6. Strategic transport impacts and benefits of the Project

The Project would provide inner city rail and bus network capacity improvements to accommodate future public transport patronage to and from the Brisbane CBD. It would allow increased public transport accessibility to the CBD from new or improved railway stations and from the busway network. This improved transport accessibility would support planned CBD population and employment growth by providing more effective and efficient transport services compared with not investing in the Project.

The forecast transport benefits of the Project would have three main beneficiaries groups:

- transport users of all modes of transport
- public transport operators – TransLink Division of TMR, Queensland Rail and Brisbane Transport
- Government – in terms of the Project contributing to wider transport objectives.

The key transport benefits, which are described following this introduction, would include:

- an increase in rail and bus passenger capacity
- an increase in rail and bus patronage
- an increase in public transport mode share especially to the CBD
- faster rail and bus trip speeds and reduced wait times that would lead to shorter rail and bus trip times
- improved rail and bus passenger LoS through reduced passenger crowding
- improved travel time reliability for both modes
- improved network resilience by providing an alternative corridor through the inner city for bus and rail when the network is interrupted by unexpected incidents or maintenance.
- improved public transport accessibility to the CBD
- a reduction in the number of buses operating on CBD streets and the Captain Cook Bridge and Victoria Bridge
- a small reduction in road trips to the CBD.

6.1 Changes to rail and bus passenger capacity

6.1.1 Rail

The development of the Project allows for a significant improvement in rail capacity to and through the CBD. The changes in routing associated with the Project would improve rail service capacity and reliability by helping to alleviate congestion and crossing constraints including:

- at Park Road junction
- across the Merivale Bridge
- rail traffic levels on the inner city Suburban lines
- turn-back into stabling at Mayne Yard rather than travelling via Park Road junction.

Table 6-1 provides a summary of CBD station peak hour train frequencies achievable for the morning peak one hour without and with the Project. 15 trains per hour would use the Project in 2021 increasing to 19 trains per hour in 2031.

Table 6-1 Forecast morning peak train numbers (per hour) at CBD stations

Scenario	Trains from the south to CBD	Trains from the east to CBD	Trains from the west to CBD	Trains from the north to CBD	Total two-way through CBD
2014	11	8	16	37	72
2021 without Project	16	8	20	39	83
2021 with Project	19 (15 in BaT)	10	20	39	88 (15 in BaT)
2031 without Project	16	8	20	41	85
2031 with Project	26 (19 in BaT)	10	20	41	97 (19 in BaT)

In 2021, the Project would accommodate an additional four trains per hour during the peak period from the Gold Coast and Beenleigh corridor and two additional trains per hour from the Cleveland corridor, compared to without the Project.

With the Project in operation in 2031, an additional 12 trains per hour would be added to the Brisbane rail network during the morning peak compared to without the Project. This represents around a 14 per cent increase in capacity compared to the scenario without the Project.

6.1.2 Bus

The Project would have a significant impact on bus network capacity:

- by facilitating significant increases in bus network capacity from the north to the Brisbane CBD from 5,200 passengers per hour, up to 11,000 and 19,000 per hour in 2021
- by doubling bus passenger capacity to 24,000 by 2021 from the south to the CBD compared to without the Project
- by providing potential for an ultimate corridor capacity (with fleet optimisation) of 35,000 passengers per hour for both directions that would be achieved by using a high capacity bus fleet.

6.2 Impacts on transport mode share with the Project

The forecast Brisbane CBD modal share by motorised modes in the morning peak with the Project is shown in **Figure 6-1**. Compared to the existing situation, car travel is expected to reduce proportionally, with growth in travel demand increasingly served by public transport modes.

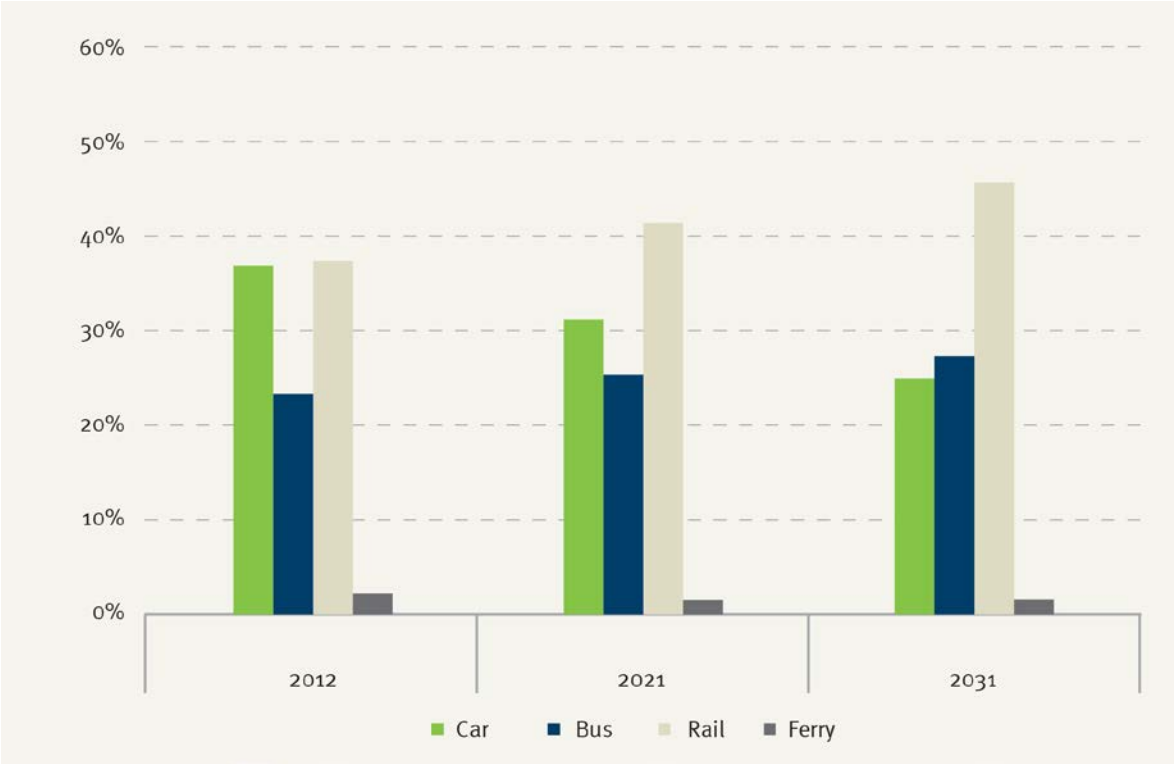
70 per cent of trips to the CBD would be by bus and rail modes with the Project. Rail would become the dominant mode for Brisbane CBD access. By 2031, with the Project in operation, over 45 per cent of CBD trips made by motorised modes are forecast to use rail. With the Project, bus travel would also increase in significance as a mode of access to the CBD in the morning peak, catering for over 25 per cent of CBD travel by 2031.

Public transport mode share would be enhanced by the creation of a range of new interchange opportunities with the Project at:

- **Woolloongabba** – providing interchange between rail services and southbound buses (notably to UQ and PA Hospital), as well as with the existing surface busway.
- **George Street** – providing new, high quality, high frequency rail and bus access to the southern areas of the CBD. As the most centrally located station in the CBD, this station would have an interchange role between the Project's rail and bus services as well as to the surface city distributive bus network.

- **Roma Street** – this major CBD interchange point for the bus and rail network would be further enhanced with an increased proportion of commuter services travelling through the interconnected surface busway, surface rail and underground bus and rail platforms.
- **PA Hospital** – an attractive location for transfer between the Project's bus services and Eastern Busway (UQ and Old Cleveland Road bound) bus services. This location would see a threefold increase in services throughout the day and services to destinations as far afield as Logan and Chermside.
- **Buranda bus/ rail station** – increased interchange opportunities between the Project's bus corridor, Cleveland Rail, South East Busway and Eastern Busway services.
- **RBWH** – this busway station would provide the opportunity to interchange between the Project, Fortitude Valley, Peak express (via Spring Hill), Inner Northern Busway and Northern Busway services.
- **Dutton Park** – this station would provide interchange opportunities between all-stops surface and express rail services in both directions. This would provide Dutton Park with a substantial increase in service frequency and may present the opportunity to introduce better integration with the bus network.
- **Altandi** – provide both a peak-period and off-peak stop for all-stops surface and express rail services and offering interchange opportunities with feeder bus and park 'n' ride.

Figure 6-1 Forecast AM peak period motorised mode share to the CBD with the Project



Analysis of cross river trips in the morning peak as illustrated in **Figure 6-2**, shows a strong trend towards more rail and bus trips and less car trips with the Project.

Figure 6-2 Forecast AM peak period travel demand (person trips) across the Brisbane River

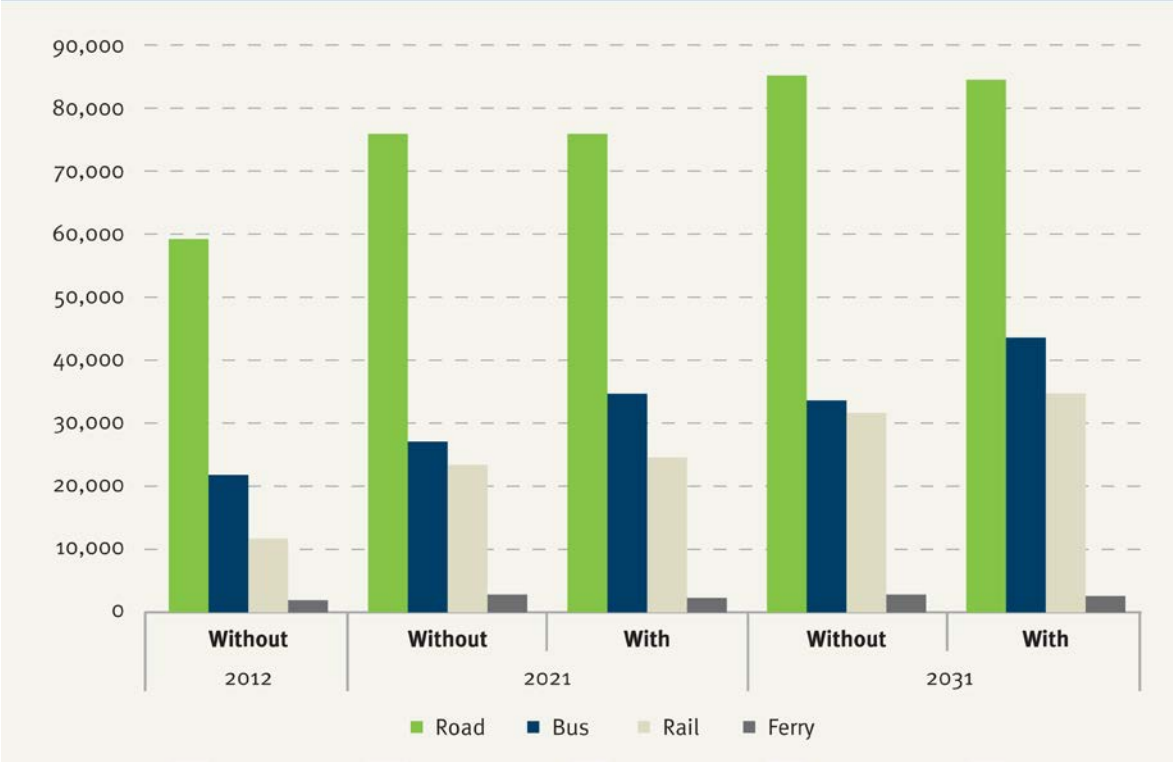


Table 6-2 presents the forecast average weekday travel and total person trip growth without and with the Project from 2012 to 2031.

The forecast total number of trips made by all motorised modes (ie car and public transport) across the Brisbane Statistical Division would be similar for both with and without the Project. However, the proportion of trips by public transport (or mode share) is higher with the Project in both 2021 and 2031.

By 2031 with the Project, 11.0 per cent of motorised trips are expected to be by public transport on an average weekday, compared to 10.8 per cent without the Project across the Brisbane Statistical Division. More significant changes in mode share would occur at the more localised level where the Project has a more direct influence on travel behaviour.

Table 6-2 Average change in weekday trips in the Brisbane Statistical Division

Parameter	2012	2021		2031	
		Without Project	With Project	Without Project	With Project
Total person trips by all modes	7,163,100	8,890,000	8,890,000	10,348,000	10,348,000
Public Transport Mode share	7.0%	9.4%	9.5%	10.8%	11.0%
Total vehicle trips* (24 hour)	4,695,000	5,755,800	5,748,100	6,680,100	6,665,200

Source: BaT Project Model. Note: Includes commercial vehicle trips*

Table 6-3 shows the forecast growth in peak and daily rail and bus patronage in the region.

The number of peak period and daily public transport trips is forecast to more than double from 2012 to 2031. By 2031, there are forecast to be more than one million daily public transport trips in the region.

Without the Project, forecast growth in both peak and daily rail demand to 2031 (160 per cent daily) is stronger than that for bus (100 per cent daily). This growth in daily demand by sub-mode increases to 165 per cent for rail and 117 per cent for bus with the Project.

Across the Brisbane Statistical Division, total bus patronage in 2031 is 42,900 more daily trips and rail patronage is 10,900 more trips than without the Project. Total vehicle trips would be reduced by around 15,000 trips. Although a smaller increase in total patronage is forecast with the Project in 2021, passengers would benefit from significant improvements to public transport LoS (decreased waiting times, reduced crowding, improved reliability).

Table 6-3 Public transport users by mode across the Brisbane Statistical Division

Period	2012	2021				2031			
		Users		Growth		Users		Growth	
		Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
Rail Users									
AM 2hr peak	59,500	104,900	105,100	76%	77%	148,600	153,400	150%	158%
PM 2hr peak	54,300	98,800	98,800	82%	82%	143,600	146,600	165%	170%
Daily	214,500	395,500	397,000	84%	85%	558,000	568,900	160%	165%
Bus users									
AM 2hr peak	58,000	88,800	97,200	53%	68%	114,400	128,400	97%	121%
PM 2hr peak	49,500	70,800	78,000	43%	58%	91,300	103,900	84%	110%
Daily	248,700	381,300	408,200	53%	64%	496,600	539,500	100%	117%

Source: BaT Project Model

Note: The number of rail and bus users include those whom may use more than one mode for a complete journey.

6.3 Rail patronage with the Project

As shown in **Table 6-3**, total rail patronage would be higher with the Project compared to without the Project. In 2021, an increase to 397,000 rail trips per average weekday is forecast and by 2031 daily rail trips would reach 568,900 trips, an increase of 2 per cent compared to without the Project. By 2031, the total number of weekday rail trips would be over double base year (2012) levels.

The forecast change in rail patronage to the CBD with the Project in the morning peak period and various system performance indicators across the Brisbane Statistical Division are presented in **Table 6-4**. With the Project, system wide average trip time and distance reductions are evident.

The forecast increase in rail trips to the CBD during the morning peak period due to the Project is significant, 20 per cent in 2021 rising to 24 per cent by 2031. The Project allows rail passenger

volumes to the CBD in the morning peak period to more than double between 2012 and 2031 and allow rail to fulfil a larger role in CBD-based travel, from its base year of 33 per cent to a potential 55 per cent of all trips in 2031.

Table 6-4 AM peak two hour rail performance indicators in the Brisbane Statistical Division

AM peak period	2021			2031		
	Without Project	With Project	% change	Without Project	With Project	% change
Total rail passenger kilometre	2,239,400	2,241,400	0.1%	3,373,200	3,452,900	2.4%
Total rail passenger hours	55,200	54,300	-1.6%	81,200	81,600	0.5%
Number of rail trips to the CBD (am peak period)	30,200	50,200	20.1%	70,600	87,500	23.8%
Average rail trip length (km)	21.3	21.3	-0.1%	22.7	22.5	-0.9%
Average rail trip time (min)	31.6	31.0	-1.9%	32.8	31.9	-2.8%
Average rail trip speed (km/ h)	40.6	41.3	1.8%	41.5	42.3	1.9%

Source: BaT Project Model

Table 6-5 provides a summary of the forecast rail patronage, expressed as two-way line loadings of travel in each direction, between rail stations in the inner city, including through the Project, for the morning peak period. In 2021, over 10,000 passengers would travel on the Project's rail services between Woolloongabba and George Street stations during the morning peak period rising to just under 15,000 by 2031. Overall the busiest section of the Project is between Dutton Park and Woolloongabba stations where over 17,000 rail passengers use this section in the 2031 morning peak two hours.

Table 6-5 Forecast rail patronage with the Project – morning peak period (2 hours)

	2012	2021	% growth	2031	% growth
BaT rail					
Dutton Park to Woolloongabba		12,800		17,300	
Woolloongabba to George Street		10,300		14,900	
George Street to Roma Street		4,100		6,500	
Surface rail					
Roma Street to Central	15,300	17,700	16%	25,000	64%
South Brisbane to Roma Street	9,400	7,300	-23%	10,000	6%
South Bank to South Brisbane	12,100	8,900	-26%	13,000	8%
Park Road to South Bank	15,200	10,600	-31%	17,100	12%
Dutton Park to Park Road	9,400	3,600	-62%	8,200	-13%

Source: BaT Project Model

6.4 Station activity

Forecast station daily passenger activity is shown in **Table 6-6** for 2021 and 2031. Forecast weekday morning peak period (7:00am to 9:00am) activity is illustrated in **Figure 6-3**. This data presents passenger movements on both bus and rail as boarding, alighting and transfer passengers and shows:

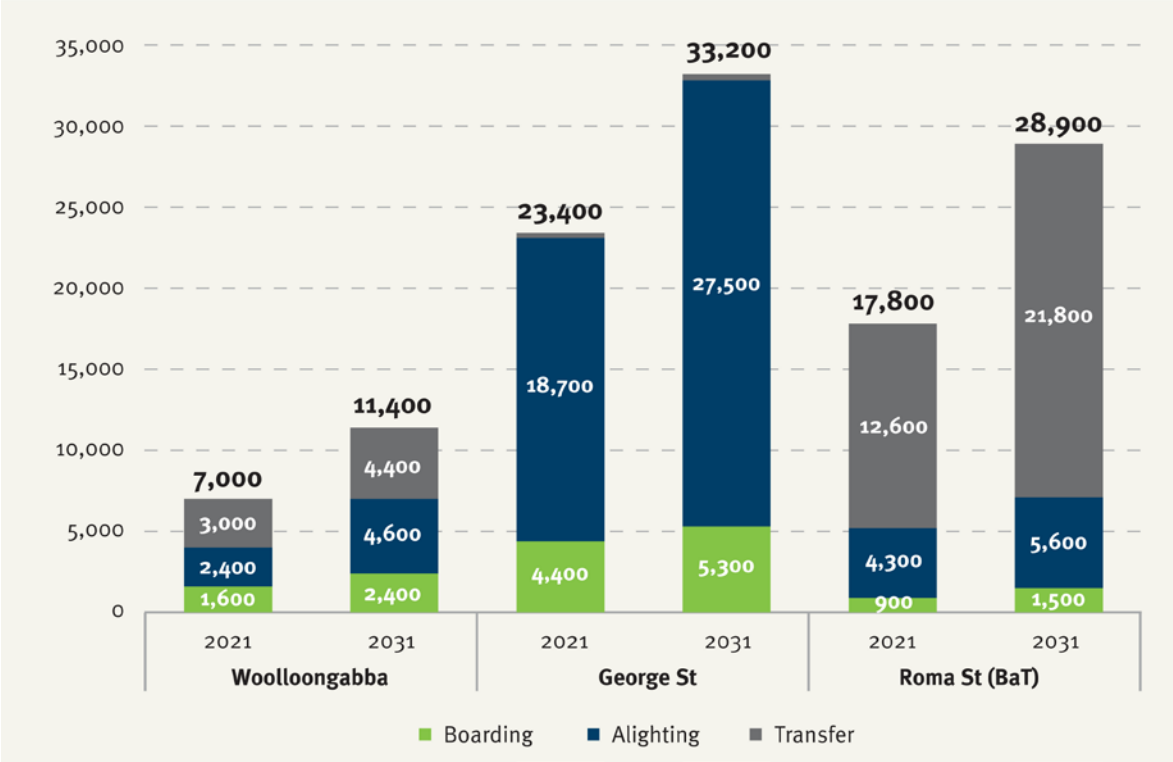
- the key interchange role played by the Woolloongabba and Roma Street Stations, with a particularly strong movement between the Project and surface rail at Roma Street that would include transfer to Brisbane Airport rail services
- the new George Street Station primarily provides a destination function, attracting approximately 23,400 passengers during the morning peak in 2021 and 33,200 in 2031, with some interchange occurring.

Table 6-6 Project station daily passenger activity - 2021 and 2031

Year	Station	Boarding	Alighting	Transfer (boarding + alighting)	Total
2021	Roma Street	10,200	10,000	44,800	65,000
	Woolloongabba	6,000	5,800	12,900	24,600
	George Street	47,700	44,400	1,400	93,500
	Total	63,900	60,200	59,100	183,100
2031	Roma Street	15,500	14,000	72,800	102,300
	Woolloongabba	13,200	13,300	16,000	42,500
	George Street	68,200	63,700	2,500	134,400
	Total	96,900	91,000	91,300	279,200

Source: BaT Project Model

Figure 6-3 Forecast BaT station throughput during the AM peak period, 2021 and 2031



6.5 Effect on rail network journey travel times

There is forecast to be a decrease in average station to station trip time with the Project (compared to without the Project) in both 2021 and 2031. This correlates to higher average morning peak period trip speeds. With the Project trip times would be almost two per cent faster across the rail network compared to with the Project as previously shown in **Table 6-4**.

The Project provides for more and faster express-running services from Helensvale and Varsity Lakes that bypass the surface network whilst also generally maintaining the 2014 service levels for Beenleigh Line stations. Consequently, the number of stops prior to the Brisbane CBD for services from the Gold Coast and Logan are reduced.

Services travelling via the Project and the new stations at Woolloongabba and George Streets would:

- provide a 3 minutes faster scheduled run time for Varsity Lakes services between Altandi and Roma Street compared to the equivalent service operating today
- offer passengers a new centrally located CBD station at George Street, reducing access time within the CBD to a convenient station.

Additionally, the modified tiering of rail services to support increased segregation of surface and Project services results in a new Helensvale service running express from Kuraby in 2021 and Loganlea in 2031. This provides travel time saving compared to the base year (2012) all-stations operation of:

- 13 minutes for some stations on the Helensvale tier in 2021 due to the ability to run these services as express from Kuraby (in 2021)
- 24 minutes for some stations on the Helensvale tier in 2031, with express running starting at Loganlea (in 2031).

6.6 Effect on level of service – rail passenger crowding

The Project provides a new rail corridor into the CBD that supports an increase in the total number of peak period train paths by up to 24 additional services per hour and per direction - an increase of 35 per cent over base year levels. (Note that by 2031 this maximum provision of trains in the new corridor would not be fully utilised.) This allows demand to be met on the south-eastern quarter of the network that would result in:

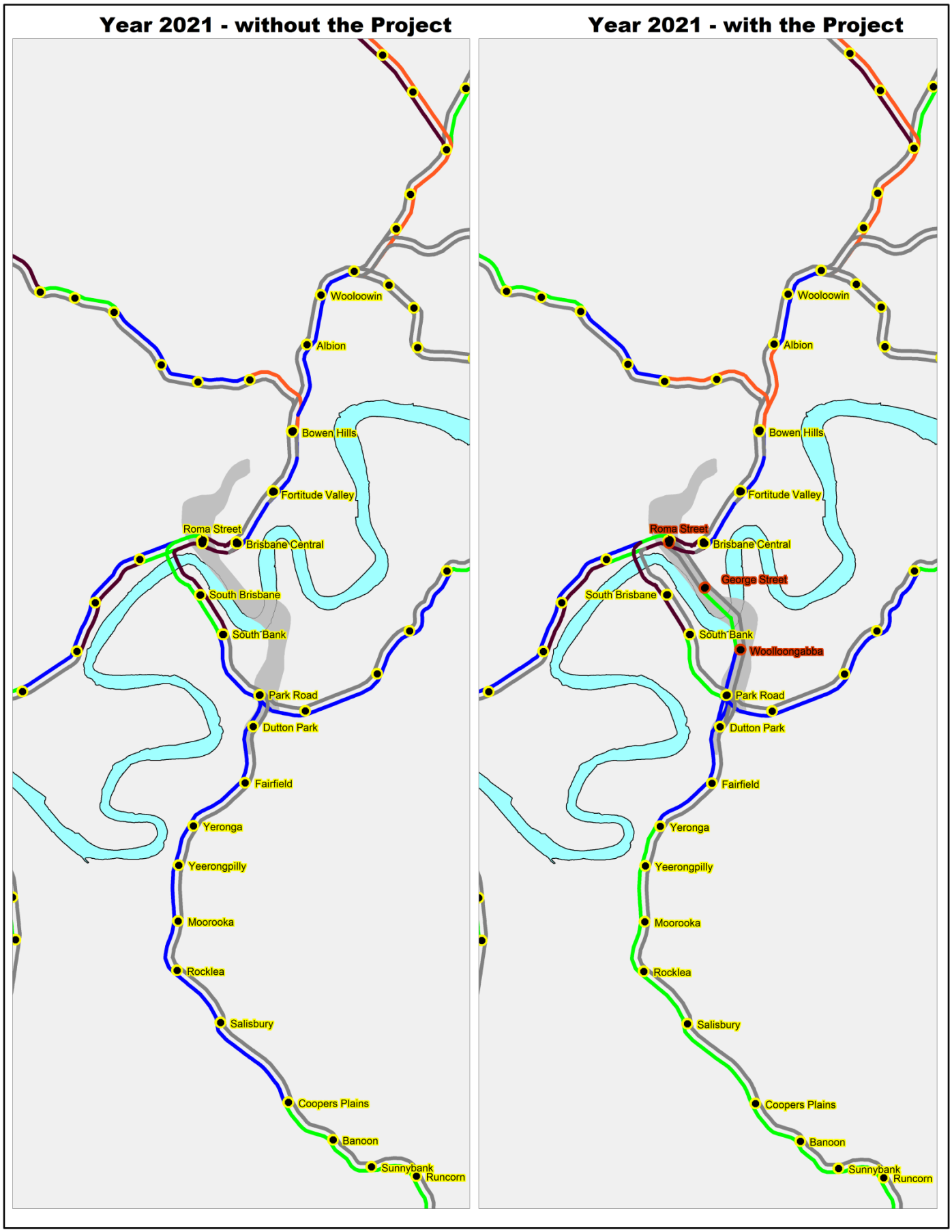
- reduced passenger crowding during commuter peak periods
- improved rail capacity to better manage future growth in public transport demand.

Addressing the base year shortfall in service capacity would substantially reduce the number of passengers standing on rail services for more than 20 minutes, as well as reducing the reliance of the rail network strategy on successfully achieving targets set for peak spreading.

With the Project the line load factors (calculated as the ratio of the number of passengers compared to seated capacity), are forecast to be significantly lower than without the Project on the southern lines. This is illustrated in **Figure 6-4** to **Figure 6-7** 2021 and 2031 and the morning and evening peak periods, with and without the Project.

Examples of reduced passenger crowding in the morning peak include:

- with the Project in 2021 crowding relief would be provided such that the load/ seat factor would fall below 1.25 on all rail approaches from the south
- in 2031 with the Project significant crowding relief would be provided in the Gold Coast-Beenleigh line
- some crowding relief on the Cleveland line as the Project facilitates two additional trains in the morning peak hour to Brisbane CBD.



