.11 Demand for rail services without the Project compared with network capacity

	2014 timetabled service	2021	2031
Demand for services from the south	19	28	33
Supply for services from the south		24	24

Note: southern services are Gold Coast, Cleveland and Beenleigh lines

4.4.2 Rail network level of service - passenger crowding and reliability

An assessment of rail passenger crowding forecast without the Project was provided through the BaT Project Model that forecasts crowding over an average of the two-hour peak periods. **Figure 4-4** to **Figure 4-7** provide an overview of forecast crowding increases in key segments of the network for 2021 and 2031 in the morning and evening peak periods without the Project.

By 2021, the demand for rail use without the Project would be close to the capacity for train movements within the inner city network during peak periods. A 50 per cent increase in rail demand across the Brisbane Statistical Division in the morning peak is forecast between 2021 and 2031. The small increase in additional train services in 2031 (compared to 2021), would not be sufficient to cater for this scale of passenger demand increase, even with a shift in some demand for travel to the shoulder peak and off-peak periods and higher capacity rolling stock.

During the current morning peak periods passenger crowding is already experienced on the approaches to the Brisbane CBD. In the future years the degree of passenger crowding is forecast to increase significantly with each line becoming more crowded. Passenger crowding in 2031 would be greater than in 2021, on all key approaches to the CBD.

By 2021, load factors (line loadings expressed as a proportion of seated capacity) on all rail lines are forecast to increase substantially. The Beenleigh and Gold Coast lines, are forecast to have load factors of up to 125 per cent (25 per cent more passengers than the seated load capacity) on average across the entire two hour morning peak period. To the north crowding would be worse with load factors over 150 per cent on sections of the Ferny Grove line and the north coast line north of Eagle Junction. Load factors would be this high on average across the entire peak period with the peak of the peak more crowded.

By 2031 without the Project the degree and extent of crowding would worsen. The extent of crowding would extend beyond inner city stations on all rail approaches to the CBD such that load/ seat factors significantly over 125 per cent for the Gold Coast, Beenleigh, Cleveland and Ipswich lines along with most of the lines to the north of the CBD, particularly the Caboolture and Kippa Ring lines.

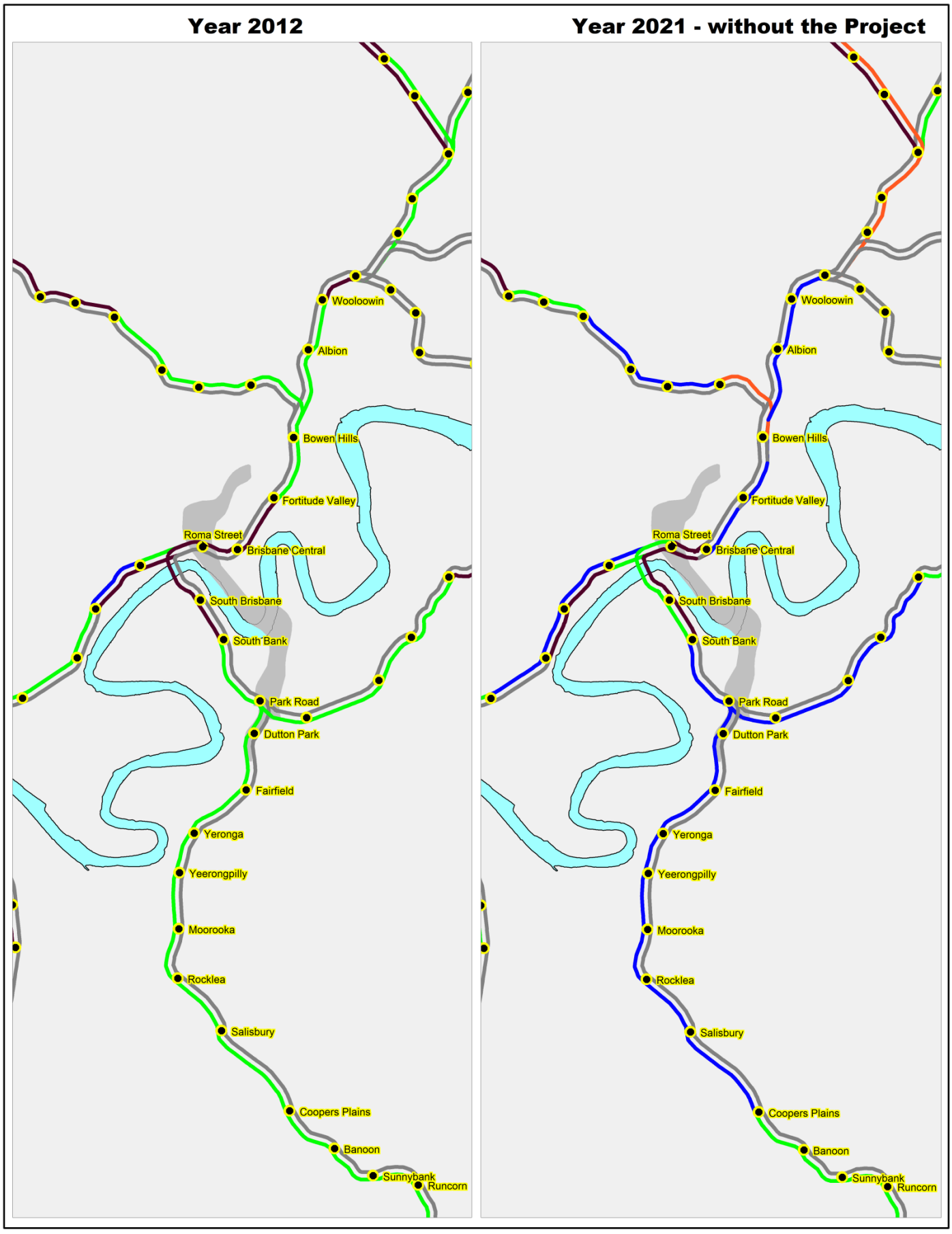
Table 4-12 shows the anticipated significant increases in time spent on crowded trains from 5,400 hours in 2012 to 55,200 hours in 2031 for an average weekday. This illustrates that the average time spent on crowded trains per passenger would increase from half a minute in 2012 to three minutes in 2031.

Table 4-12 Crowded time on trains without the Project for an average weekday

	2012	2021	2031
Additional crowded time (hours)	5,400	19,000	55,200
Average additional crowded time (minutes)	0.6	1.4	3.0

Source: BaT Project Model

The operational effects of a system at capacity would mean declining service levels and unacceptable delays as the system struggles during the peak and shoulder periods. Delays, such as the increased dwell times required for boarding and alighting in overcrowded conditions, have the potential to escalate into significant impacts across the network.



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

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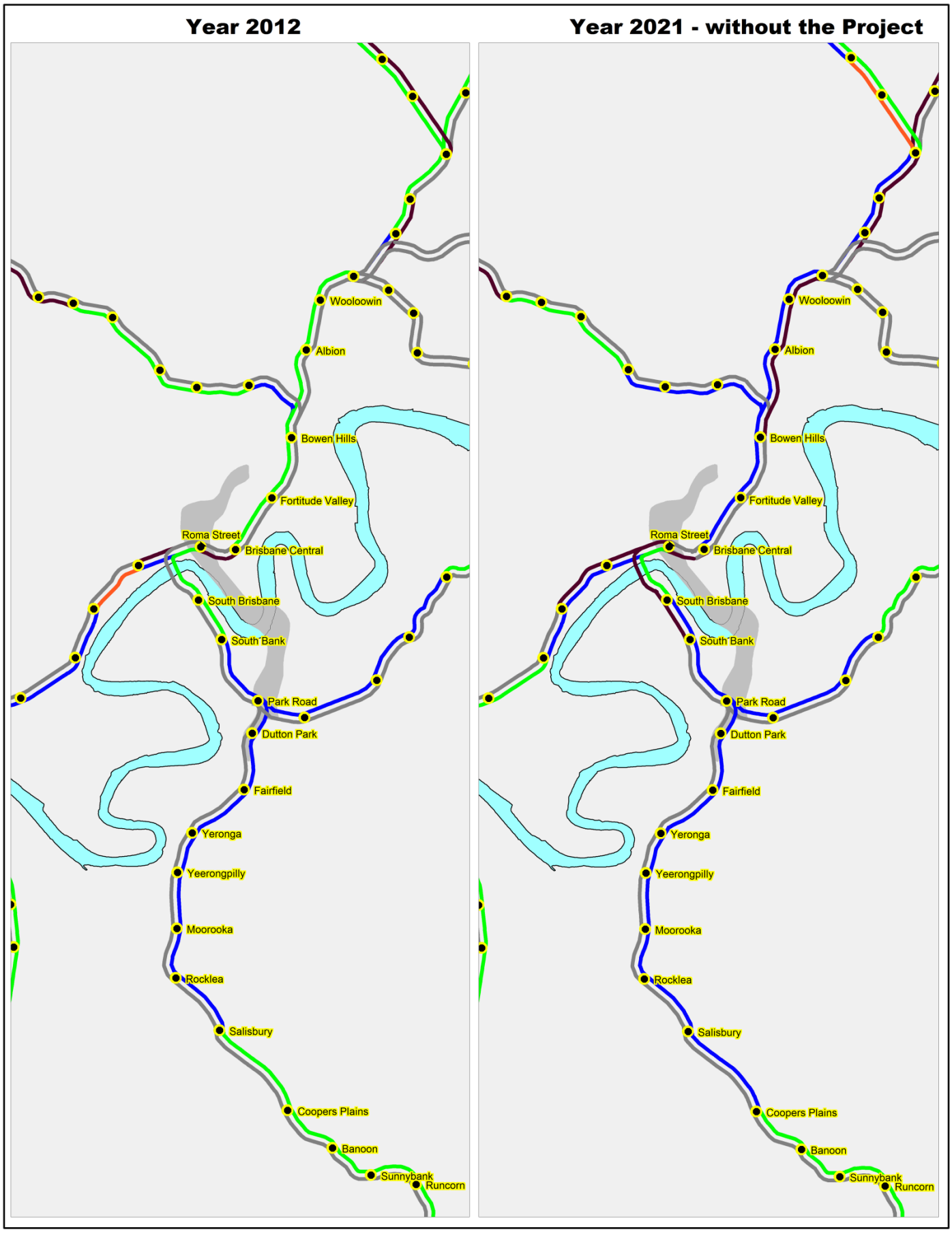
FIGURE 4-4

Rail load factors (AM peak) – 2012 and 2021 without the Project



LEGEND

PM 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

BUS AND TRAIN PROJECT
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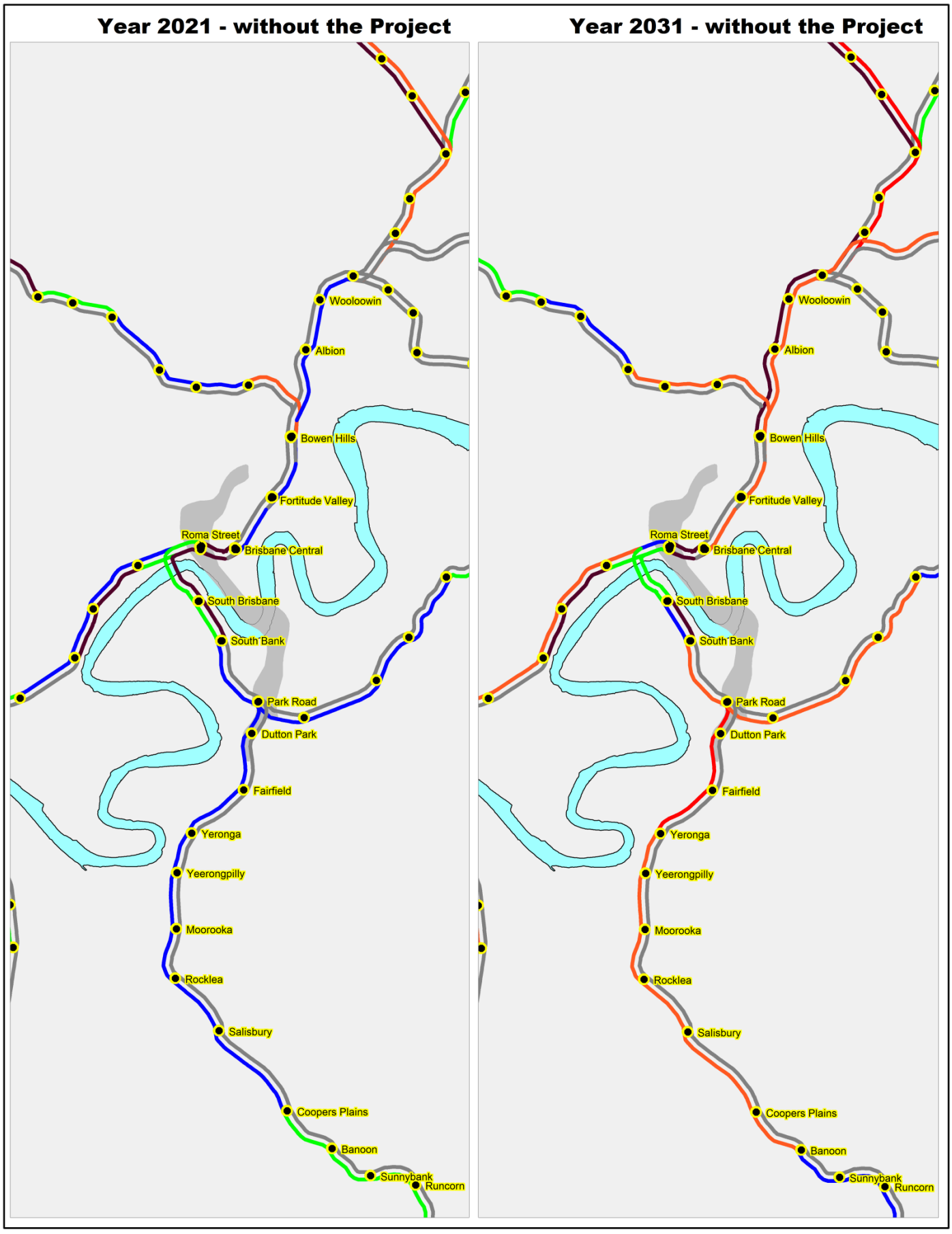
FIGURE 4-5

Rail load factors (PM peak) – 2012 and 2021 without the Project



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

BUS AND TRAIN PROJECT
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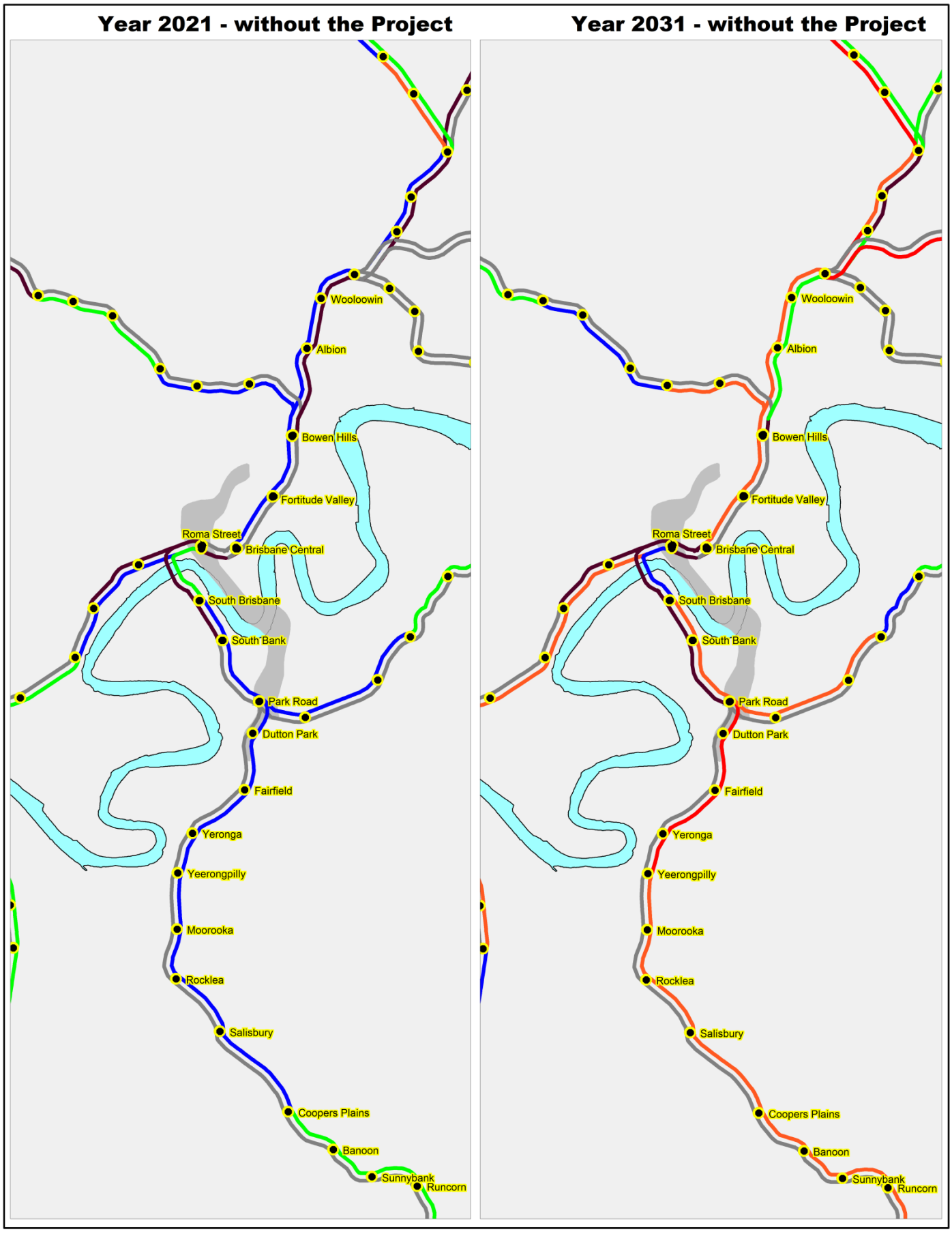
FIGURE 4-6

Rail load factors (AM peak) – 2021 and 2031 without the Project



LEGEND

PM 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

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 4-7

Rail load factors (PM peak) – 2021 and 2031 without the Project

4.4.3 Crowding on the Gold Coast line

Figure 4-4 and **Figure 4-6** illustrate that passenger crowding on the Gold Coast line currently occurs during the morning commuter peak periods. Without the Project, as the ability to provide additional services is restricted, crowding will significantly worsen in the future. Crowding from the northern lines also increases over time.

