CHAPTER SUMMARY AND RECOMMENDATIONS:

- The solution described in this chapter represents a well-considered suite of new, upgraded and existing assets, as well as network and service changes, policy and operational changes and system improvements.

- Principles have been used to guide the development of the Brisbane Metro solution in its response to the identified problems and the strategic project objectives. These principles revolve around accessibility and connectivity; capacity; journey time and reliability; customer experience; operational efficiency; protecting and shaping the city; and identity and legacy.

- The Brisbane Metro solution is comprised of five key project elements which respond to these seven project principles. The five elements of the solution are:
  - Element 1: Network and service changes
  - Element 2: Policy and operational changes
  - Element 3: Existing, upgraded and new infrastructure
  - Element 4: New vehicle fleet
  - Element 5: New vehicle management and passenger information systems

- **Network and service** changes have been developed in response to identified capacity constraints, network complexity and inefficiencies as well as aspirations for improved connectivity and customer experience (including improved frequency, legibility and quality of service). Brisbane Metro and revised bus network has significant scope for future evolution and expansion over time, to take further advantage of the capacity offered on these routes, and to progressively amend, truncate or redirect other routes as required.

- **Policy and operational** changes have been identified which specifically respond to existing deficiencies in busway operations such as on-board ticketing and single-door boarding which can result in long and uneven dwell times affecting system capacity and limiting growth.

- **Infrastructure** changes including a new underground Cultural Centre station and segregated route from Victoria Bridge to King George Square respond to identified problems such as degrading journey times and worsening reliability. Additional platform lengthening at some other busway stations is also proposed to address changes in vehicle mix (longer vehicles) as well as increased frequencies on the busway.

- New high-quality, high-capacity Metro vehicles are proposed to operate the Metro routes on the busway in line with their proposed premium rapid transit function and providing the required capacity.

- New management and information systems are also proposed to improve the efficiency of operations and maximise the use of the existing (and proposed upgraded) busway system capacity. This will include additional information and busway management systems to inform customers in advance which platform zone their service will arrive at, which as well as improving customer experience will also reduce dwell times and variability at stations.
6.1 Purpose and Overview of this Chapter

The purpose of this chapter is to document the rationale behind the development of the Brisbane Metro solution, including the principles that were used to guide its development. The solution described in this chapter represents a well-considered suite of new, upgraded and existing assets as well as network and service changes, policy changes and system improvements.

This chapter outlines:

- The seven principles underpinning the development for the Brisbane Metro solution.
- The rationale around specific components of the Brisbane Metro solution which is comprised of five key project elements:
  - Element 1: Network and service changes
  - Element 2: Policy and operational changes
  - Element 3: Existing, upgraded and new infrastructure
  - Element 4: New vehicle fleet
  - Element 5: New vehicle management and passenger information systems.

This chapter is supported by a more detailed description of the infrastructure components of the solution, presented in Chapter 9. This chapter is also inherently linked to the customer and product analysis presented in Chapter 7 as well as the city and place analysis presented in Chapter 8 where the outcomes and benefits of the solution will be assessed in detail.

6.2 Methodology and Principles

The development of the Brisbane Metro solution has been underpinned by key project principles. These principles respond to both the identified priority problems (outlined in Chapter 4) which describe the nature of the problems that are addressed by the Brisbane Metro, as well as relevant policies and strategies and project objectives which set the context for how these problems should be resolved. Each of these is described below.

6.2.1 Identified priority problems

Chapter 4 describes the problem definition process. Problems were identified at the strategic level first, then at the whole-of-transport-system level before being distilled into problems specific to the rail network and problems specific to the bus network. This identified six high priority problems that the Brisbane Metro could aim to address, as well as a range of medium to high priority problems which would be of relevance to Brisbane Metro. The relevant high priority strategic, transport system and bus related problems are as follows:

- Strategic – limited accessibility and connectivity.
- Strategic – economic growth and productivity.
- Transport network – inadequate ability to meet future public transport demand without infrastructure intervention and/or service redesign.
- Bus network – capacity constraints limit potential growth of bus services.
- Bus network – degrading journey times and reliability.
- Bus network – worsening amenity in the inner-city.
6.2.2 Policies and strategies

The overarching policies and strategies of both Council and the Queensland Government, that have been identified as relevant to Brisbane Metro include:

- Queensland State Infrastructure Plan (SIP)
- ShapingSEQ (regional land use and growth plan)
- Council’s 10 Point Public Transport Plan (public transport plan for Brisbane).

Further detail on these policies is provided in Chapter 3.

6.2.2.1 State Infrastructure Plan

The SIP sets out the Queensland Government’s infrastructure priorities. The SIP includes a framework to plan and prioritise infrastructure investment and delivery. Of specific relevance to the network planning and operations of Brisbane Metro are the SIP directions and SIP priorities listed in Table 6.1.

<table>
<thead>
<tr>
<th>SIP DIRECTIONS</th>
<th>SIP PRIORITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finding the right solutions: better planning and assessment</td>
<td>Increase capacity and resilience of SEQ’s transport system</td>
</tr>
<tr>
<td>Getting the most from what we have: better use of existing assets</td>
<td>Focus on better preservation (and optimisation) of public assets</td>
</tr>
</tbody>
</table>

*Table 6.1 – State Infrastructure Plan selected directions and priorities*

These directions and priorities set a clear policy expectation for achieving greater capacity and utilisation of existing assets through optimisation and operational improvements wherever possible, prior to investing in new infrastructure solutions.

6.2.2.2 ShapingSEQ

At the regional level, ShapingSEQ (the draft South East Queensland Regional Plan) is the Queensland Government’s plan to guide the future development of the South East Queensland (SEQ) region. It aims to accommodate future growth sustainably and in a way that responds to change positively, and enhances the social, economic and environmental systems that support the region’s liveability.

ShapingSEQ presents a number of goals, elements and strategies. Under the goal of ‘Connect’, the elements and strategies listed in Table 6.2 have been used to assist in the development of the Brisbane Metro principles.

<table>
<thead>
<tr>
<th>SHAPINGSEQ ELEMENT</th>
<th>SHAPINGSEQ STRATEGIES</th>
</tr>
</thead>
</table>
| **Element 1: An efficient movement system** | 1. Maximise the use of existing transport infrastructure to support the desired regional settlement pattern and economic network.  
2. Prioritise improving the capacity of, and delivering high-frequency services for, the region’s public transport system and extending active transport networks. |
| **Element 2: Integrated planning**         | 1. Investigate, plan and deliver a strategic transport system that connects people, places and employment efficiently with high-frequency passenger transport services.  
2. Investigate, plan and deliver transport solutions to enable the growth of areas of regional economic significance by connecting regional activity centres, knowledge and technology precincts, and major enterprise and industrial areas. |
| **Element 4: Prioritised infrastructure investment** | 3. Identify innovative or non-built solutions to service needs to reduce costly infrastructure investments. |
Table 6.2 – Extract of ShapingSEQ Elements and Strategies

6.2.2.3 Council’s 10 Point Public Transport Plan

The 10 Point Public Transport Plan was announced in September 2016 as a proposed new public transport alliance model between Council and TransLink Division within the Department of Transport and Main Roads (TMR), which is responsible for managing the public transport network in SEQ. Table 6.3 sets out the items of the plan which have specifically influenced Brisbane Metro principles and solution.