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

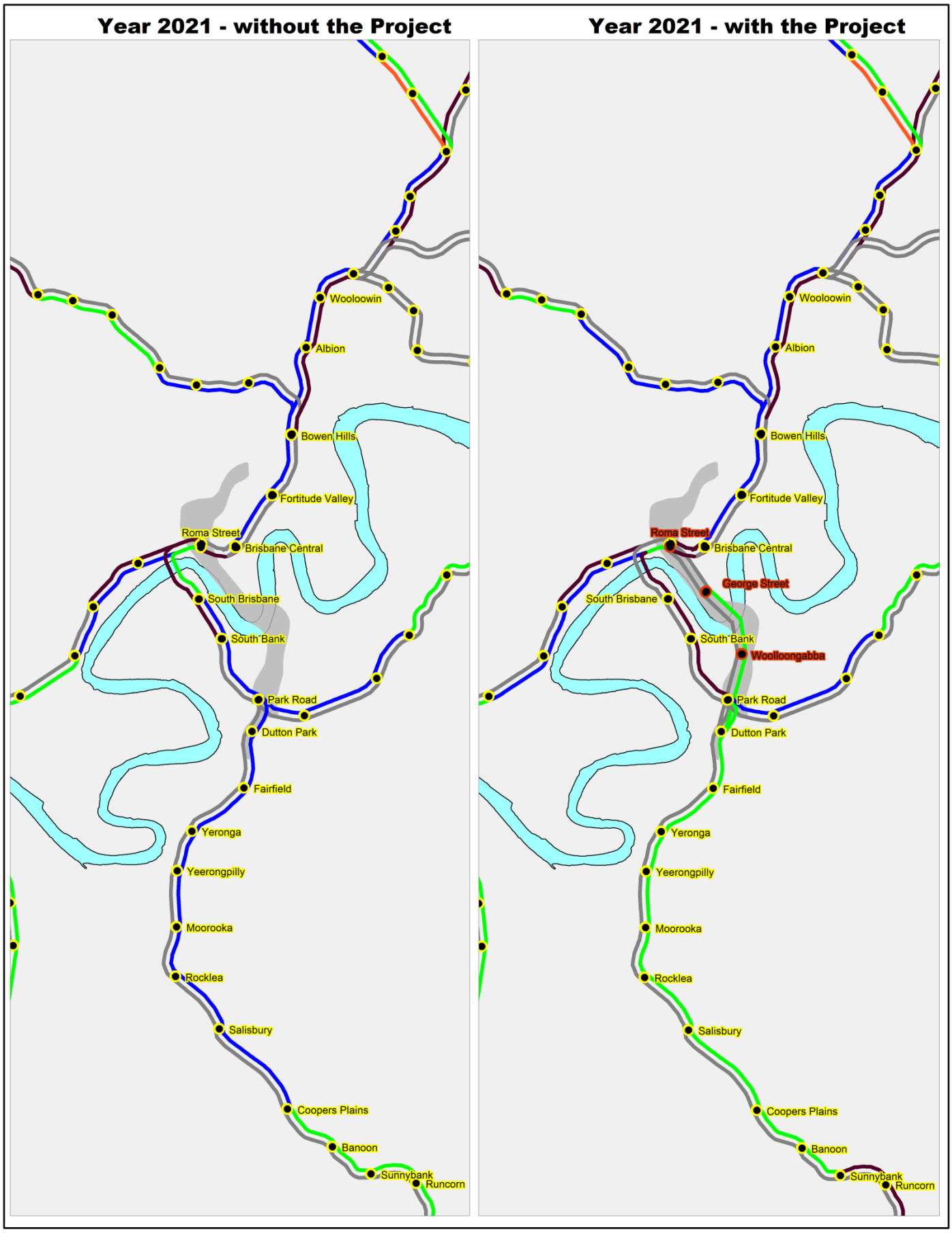
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-4

Rail load factors (AM peak) – 2021

without and with 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

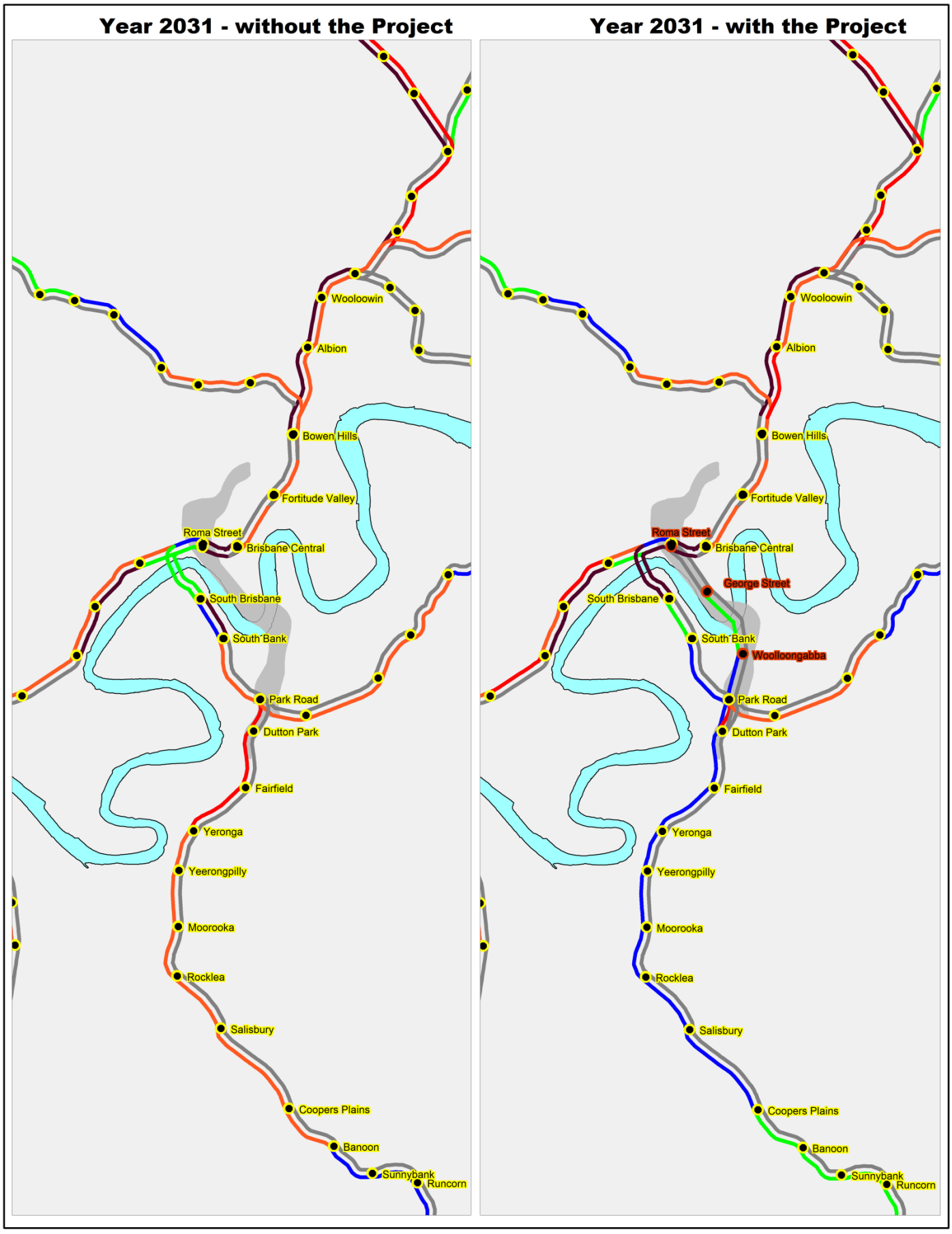
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-5

Rail load factors (PM peak) – 2021

without and with 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

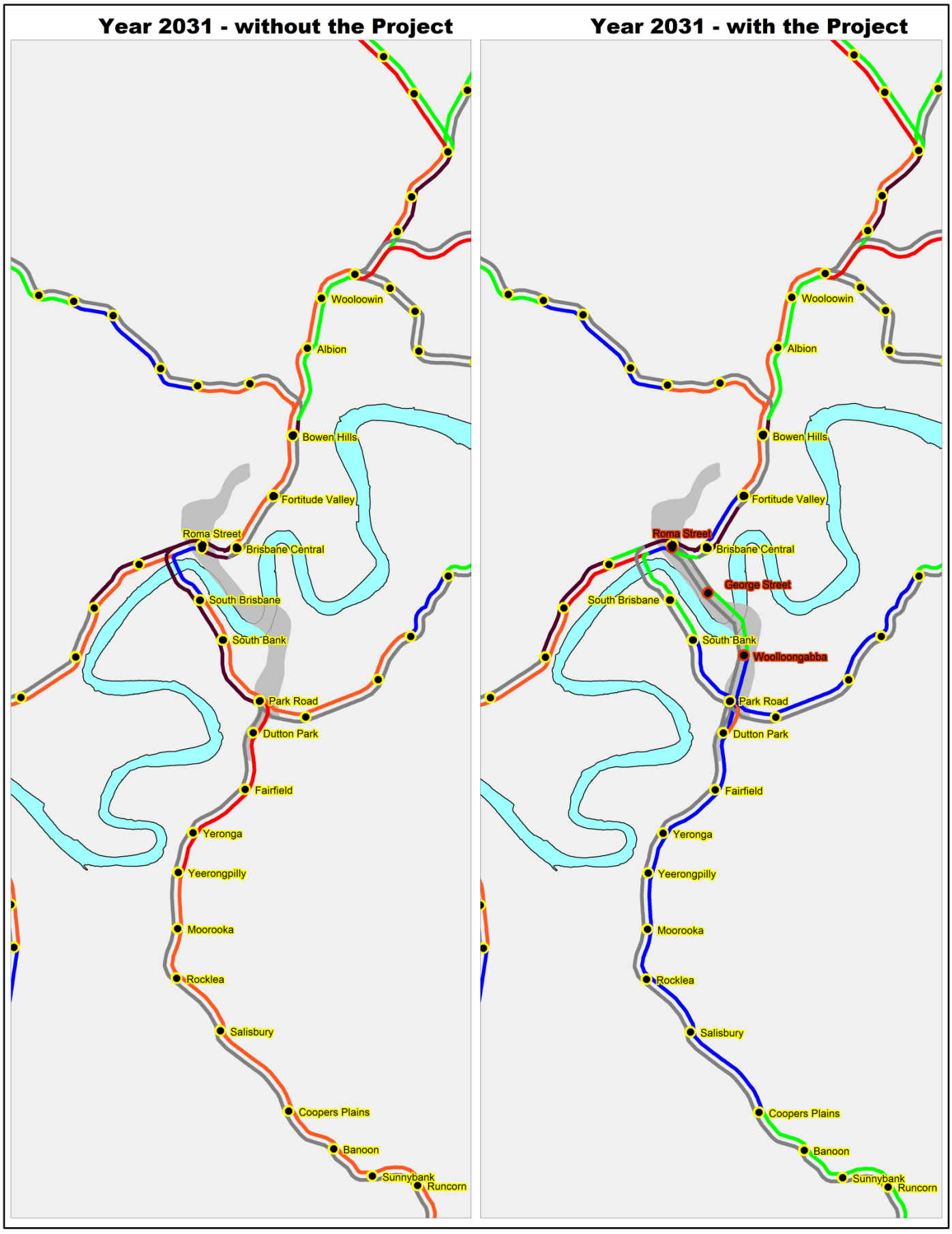
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-6

Rail load factors (AM peak) – 2031

without and with 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

BaT railway stations

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ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-7

Rail load factors (PM peak) – 2031

without and with the Project

6.6.1 Crowding relief to the Gold Coast line

As illustrated in **Table 6-7**, in 2031 express trains leaving Beenleigh would be expected to have an average loading of around 660 passengers (without the Project). This would result in over 200 passengers standing from Beenleigh for a trip of approximately 46 minutes to Roma Street Station. With the Project, on average 370 passengers would use the express rail services from the Gold Coast resulting in no passengers needing to stand from Beenleigh or from closer to the CBD.

By the time the express train services passes through Yeerongpilly, trains would be expected to be carrying an average of 730 passengers without the Project, but only around 460 with the Project that is less than the seated Project train capacity. The expected lower average passenger loadings with the Project represent a more desirable LoS on the express services between the Gold Coast and Brisbane, meaning that significantly fewer people would need to stand.

Table 6-7 Gold Coast express trains – time passengers stand without and with the Project

Location	Time to Roma Street (minutes)	2012		2021		2031	
		Passengers		Passengers		Passengers	
		Load	Standing	Load	Standing	Load	Standing
Without the Project							
Beenleigh	46	614	164	478	28	664	214
Loganlea	38	645	195	530	80	717	267
Altandi	24	645	195	541	91	731	281
Yeerongpilly	n/a	645	195	541	91	731	281
With the Project							
Beenleigh	43			423	0	363	0
Loganlea	35			459	0	394	0
Altandi	21			478	0	459	0
Yeerongpilly	15			478	0	459	0

Source: BaT Project Model

Note: Seated capacity of a BaT train is 480. Other trains have 450 seats

6.6.2 Crowding relief to all stop services from Beenleigh

The Project facilitates additional rail services for passengers from Beenleigh that would cater for strong passenger growth in the corridor and provide crowding relief. The services with the Project that are relevant to passengers using the all stop services from Beenleigh without the Project are:

- Helensvale semi express – all stops to Kuraby (including Beenleigh) then express to the Brisbane CBD via the Project.
- Kuraby all stop services – all stops to the CBD via the existing surface rail

Table 6-8 provides an illustration of changes to passenger crowding for passengers from Beenleigh. Without the Project the all-stop services on the Beenleigh line are forecast to be operating close to the seated capacity of 450 passengers in both 2012 and 2021 during the morning peak two hours. By 2031 it is forecast that over 160 passengers would be standing on the all stop services from Yeerongpilly for a trip of 18 minutes from Roma Street Station.

The additional services facilitated by the Project result in an increase in capacity such that, on average, only 78 passengers would be standing from Yeerongpilly on the Kuraby all stop services and only 5 passengers would be standing on the Helensvale semi-express service.

Table 6-8 Beenleigh all stop services – time passengers stand without and with 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	154	0	74	0	179	0
Altandi	34	319	0	262	0	404	0
Yeerongpilly	18	452	2	459	9	616	166
With the Project (semi express from Helensvale)							
Beenleigh	64			140	0	313	0
Loganlea	54			223	0	415	0
Altandi	34			405	0	485	5
Yeerongpilly	18			434	0	485	5
With the Project (all stops from Kuraby in 2021 and from Loganlea in 2031)							
Beenleigh	64			-	-	-	-
Loganlea	54			-	-	35	0
Altandi	34			96	0	274	0
Yeerongpilly	18			363	0	558	78

Source: BaT Project Model

Note: Seated capacity of a BaT train is 480. Other trains have 450 seats

6.7 Effect on level of service – rail travel time reliability

Increasing congestion of the rail network during peak times in terms of track utilisation and station and vehicle use, increases the risk of delay to scheduled services. The Project would provide substantial relief to inner city capacity constraints, so improving the reliability and punctuality of rail services. The changes in routing associated with the Project would alleviate congestion and reduce network strain due to the removal of crossing constraints allowing the operation of more services. In particular this reduces pressure:

- at South Brisbane and Park Road junctions by diverting Gold Coast services into the Project
- on the inner city Suburban lines, providing more options for empty services from the Northern lines to access stabling at Mayne Yard rather than travelling via the Park Road junction to access stabling at Clapham Yards.

Simulation modelling undertaken as part of the rail operations assessment showed a significant decrease in the forecast delay to rail passengers under the Project case (expressed as passenger weighted minutes delay). Under this measure, the Project reduces the impact of delays on passengers by 7 per cent in 2021 and 5 per cent in 2031 (when compared to without the Project).

From the perspective of an individual passenger, making two trips per day on the suburbans sector, the Project is anticipated to improve travel time reliability through reducing delays, experienced by 0.8 minutes per day in 2021 and 1.6 minutes per day in 2031.

6.8 Impacts on bus patronage

Changes in overall modelled bus patronage and performance across the Brisbane Statistical Division are shown in **Table 6-9**. This shows a forecast increase of between 5 per cent to 6 per cent in overall bus passenger kilometres travelled with the Project in both 2021 and 2031 compared to without the Project. An increase in overall bus patronage (over 8 per cent) in 2031 with the Project is forecast compared to the scenario without the Project.

By 2031 with the Project, forecast average trip lengths by bus would be shorter (-2.7 per cent), and average bus trip times would be less (-7.6 per cent). The change to shorter bus journeys is likely to be the result of a combination of factors such as:

- greater levels of bus-rail interchange
- reduction in congestion on busways and removal of many bus services from congested CBD streets
- greater reliability
- the Project providing a direct alignment to the CBD from the southern approach

Increased use of the high frequency priority bus network would continue to sustain bus patronage across the whole network, particularly in corridors without rail.

Table 6-9 Forecast daily trips by bus in the Brisbane Statistical Division

24 hours	2021			2031		
	Without Project	With Project	% change	Without Project	With Project	% change
Total bus patronage	381,300	408,300	7.1%	496,600	539,500	8.6%
Total bus passenger (km)	3,790,200	4,002,400	5.6%	4,882,400	5,159,600	5.7%
Total bus passenger hours	146,300	147,600	0.9%	196,600	197,400	0.4%
Average bus trip length (km)	9.9	9.8	-1.4%	9.8	9.6	-2.7%
Average bus trip time (minutes)	23.0	21.7	-5.7%	23.7	22.0	-7.6%

Source: BaT Project Model

6.9 Effect on bus level of service – crowding, congestion, travel time and reliability

6.9.1 In-bus crowding

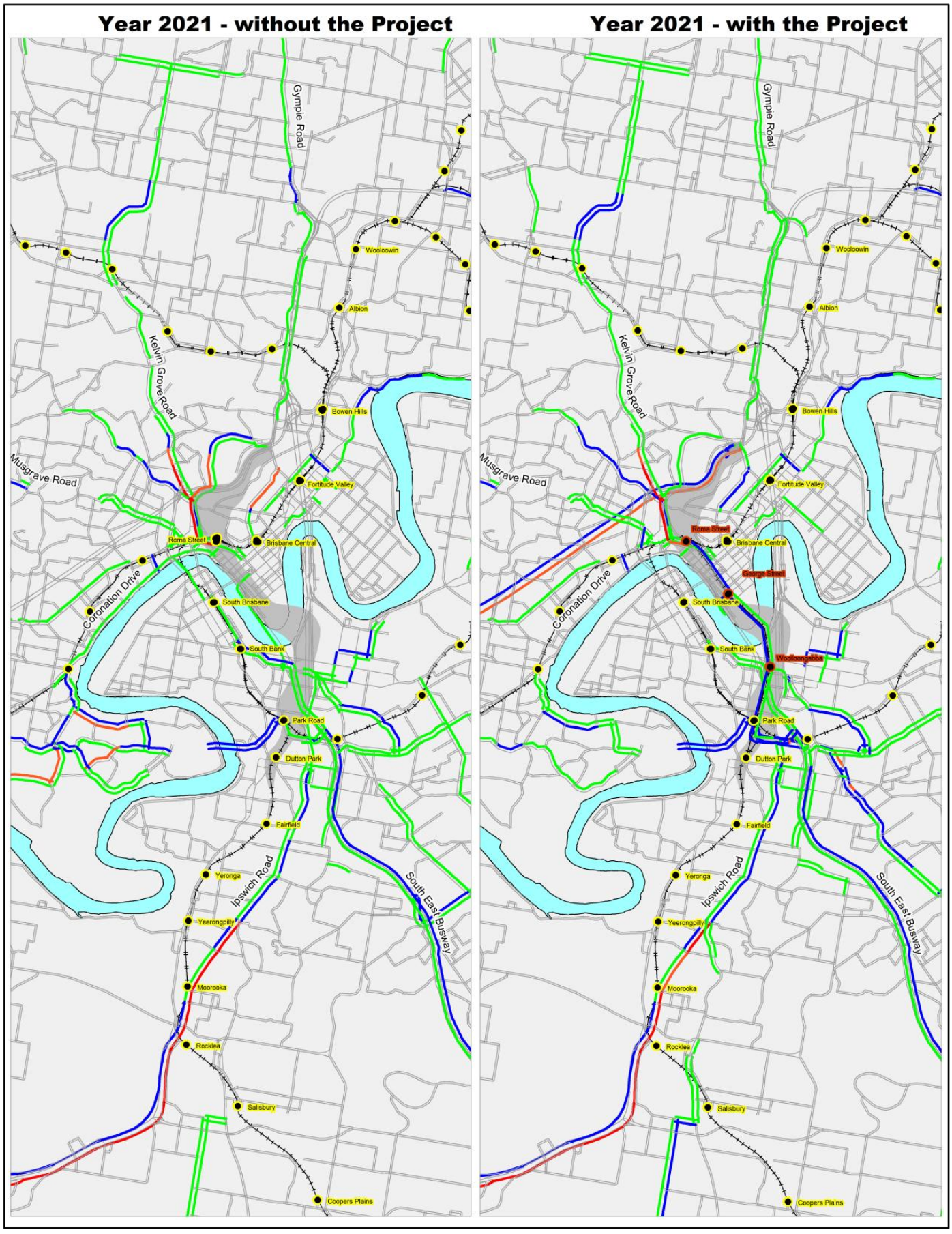
Forecast changes in bus crowding have been examined by assessment of changes in bus load factors. Bus load factors are a proportion of total bus passengers divided by total seated bus capacity. The forecast 2021 and 2031 morning and evening peak bus load factors, with and without the Project, are shown in **Figure 6-8** to **Figure 6-11**. This comparison indicates a reduction in passenger crowding on several bus corridors, such as the Victoria Bridge and Captain Cook Bridge approaches to the Brisbane CBD.

6.9.2 Bus congestion relief

The Project would reduce congestion of buses on busways and roads. By 2031 with the Project, bus volumes on the inner South East Busway, Victoria Bridge and the Captain Cook Bridge would be reduced to be equivalent to 2012 levels. Micro-simulation modelling of bus operations undertaken using VISSIM illustrate that without the Project, bus capacity on the inner South East Busway would be exceeded to the point of breakdown by 2031 (Refer to **Figure 6-12**). However, with the Project, bus capacity on the South East Busway, Captain Cook Bridge and the Project would not be exceeded in 2031 and would be able to provide for growth beyond 2031 (refer to **Figure 6-13**).

Bus congestion relief would also be provided by the Project in other locations, such as on the Vulture Street off-ramp from the Captain Cook Bridge where significant interaction between buses and general traffic occurs.

The Project would relieve bus congestion through the Cultural Centre Busway Station and the Melbourne Street portal in South Brisbane. VISSIM modelling indicates that without the Project buses would be likely to queue from the Melbourne Street portal, through the Melbourne Street and Grey Street intersection, through the Cultural Centre Station and back across the Victoria Bridge to North Quay during peak periods. With the Project, the VISSIM modelling illustrates that bus volumes would be reduced with minimal congestion and queuing occurring.



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

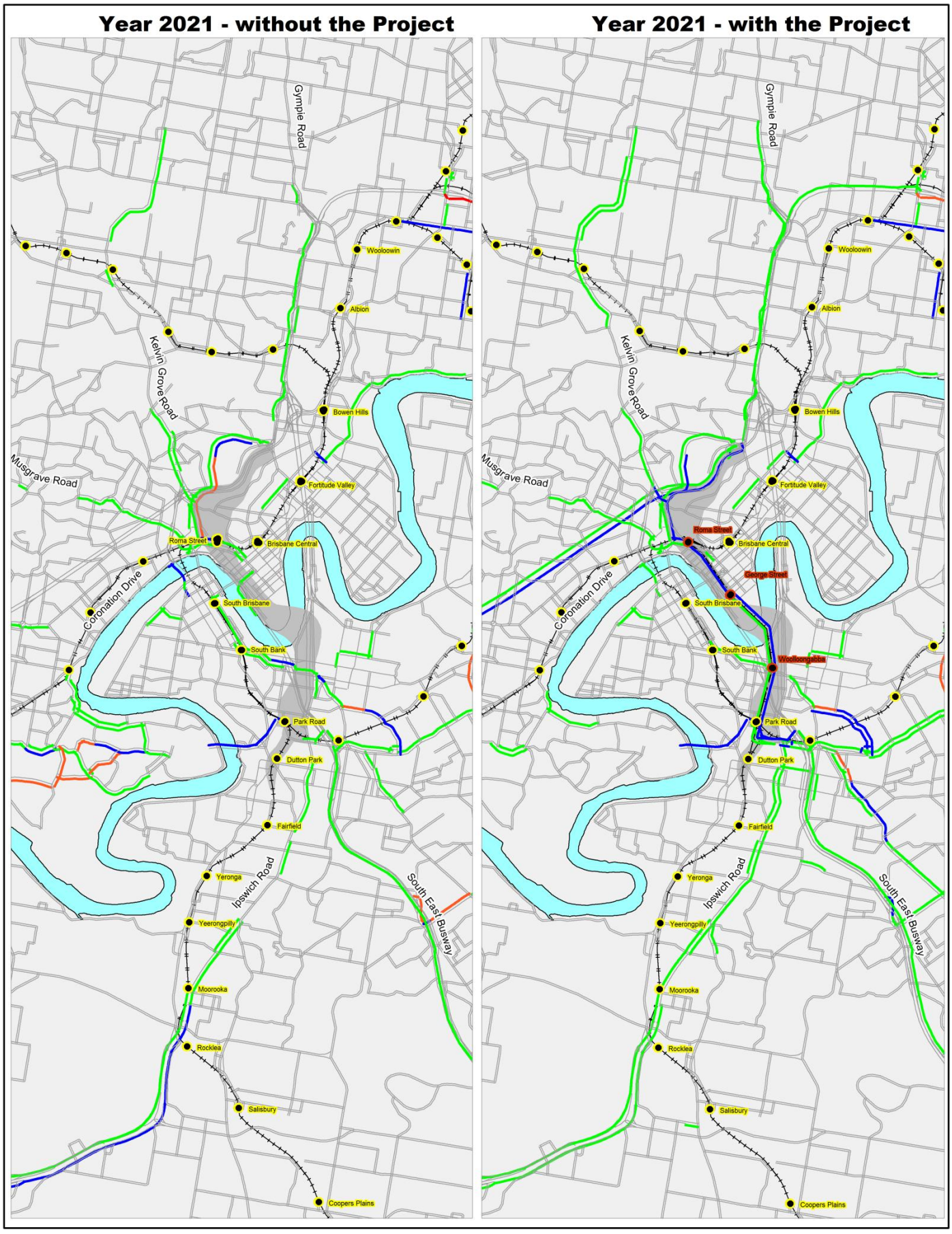
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-8

Bus load factors (AM peak) – 2021

without and with 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

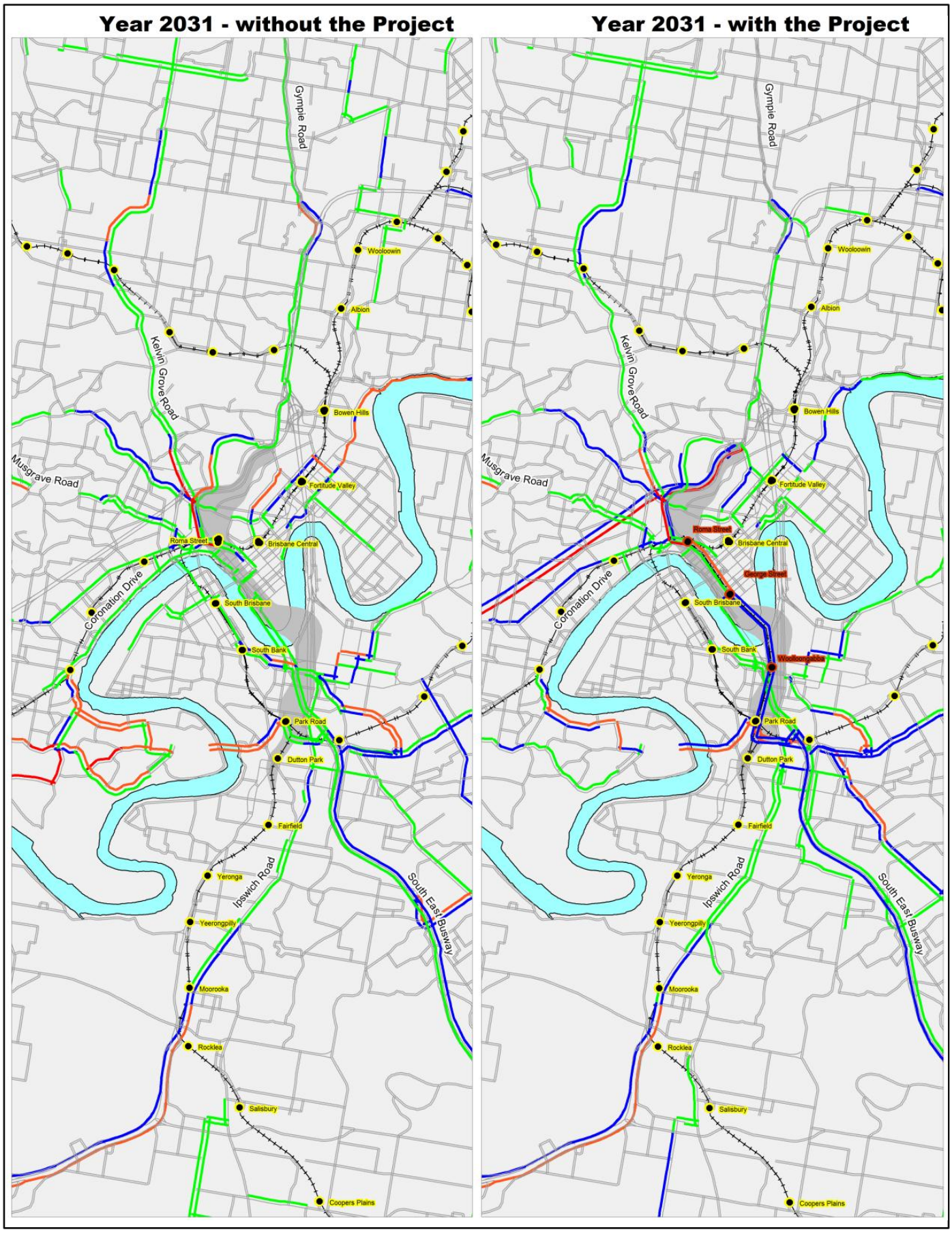
Railway stations

BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-9

Bus load factors (PM peak) – 2021 without and with 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

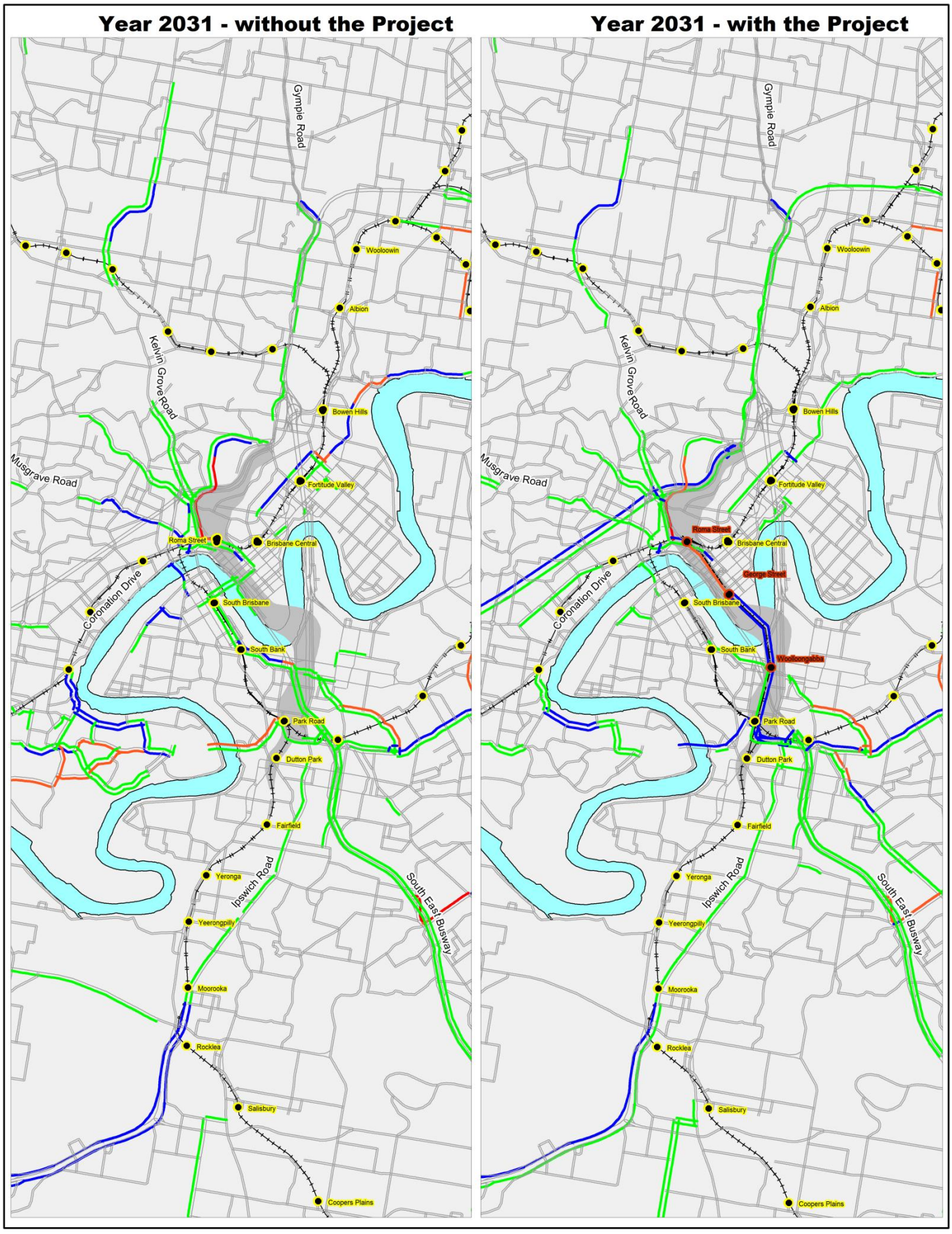
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-10