Table 4-13 illustrates the average number of passengers on a Gold Coast express service that would stand on a journey to the Brisbane CBD during the morning peak. For a seated train capacity of 480, on average around 130 passengers currently stand on each express service across the morning peak period from the Gold Coast for approximately 45 minutes with some passengers standing for a longer time. In 2031 this deteriorates to 184 passengers standing for approximately 45 minutes. By 2031 trains would be operating at capacity (480 seated and 250 standing passengers) for 24 minutes of the journey to Roma Street Station in the morning peak.

The introduction of semi express services from Helensvale in 2021 without the Project provides additional capacity for Gold Coast residents with associated crowding relief. Despite these additional services 50 passengers on average would be standing for 38 minutes on the journey to Roma Street Station.

Table 4-13 Gold Coast express trains – average time passengers stand without the Project

Location	Time to Roma Street (minutes)	2012		2021		2031	
		Passengers		Passengers		Passengers	
		Load	Standing	Load	Standing	Load	Standing
Beenleigh	46	614	134	478	0	664	184
Loganlea	38	645	165	530	50	717	237
Altandi	24	645	165	541	61	731	251
Yeerongpilly	15	645	165	541	61	731	251

Source: BaT Project Model

Note: Seated capacity of a train is 480

4.4.4 Crowding on all stop services from Beenleigh

Table 4-14 illustrates the average number of passengers on all stop services on the Beenleigh line that would stand on a journey to the Brisbane CBD during the morning peak period. These services are forecast to be operating close to the seated capacity of 480 passengers in both 2012 and 2021 as they depart Yeerongpilly (18 minutes from Roma Street Stations) during the morning peak period. The introduction of two all-stop services from Kuraby in 2021 without the Project provides crowding relief to this line. However, by 2031 it is forecast that over 130 passengers would be standing on the all stop services from Yeerongpilly that is 18 minutes from Roma Street Station.

Table 4-14 Beenleigh all stop services – average time passengers stand without the Project

Location	Time to Roma Street (minutes)	2012		2021		2031	
		Passengers		Passengers		Passengers	
		Load	Standing	Load	Standing	Load	Standing
Without the Project							
Beenleigh	64	63	0	18	0	75	0
Loganlea	53.5	154	0	74	0	179	0
Altandi	34	319	0	262	0	404	0
Yeerongpilly	18	452	0	459	0	616	136

Source: BaT Project Model Note: Seated capacity of a train is 480

4.4.5 Reliability of rail services

Reliability is directly related to available capacity. As service frequency increases towards maximum capacity, the reliability of services can deteriorate rapidly across the whole network, due to the way rail operations need to be managed. As the capacity is utilised, despite more measures being put in place to manage the issue, reliability is expected to deteriorate, with minor delays, such as the increased dwell times required for boarding and alighting in overcrowded conditions, having the potential to cumulatively escalate into significant impacts.

Peak period service performance on the passenger rail network is forecast to decline, resulting in significant reductions in service reliability and increased overcrowding across the rail network.

4.5 Future bus network performance without the Project

4.5.1 Forecast growth in bus use

Forecast demands for bus services without the Project are shown in Table 4-15. This shows a doubling in forecast bus patronage from 2012 to 2031 across the Brisbane Statistical Division. Total bus patronage is forecast to double to almost 500,000 daily bus passenger in 2031.

Table 4-15 Forecast trips by bus in Brisbane Statistical Division without the Project

24 hour	2012	2021		2031	
		Forecast	% change from 2012	Forecast	% change from 2012
Public transport trips	503,000	836,100	66%	1,115,600	122%
Total bus patronage	248,800	381,300	53%	496,600	100%
Total bus passenger kilometres	2,563,900	3,790,200	48%	4,882,400	90%
Total bus passenger hours	96,300	146,300	52%	196,600	104%
Average bus trip length (km)	10.3	9.9	-4%	9.8	-5%
Average bus trip time (minutes)	23.2	23.0	-1%	23.7	2%

Source: BaT Project Model.

4.5.2 Bus congestion within the inner city

In the scenario without the Project, it would be very challenging to meet the future demand. The South East Busway is currently operating at capacity, access to the inner city is restricted by bus station and kerbside bus bay capacity and inner city streets used by buses are congested during peak periods. Consequently, significant growth in bus services to match the demand without the Project would be challenging considering that around 550 buses per hour currently enter the CBD in the morning peak hour and growth would require over 1,000 buses to enter the CBD by 2031.

Figure 4-8 provides an estimate of volume verses capacity of key inner bus corridors at 2012, 2021 and 2031 without the Project. This illustrates that most of the major bus corridors to the CBD would be operating over capacity by 2031 including the Victoria Bridge and Captain Cook Bridge and routes through the CBD. **Table 4-16** summarises the bus service levels feasible on two major approaches to the CBD for the peak one hour without the Project.

Table 4-16 Estimated bus volumes on major CBD approaches during the peak one hour

Link	2012	2021 volume without the Project	2031 volume without the Project
Victoria Bridge	225	226	226
Captain Cook Bridge	221	287	309

Due to the capacity constraints of the inner city busway network the bus operation strategy without the project (refer to **section 4.1**) would see an increase in bus services using the inner city road network as a greater proportion of buses would be diverted to alternative routes such as the Captain Cook Bridge. With more buses mixing with general traffic in congested conditions travel time, reliability and service quality will be impacted.

4.5.3 Bus travel time without the Project

To further assess the performance of the inner Brisbane busway system and the Captain Cook Bridge without the Project, traffic modelling of bus services using the VISSIM micro-simulation software was undertaken. The bus travel time results for key links are shown in **Table 4-17**. This shows that increasing congestion on the inner city bus network would lead to significantly longer travel times and a deterioration of LoS for bus passengers in the future.

Table 4-17 Forecast changes in bus travel time on key bus links without the Project

Bus Link	2014 observed data (Peak one hour)	2021 simulation results (Peak one hour)	2031 simulation results (Peak one hour)
Buranda – Queen Street northbound via busway AM peak	06:28	09:10 (+02:42)	09:07 (+02:40)
Queen Street – Buranda southbound via busway AM peak	07:37	14:00 (+06:23)	13:50 (+06:13)
Queen Street – Buranda southbound via busway PM peak	08:59	15:28 (+06:29)	15:50 (+06:51)
Alice Street Stop (QUT) – Buranda via Captain Cook Bridge PM peak	04:43	09:22 (+04:39)	12:40 (+07:57)

Source: VISSIM model. Times are in minutes:seconds

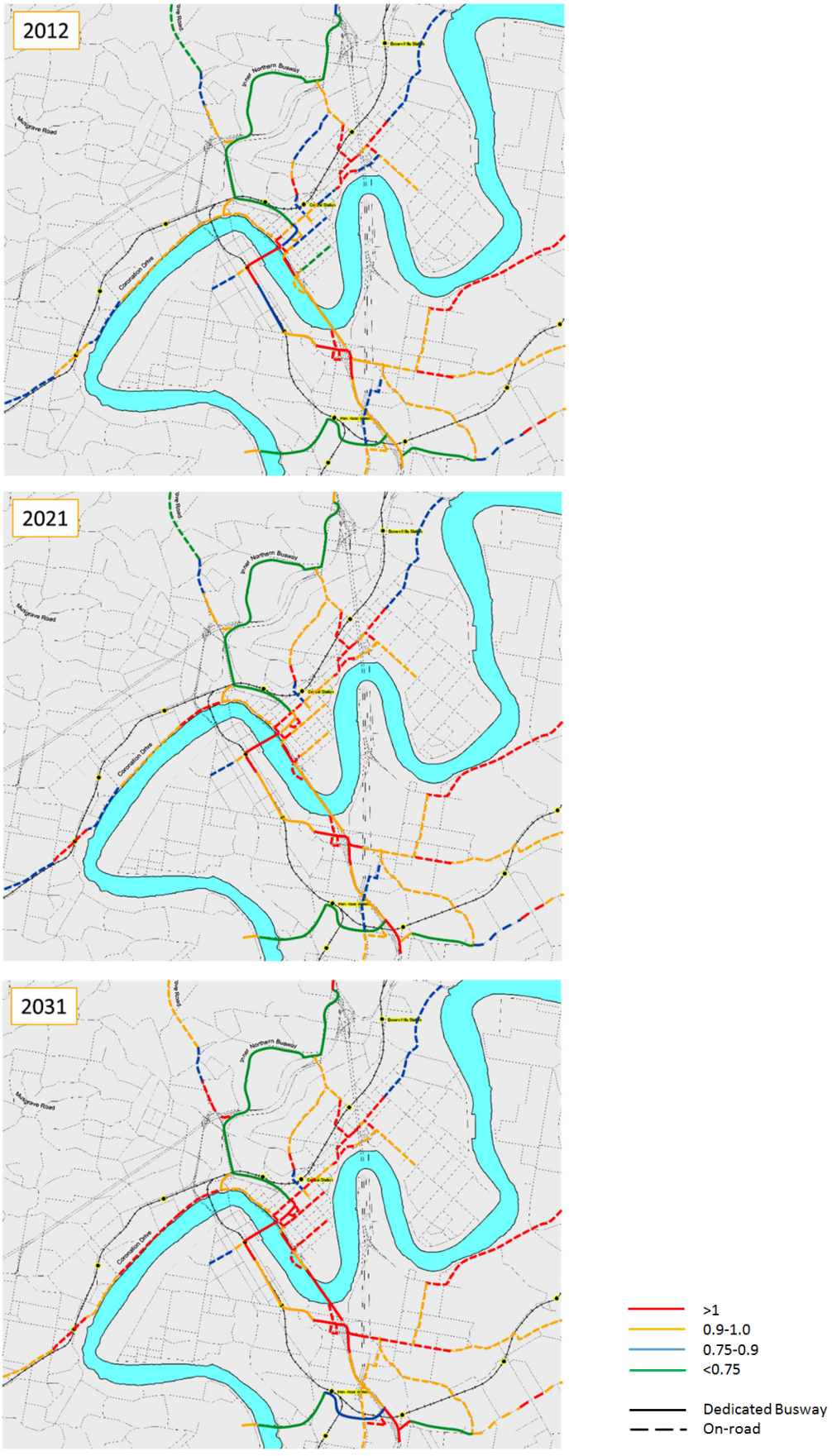


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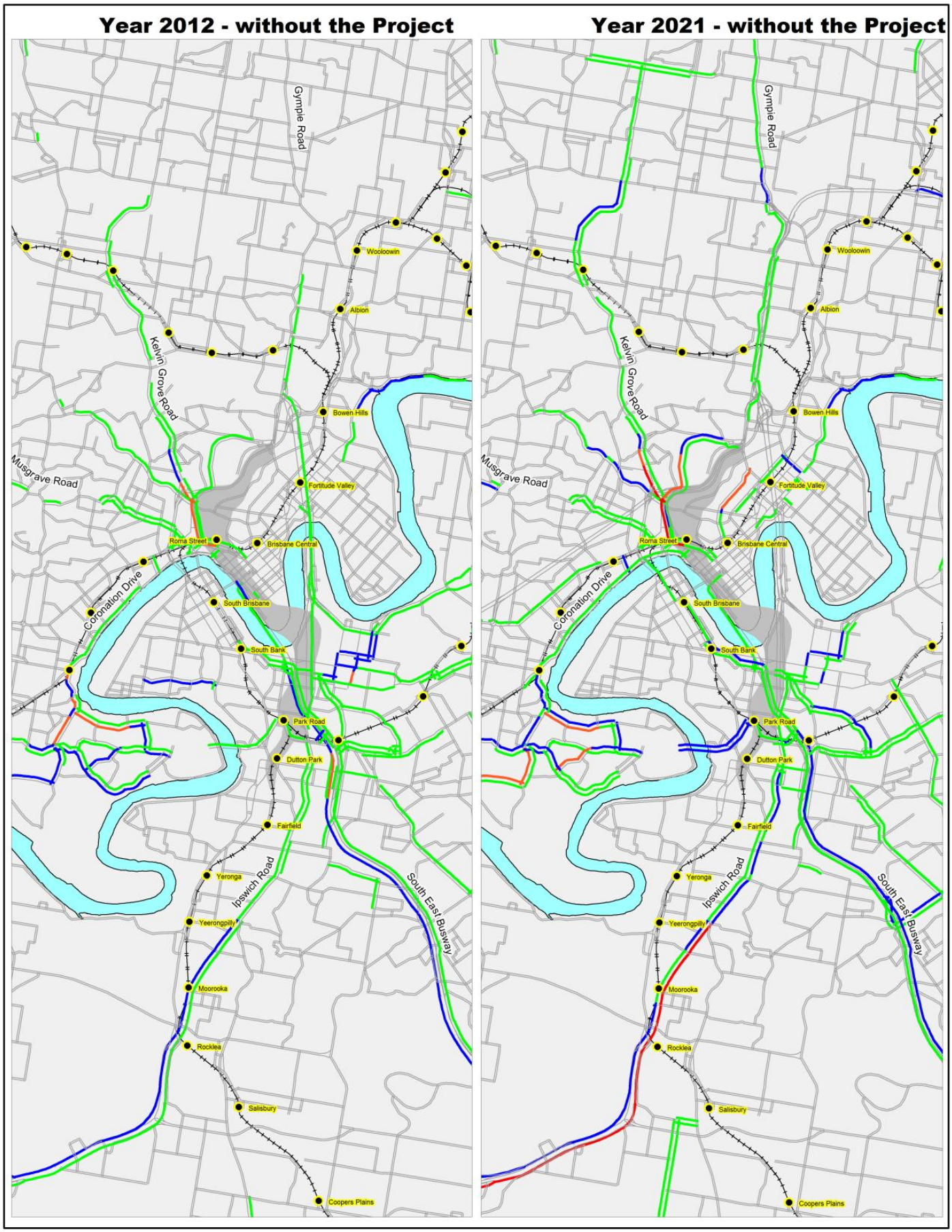
FIGURE 4-8

Estimated volume versus capacity of key inner bus corridors at 2012, 2021 and 2031

Travel times are forecast to increase inbound on the South East Busway in the morning peak, and outbound on the South East Busway and Captain Cook Bridges in the evening peak in the direction of peak commuter flow. Travel times would also increase significantly in the outbound direction on the South East Busway in the morning peak. This is because the addition of inner-city distribution services westbound on Melbourne Street in the morning peak would exacerbate congestion at the Melbourne Street busway portal and lead to queue spillback through the intersection of Melbourne Street and Grey Street, the Cultural Centre busway station and back across the Victoria Bridge.

4.5.4 Bus passenger crowding

Figure 4-9 to Figure 4-12 illustrate the forecast passenger crowding on buses for the morning and evening peak periods in 2012, 2021 and 2031. These illustrates some passenger crowding occurring in the base year (2012) with crowding worsening over time to 2031.