<table>
<thead>
<tr>
<th>RELEVANT PRINCIPLES FROM COUNCIL’S 10 POINT PUBLIC TRANSPORT PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. A progressive review of the Brisbane bus network, involving staged and systematic localised reviews</td>
</tr>
<tr>
<td>3. Route simplification and re-branding of routes to improve network legibility for passengers</td>
</tr>
<tr>
<td>4. Developing a clear strategy for the use of high-capacity vehicles on the bus network</td>
</tr>
</tbody>
</table>

Table 6.3 – Relevant principles from Council’s 10 Point Public Transport Plan

6.2.3 Brisbane Metro principles

Through the analysis of the policies and strategies discussed in the previous section, along with reflection back to the project objectives, a set of common principles have been developed which respond to the Problems, as outlined in Figure 6.1.
Figure 6.1 – Identified problems and linkages to Brisbane Metro principles

Table 6.4 provides further context on each principle.
<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve accessibility and connectivity</td>
<td>Maximise the ability of customers to be able to access a wide range of destinations in a timely manner.</td>
</tr>
<tr>
<td>Improve effective capacity</td>
<td>Improve the utilisation of existing transport infrastructure by maximising carrying capacity (throughput) at optimal levels of reliability (i.e. more people on vehicles).</td>
</tr>
<tr>
<td>Improve journey times and reliability</td>
<td>Reduce journey times and improve the reliability of journey times, with less variability between peak and off peak and from one day to the next.</td>
</tr>
</tbody>
</table>
| Improve the customer experience | Improve the overall quality of the public transport experience for the customer, including:  
  • Improved legibility – i.e. an integrated public transport network that is simpler to use and understand, including where and when to transfer between services and modes, particularly for occasional users.  
  • Improved frequency and span of hours – High-frequency routes (i.e. a minimum of 4 services per hour) with a long span of hours every day, is the core of the public transport network. Good frequency and span also assist in creating a sense of a reliable network for customers.  
  • Improved quality of the vehicles and stations.                                                                                                                                                                                                                                                |
| More efficient operations       | A more efficient network is one that moves more people on vehicles, recognising the constraints on our inner-city infrastructure including busways, streets, stops and stations.                                                                                                                                                                                             |
| Protect and shape the city      | Supporting Brisbane’s transformation towards a sustainable, diverse, integrated, and productive New World City.                                                                                                                                                                                                                                               |
| Create identity and legacy     | A world class identity is established that is distinct, vibrant, and well defined. A range of activities are supported, local character is celebrated and precincts showcase a high-quality public realm and amenity. Stations contribute to a sense of place.                                                                                                                                                  |

Table 6.4 – Brisbane Metro principles

6.3 Project elements

The Brisbane Metro solution is more than an infrastructure solution. In order for Brisbane Metro to successfully address the identified problems; there are a range of elements that are required to complement and work in conjunction with this infrastructure. Figure 6.2 identifies the various elements that will form the scope of Brisbane Metro.
Table 6.5 summarises the key project elements of the Brisbane Metro solution which will be further described in the following sections of this chapter.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network and Services</td>
<td>Encourages interchange through a reliable, frequent trunk service, provides the catalyst for a revised network, increasing network efficiency and freeing space on the busway for higher occupancy metro vehicles.</td>
</tr>
<tr>
<td>Metro lines</td>
<td>• Metro 1 – Eight Mile Plains busway station to Roma Street busway station</td>
</tr>
<tr>
<td></td>
<td>• Metro 2 – UQ Lakes busway station to RBWH busway station</td>
</tr>
<tr>
<td>Frequency of services (day one of</td>
<td>• Metro 1 – every three minutes (peak periods)</td>
</tr>
<tr>
<td>operations)</td>
<td>• Metro 2 – every three minutes (peak periods)</td>
</tr>
<tr>
<td></td>
<td>• Metro service every 90 seconds between Mater Hill and Roma Street busway stations (peak periods)</td>
</tr>
<tr>
<td>Hours of operation</td>
<td>• Weekday – 20-21 hours</td>
</tr>
<tr>
<td></td>
<td>• Weekend – 24 hours</td>
</tr>
</tbody>
</table>
### Key metro/rail interchanges
- Roma Street (all lines) (Cross River Rail)
- South Brisbane/Cultural Centre (Beenleigh/Gold Coast, Cleveland lines)
- Buranda (Cleveland line)
- Boggo Road (Cross River Rail)

### Key metro/bus interchanges
- RBWH
- Roma Street
- King George Square
- Princess Alexandra Hospital (PAH)
- Griffith University
- Upper Mount Gravatt
- Eight Mile Plains

### Metro depot and layovers
Refuelling of metro vehicles to occur at a proposed depot. Additional layover facilities for metro vehicles to be available at:
- Ernie’s Roundabout (RBWH)
- Countess Street (Roma Street)
- UQ Lakes
- Eight Mile Plains

### Policy and operations
Policy and operational changes reduce vehicle dwell times and, combined with set dwell times at stations, improve busway capacity and reduce travel time variability.

### Ticketing
- Ticketing gates or platform card reads to be installed at metro platforms
- No on-board ticket purchases will be available on metro services

### Boarding
All door alighting and boarding on metro services and bus services at metro busway stations

### Infrastructure
Targeted investment in new infrastructure, along with upgrades to existing infrastructure, will help address critical inner-city bottlenecks and increase the capacity of the busway.

### Route length
21 kilometres of existing busway

### Tunnels/portals
- Cut and cover tunnel along Adelaide Street to connect to King George Square station
- Tunnel from busway near South Brisbane train station to underground Cultural Centre station (passing under the Queensland Rail corridor)
- Portal and transition from underground Cultural Centre station to Victoria Bridge

### Victoria Bridge
- Victoria Bridge becomes a public and active transport only bridge
- Modifications to pedestrian access on upstream side of bridge with a connection to Adelaide Street
- Modification to pedestrian access on the downstream side with an additional 1.2m width providing increased pedestrian capacity and enhanced connection to Reddacliff Place

### North Quay
North Quay closed to general traffic between Adelaide Street and Queen Street, but access to Brisbane Square remains via Adelaide Street.

### New stations
- Underground station at Cultural Centre

### Existing station upgrades
- Roma Street
- King George Square
- Buranda
- Griffith University
- Eight Mile Plains
- Upper Mount Gravatt
- Minor upgrades to several other busway stations
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance depot</td>
<td>New metro-only depot to be constructed. The location of the depot and maintenance facility will be at a location near Eight Mile Plains busway station.</td>
</tr>
<tr>
<td>Vehicles</td>
<td>The vehicle carries more customers per driver and litre of fuel, increasing efficiency. The vehicle also integrates with the 12.5 metre bus maximising station performance in dual operations minimising need for new infrastructure.</td>
</tr>
</tbody>
</table>
| Vehicle type      | Metro vehicle:  
  • 24 metres long, 2.55 metres wide, 3.5 metres high  
  • four double leaf access doors  
  • four axles/12 tyres |
| Power supply      | To be determined                                                                                                                        |
| Capacity          | 150 customers                                                                                                                           |
| Fleet size        | 60 vehicles in 2022                                                                                                                      |
| Systems           | Station, platform and on-board system improves passenger information and will reduce vehicle dwell times by allowing first in-first-out at stations and less passenger walk time once the vehicle arrives. This improves the customer experience by providing advance notification of stop location, improves capacity, reduces travel time variability and improves vehicle efficiency. |
| Station/Platform systems |  
  • Dynamic vehicle bay allocation system  
  • Platform display information signs advise customers on what services are arriving at each bay  
  • Information screens to advise the next 3 to 5 services and the stopping bay allocation for each service.  
  • Public address system to notify customers that services have arrived, that vehicle doors are closing, and vehicles are departing.  
  • Information screens and public address/voice announcement of travel time from current station to King George Square, Buranda, RBWH and Eight Mile Plains |
| On-vehicle systems |  
  • Wi-Fi access  
  • Real-time travel updates from current station to King George Square, Buranda, RBWH and Eight Mile Plains  
  • Public address/voice announcements that the next station will be reached in one minute  
  • Real-time vehicle location through Global Positioning System (GPS) or Radio Frequency Identification Tags (RFIT) to support dynamic vehicle bay allocations |

Table 6.5 – Description of key elements of Brisbane Metro
6.4  Element 1: Network and services

6.4.1  Rationale for the metro service alignment

Brisbane Metro proposes two new high-capacity metro lines:

- Metro 1 – Eight Mile Plains station to Roma Street station via South East Busway and Inner Northern Busway
- Metro 2 – RBWH station to UQ Lakes station via Inner Northern Busway, South East Busway and Eastern Busway.

The Brisbane Metro lines are fully contained within the South East Busway, Inner Northern Busway and parts of the Eastern Busway in order to maintain the higher speed and reliability characteristics expected of metro services.

The metro service terminus points were selected based on a range of factors, including demand, operational efficiencies and infrastructure for turning around metro vehicles.

- Eight Mile Plains busway station was selected as the southern terminus of the Metro 1 line due to the commencement of the busway, and the demand generated by the large park and ride facility at Eight Mile Plains. While Upper Mount Gravatt has higher patronage throughput due in part to the proximity of the Garden City shopping centre, there would be limited space for a large turnaround for metro vehicles, and this would adversely impact on operations due to the large volume of suburban services entering the busway at Mount Gravatt to either truncate with metro services or continue travelling through the busway.

