Lytton Road - Wynnum Road Corridor Upgrade Feasibility Study
Main Report

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Volume 2  Crash Data Report
Volume 3  Road Safety Audit
Volume 4  Structural Report (Canning Bridge Options)
Volume 5  Traffic and Transport Report
Volume 6  Pedestrian Access Mobility Plan (PAMP)
Volume 7  Public Transport Assessment
Volume 8  Environmental Approval Report
Volume 9  Geotechnical Report
Volume 10 Public Utility Plant Report
Volume 11 Urban Design Report
Volume 12 CGI Cost and Risk Report

Addendum
Concept Layout Drawings
EXECUTIVE SUMMARY

The Lytton Road – Wynnum Road corridor is designated as an arterial route and regional radial. Its primary transport function is to provide east-west access between catchment suburbs/commercial centres and the CBD and adjacent areas. It does not have a strong interaction to the south, except to Woolloongabba and East Brisbane via Wellington Road and Latrobe Street.

The Lytton Road – Wynnum Road corridor west of Riding Road, carries around 40,000 to 50,000 vehicles per day.

Shafston Avenue is a 750m long four lane divided road extending between Main Street - Bradfield Highway in Kangaroo Point and the Lytton Road/Wellington Road intersection in East Brisbane.

The Clem Jones Tunnel is currently under construction, with completion expected in 2010. The tunnel will extend approximately 5km between Ipswich Road in Woolloongabba and Lutwyche Road in Windsor. The tunnel project includes a new river crossing parallel to Story Bridge (Bradfield Highway) and upgrade of Shafston Avenue to provide northbound entry to the tunnel and southbound exit from the tunnel. Traffic patterns and volumes will however remain relatively unchanged on the Lytton Road – Wynnum Road corridor after the opening of the tunnel.

Running east from the end of Shafston Avenue, Lytton Road is generally a four lane undivided road, approximately one kilometre in length, extending between the Shafston Avenue / Wellington Road intersection and Wynnum Road at Norman Creek in East Brisbane.

The section of Wynnum Road between Lytton Road and Hawthorne Road is a four lane undivided road, approximately one kilometre in length.

Between Hawthorne Road and Riding Road, Wynnum Road and Balmoral Street form a couplet. Balmoral Street is a two lane eastbound road. Between Hawthorne Road and Bennetts Road, Wynnum Road is a two lane one-way westbound road, and between Bennetts Road and Riding Road, Wynnum Road is a four lane two-way road.

WorleyParsons were commissioned by Council to undertake a feasibility study along the corridor from Main Street to Riding Road. The purpose of the feasibility study was to:

- Determine the current and future traffic demand for the Lytton Road – Wynnum Road corridor and key intersecting roads;
- Identify, analyse and ran options for addressing the strategic and project objectives for the Lytton Road – Wynnum Road corridor between Main Street and Riding Road;
- Prepare concept plans for each option, including determination of land acquisition requirements;
- Determine the environmental impact and potential mitigation strategies for each option; and
- Develop comparative costs and benefits for each option including Cost Benefit Analysis.
Travel time surveys undertaken by the project team indicated that there is a higher level of congestion delay on the corridor during the AM peak period over the PM period and suggests that a higher benefit may be realised by the provision of upgrades in the inbound direction rather than the outbound direction.

Traffic modelling has indicated that Wynnum Road / Lytton Road corridor will experience negligible growth to 2026, even with the CLEM 7 Tunnel in operation. The fact that the corridor west of Hawthorne Road is near or at capacity limits the growth potential of the corridor.

Some priority for buses is currently provided by the AM peak hour bus lane which runs along part of the Wynnum Road side of the couplet between Riding Road and Hawthorne Road. Existing provision for active transport is generally of a low standard, with no current on road bike facilities.

The corridor has number of sub-standard road elements, with the horizontal curve at the Heidelberg Street intersection of particular concern considering the function of the route.

A large number of options were developed for the corridor. There were three (3) main options, with a number of sub-options. These were broadly as follows:

- Option 4 (4A /4B /4C) – generally retains the existing four (4) lane corridor with targeted intersection upgrades to provide increased traffic capacity and bus/cyclist priority;
- Option 5 (5A/ 5B / 5C) – five (5) lanes (with or without inbound bus / HOV lane);
- Option 6 (6A /6B /6C) – six (6) lanes (with or without inbound bus / HOV lane).

Traffic modelling of the options indicated that Option 5 and Option 6 provided similar corridor capacity performance. The addition of the additional sixth lane attracted additional traffic to the corridor which reduced the benefit of providing the additional capacity.

Considering intersection performance, Option 6C with additional lanes as general traffic lanes provides the highest level of service. Again the performance is only marginally superior to the equivalent Option 4C and 5C.

Taking both the strategic and intersection level performance of the various options that have been tested, Option 6C with additional general traffic lanes provides the greatest capacity relief to the Wynnum Road corridor, whilst also maintaining a generally satisfactory level of service for key intersections. However it is noted that there is generally no significant improvement to the corridor capacity / intersection operation under Options 6C compared to Options 4C and 5C. In fact, Option 4C is often at a superior level of performance for a number of intersections.

The intersections that form the current Wynnum Road / Balmoral Street couplet operated at a higher level of service with the existing couplet retained.

Cost estimates were developed for each option and property acquisition requirements were identified. Options 5 and 6 had a high capital cost associated with them and significant property acquisition requirements.
The benefit cost ratio for each option was also calculated and the summary results are shown on Table 0.1 below. The figures in () for Option 4C are if an interim scheme at the Heidelberg Street curve is adopted.
### Table 0.1 - BCR Calculations Summary

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Option 3</th>
<th>Option 4A</th>
<th>Option 4B</th>
<th>Option 4C</th>
<th>Option 5A</th>
<th>Option 5B (GT)</th>
<th>Option 5B (BL)</th>
<th>Option 5C (GT)</th>
<th>Option 5C (BL)</th>
<th>Option 6A</th>
<th>Option 6B (GT)</th>
<th>Option 6B (BL)</th>
<th>Option 6C (GT)</th>
<th>Option 6C (BL)</th>
<th>Option 6C (BL)</th>
</tr>
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<tbody>
<tr>
<td>Vehicle Benefits</td>
<td>$39.6M (100%)</td>
<td>$67.0M (86%)</td>
<td>$60.0M (85%)</td>
<td>$87.9M (78%) (GT)</td>
<td>$15.8M (35%)</td>
<td>$77.4M (83%)</td>
<td>$19.2M (37%)</td>
<td>$68.1M (81%)</td>
<td>$25.6M (45%)</td>
<td>$4.7M (13%)</td>
<td>$121.5M (87%) (GT)</td>
<td>-$8.5M (-32%)</td>
<td>$104.5M (86%) (GT)</td>
<td>$13.3M (28%)</td>
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<tr>
<td>Public Transport (Bus) Benefits</td>
<td>-</td>
<td>$8.5M (10%)</td>
<td>$8.5M (12%)</td>
<td>$9.3M (9%) (GT)</td>
<td>$17.6M (39%)</td>
<td>$4.3M (5%)</td>
<td>$20.8M (40%)</td>
<td>$4.3M (5%)</td>
<td>$20.2M (35%)</td>
<td>$18.6M (53%)</td>
<td>$5.4M (4%)</td>
<td>$23.0M (87%) (GT)</td>
<td>$5.4M (4%)</td>
<td>$22.5M (47%)</td>
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<tr>
<td>Crash Reduction Benefits</td>
<td>-</td>
<td>$2.7M (4%)</td>
<td>$2.0M (3%)</td>
<td>$11.6M (2%) (GT)</td>
<td>$11.6M (26%)</td>
<td>$11.6M (12%)</td>
<td>$11.6M (23%)</td>
<td>$11.6M (14%)</td>
<td>$11.6M (20%)</td>
<td>$12.1M (34%)</td>
<td>$12.1M (9%)</td>
<td>$12.1M (45%) (GT)</td>
<td>$12.1M (10%)</td>
<td>$12.1M (25%)</td>
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<td>TOTAL BENEFITS</td>
<td>$39.6M</td>
<td>$78.1M</td>
<td>$70.5M</td>
<td>$108.9M (GT)</td>
<td>$45M</td>
<td>$93.3M</td>
<td>$51.5M</td>
<td>$84M</td>
<td>$57.4M</td>
<td>$35.4M</td>
<td>$139.0M</td>
<td>$26.6M</td>
<td>$122.0M</td>
<td>$47.9M</td>
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<td>Costs</td>
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<td>Capital Costs</td>
<td>$0.1M (43%)</td>
<td>$60.1M (95%)</td>
<td>$31.6M (92%)</td>
<td>$90.7M (96%) (GT)</td>
<td>$170.7M (97%)</td>
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<td>$199.5M (97%)</td>
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<td>Operation and Maintenance Costs</td>
<td>$0.13M (56%)</td>
<td>$3.1M (5%)</td>
<td>$2.8M (8%)</td>
<td>$3.5M (4%) (GT)</td>
<td>$5.8M (3%)</td>
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<td>$5.7M (3%)</td>
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<td>$6.4M (3%)</td>
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<tr>
<td>TOTAL COSTS</td>
<td>$0.23M</td>
<td>$63.2M</td>
<td>$34.4M</td>
<td>$94.2M (GT)</td>
<td>$176.5M</td>
<td>$176.7M</td>
<td>$176.7M</td>
<td>$155.5M</td>
<td>$155.5M</td>
<td>$206.1M</td>
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<td>BENEFIT COST RATIO (BCR)</td>
<td>172</td>
<td>1.24</td>
<td>2.05</td>
<td>1.15 (1.35)</td>
<td>0.25</td>
<td>0.53</td>
<td>0.29</td>
<td>0.54</td>
<td>0.37</td>
<td>0.17</td>
<td>0.67</td>
<td>0.13</td>
<td>0.63</td>
<td>0.25</td>
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Finally a Multi Criteria Analysis was undertaken on all options to determine the preferred option. The recommended option for further investigation and design was Option 4C which will incorporate the following intersection and corridor improvements;

- Additional inbound traffic lane at the Lytton Road / Wellington Road/ Shafston Avenue intersection;
- Additional inbound traffic lane at the Lytton Road / Latrobe Street intersection;
- Additional inbound lane at the Lytton Road / Heidelberg Street intersection;
- Signalisation of the Wynnum Road / Laidlaw Parade intersection, incorporating a protected right turn lane into Laidlaw Parade;
- Improvements at the Wynnum Road / Norman Avenue intersection including the addition of a short inbound traffic lane and lengthening of the right turn lane into Norman Avenue.
- Additional inbound lane on the Wynnum Road / Riding Road / Balmoral Street intersection.
- Provision of an additional general traffic lane from Scanlan Street to Wellington Street. At the Lytton Road / Shafston Avenue / Wellington Street intersection, the additional lane is achieved by conversion of the existing right turn lane into a through lane and the removal of the right turns into Wellington Street. Right turns to access the Wellington Street precinct can be undertaken further to the west at the recently constructed Shafston Avenue / O’Connell Street intersection. It is noted that the intersection works at the Lytton Road / Shafston Avenue / Wellington Street intersection are being undertaken as part of the Clem 7 tunnel project.

The option incorporates the following public transport elements;

- Provision of a bus only stand up lane at the Wynnum Road / Bennetts Road intersection.
- Extension to the east of the existing a.m. peak hour Wynnum Road inbound bus lane from the current starting point adjacent to Hipwood Street to the Wynnum Road / Bennetts Road intersection. This benefit would require the prohibition between 0700 and 0900 of the currently unrestricted on street residential parking along the south side of Wynnum Road.
- Extension to the west of the existing a.m. peak hour Wynnum Road inbound bus lane from the termination point at the Hawthorne Road intersection to a point immediately west of Overend Street.
- Rationalisation of bus stops and indentation of bus stops at Norman Avenue.

Active Transport improvements associated with Option 4C include:

- Provision of a wide 4.5 m wide inbound kerbside lane between Riding Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.
• Provision of inbound on road bike lane from Overend Street to Laidlaw Parade.
• Provision of outbound on road bike lane from Laidlaw Parade to Riding Road, except the bike lane is discontinuous between Norman Avenue and Hawthorne Road.
• Provision of a 3.0 m wide off road cycle path on the northern verge from Riding Road to Laidlaw Parade.

Road geometry upgrades to improve road safety incorporated into the option include:
• Upgrade of the Wynnum Road curve around the perimeter of the cemetery at the Riding Road intersection to 60km/h.
• Upgrade of the Wynnum Road inbound curve at Bennetts Road to 50km/h design speed with curve widening for semi trailers.
• Improvement of the vertical alignment at the Hawthorne Road intersection to provide Safe Stopping Distance (SSD), Minimum Gap Sight distance (MGSD) and Manoeuvring Sight Distance (MSD) for a for a 1.15m driver height to 0.6 m (indicator at rear of vehicle) for a 60 km/hr. This is considered a minimum design standard and can be achieved for a relatively low cost by filling to the east of the existing crest.
• Upgrade of the inbound horizontal alignment approaching the Hawthorne Road intersection to a design speed of 60km/h.
• Upgrade of the Balmoral Street horizontal geometry to a 60 km/h design speed.
• Upgrade of the horizontal curve at Heidelberg Street to a 60km/h design speed, with provision of a central median and curve widening for semi trailer vehicles.
• Cul-de-sacing of Eskgrove Street intersection with Lytton Road.

The option will result in improved AM peak hour intersection performance along the corridor and will achieve travel time savings for bus passengers in the order of 4 minutes during the AM Peak.

The option has the ability to accommodate future upgrade to an Option 5 solution. In fact the option could be considered as a staged Option 5 solution.

The feasibility study total capital cost has been estimated at $90.7M with property acquisition costs of $37.7M, with seventy eight (78) properties requiring resumption.

The Option 4C could be constructed in six (6) distinct stages. The recommend stages would be;

• **Stage 1** - Construction of additional inbound general traffic lane from Scanlan Street to Wellington Road including the upgrade to the Heidelberg Street curve to achieve a 60 km/hr design speed. The total capital cost for this stage has been estimated at $34M;
• **Stage 2** - Upgrade to Norman Avenue intersection incorporating the addition of a short inbound traffic lane and lengthening of the right turn lane into Norman Avenue. The total capital cost for this stage has been estimated at $21.3M;
• **Stage 3** - Extension of inbound am peak bus only lane from Riding Road to immediately west of Overend Street including improvements to Riding Road, Bennetts Road and Hawthorne Road intersections including vertical geometry improvement at Hawthorne Road intersection. The total capital cost for this stage has been estimated at $16.9M;

• **Stage 4** - Upgrade to Balmoral Street horizontal geometry and incorporation of on road bike lanes. The total capital cost for this stage has been estimated at $2.3M;

• **Stage 5** - Widening between Overend Street and Laidlaw Parade, and incorporating on road bike lanes and widened off road bike path. The total capital cost for this stage has been estimated at $15.9M. This stage includes an estimated allowance of $4.2M for the rehabilitation of the Canning Bridge;

• **Stage 6** - Signalisation of Laidlaw Parade Intersection. The total capital cost for this stage has been estimated at $0.3M;

Option 4C could be upgraded to the five (5) lane option 5C by construction of the following works;

• An additional inbound lane from Overend Street to Norman Crescent and from Bodalla Street to Scanlan Street;

• Widening of the Canning Bridge;

The additional feasibility study total capital cost to upgrade Option 4C to Option 5C has been estimated at $59.1M, with additional property acquisition costs of $28.3M. The upgrade includes an estimated allowance of $4.2M for the widening of the Canning Bridge.
1. INTRODUCTION

1.1 Purpose of this Report

The purpose of this feasibility study is to:

- Determine the current and future traffic demand for the Lytton Road – Wynnum Road corridor and key intersecting roads;
- Identify, analyse and plan options for addressing the strategic and project objectives for the Lytton Road – Wynnum Road corridor between Main Street and Riding Road;
- Prepare concept plans for each option, including determination of land acquisition requirements;
- Determine the environmental impacts and potential mitigation strategies for each option; and
- Develop comparative costs and benefits for each option including Cost Benefit Analysis.