Bus load factors (AM peak) – 2031

without and with 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

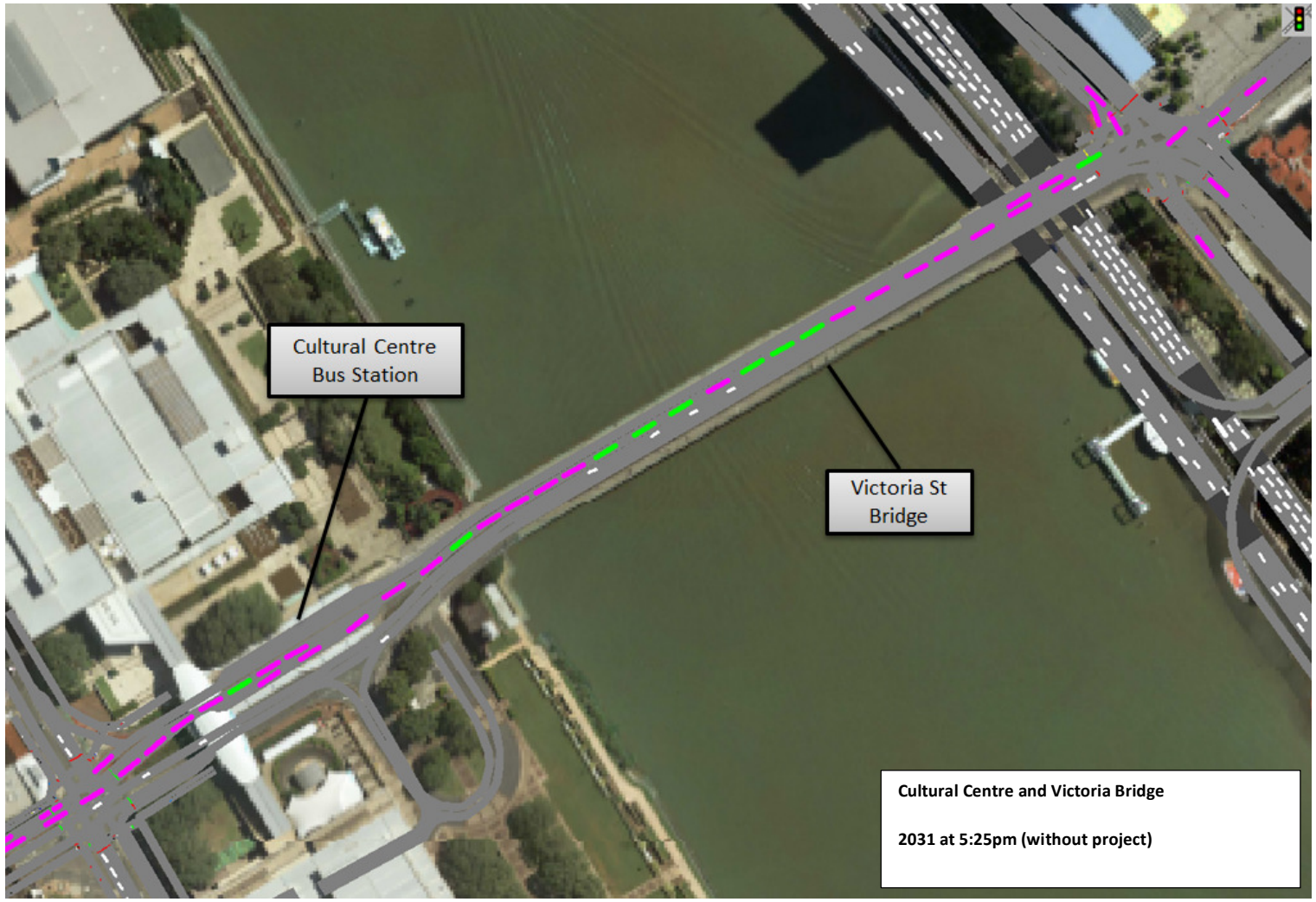
BaT railway stations

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-11

Bus load factors (PM peak) – 2031

without and with the Project



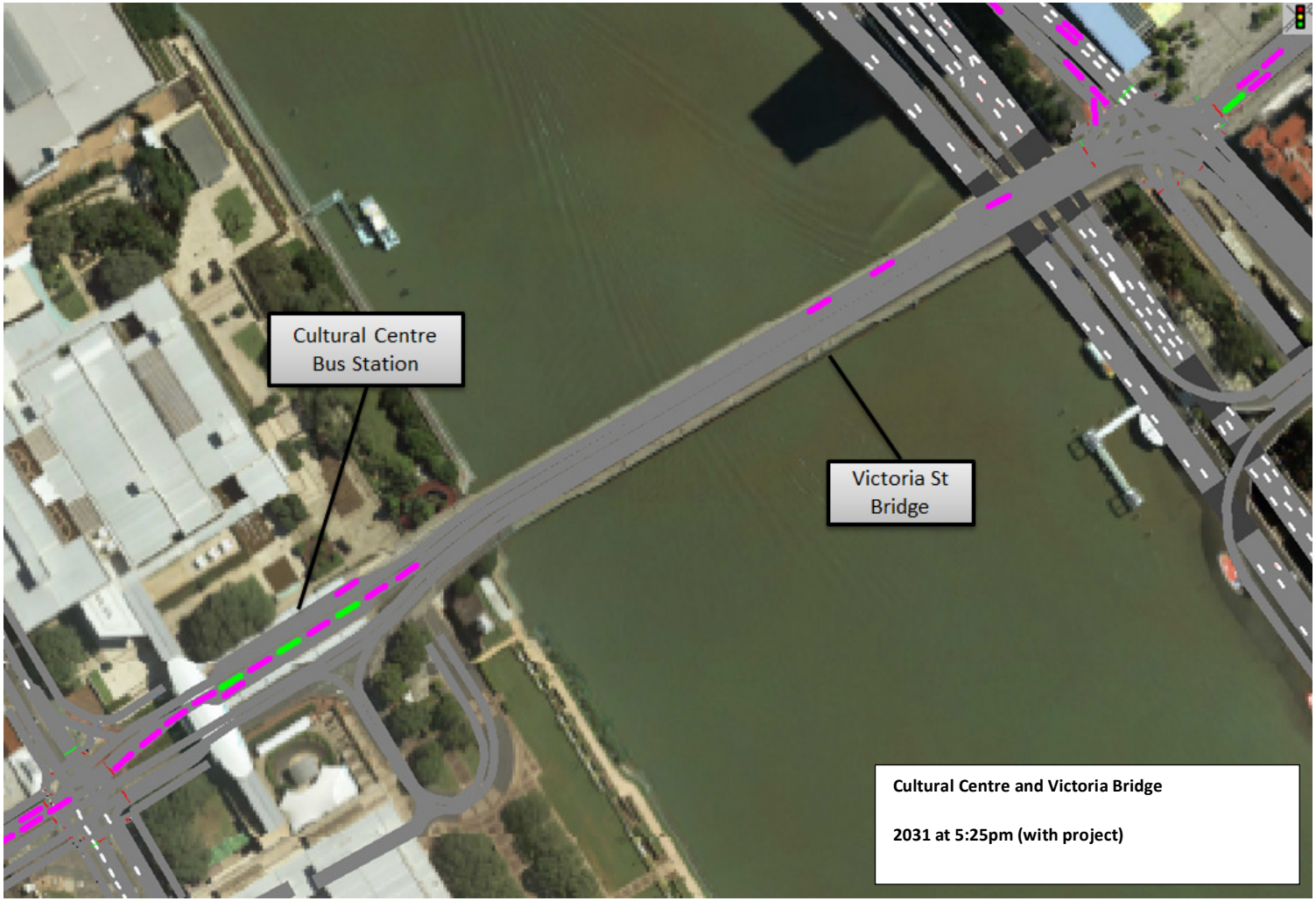
Legend

- General purpose vehicle
- In service bus
- Out of service bus

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-12

2031 PM peak bus queues on the Victoria Bridge without the Project



Legend

- General purpose vehicle
- In service bus
- Out of service bus

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 6-13

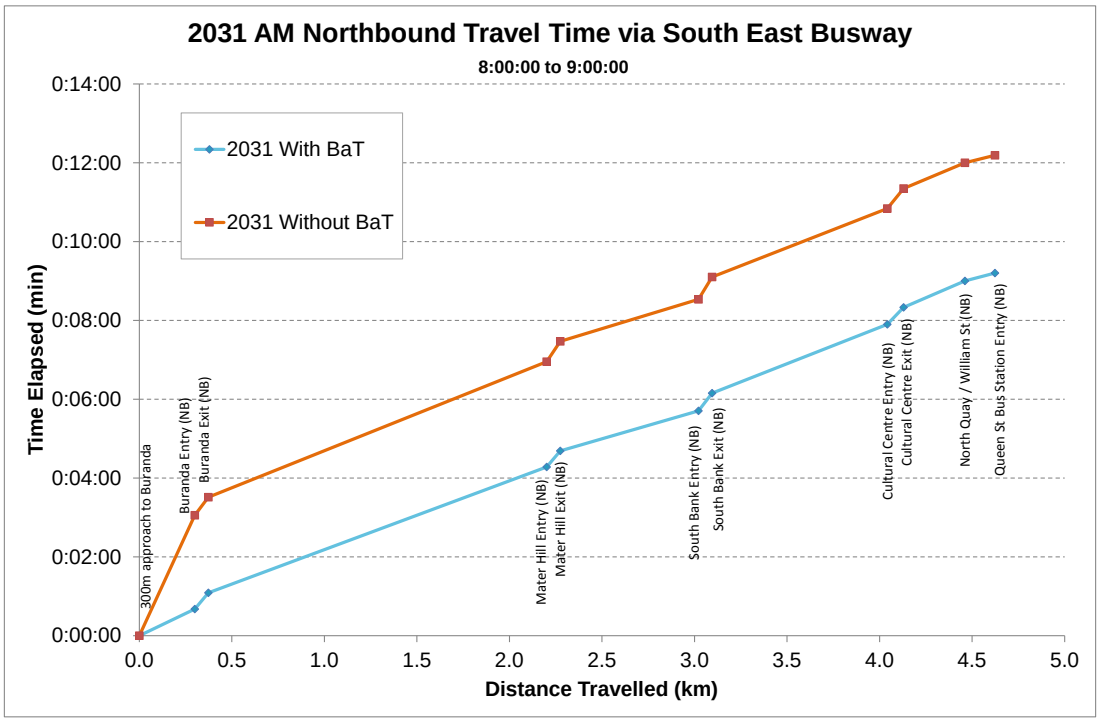
2031 PM peak bus queues on the Victoria Bridge with the Project

6.9.3 Bus travel time savings

Bus services that would operate on the Project are expected to save around four minutes per journey compared to their existing travel times on the inner city busways. A bus is expected to take an average of around seven minutes to travel between RBWH and George Street or Buranda and George Street. These trips would take approximately 12 minutes in 2031 via the inner city busways without the Project or nine minutes with Project in place. Selected western and Centenary suburbs services could save up to 12 minutes on current journey times by travelling via Legacy Way and the Project connection to the ICB at Bowen Hills.

As illustrated in **Figure 6-14**, the Project is also anticipated to reduce travel-times and delays on the inner-city bus network and the Captain Cook Bridge.

Figure 6-14 Bus travel time benefits with the Project



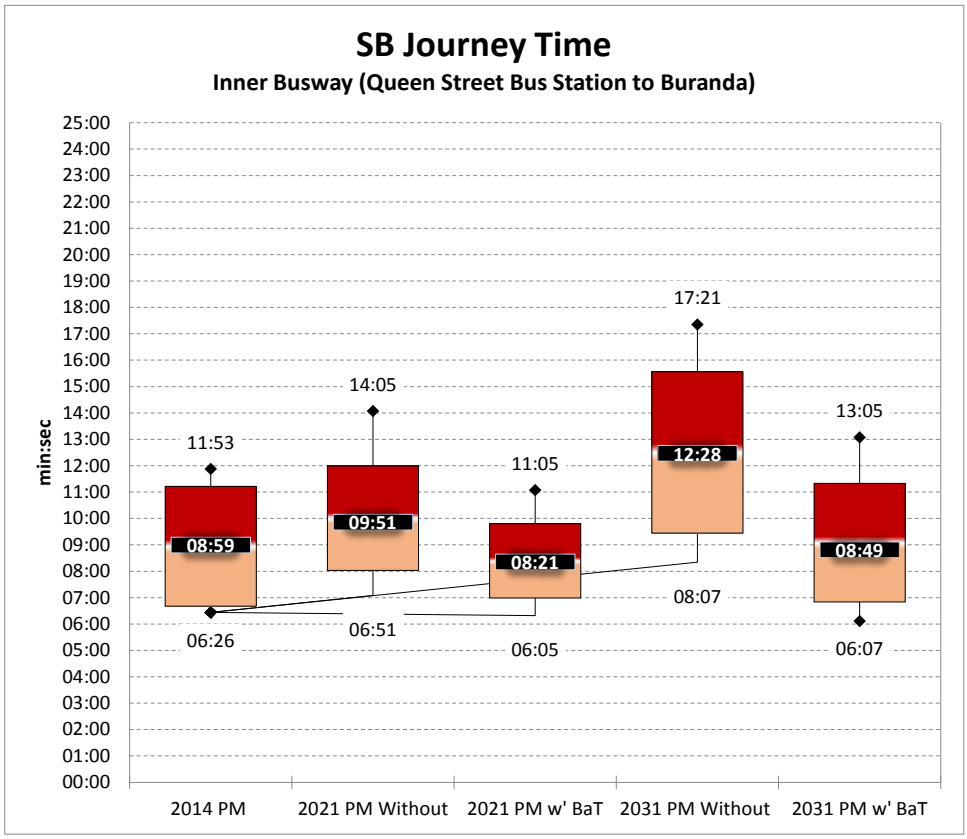
6.9.4 Bus travel time reliability

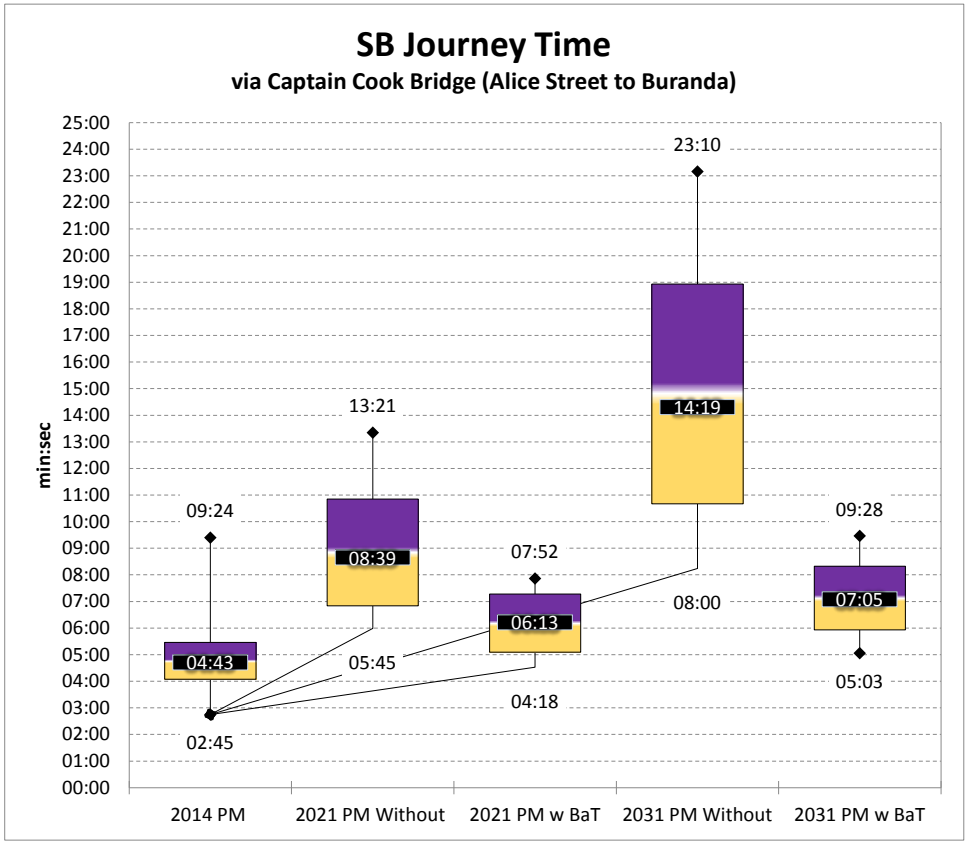
The Project provides the first bus only grade separated route through the CBD not affected by intersections from the north or south. This will provide fast and reliable bus travel through the Project with less variability in travel times for services and across the inner busway network

Advanced headway management systems and platform management will assist with maintaining reliable operation of station platforms, improving the ability to maintain timetables.

With the Project in place, buses travelling to the city via the existing inner busways or the Captain Cook Bridge are expected to experience more consistent and reliable journey times. These improvements are illustrated in **Figure 6-15**, which shows the average and range of travel times during the evening peak extracted from the VISSIM micro-simulation modelling for a sample of bus routes. The average travel time is in the central band. Travel time variations for the 5th and 95th percentile are presented by the colour bands, and the minimum and maximum travel times in the simulation are represented by the tips of the thin lines.

Figure 6-15 Bus travel time reliability changes with the Project





6.10 Overall travel time improvements with the Project

The previously discussed travel time improvements for rail and bus trips were related to station to station movements. Travel time savings of the Project for a sample of overall journeys, such as from a home to a place of work, have been assessed and are shown in **Table 6-10**. The sample journeys assessed for the 2021 morning peak period covered suburbs to the north, south, east and west of the CBD, namely Windsor, Beenleigh, Manly, and Indooroopilly travelling to destinations close to the three proposed underground stations.

Total elapsed time for a journey was calculated as the sum of public transport in-vehicle time, wait time, boarding time and access time (walk). The analysis shows that the Project would generate significant travel time savings of up to 15 minutes to locations that are not currently well served by public transport. For example the QUT Gardens Point campus would be much closer to the Projects' rail and busway station located at George Street than the existing alternatives at Roma Street, Central and South Bank.

Suburbs such as Beenleigh and Windsor that are located on public transport corridors that would be directly serviced by the Project, would also benefit from substantial travel time savings.

Table 6-10 Total travel time (minutes) due to the Project during 2021 morning peak period

To	QUT (Gardens Point)			Roma Street			Woolloongabba		
From	Without Project	With Project	% change	Without Project	With Project	% change	Without Project	With Project	% change
Beenleigh	80.5	70.9	-12%	78.3	71.3	-9%	82.5	67.2	-19%
Manly	67.4	66.6	-1%	65.3	64.3	-2%	69.4	66.3	-4%
Indooroopilly	48.4	44.2	-9%	32.7	33.0	1%	51.7	46.2	-11%
Windsor	51.7	36.2	-30%	35.2	33.0	-6%	49.7	38.2	-23%

Source: BaT Project Model

6.11 Impacts on ferry patronage

Only very small changes are forecast for ferry trips as rail and busway trips are largely non-competing. With the Project there will continue to be little or no transfer between ferry and both rail and busway services.

6.12 Impacts on the road network with the Project

The impact of the Project on the road network has been assessed using underlying principles of a road impact assessment. Analysis of the following model results has been undertaken to inform this assessment:

- differences in traffic volumes and mode share with and without the Project in 2021 and 2031 across the Brisbane Statistical Division.
- forecast changes in traffic volumes and levels of service along five screen lines across the study corridor and a cordon of road links surrounding the Brisbane CBD
- changes in traffic volumes on State-controlled roads within or immediately surrounding the study corridor for both the morning peak, and average weekday, to determine whether the Project leads to an increase of (5 per cent or more) in traffic on these key road links. This benchmark is typically the trigger for the need for detailed analysis of impacts and mitigation measures in accordance with TMR's Guidelines for the Assessment of the Road Impacts of Development.

6.12.1 Changes at the regional level

Road network volumes and performance on a typical weekday with the Project in operation are forecast for the Brisbane Statistical Division to provide a cumulative reduction in road traffic activity. By 2031, the reduction in private vehicle use associated with the Project (compared to without the Project) is forecast to reach 249,500 vehicle kilometres per day or in the order of 80 million vehicle kilometres per annum.

A comparison of total vehicle trips (average weekday) is presented in **Table 6-11** which shows that there would be 15,000 fewer road vehicle trips on the network with the Project compared to without the Project in 2031 in the Brisbane Statistical Division.

Table 6-11 Vehicle trips with and without the Project in the Brisbane Statistical Division

Average weekday (24 hours)	2021			2031		
	Without Project	With Project	Change	Without Project	With Project	Change
Total vehicle trips	5,310,000	5,303,000	-7,000	6,177,000	6,162,000	-15,000

Source: BaT Project Model

Note – does not include commercial vehicles

6.12.2 Changes within the study corridor

Within and surrounding the study corridor, traffic volumes crossing selected major links along five screen lines and the CBD cordon are reported in **Table 6-12**.

This table shows that across all screen lines, two-way traffic volumes in the morning peak period would be similar when comparing the with Project case with the without Project case. A reduction in vehicle trips across the CBD cordon is forecast to be 800 vehicles by 2031 during the morning peak period.

Table 6-12 Two way vehicle volumes on selected screen lines in the AM peak two hour period

Screen line location	2021 AM peak vehicle trips			2031 AM peak vehicle trips		
	Without Project	With Project	Change	Without Project	With Project	Change
Inner north	42,300	43,000	700	47,400	47,800	400
Inner south	44,100	44,000	-100	48,600	48,400	-200
Outer north	34,600	34,700	100	36,000	36,500	500
Outer south	39,500	39,600	100	44,500	44,600	100
CBD cordon	54,900	54,600	-300	60,000	59,200	-800
CBD river crossings	63,400	63,300	-100	71,300	70,500	-800

Source: BaT Project Model

Notes: Inner north includes Kelvin Grove Road, Lutwyche Road, Airport Link, Abbotsford Road. Inner south includes Annerley Road, Ipswich Road, M3, Logan Road. Outer north includes Samford Road, South Pine Road, Shand Street, Webster Road, Lutwyche Road, Sandgate Road. Outer south includes Fairfield Road, Ipswich Road, M3, Logan Road. CBD cordon is bounded by the Brisbane River, Hale Street, Leichhardt Street, Boundary Street (Spring Hill). CBD river crossings include the Go Between Bridge, William Jolly Bridge, Victoria Bridge, Captain Cook Bridge, Story Bridge and Clem Jones tunnel.

Changes in road traffic volumes in the morning peak period for specific State controlled road links are presented in **Table 6-13**. This illustrates a forecast minor reduction or no change in road traffic volumes on State controlled roads in, and immediately surrounding, the study corridor in the morning peak period due to the Project.

Table 6-13 Vehicle volumes on State-controlled roads in the AM peak two hour period

Location	2021 AM peak vehicle trips			2031 AM peak vehicle trips		
	Without Project	With Project	Change	Without Project	With Project	Change
M3 Pacific Motorway (north of O'Keefe Street)	18,700	18,600	-100	20,200	20,100	-100
Gympie Road (north of Stafford Road)	15,100	15,100	0	16,000	16,000	0
Captain Cook Bridge	20,100	19,900	-200	21,700	21,400	-300

Source: BaT Project Model

Note: excludes changes in bus volumes

The minor reduction of vehicle trips compared to without the Project into the Brisbane CBD and across CBD river crossings illustrates that the Project would not increase road traffic due to changes in private vehicle and commercial vehicles activity. Significant reductions in vehicle trips would not be achieved due to the demand for travel to region wide destinations beyond the Project corridor. Reduction in bus volumes were previously discussed in **section 5.5**.

6.12.3 Road crash cost savings

Road crashes and their costs vary by vehicle kilometres travelled and the type of road (motorway, arterial, local). Furthermore, the type of crash also varies by traffic speed. The change of vehicle kilometres travelled on the metropolitan network provides a forecast reduction of -0.3 per cent in 2031 that would lead to a reduction in crashes.

6.13 Impacts on rail freight operations

The rail corridor south of the Project's southern portal (including the dual gauge track) is important for freight connections between the Port of Brisbane and Salisbury. Despite the projected increase in passenger services on the southern line, the timetable benefits from reduced interaction between Gold Coast services and operations on the Cleveland line with the Project mean that passenger services south of the portal can be managed to maintain existing off-peak narrow gauge freight paths, thereby avoiding moving operation of these freight services into the late evening or overnight.

With respect to rail freight, the situation with the Project is nearly identical to the January 2014 timetable, with two freight paths available during the weekday off-peak period. Consequently, freight capacity on the dual-gauge line itself outside of the periods of peak passenger operation remains largely unaffected with the Project.

6.14 Transport benefits of the Project

The Project would improve the efficiency and sustainability of South East Queensland's transport system particularly for the modes of bus and rail. The key transport benefits of the Project have been derived from an assessment of the modelled difference in the future travelling and operating conditions on the regional and inner city rail, bus and road networks with and without the Project in the network. **Table 6-14** summarises the key transport benefits that are attributable to the Project.

Table 6-14 Transport benefits of the Project

Benefit	What does this mean?
Additional bus and rail capacity and growth in patronage	Increased ability for public transport operators to provide more buses and trains on the network to 2031 and beyond, with timetables that better meet increasing travel demand to Brisbane's inner city and CBD. Provides the additional cross-river and public transport network capacity to accommodate passenger growth to 2031 and beyond – total additional growth in rail passenger demand of about 10,900 daily rail passengers (2031) and 42,900 bus passengers (2031) daily would be accommodated over and above the growth without the Project.
Improved mode share to public transport	Assists in increasing public transport mode share to 11.1 per cent by 2031, compared with 10.8 per cent without the Project.
Improved modal integration	Opportunities for the development of greater rail/ bus integration, particularly at Woolloongabba and Roma Street stations. A range of interchange opportunities to an enhanced city distributive bus network and surface rail at George Street and Roma Street respectively. Shifting transfers away from the congested busway stations at Buranda and Cultural Centre, to more locations such as PA Hospital, Woolloongabba, Roma Street and RBWH. More effective transfers and less wait time would be provided by the Project. The Project would reduce total network-wide wait times by about 2 per cent (2021 and 2031), compared to without the Project.
Improved rail and bus travel time and reliability	Opportunities to simplify rail operations and improve service reliability. More trains at higher frequencies would access the Brisbane CBD. Reduction in morning peak average rail trip time across network of 1.9 per cent in 2021 and 2.8 per cent in 2031 compared to without the Project. Significant increase in peak period bus passenger capacity to the CBD from the north and south due to the Project. Bus congestion on South East Busway, Captain Cook Bridge and Victoria Bridge reduced due to the use of the Project by 158 buses per hour in the morning peak in 2021 rising to 172 per hour buses in 2031. Significant savings in peak period elapsed travel time for public transport users travelling to CBD locations close to the George Street Station, for example up to 15 minutes in 2021. Travel time savings of around 4 minutes for all buses using the Project compared to existing travel times on inner city busways. Less variability in bus travel times for Project services expected due to the ability of buses to travel on a grade separated route through the CBD.
Improved public transport network resilience	Improved network resilience by providing an alternative through connection for bus and rail when the network is interrupted by unexpected incidents or maintenance.
Reduced crowding	Significant crowding relief on trains in the Gold Coast-Beenleigh line. Reduction in crowding on bus routes using the Victoria Bridge and Captain Cook Bridge. The Project would provide capacity relief to passenger activity at Central Station by providing alternative CBD stations.

Benefit	What does this mean?
Improved CBD accessibility	The Project allows an additional 16 trains into the Brisbane CBD in the two-hour peak period upon commencement in 2021 (compared to 2012 services). Provides capacity to meet demand for an additional 12 trains into the CBD in the peak hour in 2031, compared to without the Project. The Project would significantly enhance accessibility to the southern area of the CBD with travel time savings of around 15 minutes to locations such at QUT Gardens Point campus. Better and more effective passenger distribution between CBD rail stations, with the new centrally-located George Street station expected to provide convenient accessibility for 93,500 passengers daily in 2021 increasing to over 134,000 passengers daily in 2031. Reduced CBD station interchange delays and station access times – proposed changes to CBD station arrangements, including improved access arrangements to the CBD south areas through the new George Street Station, would provide access time benefits for those passengers using these stations.
Facilitates growth of the inner city	Provides the transport capacity to cater for efficient, reliable, safe and sustainable means to cater for transport demand associated with the economic growth of the inner city. Supports growth of future development areas at the Queens Wharf Brisbane development and at Woolloongabba by providing new bus and train stations at these growth precincts. The future development area at Boggo Road would be supported through the Project and surface train services stopping at Dutton Park Station. Supports residential growth throughout the region by improving access to job opportunities in the inner city.
Reduced dependence on private transport	The Project would avoid 275 million private vehicle kilometres by 2031 and reduce the need for car travel in the Brisbane CBD.
Reduced road congestion	The Project would attract car drivers to public transport and generate less road traffic, less vehicle kilometres travelled resulting in a reduction of around 1 per cent of vehicles on the road cordon around the inner city. Bus volumes on several CBD streets would decline, including over a 50 per cent reduction in buses on Elizabeth Street and 15 per cent compared to the current situation, reducing traffic congestion and improving pedestrian capacity and urban amenity.
Rail freight unaffected	Rail freight paths can be maintained for freight connections between Port of Brisbane and Salisbury due to timetabling benefits on the southern corridor with the Project.

7. Local transport impacts of the Project

This section presents change in patronage at relevant bus and train stains and the impact of those changes on the local transport network.

7.1 Changes to patronage at existing rail and busway stations

7.1.1 Brisbane CBD stations

The morning peak period usage at Brisbane CBD stations and stops and those on the fringe of the CBD in 2021 and 2031 with the Project are forecast to experience an increase in patronage. There would also be a distributional change in the locations where bus and train boardings and alightings occur.

In 2021 with the Project there is forecast to be around 130,000 passengers boarding and alighting bus and rail services in the CBD in the morning peak period using all stations and stops. This would be 20 per cent higher compared to without the Project scenario. By 2031 this is forecast to increase to over 180,000 passengers – some 30 per cent greater than the without Project scenario.

The Project stations provide more opportunities for boarding, alighting and transfer between bus and rail modes. A reduction in passenger activity at the existing Brisbane CBD stations is forecast with the Project as passengers take the opportunity to use the improved accessibility offered by the George Street Station and the greatly increased number of services at Roma Street.

Table 7-1 provides a summary of the forecast change in total passenger activity (boarding, alighting and transfers) during the morning peak period for both 2021 and 2031 in the Brisbane CBD. CBD stations include Roma Street, Central Station, King George Square Busway Station, QSBS, bus stops on the CBD streets and the Project stations at George Street and Roma Street.

Table 7-1 CBD Station forecast passenger activity (AM peak two hour period)

Station	2012	2021				2031			
		Without Project	With Project	Change	% change	Without Project	With Project	Change	% change
Roma Street									
Surface rail	12,600	23,100	26,100	3,000	13%	42,500	45,200	2,700	6%
Surface bus	5,300	6,500	5,900	-600	-9%	8,900	7,600	-1,300	-15%
BaT rail	-	-	4,100	-	-	-	6,400	-	-
BaT bus	-	-	13,600	-	-	-	22,400	-	-
Roma Street total	*17,900*	*29,600*	*49,700*	*20,100*	*68%*	*51,400*	*81,600*	*30,200*	*59%*
George Street									
BaT rail	-	-	7,700	-	-	-	11,300	-	-
BaT bus	-	-	15,700	-	-	-	21,800	-	-
George Street total	-	-	*23,400*	-	-	-	*33,100*	-	-
Central - rail	27,400	46,100	39,700	-6,400	-14%	45,700	44,600	-1,100	-2%
QSBS - bus	4,300	3,000	2,900	-100	-3%	4,300	2,700	-1,600	-37%

Station	2012	2021				2031			
		Without Project	With Project	Change	% change	Without Project	With Project	Change	% change
KGS - bus	10,300	7,300	4,400	-2,900	-40%	8,100	4,100	-4,000	-49%
CBD streets - bus	16,900	23,800	12,100	-11,700	-49%	29,600	15,600	-14,000	-47%
CBD Total Rail	40,000	69,200	77,600	8,400	12%	88,200	107,500	19,300	22%
CBD Total Bus	36,800	40,600	54,600	14,000	34%	50,900	74,200	23,300	46%
CBD Total	76,800	109,800	132,200	22,400	20%	139,100	181,700	42,600	31%

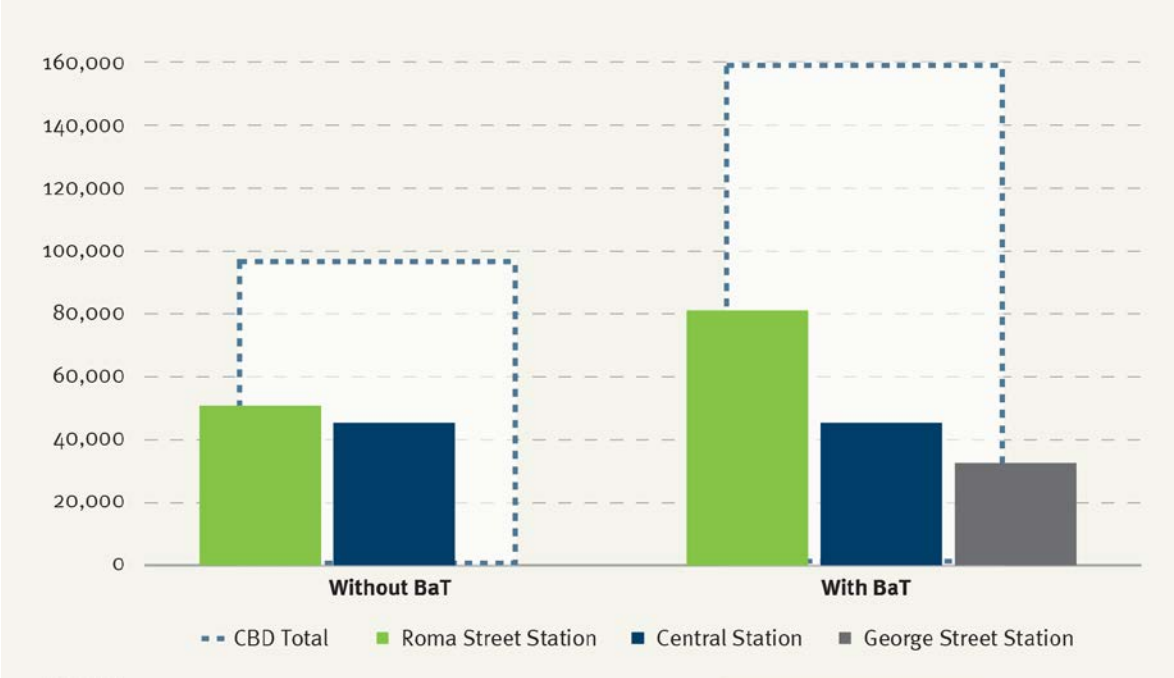
Source: BaT Project model.