- Roma Street busway station was selected as the northern terminus of the Metro 1 line as the majority of patronage demands on this route are to and from the CBD. Roma Street also provides interchange to a wide range of north-west bus routes, as well as all passenger rail services. The existing Countess Street layover facility to the north of the station also means that Metro 1 services can terminate at Roma Street and then access this layover facility with minimal dead running and without leaving the busway. Lastly, additional capacity (that will be provided by Metro 2) is not required north of Roma Street.

- UQ Lakes station was determined as the southern terminus for the Metro 2, as it is physically the western end of the Eastern Busway and serves a major university trip generator for the Brisbane region.

- RBWH station was the selected northern terminus of the Metro 2 line as it is already a strategic interchange location for the bus services to and from north Brisbane and is a major trip generator in its own right, serving both the adjacent hospital and the wider Herston health and medical research precinct.

Figure 6.3 provides an overview of the Brisbane Metro alignment.
Figure 6.3 – Brisbane Metro Alignment Overview
6.4.2 Rationale for the metro service frequency

The Brisbane Metro proposes to operate a high-frequency service, every day, in line with frequent metro-style services around the world. In the local context, Brisbane Metro will provide higher frequencies and longer span of hours than current frequent services including BUZ and Glider, in line with its proposed status as the premium product in the public transport network. Table 6.6 compares the proposed opening year Brisbane Metro frequencies and span of hours, to selected frequent rapid bus or metro services in Brisbane, Sydney and Auckland.

<table>
<thead>
<tr>
<th></th>
<th>BRISBANE METRO</th>
<th>GLIDER SERVICES (BRISBANE)</th>
<th>B LINE (SYDNEY) (^1)</th>
<th>NORTHERN EXPRESS (AUCKLAND)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday peak frequency</td>
<td>3 minutes</td>
<td>5 minutes</td>
<td>5 minutes</td>
<td>3-5 minutes</td>
</tr>
<tr>
<td>Weekday interpeak frequency</td>
<td>5 minutes</td>
<td>10 minutes</td>
<td>10 minutes</td>
<td>7-15 minutes</td>
</tr>
<tr>
<td>Other off peak times (incl. weekends) frequency</td>
<td>5-10 minutes</td>
<td>10-15 minutes</td>
<td>10-15 minutes</td>
<td>10-15 minutes</td>
</tr>
<tr>
<td>Weekday span</td>
<td>20-21 hours</td>
<td>18 hours</td>
<td>19 hours</td>
<td>18.5 hours</td>
</tr>
<tr>
<td>Weekend span</td>
<td>24 hours</td>
<td>24 hours</td>
<td>19 hours</td>
<td>20 hours</td>
</tr>
</tbody>
</table>

Table 6.6 – Comparison of Brisbane Metro proposed service plan to similar services

Over the subsequent years of operations, metro frequencies in peak times would continue to increase in line with demand. However, in off peak times, the same high-frequency of services is proposed to operate in all future forecast years. Table 6.7 summarises the proposed changes in frequencies (expressed as headway or time interval between services) between opening year and Year 20.

<table>
<thead>
<tr>
<th></th>
<th>YEAR 1</th>
<th>YEAR 10</th>
<th>YEAR 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday peak frequency</td>
<td>3 minutes (both Metro 1 and Metro 2)</td>
<td>2 minutes (both Metro 1 and Metro 2)</td>
<td>1.5 minutes (Metro 1) and 2 minutes (Metro 2)</td>
</tr>
<tr>
<td>Weekday interpeak frequency</td>
<td>5 minutes (both Metro 1 and Metro 2)</td>
<td>5 minutes (both Metro 1 and Metro 2)</td>
<td>5 minutes (both Metro 1 and Metro 2)</td>
</tr>
<tr>
<td>Other off peak times (incl. weekends)</td>
<td>5 minutes weekend/public holiday (daytime) 10 minutes (late evening/early morning)</td>
<td>5 minutes weekend/public holiday (daytime) 10 minutes (late evening/early morning)</td>
<td>5 minutes weekend/public holiday (daytime) 10 minutes (late evening/early morning)</td>
</tr>
</tbody>
</table>

Table 6.7 – Proposed Brisbane Metro service frequencies and spans over 20 years

6.4.3 Rationale for public transport network integration

The Brisbane Metro proposes to form part of the wider SEQ public transport network. The overarching vision for the integration of metro, Glider and frequent bus and rail (existing and future) have been established in various plans and strategies. The proposed long term network integration plan is presented in Figure 6.4 below. This shows a clear inter-relationship between the different modes and services, each serving a range of destinations and connecting at key interchanges to allow customers to transfer between services.

\(^1\) Proposed to commence operations in late 2017
For example the Queensland Government’s proposed Cross River Rail (CRR) Project, linking Dutton Park and Bowen Hills, provides a new corridor for trunk passenger rail services, transporting large numbers of passengers from the north and south of Brisbane into the CBD. Brisbane Metro also acts as a trunk passenger route for large sections of Brisbane not served by the rail network, as well as improving the distribution of passengers within the inner-city including between the CBD and key trip generators on the busway.

Coordinated planning of the two projects (i.e. a public transport network solution) has the potential to provide a world class public transport network to support the future growth and development of Brisbane. Chapter 7 provides further detail regarding the complementary benefits of CRR and Brisbane Metro.

![Figure 6.4 – Future SEQ Public Transport Network Integration Plan](image)

The map above illustrates the potential future integrated public transport network, including the proposed CRR alongside metro, frequent bus and other rail lines. This shows that there is potential for metro services to be expanded to other areas of Brisbane in the future such as to Chermside, Carindale and Springwood. Future extensions of the metro network will be reliant on new segregated bus/busway infrastructure. This will ensure metro services do not compete for road space with general traffic, allowing future services to operate as high-
frequency, high-capacity services and achieve the ongoing aim of fast and reliable journey times for customers.

6.4.4 Rationale for a hybrid network integration strategy

There are several models for integrating public transport services within a network, including:

- Direct service model
- Trunk and feeder model
- Hybrid model.

A short description of each of these models is provided in the sections below.

Direct service model

A direct service model involves a network where customers largely have direct services to, and then along, a major bus corridor such as a busway or arterial road. Most bus routes within the inner 10 kilometres of Brisbane currently operate a direct (single-seat) service to the Brisbane CBD, with limited exceptions being cross-town or local coverage routes to regional centres.

The main advantage of the direct service model is:

- The majority of customers within the wider catchment area surrounding a major road or busway are able to board a direct service to a CBD destination without having to change services at an intermediate station, thereby staying in a ‘single seat’. This overcomes the inconvenience to customers that may be incurred when transferring.

- Where services overlap on the main trunk corridor, this model provides opportunities for different stopping patterns and therefore can offer operating and capacity efficiencies.

Disadvantages of the direct service model are:

- Network legibility for the customer may be poor as there are multiple bus routes that operate along the same corridor, but with different route numbers and destinations and different stopping patterns.

- There can be a lack of clarity for the customer travelling cross-town about where and when to interchange between bus services. There can also be limitations with service coordination, which can result in long wait times for customers at interchange locations which are constrained and lacking in convenient customer facilities.

- Careful headway management is essential under a high throughput corridor, however typically frequencies of services may not be properly coordinated due to unforeseen circumstances and delays leaving uneven gaps in services.

- Significant congestion can occur due to buses ‘bunching’ on the corridor.

- Potential over-supply of capacity in some sections of a corridor or some times of day can result in inefficient use of resources with adverse operating cost implications.

Figure 6.5 provides a schematic of the direct service model.
Trunk and feeder model

A trunk and feeder model involves a high-frequency/high-quality trunk service operating along a busway, railway or other major corridor. At strategic locations, including termini, other services would ‘feed’ customers to the trunk corridor. These services may terminate or they may continue on to serve other non-busway destinations and provide ‘cross corridor’ connectivity. Depending on the length and physical complexity of the busway or major road corridor, multiple trunk routes could operate together including potentially, both all stops and express services.