1.2 Study Area

The study area is shown in Figure 1.1 below and extends along the Lytton Road – Wynnum Road corridor from Main Street in the west to Riding Road in the east.
1.3 Background

The Lytton Road – Wynnum Road corridor is designated as an arterial route and regional radial. Its primary transport function is to provide east-west access between catchment suburbs/commercial centres and the CBD and adjacent areas. It does not have a strong interaction to the south, except to Woolloongabba and East Brisbane via Wellington Road and Latrobe Street.

The Lytton Road – Wynnum Road corridor west of Riding Road, carries around 40,000 to 50,000 veh/day.

Shafston Avenue is a 750m long four lane divided road extending between Main Street - Bradfield Highway in Kangaroo Point and the Lytton Road/Wellington Road intersection in East Brisbane.

The Clem Jones Tunnel is currently under construction, with completion expected in 2010. The tunnel will extend approximately 5km between Ipswich Road in Woolloongabba and Lutwyche Road in Windsor. The tunnel project includes a new river crossing parallel to Story Bridge (Bradfield Highway) and upgrade of Shafston Avenue to provide northbound entry to the tunnel and southbound exit from the tunnel. Traffic patterns and volumes will however remain relatively unchanged on the Lytton Road – Wynnum Road corridor after the opening of the tunnel.

Running east from the end of Shafston Avenue, Lytton Road is generally a four lane undivided road, approximately one kilometre in length, extending between the Shafston Avenue / Wellington Road intersection and Wynnum Road at Norman Creek in East Brisbane.

The section of Wynnum Road between Lytton Road and Hawthorne Road is a four lane undivided road, approximately one kilometre in length.

Between Hawthorne Road and Riding Road, Wynnum Road and Balmoral Street form a couplet. Balmoral Street is a two lane eastbound road. Between Hawthorne Road and Bennetts Road, Wynnum Road is a two lane one-way westbound road, and between Bennetts Road and Riding Road, Wynnum Road is a four lane two-way road.

1.4 Planning Context

Transport Plan for Brisbane 2008 – 2026

The Transport Plan for Brisbane has been developed as an Integrated Local Transport Plan (ILTP) under the objectives of the South East Queensland Regional Plan and Integrated Regional Transport Plan (IRTP) for South East Queensland. As such, the ILTP supports the IRTP by seeking to integrate local, regional and state transport planning priorities.

The Transport Plan for Brisbane sets out the commitment of the City Council to focus on specific ‘transport corridors’ which are the major arterial routes through the city.

Key elements of targeted improvements for these corridors are:

- Additional road space
• Additional public transport
• Provision of walking and cycling facilities
• Improved signal co-ordination

One of the vehicles by which identified schemes are to be delivered is the Road Action Programme (RAP), of which this study forms part.

Increases in available road space and corridor capacity need to be balanced by high quality provision for public and active transport to ensure that the benefits derived from any corridor upgrade are not eroded by the encouragement onto the network of considerable additional numbers of private vehicles.

The Transport Plan for Brisbane addresses this issue by setting out to ensure that the transport network within the city is designed to maintain a suitable level of service for both private and public transport, and at all hours of the day, including the morning peak.

One of the key elements in achieving this goal is the setting of achievable mode share targets to contribute towards the benefits made available by delivery of the plan. These include:

• Improvement of air quality and reduction of greenhouse gases
• Improved urban design
• Facilitation of economic growth
• Safeguarding of Brisbane’s liveability
• Increased accessibility to employment, educational and community facilities
• Protection of environmental health
• Promotion of greener travel

To contribute towards the desired outcomes outlined in the Transport Plan for Brisbane this scheme should deliver a framework by which:

• Quality of public transport provision can be enhanced
• Travel demand can be managed
• Transport and land use planning can be co-ordinated
• Safety and efficiency of the corridor is improved
• Freight can be punctually delivered to the right place
• More cleaner and greener personal transport can be employed
1.4.1 Translink Draft Network Plan

The TransLink Network Plan is intended to guide the delivery of better public transport services and infrastructure across the south east region. The key elements of the TransLink Network Plan are a 10-year plan for developing the public transport network (2004 to 2014) and 4-year rolling program of public transport service and infrastructure improvements (2005/04 to 2007/08).

Listed under the 10-year plan is the action to ‘plan and implement priority bus corridor’ relating to Shafston Avenue and Lytton Road from Main Street to Heidelberg Street.

1.4.2 Action Plan for Walking, 2008 - 2010

The Action Plan for Walking 2008 – 2010 is written by Queensland Transport (QT) in consultation with the State Pedestrian Committee. The State Pedestrian Committee is comprised of various government and non-government agencies including BCC.

The Action Plan for Walking 2008-2010 sets out eight action areas to encourage walking by providing environments and facilities which support and promote the benefits of walking. The action areas in the Action Plan for Walking 2008-2010 are as follows:

- A culture of walking – create a positive image of walking and actively encourage all members of the public to walk whenever and wherever they can as part of their daily lives.
- Increased inclusive mobility – regardless of age, gender, ability, socioeconomic background, cultural background all individuals should have access to streets, buildings and public transport systems.
- Well designed and managed spaces and places for people – plan for facilities which allow members of the community to live in a healthy, convenient and attractive environment.
- Improved integration of networks – ensure a network of connected, direct and easy to follow walking routes, which are safe, comfortable, attractive and well maintained, linking homes, shops, schools, parks, green spaces and public transport interchanges.
- Supportive land use and spatial planning – develop and advise on land-use and spatial planning policies which allow members of the community to walk to the majority of everyday services and facilities, maximising the opportunities for walking and reducing car dependency.
- Reduced road danger – streets designed for enjoyable safe walking, clear of obstacles and free of conflict with vehicles.
- Increase security and safety – the urban environment is designed, maintained and observed to increase safety and reduce perceived fear.
- More supportive authorities – government agencies and other key stakeholders committed to planning for and promoting walking.
For each action area, individual actions are outlined with lead and partner agencies identified. Individual actions with greatest relevance to Lytton Road - Wynnum Road Feasibility Study are identified in Table 1.1 below.

Table 1.1 - Individual Action Items with Greatest Relevance to Lytton/Wynnum Roads Corridor Project

<table>
<thead>
<tr>
<th>Action</th>
<th>Lead agency</th>
<th>Partner agencies</th>
<th>Target group</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>4) Improved integration of networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 Encourage the improvement of walking and cycling routes to all major centres, bus interchanges, railway stations and ferry terminals.</td>
<td>Councils / BCC</td>
<td>QT, LGAQ, SIA, COTA</td>
<td>All groups</td>
<td>O</td>
</tr>
<tr>
<td>4.5 Explore opportunities to incorporate and support walking within planning.</td>
<td>QT</td>
<td>MR, SRQ, LGAQ, HF</td>
<td>All groups</td>
<td>M</td>
</tr>
<tr>
<td>4.7 Promote pedestrian access to public transport facilities.</td>
<td>QT</td>
<td>MR, LGAQ</td>
<td>All groups</td>
<td>M</td>
</tr>
<tr>
<td>5) Supportive land use and spatial planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5 Encourage school environments that promote walking, cycling and public transport use.</td>
<td>Councils / BCC</td>
<td>QT, LGAQ, QH</td>
<td>Younger pedestrians</td>
<td>O</td>
</tr>
<tr>
<td>5.6 Incorporate appropriate pedestrian and cycling facilities in relevant infrastructure projects on state controlled roads.</td>
<td>MR</td>
<td>QT, LGAQ, BCC</td>
<td>All groups</td>
<td>S</td>
</tr>
<tr>
<td>5.7 Incorporate safe and convenient walking and cycling facilities in all relevant transport and traffic projects and other appropriate projects such as road/intersection upgrades and parkland/waterway enhancements.</td>
<td>Councils / BCC</td>
<td>QT, LGAQ, SIA, QH, COTA</td>
<td>All groups</td>
<td>O</td>
</tr>
<tr>
<td>6) Reduced road danger</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 Pursue opportunities to enhance pedestrian safety based on crash data analysis and road safety audits.</td>
<td>MR</td>
<td>LGAQ, BCC, CARRS-Q, COTA</td>
<td>All groups</td>
<td>O</td>
</tr>
<tr>
<td>6.5 Improve pedestrian safety and convenience at signalised intersections</td>
<td>Councils / BCC</td>
<td>QT, LGAQ, MR, SIA, CARRS-Q, COTA</td>
<td>All groups</td>
<td>M</td>
</tr>
</tbody>
</table>
Priority Legend

- Short term (S) - to be started in 2008
- Medium term (M) - to be started in 2009
- Long term (L) - to be started in 2010
- Ongoing (O) - to be started in 2008 and continued for the life of the action plan

The above actions are considered to represent sound principles for encouraging walking and should be applied where reasonable and practical to do so.

1.4.3 South East Queensland Principal Cycle Network Plan

Cycling is supported at state level by the South East Queensland Principal Cycle Network Plan (PCNP) and at local government level by the Brisbane Active Transport Strategy: Walking and Cycling Plan 2005-2010.

The PCNP, prepared by QT in consultation with the Department of Main Roads (DMR) and BCC provides a framework for future cycle network planning across the south east region. The PCNP identifies principal cycle routes which serve as connections between population areas and activity centres. It is the intention of the PCNP that these principal routes form spines from which local cycle networks are built. In the preparation of the PAMP in Volume 6 it was therefore essential that principal routes and local routes were considered concurrently.

The PCNP principal routes within the study area are shown in SEQ Principal Cycle Network Figure 1.2
Figure 1.2 - SEQ Principal Cycle Network Map 8
1.5 Project Objectives, Outcomes and Deliverables

The Council’s Transport Plan for Brisbane 2008 – 2026 outlines six (6) strategic objectives to be achieved by future transport development within the city. The objectives are shown below, together with the desired strategic outcome and project specific deliverables for the achievement of each.

1.5.1 Strategic Objective 1 – Quality Public Transport

Desired Outcome
Public transport is the preferred mode of travel to the city’s major centres. It provides a high level of access to all facilities and services in Brisbane, reducing the need to use a car.

Project Deliverables
Deliver enhanced bus priority and appropriately located bus stops, consistent with the corridor’s role as a public transport link for buses.

1.5.2 Strategic Objective 2 – Manage Travel Demand

Desired Outcome
A sustainable level of travel demand where the growth in traffic is less than the growth in population.

Project Deliverables
Deliver enhanced bus, cyclist and pedestrian facilities which will encourage changes in travel behaviour.

1.5.3 Strategic Objective 3 – Coordinated Transport and Land Use

Desired Outcome
Transport and land uses are managed to create a preferred urban form that increases accessibility and connectivity and supports sustainable travel behaviour.

Project Deliverables
Deliver improved access to Wynnum Central, which is a major centre, and improved connectivity with Morningside station.

1.5.4 Strategic Objective 4 – Safe and Efficient Road Network

Desired Outcome
People and goods can move safely on the road network by the most efficient modes and routes, and the impact of traffic on neighbourhoods and the environment is minimised.
Project Deliverables
Deliver an upgraded road corridor, consistent with the function of a Regional Radial route to provide connections with the metropolitan area and connect with the intra-state road network.

1.5.5 Strategic Objective 5 – Deliver Goods on Time to the Right Place
Desirable Outcome
Freight moves efficiently and safely within Brisbane while the liveability of residential areas is protected.

Project Deliverables
Deliver an upgraded road corridor, consistent with the function of a Secondary Freight Route to accommodate urban and local freight movements.

1.5.6 Strategic Objective 6 – More Clean and Green Transport
Desirable Outcome
Clean and green personal transport is safe and attractive and provides a genuine alternative to driving.

Project Deliverables
Deliver improved off road and/or on road cycling facilities and improved pedestrian facilities, which connect with adjacent and intersecting pedestrian/cyclist facilities and destinations.

1.6 Risk Management

1.6.1 Risk Assessment Process
The project team have utilised Brisbane City Council’s formalised process for the identification and management of business and project risks so that the best objectives can be achieved.

The process is based on the Australian and New Zealand Standard for Risk Management AS/NZS 4360:2004, which is considered an international benchmark standard in risk management.

As an initial step in the risk management process the Client had developed a provisional list of risks using a project risk template which was populated prior to a Risk Workshop held as part of this study. All entries on the provisional list were reviewed and amended / agreed during the workshop.

Where a risk was identified and considered credible the inherent risk, current controls and possible consequences were investigated and recorded. The risk was then characterised based on the identified consequence and likelihood of occurrence using a risk matrix.

The overall process involved the following steps:
The project risks are identified involving key stakeholders in the project. 

The risks are evaluated, analysed and prioritised into broad categories (e.g. extreme, very high, high, medium and low risks), based on the likelihood of the risk occurring, and the consequences if it were to occur.

The critical risks are assessed and treated – treatment can include actions to reduce either the likelihood or the consequences or both, the transfer of risks to another party more suitable to accept such risks, or the acceptance and on-going management of a risk. The treatment of a risk may involve allocating some money to cover the treatment.

Opportunities are also identified utilising this process by focusing on the possible additional benefits which could be extracted.

The output from this process is a Risk Management Plan, which includes the following document:

- Risk Register, Risk Treatment Plan and Risk Action Plan.

### 1.6.2 Risk Assessment Summary

The assessment and workshop process did not result in any risks being identified as having a residual risk of “Extreme” or “Very High” although the following risks were assessed as having a residual risk of “High”:

- Community expectations greater than scope of project (Community)
- Local businesses non supportive of project (Political)
- Funding Risk – project does not receive necessary full funding (Financial)
- Promised cash-flow not available in future years – unable to get commitment for full project (Financial)
- Delays to program due to land acquisitions (Program, Delivery and Co-ordination)

The full workshop output by category of risk can be summarised as follows:-

<table>
<thead>
<tr>
<th>Residual Risk</th>
<th>Extreme</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Negligible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>132</td>
<td>86</td>
<td>23</td>
</tr>
</tbody>
</table>
The full workshop risk assessment findings are presented in Volume 1 report entitled “Risk Management Report”.
2. EXISTING CONDITIONS

2.1 Existing Road Features

The Lytton Road – Wynnum Road corridor is designated as an arterial route and regional radial. Shafston Avenue is a 750m long four lane divided road extending between Main Street - Bradfield Highway in Kangaroo Point and the Lytton Road/Wellington Road intersection in East Brisbane.