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

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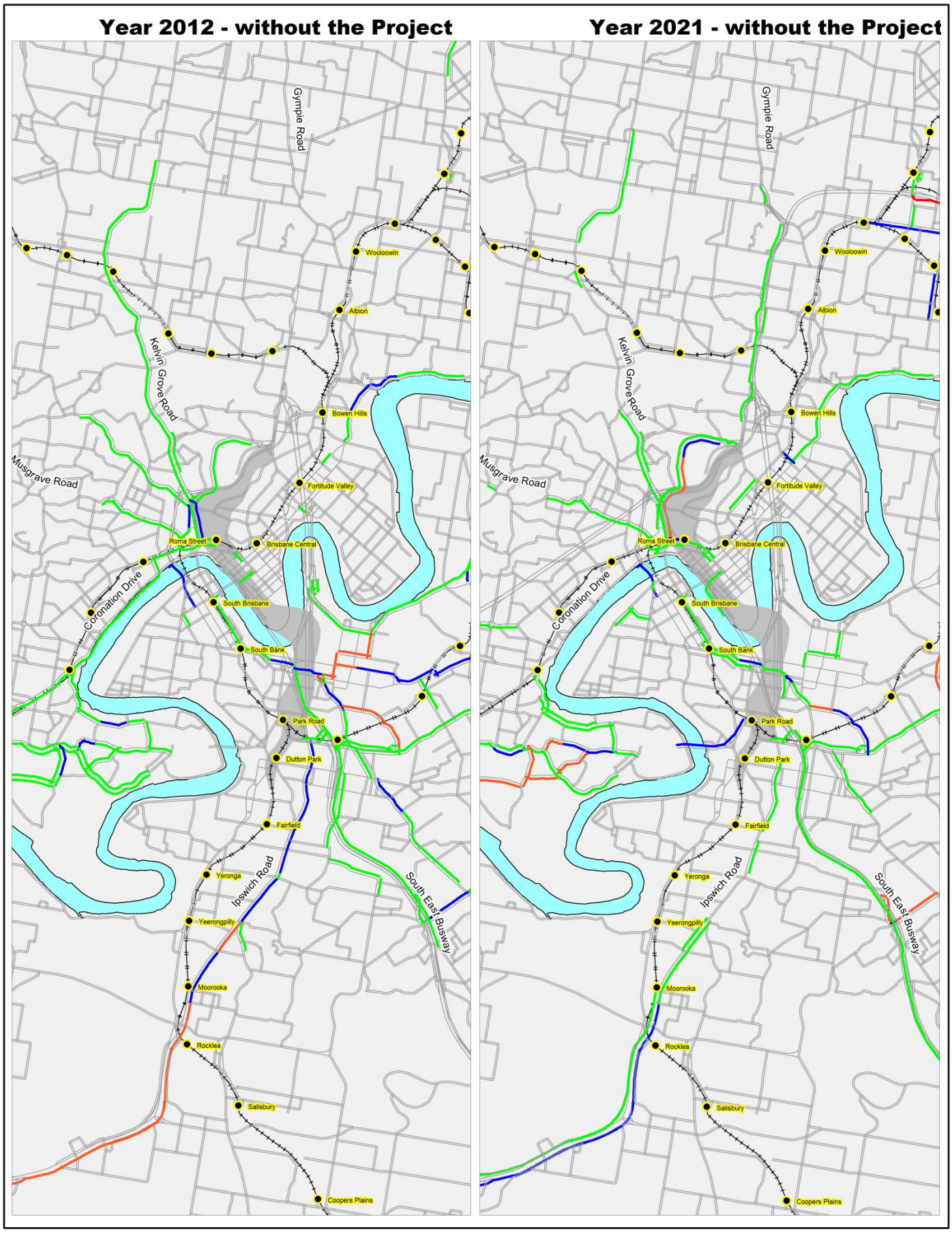
FIGURE 4-9

Bus load factors (AM peak) – 2012 and 2021 without the Project



LEGEND

PM 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

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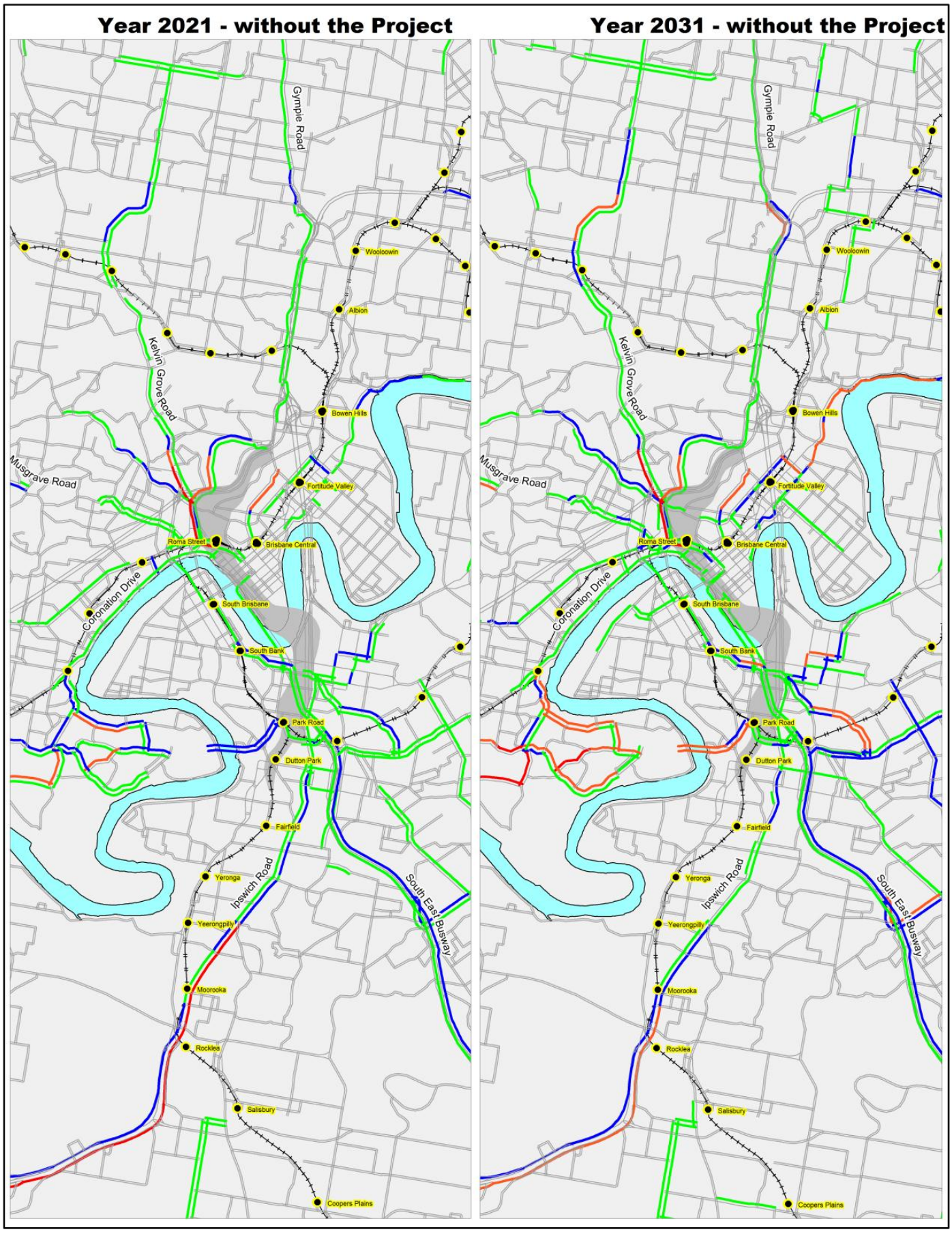
FIGURE 4-10

Bus load factors (PM peak) – 2012 and 2021 without the Project



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

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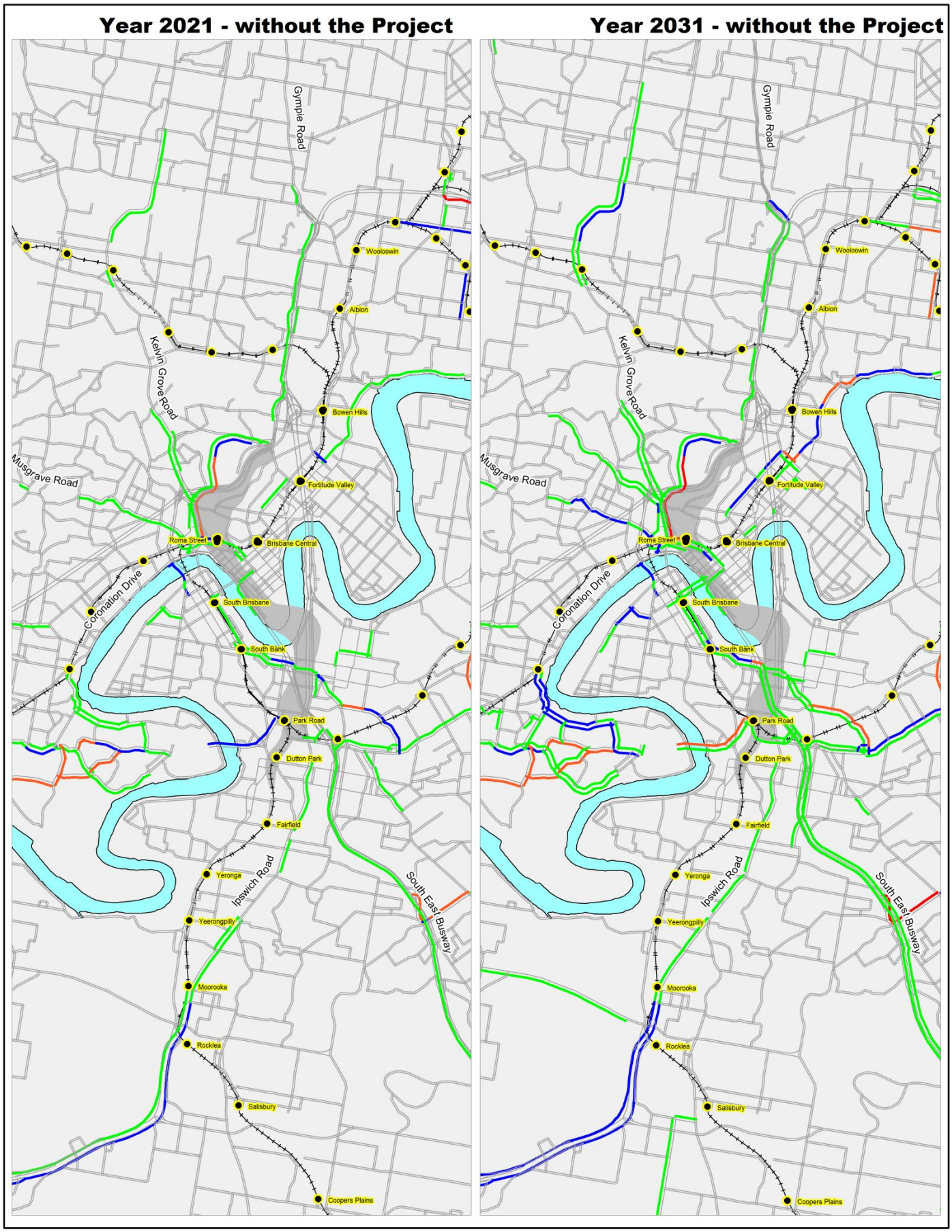
FIGURE 4-11

Bus load factors (AM peak) – 2021 and 2031 without the Project



LEGEND

PM 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

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FIGURE 4-12

Bus load factors (PM peak) – 2021 and 2031 without the Project

4.5.5 Bus travel time reliability without the Project

The reliability of bus travel times would further deteriorate during the commuter peaks. The VISSIM micro-simulation modelling illustrated the travel time variability on the inner South East Busway and the Captain Cook Bridge without the Project in peak periods. The worsening of travel time reliability is illustrated in **Table 4-19**.

This demonstrates that without the Project, average evening peak period outbound bus travel times via the Victoria Bridge would increase by about a minute by 2021. Reliability would also deteriorate with some journeys taking over 14 minutes. By 2031 maximum travels would be over 17 minutes.

Due to worsening traffic congestion and the number of buses using the Captain Cook Bridge journey times would double by 2021 to over eight and a half minutes, with a corresponding decrease in reliability, with some journeys taking over 13 minutes. This deteriorates further by 2031.

Table 4.18 Bus travel time reliability changes without the Project during PM peak period

Service	2014	2021	2031
Queen Street Bus Station to Buranda (via South East Busway)			
Minimum travel time	06:26	06:51	08:07
Average travel time	08:59	09:51	12:28
Maximum travel	11:53	14:05	17:21
Alice Street to Buranda (via Captain Cook Bridge)			
Minimum travel time	02:45	05:45	08:00
Average travel time	04:43	08:39	14:19
Maximum travel	09:24	13:21	23:10

Source: VISSIM model. Times are in minutes:seconds

4.5.6 Other bus network delays without the Project

Other bus network delays without the Project highlighted by the micro-simulation modelling include:

- traffic congestion on the Riverside Expressway would hinder the ability for buses to efficiently access the CBD in the morning peak and egress the CBD in the evening peak
- queuing on the Vulture Street off-ramp (Riverside Expressway south bound) by general traffic and buses tailing back onto the Captain Cook Bridge would lead to increasing traffic congestion in the evening peak
- Buranda Busway Station would become a major constraint inbound in both the morning peak (causing queues to the south along the busway), and outbound in the evening peak (causing queues causing queues to tail-back towards the Brisbane CBD)
- bus queues across the Victoria Bridge would increase to the extent of continuing throughout the peak periods, and queues would not disperse until after the peak periods.

4.6 Pedestrian activity in the CBD without the Project

Pedestrian activity in the CBD will increase over time and with more pedestrians walking between public transport nodes and offices, education, retail and leisure destinations the pedestrian network would get more congested. Passenger activities related to on-street bus stops are forecast to significantly increase (refer to **section 4.3**) and would add to footpath congestion as passengers wait and alight from buses on CBD footpaths.

4.6.1 George Street – future year (2021) pedestrian activity without the Project

Pedestrian demands were increased at the rate of 0.5 per cent per annum. This results in minimal increase in the pedestrian volumes and therefore pedestrian movement characteristics and performance that are comparable to the current year (2014). **Figure 4-13** and **Figure 4-14** present the forecast 15 minute pedestrian volumes and consequent LoS for the AM and PM peak periods in 2021 without the Project.

Figure 4-15 and **Figure 4-16** present the consequent LoS for pedestrians on George Street for the am and pm peak hours respectively. These figures show that areas of particular pedestrian congestion during the morning peak hour peak (8.00am to 9.00am) would include:

- the northern side of George Street, resulting in significant pedestrian congestion on the north-east corners of all intersections between Elizabeth Street and Alice Street and along the northern footpath between these intersections during the morning peak hour
- during the evening peak hour congestion occurs but it is not as severe as in the morning peak hour.