The advantages of the trunk and feeder model are:

- The high-quality/high-frequency (and generally high-capacity) service that is provided along the trunk route is simpler for customers to understand and use.
- As the services are typically restricted to the dedicated infrastructure, they are not subject to delays from operating on road like regular bus services.
- As the services generally only use the dedicated infrastructure, both the vehicle and the stations can be designed in parallel and optimised to overall system objectives, such as capacity, quality, speed or fast boarding/alighting.
- There may be opportunities to provide higher frequencies on feeder services if a significant portion of their travelling time is reduced compared to operation of direct services.

The disadvantages the trunk and feeder model are:

- Some customers will be required to change in order to complete their journey.
- Very ‘rigid’ trunk-feeder networks may require multiple transfers for cross city journeys. This inconvenience can however be mitigated through minimising the walking distance between feeder and trunk services, minimising the connection time (through frequent services), and providing sufficient capacity on the trunk to accommodate the demands from other services.
- Although trunk-feeder networks can be more cost effective when transferring customers from small capacity vehicles or loads to high-capacity vehicles, these benefits dissipate when requiring transferring of high customers loads to similar size or marginally different sized vehicles particularly in busy peak hours.
- The infrastructure at interchange locations also need to be designed effectively to accommodate the projected customer numbers on platforms, and provide sufficient bus layover at termini.
Figure 6.6 provides a schematic of the trunk and feeder model.

![Schematic of the trunk and feeder model](image)

**Figure 6.6 – Trunk and feeder model**

**Hybrid model**

Given the inherent flexibility of busways, a hybrid of the above two concepts exists, such as where a trunk service operates as the primary service along a busway, supported by numerous feeder routes and with a limited number of other routes also operating direct to the CBD.

A hybrid system offers a combination of advantages including simplification of the network to create more legible high-capacity trunk service(s), as well as the retention of selected key ‘through running’ bus routes along the trunk route. With appropriate infrastructure design, trunk services could be operated alongside other bus routes without adverse impact on capacity or quality of both types of services provided.

The key advantages of the hybrid model include:

- An increase in the overall capacity of the network, with a proportion of direct connections maintained (particularly in peak hours), which would preserve many of the benefits that existing customers are used to.

- High-quality core trunk route(s) could be introduced and would act as the flagship service on the busway, providing improved system legibility for the customer and attracting new patronage.

- Planning for selected routes to feed the trunk route(s) at a limited number of locations would reduce the need to invest in new interchange facilities at every station.

Figure 6.7 provides a schematic of the hybrid model.
After reviewing the above models, and the potential implications for the Brisbane bus network, the proposed network strategy for the Brisbane Metro is one which aims to evolve the network from one which is almost exclusively a direct service (single-seat) model to one which involves increased feeding to trunk services using a hybrid model.

Adoption of this hybrid strategy allows flexibility for growth by incorporating some route truncations at Brisbane Metro stations to reduce the number of bus services into the CBD, subsequently resulting in reduced congestion and better utilisation of fleet and infrastructure, while still retaining and where possible improving legibility and connectivity for customers. Selected high performing parallel services will continue to operate directly to serve the CBD.

6.4.5 Summary of Element 1: Network and services

Overall, the network and service strategy and proposed response as outlined above delivers two flagship metro lines to create a legible backbone to the busway network.

Supplementing this will be a limited number of frequent all day (BUZ and Glider) services maintaining high-quality direct connections from primary corridors beyond the busway network to the CBD via varying lengths of the busway network. High performing Rocket (peak only express) services to the CBD will also be retained, maintaining a strong complementary network of express commuter services for CBD bound customers.

The network and service strategy also provides a wide range of interchange opportunities between Brisbane Metro and other bus services, and is not focused on transfers just at Brisbane Metro terminus locations. As such, the wider bus network redesign will be able to take advantage of the capacity and high-frequency trunk service that will be provided by Brisbane Metro at several busway stations where customer interchanges can occur on the same platform, including Eight Mile Plains, Griffith University, Buranda, Boggo Road, RBWH and Roma Street busway stations. Furthermore, interchange between bus and rail will be made even more attractive at the existing multi-modal interchanges such as Boggo Road and Roma Street.

Table 6.8 summarises the network and service solution for the Brisbane Metro in the context of the established principles.
### Table 6.8 – Brisbane Metro network and services outcomes against principles

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>ELEMENT 1: SERVICE SOLUTION</th>
</tr>
</thead>
</table>
| 1. Improve accessibility and connectivity | Connectivity and accessibility will be enhanced as follows:  
- Brisbane Metro lines will provide improved direct connectivity to several key travel generators on the busway network other than the CBD and city frame – including Royal Brisbane and Women’s Hospital, Garden City/Upper Mount Gravatt, Griffith University, and the University of Queensland – through journey time and frequency upgrades.  
- The Brisbane Metro will also provide enhanced connectivity (through reduced transfer times and improved reliability) to enable customers to access other parts of the bus and rail network at key interchange locations, such as Boggo Road, Buranda, Griffith University, Roma Street and RBWH.  
- Direct bus connectivity (single-seat journey) between the city centre and major centres located beyond the busway will be maintained where these corridors are able to support a frequent service – either via all day frequent BUZ routes or peak only frequent rocket routes.  
- Other bus services (e.g. local, all stops, coverage routes) which are unable to operate at frequent levels, will be reconfigured to feed to frequent Brisbane Metro or rail services where the infrastructure is suitable for safe and efficient transfer and/or where there are significant destination trips also available at that location (e.g. a town centre, hospital precinct or university).  
- Other upgrades to the design of truncated routes (e.g. directness, frequency, span) as well as the introduction of new inner-city distributor routes will be investigated to enhance overall accessibility for customers, to mitigate for the transfer. |
| 2. Increase effective capacity | Higher capacity will be provided in terms of improved frequency of services. The frequency of Brisbane Metro services, in conjunction with new infrastructure, complementary bus network changes, policy and operational changes and higher capacity vehicles, provide capacity for growth. |
| 3. Improve journeys times and reliability | The premium Brisbane Metro lines will operate wholly within the busway network to offer fast and reliable journey times that avoid conflict with other vehicles. Other high- frequency routes that remain on the busway network will also benefit from the same journey times and reliability improvements as Brisbane Metro routes, at least in part. |
| 4. Improve customer experience | The Brisbane Metro lines will be the higher order, higher capacity trunk routes on the busway corridors with clear identity/branding/route numbering. Simplification and rationalisation of other routes at logical and intuitive interchange locations further achieves legibility objectives.  
The two Brisbane Metro lines will operate at 3 minute headways in peak times from the proposed commencement of operations in December 2022, and are anticipated to operate up to every 5 minutes inter peak during the day providing a turn up and go style service. A long span of hours similar to current BUZ and Glider routes is anticipated providing a high-quality customer experience of the service. |
| 5. More efficient operations | Through the Brisbane Metro, the number of bus routes on the busway corridors will be reduced, with priority given to high-frequency bus services. |
| 6. Protect and shape the city | The Brisbane Metro network and service strategy connects Brisbane’s economic, knowledge, innovation, health and research clusters. The high-frequency, high-capacity metro will drive economic growth, business interaction and agglomeration. This "system-level connectivity" more efficiently brings people, jobs and firms closer together elevating Brisbane as a centre for global business. |
| 7. Create identity and legacy | Brisbane Metro will enhance the city’s image through improved public realm and station precinct wayfinding. Over time, Brisbane Metro will also encourage more activity around station precincts enabling residents and workers to shop, walk, meet and relax in local streets and spaces rather than having to travel to do so. These types of changes will contribute to an enhanced liveability and lifestyle.  
Brisbane Metro will enhance the Cultural Centre as a key destination by improving amenity through enhanced public realm and by and reducing the number of surface buses. This will contribute an improved sense of place, and improved pedestrian movement around the Grey Street and Melbourne Street intersection.  
Inner-city amenity will also be enhanced by a reduction in bus volumes on some CBD streets, Victoria Bridge, and Captain Cook Bridge. |
6.5 Element 2: Policy and Operations

6.5.1 Background to busway station and platform operations

Current policies and operational practices at stations, as identified in Chapter 4, are contributing to a range of sub-optimal outcomes for the busway network, both for customers and for operators. Table 6.9 summarises the key current issues and their implications for current operations.