Note: Passenger movement is the total of boarding, alighting and transfers.

Characteristics of the patronage changes at stations with the Project are:

- a more even distribution of passenger usage across CBD stations is anticipated. This would significantly decrease cross town pedestrian movements and total trip times for passengers
- **Figure 7-1** illustrates the significant forecast increase in patronage at the three major stations (Roma Street, Central Station and George Street) by 2031 during the morning two hour peak period. This shows that compared to without the Project there is no growth in patronage activity at Central Station during peak periods whilst activity at Roma Street Station almost doubles. The George Street Station is forecast to cater for over 33,000 passenger movements
- a high number of rail to rail transfers and between bus and rail services at Roma Street Station are expected to occur between the Project platforms and surface platforms in both 2021 and 2031. Transfer activity would include interchange to Brisbane Airport rail services from the Project. Pedestrian activity between Roma Street Station and the surrounding footpaths would be similar to that without the Project
- a significant reduction of the number of passengers (14,000) using CBD street bus stops on Adelaide Street, George Street, Elizabeth Street, Edward Street, Queen Street, Ann Street, Creek Street and Alice Street during the 2031 morning peak period is expected. This would bring amenity benefits.

Figure 7-1 CBD major station patronage: 2031 morning peak period



A benefit of the Project on the CBD streets would include a reduction in the number of buses and also the number of passengers accessing and waiting at kerbside bus stops.

The reduction in passenger activity at King George Square Busway Station, QSBS and on-street bus stops in the CBD would lead to an easing of footpath congestion, traffic congestion and improved LoS compared to the current situation. This would be due to reductions related to:

- the number of pedestrian accessing these stations and stops
- the number of passengers waiting on CBD footpaths at bus stops
- the number of buses operating on the CBD streets
- passenger car vehicle drop-off and pick-up at the existing stations.

7.1.2 CBD accessibility

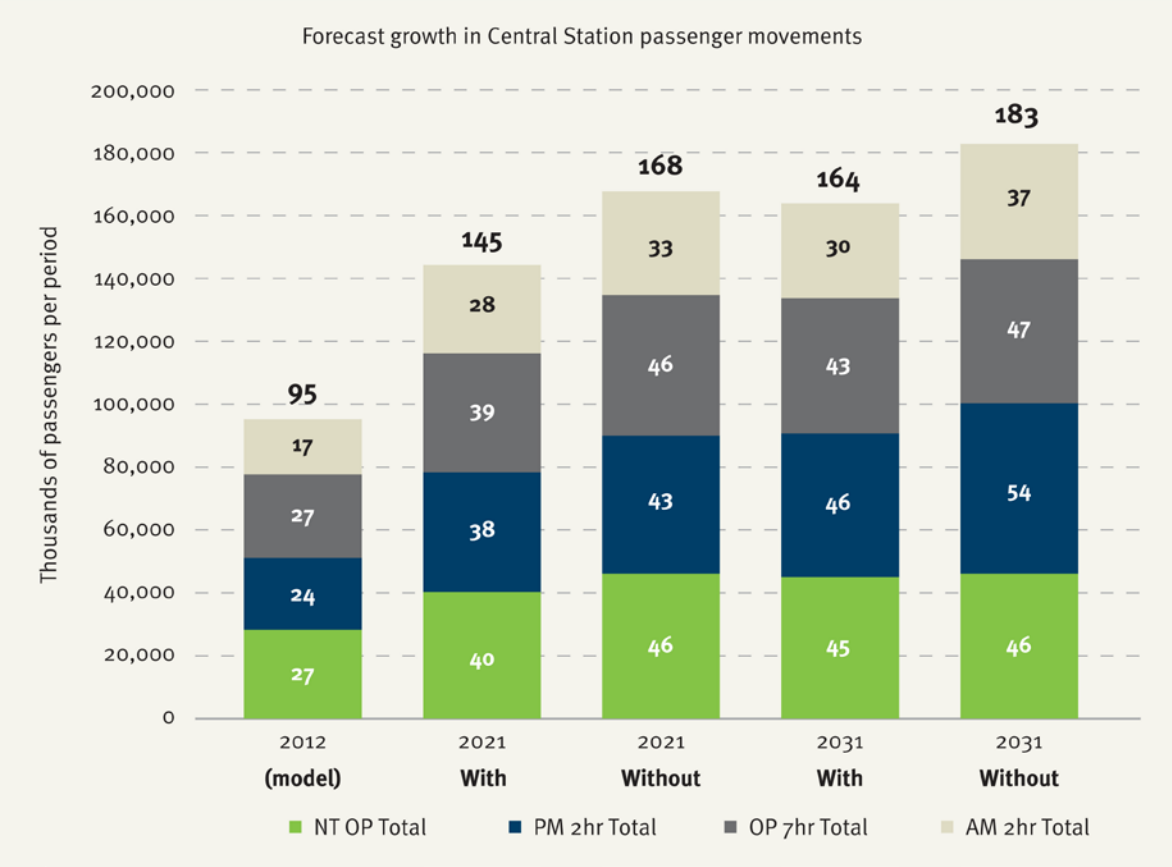
The Project would provide increased access to CBD employment destinations. The George Street Station would improve access to CBD destinations by bus and rail with no part of the CBD more than a 15 minute walk from a station, with the vast majority within a 10 minute walk.

7.1.3 Reduction in crowding at Central Station

Activity at Central Station is forecast to be lower in the morning peak with the Project than without the Project and would be below its operating capacity of around 45,000 passenger movements during the two hour peak periods. This is because the Project's bus and train services use Roma Street and George Street stations in the CBD, and not Central Station. The forecast reduction in overall passenger movements at Central Station with the Project would provide crowding relief within the station and the surrounding pedestrian precinct. Approximately 14 per cent fewer platform movements are forecast at Central Station in 2021 than would be expected without the Project. By 2031 this would be 12 per cent less than without the Project.

Figure 7-2 illustrates the effect of the Project on passenger use of Central Station, illustrating that the Project can be expected to help balance passenger loads sufficiently to keep Central Station below its capacity threshold of around 43,000 passenger movements in the two hour peak periods past 2031.

Figure 7-2 Passenger movements at Central Station without and with the Project



The impact of increased patronage on the local pedestrian network at the George Street and Roma Street station precincts is discussed later in this chapter.

7.1.4 CBD fringe stations

Forecast change in passenger activity at Brisbane CBD stations and the CBD fringe stations of Mater Hill, South Bank, South Brisbane, Cultural Centre and Fortitude Valley are illustrated in **Table 7-2**. A reduction in passenger activity is forecast at all of the CBD fringe stations.

This would generally be due to the improved attractiveness of bus and train services in the Brisbane CBD provided by the George Street Station. Public transport passengers that currently access the CBD by alighting at Mater Hill, South Bank, South Brisbane and Cultural Centre stations and walking across the river to the CBD would find that the George Street Station offers improved accessibility and travel times compared to the southern area of the CBD.

The reduction in passenger activity at the Brisbane CBD fringe stations compared to without the Project and in some cases compared to the current situation would also lead to an improvement in LoS for pedestrians and traffic at those CBD fringe stations.

Table 7-2 CBD and CBD fringe station passenger activity (AM peak two hour period)

Station	2012	2021				2031			
		Without Project	With Project	Change	% Change	Without Project	With Project	Change	% Change
CBD (including BaT stations)									
Surface rail	40,000	69,200	77,600	8,400	12%	88,200	107,500	19,300	22%
Surface bus	36,800	40,600	54,600	14,000	34%	50,900	74,200	23,300	46%
CBD total	76,800	*109,800*	*132,200*	*22,400*	*20%*	*139,100*	*181,700*	*42,600*	*31%*
South Bank									
Surface rail	5,000	8,900	5,400	-3,500	-39%	13,400	9,400	-4,000	-30%
Surface bus	4,400	4,800	4,600	-200	-4%	6,500	5,200	-1,300	-20%
South Bank total	*9,400*	*13,700*	*10,000*	*-3,700*	*-27%*	*19,900*	*14,600*	*-5,300*	*-27%*
South Brisbane (Rail)	3,100	6,500	3,900	-2,600	-40%	11,300	6,700	-4,600	-41%
Cultural Centre (Bus)	6,500	5,800	4,200	-1,600	-28%	7,300	5,200	-2,100	-29%
Mater Hill (Bus)	3,800	4,600	2,700	-1,900	-41%	6,600	3,700	-2,900	-44%
Fortitude Valley (Rail)	5,000	8,500	7,200	-1,300	-15%	12,900	11,100	-1,800	-14%
Total rail	53,100	93,100	94,100	1,000	1%	125,800	134,700	8,900	7%
Total bus	51,500	55,800	66,100	10,300	18%	71,300	88,300	17,000	24%
Total	104,600	148,900	160,200	11,300	8%	197,100	223,000	25,900	13%

Source: BaT Project model.

Note: Passenger movement is the total of boarding, alighting and transfers.

7.2 Dutton Park Station

With the Project, Dutton Park Station would be served by both trains from the Project and all stopping services. Dutton Park Station would continue its current function to provide rail access to the surrounding residential, employment and education land uses. The addition of trains from the Project would increase patronage at this station and provide a last change for interchange between the Project and all stopping services to and from the Brisbane CBD.

Figure 7-3 illustrates the proposed layout of the upgraded Dutton Park Station provided by the Project. To facilitate project trains servicing Dutton Park the existing station, including platforms would be upgraded. This would incorporate a widened footpath on the northern side of the Annerley Road bridge and lifts to connect this footpath to the station platforms. The existing bikeway along Kent Street would be extended to Cornwall Street.

Table 7-3 illustrates the forecast patronage for Dutton Park for the two hour peak period. Commuters alighting train services to walk to major employment activities at, for example, the PA Hospital campus and the Boggo Road Urban Village dominate the station function. Compared to without the Project the

addition of rail services to Dutton Park increases forecast morning peak period patronage from 700 to over 5,000 in 2031.

As with the existing operation of the station commuter car parking and passenger kiss and ride activities should be discouraged through the Dutton Park Traffic Area.

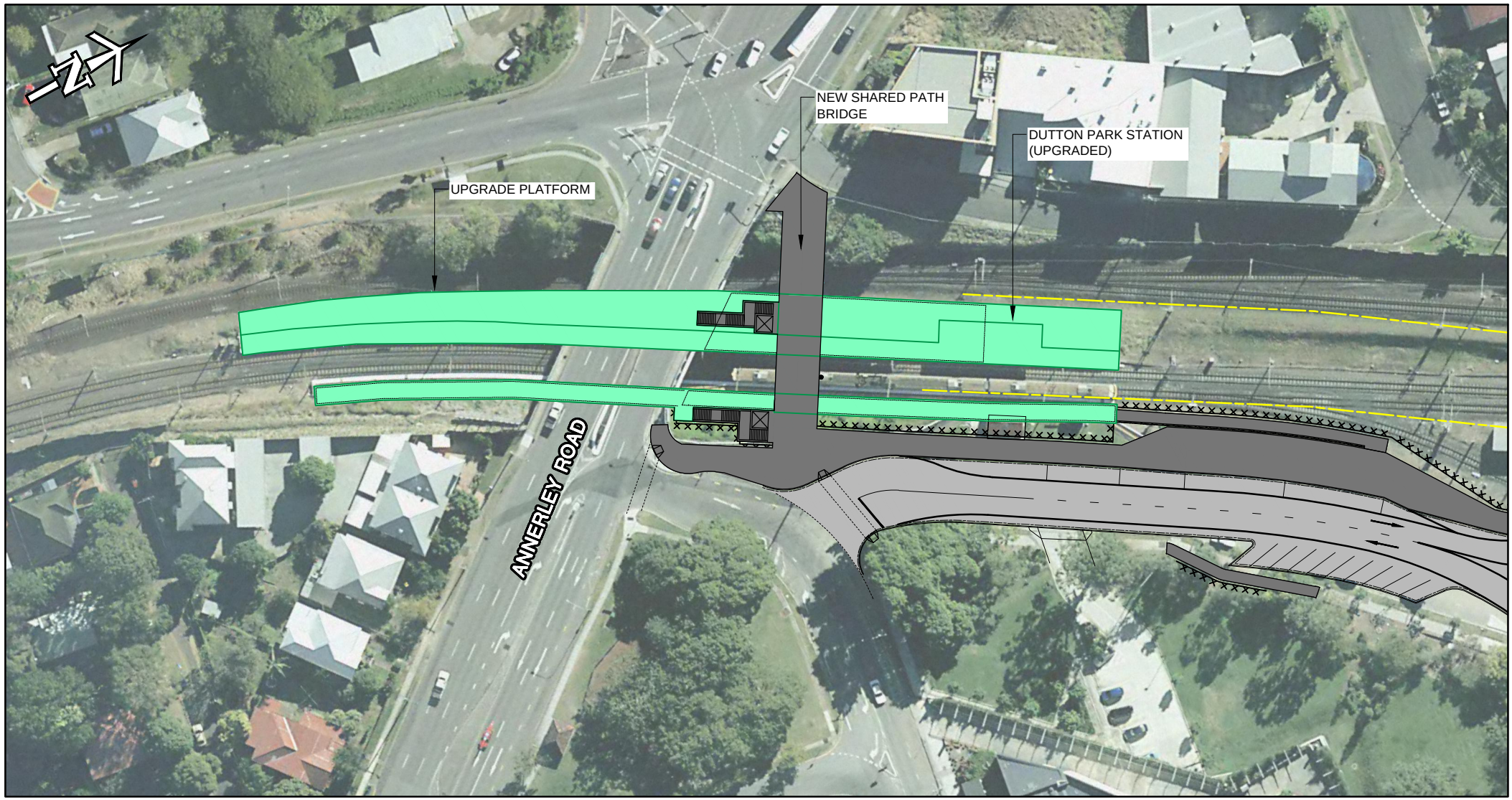
Table 7-3 Dutton Park Station – two hour AM peak period patronage

	Without the Project			With the Project		
	Board	**Alight**	**Total**	**Board**	**Alight**	**Total**
2012						
Rail	200	500	700			
2021						
Rail	200	300	500	500	1,200	1,700
2031						
Rail	200	500	700	1,900	3,200	5,100

Source: BaT Project model.

Note: Passenger movement is the total of boarding, alighting and transfers.

The Project would also introduce a bus layover facility and bus access to the busway at Dutton Park. This is illustrated in **Figure 7-4**. This facility maintains the existing controlled access for hospital service vehicles along Kent Street. The change in the number of vehicles using Kent Street would be limited to buses accessing the busway and layover facility and hospital service vehicles. Consequently only minor change to the performance of the intersections with Annerley Road and Cornwall Street are anticipated.



LEGEND

- PAVEMENT
- FOOTPATH
- UPGRADED AND EXISTING RAIL PLATFORMS
- PROPOSED Bat RAIL CENTRELINES
- PROPOSED RETAINING WALL

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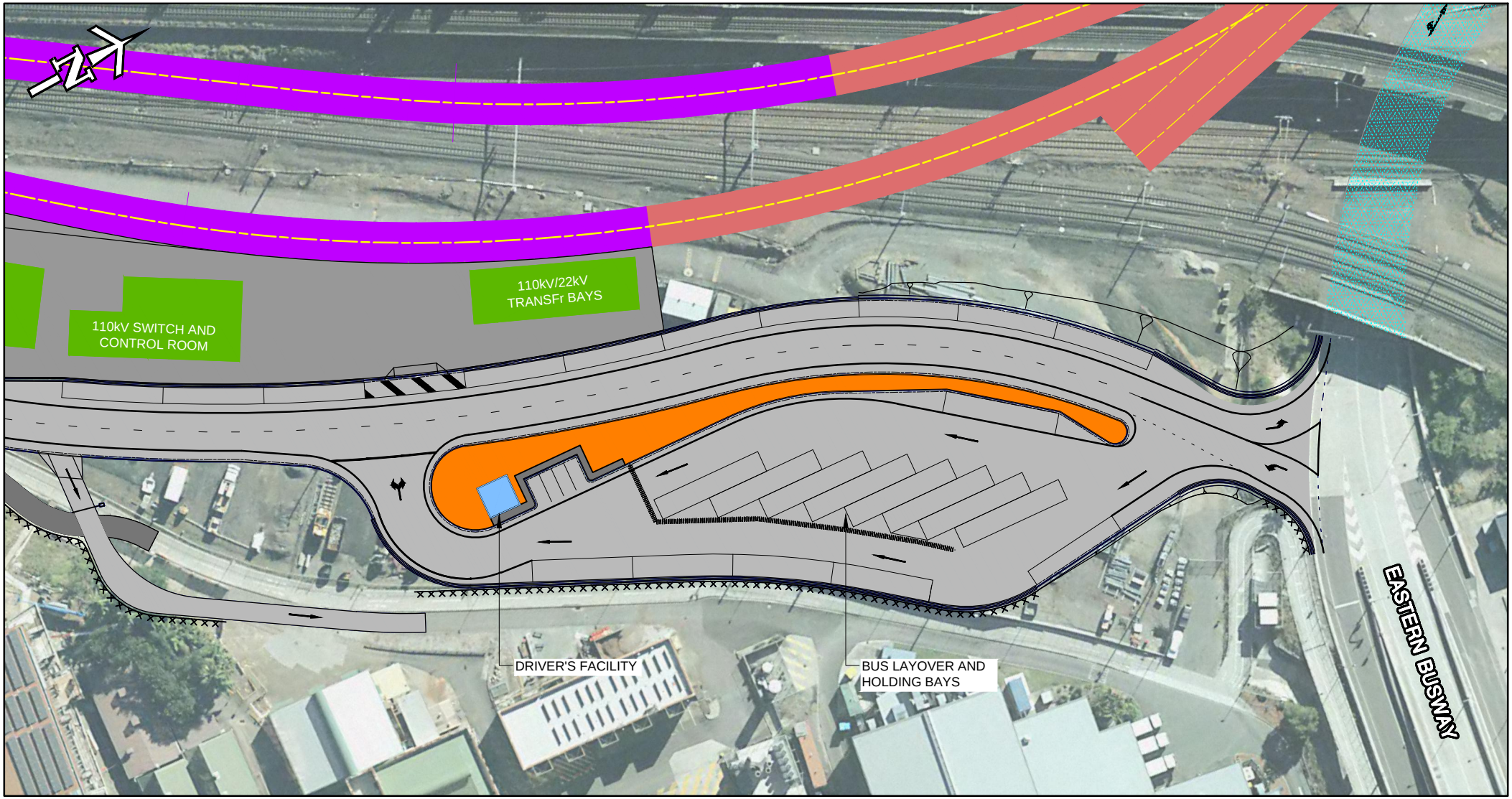
FIGURE 7-3

Dutton Park Station proposed layout



LEGEND

- PAVEMENT
- TRAFFIC ISLAND
- MINDED TUNNEL
- DIVE / TRANSITION STRUCTURE
- PROPOSED Bat RAIL CENTRELINES
- PROPOSED RETAINING WALL

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FIGURE 7-4

Dutton Park bus layover and connection to the busway

7.3 Woolloongabba Station

The Woolloongabba Station would be located at the site currently operated by the Queensland Government GoPrint Centre. This location is boarded by Stanley Street, Leopard Street, Vulture Street and Main Street. Located at this site is the existing Woolloongabba busway station that would be integrated with the newStation.

The function of the Woolloongabba Station would be:

- serve current and proposed residential and commercial land uses and the nearby Mater Hospital complex
- provide a network junction between the South East Busway and the Project so providing interchange opportunities for trips between UQ, Park Road, the CBD and South Brisbane
- provide significant transport operations for events held at the Gabba Stadium.

Woolloongabba Station is forecast to cater for 8,600 passenger boardings and alightings in the morning peak in 2021, and over 14,200 passenger boardings and alightings by 2031. **Table 7-4** provides forecasts of patronage activity at Woolloongabba Station with and without the Project during the morning peak period.

This station would be a major bus-rail interchange with around 40 per cent of station boardings and alightings involving a bus transfer (project bus and surface bus) in both 2021 and 2031. By 2031, the expected development of the surrounding precinct of high density mixed use activities, associated with the Woolloongabba Priority Development Area, would lead to an increase in pedestrian access to the station. The station has been designed to cater for passenger demands beyond 2031.

Table 7-4 Woolloongabba Station – two hour AM peak period patronage

	Without the Project			With the Project		Diff of total (with – without)		
	Board	Alight	Total	Board	Alight	Total	Change	% Change
2012								
Surface bus	1200	1100	2300	-	-	-	-	-
Total	1200	1100	2300	-	-	-	-	-
2021								
Surface bus	1700	1300	3000	1600	500	2100	-900	-30%
BaT bus				2,600	1,600	4200	4200	
BaT rail				300	2,000	2300	2300	
Total	1700	1300	3000	4500	4100	8600	5600	187%
2031								
Surface bus	2700	3,500	6,200	2300	800	3100	-3100	-50%
BaT bus				3,500	4,300	7800	7800	
BaT rail				200	2,800	3000	3000	
Total	2700	3500	6200	6000	7900	13900	7700	124%

Source: BaT Project model.

Note: Passenger movement is the total of boarding, alighting and transfers.

7.3.1 Woolloongabba – pedestrian assessment

An assessment of the impact of station passengers on the surrounding footpath network and any consequential impact on the traffic network due to necessary pedestrian measures has been carried out. With the Project, it is forecast that almost 1,000 pedestrian per hour during the morning peak in 2021 would use the existing pedestrian infrastructure (walk across the existing pedestrian bridge) over the busway and then cross Stanley Street and its associated service road. The pedestrian assessment concludes that the following environmental design requirements are necessary to ensure there is sufficient safe and efficient pedestrian infrastructure:

- 1mwidening of the footpath between the existing busway pedestrian bridge and the northern footpath of Stanley Street for the length of signalised crossing. This widening would be achieved by widening over the vertical space above the existing busway station (ie not decreasing the width of Stanley Street traffic lanes)
- countdown timer for Stanley Street pedestrian crossing to encourage pedestrians to cross the road in the available green time
- a pedestrian raised crossing on the Stanley Street service road to improve road safety.

Figure 7-5 illustrates the location of the proposed pedestrian raised crossing and the proposed site for widening of the queuing area adjacent to Stanley Street into the vertical space above the existing busway station.

Table 7-5 illustrates the pedestrian performance of Stanley Street pedestrian crossing outside the Woolloongabba Station that includes project passenger demands with and without pedestrian environmental design requirements. This assessment is for typical weekday morning and afternoon peak one hour pedestrian demands.

Table 7-5 Stanley Street 2021 weekday peak one hour pedestrian assessment

Intersection /scenario	Demand	Max No. peds/ queuing space	Max queue density m^2/ ped	Queue LoS	Max crossing density m^2/ ped	Crossing LoS
Stanley Street pedestrian crossing						
2021 'with Project' no upgrades	940	32	1.04	B	4.1	A
2021 'with Project' with upgrades	940	34	1.51	A	4.1	A

The upgrade works result in more space to queue, and the eradication of pinch points. As a result, pedestrians are able to queue more safely. Stanley Street is a busy arterial road, and safety risks taken at this crossing are hazardous. Safety considerations are the primary consideration at this station, rather than capacity. An increased pedestrian queuing area is recommended for safety rather than LoS reasons.

The existing pedestrian overbridge would perform at a LoS A, with more than 5m^2/ ped in both scenarios. The walkway between the two sections of Stanley Street is metered by the signalised crossing, so would also perform at LoS A.

7.3.2 Woolloongabba Station – traffic assessment

It is not expected that car traffic (park ‘n’ ride or kiss ‘n’ ride) would be significant for station passengers. Commuter car parking would be prevented through the continued operation of the Gabba Traffic Area. The pedestrian environmental design requirements would not impact on the traffic performance of Stanley Street.

LEGEND

- Raised pedestrian table
- Queuing area widening

Aerial Photo: Brisbane City Council 2012

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FIGURE 7-5

Pedestrian mitigation works at Stanley Street - indicative layout

N

0 10 20
Metres
1:500 (at A4)
Projection: GDA 1994 MGA56

G:\QENV2\Projects\QE06863\Spatial\ArcGIS\Figures\Final_EIS_Figures\04_Transport\Tech_Report\TransportTechRpt_Figure7-5_Wgabba_StanleySt_PedWorks.mxd Date: 14/08/2014

7.3.3 Woolloongabba Station – Gabba Stadium events

Maximum pedestrian activity would occur at this station after events at the nearby Gabba Stadium which can accommodate up to 42,000 attendees. The introduction of the Woolloongabba Station could completely change the mode split for travel to Gabba events and access from the south and west by public transport would become an attractive option for event attendees.

The Project provides an opportunity to significantly amend the current Gabba Stadium Transport Management Plan (TMP) to accommodate event attendees that would use the station. The current TMP involves significant road closures and other management measures around the stadium due to the need for bus alighting, loading and marshalling activities occurring on traffic lanes. The Woolloongabba Station may reduce the need for such road closures.

The queuing space between the entry to the station and Main Street was assessed for the queuing capacity under event scenarios. It was assumed that pedestrians would queue at a mid-band LoSD. Under these conditions, a total of 4,400 pedestrians are able to queue in the space that consists of the station forecourt and the wide pedestrian footpath between the forecourt and Main Street.

The passenger throughput capacity of the Woolloongabba Station is dependent on many factors including:

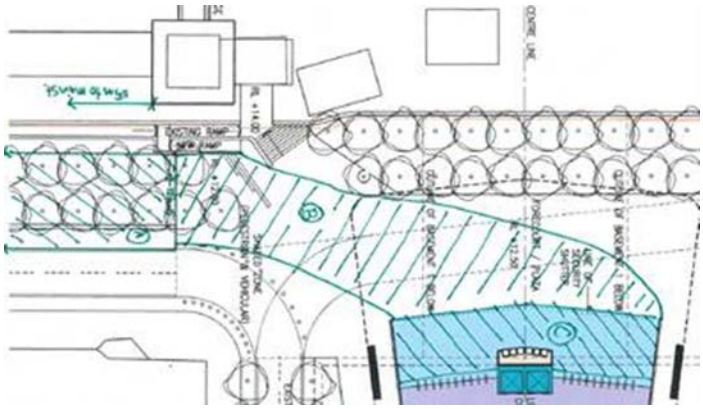
- capacity of the tickets gates, vertical transportation facilities and station concourses
- queuing capacity of the bus and train platforms
- number and frequency of buses and trains
- number of event attendees that would use project services
- passenger boarding time for buses and trains.

These factors should be assessed so that a robust analysis can be made to determine if the queuing space between the station and Main Street would be able to cater for event crowds. An amended Gabba Stadium TMP, prepared in consultation with the relevant stadium management parties, should identify and provide the appropriate management measure to allow passengers to safely cross Main Street. The TMP should also identify how the passenger queue should be managed so as to not block Main Street.

The Stanley Street entrance to the Woolloongabba Station should be closed during events as the size of the infrastructure and particularly the footpaths on Stanley Street are not appropriate for event crowds. The existing overbridge of the busway would remain open and all passengers would access both the busway and the station via the Main Street access during event periods.

The queuing space (refer **Figure 7-6**) between the entry to the station and Main Street was assessed for the queuing capacity under event scenarios. It was assumed that pedestrians would queue at a mid-band LoS D. Under these conditions, a total of 4,400 pedestrians are able to queue in the space that consists of the station forecourt and the wide pedestrian footpath between the forecourt and Main Street.

Figure 7-6 Woolloongabba Station queuing space under event scenarios



The ticket gates are able potentially to service 33 pax/ m/ min in 'scan' mode[14] and 50 pax/ m/ min in 'open' mode[15].

7.4 George Street Station

The George Street Station would be located at 63 George Street on the corner of George Street and Mary Street as illustrated in **Figure 7-7**. The function of the George Street Station would be to:

- provide bus and train opportunities for the significant employment (office, retail and services) and education (QUT Gardens Point Campus) trip generators
- provide public transport opportunities for the Brisbane CBD residential population and for leisure and retail trips
- provide a high level of public transport access to the Queen's Wharf Brisbane precinct redevelopment
- enable interchange with the distributive bus network.

[14] *E2 Gate Data Sheet*, Cubic Transport Systems, 2008
[15] *NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems – 2007 Edition*, National Fire Protection Agency (NFPA), 2007

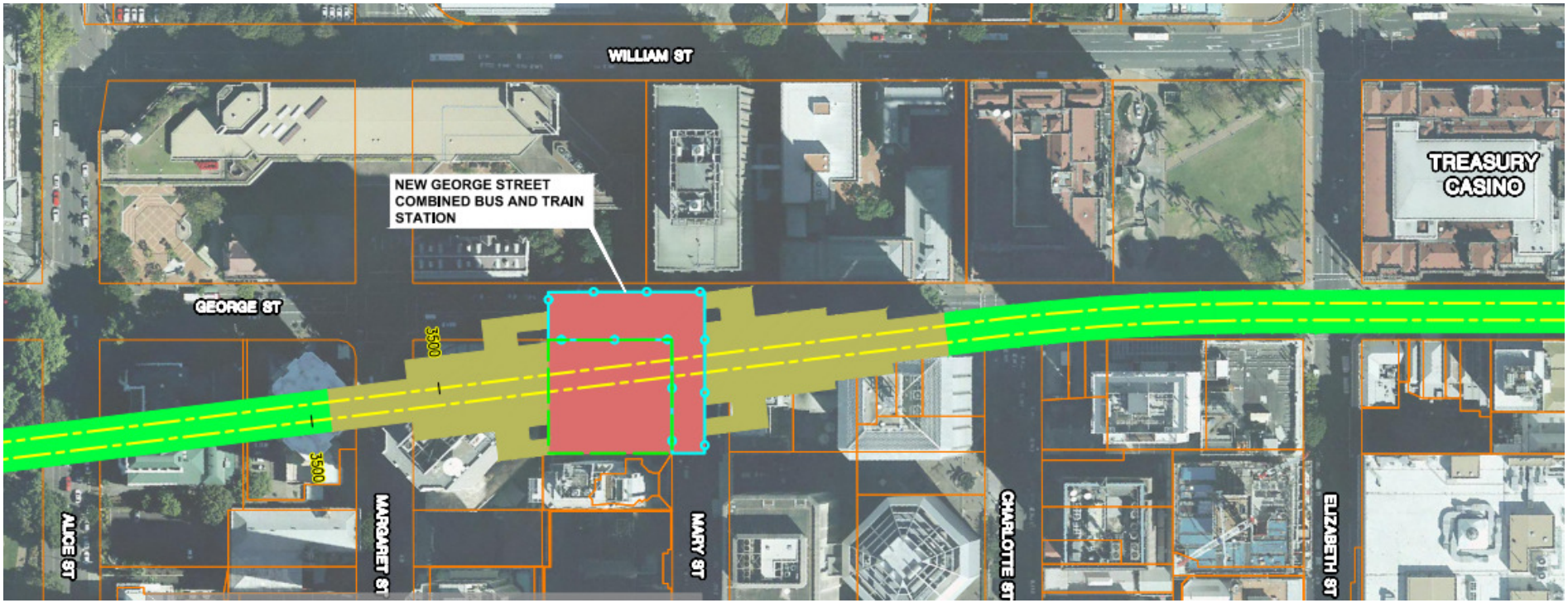


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FIGURE 7-7

Proposed location of the George Street Station

Table 7-6 presents the morning peak period patronage forecasts for the George Street Station. The station is forecast to generate significant increases and changes to pedestrian activity in and around George Street with over 23,000 boarding and alighting bus and train passengers forecast to pass through the station entrance during the two hour morning peak period in 2021. This number of passengers is forecast to increase to over 33,000 in 2031. Bus passengers would account for around two-thirds of this activity. The station would be designed to accommodate the passenger demand beyond 2031.