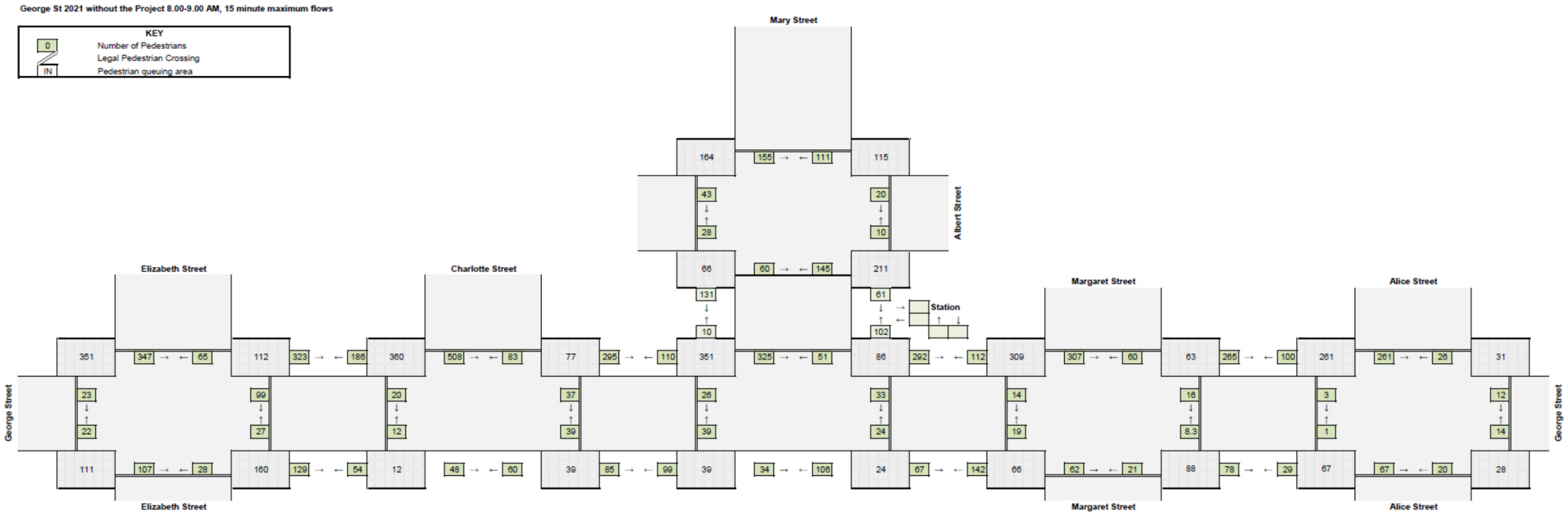

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FIGURE 4-13

George Street without the Project (2021) 15 minute maximum pedestrian volumes – AM peak hour

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FIGURE 4-14

George Street without the Project (2021) 15 minute maximum pedestrian volumes – PM peak hour

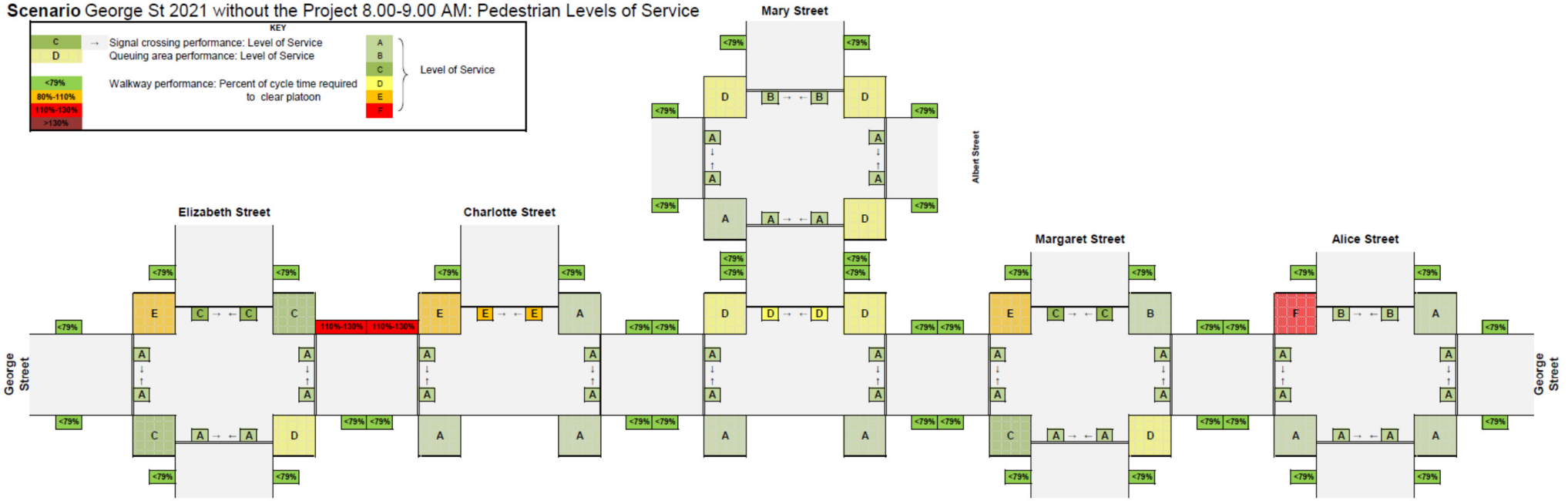

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FIGURE 4-15

George Street without the Project (2021) pedestrian level of service – AM peak hour

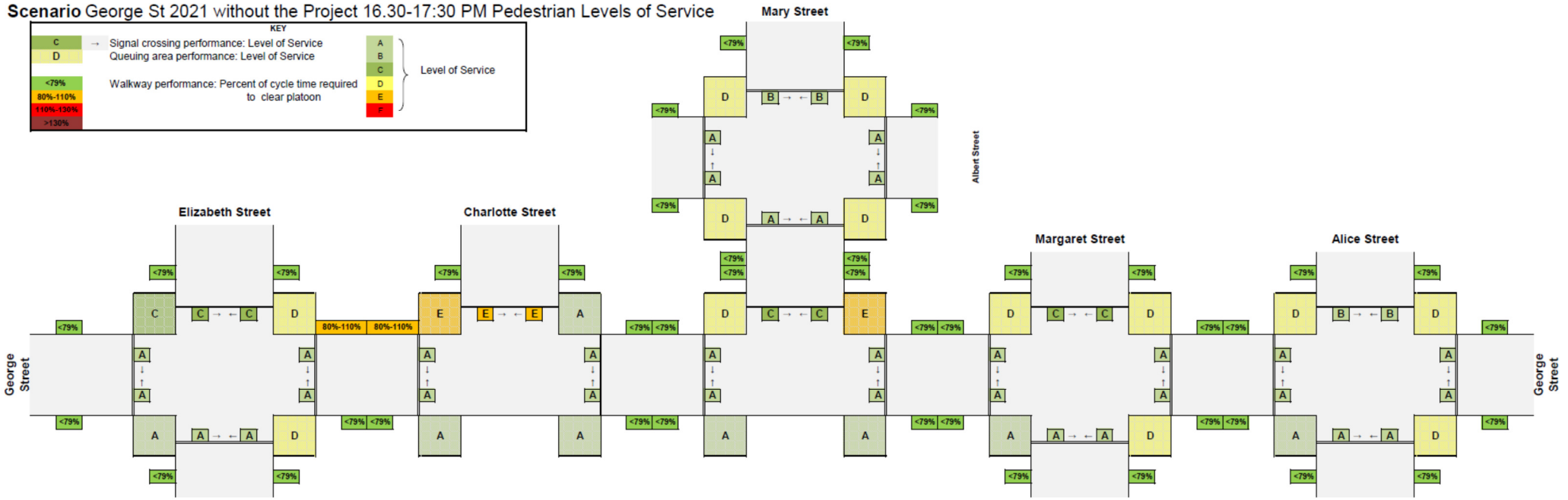

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FIGURE 4-16

George Street without the Project (2021) pedestrian level of service – PM peak hour

4.6.2 Roma Street – future year (2021) pedestrian activity without the Project

Pedestrian demands were increased at the rate of 0.5 per cent per annum. This results in minimal increase in the pedestrian volumes and therefore pedestrian movement characteristics and performance that are comparable to the current year (2014).

Roma Street entrance

For the Roma Street entrance **Figure 4-17** and **Figure 4-18** present the forecast 15 minute pedestrian volumes and consequent LoS for the AM and PM peak periods in 2021 without the Project.

Figure 4-19 and **Figure 4-20** present the consequent LoS for pedestrians on Roma Street for the AM and PM peak hours respectively. These figures show that there are no areas of particular pedestrian congestion during the morning and evening peak hours without the Project.

Albert Street entrance

For the Albert Street entrance **Figure 4-21** to **Figure 4-22** present the forecast 15 minute pedestrian volumes and consequent LoS for the AM and PM peak periods in 2021 without the Project.

Figure 4-23 and **Figure 4-24** present the consequent LoS for pedestrians on Albert Street for the am and pm peak hours respectively. These figures show that there are no areas of pedestrian congestion during the morning and evening peak hours without the Project.

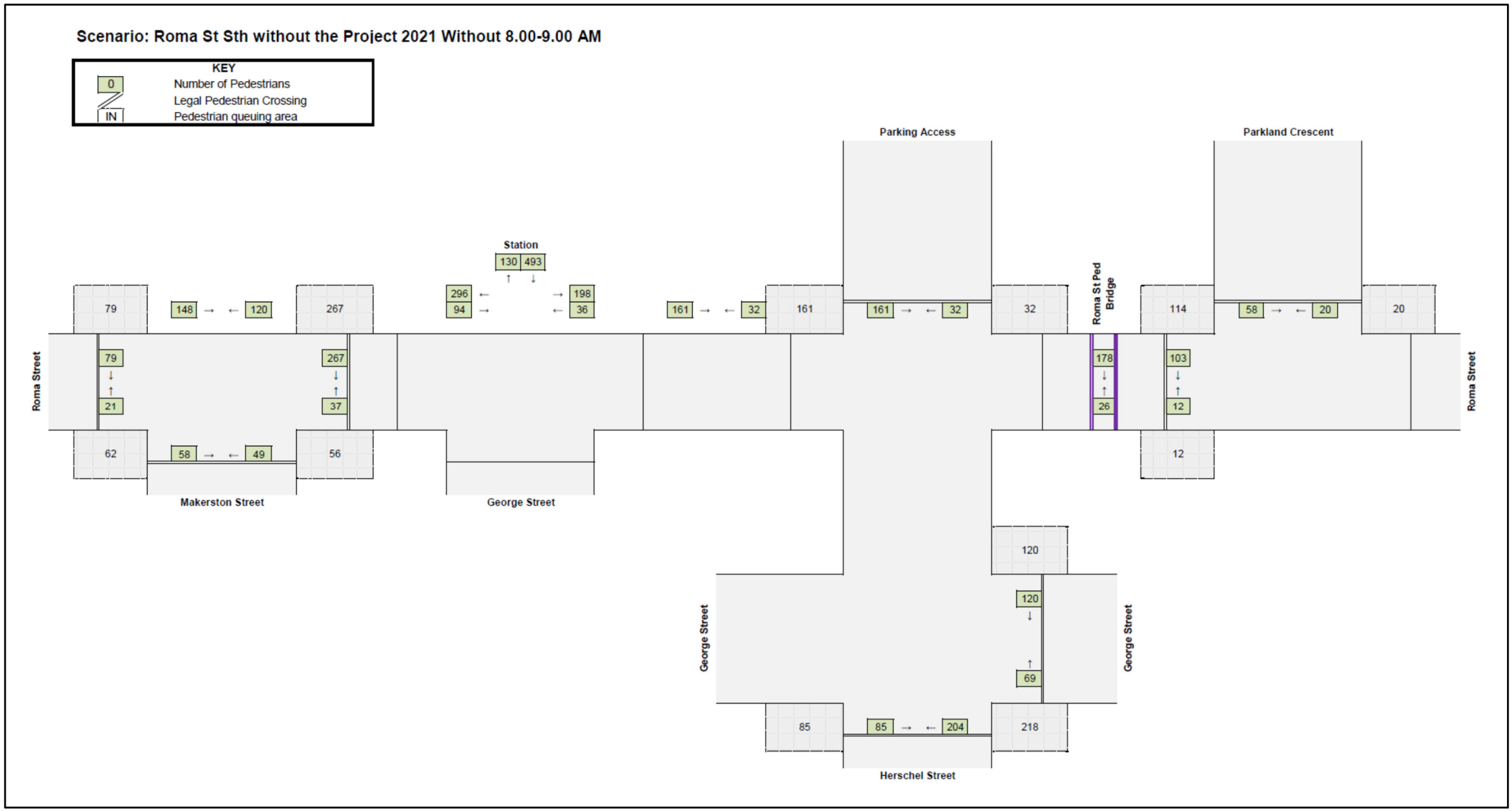

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FIGURE 4-17

Roma Street Station without the Project (2021) 15 minute maximum pedestrian volumes (Roma Street entrance) – AM peak hour

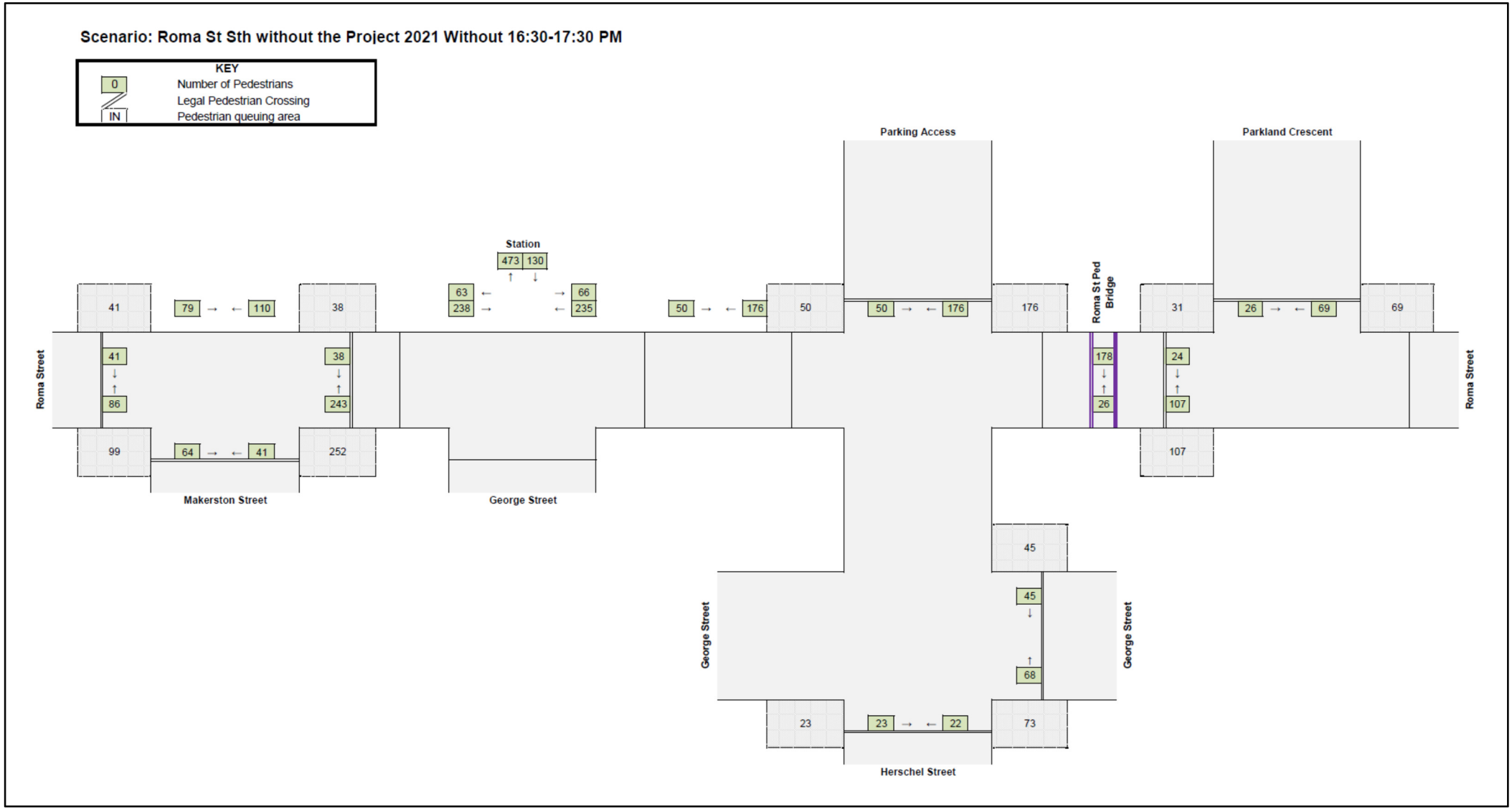

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FIGURE 4-18

Roma Street Station without the Project (2021) 15 minute maximum pedestrian volumes (Roma Street entrance) – PM peak hour

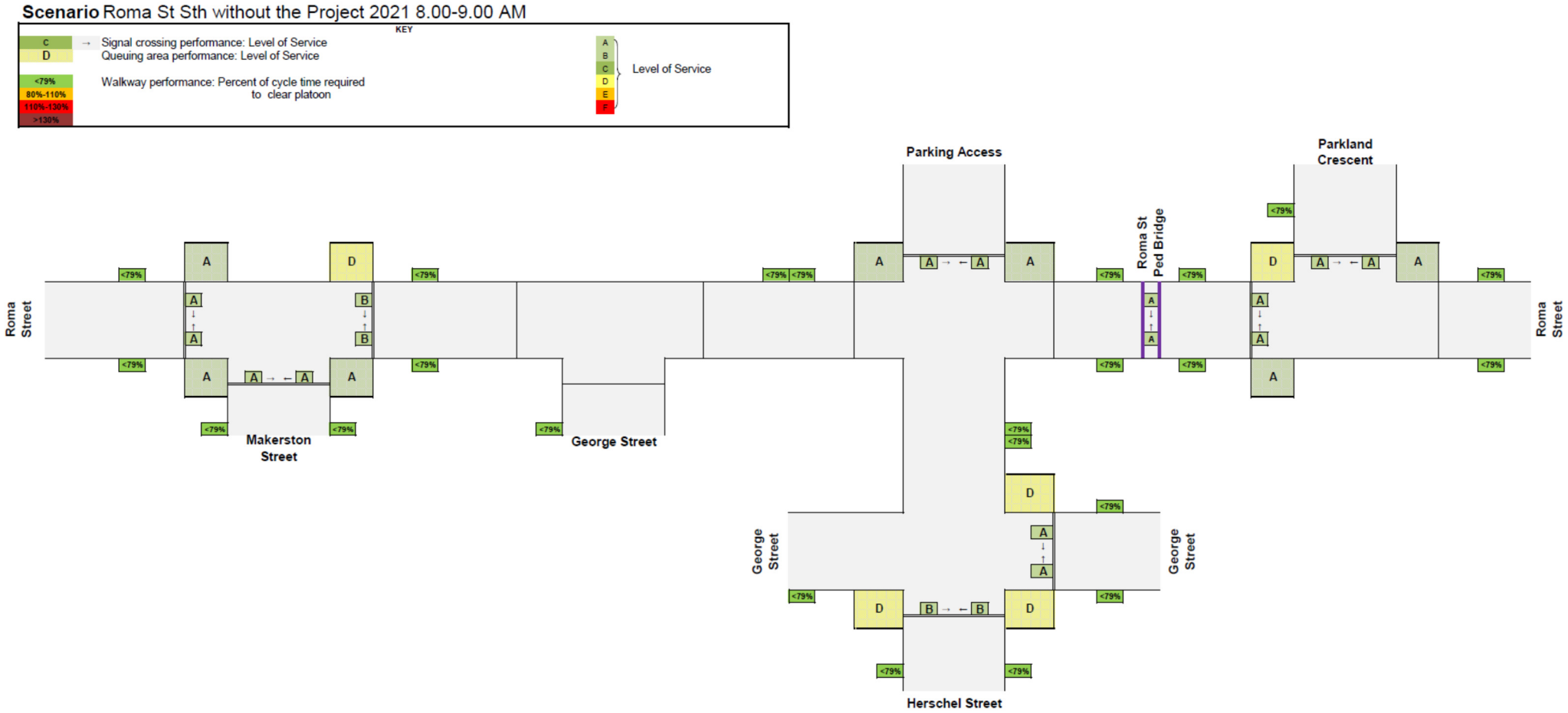

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FIGURE 4-19

Roma Street Station without the Project (2021) pedestrian level of service (Roma Street entrance) – AM peak hour