Running east from the end of Shafston Avenue, Lytton Road is generally a four lane undivided road, approximately one kilometre in length, extending between the Shafston Avenue / Wellington Road intersection and Wynnum Road at Norman Creek in East Brisbane.

The section of Wynnum Road between Lytton Road and Hawthorne Road is a four lane undivided road, approximately one kilometre in length.

Between Hawthorne Road and Riding Road, Wynnum Road and Balmoral Street form a couplet. Balmoral Street is a two lane eastbound road. Between Hawthorne Road and Bennetts Road, Wynnum Road is a two lane one-way westbound road, and between Bennetts Road and Riding Road, Wynnum Road is a four lane two-way road.

The existing lane widths along the corridor vary, but are typically in the range of 2.8m to 3.1m.

The posted speed on the corridor for the length of the study area is 60 km/hr.

Table 2.1 below provides a summary of the existing standard of the horizontal geometry along the study corridor.

<table>
<thead>
<tr>
<th>Location</th>
<th>Existing Design Speed</th>
<th>Curve Widening</th>
<th>Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lytton Road - Heidelberg Street Intersection</td>
<td>40km/hr</td>
<td>No</td>
<td>R36 (outbound kerb lane)</td>
</tr>
<tr>
<td>Wynnum Road - Canning Bridge</td>
<td>60km/hr</td>
<td>19m Semi Trailer</td>
<td>R190</td>
</tr>
<tr>
<td>Wynnum Road / Norman Ave Intersection</td>
<td>50km/hr (outbound)</td>
<td>No</td>
<td>R70 (outbound)</td>
</tr>
<tr>
<td></td>
<td>60km/hr (inbound)</td>
<td></td>
<td>R145 (inbound)</td>
</tr>
<tr>
<td>Wynnum Road – Overend Street / Kingsbury Street</td>
<td>60km/hr</td>
<td>No</td>
<td>R 195</td>
</tr>
<tr>
<td>Wynnum Road - Hawthorne Road Intersection</td>
<td>60km/hr</td>
<td>No</td>
<td>R100</td>
</tr>
</tbody>
</table>
From the table above it is evident that the horizontal geometry does not accommodate a 60 km/hr design speed over the entire length of the corridor.

With respect to vertical geometry along the study corridor, the only existing sub-standard element is the vertical curve at the Wynnum Road / Hawthorne Road intersection which has an existing radius of R320. On the outbound approach to the intersection, safe stopping distance (SSD) and Safe Intersection Sight Distance (SISD) to the left turn movements from the Wynnum Road leg of the couplet is not available for a 60 km/hr design speed. Additionally Minimum Gap Sight Distance (MGSD) is not available to vehicles approaching from the west. This is particularly an issue for vehicles exiting the driveways to the east of the intersection on Balmoral Street. Manoeuvre Sight Distance (MSD) is not available for vehicles approaching from the west to vehicles exiting driveways or to buses entering or exiting the bus stop on Balmoral Street.

### 2.2 Crash Data

Crash data from a search of Queensland Transport’s Webcrash database was supplied by Council for the years 2003 to 2009 inclusive. This search is considered to represent data from the most recent four (4) to five (5) year period for which records are available.

A period of this duration is considered appropriate for the achievement of statistical reliability as a longer period is likely to include crashes which occurred under historical road layouts or features which may have been causal factors.

Following review of the data for the last five years, a Crash Data Report was produced to assess crashes that have occurred within the study corridor, identify any crash clustering or common factors and provide recommendations to inform the planning and design of proposed upgrade options for the corridor.

The methodology for undertaking the crash study was based on the processes outlined in Part 4 of the Austroads Guide to Traffic Engineering Practice: Treatment of Crash Locations (2003) and is outlined below:
The review, which considered 207 crashes recorded within the limits of the study corridor from 2003 to 2008 inclusive, found that 45% of these were rear-end crashes and that a further 18% involved vehicles travelling in opposing directions.

For a study corridor which contains seven (7) signalised intersections, numerous priority intersections and direct property accesses while also experiencing significant traffic congestion at peak times, the occurrence of such crashes is not unexpected.

Common causes for such crashes include:

- Inattention to vehicles stopped at traffic signals;
- Inattention to vehicles stopped to complete turns from Wynnum Road – Lytton Road into minor streets (at priority controlled intersections and property accesses);
- Misjudging turns in the face of oncoming traffic; and
- Disobeying traffic signals.

While such causes are generally the result of driver error or inattention, improvement of the existing road layout may reduce the likelihood of such crashes. As part of the development of upgrade options for the study corridor it is recommended that, where possible, road layout features are developed to minimise the likelihood of the crashes identified by this study.

For the corridor as a whole, this would include:

- Signal control at intersections being conspicuous to approaching traffic;
- Legibility of intersections being clear to approaching traffic;
- Limiting turning movements from through traffic lanes (including turns into properties and intersections), by providing auxiliary turning lanes; and
- Rationalising turning movements where possible.

Specifically the road layout at the following locations should also be addressed:

- The appropriateness of allowing all turns access at Eskgrove or Northcote Streets;
- The adequacy of the horizontal geometry of Lytton Road through the Heidelberg Street intersection;
The interaction between cyclists and vehicles turning from the Waldo Street and Wendell Street intersections with Wynnum Road;

The adequacy of horizontal and vertical geometry on Balmoral Street between Hawthorne Road and Riding Road.

It is anticipated that the benefit of crash reductions through changes to road layouts as part of upgrade options will be quantified as part of cost-benefit analysis calculations completed as part of this commission.

For complete details refer to Volume 2 report entitled “Road Crash Data Report”.

### 2.3 Road Safety Audit

A Road Safety Audit of the existing layout of the study corridor was undertaken on 17th and 18th March 2009. The findings of the report are contained in Volume 3 report entitled “Road Safety Audit”.

The study corridor is classified as an “Arterial Route” in the Brisbane City Plan and should be capable of carrying between 20,000 and 30,000 vpd (vehicles per day). The whole of the section being audited has a posted speed limit of 60 km/h.

Driving the corridor in both directions the following issues were immediately apparent:

- Signage along both sides of the road is unclear, being obscured by overgrown vegetation, power poles or other signs.
- Pavement widths and lane widths are generally narrow for the corridor’s position in the road hierarchy and for the volume of traffic it carries.
- There are direct accesses to properties along the length of the corridor and motorists wishing to access properties on the right hand side of the road make turns from the right hand general traffic lane. At peak times, the need to find a gap in two lanes of opposing traffic and the desire to avoid delaying following vehicles may see motorists execute unsafe right turns.
- Right turn slip lanes are currently only been provided for major intersections along the corridor. Motorists wishing to turn right into the smaller side streets are in a similar position to those wishing to access properties as described above.

### 2.3.1 General Issues

As outlined in the study, the crash history of Wynnum Road shows that the greatest number of crashes involves a vehicle travelling through colliding with a vehicle turning right from the opposing direction (and rear end collision involving two vehicles travelling in the same direction). Of these latter noted crashes, the great majority are of vehicles waiting for a vehicle to turn right being rear-ended by a vehicle following too closely.

Increased numbers of each type of these crashes are indicative of increasing levels of driver frustration, which is characteristic of a road carrying flows in excess of its design capacity.
2.3.2 Pavement Width

For the greater part of Wynnum Road, the pavement and lane widths are substandard. The section of Lytton Road which leads north-east from Heidelberg Street carries the greatest volume of traffic, but has two lanes with widths measured in one location of 2.8m for the kerb lane and 3.1m for the centre in each direction. Curve widening does not appear to have been provided.

The overall situation is further aggravated by the absence of right turn slip lanes on all but signalised intersections, which causes the number of through lanes to be reduced to one while a right turn into a smaller side street or a driveway is being attempted.

The above issues create driver frustration, increasing the risk of unsafe manoeuvres.

This is a high risk situation which could be addressed by, for example, the banning of right turns into driveway accesses or side streets without right turn slip lanes.

In this instance alternative facilities could be provided as follows:

- Creation of U-turn facilities at major signalised intersections for left in / left out manoeuvres
- Divert routes via the local road network
- Construction of additional right turn slip lanes for side streets
- Increased storage for existing right turn slip lanes.

2.3.3 Horizontal Alignment and Delineation

Generally the horizontal alignment and delineation along Wynnum Road is acceptable for an “Arterial Route”. However, there are two areas of particular concern:

The curve at the intersection of Lytton Road and Heidelberg Street is an area of great concern. The combination of a tight radius curve together with narrow lane widths causes motorists to have difficulty staying within their own marked lanes. (See Figure 2.1 below).
Figure 2.1 - Vehicles travelling through the Lytton Road / Heidelberg Street intersection

On each approach to the intersection curve warning signs are provided, together with 40km/h speed warning signs. Despite this, the great majority of motorists seem to drive as close to the 60km/h posted speed limit as possible, encroaching on neighbouring lanes if necessary.

This situation places motorists at a high risk of having a head-on crash and could be addressed by remodelling of the intersection layout by providing a larger radius curve, with curve widening as appropriate, to ensure the intersection can be safely negotiated at the posted 60 km/h speed limit.

Figure 2.2 - Approaching the Wynnum Road & Hawthorne Road intersection
The delineation over the crest at the intersection of Wynnum Road and Hawthorne Road does not provide the necessary Safe Stopping Distance (SSD) for the posted 60km/h speed limit, meaning that motorists can easily lose their way while travelling over the crest (See Figure 2.2 above) and could lead to possible collisions with vehicles seeking to make the uncontrolled right turn immediately over the crest from Wynnum Road into Balmoral Street.

The existing situation could be improved by:

- Increased delineation through the intersection and over the crest, through a combination of signage and line marking.
- Reprofiling of the existing vertical alignment.
- Prohibition of the right turn manoeuvre from Wynnum Road to Balmoral Street.

### 2.3.4 Roadside Hazards

A “clear zone” is an area to the side of the road in which a driver can attempt to regain control of an errant vehicle. The clear zone should be free of objects which might prevent the driver from regaining control or else cause damage to the vehicle and injury to its occupants.

With reference to the Queensland Department of Main Roads Road Planning and Design Manual (RPDM) Figure 7.12, the minimum permissible clear zone size is determined by a combination of design speed and traffic volume.

Brisbane City Council Standard Drawing UMS 122 locates poles and non-frangible trees at 800mm – 1000mm from the invert of the kerb.

During the audit it was noted that new trees were being planted directly behind the kerb on the side of the road. This practice creates two additional hazards:

- If the trees are non-frangible, then there is an increased risk of severe damage to errant vehicles and of injury to those travelling in them.
- Trees planted directly behind the kerb tend to obscure traffic signage, particularly if their foliage is not trimmed regularly.

The presence of substantial hazards in the clear zone presents high risk and these issues should be addressed immediately by, for example:

- Moratorium on the planting directly behind the kerb of tree species that will ultimately become non-frangible.
- Relocation of trees that have already been planted there.
- Relocation of power poles to a position against the property boundaries on either side of the corridor.
2.4 Canning Bridge

The existing Canning Street Bridge was built in 1956 and is therefore approximately 53 years old. Its initial purpose was for the carriage of road, pedestrian and tramway traffic across Norman Creek at its confluence with the Brisbane River. The structure is approximately 50m long, 23m wide and consists of 3 continuous spans.

Tramway operations in Brisbane ceased in 1969 and in the intervening period the tram lines have been surfaced over. The bridge is currently used by general road vehicle and pedestrian traffic only.

As part of this feasibility study and concept design a Level 2 Bridge Inspection was carried out by Brisbane City Works to assess the current condition of the bridge, and this indicates the presence of cracks in both the headstocks and bridge girders. The report entitled “Structural Report (Canning Bridge Options)” forms Volume 4 of this report.

There is no indication of the age or current status of these cracks and therefore it is recommended that a Level 3 inspection be undertaken to determine whether these are superficial or of a more serious nature, i.e. flexural or shear cracks, which would reduce the current or future capacity of the bridge.

2.5 Traffic Issues

The existing daily two-way volumes (pre Clem 7 Tunnel) along the corridor based on modelling using Council's Brisbane Strategic Transport Model (BSTM) are in the order of 56,000 vehicles per day (vpd) on Shafston Avenue, 56,000 vpd on Wynnum Road at the Norman Creek crossing, 49,000 vpd on Wynnum Road West of Hawthorne Road, and 31,000 vpd on the Hawthorne Road / Balmoral Street couplet.

The BSTM modelling indicates that the corridor is operating at or near capacity from Hawthorne Road to Wellington Street. East of Hawthorne Road the corridor is operating below mid-block capacity.

Intersection analysis of the existing intersections was undertaken using Sidra and year 2008 traffic counts. The results of the analysis indicate that the Heidelberg Street intersection (AM peak period) and Norman Avenue intersection (both periods) is operating over capacity. The remaining intersections are operating below capacity.

It is noted, however that the Sidra intersection analysis assumes no effect from downstream queuing. The analysis has indicated that the AM peak queues for the following intersections queue back through the upstream intersections:

- Lytton Road / Wellington Road / Shafston Avenue
- Lytton Road / Latrobe Street
- Wynnum Road / Norman Avenue
As a result, the actual AM peak operations of the Latrobe Street intersection and Hawthorne Road intersection will be worse that that predicted by Sidra, and it is likely that they operate over capacity. This is consistent with site observations made by the project team during AM peak periods.

The analysis has indicated that the PM peak queues for the following intersections queue back through the upstream intersections:

- Lytton Road / Latrobe Street
- Lytton Road / Heidelberg Street

As a result, the actual PM peak operations of the Wellington Road/ Shafston Avenue and the Latrobe Street intersection will be worse that that predicted by Sidra, and it is likely that they operate over capacity.

Full details of the existing corridor’s traffic performance are contained in the Volume 5 report entitled “Traffic and Transport Report”.