Most of the passengers would arrive and depart the station on foot. Transfer activity between bus and rail modes at the George Street Station is forecast to be minimal.

Table 7-6 George Street Station – two hour AM peak period patronage

	Boardings	Alightings	Total
2021			
BaT bus	4,100	11,600	15,700
BaT rail	500	7,200	7,700
Total	4,600	18,800	23,400
2031			
BaT bus	5,300	16,500	21,800
BaT rail	300	11,000	11,300
Total	5,600	27,500	33,100

Source: BaT Project model

Note: Passenger movement is the total of boarding, alighting and transfers.

7.4.1 George Street Station – pedestrian impacts

An assessment of the impact of the change in pedestrian movement in the George Street precinct without any change to the pedestrian infrastructure has been carried out. This assessment excludes consideration of any specific infrastructure or specific pedestrian demands associated with the proposed Queen's Wharf Brisbane development as such information was not available at the time of carrying out the assessment[16]. Recent changes proposed by Brisbane City Council to Albert Street have also not been taken into consideration.

Figure 7-8 and **Figure 7-9** presents pedestrian volumes with the Project and with no pedestrian upgrades for the am and pm peak respectively.

[16] The assessment includes pedestrian demands to the Queen's Wharf Brisbane area as forecast by the BaT Project Model that allowed for an assumed level of activity for the relevant zones.

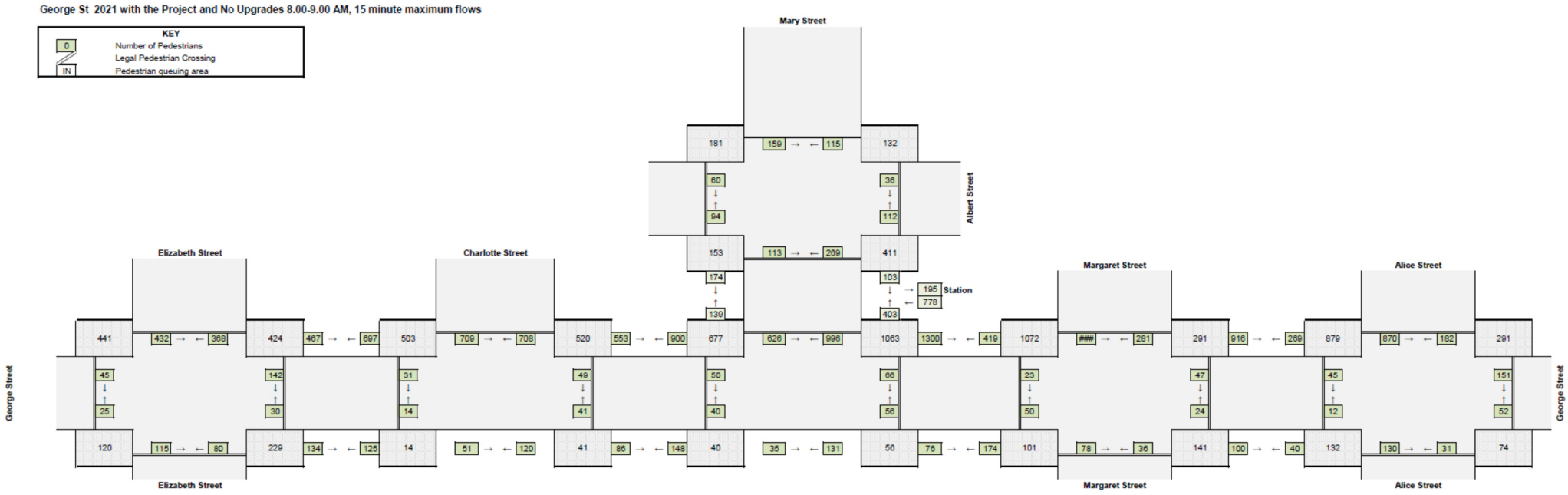

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FIGURE 7-8

George Street with the Project (2021) and no pedestrian upgrades 15 minute maximum pedestrian volumes – AM peak hour

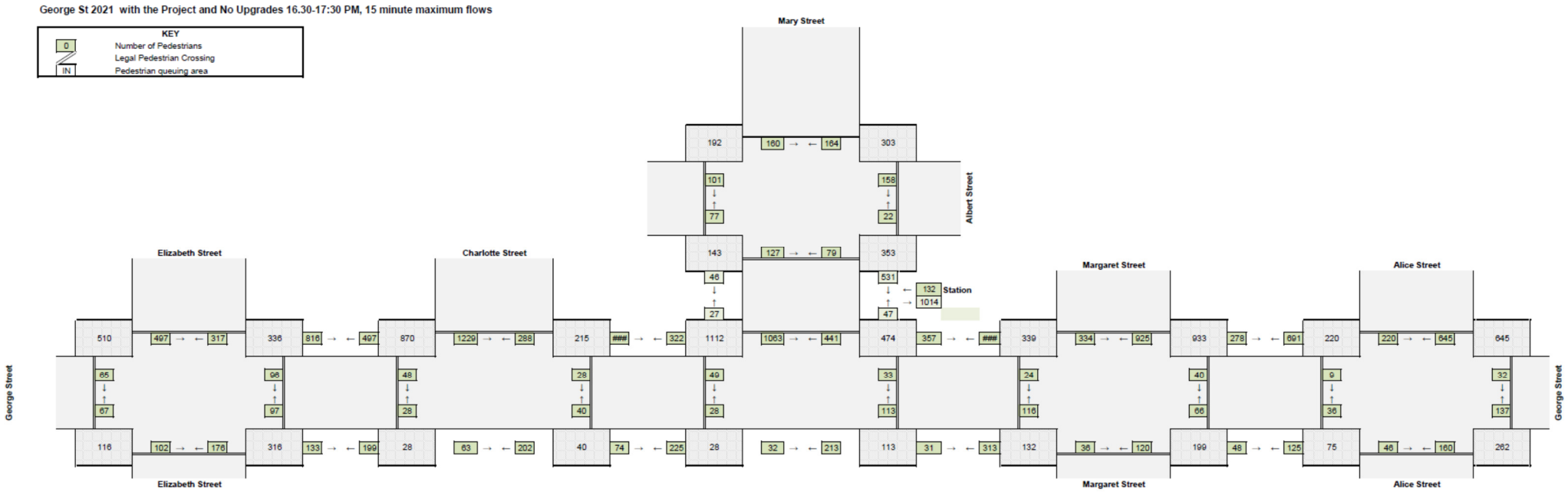

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FIGURE 7-9

George Street with the Project (2021) and no pedestrian upgrades 15 minute maximum pedestrian volumes – PM peak hour

Figure 7-10 and **Figure 7-11** presents the forecast LoS of the George Street pedestrian environment with the station operational and without any pedestrian infrastructure improvements. This LoS representation is for the 2021 morning peak period.

The northern footpath (CBD side) of George Street between Elizabeth Street and Margaret Street currently experiences congestion during commuter peak periods. The George Street Station is forecast to generate a significant increase in pedestrian volumes in the George Street precinct compared to the scenario without the Project. Characteristics of the additional demand generated by the George Street Station include:

- pedestrian volumes in the maximum 15 minutes in the am peak period are more than double the case without the Project with over 1,000 pedestrian travelling on all sections of the northern (CBD) side of George Street
- over 1,500 pedestrians are forecasted to use the George Street footpath between Charlotte Street and Mary Street and also between Mary Street and Margaret Street during the maximum 15 minutes in the am peak period
- the dominant pedestrian movements are away from George Street Station in the morning peak period. However, significant pedestrian volumes continue to enter this precinct from Elizabeth Street so creating conflict between pedestrians moving in opposite directions
- use of the southern footpath (river side) of George Street is significantly less than the northern footpath
- queuing areas along the northern sides of intersections perform at LoS F – requiring between 10 – 50m^2 overflow area for people to queue comfortably. This also applies to the intersection of Mary Street with Albert Street
- the footpath on the northern side of George Street between Elizabeth Street and Margaret is highly congested, with queues potentially interfering with pedestrians' ability to cross at the lights.

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FIGURE 7-10

George Street with the Project (2021) and no pedestrian measures – pedestrian level of service during the AM peak hour

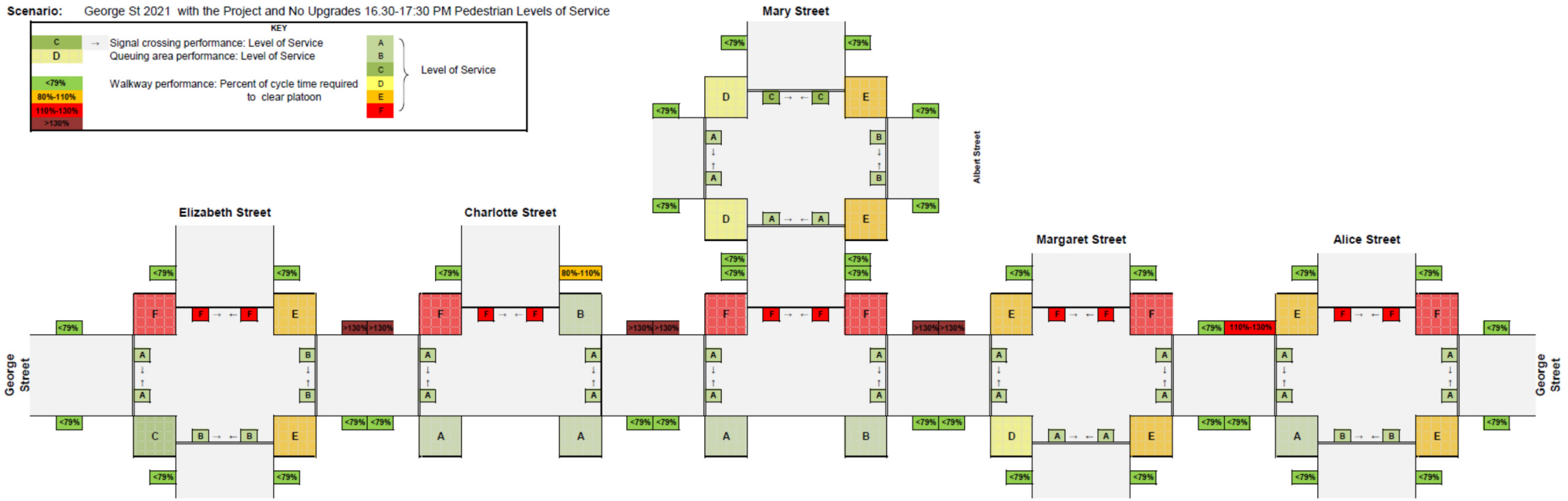

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FIGURE 7-11

George Street with the Project (2021) and no pedestrian measures – pedestrian level of service during the PM peak hour

This LoS assessment illustrates that with the Project the total pedestrian demand in the George Street precinct would create inappropriate levels of pedestrian congestion at several locations:

- queuing areas along the northern sides of intersections perform at LoS F – meaning that there is insufficient space for people to queue comfortably. This applies to the intersections of George Street with Elizabeth Street, Charlotte Street, Mary Street, Margaret Street and Alice Street
- the footpath on the northern side of George Street between Elizabeth Street and Margaret Street is highly congested, with queues potentially interfering with pedestrians' ability to cross at the intersections
- as with the existing situation, activity associated with outdoor dining and queues of people accessing cafes on the northern side of George Street between Elizabeth Street and Margaret Street reduce the effective width available to pedestrians to 1.0m despite there being approximately 3.0m between buildings and street furniture
- the intersection of Mary Street and Albert Street operates at LoS F
- there is spare capacity on the southern footpath of George Street.

7.4.2 Pedestrian mitigation measures

The pedestrian assessment of the impact of the George Street Station clearly illustrates that mitigation measures are required such that an appropriate LoS can be achieved (generally no worse than LoS D). The assessment also shows that the southern footpath of George Street has spare capacity and that measures are required to relieve the pedestrian crowding that is forecast to occur at the intersection of Mary Street and Albert Street. Mitigation measures were investigated that would encourage pedestrians to cross the road and so use the spare capacity.

Two scenarios were prepared to cater for the demand of the George Street Station, the details of each are shown in **Table 7-7**.

- Scenario A: High traffic impact (Scramble at Alice Street/ George Street)
- Scenario B: Low traffic impact (Scramble at Margaret Street/ George Street)

Both scenarios achieve comparable levels of pedestrian congestion to the current amenity on George Street and generally perform within or better than LoS D, in both the AM and PM peak.

Scenario B has a lower impact on traffic, but requires more substantial mitigation works on George Street. Consistent with comments made by the traffic modelling outcomes, the increase in delays on Alice Street generated by Scenario A are undesirable. Scenario B is the recommended scenario.

Table 7-7 George Street upgrade measures investigated

Upgrade measure	Scenario A high traffic impact	Scenario B) low traffic impact
Scramble at Alice Street	✓	
Scramble at Margaret Street		✓
Walk on green	Elizabeth Street/ George St; Charlotte Street/ George St; Mary Street/ George St; and Margaret Street/ George St	
Countdown Timers	Elizabeth Street/ George St;	

Upgrade measure	Scenario A high traffic impact	Scenario B) low traffic impact
	Charlotte Street/ George St; Mary Street/ George St; Mary Street/ Albert St; and Margaret Street/ George St	
Scramble crossing removal at Mary Street	✓	✓
Optimise street furniture	✓	✓
Provide wider signal crossings	Charlotte Street (N) – 7m crossing space* Mary Street (N) – 7m crossing space* Margaret Street (S) 7m crossing space* Mary Street/ Albert Street, 6m crossing space*	
	Alice Street (N) – 4m crossing space*	Alice Street (N) – 7m crossing space*
George Street Underpass	Ensure that footpath on southern side of George Street is a minimum of 3m wide between Mary and Margaret Streets. Underpass exit should be a minimum of 5m width for pedestrians.	
Mary Street midblock crossing	✓	✓
2.4m total width clear footpath required on George Street North, between Elizabeth and Mary**	✓	✓
Station exit 'portal'	✓	✓
Minimum footpath width on George Street North between Margaret and Alice Streets	Current width sufficient	Minimum of 3m required on George Street North between Margaret and Alice Streets, with no pinch points less than 3m
Lane take and parking removal	None required	Removal of northbound lane on George Street between Margaret and Alice Streets to cater for wider queuing areas at Margaret and Alice Street intersections
Recommended: lane take on Mary Street	A total of one lane on Mary Street could be taken from 30m north of the station entrance to provide a wide footpath and a 'portal' to the precinct	

** Crossing space sum of the crossing width and setback distance of stoplines. In the study areas considered, the setback distance for stoplines was typically 1m, which would give 6m of crossing with for a crossing space of 7m.*

*** Obstacles such as tables, chairs have lower effective width requirements than hard walls. To cater for these, a total width of 2.4m is recommended.*

Environmental design requirements that are recommended to mitigate the congestion caused by the increased pedestrian demands are aimed at encouraging use of all pedestrian footpaths in the George Street Station precinct. The measure that make up scenario B include:

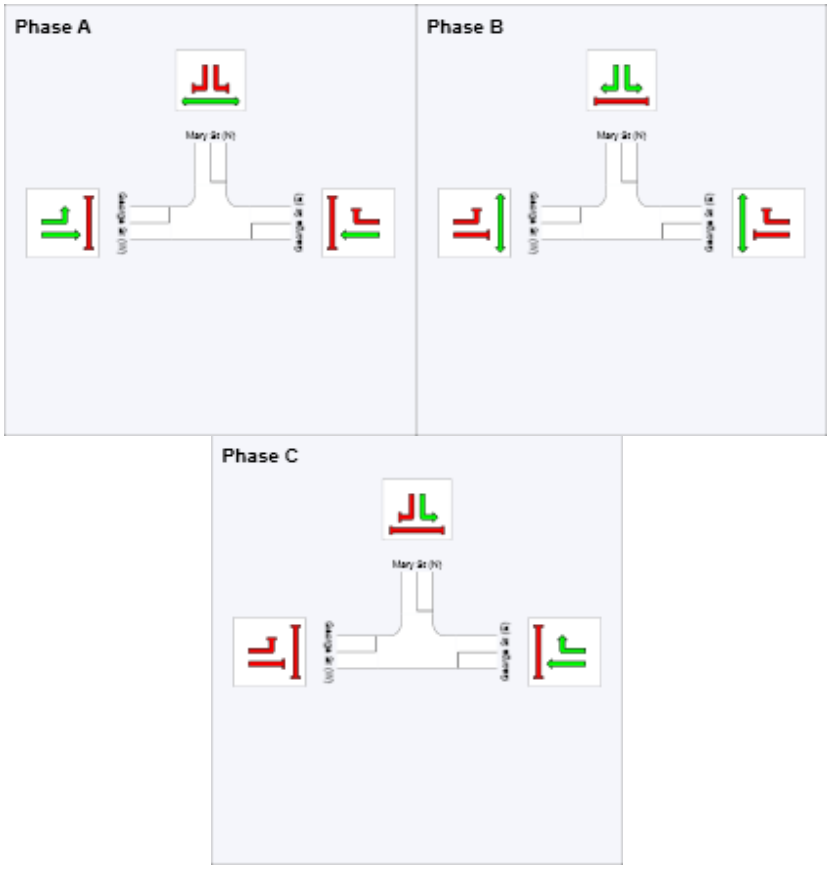
- **provision of pedestrian 'walk on green'** measures to maximise pedestrian crossing time at the intersections of Elizabeth Street/ George Street, Charlotte Street/ George Street, Mary Street/ George Street, and Margaret Street/ George Street. 'Walk on green' measures include the

pedestrian phase being called every cycle regardless if the call button is activated or not and maximising the walk time beyond any minimum time required for safe pedestrian clearance where possible.

- **provision of pedestrian count down timers** at Elizabeth Street/ George Street, Charlotte Street/ George Street, Mary Street/ George Street, Mary Street/ Albert Street and Margaret Street/ George Street
- **provide wider signal crossings** at:
  - Charlotte Street (N) – 7m crossing space
  - Mary Street (N) – 7m crossing space
  - Margaret Street (S) 7m crossing space
  - Mary Street/ Albert Street, 6m crossing space
  - Alice Street (N) – 7m crossing space
- **maximising pedestrian crossing time** at the intersection of Mary Street and George Street

  To maximise the amount of green time for pedestrians, a three phase operation is proposed at Mary Street, similar to the signal phasing currently operating at Charlotte Street/ George Street. The phasing is proposed to be three phase operation, as per **Figure 7-12**.

Figure 7-12 Proposed signal phasing – Mary Street/ George Street



By allowing the Mary Street (N) crossing to run at the same time as the major traffic demand, the phase time for the signal crossing increases by between 17s-18s compared with the scramble

crossing operation. **Table 7-8** provides a comparison of the time available to pedestrians. The statistics were calculated using signal times from the SAJV LinSig Analysis, see George Street Station Precinct – Intersection Performance for 2021 end state operation (SAJV, 2014) for more details about the traffic performance of each option

Table 7-8 Signal time for Mary Street (N) Crossing for Mary Street / George Street intersection

Scenario	Green time	Phase time*	% Change green time from base
Scramble crossing AM	8s	23s	-
Three phase AM	25s	36s	+213%
Scramble crossing PM	8s	23s	-
Three phase PM	26s	37s	+225%

**Phase time is reported as the sum of green time + red flashing time + red time when no other phase was running. The intergreen (amber and red phase) time remained constant in both variants.*

- **optimise street furniture** – street furniture at traffic signals, including bins, seats, news-stands, telephone boxes and CityCycle Stations are recommended to be removed within 1m of the bounds of the pedestrian crossings. Additionally, on the northern footpath of George Street between Elizabeth Street and Mary Street, measures to move outdoor dining and pedestrian queues at cafes should be put in place to ensure that there is an unobstructed pedestrian width of 2.4m.
- **station exit 'portal'** – The George Street Station would be a major portal for bus and train passengers to access the Brisbane CBD, with forecast demands of over 23,000 pedestrians accessing and exiting the station during two hour morning peak period in 2021.

  The station exit should open onto a plaza or be as wide and 'v' shaped as possible to provide good visibility to assist pedestrians with way finding. Clear signage should be provided to direct passengers to George Street and into the CBD via Albert Street. This measure integrates with a recommendation to remove a traffic lane on the upper section of Mary Street to widen the footpath outside the station.
- **grade separated pedestrian crossing of George Street in the vicinity of the Station and associated necessary footpath width to facilitate an entrance to a grade separated facility.** A grade separated pedestrian facility at George Street such as an underpass exit should be located to connect to the opposite side of George Street (ie the river side) of the proposed station location. The underpass exit should be a minimum of 5m wide, and have sufficient vertical transport to accommodate an anticipated demand of 5,000 pedestrians per hour during commuter peak operations. **Figure 7-14** illustrates a possible location of an underpass entrance point on George Street opposite the station.

To cater for the forecast demand, the footpath adjoining the underpass exit is recommended to be a minimum of 3m effective width (3.6m total width). Consequently, the footpath on George Street (river side) between Mary Street and Margaret Street is recommended to be a minimum of 3.6m wide to accommodate the demand from the underpass. This increase in footpath width can be achieved without impacting on the traffic lanes through removing a telephone box and widening into a flower bed that runs along the footpath. **Figure 7-13** illustrates the existing conditions of this footpath.

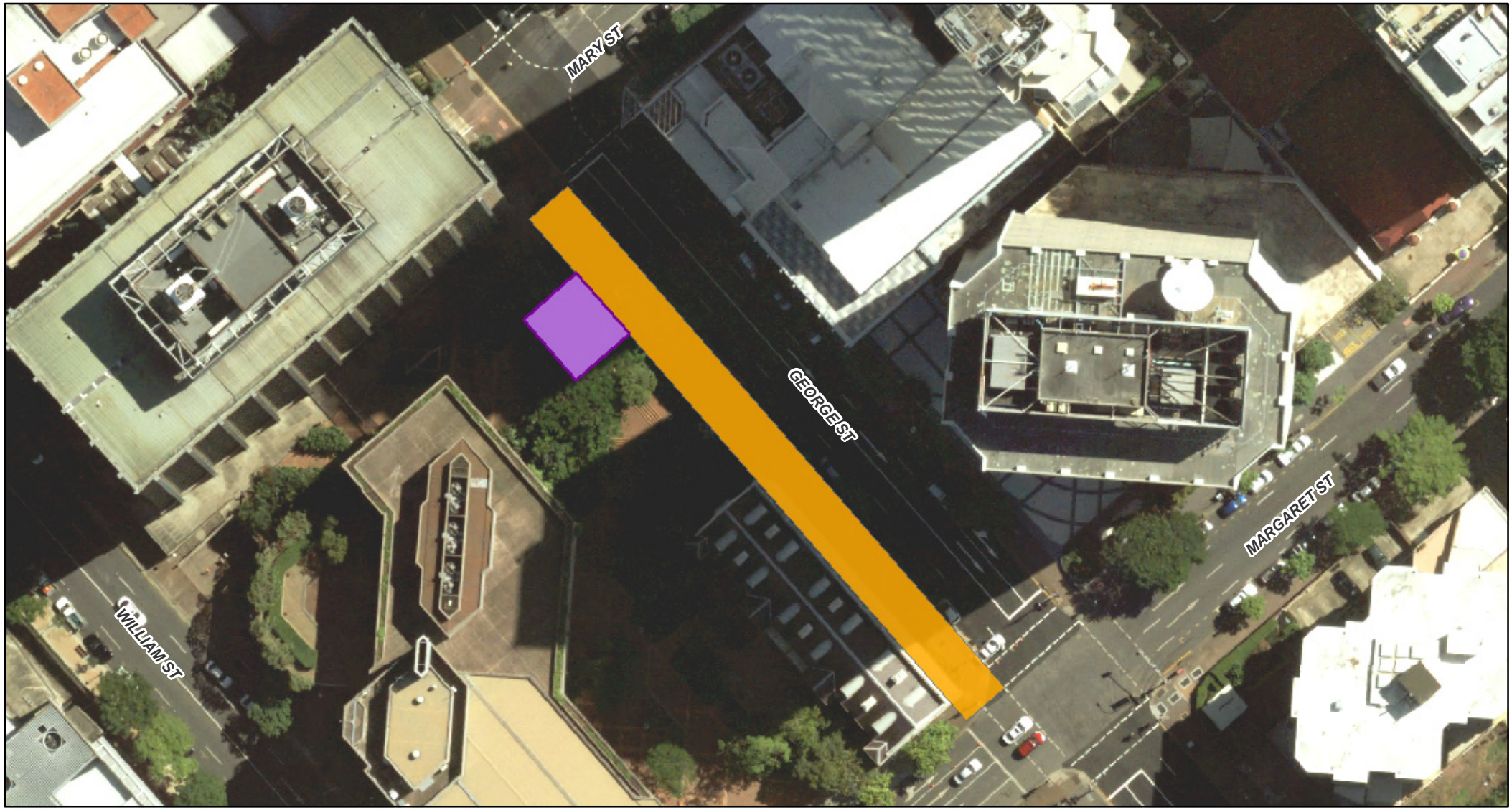
Figure 7-13 George Street (south) between Mary Street and Margaret Street

- **provision of minimum footpath width on George Street (north side) between Margaret and Alice Streets.** To cater for the preference for the northern side of George Street between Margaret and Alice Streets, the footpath should be a minimum of 3m effective width (3.6m total width between pinch points) for its length. **Figure 7-15** shows the location of the minimum width requirement.

  To provide the minimum 3m effective width (3.6m total width) footpath width between Margaret Street and Alice Street, a traffic lane would need to be removed on George Street between Margaret Street and Alice Street. The removal of car parking and a bus stop on the southern side would have the less impact on traffic performance compared with taking any other lane. The bus stop could be relocated to Alice Street to the north of its intersection with George Street.

- **Mary Street mid-block pedestrian crossing** – A mid-block pedestrian crossing on Mary Street would encourage pedestrians to cross Mary Street in a safe manner and so provide relief to the pedestrian facilities at the intersection of Mary Street and Albert Street.

- **recommended additional footpath width on Mary Street.** Due to the large volumes exiting the station, it is recommended from an amenity and safety perspective that a traffic lane be removed on Mary Street from 30m north of the station to George Street to provide a wide footpath at the entrance to the Station and should integrate with the suggested mid-block pedestrian crossing of Mary Street. **Figure 7-16** provides an indicative layout.