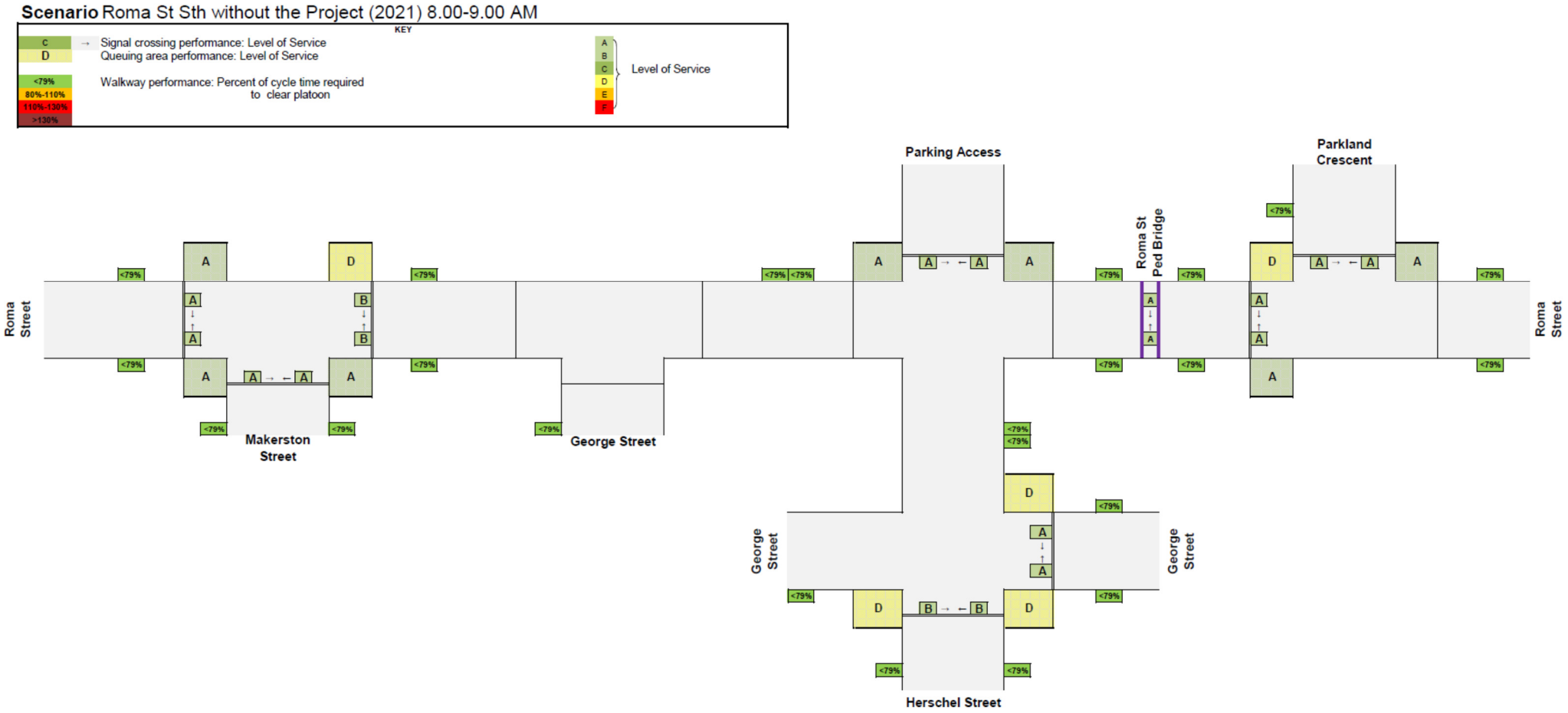

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FIGURE 4-20

Roma Street Station without the Project (2021) pedestrian level of service (Roma Street entrance) – PM peak hour

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FIGURE 4-21

Roma Street Station without the Project (2021) 15 minute maximum pedestrian volumes (Albert Street entrance) – AM peak hour

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FIGURE 4-22

Roma Street Station without the Project (2021) 15 minute maximum pedestrian volumes (Albert Street entrance) – PM peak hour

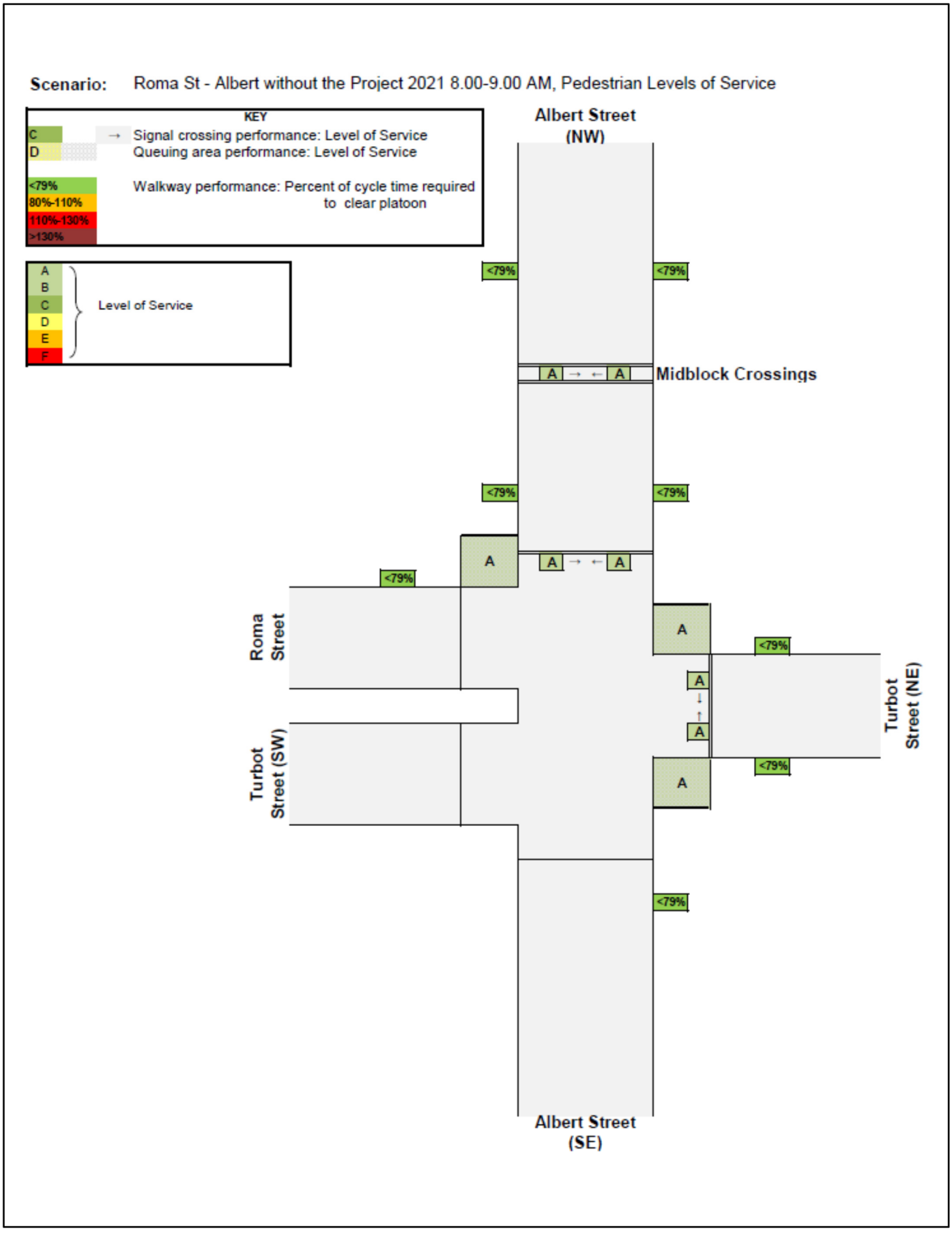

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FIGURE 4-23

Roma Street Station without the Project (2021) pedestrian level of service (Albert Street entrance) – AM peak hour

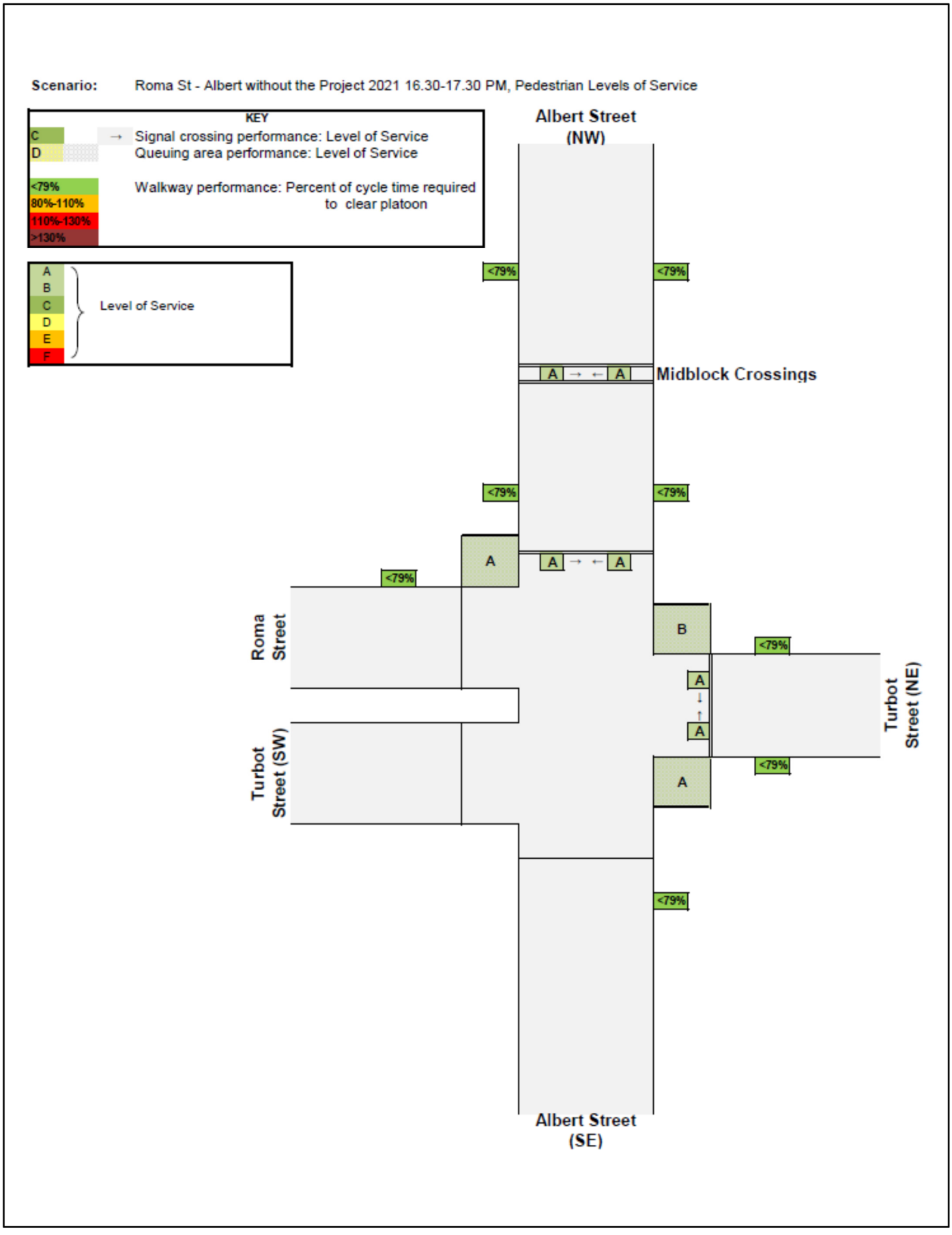

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FIGURE 4-24

Roma Street Station without the Project (2021) pedestrian level of service (Albert Street entrance) – PM peak hour

4.7 Ferry services without the Project

No major changes to ferry operations are expected within the study corridor. However, moderate frequency improvements are expected to continue to provide more regular services.

By 2031, ferry patronage is forecast to increase significantly compared to 2012 to just over 30,000 trips per average weekday. Ferries would continue to cater for less than one per cent of all travelof overall trips across the city. There would be a trend towards slightly longer average trip lengths and average trip times by ferry between 2012 and 2031.

There is no proposed development of any ferry to rail interchanges and transfer between these modes is expected to remain negligible.

4.8 Road network performance without the Project

Forecast growth in vehicle trips across the Brisbane Statistical Division, inclusive of commercial vehicle volumes, is shown in **Table 4-19**. This shows a forecast overall increase in daily vehicle trips of approximately 42 per cent by 2031.

Table 4-19 Forecast changes in vehicle trips in Brisbane Statistical Division without the Project

24 hours	2012	2021	2031
Total person trips	7,165,000	8,890,000	10,348,000
Total person trips by motorised travel modes	5,860,700	7,090,200	8,128,800
Car/ light vehicle trips	4,303,900	5,310,000	6,177,000
Commercial vehicle trips	391,100	445,500	503,500
Total vehicle trips	4,695,000	5,755,800	6,680,100
Percentage growth in vehicle trips compared to 2012	-	23%	42%

Source: BaT Project Model

Between 2012 and 2021, a limited number of new road projects will become operational including Legacy Way, widening of the Centenary Motorway from the Toowong roundabout to Moggill Road and widening of the Gateway Motorway south of Deagon. This follows the completion of many significant road initiatives in recent years including the Gateway Upgrade Project, CLEM7, Go Between Bridge and Airport Link. These regional road network improvements have, or are forecast to, reduce traffic on some routes such as the Story Bridge, Milton Road, Kingsford Smith Drive, Lutwyche Road and Sandgate Road, and increase demands on other routes including the Pacific Motorway, Western Freeway, Gympie Road, ICB and Stafford Road.

The performance of the road network in the peak hour is forecast to decline between 2012 and 2021 despite the above capacity improvements. Volume to capacity ratios in excess of 90 per cent over extensive sections of the Pacific Motorway, Ipswich Motorway, Gympie Road, Old Northern Road and Beaudesert Road would be experienced during peak periods.

Between 2021 and 2031, fewer major improvements to the road network are envisaged within the metropolitan area. Traffic volumes on the regional road network on several routes within or close to the study corridor including the Pacific Motorway, Ipswich Road, Kingsford Smith Drive and the ICB would increase, with a progressive decline in LoS.

Traffic volumes on the inner city river crossings of the Go Between Bridge, William Jolly Bridge, Victoria Bridge, Captain Cook Bridge, CLEM7 and Story Bridge are forecast to increase from a

combined two way average morning peak two hour volume of 46,000 vehicles in 2012 to 60,000 vehicles in 2021.

By 2031 the traffic volume using these river crossings is forecast to reach approximately 69,000 vehicles in the morning peak two hours. This equates to an increase in demand of 30 per cent over the 9 years between 2012 and 2021 (an average of approximately 3.4 per cent per annum) but only 15 per cent in the 10 years from 2021 to 2031 (an average of approximately 1.5 per cent 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.

Table 4-20 shows a sample of the reduction in travel speeds for key city inner city access routes that illustrates the likely impact of increasing traffic congestion.

Table 4-20 Travel speeds (km/h) during the AM peak two hour period without the Project

Route	2012	2031	Reduction
Captain Cook Bridge	71	30	58%
Story Bridge	21	14	33%
Ipswich Road (South of Cornwall Street)	37	36	3%
Bowen Bridge Road (North of Herston Road)	36	36	0.0%

Source: BaT Project model

4.9 Freight rail without the Project

With the increase in demand for passenger services and the provision of 15 minutes off-peak frequencies that are expected in a metro rail network, there will be few paths available for freight services in the future.