2.6 Active Transport Issues

2.6.1 Pedestrians

The existing longitudinal pedestrian facilities within the project corridor generally comprise of shared pathways and footpaths. The standard of shared paths and footpaths varies substantially along the corridor. The details by road segments are as follows;

- Shafston Avenue (Main Street to Wellington Street). Shared paths (width approximately 2.5m) are provided both sides of corridor;
- Lytton Road (Wellington Street to Heidelberg Street). Footpath 1.8m in widths on northern side of corridor, increasing to approximately 3.0m between the path connection from Mowbray Park and Heidelberg Street intersection. A shared path of approximately 3.0m width is provided on the southern side of the corridor; however this width is reduced locally by street furniture, vegetation and signage. The effective width of the path should therefore only be considered to be in the order of 1.5m
- Lytton Road (Heidelberg Street to Canning Bridge) has a 1.0m footpath on both sides of the corridor. The footpath widens to 1.8m on the northern side between Laidlaw Parade and Canning Bridge.
- Wynnum Road (Canning Bridge to Hawthorne Road) has a 2.0m wide shared path on the northern side from Canning Bridge to Norman Avenue, while from Norman Avenue to Hawthorne Road a footpath width of generally 1.6m to 1.8m is provided. The footpath width on the southern side varies between 1.0m and 1.2m.
Wynnum Road and Balmoral Street (Hawthorne Road to Riding Road) have footpaths provided on both sides of Wynnum Road and Balmoral Street and vary in width between 1.0m to 1.2m.

Existing signalised pedestrian crossing points exist at the intersections of the corridor with:

- Riding Road
- Bennetts Road
- Hawthorne Road
- Norman Avenue
- Heidelberg Street
- Latrobe Street
- Wellington Road
- O’Connell Street

There are no signalised mid-block crossing points away from these intersections, except for an underpass of the Canning Bridge. The grade of the paths accessing the underpass is considered to be an accessibility issue. Further, directing corridor users through such a facility is deemed not to meet Crime Prevention through Environmental Design (CPTED) principles.

A full assessment of the existing pedestrian facilities within the study corridor is contained in the Volume 6 report entitled “Pedestrian Access Mobility Plan”.

### 2.6.2 Cyclists

No dedicated on-road cycle facilities are present within the study corridor. Cycling on-road generally requires utilisation of a general traffic lane. Some widening in road carriageway in the vicinity of the Balmoral Street couplet potentially allows cyclists to utilise on-road space clear of general traffic lanes however such widening is generally limited and may also be used for on-road parking of vehicles.

Off-road longitudinal facilities within the project corridor are generally made up of shared pathways and footpaths as described in section 2.6.1 above. The majority of cyclists use the off-road path on the northern side of the corridor.

A full assessment of the existing cycle facilities within the study corridor is contained in the Volume 6 report entitled “Lytton Road – Wynnum Road Corridor Upgrade Feasibility Study, Pedestrian Access Mobility Plan”.

2.7 Public Transport Issues

2.7.1 Travel time and bus priority

Existing bus priority measures along the study corridor are limited to a short length of AM peak hour only inbound bus lane on the Wynnum Road side of the couplet between a point to the east of Hipwood Street and the Wynnum Road / Hawthorne Road intersection.

During the AM peak hour access to the bus lane is often restricted due to the presence of on-street parking on the left hand side of Wynnum Road between Bennetts Road and the beginning of the bus lane and the general traffic queue from the Wynnum Road / Hawthorne Road intersection. Thus the benefit of the bus lane facility is reduced.

Heading inbound from Hawthorne Road to the Main Street intersection buses queue with the general inbound traffic stream before joining the Story Bridge.

This lack of bus priority measures leads to a lack of journey time reliability for bus passengers. This serves to discourage any modal shift from those who would use public transport if it could offer better journey time reliability than the private car.

Bus travel time surveys found that the average travel time for an AM peak hour inbound service was 18 minutes including 2 minutes of passenger loading time. The average travel time for an off-peak inbound service was 5 minutes 47 seconds including 1 minute 10 seconds passenger loading time. Excluding passenger loading time, the difference in average inbound travel time between the AM peak hour and off-peak periods was 11 minutes 21 seconds. This represents a significant delay to bus travel times in the AM peak.

By contrast, excluding passenger loading time, the difference in average outbound travel time between the PM peak hour and off-peak periods was only 18 seconds.

The travel time survey findings signify a higher degree of congestion delay within the corridor during the AM period over the PM period and suggest higher benefit may be realised by the provision of bus priority measures in the inbound direction in the AM peak than in the outbound direction. It is therefore recommended that bus priority measures be considered for the inbound direction above the outbound direction.

Full details of the existing public transport issues are contained within the Volume 7 report entitled “Public Transport Assessment”.

2.7.2 Bus stop placement

A bus stop spacing of 400m is generally accepted as providing a balance between passenger accessibility and service efficiency for urban operations.

The current spacing of bus stops within the study corridor ranges from 140m to 450m in the inbound direction and 160m to 350m for the outbound direction.
Based on these existing spacings, opportunity exists to rationalise bus stop locations in order to improve service efficiency. It is proposed that rationalisation of bus stops is completed with regard to passenger loading data in order to minimise any impacts to passenger accessibility.

2.8 Environmental Issues

An environmental assessment has been undertaken as part of this study and is included within the Volume 8 report entitled “Environmental Approval Report”.

The key environmental elements assessed in relation to this Project include: climate, soils/topography/geomorphology, flora, fauna, water quality, hydrology/hydraulics, noise, air quality, planning and land use, landscape and visual amenity, social and economic, cultural heritage and waste management. Assessments were performed of environmental elements with the purpose of identifying relevant environmental values of the site and surrounds, potential impacts from the construction and operation of the Project and developing mitigation measures to minimise these impacts.

The EAR demonstrates that the Lytton Road – Wynnum Road corridor upgrade has only limited potential to impact on existing environmental values due to the area already being highly disturbed by existing development and infrastructure. The main issue for concern with this proposal is the potential impact to cultural heritage within the area.

These impacts can be minimised or avoided through appropriate design and effective implementation of suitable environmental management actions and controls.

Notwithstanding this, the following items serve as key issues to be addressed during the development of any preferred option.

2.8.1 Indigenous Cultural Heritage

The proposed corridor upgrade is located in developed areas and therefore it is unlikely that the activity will impact Aboriginal cultural heritage. An assessment of Cultural Heritage will however be required to ensure compliance with the requirements of the Aboriginal Cultural Heritage Act 2003 (QH Act).

The site is highly urbanised and disturbed and it is therefore considered unlikely that any new indigenous cultural heritage values will be found. The aboriginal parties known for the project area, the Turrbal People and the Jagera People, should be informed of the proposed works.

2.8.2 Native Title

Native Title describes the right and interests of the Indigenous People under their traditional laws and customs. The Turrbal People and the Jagera People have a Native Title Claim over the project area which applies to all land within the study corridor apart from freehold land for which Native Title has
been extinguished. It is recommended that a tenure search is undertaken through the Native Title Office once a preferred option is has been confirmed.

2.8.3 Non Indigenous Heritage

A search of the Queensland Heritage Register revealed three places of state heritage significance within the portion of the overall study area where corridor upgrade works are likely to take place:

1. Mowbray Park and East Brisbane War Memorial, 38 - 78 Lytton Road, East Brisbane

![Figure 2.3 - Mowbray Park](image)

Mowbray Park is significant for its close association with the development of East Brisbane, both in its connection with the Mowbray family and as an initiative of the former South Brisbane Council in preserving urban public space during a population and housing boom. Items of significance within the park include: a finely crafted First World War Memorial, a retaining wall, steps and boat house which are associated with the former baths house.

It is noted from discussions with representatives of both Brisbane City Council and DERM that any works on the widening of the Lytton Road corridor are unlikely to affect the war memorial. Indeed the proposed widening of the footpaths in this area would offer increased public accessibility to the memorial.

2. Hanworth Home for the Aged, 109 Lytton Road, East Brisbane - Erected in 1864-1865
Figure 2.4 - ‘Hanworth’ Home for the Aged

Hanworth is important in demonstrating the early development of East Brisbane and remains one of the suburb’s earliest surviving riverine houses. It was designed by early architect James Cowlishaw.

3. Brisbane City Council Tramway Substation No. 9 (former)

The former tramway substation is important in demonstrating an important aspect of Queensland’s industrial development. The former substation is now uncommon evidence for an important mode of transport which was discontinued in Brisbane in 1969 and for which much of the infrastructure has been removed.

A meeting was held with Maureen Lily from the Department Environment and Resource Management (DERM) on the 7 May 2009. DERM expressed concern over the impact the works may have on Hanworth Home, particularly any impact to the front wall and gate. DERM indicated that the works planned to impact Mowbray Park should not pose a significant issue. A Development Application will need to be lodged with DERM for any works that impact properties listed on the Queensland Heritage Register.

A search was also undertaken of the BCC City Plan Cultural Heritage Register (CPCHR). The search revealed sixteen properties which may be impacted by the proposed works listed on the CPCHR which hold local significance. Four of these properties (including those listed above) are also included on the State Register. Those properties not listed above which are included on the CPCHR and could be directly affected by the current corridor upgrade options are listed below:

- Canning Bridge and Reserve, 186 Lytton Road
- Norman Park Ferry Reserve, 66 Wynnum Road
- 19th Century Residence, ‘Bronte’, 118, Wynnum Road
- Brethren Meeting Room, 62 Balmoral Street
For those properties listed on the CPCHR only, it should be noted that under Chapter 3 of the BCC City Plan, any development involving the construction, maintenance or operation of roads and bus ways, and things associated with roads and bus ways by or on behalf of or under contract with BCC or the Queensland Government, is classed as exempt development. Therefore the proposed works that impact properties on the City Plan Heritage Register do not require approval.

2.8.4 Riparian Vegetation

Marine plants are protected under the Fisheries Act, 1994, and their removal is prohibited unless specifically covered by permit.

Several mangrove species were identified beneath and adjacent to Canning Bridge.

The mangroves are likely to be removed or damaged through any widening of Canning Bridge.

A permit is required from the Department of Primary Industries (DPI) if marine plants will be removed, destroyed or damaged.

![Mangroves along Norman Creek](image-url)
2.9  **Geotechnical Issues**

Full details of the geotechnical issues along with corridor are contained in the Volume 9 report entitled “Geotechnical Desktop and Visual Assessment”.

2.9.1  **Topography**

The topography mapping for the Kangaroo Point, East Brisbane and Norman Park areas indicate the Lytton Road – Wynnum Road corridor between Main Street, Kangaroo Point and Riding Road, Hawthorne to comprise rolling to hilly terrain with gentle to moderate slopes. Contour mapping indicates the ground level at Main Street, Kangaroo Point is approximately 30.5m AHD generally decreasing at 5% grade towards the east along Shafston Avenue to Thorn Street intersection. The section of Shafston Avenue and Lytton Road between Thorn Street and Heath Street intersections and adjacent to Mowbray Park appears to be as generally level at about 13.5m AHD. The grade of Lytton Road – Wynnum Road generally increases slightly from Heath Street to Bodalla Street, where the grade increases again to approximately 5% to 16.5m AHD at Riding Road.

2.9.2  **Study Corridor Regions**

The Lytton Road – Wynnum Road Study Corridor between Main Street, Kangaroo Point and Riding Road, Hawthorne has been divided into several regions based on common location, topography, existing earthworks and structures and geology. The region locations are summarised below in Table 2.2.
Table 2.2 – Region Locations

<table>
<thead>
<tr>
<th>Regions</th>
<th>Location</th>
<th>Topography Features</th>
<th>Earthworks / Structures</th>
<th>Geology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kangaroo Point - Main Street / Bradfield Highway / Shafston Avenue interchange</td>
<td>Ridge- Moderate Grade</td>
<td>Grade Separated Interchange - Cuttings &amp; Filled Embankment Ramps</td>
<td>Brisbane Tuff</td>
</tr>
<tr>
<td>2</td>
<td>Mowbray Park - Rawlins Street to Stafford Street (Lytton Road)</td>
<td>Natural water course transecting from south to north into Mowbray Park.</td>
<td>Retaining structure and filling along northern side of Lytton Road.</td>
<td>Quaternary Alluvium</td>
</tr>
<tr>
<td>3</td>
<td>Stafford Street to Norman Creek (Lytton Road)</td>
<td>Ridge off Sinclairs Hill and low lying area adjacent to Norman Creek</td>
<td>Cuttings &amp; Retaining structure along eastern side of Lytton Road.</td>
<td>Neranleigh Fernvale &amp; Quaternary immediately adjacent to Norman Creek</td>
</tr>
<tr>
<td>4</td>
<td>Norman Creek to Norman Avenue (Wynnum Road)</td>
<td>Ridge down to Norman Creek - Moderate Grade separation</td>
<td>Abutments and revetment walls on both sides of Norman Creek</td>
<td>Neranleigh Fernvale &amp; Quaternary immediately adjacent to Norman Creek</td>
</tr>
<tr>
<td>5</td>
<td>Norman Avenue to Overend Street (Wynnum Road)</td>
<td>Crest of Hill – Steep Grade</td>
<td>Cuttings &amp; Retaining walls</td>
<td>Brisbane Tuff</td>
</tr>
<tr>
<td>6</td>
<td>Overend Street to Hawthorne Road (Wynnum Road)</td>
<td>Gallows Hill – Moderate Grade</td>
<td>Cutting, Grade separation &amp; Retaining walls</td>
<td>Neranleigh Fernvale</td>
</tr>
<tr>
<td>7</td>
<td>Hawthorne Road to Riding Road (Balmoral Street and Wynnum Road)</td>
<td>Ridge associated with Gallows Hill Valley/Gully – Moderate Grade</td>
<td>Cutting &amp; Facing / Retaining walls</td>
<td>Neranleigh Fernvale</td>
</tr>
</tbody>
</table>

2.9.3 Visual site assessment

A general visual site assessment of the Lytton Road – Wynnum Road corridor between Main Street, Kangaroo Point and Riding Road, Hawthorne was undertaken by a WorleyParsons geotechnical engineer on the 16th April, 2009. The aim of the visual site assessment was to identify and assess:
• Topographic features
• Surface geology
• Existing road cuttings, filling and retaining structures.

The Lytton Road – Wynnum Road Study Corridor has been divided into several regions based on common location, topography and geology. (See Table 2.2)

2.9.4 Region 1 - Kangaroo Point

Geological mapping shows the western section of the study corridor at Main Street, Kangaroo Point and along Shafston Avenue, between O’Connell Street to Castlebar Street/Rawlins Street to be underlain by Brisbane Tuff and this was confirmed by observations of a number of cuttings inspected during the site walkover.

The exposures of Brisbane Tuff encountered in the inspections in the Kangaroo Point area were generally of a high strength and with a relatively large joint spacing. As such it would be expected that any excavations in these materials would require rock breakers, rock saws or, possibly, blasting.

2.9.5 Region 2 - Mowbray Park

The area between Castlebar Street /Rawlins Street and Latrobe Street is recorded to be typically underlain by quaternary alluviums and some earthworks fills were identified. These materials would be expected to comprise lower strength clay soils. The natural ground surface around Mowbray Park is believed to be an old watercourse and groundwater may potentially be at shallow depths in areas. As such there is the potential for excavation and construction difficulties and it is unlikely that open cut excavations beyond 1-2m depth will be stable for any length of time. Accordingly appropriate excavation support and sub-grade conditioning should be budgeted for where construction is to be undertaken in these materials.