LEGEND

- Minimum 3m effective width
- Underpass exit

Aerial Photo: Brisbane City Council 2012

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

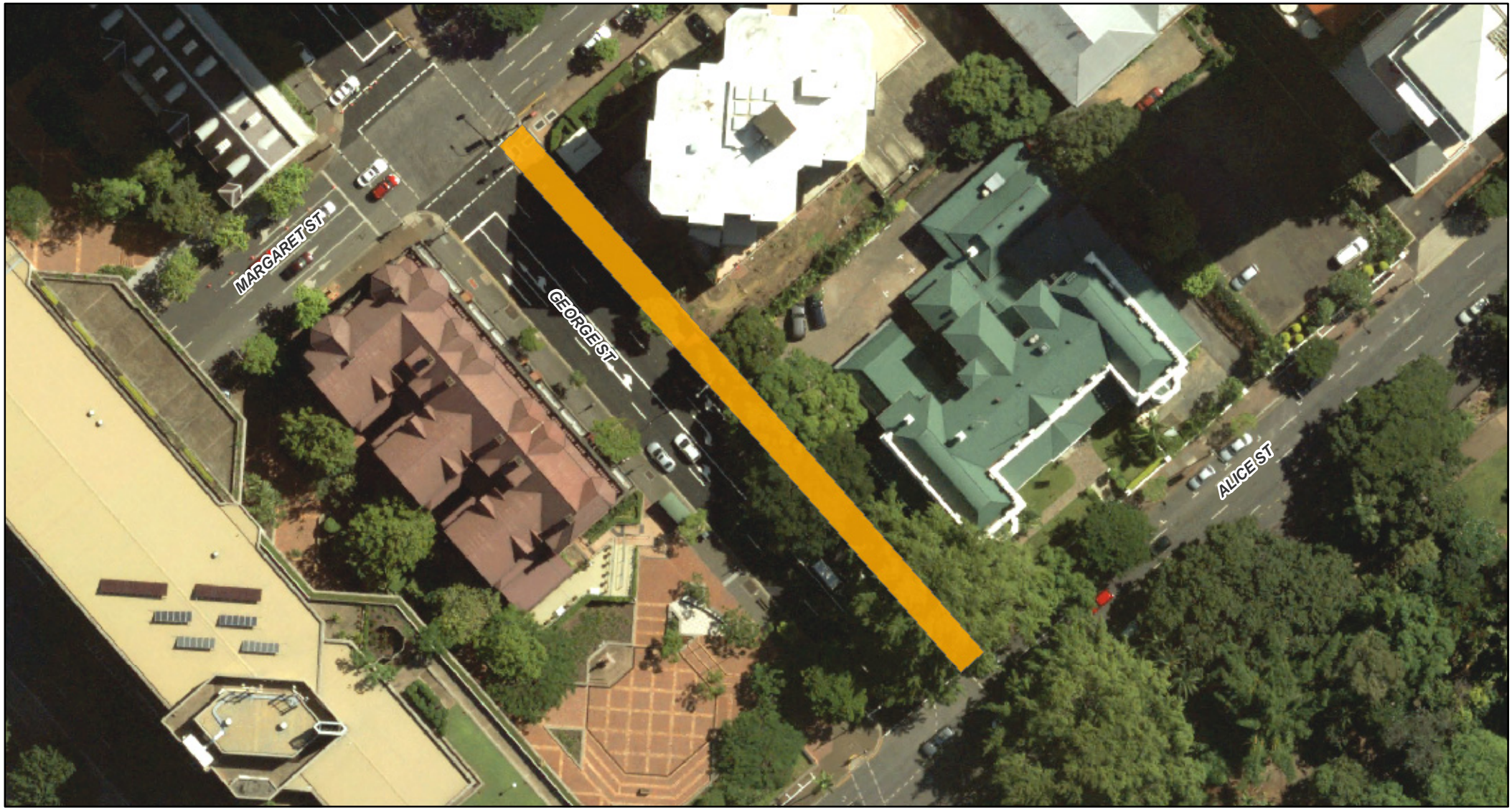
FIGURE 7-14

George Street underpass - indicative layout

N

0 10 20
Metres
1:750 (at A4)
Projection: GDA 1994 MGA56

G:\QENV2\Projects\QE06863\Spatial\ArcGIS\Figures\Final_EIS_Figures\04_Transport\Tech_Report\TransportTechRpt_Figure7-14_GeorgeStreet_Underpass.mxd Date: 14/08/2014



LEGEND

Proposed widening works

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-15

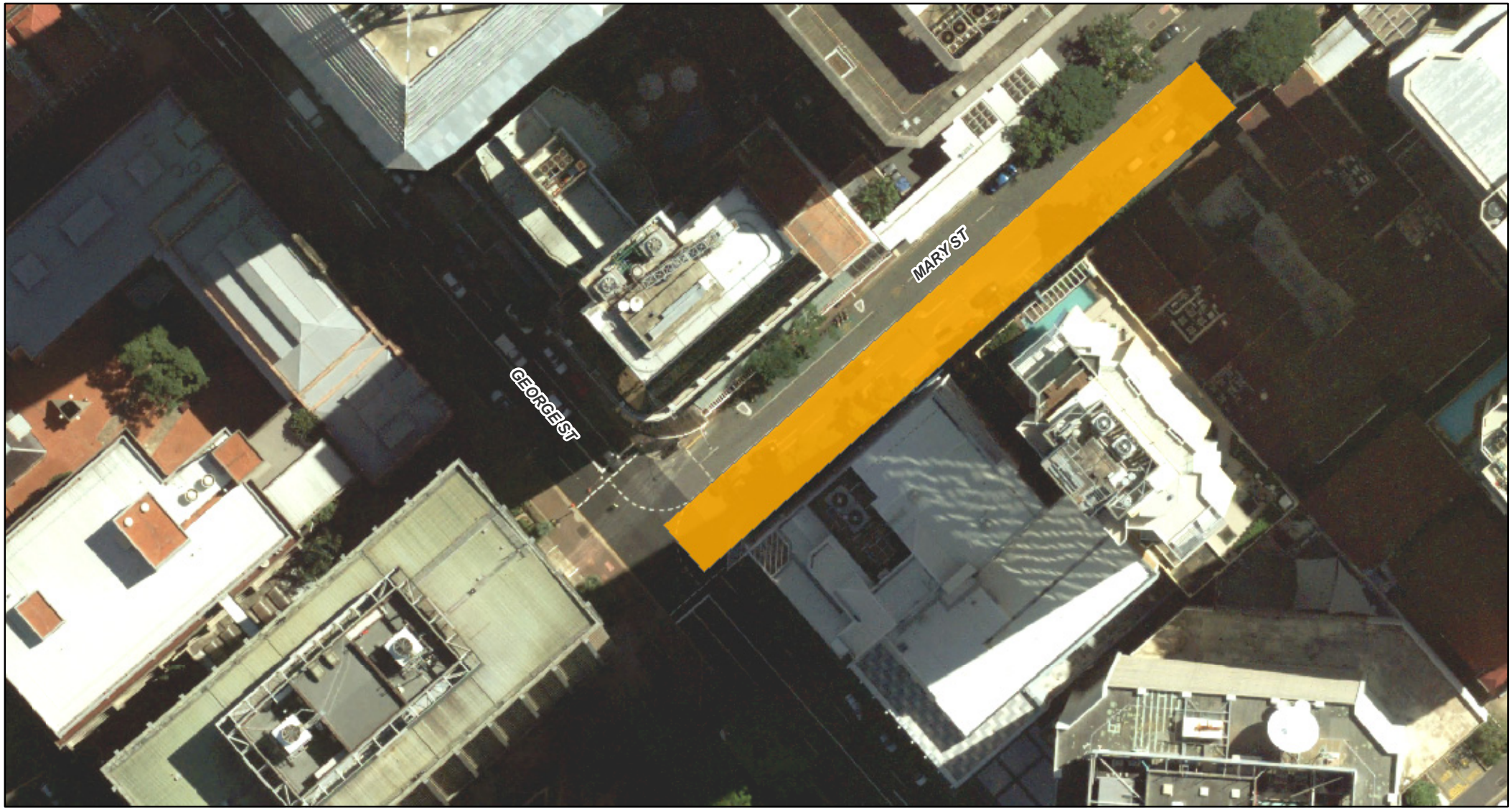
Minimum footpath width of 3m on George Street (north side) - between Margaret and Alice Streets - indicative layout

N

0 10 20
Metres
1:750 (at A4)
Projection: GDA 1994 MGA56

Aerial Photo: Brisbane City Council 2012

G:\QENV2\Projects\QE06863\Spatial\ArcGIS\Figures\Final_EIS_Figures\04_Transport\Tech_Report\TranspTechRpt_Figure7-15_GeorgeStreet_Footpath_Widening.mxd Date: 14/08/2014



LEGEND

Proposed widening works

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-16

Footpath widening on Mary Street - indicative layout

N

0 10 20
Metres
1:750 (at A4)
Projection: GDA 1994 MGA56

Aerial Photo: Brisbane City Council 2012

G:\QENV2\Projects\QE06863\Spatial\ArcGIS\Figures\Final_EIS_Figures\04_Transport\Tech_Report\TranspTechRpt_Figure7-16_MaryStreet_Footpath_Widening.mxd Date: 14/08/2014

7.4.3 George Street – preliminary assessment outcomes

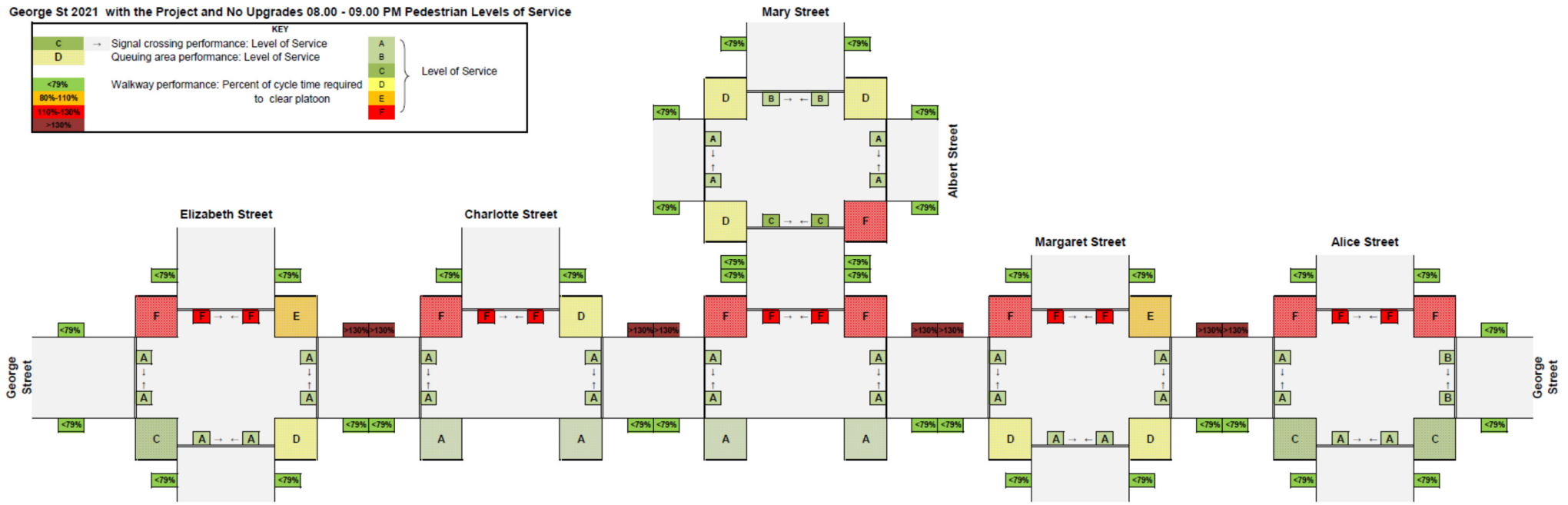
Pedestrian volumes with the project and with pedestrian measures are presented in **Figure 7-17**and **Figure 7-18** for the morning and evening peak respectively.

The pedestrian LoS of these measures for the 2021 morning peak has been assessed and is illustrated in **Figure 7-19**. The evening peak LoS is illustrated in **Figure 7-20**. The evening peak period generally has less congestion. The walkway performance would be between LoS B and C, with a greater balance in the use of the northern and southern (river side) footpaths of George Street. The LoS at intersections is also generally appropriate and the measures recommended to encourage pedestrian to cross George Street and Mary Street achieve the aim of spreading pedestrian densities more evenly across the footpath network.

The pedestrian footpath on the northern side of George Street between Mary Street and Margaret Street would be operating close to the LoS trigger point of D in 2021. To mitigate the risk of the LoS trigger point of this footpath being reached soon after 2021 and to also provide an amenable environment for pedestrians it is suggested that a footpath width of at least 3.6m be provided. This width could be provided through ensuring the George Street Station building would be 3.6m from the kerb (the current width is approximately 3.6m) without impacting on the adjacent traffic lane and removal of street furniture.

These measures combine through providing efficient access to all footpaths to create an appropriate pedestrian LoS at the year of opening (2021) of the Project.

Specific detail relating to other proposed developments such as the Queen's Wharf Brisbane precinct and proposed changes to Albert Street have also not been taken into consideration in this assessment. These developments are likely to have an impact on pedestrian movement. It is recommended that the relevant authority undertake a pedestrian movement assessment that takes into account all significant developments when the relevant information is available.



BUS AND TRAIN PROJECT
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FIGURE 7-17

George Street with the Project (2021) and with pedestrian upgrades – 15 minute maximum pedestrian volumes during the AM peak hour

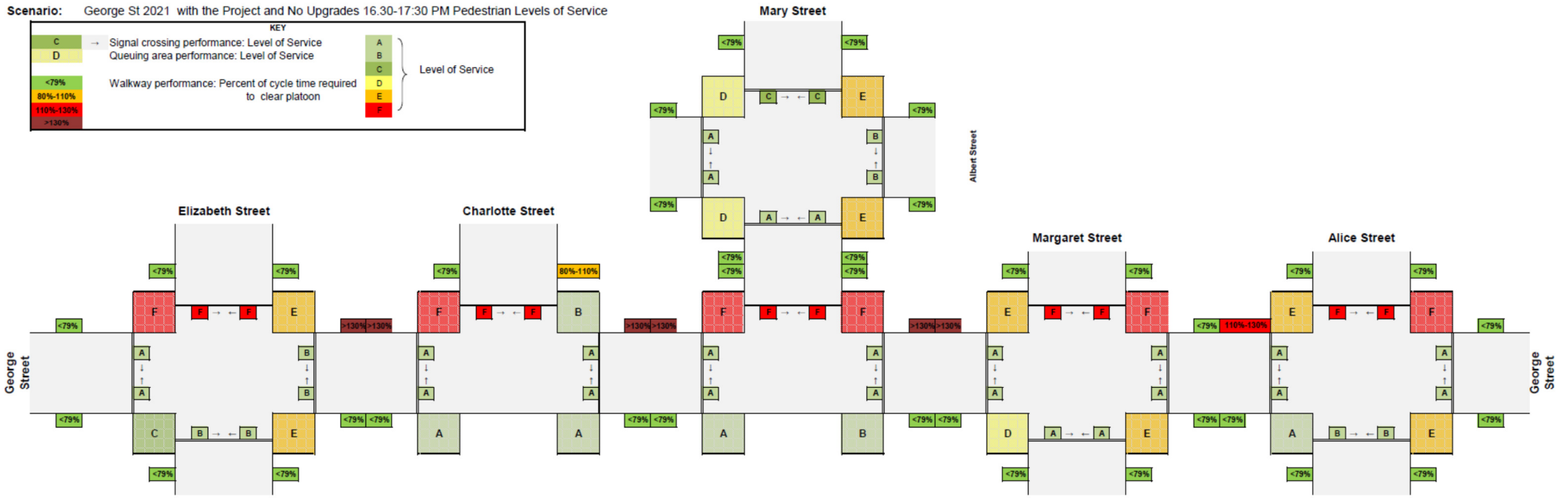

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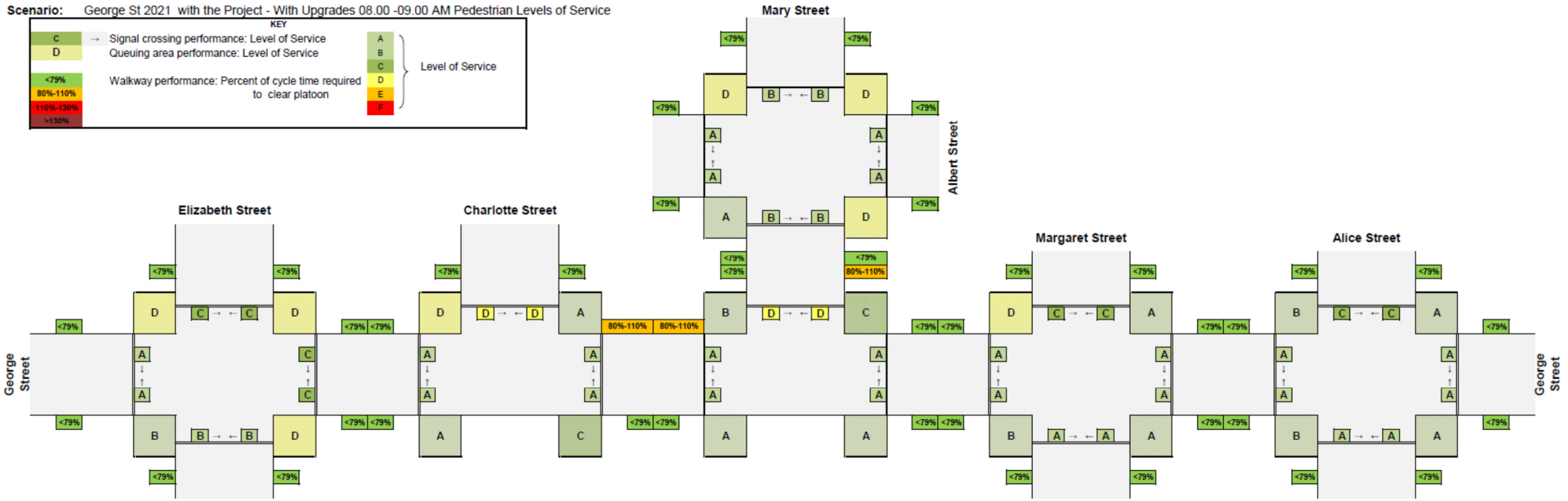
FIGURE 7-18

George Street with the Project (2021) and with pedestrian upgrades – 15 minute maximum pedestrian volumes during the PM peak hour



BUS AND TRAIN PROJECT
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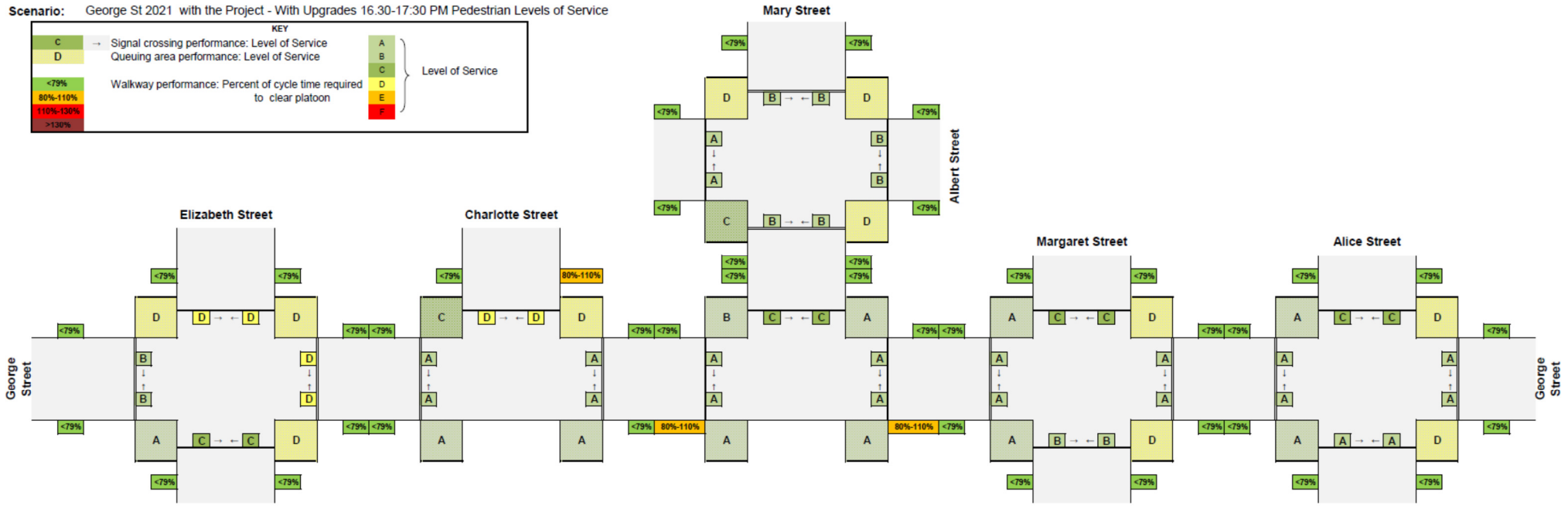
FIGURE 7-19

George Street with the Project (2021) and with pedestrian mitigation measures – pedestrian level of service during the AM peak hour



BUS AND TRAIN PROJECT
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FIGURE 7-20

George Street with the Project (2021) and with pedestrian mitigation measures – pedestrian level of service during the PM peak hour

7.4.4 George Street – Pedestrian simulation model results

Compared with other study areas, George Street is comparatively congested. Site visits show queues overspilling, for example on the northern side of Elizabeth Street. Some of the queuing areas, walkways and crossings already exceed the trigger LoS in the 2014 Existing and 2021 'without project' scenarios.

Table 79 shows the intersection performance for pedestrian in the AM peak period at George Street Station for each scenario.

Table 79 AM Peak Hour Pedestrian Intersection Performance

Intersection/ scenario	Demand	Max No. peds/ queuing space	Max queue density m^2/ped	Queue LoS	Max crossing density m^2/ped	Crossing LoS
Elizabeth Street/ George Street						
2014 base year	2460	28	0.47	D	1.3	D
2021 without project	2547	28	0.43	D	1.3	D
2021 with project no upgrades*	4051	-	<0.19	F	<0.46	F
2021 with project Scenario A	5557	27	0.50	D	1.3	D
2021 with project Scenario B	5557	26	0.56	D	1.3	D
Charlotte Street/ George Street						
2014 base year	2326	12	0.33	D	1.3	D
2021 without project	2409	12	0.33	D	1.2	D
2021 with project no upgrades*	5643	-	<0.19	F	<0.46	F
2021 with project Scenario A	4767	45	0.44	D	1.1	D
2021 with project Scenario B	4767	46	0.47	D	1.1	D
Mary Street / George Street						
2014 base year	1466	15	0.41	D	1.2	D
2021 without project	1518	16	0.38	D	1.2	D
2021 with project no upgrades*	6672	-	<0.19	F	<0.46	F
2021 with project Scenario A	4439	26	0.74	C	1.2	D
2021 with project Scenario B	4041	29	0.94	B	1.3	D

Intersection/ scenario	Demand	Max No. peds/ queuing space	Max queue density m^2/ped	Queue LoS	Max crossing density m^2/ped	Crossing LoS
Margaret Street / George Street						
2014 base year	1387	13	0.35	D	1.9	C
2021 without project	1436	14	0.32	D	1.2	D
2021 with project no upgrades	5843	-	<0.19	F	<0.46	F
2021 with project Scenario A	5468	45	0.50	D	1.3	D
2021 with project Scenario B	5383	48	0.50	D	1.2	D
Alice Street / George Street						
2014 base year	1096	10	0.21	E	3.2	D
2021 without project	1134	11	0.19	E	3.0	B
2021 with project no upgrades*	5360	-	<0.19	F	<0.46	F
2021 with project Scenario A	4524	38	0.54	D	1.8	C
2021 with project Scenario B	4492	50	0.49	D	1.3	D

** The simulation model for 2021 'with project' no upgrades was not able to finish the simulation – therefore a LoS of F or worse should be assumed.*

The 2014 base year scenario has a typical performance of LoS D for crossing and queuing areas.

The 2021 with Project, no upgrades model was unable to complete the simulation time, as walkways became fully clogged and throughput declined to effectively zero. This indicates that the capacity was insufficient to cater for the demand, and that the scenario would be considered unsafe. Pedestrians would either be required to take safety risks to complete their journey, or otherwise would not use the Project due to the poor amenity of the George Street Station precinct.

For the 2021 with Project and with upgrade scenario, the intersection performance is comparable, with pedestrians preferring to spread out rather than compromise personal space preferences. The upgrades include wider signalised crossings and removal of street furniture, which allow pedestrians to spread safely, without taking safety risks.

The demands for each of the scenarios are slightly different from west of and including Mary Street/ George Street. The location of the scramble crossing changes the locations where pedestrians are willing to cross, and their demand for the George Street underpass. The provision of the Margaret Street scramble (Scenario B) was assumed to have a slightly lower demand for the southern side of George Street, as the travel times on the southern side were larger than for the Alice Street scramble (Scenario A).

Table 7-10 shows the performance of the northern and southern walkways from Elizabeth Street to Alice Street for George Street Station model for the AM peak period, and for all scenarios. The locations with the largest demand and highest density were selected.

Table 7-10 AM Peak Hour Walkway Performance

Walkway/ scenario	Northern walkway			Southern walkway		
	Demand	Avg. density m^2/ped	Avg. LoS	Demand	Avg. density m^2/ped	Avg. LoS
Elizabeth Street – Charlotte Street						
2014 base year	1653	3.6	A	617	5.00	A
2021 without project	1711	3.5	A	638	5.00	A
2021 with project no upgrades*	4335	<0.46	F	943	5.00	A
2021 with project Scenario A	3843	1.87	C	2786	5.00	A
2021 with project Scenario B	3843	1.65	C	2786	5.00	A
Charlotte Street – Mary Street						
2014 base year	1086	5.0	A	381	5.00	A
2021 without project	1124	5.0	A	395	5.00	A
2021 with project no upgrades*	5317	<0.46	F	596	5.00	A
2021 with project Scenario A	4023	1.95	C	3538	4.07	A
2021 with project Scenario B	4023	1.75	C	3538	2.31	C
Mary Street – Margaret Street						
2014 base year	1235	5.0	A	321	5.00	A
2021 without project	1279	5.0	A	332	5.00	A
2021 with project no upgrades*	6536	<0.46	F	494	5.00	A
2021 with project Scenario A	3759	2.73	B	3187	3.55	A
2021 with project Scenario B	4571	2.09	C	3071	5.00	A
Margaret Street – Alice Street						
2014 base year	989	5.0	A	224	5.00	A
2021 without project	1024	4.7	A	232	5.00	A
2021 with project no upgrades*	4309	<0.46	F	413	5.00	A
2021 with project Scenario A	1899	3.14	B	2988	2.66	B
2021 with project Scenario B	3726	2.16	C	1150	5.00	A

** The simulation model for 2021 with project no upgrades was not able to finish the simulation – therefore a LoS of F or worse should be assumed.*

The 2014 base year and 2021 without Project performance is LoS A, with the northern side of George Street experiencing higher densities and congestion for pedestrians.

The walkway performance in the 2021 with the Project with upgrades scenario is between LoS B and C, with a greater balance in the densities for the northern and southern sides of George Street.

Table 7.11 shows the travel times in the George Street corridor in the peak direction for the AM peak period, for all scenarios.

Table 7.11 AM peak hour travel times

Scenario	North side eastbound	South side eastbound
2014 Existing	0:12:53	0:10:24
2021 without project	0:14:06	0:10:02
2021 with project no upgrades*	-	-
2021 with project Scenario A	0:11:20	0:09:39
2021 with project Scenario B	0:11:54	0:10:29

** The simulation model for 2021 with project no upgrades was not able to finish the simulation.*

The proposed upgrade works reduce the intersection delays for pedestrians, leading to a reduction of 2m12s- 2m46s in travel time compared with the 2021 without project scenario.

The south side of George Street experiences a decrease in travel time of 23s in Scenario A, and an increase in travel time of 27s in Scenario B.

Table 7.12 shows the intersection performance for pedestrian in the PM peak period at George Street Station for each scenario.

Table 7.12 PM peak hour pedestrian intersection performance

Intersection/ scenario	Demand	Max No. peds / queuing space	Max queue density m^2/ped	Queue LoS	Max crossing density m^2/ped	Crossing LoS
Elizabeth Street/ George Street						
2014 base year	2282	28	0.47	D	1.3	D
2021 without project	2363	14	0.32	D	1.6	C
2021 with project no upgrades*	5160	-	<0.19	F	<0.46	F
2021 with project Scenario A	7642	32	0.42	D	1.0	D
2021 with project Scenario B	7642	36	0.40	D	1.3	D
Charlotte Street/ George Street						
2014 base year	2372	12	0.33	D	1.3	D
2021 without project	2456	16	0.51	D	1.6	C
2021 with project no upgrades*	6323	-	<0.19	F	<0.46	F
2021 with project Scenario A	4516	45	0.55	D	0.87	E
2021 with project Scenario B	4516	32	0.64	D	0.88	E
Mary Street / George Street						
2014 base year	1034	15	0.41	D	1.2	D

Intersection/ scenario	Demand	Max No. peds / queuing space	Max queue density m^2/ped	Queue LoS	Max crossing density m^2/ped	Crossing LoS
2021 without project	1070	13	0.34	D	1.2	D
2021 with project no upgrades*	6421	-	<0.19	F	<0.46	F
2021 with project Scenario A	2509	41	0.47	D	0.77	E
2021 with project Scenario B	2509	61	0.56	D	0.67	E
Margaret Street/ George Street						
2014 base year	1612	13	0.35	D	1.9	C
2021 without project	1669	10	0.35	D	1.9	C
2021 with project no upgrades	6021	-	<0.19	F	<0.46	F
2021 with project Scenario A	5467	43	0.36	D	1.1	D
2021 with project Scenario B	5488	61	0.66	C	1.5	C
Alice Street/ George Street						
2014 base year	1591	10	0.21	E	3.2	B
2021 without project	1648	10	0.30	D	2.1	C
2021 with project no upgrades*	4640	-	<0.19	F	<0.46	F
2021 with project Scenario A	5163	39	0.42	D	1.8	C
2021 with project Scenario B	4112	26	0.30	D	1.0	D

** The simulation model for 2021 with project no upgrades was not able to finish the simulation – therefore a LoS of F or worse should be assumed.*

The 2014 Existing scenario performs between LoS C- E for queuing spaces and signalised crossings, and is generally less congested than the AM peak period. The 2021 without project scenario performs at between LoS C-D, with increases in density compared with the 2014 Existing scenario. The intersection of Alice Street/ George Street had a crossing that performed at LoS E in the 2014 Existing scenario and D in the 2021 without project scenario, despite an increase in growth for the model. This difference is due to the normal variability within the model. At this location the intersection has a comparatively small queuing area, which changes in performance significantly with each additional pedestrian. The 2021 with project no upgrades scenario was not able to complete the simulation, as per the AM peak period.

In the PM peak period, the 2021 'with project' with upgrade scenarios have an increase in opposing pedestrian traffic. As a result, the signalised crossings for two intersection at George Street – Mary Street/ George Street and Charlotte Street/ George Street, the worst LoS is marginally (by 0.06m2) within the LoS E band. This is due to the arrivals profile caused by the adjacent traffic signals. This LoS E only occurs in 28 per cent (Option A) and 22 per cent (Option B) of the time. The remainder of the time, the signalised crossings perform at an average of LoS C.

George Street is a city-centre environment, where pedestrians would accept a LoS E for a limited period of time, so this level of impact is considered acceptable.

The intersection performance is comparable to existing performance, with marginally higher densities reported at the Charlotte and Mary Street intersection signalised crossings. **Table 7-13** shows the performance of the northern and southern walkways from Elizabeth Street to Alice Street for George Street Station model for the PM peak period, and for all scenarios. The locations with the largest demand and highest density were selected.

Table 7-13 PM peak hour walkway performance

Walkway/ Scenario	Northern walkway			Southern walkway		
	Demand	Avg. density m^2/ ped	Avg. LoS	Demand	Avg. density m^2/ ped	Avg. LoS
Elizabeth Street – Charlotte Street						
2014 base year	1334	3.58	A	786	5.00	A
2021 without project	1381	3.55	A	814	5.00	A
2021 with project no upgrades*	4909	<0.46	F	1301	5.00	A
2021 with project Scenario A	2528	1.65	C	4340	3.29	A
2021 with project Scenario B	2528	1.53	C	4340	3.39	A
Charlotte Street – Mary Street						
2014 base year	1108	5.00	A	580	5.00	A
2021 without project	1147	5.00	A	601	5.00	A
2021 with project no upgrades*	5917	<0.46	F	941	5.00	A
2021 with project Scenario A	3345	1.90	C	4266	2.92	B
2021 with project Scenario B	3345	2.22	C	4266	1.74	C
Mary Street – Margaret Street						
2014 base year	1382	5.00	A	336	5.00	A
2021 without project	1431	5.00	A	348	5.00	A
2021 with project no upgrades*	7529	<0.46	F	710	5.00	A
2021 with project Scenario A	4718	0.86	E	2930	3.33	A
2021 with project Scenario B	4723	1.00	D	2925	2.80	B
Margaret Street – Alice Street						
2014 base year	1173	4.98	A	377	5.00	A
2021 without project	1215	5.00	A	390	5.00	A
2021 with project no upgrades*	3687	<0.46	F	541	5.00	A
2021 with project Scenario A	3112	3.03	B	1280	3.36	A
2021 with project Scenario B	2990	3.10	B	1268	5.00	A

** The simulation model for 2021 with project no upgrades was not able to finish the simulation – therefore a LoS of F or worse should be assumed.*

The 2014 base year scenario performs at LoS A, with the northern walkway being more congested than the southern walkway. The 2021 without project performs within the same LoS bands as the 2014 existing scenario.

The walkway performance in the PM peak 2021 with project with upgrade scenario is comparable to the existing AM peak performance as a result of the upgrade works.

Table 7-14 shows the travel times in the George Street corridor in the peak direction for the PM peak period, for all scenarios.

Table 7-14 PM Peak Hour Travel Times

Scenario	North side westbound	South side westbound
2014 existing	0:13:05	0:10:17
2021 without project	0:12:17	0:10:24
2021 with project no upgrades*	-	-
2021 with project Scenario A	0:12:10	0:10:25
2021 with project Scenario B	0:11:00	0:10:35

** The simulation model for 2021 with project no upgrades was not able to finish the simulation.*

The proposed upgrade works reduce the intersection delays for pedestrians for the northern side, resulting in a decrease of between 7s-1m17s. The travel time for the southern side experiences an increase in travel time by 1s- 11s compared with the 2021 without project scenario.

The upgrade works proposed at George Street Station achieve a similar level of congestion to what is experienced today, and what would be expected at a major multi-modal interchange. An increase in congestion is experienced on the southern side of George Street and in the PM peak when compared with the 2021 without project, but perform similarly to the George Street northern side and the AM peak, respectively.

The impact of Scenario A on traffic causes additional delays at Alice Street/ George Street, which already performs poorly during PM peak periods. The additional delays on a major arterial road exiting the Brisbane CBD is not considered acceptable, so Scenario B is the preferred suite of infrastructure upgrades to cater for the Project.

7.4.5 George Street Station – impact on the road network and traffic performance

The George Street Station precinct road network will necessitate a number of proposed changes to accommodate the anticipated growth in pedestrian demand and background traffic within the Brisbane CBD. As part of the future pedestrian operational assessment undertaken, the joint venture identified a need to improve the pedestrian connectivity within the George Street precinct.

Following the traffic analysis of two preliminary options (dated 5/06/2014), an Option B scenario was identified by the pedestrian modelling work stream.