The existing dual gauge track from Salisbury to Park Road would continue to be used by both express passenger rail (Gold Coast) services as well as freight trains between Acacia Ridge or the Western Lines (via Tennyson) and the Port of Brisbane. The continued presence of passenger rail operations would mean the continuation of avoiding rail freight operation during the peak periods and would also prevent any increase in rail freight services during the passenger off-peak frequency on the Gold Coast line. This would constrain the freight throughput between Salisbury and Yeerongpilly and between Yeerongpilly and the Port of Brisbane, such that there is limited scope to increase freight services from those currently provided.

4.10 Summary of the performance of the transport network without the Project

An analysis of the future transport network indicates that without the Project, there would be declining levels of rail passenger and bus passenger services. The inner city rail infrastructure has physical capacity constraints that would not effectively accommodate the recent high levels of existing and forecast rail passenger movement growth to the Brisbane CBD and freight rail movements across Brisbane. As previously discussed, key points of the bus network in the inner city are currently operating at capacity and cannot accommodate further growth without investment in bus infrastructure.

The expected growth of the Brisbane CBD and Inner Brisbane as an attractive destination, for jobs and cultural and social activities, would put increasing pressure on the existing public transport network to service this demand.

4.10.1 Passenger rail

Expected growth in rail network passenger use and peak commuter demand to the Brisbane CBD would result in the inner city rail network reaching capacity by 2021 as future network conditions without the Project restricts the number of additional trains through the CBD. The capacity of the Merivale Bridge would be reached by 2021 meaning that any additional demand for rail travel from the south could be not be accommodated by the provision of extra trains post 2021.

The existing arrangement of pedestrian infrastructure at Central Station would be under significant pressure to accommodate forecast passenger volumes without the Project and would be unlikely to function safely and efficiently in its current form by 2021 unless its use is effectively managed.

Progressively poorer levels of rail service, including high levels of train crowding for commuting trips 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.

4.10.2 Bus

There would be no scope to reduce bus volumes on the Victoria Bridge, and interchanging would continue to be concentrated at the Cultural Centre, contributing to continued queuing of buses over the Victoria Bridge on a daily basis for the entire two hour evening peak period. Growth in buses into the CBD would require a large number of buses to be relocated to Margaret and Alice Street and utilise additional scarce kerbside space for passenger pick-up and set-down. This would impact negatively on CBD road congestion, footpath congestion, bus travel times and general amenity of the CBD.

Bus services would not be able to increase on the inner South East Busway without the Project. Consequently, all bus growth from the south would need to be located on the Captain Cook Bridge in congested traffic conditions without the Project. This would cause bus operations to be slower, reliability of bus services would further deteriorate, be more costly to operate, and less attractive to passengers.

4.10.3 Pedestrians

Pedestrian congestion on the CBD footpaths will increase as more people walk across the CBD to access transport facilities and destinations. A significant increase in on-street bus stops will add to footpath congestion due to passengers waiting and alighting from buses on the CBD footpath.

4.10.4 Road

A 50 per cent increase in vehicle trips between 2012 and 2031 across the metropolitan area would place significant pressure on an already congested road network during peak periods.

There is very limited capacity on key routes to the inner city to support additional growth in peak period travel. With limited capacity on the road network and continued increase in demand for inner city accessibility, traffic congestion will continue to grow without the Project.

4.10.5 Freight rail

Due to the number of peak and off-peak passenger rail services, any increase in capacity for rail freight would be minimal such that the demand for rail freight could not be effectively met without the Project.

5. Future transport conditions with the Project

This chapter reports the forecast effects of the operating Project on transport conditions between the base year of 2012 and the future modelled years – 2021 and 2031. This section reports on:

- changes to the bus and rail network and its operations including the proposed rail service plans and bus operating scenario with the Project infrastructure included in the South East Queensland passenger rail network
- the forecast patronage and its effect on the bus and rail network with the operating Project
- changes to station activity (passenger demand) and interchange in the study corridor
- the effect of the Project on ferry operations with a focus on the study corridor
- the effect of the Project on pedestrian and cycle infrastructure in the study corridor
- the performance of the regional, arterial and local road network with the Project
- the effects of the Project on rail freight and rail maintenance are also reported.

Running from Dutton Park in the south through to Victoria Park in the north, the Project will include new stations at Woolloongabba, George Street and Roma Street, providing a direct rail connection into the CBD for Beenleigh and Gold Coast services and a fast, reliable bus connection from the Eastern Busway north of the PA Hospital Busway Station and the Eastern Busway, through the CBD and connecting to the Inner Northern Busway south of the RBWH busway stations.

As well as the through running services described above, the Project provides significant interchange opportunities at Woolloongabba (bus-bus and bu-rail) and Roma Street stations (bus-bus, bus-rail and rail-rail).

The Project rail and bus service plans illustrate the possible strategies for operation of the SEQ rail and bus network for the first decade of Project operations between commissioning in 2021 through to 2031. The service plans also give some consideration of opportunities for the longer-term evolution of the infrastructure. These service plans form the ’reference network’ used in assessing the Project’s network benefits and impacts.

The overarching goal for the reference network development with the Project has been to guide development of an integrated, multi-modal public transport network plan that aims to maximise benefits to passengers and maximise network efficiency to minimise whole of system operating costs. The key principles applied in developing the operational plans to achieve this have included:

- faster, more reliable travel
- a simpler, more legible network
- new and simplified connection opportunities that match demand
- transfer is a disincentive unless it provides direct passenger benefits such as faster total travel times or new connections
- minimising cost per passenger per kilometre, per hour and per service
- minimising out-of-service time and kilometres
- distributing services to reduce congestion and manage existing network constraints
- minimising supporting works required to support service growth.

5.1 Rail operating strategy

Possible service plans and operating strategies for the Project have been developed consistent with the existing policy and planning framework for development of Brisbane's integrated, multi-modal public transport network. Key service planning principles adopted for the 2021 and 2031 rail operating strategies with the Project include:

- utilise the new inner city corridor provided by the Project to reduce interaction between different sectors of trains to improve operational efficiency and reliability
- continue to support the principles established in the latest timetable change (January 2014), including supporting peak spreading of services
- support future daytime freight activity on the network by facilitating no net loss of freight rail access between peak periods.

5.1.1 Planning assumptions

Service planning for the Project has been undertaken in parallel to a detailed review of current arrangements to maximise existing capacity of the rail network. **Table 5-1** outlines the key planning assumptions for the Project rail operations.

Table 5-1 Key rail operation planning assumptions for the Project

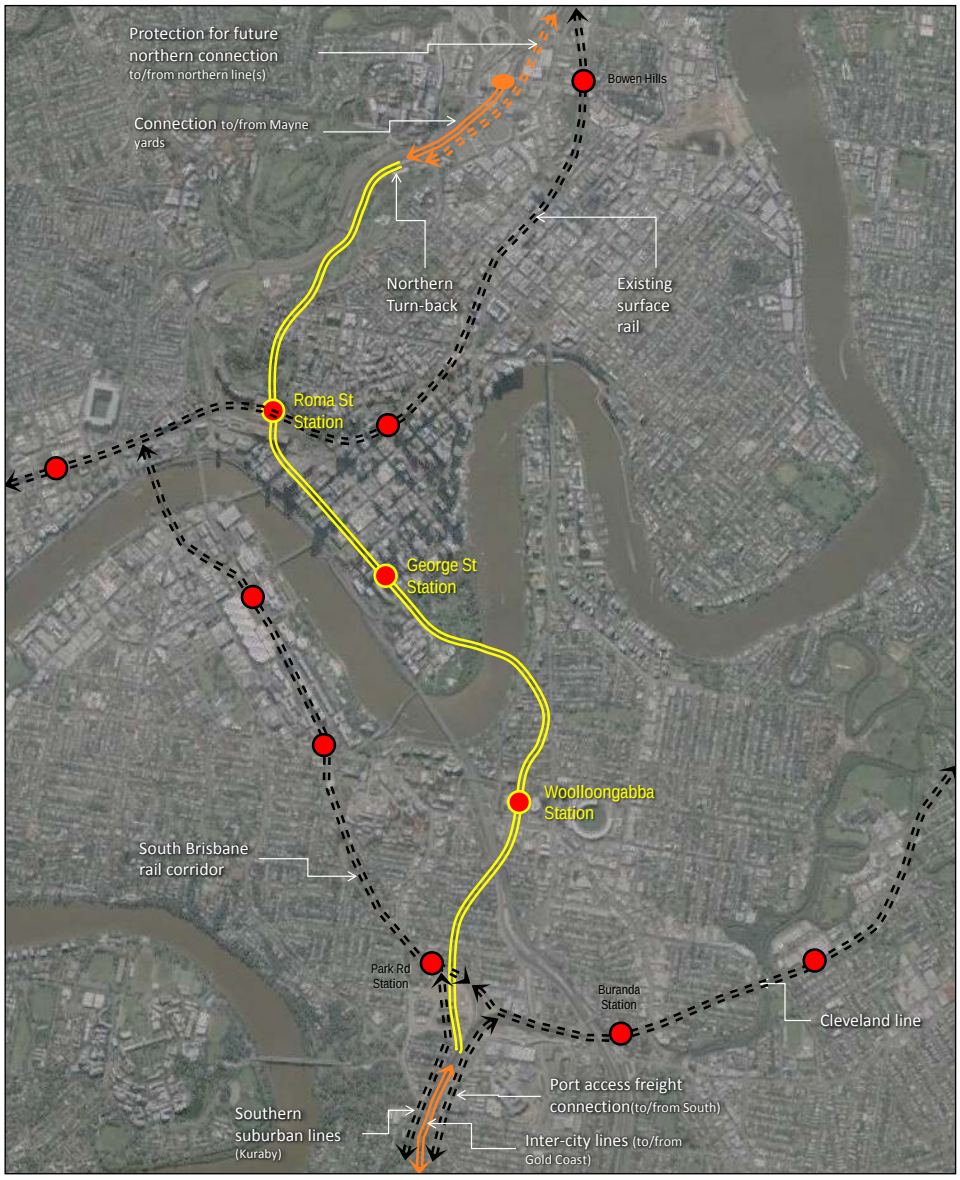
Topic	Assumption
Rollingstock	Only New Generation Rollingstock (NGR) would operate along the Project corridor to: • comply with fire and life safety requirements – NGR vehicles have a maximum fire power value of 15MW • allow 3% vertical grades • ensure reliable rollingstock operation within the tunnel.
Rollingstock capacity	Per NGR 6-car train set: • 480 seated passengers (owing to optimised floor configuration of NGR – standard rollingstock allows for 450 seated passengers) • 750 seated and standing passengers (maximum design load).
Platform lengths	All demand modelling has been based on the use of NGR 6-car train sets. However, station platforms could accommodate up to 7-car sets in the future. A move to 7-car train sets would require new rollingstock and station modifications across the network.
Dwell times	To achieve a system capacity of 24 trains per hour, assumed total average dwell time of 66 seconds per train has been allowed consisting of: • 50 seconds for passengers to board and alight trains • 16 seconds for any required warning tones, mechanical operation of the doors and clearance of any interlocks (inclusive interface requirements of the Platform Screen Doors (PSD)). The system has been designed to accommodate for variability in total average dwell time between peak periods (theoretically can accommodate a further 30 seconds without impacting on the following train during peak times) and off-peak periods (where shorter dwell times are expected for lightly loaded or off-peak services). Should the average dwell times exceed this planning allowance at any station, the system capacity would be negatively impacted (i.e. currently average dwell time at Central Station exceeds 50 seconds). Proactive dwell time management strategies may be applied to mitigate potential capacity issues and protect train capacity prior to reaching critical capacity.

Topic	Assumption
Door configuration	The NGR fleet retains the current 2-door per carriage configuration. This is adequate to support the forecast patronage growth assumed by the reference operating concept.
Automatic Train Protection	The Project assumes the implementation of an Automatic Train Protection (ATP) system to: • provide a safe and reliable tunnel signalling system (by reducing the likelihood of accidents in the tunnel by automatically applying brakes if the driver passes a red (stop) signal) • maximise the capacity of the Project's infrastructure (by allowing train headways to be reduced by facilitating more refinement of train control (e.g. mid-platform signals) at key locations such as stations). The Project Reference Design uses the European Train Control System (ETCS) Level 2 for ATP control and signalling. This system will need to be interoperable with Queensland Rail's existing signalling and control systems outside of the Project.
Platform screen doors (PSDs)	Passengers will board and alight through platform screen doors provided at all stations to assist in ventilation, as well as increase safety and amenity to passengers on platforms. To enable trains to stop accurately at passenger screen doors, some Automatic Train Operation (ATO) features will be implemented in the ETCS Level 2 implementation proposed (alongside system interfaces required to the platform screen door systems). These interfaces would need to include safety interlocks, assistance to drivers for accurate and reliable positioning of trains at stations, as well as controls to open and close platform screen doors and train doors simultaneously. The total platform screen door system is assumed to have very high availability, low fault rates and to add no more than two seconds to the total train headway.
Peak capacity	The combination of signalling, train system and dwell times described above are assumed to support the reliable operation of trains at a scheduled minimum spacing of two and a half minutes, supporting a future throughput of up to 24 trains per hour during peak periods.
Service frequencies	Service frequencies at individual stations will not be substantially decreased relative to current timetabled service levels at any time of day, except where capacity is already constrained or where it is required to take advantage of the study corridor, for example at Park Road and the inner southern (South Brisbane) rail corridor. No reduction in frequency from 20 January 2014 timetable at any station should occur on corridors unaffected by the Project, with extension of 15-minute operations to logical tiering points where appropriate.
Train stabling	Trains will use Mayne Yards as the preferred inner-city stabling site, accessing directly from the turn-back and Exhibition loop.

5.1.2 Integration with existing rail network and operations

Figure 5-1 illustrates the overall layout of the BaT rail corridor and rail service access.

Figure 5-1 The Project and associated rail access corridors



5.2 Rail network and operational changes proposed

The key rail components of the proposed Project include:

- a new twin track underground railway from Dutton Park in the south to Spring Hill in the north
- three new underground stations at Woolloongabba, George Street and Roma Street
- connection to the southern rail lines at Dutton Park.

Planning has identified a range of supporting infrastructure interventions that are either supportive, or necessary, to enable the proposed service plan operations on the wider network to support increasing

peak frequencies. These works are summarised in **Table 5-2**. Where possible, to minimise both the capital cost and impact to passengers, these works would be packaged with regular maintenance and upgrade programs and projects.

Table 5-2 Supporting infrastructure for Project rail operations

Works	Without Project	With Project	Funding source
Pre-2021			
New platform faces on the dual-gauge line between Salisbury and Park Road and signalling upgrades to all three tracks in this area	*Desirable*	*Required*	Rail Transport Service Contract
Signalling upgrades from Kuraby to the tunnel portal, for the Project and Helensvale to Beenleigh	*Capacity unusable due to inner city constraint*	*Required to enable access and increase capacity*	Rail Transport Service Contract
Turn-back or third heavy rail platform at Helensvale station	*Desirable to meet growth*	*Required to operate service plan*	CityTrain Station Upgrade Program
2021-2031			
Signalling upgrades from Kuraby to the tunnel portal, and between Varisty Lakes and Helensvale	*Capacity unusable due to inner city constraint*	*Required*	Rail Transport Service Contract
Quad track between Kuraby and Loganlea	*Desirable*	*Desirable*	Future infrastructure programs
Birkdale to Cleveland duplication	*Capacity unusable due to inner city constraint*	*Desirable*	Future infrastructure programs.

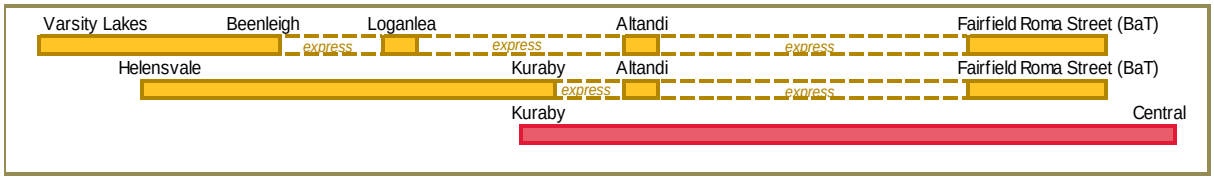
The key operating strategy change that would occur with the Project in 2021 would be the creation of a new rail operating sector servicing areas between the Gold Coast and Kuraby in the south and connecting via the new corridor to the Brisbane CBD and terminating at Roma Street. Brisbane Airport services would terminate at Park Road with selected peak services extended to south or east of Park Road. Brisbane Airport services would not be linked with the Gold Coast sector.

This rail service plan is shown in **Figure 5-3** with the Project sector coloured blue.

This service plan would provide new rail network capacity, allowing for an increase in the number of peak-direction services beyond the current limit of 24 trains per hour per direction across the Merivale Bridge to and from the southern line.

This new sector will allow for the introduction of 3-tier operations on the southern corridor as illustrated in **Figure 5-2**. These stopping patterns, and the suggested wider network changes, would be refined as part of detailed service planning to be undertaken prior to commissioning of the Project.