2.9.6 Region 3 - Stafford Street to Norman Creek

The area of the study corridor between Stafford Street and Norman Creek is predominantly underlain by sedimentary rock and this was confirmed by observations of extremely weathered to distinctly weathered Siltstone identified in several cuttings inspected during the site walkover. Accordingly it is recommended that for the purposes of preliminary design cuttings in the Siltstone are considered stable at an angle of 1.5:1 (v:h) and allowance should be made for concrete facing to protect the cuttings from further weathering.

The exposures of Siltstone encountered in the inspections in the Eskgrove to Norman Creek area were generally of a low strength with joints relatively closely spaced. As such it would be expected that any excavations in these materials would generally be within the capabilities of a large sized excavator.
The land along Walter Avenue and Hilton Street, and adjacent to Norman Creek was generally low lying and underlain by quaternary alluviums. These materials are expected to comprise lower strength soils and shallow groundwater level. As such there is the potential for excavation and construction difficulties and it is unlikely that open cut excavations beyond 1-2m depth will be stable for any length of time. Accordingly appropriate excavation support and sub-grade conditioning should be budgeted for where construction is to be undertaken in these materials.

2.9.7 Region 4 - Norman Creek to Norman Avenue

The section of the study corridor between Norman Creek and Norman Avenue is noted to be mostly underlain by Neranleigh – Fernvale Beds and this was confirmed by observations of extremely to distinctly weathered Siltstone exposed at the ground surface of 78 Wynnum Road, during the site walkover. Based on this inspection, it is suggested that for the purposes of preliminary design, any cuttings in the Siltstone are considered stable at an angle of 1.5:1 (v:h).

As such it would be expected that any excavations in these materials would generally be within the capabilities of a large sized excavator although rock breaker equipment may be required to expedite excavations through possible isolated areas of higher strength rock.

2.9.8 Region 5 - Norman Avenue to Overend Street

The section of the study corridor between Norman Avenue and Overend Street is underlain by a band of Brisbane Tuff extending across the study corridor at Norman Crescent and this was confirmed by observation of a significant cutting, during the site walkover.

The exposures of Brisbane Tuff encountered in the inspections at Norman Crescent were generally of a high strength and with a relatively large joint spacing. As such it would be expected that any excavations in these materials would be difficult and that rock breakers, rock saws or, possibly, blasting may be required.

This could be an issue in the vicinity of the southern side of Wynnum Road between the two entrances to Norman Crescent where a number of route options could require the existing cutting to be cut back to within approximately 2m of existing dwellings.

The effect of cuttings on structures is a function of a number of factors including:

- The building foundations
- The material upon which the buildings are founded upon (an it’s relationship to the cut face)
- The capacity for the building to accommodate movement
- The method of excavation
- The method of support
- The rate at which the excavation proceeds in relation to the installation of support
• The geotechnical character of the rock and the discontinuities present

In the instance of the cuttings between the entrances to Norman Crescent the exposed Brisbane Tuff is generally massive and high strength in character with limited discontinuities. Cuttings in this material can be seen to be standing without evidence of weathering and or excessive support requirements in a number of locations nearby.

Subject to confirmation of a number of geotechnical and construction aspects relating to the bullet points above it would be expected that a new cutting in the Brisbane Tuff material could be constructed to within 2m of the existing structures with the appropriate design and construction control. Such construction would almost certainly require the incorporation of a system of active support from rock bolts and/or rock anchors. The installation of these support elements would extend beneath the property boundary and may require permissions from the residents. In undertaking a cutting in the near vicinity of a structure it is inevitable that there will be a redistribution of stresses within the materials underlying the structure and a consequent movement. Depending on the geotechnical character of the materials that comprise the cutting the magnitude of this movement may be considerable or it may be barely discernable. Also the timeliness and quantity of support installed will influence the magnitude of any movement.

An additional consideration is the method by which the materials are excavated such that structural distress may be caused by the vibrations from the excavation technique. This is particularly an issue where high strength rocks like the Brisbane Tuff are to be excavated.

Structures that are constructed from relatively brittle materials such as brick or rendered blocks or where structures have extensive internal plastering it would be expected that even relatively minor movements will result in cosmetic damage comprising the cracking of finishes. Such damage would be less likely where a traditional wooden construction Queenslander type structure founded on stumps is present.

Where the structures in the section of Wynnum road between the entrances to Norman Crescent are concerned assuming the following;

• The cutting is formed only in Brisbane Tuff
• The structures have robust foundations
• The cutting is excavated with care and support applied in a timely manner
• No un-expectedly adverse ground conditions are encountered
• Installation of anchors / rock bolts beneath the property boundary are permitted

It would be expected that the cutting could be constructed without causing major structural damage and that only cosmetic repair would be required. Some realignment of drainage services may also be necessary.

However considering the potential unknown risks and the cost of construction, the options have generally adopted an alignment to the north to avoid works in the rock cutting. Only options 6 require
some excavation work in the rock face to be undertaken, but the works are on the rock face at the western end of the cutting where the cutting heights are in the 2m to 4m range.

2.9.9 Region 6 - Overend Street to Hawthorne Road

The section of the study corridor between Overend Street and Hawthorne Road is predominately underlain by Neranleigh – Fernvale Beds and this was confirmed by observations of a large cutting on the northern roadside at the corner of Hawthorne Road and Wynnum Road, during the site walkover.

The exposures of rock encountered in the inspections in the Overend Street to Hawthorne Road area were generally of very low to low strength and extremely to distinctly weathered. As such it would be expected that any excavations in these materials would generally be within the capabilities of a large excavator. There is potential for isolated areas of higher strength in this area and as such rock breaker equipment may be necessary in this case.

2.9.10 Region 7 – Hawthorne Road to Riding Road (Balmoral Street and Wynnum Road)

The section of the study corridor including Balmoral Street and Wynnum Road between Hawthorne Road and Riding Road is noted to be mostly underlain by Neranleigh – Fernvale Beds and this was confirmed by observations of a cutting located at Hipwood Street.

The exposures of rock encountered in the inspections in the Hawthorne Road to Riding Road area were generally of very low to low strength with relatively closely spaced jointing. As such it would be expected excavations in these materials would be generally within the capabilities of a large sized excavator. There is potential for isolated areas of higher strength in this area and as such rock breaker equipment may be necessary in this case.

2.10 Hydraulic Issues

The study corridor is crossed by Norman Creek (Canning Bridge) at approximately the mid-point of the corridor. Norman Creek is a tributary of the Brisbane River.

A Council “Floodwise Property Report” was obtained for Lot 2 RP 56385, which is the Council owned park on the eastern embankment immediately upstream of the Canning Bridge. The report stated that the 100 Year Average Recurrence Interval (ARI) flood level at this property was RL 3.2m AHD. This peak flood level is governed by the peak flood levels in the Brisbane River, and not by local flooding in Norman Creek. The minimum bridge deck level on the eastern abutment is RL 6.5m AHD, therefore the crossing currently has greater than 100 year ARI flood immunity, which is the minimum requirement for a major arterial route.

The “Norman Creek Flood Study” (Connell Wagner, 1995) indicates that the peak 100 Year ARI flood level immediately upstream of the bridge for a local Norman Creek flood is RL 1.76m AHD. The peak flow for this event is in the order of 400 m3/s. During the 100 Year flood event in Norman Creek the flow is contained within the main Norman Creek channel, i.e. there is no overbank flow.
BRISBANE CITY COUNCIL  
LYTTON ROAD - WYNNUM ROAD CORRIDOR UPGRADE FEASIBILITY STUDY  
MAIN REPORT

Widening of the Canning Bridge under options 5 and 6 would result in a negligible increase in upstream flood levels due to the following:

- The bridge waterway opening “matches” the upstream and downstream channel profile and there would be negligible expansion and contraction losses associated with the bridge extension;
- Any widening would adopt the same abutment spacing and profile as existing, therefore no additional affluxes as a result of pier construction would occur;
- The 100 Year flow through the bridge opening is below the soffit of the bridge and the frictional losses would be governed by the existing channel hydraulics.

It is noted that with the bridge extended under Option 5 and 6, the upstream 100 Year flood level would remain governed by flood levels in the Brisbane River.

A major local drainage crossing of the corridor occurs on the Balmoral Street section of the existing couplet, immediately west of the Wynnum Road / Riding Road / Balmoral Street intersection. The crossing is within the upper catchment of Pashen Creek. Information from Council’s report entitled “Local Stormwater Management Plan – Pashen Creek” indicates that the 50 year ARI overland flow crossing Balmoral Street is 9.4m³/s. Therefore the crossing requires upgrading to provide a trafficable roadway in a major flood event. The proposed upgrade requires the augmentation of the existing underground stormwater system with large diameter pipes constructed along the alignment of Bennetts Road and Riding Road as detailed in the “Local Stormwater Management Plan – Pashen Creek”. With the augmented stormwater line in place the 50 Year ARI overland flow across Balmoral Street would be reduced to 5.2m³/s and the depth of flow over the roadway would be in the order of 100 to 150 millimetres, i.e. the roadway would be trafficable. The cost of the stormwater line augmentation associated with the Balmoral Street crossing is included in the capital cost estimates for all options.

A desktop assessment of the adequacy of the existing longitudinal drainage along the corridor indicates that the existing drainage does not generally meet the 10 year ARI standard for minor drainage and upgrades would be required to meet standard. The upgrades included augmentations to the stormwater lines and the provision of additional inlets.

2.11 Utilities Services

The corridor contains a significant amount of existing services, both overhead and underground, for the full length of the study area.

A full assessment of the existing services along the corridor is contained with Volume 10 report entitled “Public Utility Plant Report”.

The desktop assessment undertaken as part of this study has identified the following PUP providers operating within the study area:

- Telstra – telecommunications;
• Optus Networks – telecommunications;
• Nextgen – telecommunications;
• AAPT / PowerTel – telecommunications;
• PIPE Networks – telecommunications;
• UEComm – telecommunications;
• APA Group – gas;
• Energex – power;
• Brisbane City Council – sewer, water, stormwater and traffic signals.

Notwithstanding this, preliminary liaison with the relevant service providers would suggest that the greatest concentration of potentially affected existing services is as follows:-

**Table 2.3 - Affected Service**

<table>
<thead>
<tr>
<th>Location</th>
<th>Provider</th>
<th>Affected Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balmoral Street (North Side)</td>
<td>Telstra</td>
<td>Existing copper and optical fibre services plus additional optical fibre cables scheduled for installation during 2009</td>
</tr>
<tr>
<td></td>
<td>UEComm</td>
<td>Possible service within existing duct</td>
</tr>
<tr>
<td></td>
<td>APA (Gas)</td>
<td>Medium pressure gas main</td>
</tr>
<tr>
<td>Balmoral Street (South Side)</td>
<td>APA (Gas)</td>
<td>Medium pressure gas main</td>
</tr>
<tr>
<td>Wynnum Road / Agnew Street intersection</td>
<td>Telstra</td>
<td>Numerous services emanating from Exchange Building</td>
</tr>
<tr>
<td>Lytton Road / Heath Street intersection</td>
<td>Telstra</td>
<td>Optical fibre and copper services</td>
</tr>
<tr>
<td></td>
<td>UEComm</td>
<td>Optical fibre services</td>
</tr>
<tr>
<td>Throughout</td>
<td>Energetx</td>
<td>11kV services with shallow cover in existing footpath</td>
</tr>
<tr>
<td></td>
<td>BCC</td>
<td>225mm water reticulation main</td>
</tr>
<tr>
<td></td>
<td>BCC</td>
<td>Domestic water and sewerage connections</td>
</tr>
<tr>
<td></td>
<td>Optus</td>
<td>Overhead coaxial services</td>
</tr>
</tbody>
</table>
3. FUTURE CORRIDOR REQUIREMENTS

Considering the existing conditions outlined above and to fully satisfy the deliverables for the achievement of the strategic objectives set out in Section 1.5 it is recommended that the following improvements should be made along the corridor.

3.1 Deliver Enhanced Bus Priority with Appropriately Located Bus Stops, Consistent with the Corridor’s Role as a Public Transport Link for Buses

The greatest enhancement for bus priority would be the provision of an inbound bus priority facility.

As detailed in section 2.7.1 of this report, the travel time survey findings signify a higher degree of congestion delay within the corridor during the AM period over the PM period and suggest higher benefit may be realised by the provision of bus priority measures in the inbound direction than the outbound direction. It is therefore recommended that bus priority measures be considered for the inbound direction above the outbound direction.

It is noted that there is no provision planned for bus priority measures west of Wellington Street as part of the Clem 7 tunnel project. In addition to the provision of bus priority facilities inbound on Wynnum Road, the existing bus stop provision could be rationalised to more closely match the optimised 400m spacing suggested by the City Council and Translink.

Suggested suitable bus stop locations are shown below:
### Table 3.1 - Inbound Bus Stop Spacing (proposed)

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balmoral Park – Stop 24</td>
<td>Balmoral Cemetery (Relocated)</td>
<td>575</td>
</tr>
<tr>
<td>Goulburn Street – Stop 23</td>
<td>Balmoral Cemetery (Relocated)</td>
<td>375</td>
</tr>
<tr>
<td>Balmoral Cemetery – Stop 22 (Relocated)</td>
<td>Balmoral Street</td>
<td>375</td>
</tr>
<tr>
<td>Balmoral Street – Stop 21</td>
<td>Waldo Street</td>
<td>200</td>
</tr>
<tr>
<td>Cawmore Street – Stop 21</td>
<td>Waldo Street</td>
<td>230</td>
</tr>
<tr>
<td>Waldo Street – Stop 20</td>
<td>Norman Avenue (inbound)</td>
<td>340</td>
</tr>
<tr>
<td>Norman Avenue – Stop 18</td>
<td>Walter Avenue</td>
<td>700</td>
</tr>
<tr>
<td>Walter Avenue – Stop 16</td>
<td>Mowbray Park</td>
<td>400</td>
</tr>
<tr>
<td>Walter Avenue – Stop 16</td>
<td>Heidelberg Street – Stop 14</td>
<td>300</td>
</tr>
<tr>
<td>Mowbray Park – Stop 15</td>
<td>Salstone Street</td>
<td>470</td>
</tr>
<tr>
<td>Salstone Street – Stop 11</td>
<td>Proposed Stop (O’Connell Street)</td>
<td>450</td>
</tr>
</tbody>
</table>

### Table 3.2 - Outbound Bus Stop Spacing (proposed)

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Stop (O’Connell Street)</td>
<td>Salstone Street</td>
<td>450</td>
</tr>
<tr>
<td>Salstone Street – Stop 11</td>
<td>Mowbray Park</td>
<td>400</td>
</tr>
<tr>
<td>Mowbray Park – Stop 15</td>
<td>Walter Avenue</td>
<td>390</td>
</tr>
<tr>
<td>Heidelberg Street – Stop 14</td>
<td>Walter Avenue</td>
<td>430</td>
</tr>
<tr>
<td>Walter Avenue – Stop 16</td>
<td>Norman Crescent (outbound)</td>
<td>700</td>
</tr>
<tr>
<td>Norman Avenue – Stop 18</td>
<td>Waldo Street</td>
<td>430</td>
</tr>
<tr>
<td>Waldo Street – Stop 20</td>
<td>Philip Street</td>
<td>320</td>
</tr>
<tr>
<td>Waldo Street – Stop 20</td>
<td>Cawmore Street</td>
<td>240</td>
</tr>
<tr>
<td>Philip Street – Stop 21</td>
<td>Balmoral Cemetery</td>
<td>480</td>
</tr>
<tr>
<td>Philip Street – Stop 21</td>
<td>Goulburn Street</td>
<td>450</td>
</tr>
</tbody>
</table>
In addition, where possible all stops should also be indented back from the through lanes to ensure that stopping services which are picking up or dropping off passengers at intermediate stops do not impede the progress of other services using the corridor.