<table>
<thead>
<tr>
<th>CURRENT ISSUES AND OBSERVATIONS</th>
<th>IMPLICATIONS FOR OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers board via the single front door only (except CityGlider services where front and rear door boarding is permitted).</td>
<td>Increased dwell time as not all doors are used efficiently.</td>
</tr>
<tr>
<td>Customers can alight via the front and rear doors.</td>
<td>Those alighting via the front door can cause delay to those wishing to board, increasing dwell time.</td>
</tr>
<tr>
<td>Door widths for the majority of the fleet do not facilitate two customers to board or alight together (or one to board and another to alight simultaneously) through the same door.</td>
<td>Customers take longer to board or alight from a bus.</td>
</tr>
<tr>
<td>Customers tagging on and off the bus typically cause a minimal delay but can cause significant delay if the customer has to search for their go card or the card reading equipment does not operate effectively or go card does not have sufficient funds.</td>
<td>Customers tagging on or off the bus increase the dwell time relative to off board ticket validation.</td>
</tr>
<tr>
<td>Customers are able to complete a cash transaction with the driver in peak times (except for pre-paid peak only and CityGlider services).</td>
<td>Cash transactions with drivers increases both mean dwell time, and create inconsistent (highly variable) dwell times.</td>
</tr>
<tr>
<td>Customers are able to seek information from the driver in peak times.</td>
<td>Seeking information from the driver increases both mean dwell time, and creates inconsistent (highly variable) dwell times.</td>
</tr>
<tr>
<td>Customers generally wait at a common location on the platform (generally towards the lead stop).</td>
<td>When a customer’s desired bus arrives further down a platform, the time taken for the customer to walk to the bus affects the time that the bus must wait on the platform. The walk time to that bus is also compounded when the platform is congested further delaying the departure of the bus.</td>
</tr>
<tr>
<td>When more than one bus is at a station customers sometimes have difficulty in sighting the route number of the next arriving bus.</td>
<td>This can mean a bus may stop twice on a platform as it is hailed again by customers waiting near the lead stop.</td>
</tr>
<tr>
<td>Buses leap-frogging each other at the station.</td>
<td>This can affect station capacity by creating gaps in the platform and leading to inefficient use of platform length.</td>
</tr>
<tr>
<td>Mobility impaired customers require the bus driver to deploy a ramp to assist in boarding and alighting by such customers.</td>
<td>The time taken to deploy the ramp as well as the time take for the mobility impaired person to access the bus (if it is second or third in a platoon) all increase dwell time.</td>
</tr>
<tr>
<td>Drivers sometimes undertake timing stops at busway stations, to keep to the timetable.</td>
<td>This can cause long dwell times, and take up valuable platform capacity.</td>
</tr>
</tbody>
</table>

Table 6.9 – Current operational issues and implications

The above issues and observations all impact on the dwell time of buses at stations as well as the variability of dwell time which also contributes to a deterioration of the customer experience on the busway. As discussed in Chapter 4, there are large variations in mean dwell times (from 9 seconds to over 60 seconds) and significant variability, relative to the mean, with numerous stations over 100 per cent dwell time variability.
6.5.2 Rationale for changes to busway and station operations

Addressing dwell times is critical as it is a major component of travel time delays and variability in travel time on the busway network in peak times. Due to extremely high service frequencies, the South East Busway in particular, is highly sensitive towards variable dwell times as this can initiate a sequence of visible bus queuing, bus ‘bunching’ and delays.

Dwell time fluctuations in the operation of the busway can cause a domino effect that ultimately causes not just a reduction in-service reliability, but also a reduction in corridor bus capacity. Long and variable dwell times can also impact on infrastructure requirements. Planning for long dwell times could result in longer platforms being required or would result in platforms having bus capacity constraints (i.e. the whole platform occupied by buses resulting in a queue of buses waiting to access the platform).

Typically, dwell time consists of the amount of time required for door operations and the amount of time for bus customer to board the vehicle including any fare transaction or ticket validation. However, characteristics of the fleet, busway operating procedures and the busway platform length all contribute to dwell time.

Brisbane Metro involves changes to the operation of busway stations in order to reduce the mean dwell time and make dwell times more consistent and reliable.

6.5.2.1 Proposed changes to busway and station operations

Proposed changes, including the rationale for the changes are discussed in Table 6.10 below, and comprise:

- Making all busway stations pre-paid zones to enable full off-board vehicle ticketing
- Multi-door boarding and alighting
- First in-first out operations at stations
- Eliminating timing point dwell times at busway stations.

<table>
<thead>
<tr>
<th>PROPOSED RESPONSE</th>
<th>RATIONALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make all metro stations pre-paid zones to enable full off vehicle ticketing</td>
<td>Along with other measures could result in achieving consistent boarding time of 1.5 second per passenger per door. All door alighting and optimum configuration of internal layout could also improve alighting times.</td>
</tr>
<tr>
<td>Multi-door boarding and alighting</td>
<td>Loading is currently inefficient as customers board via one door and unloading is inefficient as typically on a full standing load the front door is not used effectively as the seating layout means that most customers are closest to the rear door. It is estimated that using multi-door boarding and alighting along with optimum layout of buses could halve the time it takes to board and alight customers at busy stops.</td>
</tr>
<tr>
<td>First in-first out operations at stations</td>
<td>Under first in-first out, all vehicles will be obliged to follow the same dwell times regardless of whether they need to dwell for that long. However, the elimination of leapfrogging will give customers more confidence in the order of buses arriving at the station and the position/location they need to stand to catch the correct bus, in particular, reducing walk time to the furthest bus, which reduces dwell times. Furthermore, first in-first out will also assist the metro vehicles to line up parallel to the platform and ensure a minimal gap for customers stepping on or off the vehicle.</td>
</tr>
<tr>
<td>Eliminate timing point dwell times at busway</td>
<td>This will create more consistent and lower dwell times, making better use of the limited platform capacity, reduce excess wait times, and defer the need for further</td>
</tr>
</tbody>
</table>
PROPOSED RESPONSE | RATIONALE
---|---
stations | platform lengthening. The changes in operations to ‘first in first out’ mean that inconsistent dwell times would cause delays to other services and detrimentally affect busway capacity.
Amended disabled access arrangements and policies | Disability Discrimination Act 1992 (DDA) compliance will be assessed when it is mandated. As the metro driver will be isolated from customers, a range of automatic DDA measures will be investigated further, including:
- Automatic ramp placement in metro vehicles to avoid the need for the driver to leave the cabin to manually deploy a ramp
- Public address announcement and customer information at stations and vehicles regarding where to wait

Table 6.10 – Changes to platform and station operations
The above changes to operation are expected to lead to a significant improvement in dwell times. The benefit of the above ticketing, boarding and operational management measures are proposed to result in not only a reduction in average (mean) dwell times, but also the ability to provide more consistent dwell times, and therefore a reduction in dwell time variability.

6.5.3 Rationale for continuation of current operational activities managed by other entities
Despite the above proposed changes to certain aspects of the busway operations and policy, the overall management of the busway network and public transport system are not anticipated to change. This includes:
- Public and customer interfaces, including ticketing revenue setting and collection, customer interface complaints will continue to be the responsibility of TransLink.
- Busway management, including security services, and on platform emergency responses will continue to be the responsibility of TMR and the Busway Operations Centre (BOC).
- Bus service requirements are to continue to be managed under contract to TransLink, however a service level agreement regarding access and performance (e.g. dwell times, acceleration, deceleration, and operating speed) and service numbers for the metro service will be required.
- Busway maintenance and asset management, with the newly constructed infrastructure to be managed, monitored and scheduled for planned and unplanned maintenance, along with the existing busway infrastructure will continue to be the responsibility of TMR.
- Overall policy setting and system management will continue to be the responsibility of TMR/TransLink.

6.5.4 Summary of Element 2: Policy and operations
Overall, the proposed policy and operational changes will deliver against several principles for Brisbane Metro. Principally this measure will improve dwell times, which will deliver improved overall travel times, and improved reliability with less variation. This in turn will assist in improving accessibility by increasing the number of people accessing jobs, education and other activities within a nominal travel time.

Table 6.11 summarises the policy and operations solution for the Brisbane Metro in the context of the principles.
1. **Improve accessibility and connectivity**
   Changes to ticketing and boarding arrangements will improve dwell times, speeding up journeys making destinations which can be reached via the busway including via transfers, more accessible to more people.