Figure 5-2 Proposed stopping patterns for southern lines in operation in 2021



The three tiers of train services on the southern corridor, consisting of:

1) **Varsity Lakes express services via the Project** – The existing Gold Coast express patterns would operate via the Project, stopping all-stations to Beenleigh, then only at key interchange stations at Loganlea, Altandi and Dutton Park. Services would then run via the new Project alignment, stopping at Woolloongabba, George Street and terminating at Roma Street Station. Passengers for Brisbane Airport would be required to interchange to Airtrain services at Roma Street.

2) **Helensvale limited express services via the Project** – Beenleigh all-stations services would be extended to Helensvale, operating in a new express pattern inbound from Kuraby stopping only at key interchange stations to the Project. Services would then run via the new Project alignment, stopping at Woolloongabba, George Street and Roma Street stations. Under this operation, seven express services per hour would be offered at stations between Helensvale and Beenleigh to the inner city via the Project. This express operation would provide a substantial improvement in travel time to the CBD for stations between Beenleigh and Kuraby

3) **Kuraby all-stations services via South Brisbane** – These services would operate via the existing surface alignment to provide connectivity between Gold Coast line traffic and the Southbank precinct. The 15-minute frequency (introduced in the January 2014 timetable changes) between Coopers Plains and the city (via South Brisbane) would be extended to Kuraby. The Dutton Park Station would provide the last opportunity to transfer to the Project services.

To assist with legibility, these tiers would operate consistently on the same corridors throughout the day, enabling passengers to undertake a journey to and from the city from the same inner city station at most times of day, with only the late-night off-peak service routings reducing in frequency.

Provision of an interchange stop on the express lines at Altandi and Dutton Park would allow passengers to transfer between the surface all-stops and Project express rail services. Bus connections at Roma Street and Woolloongabba will also provide additional transfer opportunities for the express services operating through the Project.

The possible service plans with the Project for 2021 for the morning peak hour are illustrated in **Figure 5-3**.

In 2021, with the Project, the morning peak one-hour timetable would provide 39 services to approach the CBD from the north (the same as without the Project), and 20 services from the west (the same as without the Project).

From the south and east, 29 services would arrive in the peak hour, compared to 24 services without the Project. Of these 29 trains from the south and south-east, 15 trains would travel via the Project and 14 trains would travel across the Merivale Bridge.

This use of the Merivale Bridge would be ten trains per hour fewer than without the Project, which would free up line capacity and improve reliability for the surface rail services.

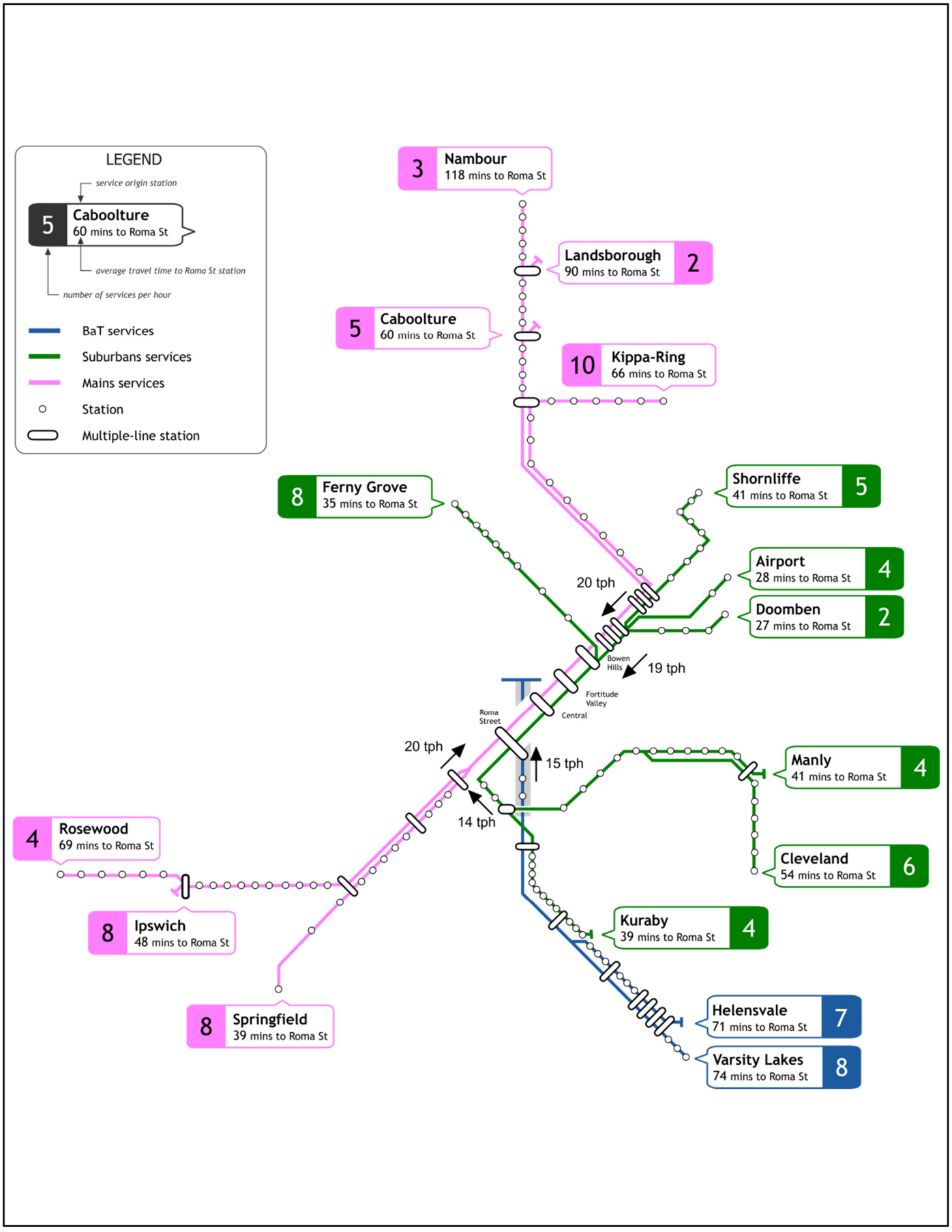


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FIGURE 5-3

Overview of 2021 rail service plan - morning peak one hour with the Project

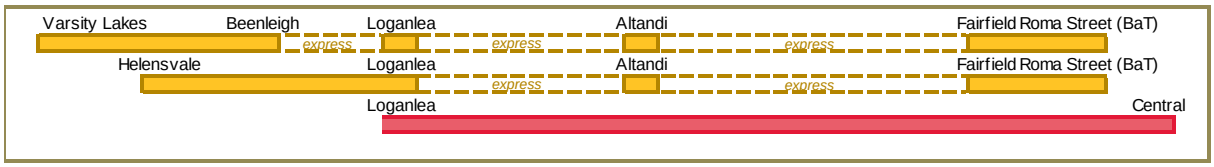
By 2031 with the Project, rail traffic between Beenleigh and Kuraby is expected to exceed the carrying capacity of the surface tracks south of Kuraby. If additional track is added to extend capacity on this section, it would open the opportunity to extend the suburban all-stops tier from Kuraby to Loganlea, making it possible to make use of spare capacity on these services and increase service frequency to at least 10 minutes during the peak periods. It is expected that this would be delivered as part of ordinary network upgrade programs.

This change would also allow a further increase in the number of Helensvale limited-express services during the peak period, allowing them to match the planned frequency of the Varsity Lakes express tier.

Staging the network in this way supports deferred investment in the new infrastructure between Kuraby and Beenleigh that is required to accommodate on-going growth along the corridor.

Figure 5-4 illustrates the stopping pattern for the southern line by 2031 in the AM peak period. This change to the stopping patterns would result in passengers at Kingston, Woodridge and Trinder Park losing access to the limited express Helensvale services that travel via the Project in return for access to all-stations services from Loganlea that connect to the city via the existing surface lines. To offset this change peak frequency of all-stations services on the Loganlea tier would be increased to provide at least a 10 minute frequency during peaks. This compares to a 15 minute frequency provided in earlier years from Kuraby.

Figure 5-4 Proposed stopping pattern for southern lines in operation by 2031



The possible service plans with the Project for 2031 for the morning peak hour are illustrated in **Figure 5-5**.

Outside peak times, typically four services per hour operating all-stations would operate between Loganlea and the Brisbane CBD via the existing surface lines. Four express services per hour would operate to the CBD via the Project, half originating at Varsity Lakes with the remainder from Helensvale.

In 2031, with the Project, the morning peak one-hour timetable would provide 41 services to approach the CBD from the north (the same as without the Project), and 20 services from the west (the same as without the Project).

From the south and east, 36 services would arrive in the peak hour, compared to 24 services without the Project. Of these 36 trains from the south and south-east, 19 trains would travel via the Project and 17 trains would travel across the Merivale Bridge.

Use of the Merivale Bridge would be seven trains per hour fewer than without the Project, which would free up line capacity and would improve reliability for the surface rail services in 2031.

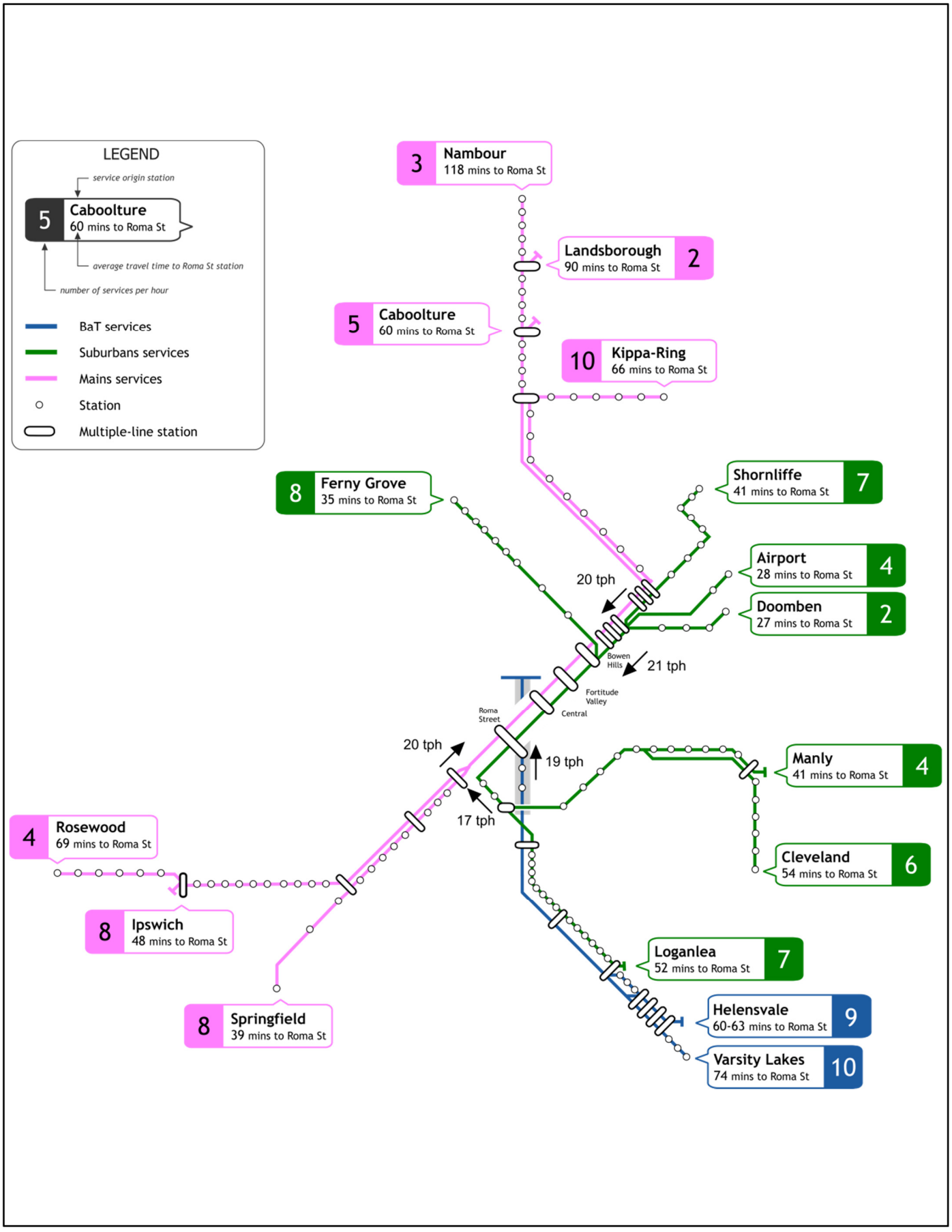


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FIGURE 5-5

Overview of 2031 rail service plan – morning peak one hour with the Project

5.3 Bus network changes proposed

5.3.1 Bus-specific operation principles

The following key bus-specific principles have been identified for the Project:

- accommodate the largest parts of growth in metropolitan bus network demand on the Project's services
- reallocate services to reduce congestion on the Victoria Bridge, whilst providing sufficient capacity to allow the surface bus network to respond to forecast population and employment growth in South Brisbane and West End
- balance the distribution of services between the Project and the surface networks to allow for the staged provision of future growth in service capacity (via increased frequencies or transition to larger vehicles) without further need for major route redistributions
- spread the passenger transfer opportunity across a larger number of stations, particularly away from the current concentration at Cultural Centre.

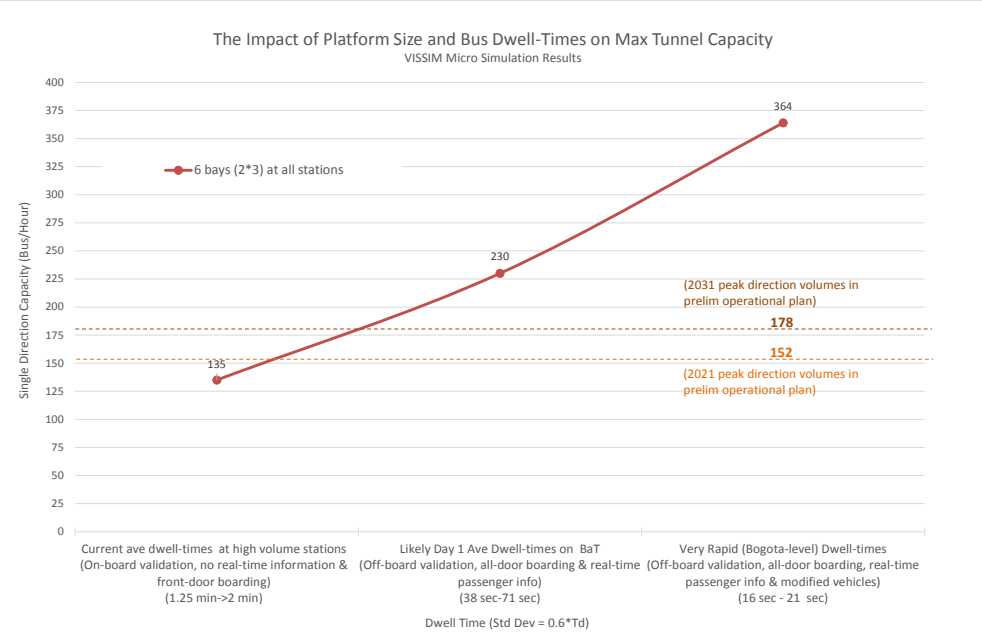
5.3.2 Integration with the existing bus network and operational sectors

Figure 5-6 illustrates the overall layout of the Project and how bus routes on major bus corridors such as the South East Busway, Eastern Busway (to UQ), Northern Busway, ICB and Bowen Bridge Road would access the Project and other connecting busway infrastructure.

5.3.3 Planning assumptions

Table 5.3 outlines the key planning assumptions for Project bus operations.

Table 5.3 Key bus operation planning assumptions for the Project

Topic	Assumption
Service capacity/dwell times	Station capacity is a function of the bus dwell-times generated by station loading demand (boarding and alighting) and the number of available bays. The below graph shows estimated corridor capacity for three average dwell-time scenarios.  Analysis suggests that dwell-times at George Street and Roma Street are likely to be comparatively similar, despite having very different usage profiles. While George Street is expected to attract the highest number of primary origin and destination-based trips, the attractiveness of interchanging to BaT buses at Roma Street is expected to attract significant interchange boardings and alightings from the suburban rail lines travelling through the existing Roma Street rail platforms.
Supporting measures	Based on this service capacity analysis, the study corridor will be able to accommodate the likely 2021 and 2031 bus service frequencies provided the following conditions and supporting measures are in place: • six bus bays (two independent zones of three) at each station • all-door boarding and off-board fare validation at bus platforms and key busway stations • accurate bus tracking and timely real-time arrivals information • active platform queue and dwell-time management in peak periods • progressive introduction of new buses designed for rapid, all door loading (more, wider doors and fewer internal obstructions). Analysis undertaken for the Project showed a minimum requirement of six bus bays per platform. Fewer bays per platform does not provide the required capacity for the Project.