Full details of proposed bus stop locations are contained in the Volume 7 report entitled “Public Transport Assessment”.

3.2 Deliver Enhanced Cyclist and Pedestrian Facilities

To deliver enhanced cyclist and pedestrian facilities the following could be implemented on the corridor:

- On-road cyclist provision (if possible) and high standard off-road shared paths are provided on Wynnum Road between Lytton Road (Canning Bridge) and Riding Road. The location of these facilities through Wynnum Road – Balmoral Street couplet may be provided on either leg of the couplet dependant on the upgrade option adopted;

- High standard pedestrian and cyclist facilities could be provided west of Canning Bridge for a route via Laidlaw Parade, Mowbray Park, Thorn Street and Lambert Street. It is noted that such facilities would have the potential for tie-in with the future planned Principal Cycle Network route on the frontage of the Brisbane River west of Mowbray Park;

- An off-road shared path could be provided on Lytton Road from Canning Bridge to Wellington Road, providing connectivity to the off-road shared path on Shafston Avenue west of Wellington Road.

It is noted that longitudinally, an on-road cyclist facility is not provided on Lytton Road west of Canning Bridge for the reason that no provision is allowed for on-road cyclists on Shafston Avenue at the location of the Clem 7 Tunnel portal. Hence, west of Canning Bridge it is intended that cyclists travel via Laidlaw Parade rather than proceed west on Lytton Road to find discontinuity in on-road provision at Shafston Avenue. Further to the above, the interchange of Shafston Avenue and Main Street and subsequent to this, the Story Bridge, do not allow for on-road cyclists.

Signalised crossing facilities could be provided at a spacing of no more that 550m for the length of the corridor. The underpass crossing at Canning Bridge has accessibility issues related to the grade and the width of the underpass paths.

It is recommended a signalised crossing be provided at the Lytton Road / Laidlaw Parade intersection to address accessibility issues associated with the existing underpass crossing beneath the Canning Bridge. The crossing would allow access from the southern side of the corridor to the recommended high-standard pedestrian and cyclist facilities provided via Laidlaw Parade, Mowbray Park, Thorn Street and Lambert Street.
3.3 Deliver Improved Access to Wynnum Central and Morningside Station

In order to fully meet this projects deliverables, the upgrade could provide:

- Public transport outcomes detailed in section 3.1
- Pedestrian / cyclist outcomes detailed in section 3.2
- Improved traffic corridor capacity through additional traffic lanes and intersection improvements.

3.4 Deliver an Upgraded Road Corridor

The study corridor serves a multiple purpose being designated as both a Regional Radial Route and Secondary Freight Route.

The existing road layout is of a comparatively low standard, not suited to either of these roles. Particular areas where upgraded alignment should be considered are shown below:

- Hawthorne Road intersection – Improvement of the vertical alignment at the Hawthorne Road intersection to provide Safe Stopping Distance (SSD), Minimum Gap Sight distance (MGSD) and Manoeuvring Sight Distance (MSD) for a for a 1.15m driver height to 0.6 m (indicator at rear of vehicle) for a 60 km/hr. This is considered a minimum design standard and can be achieved for a relatively low cost by filling to the east of the existing crest.

- Heidelberg Street curve – upgraded horizontal alignment should be provided to accommodate buses and semi trailer vehicles for posted 60km/hr design speed.

As noted in the road safety audit (Volume 3), “the curve of the intersection of Lytton Road and Heidelberg Street is an area of great concern. The combination of a tight radius curve together with narrow lane widths causes motorists to have difficulty staying within their own marked lanes.”

The suggested action was to “redesign and reconstruct the intersection and curve to have wider traffic lanes and a larger radius enabling the intersection to be safely negotiated at the posted speed of 60km/hr”.

The road crash data report (Volume 2) recommended that the adequacy of the horizontal geometry at this location be addressed. As noted in Table 2.1 of this report the outbound kerb lane is a R36 and with a frictional f value of 0.31, therefore the curve has an existing design speed of 40km/hr. The lanes do not have any existing curve widening.

There are two main issues with the existing curve,

i. The narrow lanes without curve widening causes vehicles, particularly large vehicles, to encroach onto neighbouring lanes.
ii. The existing radius has a design speed of 40km/hr, however the majority of motorists appear to ignore the 40km/hr advisory warning signs and choose to drive close to 60km/hr.

The current geometry places motorists at a high risk of having a head-on crash.

There have been seven (7) recorded accidents at this location as detailed in the crash data report (Volume 2).

Whilst the number of accidents is lower than other intersections in the study area, the nature of the crashes is of more concern when compared to other intersections. As a result the cost benefit of reducing accidents through an upgrade of this intersection would be for greater (in the order of three (3) to four (4) times) than at other intersections.

Five (5) of the crashes were vehicles leaving the carriageway and hitting an object off road. These accidents are attributed to the substandard horizontal curve. The other two (2) accidents were head on, but were not attributed to vehicles encroaching onto adjacent lanes due to lack of curve widening. The accidents were again attributable to the sub-standard curve. It is concluded therefore that whilst curve widening is an important element of any re-design, elimination of accidents is highly dependent on increasing the horizontal geometry to achieve 60km/hr design speed.

With respect to upgrading of the horizontal curve, to achieve a 60km/hr design speed and curve widening for a 19m semi-trailer, a radius R75 on the inner outbound lane would be required. The upgrade would require acquisition and demolition of the commercial building on the northern side of the intersection (96 Lytton Road). It is expected that the cost of this acquisition would be higher than the benefits derived from crash reductions at this site. Despite this it is considered that ultimately a horizontal curve with a 60km/hr design speed should be provided at this location. The provision of this standard of horizontal curve is consistent with the corridors function as secondary freight route to accommodate urban and local freight movements.

In order to upgrade the existing substandard curve without acquisition and demolition of the commercial building, only a 40km/hr horizontal curve with a central median and curve widening for a single unit truck / bus could be achieved. This design could be considered as an interim scheme and will provide a higher standard than currently exists, however it will not provide significant reduction of road crashes at this location.

• Balmoral Street – upgraded horizontal alignments for 60km/hr posted speed.

On Balmoral Street there is an existing horizontal curve with an existing design speed of 40km/hr. The road safety audit (Volume 3) identified the horizontal alignment at this location as an issue. It noted that motorists tend to negotiate the curve at 60km/hr. The road crash data report (Volume 2) indicated that there have been three (3) accidents at this location involving vehicles leaving the carriageway at the bend. It is recommended that the horizontal geometry be improved to achieve a 60km/hr design speed.
4. CORRIDOR OPTIONS

4.1 Option 1 – Do Nothing

This option retains the existing corridor configuration with no upgrades during the planning period.

4.2 Option 2 – Non Asset Solutions

The existing corridor consists predominantly of four (4) lane carriageway with little, if any, opportunity along the route for creation of additional road space within the existing road reserve.

An exception to this general rule is at the east end of the corridor from Riding Road through the Wynnum Road / Balmoral Street couplet to Overend Street.

Within this area an a.m. peak (only) bus lane runs along the Wynnum Road side of the couplet from a point slightly east of Hipwood Street to the Hawthorne Road intersection.

To maximise the journey time savings available to public transport within the existing kerb lines this bus lane could be extended by restriction of the on-street parking between 07:00 and 9:00 from Bennetts Road to the existing bus lane. This would create an inbound am peak hour bus only lane from Bennetts Road to Hawthorne Road.

4.3 Option 3 – Minor Investments Approach (i.e. Minor Works)

Co-ordination of traffic signals along the route to provide increased ‘green time’ for the dominant peak hour flows potentially reduces travel time along the corridor for all modes.

Anecdotal evidence regarding the benefits obtained from implementation of similar measures on other routes within Brisbane suggests that significant returns can be generated in return for a nominal investment.

If this option was to be combined with Option 2 above, it may be possible to generate journey time savings for a modest capital outlay.

It is understood Council has commenced the design of co-ordination of the signals within the corridor.

4.4 Options 4 – Invest in New Assets (including Land Acquisition)

Retention of the existing four (4) lane base layout plus targeted intersection upgrades to provide increased traffic capacity and bus / cyclist priority. Concept layouts for the option are contained in the drawings addendum.

The main features of each sub-option are described below.
4.4.1 Option 4A

This option uses targeted improvements at key intersections and links along the corridor to maximise the benefits for road users while minimising the resumptions required to achieve these improvements. Concept layouts for the option are contained in the drawings addendum.

The main features of Option 4A are summarised below:-

- Provision of an additional inbound lane on the approach to the Riding Road intersection. This lane flows into the existing dedicated left turn lane for access to Bennetts Road, with provision of a bus only inbound stand up lane at the Bennetts Road / Wynnum Road intersection. The design of the stand up bus lane at the Bennetts Road approach has been undertaken to ensure that with two (2) standard buses queued in the stand up lane vehicles can still undertake a left turn into Bennetts Road. The number of future bus services would be in the order of forty five (45) in the AM peak hour. Therefore the frequency of arrival would be approximately one bus every ninety (90) seconds. With a cycle time of sixty (60) seconds and a downstream bus lane, every bus queued will pass through the intersection in each cycle. Therefore the probability of two (2) buses being queued at the stand up lane would be low.

- Upgrade of the Wynnum Road curve around the perimeter of the cemetery at the Riding Road intersection to 60km/h.

- Upgrade of the Wynnum Road inbound curve at Bennetts Road to 50km/h design speed with curve widening for semi trailers.

- Extension to the east of the existing a.m. peak hour Wynnum Road inbound bus lane from the current starting point adjacent to Hipwood Street to the Wynnum Road / Bennetts Road intersection. This benefit would require the prohibition between 0700 and 0900 of the currently unrestricted on street residential parking along the south side of Wynnum Road.

- Extension to the west of the existing a.m. peak hour Wynnum Road inbound bus lane from the termination point at the Hawthorne Road intersection to a point immediately west of Overend Street.

- Provision of a 4.5 m wide inbound kerbside lane between Riding Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.

- Provision of inbound on road bike lane from Overend Street to Laidlaw Parade.

- Provision of a 3.0 m wide off road cycle path on the northern verge from Riding Road to Laidlaw Parade.

- Signalisation and the provision of a protected right turn lane at the Lytton Road / Laidlaw Parade intersection.

Signalisation of the Laidlaw Parade intersection has primarily been adopted to provide enhanced cyclist and pedestrian facilities within the corridor. Signalisation will address
accessibility issues associated with the existing underpass crossing beneath the Canning Bridge. The crossing would allow access from the southern side of the corridor to the recommended high standard pedestrian and cyclist facilities provided via Laidlaw Parade, Mowbray Park, Thorn Street and Lambert Street.

Signalisation would also have the benefits of reducing accidents at the intersection (three (3) recorded accidents) and would provide increased accessibility to existing residents in Laidlaw Parade.

The signalisation would result in additional delays along the corridor however the cycle time would be sixty (60) seconds and generally the Laidlaw Parade phase would only require a minimum green time. If pedestrians were called the green time would be longer.

- Upgrade of the horizontal curve at Heidelberg Street to a 40km/h design speed with provision of a central median and curve widening for a single unit truck / bus. This design has been adopted as the highest upgrade to the existing geometry possible without requiring acquisition / demolition of the existing commercial building on the northern side.

- Provision of an additional general traffic lane from Scanlan Street to Wellington Street. At the Lytton Road / Shafston Avenue / Wellington Street intersection, the additional lane is achieved by conversion of the existing right turn lane into a through lane and the removal of the right turns into Wellington Street. Right turns to access the Wellington Street precinct can be undertaken further to the west at the recently constructed Shafston Avenue / O'Connell Street intersection. It is noted that the intersection works at the Lytton Road / Shafston Avenue / Wellington Street intersection are being undertaken as part of the Clem 7 tunnel project.

### 4.4.2 Option 4B

This is a ‘do minimum’ solution based on the existing corridor alignment with upgrades selected to offer benefits for minimum capital outlay. Concept layouts for the option are contained in the drawings addendum.

Consequently Option 4B requires minimal resumptions along the study corridor. The main upgrades offered within Option 4B are summarised below:

- Provision of an additional inbound lane between Riding Road and Bennetts Road, as described in Option 4A above.

- Provision of a 4.5 m wide inbound kerbside lane between Riding Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.

- Upgrade of the horizontal curve at Heidelberg Street to a 40km/h design speed with provision of a central median and curve widening for a single unit truck / bus as per Option 4A.

- Provision of an additional general traffic lane from Scanlan Street to Wellington Street as per Option 4A, however the additional lane is not provided for a 150 metre road section between
the Heidelberg Street and Latrobe Street. This results in a short approach and departure lane at the Heidelberg Street intersection and a short approach lane at the Latrobe Street intersection, which is not desirable from a traffic operation perspective.

4.4.3 Option 4C

This option provides for a higher standard of upgrades with respect to the horizontal and vertical alignment compared to Option 4A. Concept layouts for the option are contained in the drawings addendum.

The main features of the option are as follows:

- Provision of additional inbound lane on the approach to Riding Road, as described in Option 4A above.
- Upgrade of the Wynnum Road curve around the perimeter of the cemetery at the Riding Road intersection to 60km/h as per Option 4A.
- Upgrade of the Wynnum Road inbound curve at Bennetts Road to 50km/h design speed with curve widening for semi trailers as per Option 4A.
- Extension of existing a.m. peak hour Wynnum Road inbound bus lane to the Bennetts Road intersection to the east and the Overend Street to the west as per Option 4A.
- Improvement of the vertical alignment at the Hawthorne Road intersection to provide Safe Stopping Distance (SSD), Minimum Gap Sight distance (MGSD) and Manoeuvring Sight Distance (MSD) for a for a 1.15m driver height to 0.6 m (indicator at rear of vehicle) for a 60 km/hr. This is considered a minimum design standard and can be achieved for a relatively low cost by filling to the east of the existing crest.
- Upgrade of the inbound horizontal alignment approaching the Hawthorne Road intersection to a design speed of 60km/h.
- Upgrade of the Balmoral Street horizontal geometry to a 60 km/h design speed.
- Cul-de-sacing of Dover Street with Balmoral Street.
- Provision of a 4.5 m wide inbound kerbside lane between Riding Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.
- Provision of inbound on road bike lane from Overend Street to Laidlaw Parade.
- Provision of outbound on road bike lane from Laidlaw Parade to Riding Road, except the bike lane is discontinuous between Norman Avenue and Hawthorne Road.
- Provision of a 3.0 m wide off road cycle path on the northern verge from Riding Road to Laidlaw Parade as per Option 4A.
• Cul-de-sacing of Kingsbury Street intersection with Wynnum Road.