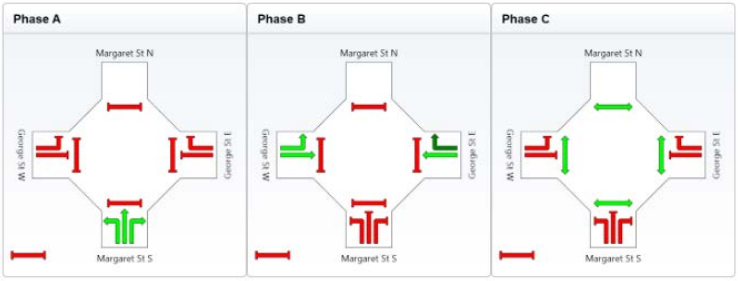
The key elements of the preferred pedestrian Option B layout include:

Option B

- introduce a scramble crossing at George Street/ Margaret Street intersection which operates under a three phase arrangement to improve pedestrian safety and remove conflict with traffic, as shown in **Figure 7-21**

- reduction in the northbound lane capacity (two lanes reduced to one) on George Street between Alice Street and Margaret Street
- reduction in lane capacity on north-eastern approach of Mary Street (two lanes reduced to one).

Figure 7-21 Margaret Street/ George Street three-phase operation

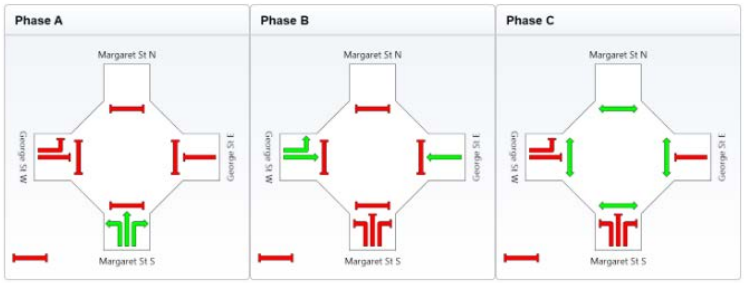


In addition to the traffic assessment of Option B as detailed above, a sensitivity test was undertaken to determine the potential improvements to intersection performance with the removal of the right turn from George Street into Margaret Street. With George Street northbound between Alice Street and Margaret Street reduced to a single lane, there is potential for right turning vehicles to block the southern approach. The alternative movement for right turning vehicles would be via William Street.

Option C – No right turn (sensitivity test)

- Ban right turns from George Street to Margaret Street, in addition to the Option B changes, as shown in **Figure 7-22**.

Figure 7-22 Margaret Street/ George Street three-phase operation



Network model

The LinSig local area network model was used to assess the impact of end state operational changes to the George Street Station precinct.

The network has been tested for 3 scenarios as listed below:

- 2021 AM and PM do nothing
- 2021 AM and PM Option B
- 2021 AM and PM Option C (no right turn).

Intersections assessed

The following intersections have been assessed in determining the network operations and performance of the George Street Station precinct:

- Alice Street/ William Street (TCS 1510);
- Alice Street/ George Street (TCS 47);
- Margaret Street/ George Street (TCS 48);
- Mary Street/ George Street (TCS 352);
- Charlotte Street /George Street (TCS 50);
- Elizabeth Street/ George Street (TCS 21);
- Margaret Street/ William Street (TCS 1509);
- Elizabeth Street/ William Street (TCS 1508).

Model assumptions and inputs

In developing this model, the following assumptions and inputs have been made:

- the existing AM and PM peak hour traffic flows are based on SCATS detector counts
- the signal phasings, saturation flows and intersection configurations are based on the provided SCATS data and TCS plots
- the future scenario models (2021 end state operational) model flows have been estimated using average growth rates from the strategic model for the Project for the without project scenario run (released to EIS team in April 2014). The growth rate applied per year is 1.016 for AM peak and 1.022 for PM peak; (Note: With project scenario growth forecasts were not available at the time of the analysis)
- the future scenarios retain the existing cycle times to allow for wider network coordination, unless otherwise noted
- average phase proportions remain comparable to existing to maintain coordination; however the options include a degree of optimisation to account for the increased delay to traffic movements due to forecast increase in pedestrian demand.

Results

The intersection performance results comparing the existing and future year option scenarios for the AM and PM peak periods are shown in **Table 7-15** and **Table 7-16** respectively.

Table 7-15 AM Peak Hour Intersection Performance

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
Alice Street / William Street (TCS 1510)						
2014 existing traffic	1723	16.9	B	0.580	41.9	William St North-West
2021 do nothing	1846	17.1	B	0.618	45.6	William St North-West
2021 operation (option b)	1846	16.6	B	0.618	45.6	William St North-West
2021 operation (option c)	1846	16.6	B	0.618	45.6	William St North-West
Alice Street / George Street (TCS 47)						
2014 existing traffic	1366	33.3	C	0.794	41.9	Alice Street North-East
*2021 do nothing	1464	34.9	C	0.675	46.3	Alice Street North-East
*2021 operation (option b)	1464	38.6	C	0.844	51.9	Alice Street North-East
*2021 operation (option c)	1454	38.1	C	0.828	51.9	Alice Street North-East

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
Margaret Street / George Street (TCS 48)						
2014 existing traffic	2312	10.6	A	0.608	43.1	Margaret Street South-West
*2021 do nothing	2476	11.0	A	0.652	41.9	Margaret Street South-West
*2021 operation (option b)	2476	41.7	C	0.909	108.1	Margaret St South-West
*2021 operation (option c)	2466	35.3	C	0.863	102.5	Margaret St South-West
Mary Street / George Street (TCS 352)						
2014 existing traffic	900	46.5	D	0.938	42.5	Mary Street North-East
*2021 do nothing	965	38.5	C	0.853	71.3	George Street South-East
*2021 operation (option b)	965	41.7	C	0.874	53.1	Mary Street North-East
*2021 operation (option c)	965	41.2	C	0.874	53.1	Mary Street North-East
Charlotte Street /George Street (TCS 50)						
2014 existing traffic	843	39.2	C	0.789	47.5	George Street South-East
*2021 do nothing	903	29.7	C	0.681	44.4	George Street South-East
*2021 operation (option b)	903	30.9	C	0.690	44.4	George Street South-East
*2021 operation (option c)	903	32.5	C	0.680	45.0	George Street South-East
Elizabeth Street / George Street (TCS 21)						
2014 existing traffic	2366	40.8	C	0.966	84.4	George Street South-East
*2021 do nothing	2531	22.4	B	0.780	96.3	George Street South-East
*2021 operation (option b)	2531	23.3	B	0.726	84.4	Elizabeth Street South-West
*2021 operation (option c)	2531	23.3	B	0.726	82.5	Elizabeth Street South-West
Margaret Street / William Street (TCS 1509)						
2014 existing traffic	2664	28.4	B	0.810	83.1	Margaret Street South-West
*2021 do nothing	2852	31.1	C	0.866	100.0	Margaret Street South-West
*2021 operation (option b)	2852	31.5	C	0.866	100.0	Margaret Street South-West
*2021 operation (option c)	2852	31.5	C	0.866	100.0	Margaret Street South-West
Elizabeth Street / William Street (TCS 1508)						

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
2014 existing traffic	2359	37.7	C	0.818	83.1	Elizabeth Street South-West
2021 do nothing	2524	42.5	C	0.982	100.6	Elizabeth Street South-West
2021 operation (option b)	2524	44.1	D	0.982	109.4	Elizabeth Street South-West
2021 operation (option c)	2524	44.1	D	0.982	110.0	Elizabeth Street South-West

** Denotes adjustment to existing phase times to accommodate the future demand and/or geometry.*

The 2021 AM do nothing intersection performance results provide a base line for the performance comparison of option b and option C.

The proposed scramble pedestrian phase and geometric changes at the George Street and Margaret Street intersection, and the proposed geometric changes at Mary Street adjacent the station access are the most significant alterations to the existing network operation.

The changes to the signal phasing (scramble pedestrian phase) and reduction in lane capacity (reduced from two lanes to one lane) on George Street south-east approach were common to both 2021 operational options assessed. The proposed scramble crossing phase at the Margaret Street and George Street intersection provides protection to pedestrians by removing the conflict with traffic. The AM peak analysis of both operational options identified a deterioration in performance from LoS A to LoS C when compared to the do nothing scenario. The average intersection delays for option B (41.7 seconds) and option C (35.3 seconds) remain within typically acceptable levels of service. option C includes the removal of the right turns from George Street into Margaret Street to eliminate the potential for turning vehicles to block the approach. The removal of the right turn improved the intersection performance by allowing additional green time to be allocated to the major Margaret Street movement.

The proposed signal phasing and geometric changes to the Mary Street and George Street intersection are common to both the 2021 operational options assessed. The results suggest, with a reallocation of green time, the overall intersection performance remains at an acceptable level during the AM peak.

Table 7-16 PM peak hour intersection performance

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
Alice Street/ William Street (TCS 1510)						
2014 existing traffic	3160	33.9	C	0.969	120.0	William Street North-West
2021 do nothing	3684	54.8	D	0.986	188.1	Alice Street North-East
*2021 operation (option b)	3684	51.2	D	0.986	145.6	William Street North-West

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
*2021 operation (option c)	3684	51.8	D	0.986	145.6	William Street North-West
Alice Street/ George Street (TCS 47)						
2014 existing traffic	2576	64.5	E	0.976	106.9	Alice Street North-East
2021 do nothing	3005	208.6	F	1.197	358.1	Alice Street North-East
*2021 operation (option b)	3005	199.4	F	1.082	299.4	Alice Street North-East
*2021 operation (option c)	2995	192.9	F	1.079	290.0	Alice Street North-East
Margaret Street/ George Street (TCS 48)						
2014 existing traffic	1562	15.0	B	0.573	38.1	Margaret Street South-West
*2021 do nothing	1822	13.4	A	0.636	48.1	Margaret Street South-West
*2021 operation (option b)	1822	37.3	C	0.880	68.1	Margaret Street South-West
*2021 operation (option c)	1812	32.0	C	0.848	63.8	Margaret Street South-West
Mary Street/ George Street (TCS 352)						
2014 existing traffic	1080	38.6	C	0.894	51.9	Mary Street North-East
*2021 do nothing	1259	34.7	C	0.809	59.4	George Street South-East
*2021 operation (option b)	1259	49.9	D	0.991	123.1	Mary Street North-East
*2021 operation (option c)	1259	50.0	D	0.991	123.1	Mary Street North-East
Charlotte Street/George Street (TCS 50)						
2014 existing traffic	1092	48.9	D	0.944	85.0	Charlotte Street North-East
2021 do nothing	1273	54.5	D	0.936	91.9	Charlotte Street North-East
2021 operation (option b)	1273	53.5	D	0.936	91.9	Charlotte Street North-East
2021 operation (option c)	1273	53.0	D	0.936	91.9	Charlotte Street North-East
Elizabeth Street/ George Street (TCS 21)						
2014 existing traffic	1520	19.1	B	0.532	40.0	Elizabeth Street South-West
2021 do nothing	1771	19.1	B	0.623	37.5	Elizabeth Street South-

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
						West
2021 operation (option b)	1771	20.0	B	0.642	37.5	Elizabeth Street South-West
2021 operation (option c)	1771	20.6	B	0.626	37.5	Elizabeth Street South-West
Margaret Street/ William Street (TCS 1509)						
2014 existing traffic	2020	27.2	B	0.720	55.6	Margaret Street South-West
2021 do nothing	2354	32.2	C	0.838	74.4	William Street South-West
2021 operation (option b)	2354	32.3	C	0.838	74.4	William Street South-West
2021 operation (option c)	2354	32.3	C	0.838	74.4	William Street South-West
Elizabeth Street/ William Street (TCS 1508)						
2014 existing traffic	1540	26.6	B	0.565	50.6	William Street South-West
2021 do nothing	1792	30.2	C	0.663	68.1	William Street South-West
2021 operation (option b)	1792	30.7	C	0.663	68.1	William Street South-West
2021 operation (option c)	1792	30.7	C	0.663	68.1	William Street South-West

** Denotes adjustment to existing phase times to accommodate the revised demand and/or geometry.*

The 2021 PM do nothing intersection performance results provide a base line for the performance comparison of option B and option C.

The PM peak analysis of both operational options identified a significant deterioration in performance from LoS A to LoS C when compared to the do nothing scenario. The average intersection delays for option B (37.3 seconds) and option C (32 seconds) remain within typically acceptable levels of service. option C includes the removal of the right turn from George Street into Margaret Street to eliminate the chance of turning vehicles blocking the approach. The removal of the right turn improved the intersection performance by allowing additional green time to be allocated to the major Margaret Street movement.

The proposed signal phasing and geometric changes to the Mary Street/ George Street intersection are common to both the 2021 operational options assessed. The results suggest the single lane approach on the Mary Street leads to a significant increase in queuing and intersection delay under the forecast demand. The Mary Street approach operates with the east-west pedestrian crossings of George Street, which results in delays to all left and right turning vehicles. The analysis estimates degree of saturation at approximately 0.99 for all options, which is greater than the practical capacity

of 0.9. With the expected capacity issues, this intersection will be susceptible to significant levels of increased delay and queuing.

Summary and recommendations

In option B, the introduction of scramble pedestrian crossing at Margaret Street/ George Street would result in increased delays and queues on George Street and Margaret Street. The modelling results indicates the level of delay and queuing observed under the option B, is more than double when compared to the do nothing scenario results.

The intersection analysis of the option C indicates an improved intersection performance with the removal of the right turn movements from George Street to Margaret Street. The results demonstrate a reduction in delay and queuing, compared to option B. However, the major benefit is eliminating the risk of right turning vehicles blocking the entire single lane approach. The removal of the right turn would necessitate vehicles using William Street to access Margaret Street.

The removal of the scramble crossing at the George Street/ Mary Street intersection has introduced a pedestrian and traffic conflict on all approaches. However, it allows for additional pedestrian green time for the anticipated dominant north south pedestrian movement along George Street, particularly during the PM peak. The impact to traffic is associated with the following:

- reconfiguration of the signal phasing to provide a dedicated right turn phase from George Street into Mary Street
- reduction of the Mary Street approach to a single traffic lane which caters for both left and right turning vehicles.

The George Street/ Mary Street results suggest the levels of delay and queuing observed with the geometric changes and forecast increase in pedestrian activity leads to a significant level of delay to the forecast traffic demand. Potential mitigation would be to retain the existing two dedicated turning lanes on the Mary Street approach.

Conclusion

Following detailed review of the results, the preferred option C was modified at the George Street/ Mary Street intersection to maintain the existing two dedicated turning lanes from Mary Street. The results for the Mary Street/ George Street intersection are shown in **Table 7-17**.

Table 7-17 AM and PM peak hour intersection performance – Mary Street/ George Street

Intersection/ scenario	Vehicles	Average delay (sec)	LoS	DoS	Mean max queue (m)	Queue occurs on approach
Mary Street/ George Street (TCS 352)						
2014 existing traffic	900	46.5	D	0.938	42.5	Mary Street North-East
*2021 do nothing	965	38.5	C	0.853	71.3	George Street South-East
*2021 option c (preferred)	965	40.0	C	0.845	38.8	George Street South-East
Mary Street/ George Street (TCS 352)						
2014 existing traffic	1080	38.6	C	0.894	51.9	Mary Street North-East
*2021 do nothing	1259	34.7	C	0.809	59.4	George Street South-East
*2021 option c (preferred)	1259	25.1	B	0.809	53.8	George Street North-West

Summary of traffic outcomes

The recommended environmental design requirements would introduce amendments to traffic operations on George Street and the adjacent streets. Amendments would include reduction in lane capacity, amendments to some turning movements and alterations to traffic signal timings.

This assessment does not include any other road network changes that may be developed as part of proposals for the Queen's Wharf Brisbane development and further pedestrianisation of Albert Street.

The key changes to the road layout and traffic signal operation of the recommended pedestrian layout include:

- removal of a scramble crossing at the intersection of George Street and Margaret Street that would operate under a three phase arrangement to improve pedestrian safety and remove conflicts with traffic
- reduction in the northbound lane (towards Roma Street) capacity (two lanes reduced to one) on George Street between Alice Street and Margaret Street. As only one lane would be available at the stop, the right turn from George Street to Margaret Street would be banned. Alternative routes via William Street are available
- removal of a CityCycle facility on Mary Street at the intersection with George Street so that separate left and right turning lanes can be provided from Mary Street to George Street despite the increase in footpath width on Mary Street at the station entrance
- no change to the layout or operation of the Alice Street/ George Street intersection.

The performance of this amended traffic network and operation has been assessed in a LinSig local area traffic network model. The network has been tested for 3 scenarios as listed below:

- 2014 morning and evening peaks
- 2021 morning and evening peaks without the Project pedestrian mitigation measures
- 2021 morning and evening peaks with the Project pedestrian mitigation measures

The following intersections have been assessed in determining the network operations and performance of the George Street Station precinct:

- Alice Street/ William Street
- Alice Street/ George Street
- Margaret Street/ George Street
- Mary Street/ George Street
- Charlotte Street/George Street
- Elizabeth Street/ George Street
- Margaret Street/ William Street
- Elizabeth Street/ William Street

The addition of the George Street Station is forecast to generate an insignificant number of kiss 'n' ride activity and no park 'n' ride demand is expected. There is assumed to be no additional vehicular trips due to the Project.

The summary outcomes of the traffic assessment are illustrated in **Table 7-18**.

Table 7-18 Traffic performance due to pedestrian mitigation measures on George Street

Intersection	Peak hour	2014		2021			
		Existing		Without the Project		With the Project	
		DoS	LoS	DoS	LoS	DoS	LoS
Alice Street/ William Street	AM	0.58	B	0.62	B	0.62	B
	PM	0.97	C	0.99	D	0.99	D
Alice Street/ George Street	AM	0.79	C	0.67	C	0.83	C
	PM	0.98	E	1.20	F	1.08	F
Margaret Street/ George Street	AM	0.61	A	0.65	A	0.86	C
	PM	0.57	B	0.64	A	0.85	C
Mary Street/ George Street	AM	0.94	D	0.85	C	0.87	C
	PM	0.89	C	0.81	C	0.99	D
Charlotte Street/ George Street	AM	0.79	C	0.68	C	0.68	C
	PM	0.94	D	0.94	D	0.94	D
Elizabeth Street/ George Street	AM	0.97	C	0.78	B	0.75	B
	PM	0.53	B	0.62	B	0.63	B
Margaret Street/ William Street	AM	0.81	B	0.87	C	0.87	C
	PM	0.72	B	0.84	C	0.84	C
Elizabeth Street/ William Street	AM	0.82	C	0.98	C	0.98	D
	PM	0.56	B	0.66	C	0.66	C

Source: LinSig Model

The introduction of a scramble pedestrian crossing at the intersection of Margaret Street and George Street would result in increased traffic delays and queues on George Street and Margaret Street. The

modelling results indicates the level of delay and queuing observed would be more than double when compared to without the Project. However, in both the 2021 morning and evening peak periods a LoS C and degree of saturation of less than 0.9[17] is forecast. Consequently, the operational performance of this intersection would be appropriate.

The removal of the right turn from George Street to Margaret Street would provide the major benefit of eliminating the risk of right turning vehicles blocking the entire single lane approach. This would necessitate less than 20 vehicles an hour using William Street to access Margaret Street as an alternative route.

The removal of the scramble crossing at the intersection of George Street and Mary Street would allow for additional pedestrian 'green time' for the anticipated dominant north to south pedestrian movement along George Street, particularly during the evening peak period. The impact to traffic would be associated with:

- the reconfiguration of the signal phasing to provide a dedicated right turn phase from George Street into Mary Street
- maintaining separate traffic lanes for left and right turning moves from Mary Street to George Street to provide satisfactory operating performance.

The intersection of George Street and Alice Street has been modelled to currently operate with a LoS E and DoS of almost 1.00 in the evening peak period. Without the Project in 2021, growth in traffic results in a deterioration of the performance of this intersection to a LoS of F and a DoS of 1.20. Due to this level of congestion, the Project has not proposed any amendments to the layout or operation of this intersection to provide improved crossing conditions for pedestrians. The performance of this intersection with the Project would remain similar to that without the Project in 2021.

Other proposed developments such as the Queen's Wharf Brisbane precinct and proposed changes to Albert Street have also not been taken into consideration in this assessment. These developments are likely to have an impact on the layout of the road network and traffic movements and performance. It is recommended that the relevant authorities such as Brisbane City Council, TMR and the Department of State Development, Infrastructure and Planning undertake a detailed traffic assessment that takes into account all significant development in the wider George Street precinct when the relevant information is available.

7.5 Roma Street Station

The Roma Street Station would be located under the existing Roma Street rail and busway station and so provide a major network interchange. The function of Roma Street Station would be:

- provide a network junction between all rail services including busway services including those in the Project. This station would provide interchange opportunities to services to the Airport, western suburbs, Fortitude Valley, north west suburbs and the Gold Coast
- to serve the residential population around the station
- to serve employment land uses (office and services) on the western side of the Brisbane CBD
- provide access to leisure opportunities at Roma Street Parklands, the Caxton Street entertainment precinct and Suncorp Stadium.

[17] Degree of Saturation (DoS): This is the calculated ratio between the demand flow rate and the capacity for each movement. When the maximum DoS value for any movement is above 90% then the intersection is regarded as over saturated or operating above its practical capacity. This means that it will take more than one cycle of the signals to progress through the intersection. DoS values above 1.0 typically indicate that several movements will fall within this category.

Passengers would be able to access the station from both the existing Roma Street entrance and new entrance to Albert Street via Roma Street Parklands. This new entrance would provide a convenient route for passengers with destinations in the CBD area of King George Square and extending onto Albert Street and the Queen Street Mall.

Table 7-19 presents the Roma Street forecast 2 hour morning peak period patronage with and without the Project. This table also illustrates the number of forecast transfers.

The patronage forecasts illustrate that there would be a significant increase in the use of Roma Street Station with the Project. In the 2021 morning peak period, almost 50,000 passengers are forecast to use the station and over 81,000 in 2031.

A significant amount of patronage growth would be associated with transfers between bus and rail modes and surface platforms and Project platforms. Passengers from the west and north would be able to interchange to Project services to access the other Project stations at George Street, Woolloongabba and Dutton Park. In both the 2021 and 2031 morning peak periods transfers would account for around 75 per cent of all passenger activity at Roma Street. This would include transfer to Brisbane Airport services. The station has been designed to cater for these demands.

In the 2021 morning peak period there are forecast to be over 12,000 passengers walking to and from the station compared to 9,500 passengers without the Project.

Table 7-19 Roma Street – two hour AM peak period patronage

	Without the Project				With the Project				Diff of total (with – without)	
	Board	Alight	Transfers (board+ alight)	Total	Board	Alight	Transfers (board+ alight)	Total	Change	% Change
2012										
Surface bus	300	600	4,400	5,300	-	-	-	-	-	-
Surface rail	400	4,500	7,700	12,600	-	-	-	-	-	-
Total	700	5,100	12,100	17,900	-	-	-	-	-	-
2021										
Surface bus	500	900	5,100	6,500	300	400	5,200	5,900	-600	-9%
Surface rail	1,100	7,000	15,000	23,100	800	5,600	19,700	26,100	3,000	13%
BaT Bus	-	-	-	-	800	3,000	9,900	13,700	-	-
BaT Rail	-	-	-	-	100	1,300	2,700	4,100	-	-
Total	1,600	7,900	20,100	29,600	2,000	10,300	37,500	49,800	20,200	68%
2031										
Surface bus	600	1,100	7,100	8,800	400	400	6,900	7,700	-1,100	-13%
Surface rail	2,600	16,600	23,300	42,500	1,500	9,600	34,100	45,200	2,700	6%
BaT Bus	-	-	-	-	1,400	3,600	17,400	22,400	-	-
BaT Rail	-	-	-	-	100	2,000	4,400	6,500	-	-
Total	3,200	17,700	30,400	51,300	3,400	15,600	62,800	81,800	30,500	59%

Source: BaT Project model.

Note: Passenger movement is the total of boarding, alighting and transfers.

An assessment of the passenger demand on the pedestrian infrastructure at both the Roma Street entrance and the Albert Street entrance has been carried out. Characteristics of the additional demand generated by the Roma Street BaT station include:

- in 2021 during the maximum 15 minutes in the morning peak period there are forecast to be around 1,800 passengers exiting and 350 passengers entering from Roma Street.
- around of half these pedestrians cross Roma Street to access Herschel Street and George Street with only around 300 using the existing pedestrian bridge that link George Street to the Station.
- use of the southern footpath (river side) of George Street is significantly greater than the northern footpath.
- in 2021 during the maximum 15 minutes in the morning peak period there are forecast to be around 300 passengers exiting and 100 passengers entering the station from the new Albert Street entrance.

Figure 7-23 and **Figure 7-24** presents the forecast pedestrian volumes at Roma Street with the Station for the morning and evening peak hours. **Figure 7-25** and **Figure 7-26** forecast LoS of the Roma Street pedestrian environment with the Project operational and without any pedestrian infrastructure improvements the morning and evening peak hours. This LoS representation is for the 2021 morning peak period. This figure illustrates that a pedestrian LoS of F would occur at the intersections of:

- Roma Street with Makerston Street
- Herschel Street with George Street

The LoS of the footpaths are within LoS D and are appropriate. The pedestrian demands for the Albert Street entrance are below the design capacity, with no LoS issues. For safety, a pedestrian crossing should be provided across Albert Street close to the station entrance (via the Parklands boardwalk) to safely align them with the existing pedestrian crossing of Turbot Street.

The following environmental design requirements are recommended to cater for the increased pedestrian demands at Roma Street Station in association with the Project:

- Way finding signage to promote use of pedestrian overbridge within the station and on George Street, Tank Street and Herschel Street
- formalisation of the waiting area at Roma Street Station entrance north of the Makerston Street intersection where there are two pedestrian crossings. A pedestrian waiting area of 40m^2 would be required adjacent to the northern side of Roma Street. This waiting area can be achieved without extending the footpath into the road as there are two pedestrian crossings of Roma Street at this intersection. Street furniture should be removed and the footpath widened into the landscaped area in front of the Transit Centre. This pedestrian waiting area of 40m^2 would provide an appropriate LoS at the queuing area.
- countdown timers on:
  - Roma Street/ Makerston Street
  - Herschel Street/ George Street
- paint wider signalised pedestrian crossings at:
  - Roma Street (E), at Makerston Street – 7m crossings space
  - Roma Street (W), at Makerston Street – 7m crossings space
  - George Street (SE), at Herschel Street – 7m crossings space.

Figure 7-27 and **Figure 7-28** shows the forecast LoS for the Roma Street entrance with the mitigation measures applied. This illustrates an appropriate outcome for pedestrians.

Albert Street entrance

Figure 7-29 and **Figure 7-30** present the forecast pedestrian volumes at the Albert Street footpaths associated with the Roma Street Station with the Project for the morning and evening peak hours in 2021.

Figure 7-31 and **Figure 7-32** present the forecast pedestrian LoS at the Albert Street footpaths associated with the Roma Street Station with the Project for the morning and evening peak hours in 2021. No pedestrian mitigation measures were required.

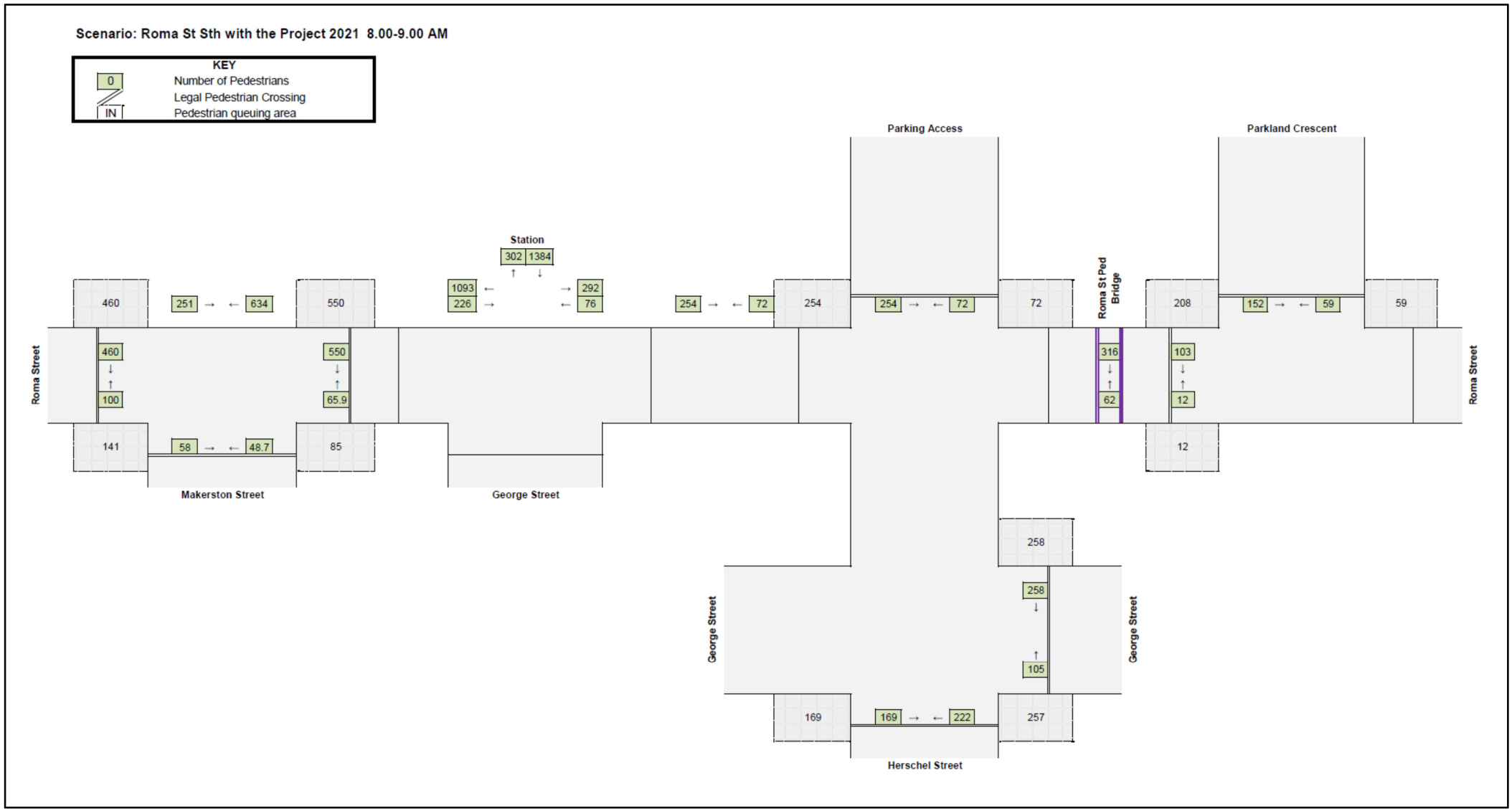


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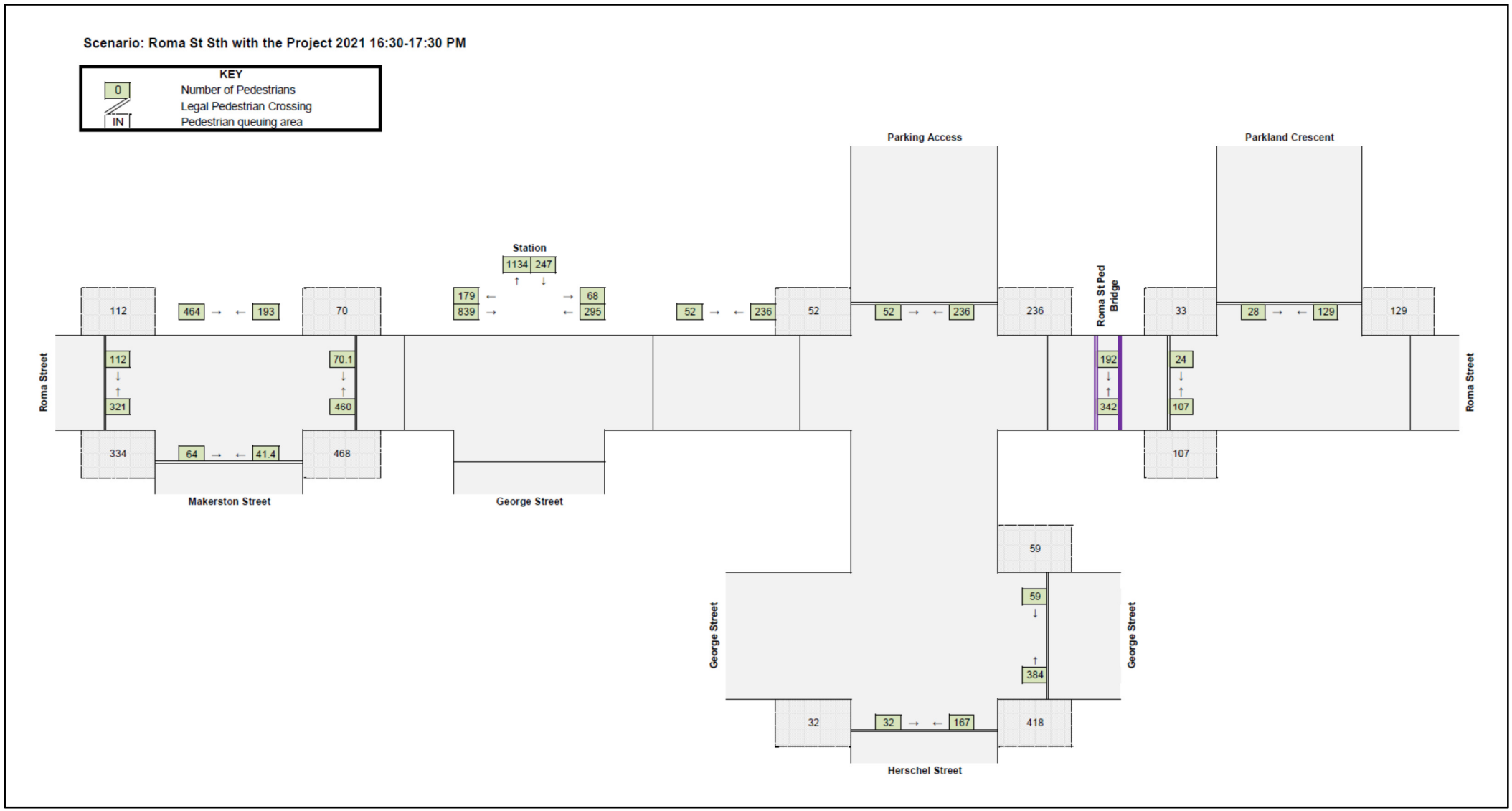
FIGURE 7-23