2. **Increase effective capacity**
   Improved dwell times improve journey times which increase the number of vehicles per hour (and hence capacity) of each station.

3. **Improve journeys times and reliability**
   Improved dwell times directly improve journey times. Eliminating practices which introduce long dwell times, such as timing points and cash transactions, will reduce the variability of dwell times making them consistently faster.

4. **Improve customer experience**
   Changes to operational policies and practices will improve the customer’s experience of the system with less frustration (i.e. customers purchasing tickets from the driver, which increases dwell times).

5. **More efficient operations**
   Policies and procedures which reduce dwell time and improve journey times and reliability mean that the time taken to operate services on the busway reduce, saving operating hours and potentially saving fleet (or alternatively more services can be delivered with the same fleet and the same operating hours because they can cover more kilometre in the same amount of time).

6. **Protect and shape the city**
   Improved travel times and reliability delivered by Brisbane Metro will support businesses and residents with fast convenient access to employment, education and services. It will enable workers and businesses to quickly connect and collaborate, with reduced travel time between key economic precincts.

7. **Create identity and legacy**
   Brisbane’s city image is improved through a faster, more reliable transit system for residents and visitors.

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>ELEMENT 2: POLICY AND OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve accessibility and connectivity</td>
<td>Changes to ticketing and boarding arrangements will improve dwell times, speeding up journeys making destinations which can be reached via the busway including via transfers, more accessible to more people.</td>
</tr>
<tr>
<td>2. Increase effective capacity</td>
<td>Improved dwell times improve journey times which increase the number of vehicles per hour (and hence capacity) of each station.</td>
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<td>3. Improve journeys times and reliability</td>
<td>Improved dwell times directly improve journey times. Eliminating practices which introduce long dwell times, such as timing points and cash transactions, will reduce the variability of dwell times making them consistently faster.</td>
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<td>Changes to operational policies and practices will improve the customer’s experience of the system with less frustration (i.e. customers purchasing tickets from the driver, which increases dwell times).</td>
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<td>5. More efficient operations</td>
<td>Policies and procedures which reduce dwell time and improve journey times and reliability mean that the time taken to operate services on the busway reduce, saving operating hours and potentially saving fleet (or alternatively more services can be delivered with the same fleet and the same operating hours because they can cover more kilometre in the same amount of time).</td>
</tr>
<tr>
<td>6. Protect and shape the city</td>
<td>Improved travel times and reliability delivered by Brisbane Metro will support businesses and residents with fast convenient access to employment, education and services. It will enable workers and businesses to quickly connect and collaborate, with reduced travel time between key economic precincts.</td>
</tr>
<tr>
<td>7. Create identity and legacy</td>
<td>Brisbane’s city image is improved through a faster, more reliable transit system for residents and visitors.</td>
</tr>
</tbody>
</table>

*Table 6.11 – Brisbane Metro policy and operations outcomes against principles*
6.6 **Element 3: Existing, Upgraded and New Infrastructure**

The Brisbane Metro includes re-use of significant parts of the busway infrastructure along with a minimal amount of new busway and station infrastructure, as well as upgrades to existing infrastructure, including:

- New underground Cultural Centre station
- New Adelaide Street tunnel
- Platform extensions to existing busway stations
- New metro depot
- Upgrades to layovers and turnarounds.

The rationale and key features of these are described in the subsequent sections.

### 6.6.1 Rationale for the underground Cultural Centre and southern grade separation

As outlined in Chapter 4, the existing Cultural Centre busway station currently experiences crowding for both buses and customers during peak periods, resulting in long queues of buses entering the station, excessive platform dwell times and customer crowding and conflicts on the platforms.

By 2041, without Brisbane Metro, it is forecast that morning peak hour activity will double from around 3,200 in 2016 to around 6,400 customers, and daily activity will increase from 32,000 to over 62,000. This will result in significant further deterioration of the bus and customer capacity issues that are currently experienced at Cultural Centre. Of particular concern is the capacity and safe operations of Platform 2 (outbound), which is surrounded by traffic and bus lanes with only a single stair and lift at the southern end of the platform providing access in and out of the station.

As well as platform capacity issues outlined above, the existing Cultural Centre station is critically constrained by two closely spaced intersections immediately south of the station, namely Melbourne Street, Grey Street and the busway portal. These intersections limit bus throughput of the station, constraining its overall capacity, and preventing any further growth in services through the station in peak hours.

Brisbane Metro will provide a new underground station at Cultural Centre with a new section of segregated busway connecting Victoria Bridge to the South East busway bypassing these two intersections. The proposed infrastructure changes will significantly increase station capacity for both vehicles and customers and enhance customer experience. In addition to crowding relief, customers that use the Cultural Centre underground station will benefit from a modern station that will include a climate controlled environment with platform screen doors and improved customer information.

### 6.6.2 Rationale for grade separation between Victoria Bridge and King George Square station (Adelaide Street tunnel)

Similar to the intersection constraints on the southern side of the Victoria Bridge discussed above, bus movements are also constrained by the intersection capacities at North Quay/William Street/Queen Street tunnel and Victoria Bridge. This intersection is complex with a number of conflicting traffic, pedestrian and bus movements causing significant delay and long queues of buses frequently occur, particularly during peak periods. This results in longer than scheduled bus journey times and poor journey time reliability.
Furthermore, the current route for buses from Victoria Bridge to King George Square station is via the existing Queen Street and Albert Street tunnels. The Queen Street tunnel itself suffers from peak period congestion, as it is the terminus for over 30 routes from the south, east and west. The station is constrained by the T-intersection at its northern end, which allows northern through services to turn left (towards King George Square station) and terminating south, east and western routes to turn right (to access their setdown or pickup bay). The intersection however only allows one movement at a time due to width constraints which prevent simultaneous movements to and from the link tunnel to King George Square. As such, this intersection constrains the capacity of this critical central link in the inner-city busway network.

The proposed Adelaide Street tunnel, along with changes to the configuration of North Quay to remove conflicting movements, creates a dedicated and segregated busway corridor from the Victoria Bridge to King George Square station, bypassing the Queen Street tunnel and its intersection constraints. This will allow buses to operate at higher average speeds with less conflict and less variability in journey time caused by bus congestion and signal delays.

### 6.6.3 Rationale for busway platform extensions

Brisbane Metro includes a range of fleet and network changes that will change the number of vehicles stopping at stations, as well as the mix of vehicles including average length. These changes, combined with the policy and operational changes will result in changes to the average dwell time and dwell time variability which will affect station capacity.

An assessment of required capacity (i.e. platform length) has been undertaken based on the Transit Capacity and Quality of Service Manual (TCQSM) bus loading area (or bay) capacity calculations and microsimulation modelling. A review of other methodologies for platform capacity used in past studies concluded that the TCQSM calculation, coupled with appropriate dwell times inclusive of contingency and modelling, are suitable for this analysis.

Analysis, including microsimulation modelling, showed that two pairs of two bays (i.e. two lead stops) provides more effective capacity than 4 bays in line (i.e. one lead stop), in part due to the inefficiencies of customers manoeuvring and repositioning themselves along a long platform to access their required service. The platform length recommendations for the Brisbane Metro have taken these inefficiency factors into account.

Key findings from the Brisbane Metro platform capacity assessment indicate that based on proposed 2041 operations and patronage forecasts, platform lengthening is likely to be required at the following locations:

- **Eight Mile Plains station** – extension of 9.25 metres to create 64.5 metre long platforms
- **Upper Mount Gravatt (Garden City) station** – extension of 9.25 metres to create 64.5 metre long platforms
- **Griffith University station** – extension of 29 metres to achieve ultimate platform lengths of 84.5 metres
- **Buranda station** – extension of 29.5 metres to create 84.5 metre long platforms
- **New Cultural Centre underground station** – platforms will be 100 metres to provide for future flexibility to accommodate forecasted 2041 operational requirements
- **King George Square station** – reconfiguration of existing bays only, including Platform Screen Doors (PSDs) to allow for two lead stops.
The above platform lengths have been incorporated into the Brisbane Metro concept design (as described in Chapter 9), and used in the microsimulation assessment of busway and station performance.