• Improvements at the Wynnum Road / Norman Avenue intersection including the addition of a short inbound traffic lane and lengthening of the right turn lane into Norman Avenue.

• Signalisation of the Laidlaw Parade intersection, as per Option 4A.

• Creation of an additional inbound lane from Scanlan Street to Wellington Street, as per Option 4A.

• Upgrade of the horizontal curve at Heidelberg Street to a 60km/h design speed, with provision of a central median and curve widening for semi trailer vehicles. An interim scheme at this location is to upgrade to a 40km/h design speed with provision of a central median and curve widening for a single unit truck / bus. This interim scheme is as per Option 4A and is the highest upgrade to the existing geometry possible without requiring acquisition / demolition of the existing commercial building on the northern side.

• Cul-de-sacing of Eskgrove Street intersection with Lytton Road.

• Provision of an additional general traffic lane from Scanlan Street to Wellington Street. At the Lytton Road / Shafston Avenue / Wellington Street intersection, the additional lane is achieved by conversion of the existing right turn lane into a through lane and the removal of the right turns into Wellington Street. Right turns to access the Wellington Street precinct can be undertaken further to the west at the recently constructed Shafston Avenue / O’Connell Street intersection. It is noted that the intersection works at the Lytton Road / Shafston Avenue / Wellington Street intersection are being undertaken as part of the Clem 7 tunnel project.

4.5 Options 5 and 6 – Invest in New Assets (including Land Acquisition)

Options 5 and 6 generally involve the provision of additional traffic lanes throughout the corridor between Riding Road and Wellington Street. Concept layouts for the options are contained in the drawings addendum.

In each case the additional lane(s) could be designated for use as follows:-

• Bus Only

• High Occupancy Vehicle (HOV)

• General Traffic

For options 5 an additional inbound lane was provided, whilst for Options 6 an additional inbound and outbound lane was provided. In both of the cases the designation of options was as follows:-

A Removal of the existing couplet between Riding Road and Hawthorne Road, however additional inbound lane not provided on Balmoral Street section of corridor. Inbound buses to use Wynnum Road and a bus only stand up lane provided at the Wynnum Road approach to
the Wynnum Road / Hawthorne Road / Balmoral Street intersection. Thus option assessed additional lanes as bus only lanes (i.e. HOV and general traffic lane not considered).

B  Removal of existing couplet between Riding Road and Hawthorne Road.

C  Retention of the existing couplet between Riding Road and Hawthorne Road

The features of the individual options are described below:

4.5.1 Option 5A

- Removal of the existing couplet between Riding Road and Hawthorne Road, however additional inbound bus lane not provided on Balmoral Street section of corridor. Inbound buses to use Wynnum Road and a bus only stand up lane provided at Wynnum Road approach to the Wynnum Road/ Hawthorne Road/ Balmoral Street intersection.

- Inbound bus lane from Riding Road to Latrobe Street.

- Improvement of the vertical alignment at the Hawthorne Road intersection to provide Safe Stopping Distance (SSD), Minimum Gap Sight distance (MGSD) and Manoeuvring Sight Distance (MSD) for a for a 1.15m driver height to 0.6 m (indicator at rear of vehicle) for a 60 km/hr. This is considered a minimum design standard and can be achieved for a relatively low cost by filling to the east of the existing crest.

- Improvement to the horizontal alignment of Balmoral Street to a 60 km/h design speed.

- Cul-de-sacing of Philip Street, Coventry Street and Dover Street with Balmoral Street.

- Reconfiguration and realignment of the Wynnum Road / Riding Road / Balmoral Street intersection and the Wynnum Road / Hawthorne Road / Balmoral Street intersections to accommodate removal of the existing couplet operation

- Provision of inbound and outbound on road bike lanes from Riding Road to Laidlaw Parade, except the outbound bike lane is discontinuous between Norman Avenue and Hawthorne Road.

- Provision of a 3.0 m wide off road cycle path on a widened northern verge from Riding Road to Laidlaw Parade.

- Cul-de-sacing of Kingsbury Street intersection with Wynnum Road.

- Lengthening of the right turn lane at the Wynnum Road / Norman Avenue intersection to 90 metres as per Option 4C.

- Widening of the Canning Bridge.

- Signalisation and the provision of a protected right turn lane at the Lytton Road / Laidlaw Parade intersection.
• Upgrade of the horizontal curve at Heidelberg Street to a 60km/h design speed, with provision of a central median and curve widening for semi trailer vehicles as per Option 4C.

• Cul-de-sacing of Eskgrove Street intersection with Lytton Road.

• Provision of an additional general traffic lane from east of Latrobe Street to Wellington Street. At the Lytton Road / Shafston Avenue / Wellington Street intersection as per Options 4A / 4B / 4C

4.5.2 Option 5B

• Removal of the existing couplet between Riding Road and Hawthorne Road.

• Provision of an additional inbound lane from Riding Road to Wellington Street. Additional lane could be considered as bus only lane, HOV lane or general traffic lane from Riding Road to east of Latrobe Street. For the section from Latrobe Street to Wellington Street additional lane is a general traffic lane only.

• Upgrade of the horizontal alignment of Balmoral Street to a 60km/h design speed

• Cul-de-sacing of Philip Street, Coventry Street and Dover Street with Balmoral Street.

• Improvement of the vertical alignment at the Hawthorne Road intersection as per Option 5A. Reconfiguration and realignment of the Wynnum Road / Riding Road / Balmoral Street intersection and the Wynnum Road / Hawthorne Road / Balmoral Street intersections to accommodate removal of the existing couplet operation

• Conversion of current signalised Agnew Street approach to an unsignalised left turn stand up lane at the Wynnum Road / Hawthorne Road / Balmoral Street intersection.

• Cul-de-sacing of the Wynnum Road approach to the Wynnum Road / Hawthorne Road / Balmoral Street intersection.

• Layout west of Hawthorne Road as per Option 5A.

4.5.3 Option 5C

• Retention of the existing couplet layout between Riding Road and Hawthorne Road.

• Additional inbound lane would be in the form of a 4.5m wide kerbside lane between Bennetts Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.

• Upgrade of the Wynnum Road inbound curve at Bennetts Road to 50km/h design speed with curve widening for semi trailers.

• Upgrade of the horizontal alignment of Balmoral Street to a 60km/h design speed.
- Improvement of the horizontal and vertical alignment at the Hawthorne Road intersection, as per Option 5A / 5B above.
- Layout west of Hawthorne Road as per Options 5A/5B.

4.5.4 Option 6A
- As per Option 5A but with additional outbound bus only lane from Wellington Street to Riding Road, except inbound on road bike lane discontinuous between Norman Crescent and Norman Avenue.

4.5.5 Option 6B
- As per Option 5B but with additional outbound lane from Wellington Street to Riding Road, except inbound on road bike lane discontinuous between Norman Crescent and Norman Avenue.

4.5.6 Option 6C
- As per Option 5C but with additional outbound lane from Wellington Street to Riding Road, except inbound on road bike lane discontinuous between Norman Crescent and Norman Avenue.
5. OPTION ANALYSIS

5.1 Traffic

The Brisbane Strategic Transport Model (BSTM) was used for the strategic modelling to determine the current and future traffic demands on the corridor and key intersections. The model was used to assess the performance of each option. Full details of the modelling and the results of the option testing are contained in the Volume 5 report entitled “Traffic and Transport Report”.

The key conclusions from the Strategic Model option testing can be summarised as follows:

- Under base case networks and growth conditions, traffic volumes continue to increase to the long term forecast horizon, resulting in increasing Volume/Capacity ratios (to the point of oversaturation) and poor level of service.

- Options 4A/4B/4C involves the addition of an inbound bus lane on Wynnum Road from Riding Road to Overend Street and an inbound general traffic lane between Scanlan Street and Wellington Street. This option results in only minor changes in volumes when compared to the 2026 ‘Do Nothing’ scenario. Similarly the Volume/Capacity ratios for the corridor are essentially unchanged when compared to the 2026 ‘Do Nothing’ scenario.

- Option 5A and 6A, where the additional lane/lanes are bus only lanes, do not attract any additional traffic to the corridor and therefore the Volume/Capacity ratios for the corridor are essentially unchanged when compared to the 2026 ‘Do Nothing’ scenario.

- Options 5B and 5C, with the additional inbound lane as a bus only lane, do not attract any additional traffic to the corridor and therefore the Volume/Capacity ratios for the corridor are essentially unchanged when compared to the 2026 ‘Do Nothing’ scenario.

- Options 6B and 6C, with the additional inbound and outbound lanes as a bus only lane, do not attract any additional traffic to the corridor and therefore the Volume/Capacity ratios for the corridor are essentially unchanged when compared to the 2026 ‘Do Nothing’ scenario.

- Options 5B and 5C, with the additional inbound lane as a general traffic lane, attracts an additional 3,500 vehicles per day to the Wynnum Road corridor. The Volume/Capacity ratios in this option show minor improvement over the 2026 ‘Do Nothing’ corridor.

- Option 6B and 6C, with the additional inbound lanes as general traffic lanes, attract an additional 5,000 vehicles per day to the Wynnum Road corridor, an increase over Option 5 due to the additional outbound lane in this option. The Volume/Capacity ratios in this option show little improvement over the data from Option 5 for the AM Peak inbound direction. Some improvement can be seen in the PM Peak outbound direction due to the additional outbound lane being in place.
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- Options 6B and 6C, with the additional lanes as general traffic lanes, provide the greatest increase in road capacity due to the additional lanes in each direction and provide the greater improvement to Volume/Capacity ratios (congestion) of the options tested. However, this increased road space is rapidly taken up by traffic growth providing only relatively small reductions in the level of congestion. The Volume/Capacity ratios for the AM Peak inbound direction are the same as Options 5B and 5C, with the Volume/Capacity ratios for the PM Peak outbound only marginally improved compared to Options 5B and 5C.

In the traffic modelling it was clear that the morning in-bound peak hour provided the highest level of congestion. Outbound trips display a higher degree of “peak hour spreading”. These results are consistent with the travel time surveys undertaken by the project team. Yet in relative terms the introduction of a bus only in-bound lane coupled with an increase in services (as a scenario option bus frequencies were doubled) produced a large relative increase in bus patronage levels.

The operation of the key intersections associated with each option was determined using the results of the BSTM modelling and the Sidra intersection analysis package. Full details of the Sidra analysis and the results of the option testing are contained in the Volume 5 report entitle “Traffic and Transport Report”.

The key conclusions from the SIDRA intersection analysis can be outlined as follows:

- The Lytton Road/Wellington Road intersection is currently operating at capacity. However the intersection changes to be undertaken as part of the Clem 7 project where an additional stand up lane is provided by conversion of the existing right turn lane into a through lane will provide considerable additional capacity. Under all options the intersection will take the same form and generally operates slightly over capacity during the AM Peak. The AM Peak queue generally extends through to the Latrobe Street intersection.

- The Lytton Road/Latrobe Street intersection generally operates satisfactorily under all options, although it may operate at worse levels than indicated by Sidra due to queuing effects from the downstream Wellington Street intersection.

- The Lytton Road/Heidelberg Street intersection operates below capacity when the additional lanes are general traffic lanes, although it is noted that queuing from the Latrobe Street intersection may result in a worse level of operation than that indicated by Sidra. For the AM Peak there was no significant improvement in the operation under Options 6 compared to Options 5. Where the additional lanes are bus only lanes, the intersection will operate above capacity for the AM Peak under all options.

- The Wynnum Road/Norman Avenue intersection operates above capacity during the AM Peak for Options 4A / 4B / 5A / 6 A and for the all options where the additional lanes are bus only lanes. For Option 4C and Options 5B / 6B / 5C and 6C where the additional lanes are general traffic lanes the intersection will operate below capacity. Additionally the AM Peak
queue will extend upstream to the Hawthorne Road intersection for Options 4A / 4B / 5A and 6A. For the AM Peak there was no significant improvement in the operation under Options 6 compared to Options 5.

- The Wynnum Road/Hawthorne Road intersection generally operates satisfactorily under capacity for all options except for Options 5A and 6A where the intersection operates over capacity during the AM Peak due to the addition of phase to accommodate the bus only leg on the Wynnum Road approach. It is noted however that for Options 4A / 4B / 5A and 6A the intersection capacity will be affected by the queuing from the Norman Avenue intersection during the AM Peak. For the AM Peak there was no significant improvement in the operation under Options 6 compared to Options 5.

- For the Wynnum Road / Hawthorne Road intersection under Option 6C, with the additional lane as a general traffic lane, the intersection operates over capacity during the PM Peak due to the fact that the additional outbound lane is a shared through / left lane. The left turns into Hawthorne Road could interfere with the through movements in this lane, and the through movements have the potential to “hold up” vehicles turning left into Hawthorne. This interaction results in reduced capacity for this lane.

- The Wynnum Road/Bennetts Road intersection operates satisfactorily under all options.

- The Wynnum Road/Riding Road intersection generally operates below capacity during the AM Peak for all options except for Options 6A and 6B with the additional lane as a bus only lane. During the PM Peak the intersection operates over capacity for Options 5A / 5B / 5C / 6A / 6B / 6C whether the additional lane is a general traffic lane or bus only lane. This is because the addition of the inbound / outbound lanes adds to the pedestrian crossing time and therefore additional green time is allocated the side streets at the expense of green time for the major though movements.

- The addition of the inbound and outbound lanes as bus only lanes generally only provides marginal improvement to the intersection operation with respect to general traffic compared to the “Do Nothing” case.

- The intersections at the eastern end of the study area (i.e. Hawthorne Road and Riding Road) operate at a slightly improved level with the existing couplet arrangement retained (i.e. Options 5C and 6C).

With respect to corridor performance, the Options 6B and 6C with the additional lanes as general traffic lanes, result in the highest corridor capacity. However, the resultant capacity is only marginally greater than the equivalent Options 5B and 5C.
Considering intersection performance, Option 6C with additional lanes as general traffic lanes provides the highest level of service. Again the performance is only marginally superior to the equivalent Option 4C and 5C.

Taking both the strategic and intersection level performance of the various options that have been tested, Option 6C with additional general traffic lanes provides the greatest capacity relief to the Wynnum Road corridor, whilst also maintaining a generally satisfactory level of service for key intersections. However it is noted that there is generally no significant improvement to the corridor capacity / intersection operation under Options 6C compared to Options 4C and 5C. In fact, Option 4C is often at a superior level of performance for a number of intersections.

5.2 Environment and Community

Each of the options developed was assessed to determine the environmental and community impact it would generate.