Topic	Assumption
Station arrangement	The bus platforms would be configured to accommodate up to six buses at a time across two independent three-bay stopping zones. This arrangement will: • require a through lane to allow zones to operate independently • involve each bus stopping at the front of a bay capable of accommodating an 18-metre articulated bus, thus all buses stop with the front door at a predictable position, facilitating equitable access in line with the requirements of the *Disability Discrimination Act* • allow the use of mid-cavern queuing in the through lanes for buses waiting to enter the front bays, guaranteeing free movement of buses from the rear zones, even at very high volumes • provide the greatest flexibility in accommodating all other vehicles within the current and future fleet • recognise the operational benefits of increasing route capacity and absorbing demand through higher capacity vehicles rather than additional services where frequencies on a route are already very high, such as ≤ 5min in peak or ≤ 10 mins in off-peak • operate under an enter in order/exit in order (EIO/ EIO) configuration, that is, buses cannot turn in or pull-out in front of or behind a stationary bus at the same platform • include closely spaced PSDs and a passenger boarding zone outside the passenger screen to cater to variable door spacing.

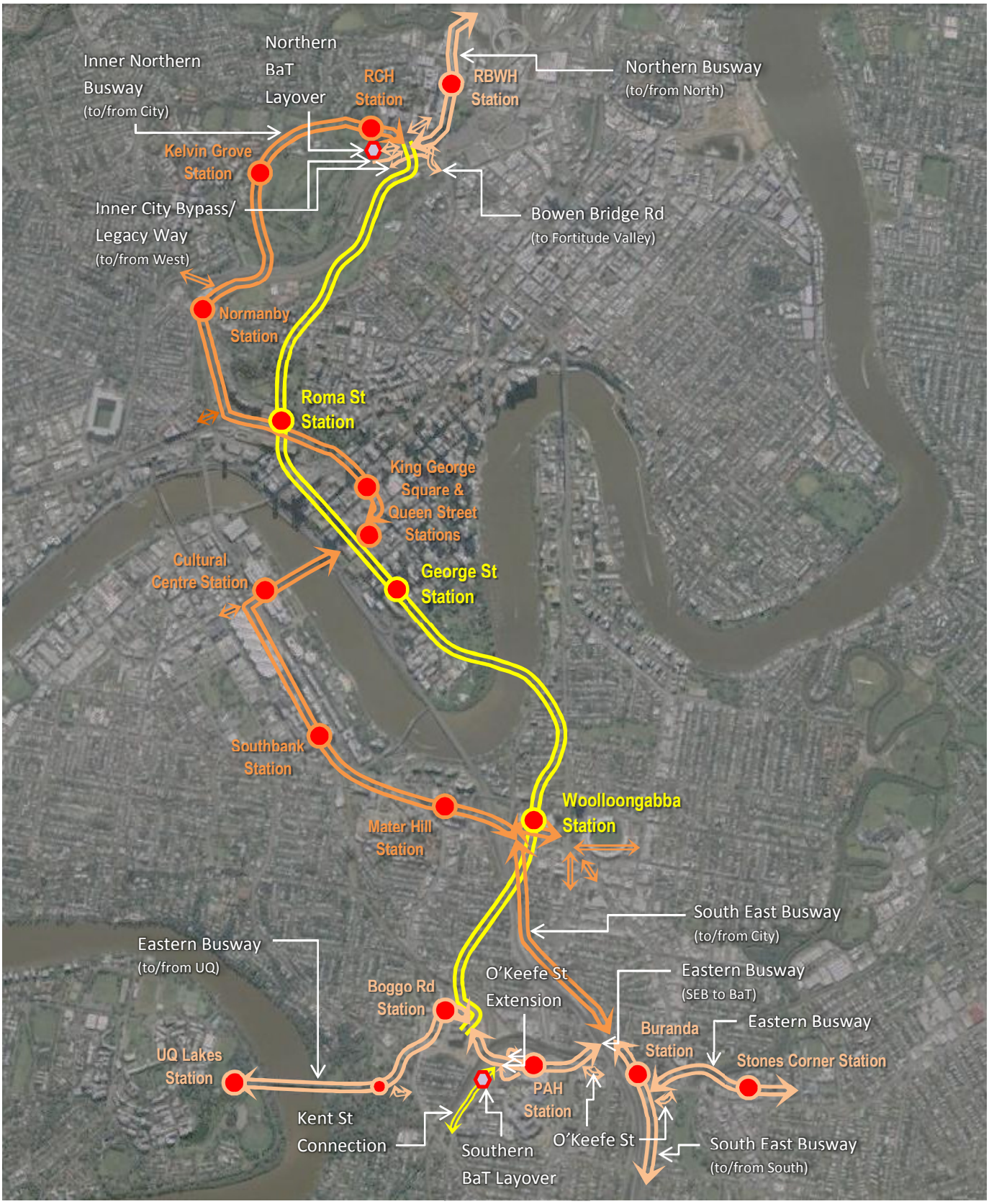


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FIGURE 5-6

Connectivity of the Project to busway infrastructure

5.4 Bus operating strategy

The service plans developed provided 'reference networks' used in assessing the reference design and the Project's network benefits and impacts. A range of bus network design and planning principles (eg legibility, reliability, network efficiency) underpin the development of the service plans. Broadly, the bus service plans have focussed on routes that offer the best opportunities for patronage growth and which would have good access to the Project, or were able to capitalise upon opportunities on the existing network, created through redistribution of services into the Project.

The Project would complement the South East Busway and INB by offering a second high-standard path of travel for buses through the Brisbane CBD. the Project is more direct to the CBD and has less intersections and stations when compared with the South East Busway and INB, and therefore offers fast, reliable and direct service to and through the CBD. Conversely, the existing busways offer a closer station spacing and wider coverage of non-CBD destinations. These complementary differences offer the opportunity to use the Project and South East Busway/ INB in combination to provide two access paths through the CBD for services from high frequency corridors across the network.

In many of the main catchments currently served by high frequency bus routes, users would therefore have the option of travelling either via the Project or the existing inner city busways depending on their destination. **Figure 5-7** depicts the (conceptual) bus service plan adopted for 2021, showing the key corridors with services utilising the Project tunnel. While the detail within the service plans may change in response to ongoing development of network, infrastructure and operational strategies, the broader approaches and principles would remain in place.

While the Project opens up further opportunities for travel within the inner city, for example from Woolloongabba to George Street, it is expected that forecast population and jobs growth within the inner city will drive the need for further 'distributor' style services. As part of the Project's bus service plan, two new inner-city CityGlider-style services (Northshore- Mary Street and West End-Mary Street-New Farm) were also developed as potential connections. These services would both interface with the George Street Station to provide access between the study corridor and locations such as Eagle Street and the Cultural Centre. They would also provide an alternative east-west corridor through Brisbane CBD, relieving pressure on Adelaide Street based inner-city distribution services.

On key corridors with high combined frequencies, such as Ipswich Road, Mains Road, South East Busway, Logan Road, Cavendish Road, Old Cleveland Road, Gympie Road, and the Western Freeway, buses would service both the Project and the existing busway corridors. This split would offer passengers a choice of destinations and interchange opportunities, while maintaining a good LoS and frequency along each of the core inner-city bus corridors.

Suburban route coverage that would use the Project extends to UQ Lakes, Inala, Eight Mile Plains, Garden City, Browns Plains, Drewvale, Stretton, Mt Gravatt, Garden City, Wynnum, Carindale, Capalaba, Brighton, Chermside, Carseldine, Newmarket, Kenmore, Fig Tree Pocket, Moggill, Riverhills, Mt Ommaney and Logan Hyperdome. These routes and the suggested wider network changes would be refined and confirmed as part of detailed service change planning to be undertaken closer to commissioning of the Project.

Corridors that do not have the frequency to allow some services to be relocated to the Project, would provide greater opportunity for passengers to interchange on a connected network that would enable access to the Project from anywhere via convenient interchange.

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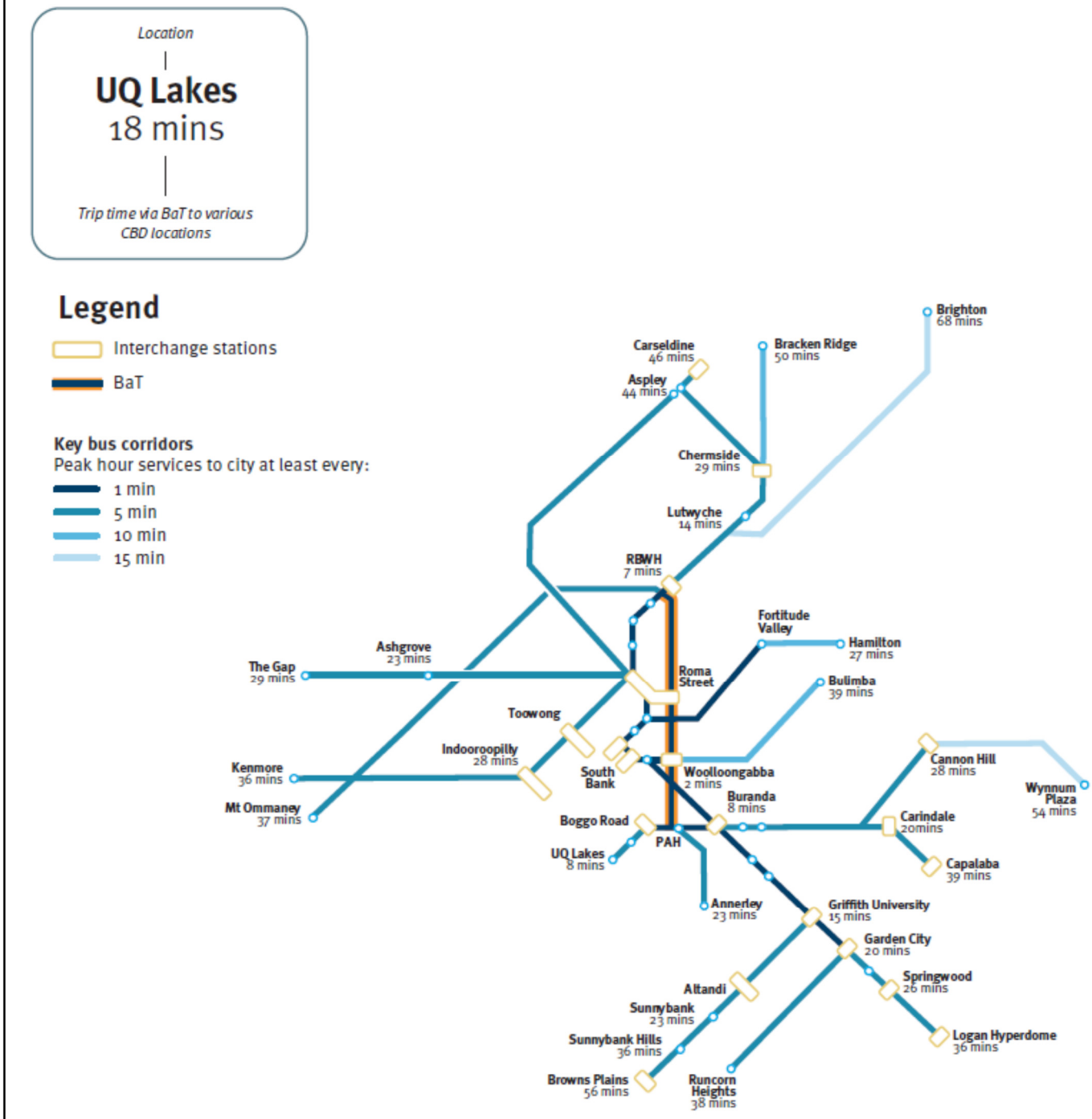

- Bus travel times are estimates assuming current travel speeds on-road.
- Bus travel times assume a service using BaT, some services may not use BaT.

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FIGURE 5-7

Bus network with the Project

5.5 Bus service plan impacts

Applying the operational planning principles, the key changes in bus service numbers associated with the reference network are outlined below.

Table 5-4 shows the bus volumes on the major routes across the Brisbane River in the morning peak one hour. Despite the significant increase in inner-city distributor services, overall bus volumes across the Victoria Bridge reduce compared to base year (2012) volumes. Overall, to 2021, the number of buses (as opposed to the LoS) across the river decline slightly from the base year (2012), reflecting increased bus fleet capacity, better balancing of passengers across services, and greater efficiency of operations.

Table 5-4 Bus volumes on major river crossings with the Project in AM peak one hour

Link	2012 volume	2021 volume	2031 volume
Victoria Bridge	225	179	199
Captain Cook Bridge	221	105	111
The Project	-	158	172
Total	446	442	482

Table note – bus volumes are in-service buses and does not include dead running buses

Table 5-5 shows the bus volume reductions at the congested busway intersection with Allen Street and through the Mater Hill station in the morning peak one hour.

Table 5-5 Bus volumes on the inner city busways with the Project in AM peak one hour

Link	2012 volume	2021 volume	2031 volume
South East Busway inbound approaching Allen Street intersection	379	217	231
Turning left from South East Busway at Allen Street toward the Captain Cook Bridge	221	105	111
Proceeding through the South East Busway to and through Mater Hill Busway Stations	159	112	120

Table note – bus volumes are in-service buses and does not include dead running buses

Table 5-6 details the expected use of Brisbane CBD streets by buses with the Project operational, and identifies reductions in bus volumes compared to base year peak period conditions. These are significant reductions that would lead to some improvements in the amenity and traffic operation of the CBD streets.

Table 5-6 Bus volumes on key CBD streets with the Project in AM peak one hour

AM Peak one hour total bus volumes			
CBD Street	**2012**	**2021**	**Change**
Elizabeth Street	219	108	*-111*
Adelaide Street	224	190	*-34*
Edward Street	43	35	*-8*
Ann Street	26	19	*-7*
Queen Street	39	36	*-3*

Table note – one-way inbound buses

Some key findings about the potential change in bus service volumes with the Project include:

- **Victoria Bridge:** Used by 179 buses per hour in 2021 with the Project represents 20 per cent lower volumes than in 2012, which would reduce delays and allow for growth in bus services using this river crossing beyond 2031.
- **Captain Cook Bridge:** With the Project, the number of buses on the Captain Cook Bridge in the morning peak one hour would be halved, taking many services out of congested general traffic lanes.
- **The Project:** Consistent with the service design principles, the majority of growth in bus services using the network would occur via the Project services. Between 2021 and 2031, a further 14 buses would be added to the Project to service growth in demand, taking the volume to 172 buses in the Project. Capacity would also be enhanced in the Project by operating many services with high-capacity articulated buses by 2031.
- **Mater Hill:** Bus volume reductions would reduce congestion that is currently experienced at Mater Hill station.
- **South East Busway – Allen Street intersection:** Bus volume reductions would significantly enhance the performance of the South East Busway at the Allen Street intersection.
- **CBD streets:** The bus service plan to be implemented with the Project leads to significant reduction in peak period bus volume reductions on Brisbane CBD streets, for example over a 50 per cent reduction in buses on Elizabeth Street in 2021 compared to the base year situation and 15 per cent on Adelaide Street. This would reduce traffic congestion, improve pedestrian capacity and urban amenity, and would allow for rationalisation of CBD kerbside bus operations.

5.5.1 Bus fleet implications

The proposed stations and associated infrastructure would be designed to accommodate a wide variety of vehicle types, both now and into the future. The SEQ bus fleet has undergone significant expansion over the last 6 years, and with an expected lifespan of 20 years for a bus, a significant part of the current bus fleet would service the Project in 2021 and 2031.

By 2021 the collective urban services fleet that might use the Project could consist of: 12.5m rigid vehicles (77 passenger capacity); long chassis rigid buses, 14.5m (89 passenger capacity); and 18m articulated buses (89 passenger capacity). All buses in the wider South East Queensland urban service fleet will be air-conditioned with low floor, accessible front entry

To meet higher demand along key corridors, it is envisaged that many services on the key routes would be allocated articulated buses. Beyond 2031, it is envisaged that the Project and the whole busway network would migrate in stages to a more metro-like operation possibly shifting to bi-articulated bus.

Table 5-7 outlines the estimated impact on bus fleet purchase requirements for the periods to 2021 and between 2021 and 2031 with the Project. Due to slower journey times, a larger fleet would be required without the Project. The Project would result in a requirement for 46 fewer buses in 2031 compared to without the Project.

Table 5-7 Estimated bus fleet requirement with the Project service plans

Year	Standard Rigid	Long Rigid	Articulated	Total
Total Change with Project 2012-2021	+524	-67	+184	+641
Total Change with Project 2021-2031	+1,281	+55	+104	+1440
Total Change with project 2012-2031	**+1,806**	**-12**	**+288**	**+2081**
Diff with Project to without 2012-2021	-66	-44	12	-98
Diff with Project to without 2021-2031	-22	+42	+31	+52
Diff with Project to without 2012-2031	-87	-2	+43	-46