### 6.6.4 Rationale for a new Depot

Brisbane Metro includes a fleet of 60 metro vehicles (as discussed in Section 6.7) to serve the proposed Metro 1 and Metro 2 lines. As such the new vehicles will require separated depot facilities to the Transport for Brisbane fleet. The functional requirements which underpin the rational for the depot location and design are as follows:

- Allows for safe and efficient operations, including entry and egress
- Provide staff facilities for drivers including carparking, meal break facilities, driver sign in/sign out and lockers
- Cater for vehicle refuelling including fuel storage tanks (depending on fuel type)
- Allow for mechanical maintenance facilities, including diagnostic equipment, hoists, pits etc.
- Provide cleaning facilities including both external washdown and internal cleaning
- Provides stabling capacity for up to 115 vehicles, more than sufficient for 2041 operations.

A new depot location continues to be investigated by Council with a location likely near the Eight Mile Plain station.

Chapter 9 further discusses the specific design response to the required depot functions outlined above. As well as the depot, remote layover facilities will be required to suit scheduled service requirements as outlined below.

### 6.6.5 Rationale for layover and turnaround for metro vehicles

As well as layover at the depot itself, other layover facilities will be required for the metro vehicles to allow for a period of recovery time between scheduled services. This allows for minor fluctuations in journey time to be recovered so as not to cascade and delay subsequent services.

Additional layover facilities to be available at:

- Ernie’s Roundabout (RBWH)
- Countess Street (Roma Street)
- UQ Lakes
- Eight Mile Plains.

As well as layover and turnaround facilities for metro vehicles, some new or augmented facilities will be required for other bus services at:

- Griffith University – existing bus fleet layover (four vehicles) and new turnaround
- Boggo Road – existing bus fleet recovery layover (one vehicle)
- Woolloongabba – New bus fleet turnaround.

### 6.6.6 Summary of Element 3: Infrastructure

Overall, the infrastructure changes will support several of the principles for Brisbane Metro. Principally this element of the solution will improve the speed and reliability of services in the
critical inner-city section of the corridor, with additional benefits to buses and metro vehicles progressing through congested suburban stations such as Buranda. This in turn will assist in improving accessibility and connectivity by increasing the number of people accessing jobs, education and other activities within a nominal travel time.

Table 6.12 summarises the infrastructure solution for the Brisbane Metro in the context of the established principles.

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>ELEMENT 3: INFRASTRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve accessibility and connectivity</td>
<td>Faster and more reliable journeys through current bottlenecks will increase the number of people able to access key employment and other opportunities improving regional accessibility.</td>
</tr>
<tr>
<td>2. Increase effective capacity</td>
<td>Improving bus throughput at key bottleneck unlocks overall busway system capacity allowing more services to operate and forecast patronage growth.</td>
</tr>
<tr>
<td>3. Improve journeys times and reliability</td>
<td>Major delays caused by intersection and station capacity delays between South Bank and King George Square will be removed improving travel times in peak hours and significantly reducing the variability of journey times.</td>
</tr>
<tr>
<td>4. Improve customer experience</td>
<td>New station infrastructure such as at Cultural Centre will provide superior customer experience for customers reducing crowding and providing a safer and more comfortable waiting environment.</td>
</tr>
<tr>
<td>5. Increase efficient operations</td>
<td>The improved travel time on the busway along with improved reliability mean that the time taken to operate services on the busway reduce, saving operating hours (or alternatively more services can be delivered with the same fleet and the same operating hours because they can cover more kilometres in the same amount of time).</td>
</tr>
<tr>
<td>6. Protect and shape the city</td>
<td>Optimising the use of Brisbane’s existing busway infrastructure is consistent with regional policies, and reinforces the city’s preferred pattern of development. A new underground station at the Cultural Centre removes the majority of buses on Melbourne Street and closes the Melbourne Street busway portal, reducing modal conflicts, and improving the public realm at the Melbourne and Grey Street intersection and prioritises pedestrians.</td>
</tr>
<tr>
<td>7. Create identity and legacy</td>
<td>Decongestion at the Cultural Centre precinct and new public realm significantly improves access and amenity. This reinforces its importance as Brisbane’s preeminent cultural and entertainment location.</td>
</tr>
</tbody>
</table>

*Table 6.12 – Brisbane Metro infrastructure outcomes against principles*
6.7  Element 4: Vehicles

6.7.1  Rationale for the metro vehicle

Brisbane Metro requires a high-quality vehicle to operate the flagship Metro 1 and Metro 2 services on the busway. The functional requirements of the metro vehicles are:

- High-capacity – to allow for the replacement of existing services, provide capacity for customers from terminated/feeder services and provide capacity for growth
- Low floor and accessible – for quicker boarding and alighting
- Multiple, large (double) doors – to allow for efficient boarding and alighting
- Metro-like style and quality.

Low floor metro vehicles with four double doors and capacity for around 150 people each are therefore envisaged to operate the two Brisbane Metro lines.

The number of metro vehicles required has been calculated based on the peak operating headways, the forecast (modelled) journey times for each metro service and other assumptions around the recovery layover time and the number of spare vehicles required for servicing and maintenance.

For analysis purposes, an additional 10 per cent of the number of vehicles required to operate normal peak scheduled services has been assumed as spares, in order to arrive at a total fleet requirement. As noted in Table 6.13 below, the calculated fleet requirements on day one of operations is 60 vehicles, rising to up to 95 vehicles by 2041, in order to operate ultra-high frequency services by that time.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of vehicles (rounded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>60</td>
</tr>
<tr>
<td>Year 5</td>
<td>60</td>
</tr>
<tr>
<td>Year 10</td>
<td>74</td>
</tr>
<tr>
<td>Year 15</td>
<td>80</td>
</tr>
<tr>
<td>Year 20</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 6.13 – Forecasted fleet number requirements out to 2041

6.7.2  Rationale for improved on-board customer experience

To enhance the travel experience for customers, the metro vehicles will be fitted with a range of features, including:

- Free Wi-Fi access
- Real-time travel updates such as via customer information screens displaying travel time to the next station, to other key stations and/or to the terminus station
- Public Announcement/voice announcements indicating what the next station will be and when it is likely to be reached.

The real-time travel updates will rely on improved passenger information systems and technologies which are discussed further in Section 6.8.

6.7.3  Summary of Element 4: Vehicles

Overall, the vehicle changes proposed as part of Brisbane Metro will support several of the principles. Principally this element of the solution will improve the capacity of the system and contribute to improved customer experience.

Table 6.14 summarises the vehicles solution for the Brisbane Metro in the context of the established principles.
### Table 6.14 – Brisbane Metro vehicles outcomes against principles

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>ELEMENT 4: VEHICLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve accessibility and connectivity</td>
<td>The metro vehicles allow for higher capacity, strengthening connectivity between key busway destinations and interchange locations.</td>
</tr>
<tr>
<td>2. Increase effective capacity</td>
<td>The metro vehicles provide higher vehicle capacity than standard buses.</td>
</tr>
<tr>
<td>3. Improve journeys times and reliability</td>
<td>The higher capacity vehicle allows for other buses to be truncated and removed from the busway.</td>
</tr>
<tr>
<td>4. Improve customer experience</td>
<td>The new metro vehicles will have more space for manoeuvring and for boarding and alighting with less chance of being left behind.</td>
</tr>
<tr>
<td></td>
<td>The vehicles will have high-quality information and Wi-Fi providing a high-quality customer experience.</td>
</tr>
<tr>
<td></td>
<td>The vehicles will be iconic, recognisable and a legible flagship service on the busway network.</td>
</tr>
<tr>
<td>5. Increase efficient operations</td>
<td>The high-capacity metro vehicles allow more people to be carried on a single vehicle, allow for low patronage, low-frequency services to be truncated, saving operating kilometres and resulting in lower per passenger operating costs.</td>
</tr>
<tr>
<td>6. Protect and shape the city</td>
<td>The greater capacity offered by Brisbane Metro will strengthen land use and public transport integration across the region, providing additional capacity to cope with a growing regional population, and supporting access and connectivity to key employment generators.</td>
</tr>
<tr>
<td>7. Create identity and legacy</td>
<td>High-capacity vehicles that make the most of existing infrastructure provide a more attractive and legible transit system for customers.</td>
</tr>
</tbody>
</table>
6.8 Element 5: Management and Information Systems

6.8.1 Rationale for new passenger and vehicle management systems

Dwell times currently used in the assessment of Brisbane Metro have been calculated based on patronage demands and fleet mix at each station, plus an allowance of 5 seconds for the bus doors to open and close. A minimum dwell time of 20 seconds has been adopted in all cases. These two variables allow for a few seconds of walk time. However, there is no additional allowance for longer walk times, as it has been assumed that customers would be in reasonably close proximity to the vehicle they wish to board. Therefore, a system that informs and encourages customers to move to an appropriate platform zone prior to a bus arriving is required to enable the currently projected dwell times to be realised.