Roma Street Station with the Project (2021) pedestrian volumes (Roma Street entrance) – AM peak hour



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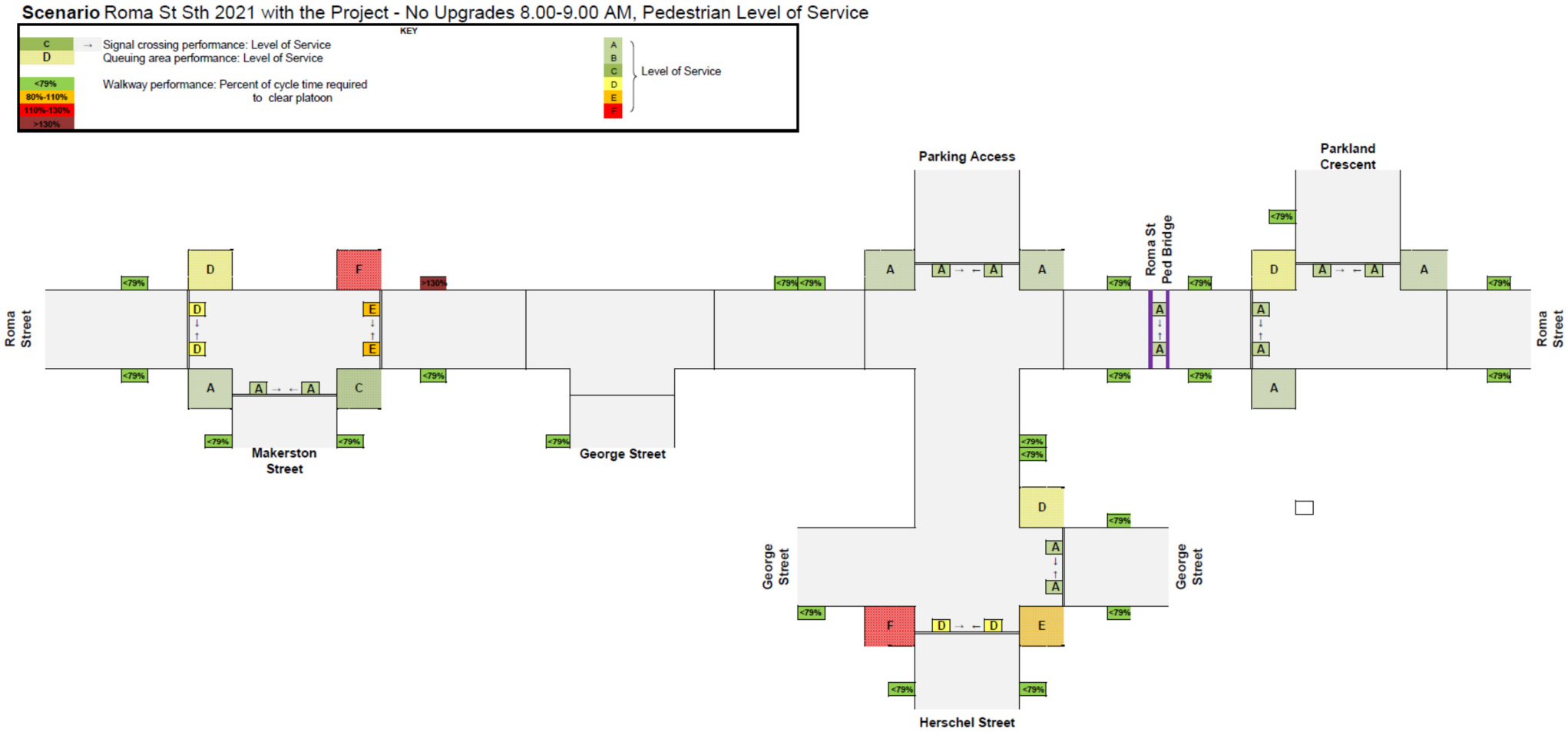
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-24

Roma Street Station with the Project (2021) pedestrian volumes (Roma Street entrance) – PM peak hour



BUS AND TRAIN PROJECT
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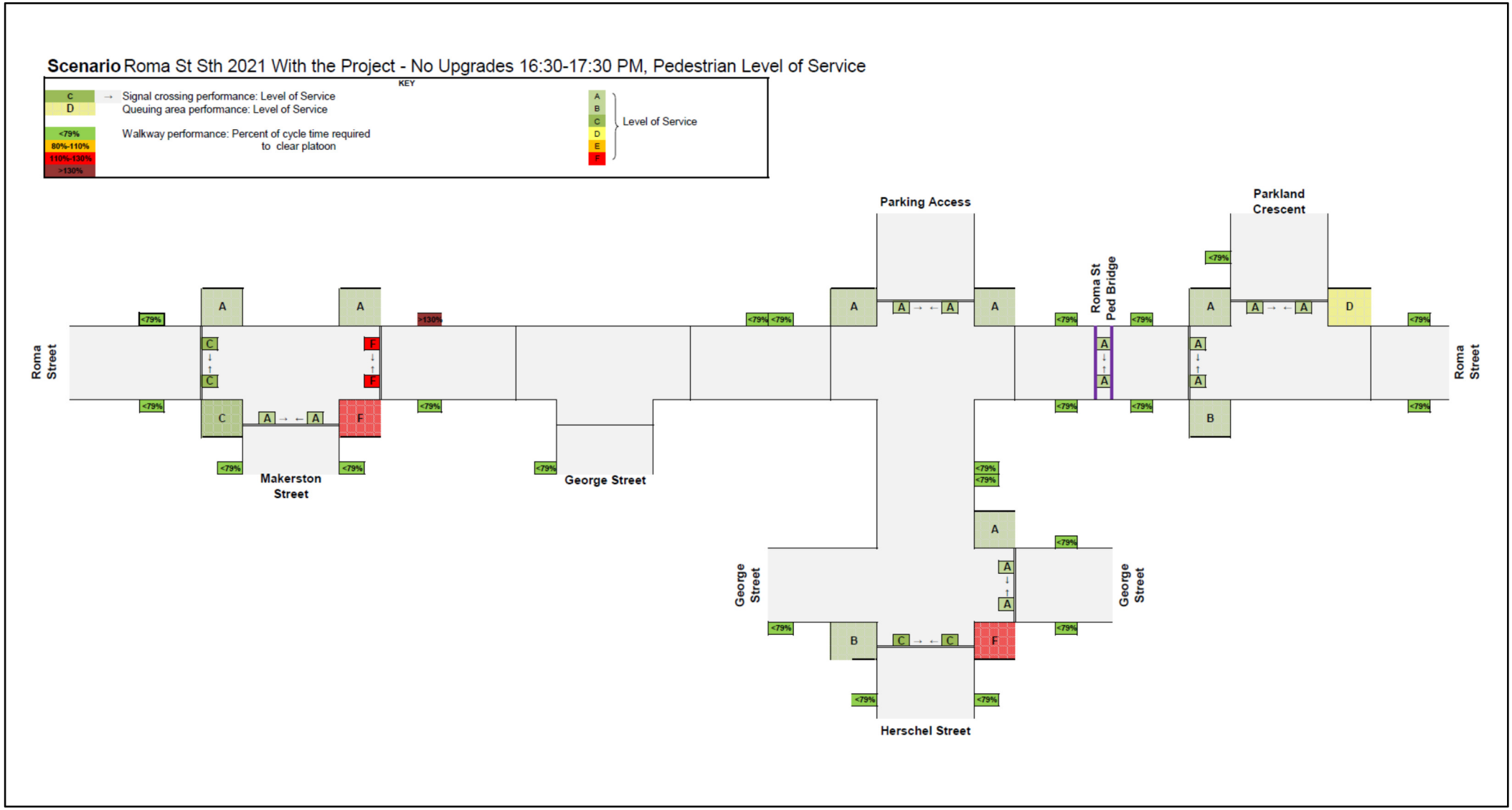
FIGURE 7-25

Roma Street Station with the Project (2021) and no pedestrian measures (Roma Street entrance) – pedestrian level of service during the AM peak hour



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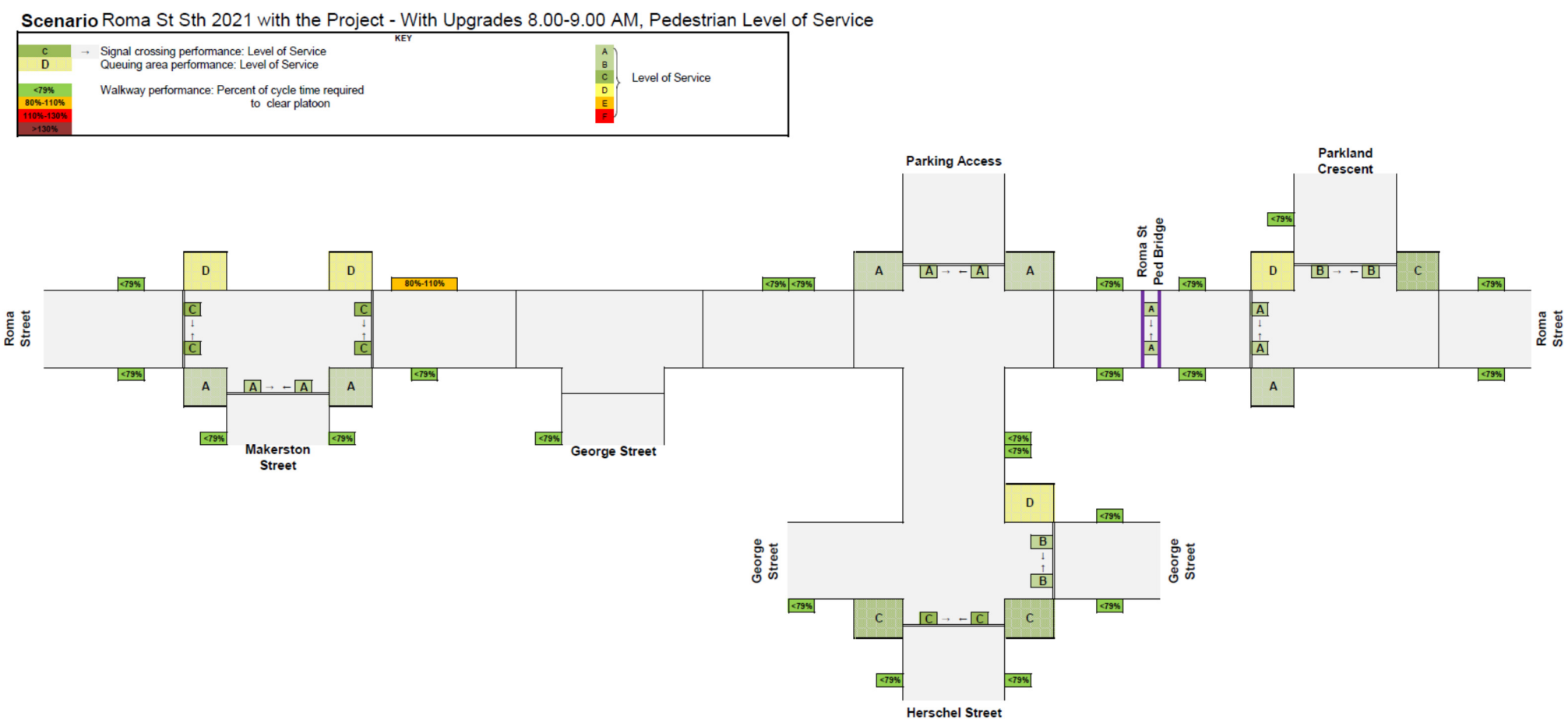
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-26

Roma Street Station with the Project (2021) and no pedestrian measures (Roma Street entrance) – pedestrian level of service during the PM peak hour



BUS AND TRAIN PROJECT
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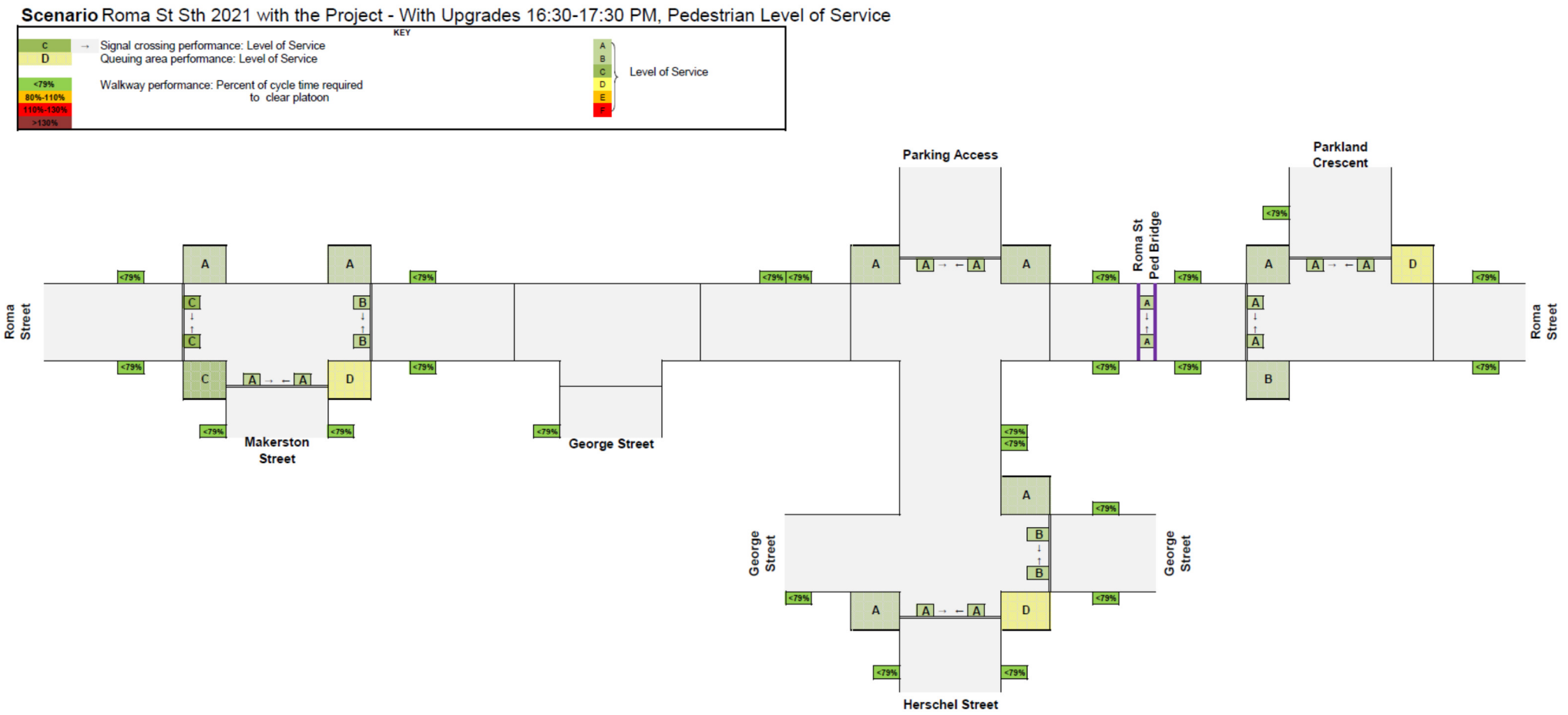
FIGURE 7-27

Roma Street Station with the Project (2021) and with pedestrian measures (Roma Street entrance) – pedestrian level of service during the AM peak hour



BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-28

Roma Street Station with the Project (2021) and with pedestrian measures (Roma Street entrance) – pedestrian level of service during the PM peak hour

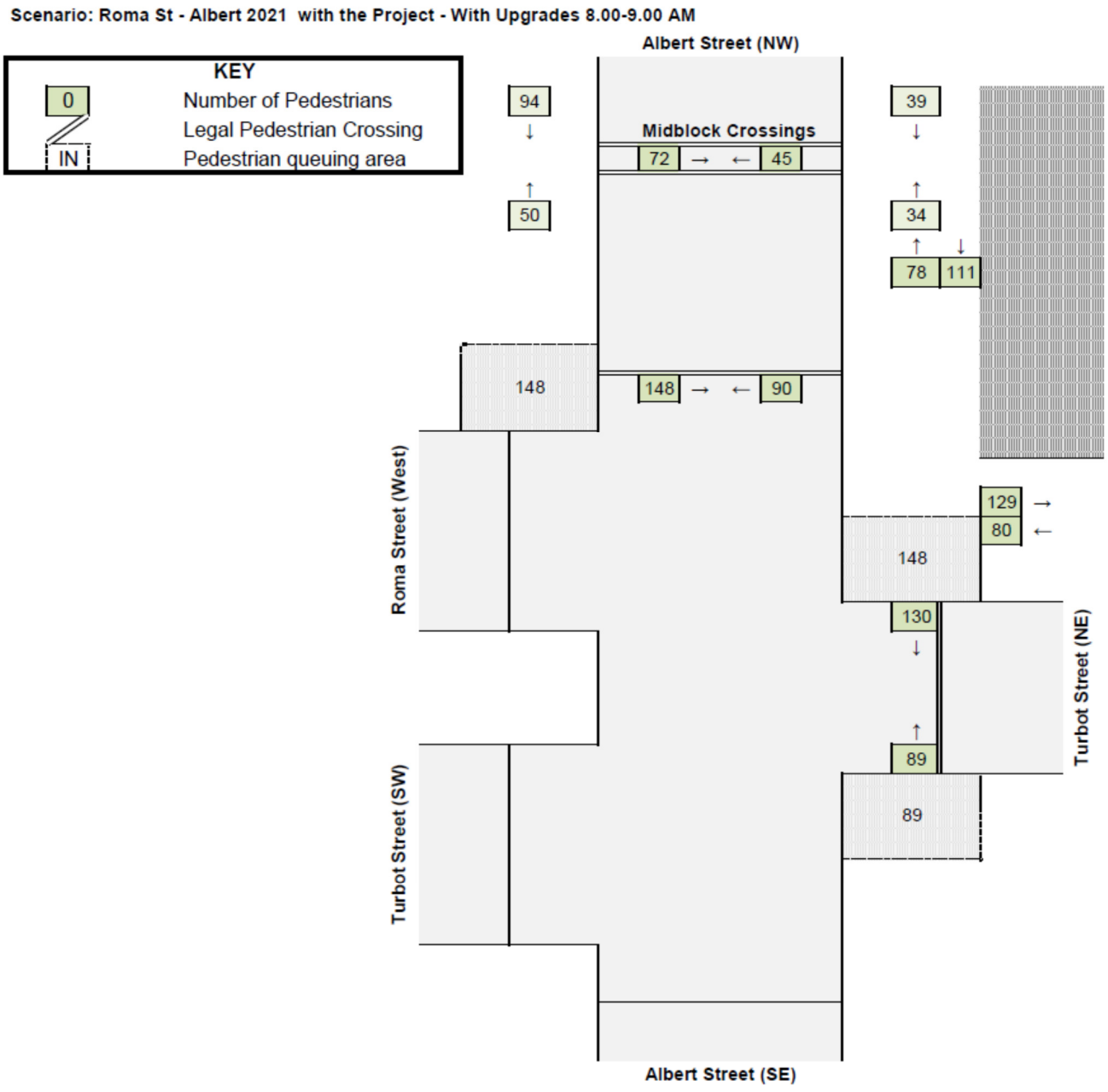


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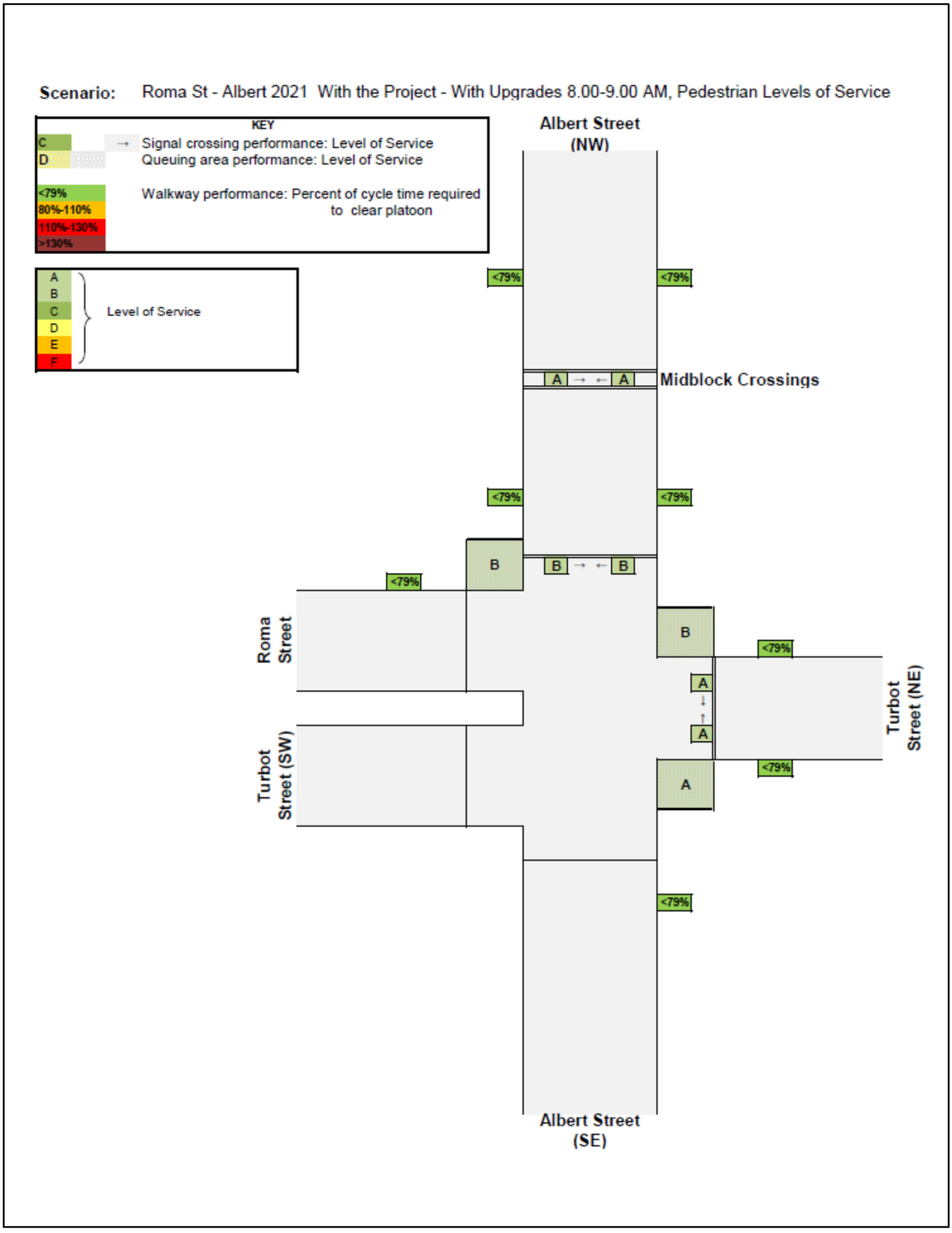
FIGURE 7-29

Roma Street Station with the Project (2021) pedestrian volumes (Albert Street entrance) – AM peak hour

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-30

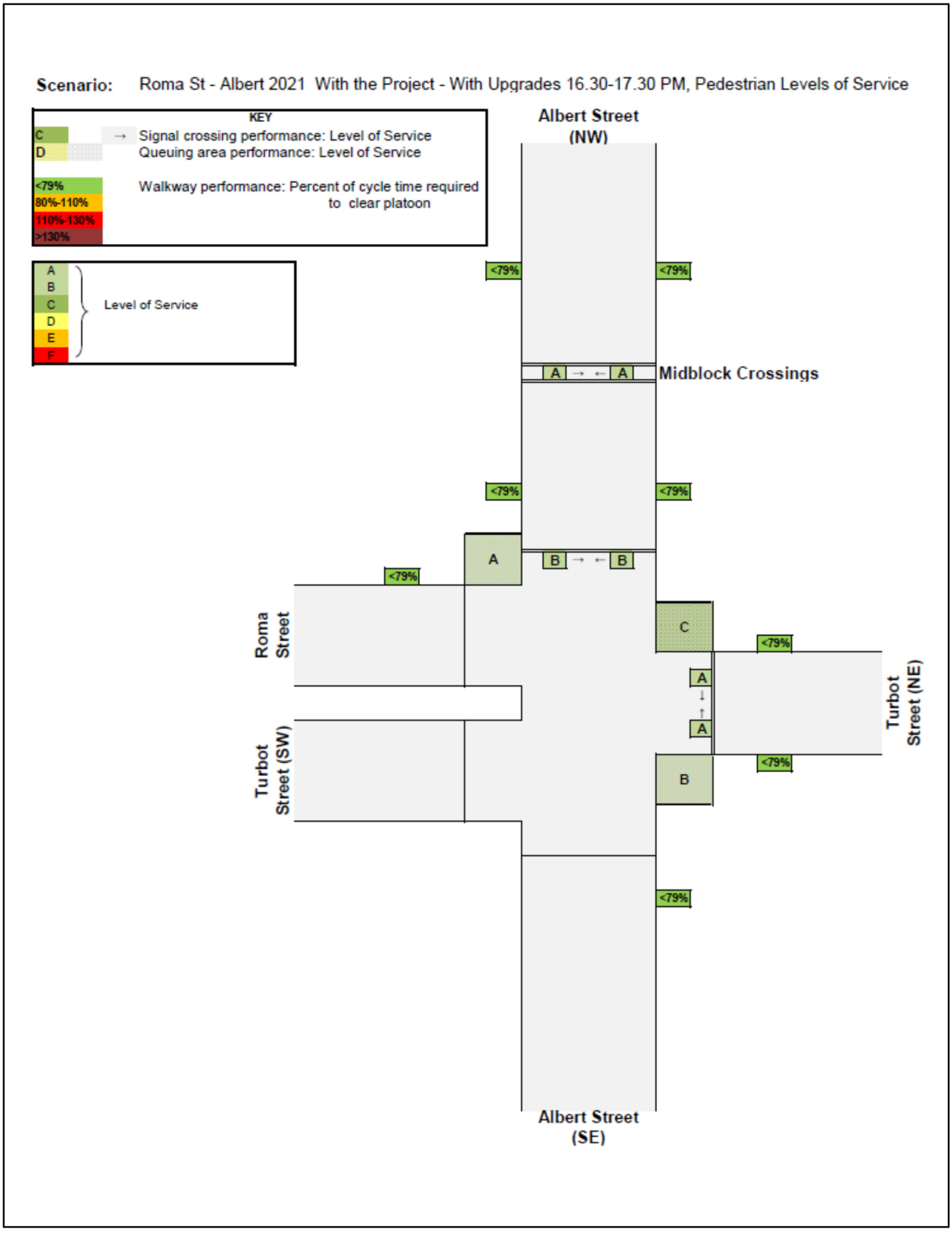
Roma Street Station with the Project (2021) pedestrian volumes (Albert Street entrance) – PM peak hour



BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-31

Roma Street Station with the Project (2021) pedestrian level of service (Albert Street entrance) – AM peak hour



BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-32

Roma Street Station with the Project (2021) pedestrian level of service (Albert Street entrance) – PM peak hour

7.5.1 Roma Street Station – traffic impacts

The environmental design requirements would provide a suitable LoS for pedestrians do not require any amendment to the road network and minimal amendment to traffic signal operation. As amendments to traffic operations would be limited to the minimal amendment of traffic signal operations the performance of traffic operations at Roma Street can be assumed to be similar to the without Project case.

7.6 Herston

The Project bus infrastructure would connect with the INB at Herston adjacent to Gilchrist Avenue. A bus layover is proposed at Gilchrist Avenue as part of the Project works. It would be accessed via an at grade intersection with the INB and provide reliable and quick access for buses exiting the Project busway. An additional bus turnaround is required at Gilchrist Avenue to permit bus access. Refer to **Figure 7-33**.

The proposed layover facility would require the removal of around 110 metered on-street car parks from both sides of Gilchrist Avenue. Approximately 40 car parks would remain in place. The impact of the removal of these car parks would be minimal due to the high number of on-street and off-street car parks, including several multi-deck facilities, provided in the area associated with the Herston hospital precinct.

The movement of buses from the Project busway and the INB infrastructure would be contained within Gilchrist Avenue and the busway infrastructure and would not impact on the wider road network.

TMR proposes to construct The North Brisbane Bikeway that will link Brisbane's CBD to the northern suburbs. A 710m pathway from Victoria Park at Gilchrist Avenue, Herston to O'Connell Terrace, Bowen Hills, via the heritage listed Victoria Park, RNA showgrounds and Bowen Park is planned to be complete by the end of 2015. The Project would require a minor re-alignment of the proposed bikeway adjacent to Gilchrist Avenue. The bikeway would have an at-grade crossing of Gilchrist Avenue to the immediate west of the intersection of Gilchrist Avenue with the INB that would not be impacted by the Project. In summary the Project would not impact on the functionality of the proposed bikeway.

LEGEND

PROPOSED WORKS

BUS AND TRAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 7-33

Gilchrist Avenue proposed BaT layover location