A shortcoming of the existing Brisbane bus management and information system is that the existing real-time automatic vehicle location system relies on input of transit schedules and stops to provide comparison to historic data for public information (General Transit Feed Specification output). Location information from the bus is sent out every 30 seconds compared to other systems in use around Australia which polls at 6 seconds or better frequency that better allows for micro management of vehicles. There are also ‘GPS shadows’ in the busway network resulting in bus location signals not being received by the system. Therefore, the automatic vehicle location information cannot be used for informing customers and drivers on precisely when and where on a bus platform the bus should arrive and depart.

To facilitate the modelled improvement to dwell times, as well as enhance the level of information on services to customers, an enhanced passenger and vehicle management system is proposed to undertake the following tasks:

- Inform customers in advance which bay or platform zone the service they wish to board will arrive at. 60 second notice of the intended bay or zone is likely to be required as this will allow customers 30 seconds to observe the display, to then walk at a speed of 1 metre per second for half the average station length to the appropriate platform zone prior to a vehicle arriving.

- Each station platform would be operate as a series of zones with different vehicle types occupying a different number of zones, whereby different vehicle length and arrival variations mean that some vehicles occupy two zones, others three zones and other four zones. The passenger and vehicle management system will need to provide relevant information to Passenger Information Display (PID) screens at each zone.

- Existing or upgraded PID screens will be utilised to show the vehicle arriving at each platform zone or part thereof. These screens are expected to be able to advise the next 10 or more services and the stopping bay allocation for at least the next three to four services (depending on platform length). Platform displays will be allocated on the middle of the platform to encourage customers to congregate in the platform centre and reduce walk times to services.

- The public announcement system may be used to notify customers that vehicle doors are closing, and vehicles are departing. The public announcement system may also be used announce the arrival of services.

- Additional dedicated travel time screens displaying current station to key destination stations such as King George Square/Roma Street and Queen Street bus station in the city as well as terminus stations such as RBWH, Eight Mile Plains and UQ will be provided at stations and supported by public announcement/voice description.
The BOC is the traffic control and management centre for the operation of the Brisbane busway network. It is integrated with the Brisbane Metropolitan Traffic Management Centre (BMTMC), and located at Brisbane Square in the CBD. It is manned by trained busway operations staff, 24 hours a day, seven days a week and its primary function is to manage and monitor busway operations, including stations, and to respond to any incidents that might occur on the busway network. It is envisaged that the BOC will manage the busway and be augmented to accommodate the proposed passenger and vehicle management system. In order to support this, the following changes to busway systems are likely to be required:

- Upgraded real-time vehicle location is required to be able to determine the order of the vehicles. Real-time vehicle location can be provided by GPS or Radio Frequency Identification Device (RFID) on the vehicles and RFID readers along the busway. Current GPS derived bus locations are polled every 30 seconds, and this will need to be increased to every 10 seconds to provide accurate customer information and management of vehicle movement.
- CCTV coverage to assist the BOC to advise customers of changes and observe the information displayed will be monitored from the BOC.
- Upgraded Public Address system, in order to support the increased use of active platform management.

The proposed passenger and vehicle management system will be implemented across all 18 busway stations served by metro.

### 6.8.2 Rationale for other station and busway systems

As well as the critical passenger and vehicle management system, several other systems will be required to support the Brisbane Metro.

The new Cultural Centre underground station and well as the proposed modifications to the King George Square station will require controlled access through Platform Screen Doors, which separate the waiting customers from vehicle environment. This allows for the customer waiting environment to be air conditioned as well as reducing noise and emission in the customer waiting area. These stations will require new Platform Screen Door systems to manage the different fleet types and vehicle arrival combinations.

These two underground stations as well as the new sections of tunnel near Cultural Centre and King George Square will require new ventilation and Fire and Life Safety systems in accordance with relevant standards.

Off-board ticketing systems will also need to be provided at all 18 busway station served by metro services.

### 6.8.3 Summary of Element 5: Systems

Overall, the systems changes proposed as part of the Brisbane Metro solution will support the principles. This element of the solution will improve the capacity of the system and contribute to improved customer experience.

Table 6.15 summarises the systems solution for Brisbane Metro in the context of the established principles.
<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>ELEMENT 5: SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve accessibility and connectivity</td>
<td>The busway management systems will assist in reducing dwell times, which reduce overall journey times and improving accessibility (or reach) of the network.</td>
</tr>
<tr>
<td>2. Increase effective capacity</td>
<td>The reduced dwell time (and hence journey time) potential of the adopted customer focussed information systems will allow for the station to accommodate more vehicles per hour increasing effective capacity for growth.</td>
</tr>
<tr>
<td>3. Improve journeys times and reliability</td>
<td>As above – reduced dwell times will improve journey times, reducing the likelihood of highly variable dwell times will also assist in improving reliability.</td>
</tr>
<tr>
<td>4. Improve customer experience</td>
<td>Improved information systems will provide enhanced legibility of the stations, giving customers confidence about where to wait and what service will turn up.</td>
</tr>
<tr>
<td>5. Increase efficient operations</td>
<td>Improvements to capacity as a result of journey time improvements will allow for existing services to operate faster with less operating hours for the same services.</td>
</tr>
<tr>
<td>6. Protect and shape the city</td>
<td>Improved travel times and reliability delivered by the Brisbane Metro supports businesses and residents with fast convenient access to employees, jobs, education and services. It will enable workers and businesses to quickly connect and collaborate, with reduced travel time between key economic precincts.</td>
</tr>
<tr>
<td>7. Create identity and legacy</td>
<td>Brisbane’s city image is improved through a faster, more reliable transit system for residents and visitors.</td>
</tr>
</tbody>
</table>

Table 6.15 – Brisbane Metro systems outcomes against principles

6.9 Summary and Next Steps

Brisbane Metro is a suite of five key elements:

- Network and service changes
- Policy and operational changes
- Existing, upgraded and new infrastructure
- New vehicle fleet
- New vehicle management and passenger information systems

The network and service changes evolve the network from one which is almost exclusively a direct service model, to a hybrid network approach, which incorporates some services feeding to a simple, legible higher frequency trunk network of metro services on the busway, while concurrently retaining operation of selected high performing direct services to the CBD. This strategy will allow flexibility for growth by incorporating some bus route truncations at metro stations to reduce the number of bus services into the CBD, thereby reducing congestion and achieving better utilisation of fleet and infrastructure. At the same time, customers will benefit from improving legibility and better, convenient connectivity to a wider range of growth destinations. This network approach would also be readily expandable if the metro coverage were to extend geographically in the future.

Policy and operations changes principally address long and inconsistent dwell times through the implementation of off board ticketing and multi-door boarding combined with simpler bus operations.

Infrastructure changes are targeted at unlocking key constraints on the existing busway to facilitate growth in services and customer volumes. This includes the elimination of some
intersection delays, through grade separations as well as station and platform delays through platform lengthening or augmented station capacity.

Vehicle changes will see the introduction of the high-capacity metro vehicles enabling more efficient busway operations, allowing more people to be carried with fewer vehicles for lower overall operating costs per passenger. This also provides the capacity for growth on the network.

Changes to systems revolve around improved information and management of the system to better manage congestion, incidents and events.

The overall suite of initiatives proposed as part of the Brisbane Metro solution is expected to result in positive outcomes relative to the project principles namely:

- Improved accessibility and connectivity
- Increased effective capacity
- Improved journey times and reliability
- Improved customer experience
- More efficient operations
- Protecting and shaping the city
- Creating identity and legacy.

The detailed analysis of the customer and product outcomes and benefits are discussed further in Chapter 7 while the city and place outcomes and benefits are discussed in Chapter 8. The customer and product analysis then provides a base for a number of these benefits to be captured in the economic analysis.