Generally those options with the greatest benefits in terms of additional road space created the greatest impact on the environment and community residing along the corridor. An exception to this general rule is the provision of traffic signals the currently uncontrolled Laidlaw Parade intersection which would generate the following benefits with minimal environmental impact:

- Improved connectivity with the Brisbane CBD for residents of Laidlaw Parade and Scanlan Street
- Creation of new at grade corridor crossing point for cyclists and pedestrians

Many of the options would involve works directly adjacent to or resumption from heritage listed properties such as Hanworth House on Lytton Road. In such cases all appropriate licences would be sought and adverse impacts on the setting of the property kept to a minimum. This is particularly important at the west end of the corridor where a strip of land approximately 8m wide may need to be resumed from the front of Mowbray Park. While the part of the park important from a heritage perspective is nearer the river, involving the setting for the former Mowbray House which was destroyed by fire some time ago care must be taken not to adversely affect the setting of the war memorial at the front of the park near Lytton Road. In this case the loss of land from the front of the park could be compensated for by the provision of wider footpaths allowing easier access to the memorial.

Other heritage listed features along the route such the Canning Park, adjacent to the bridge, Norman Park ferry reserve, the former tramway sub-station and heritage listed wall and Telstra Exchange at the Hawthorne Road intersection should be largely unaffected by any of the proposed options.

Any strengthening works for the Canning Bridge which may affect the Norman Creek flowing below it may need to be specially licensed due to the presence of mangroves under the bridge but, as noted in the Environmental Assessment Report the project is not expected to have an overall detrimental effect on the character of the corridor.
Table 5.1 – Affected Property

<table>
<thead>
<tr>
<th>Road Option</th>
<th>Affected Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 4A</td>
<td>Mowbray Park, Tramway Substation No. 9, Balmoral Cemetery</td>
</tr>
<tr>
<td>Option 4B</td>
<td>Mowbray Park</td>
</tr>
<tr>
<td>Option 4C</td>
<td>Mowbray Park, Tramway Substation No. 9, 19th Century Residence ‘Bronte’, Balmoral Cemetery</td>
</tr>
<tr>
<td>Option 5A</td>
<td>Mowbray Park, Hanworth Home, Tramway Substation No. 9, Canning Bridge, 19th Century Residence ‘Bronte’, Wynnum Rd Retaining Wall, Balmoral Cemetery</td>
</tr>
<tr>
<td>Option 5B</td>
<td>Mowbray Park, Hanworth Home, Tramway Substation No. 9, Canning Bridge, 19th Century Residence ‘Bronte’, Wynnum Rd Retaining Wall</td>
</tr>
<tr>
<td>Option 5C</td>
<td>Mowbray Park, Hanworth Home, Tramway Substation No. 9, Canning Bridge, 19th Century Residence ‘Bronte’, Substation 224, Wynnum Rd Retaining Wall, Balmoral Cemetery</td>
</tr>
<tr>
<td>Option 6A</td>
<td>Mowbray Park, Hanworth Home, Tramway Substation No. 9, Canning Bridge, Norman Park Ferry Reserve, 19th Century Residence ‘Bronte’, Wynnum Rd Retaining Wall, Balmoral Cemetery</td>
</tr>
<tr>
<td>Option 6B</td>
<td>Mowbray Park, Tramway Substation No. 9, Canning Bridge, Norman Park Ferry Reserve, 19th Century Residence ‘Bronte’, Wynnum Rd Retaining Wall</td>
</tr>
<tr>
<td>Option 6C</td>
<td>Mowbray Park, Tramway Substation No. 9, Norman Park Ferry Reserve, 19th Century Residence ‘Bronte’, Brethren Meeting Room, Substation 224, Wynnum Rd Retaining Wall, Balmoral Cemetery</td>
</tr>
</tbody>
</table>

5.3 Constructability

The Lytton Road – Wynnum Road corridor is a high volume arterial route and existing development on either side of the study corridor is predominantly residential. These factors combine to make construction of the preferred option an activity requiring a high degree of planning and consultation with the local community.

The need to avoid unnecessary disruption of the high traffic volumes flowing along the corridor each day would tend to make night work an attractive option, but this is likely to conflict with the wishes of the community resident in the large number of dwelling properties bordering the road.

It is noted that the resurfacing works undertaken on the corridor in late 2008 were completed as night works, although the duration of the proposed corridor upgrade may make this option less attractive.

Irrespective of the preferred upgrade option chosen it is recommended that four traffic lanes should be maintained along the corridor during both the a.m. and p.m. peak periods, and that night and...
weekend works should be considered to minimise the construction period and, therefore, contractor’s site establishment and overhead costs and general disruption to those residents living along the corridor.

It should also be noted that there is very little space along the corridor in which the contractor would be able to establish site facilities. Depending upon the phasing of the respective projects it may be possible for the corridor upgrade contractor to take over the site of the existing compound area currently occupied by the Clem 7 team.

This area is located at the western extremity of the study corridor and does have restricted egress, meaning that works traffic wishing to exit this compound to head east through the work site would be required to make a fairly lengthy detour via Main Street and Wellington Road.

A possible alternative location for any contractor’s site establishment could be on the site of any properties needing to be resumed and subsequently demolished to facilitate implementation of the chosen option.

5.4 Property Resumptions

Each of the options requires a significant number of resumptions, both full and partial of a variety of commercial / retail premises and residential properties.

To assist in the assessment of the likely resumption costs, the values of affected properties were estimated as part of an inspection of the corridor in April 2009. This base information was used to compile a database to assist in the valuation of the full and partial resumptions required.

Assessment of the resumptions required was undertaken using a combination of aerial photographs and resumption boundary lines shown on the option layout plans.

These assessments were then reviewed by property valuation staff from Brisbane City Council who were able to adjust the base figures adding further costs such as disturbance costs for the affected properties to establish a likely ‘full’ cost to Council for each of the options.

The range of resumption costs for each option is shown in Table 5.2 below, while more detailed figures for each option are included in Appendix A at the rear of this document. The figure in brackets for Option 4C is the reduced resumption cost if the interim scheme at the Heidelberg Street curve is adopted.
Table 5.2 – Resumption Costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Full Resumptions (No.)</th>
<th>Part Resumptions (No.)</th>
<th>Total Resumptions</th>
<th>Estimated Full Cost to Council ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>10</td>
<td>44</td>
<td>54</td>
<td>21</td>
</tr>
<tr>
<td>4B</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>5.5</td>
</tr>
<tr>
<td>4C</td>
<td>23</td>
<td>55</td>
<td>78</td>
<td>37.7 (27.5)</td>
</tr>
<tr>
<td>5A</td>
<td>55</td>
<td>49</td>
<td>104</td>
<td>79.6</td>
</tr>
<tr>
<td>5B</td>
<td>55</td>
<td>47</td>
<td>102</td>
<td>79.6</td>
</tr>
<tr>
<td>5C</td>
<td>37</td>
<td>60</td>
<td>97</td>
<td>66</td>
</tr>
<tr>
<td>6A</td>
<td>66</td>
<td>65</td>
<td>131</td>
<td>94.5</td>
</tr>
<tr>
<td>6B</td>
<td>66</td>
<td>59</td>
<td>125</td>
<td>96.2</td>
</tr>
<tr>
<td>6C</td>
<td>66</td>
<td>59</td>
<td>125</td>
<td>86.4</td>
</tr>
</tbody>
</table>

5.5 Cost Estimates

Capital cost estimates were developed for Options 4A / 4B / 4C / 5A / 5B / 5C / 6A / 6B and 6C using the principles outlined in the Main Roads Project Cost Estimation Manual.

A quantity “take-off” on each concept layout was undertaken, with earthwork quantities derived from preliminary modelling in the 12D package.

The rates applied to the quantities were based on historical data and were considered direct costs.

Principal’s costs incurred by Council including land acquisition costs (refer section 5.3), design costs, administration costs, public artwork, co-ordination costs and insurance costs were applied to the costs estimates.

The estimates were derived using the following assumptions:

- Estimates excluded GST
- Pavement quantities for new pavement areas based on heavy duty unbound gravel pavement with an asphalt surfacing
- Allowance made for asphalt overlay of existing pavement area retained
- Longitudinal drainage upgraded to a 10 Year ARI standard based on desktop analysis
• Allowance made in all estimated for strengthening of existing Canning Bridge
• Public utility relocation costs based on “order of” estimates provided by relevant service authorities;
• Traffic signal and street lighting estimates based on single item rates
• Widening of Canning Bridge based on square metre rate
• All estimates have allowance for escalation to Year 2011 based on escalation rate of 10 percent per annum

A copy of the WorleyParsons cost estimates (without risk) is contained in Appendix B.

It is noted that the estimates developed by WorleyParsons for all options do not include risk costs. Sub-consultant CGI was engaged to determine the planned and unplanned risks for the options. The estimates for options 4C, 5C and 6B which, between them, covered the greatest range of potential corridor layouts were then passed to CGI Consulting who reviewed the data provided against rates developed from recently prepared first principles build-ups of similar works. Those rates were at direct cost level therefore an allowance for overheads and other project related indirect costs was added.

The cost thus generated was then subjected to a P90 risk assessment process to generate an implementation figure in which Council could have a 90% confidence level.

As CGI only completed a P90 on three (3) of the options, the WorleyParsons estimates were increased on a pro-rata basis within each sub-option range to determine a relative P90 estimate for all options.

A copy of the CGI estimates is included as Appendix C.

The overall capital costs for each option are as shown in Table 5.3 below. The figure in brackets for Option 4C is the estimated total cost if the interim scheme at the Heidelberg Street curve is adopted.
Table 5.3 - Capital Costs

<table>
<thead>
<tr>
<th>Option</th>
<th>WP Estimate ($)</th>
<th>CGI P90 Estimate</th>
<th>Extrapolation Factor for Application to WP Sub-option Estimates</th>
<th>CGI P90 or Factored WP Estimates ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>48,100,000</td>
<td></td>
<td></td>
<td>60,125,000</td>
</tr>
<tr>
<td>4B</td>
<td>25,300,000</td>
<td></td>
<td></td>
<td>31,625,000</td>
</tr>
<tr>
<td>4C</td>
<td>72,400,000</td>
<td>90,730,000</td>
<td>1.25</td>
<td>90,730,000 (75,000,000)</td>
</tr>
<tr>
<td>5A</td>
<td>137,700,000</td>
<td></td>
<td></td>
<td>170,700,000</td>
</tr>
<tr>
<td>5B</td>
<td>137,800,000</td>
<td></td>
<td></td>
<td>170,900,000</td>
</tr>
<tr>
<td>5C</td>
<td>121,100,000</td>
<td>149,800,000</td>
<td>1.24</td>
<td>149,800,000</td>
</tr>
<tr>
<td>6A</td>
<td>160,900,000</td>
<td></td>
<td></td>
<td>199,500,000</td>
</tr>
<tr>
<td>6B</td>
<td>163,100,000</td>
<td>202,000,000</td>
<td>1.24</td>
<td>202,000,000</td>
</tr>
<tr>
<td>6C</td>
<td>150,400,000</td>
<td></td>
<td></td>
<td>186,500,000</td>
</tr>
</tbody>
</table>

5.6 Benefit Cost Analysis

A Benefit Cost Analysis (BCA) reflects the concept of economic efficiency and measures the benefits and costs in relation to the project. An allocation of resources increases economic efficiency if the sum of benefits exceeds the sum of costs associated with the project. The quantification of the economic efficiency is expressed as a Benefit Cost Ratio (BCR), which is the ratio of the total Present Value of Benefits (PVB) over the Present Value of Costs (PVC).

5.6.1 Methodology

The purpose of this BCA is to determine and quantify the benefits and costs relating to various options for upgrading the Lytton Road – Wynnum Road corridor. Upgrade options are generally described by Table 5.4.
Table 5.4 - Options Description (General)

<table>
<thead>
<tr>
<th>Upgrade Option</th>
<th>Option Description General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Do nothing</td>
</tr>
<tr>
<td>Option 2</td>
<td>Non-Asset solution</td>
</tr>
<tr>
<td>Option 3</td>
<td>Minor asset solution – traffic signal coordination</td>
</tr>
<tr>
<td>Option 4</td>
<td>Targeted intersection upgrades</td>
</tr>
<tr>
<td>Option 5</td>
<td>Additional inbound lane</td>
</tr>
<tr>
<td>Option 6</td>
<td>Additional inbound and outbound lanes</td>
</tr>
</tbody>
</table>

Variants of the above options exist with respect to the treatment of the Wynnum Road – Balmoral Street couplet and the provision of general traffic, high occupancy vehicle or bus lanes. Full details of upgrade options are provided in Section 4 of this report and shown on layout drawings (where relevant) contained in Addendum 1.

The BCR calculation will take into account benefits in terms of operation (reduced delays and vehicle operating costs) and safety (reduced crash costs). Costs of the upgrade are based on completed construction cost estimates and ongoing maintenance costs. Benefits and costs for determining the BCR are listed in Table 5.5.

Table 5.5 - Benefits and Cost for BCA

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vehicle travel time savings</td>
<td>• Capital construction costs including property resumption costs</td>
</tr>
<tr>
<td>• Vehicle operating cost savings</td>
<td>• Operation and maintenance costs</td>
</tr>
<tr>
<td>• Public transport passenger travel time savings</td>
<td></td>
</tr>
<tr>
<td>• Public transport operating cost savings</td>
<td></td>
</tr>
<tr>
<td>• Road crash cost savings</td>
<td></td>
</tr>
</tbody>
</table>
5.6.2 Benefits and Costs

5.6.2.1. Vehicle Benefits

Operating cost and travel times savings for corridor upgrade options have been determined from analysis using the SIDRA Intersection software program. SIDRA calculates operating costs which allow for vehicle operating costs and the value of travel time. The difference between the operating costs for a ‘do nothing’ case and an ‘upgrade option’ case constitute the benefits that may be derived from that particular upgrade.

It is noted that only intersection travel time savings have been assessed and not the travel time savings between intersections.

It is noted that an effect of upgrade Options 5 and 6 is that additional trips are attracted to the corridor. Intersection operating costs including these additional trips do not represent the actual benefit derived from the upgrade, as these benefits would be realised at locations external to the upgrade corridor from where additional trips are diverted to use Wynnum Road – Lytton Road corridor.

To determine benefits for upgrade Options 5 and 6, intersection analysis to determine operating costs is completed by applying ‘do nothing’ traffic volumes to upgrade Option 5 and 6 layouts. Such benefits, while they may not eventuate at the intersection under analysis, are considered to be equal to benefits realised at locations external to the corridor.

Appendix F of the report outlines the operating costs for ‘do nothing’ and ‘upgrade option’ cases for years 2012 and 2026 respectively. Operating costs for AM and PM peak hour periods are provided. The benefit for the upgrade is taken as the difference between the average peak hour operating cost for the upgraded signalised intersection and the existing roundabout. It is noted that costs reflect 2007 values, the default settings from SIDRA at the time of production.

A uniform cycle time of 120s was adopted for the purposes for completing the BCA with a half cycle time of 60s adopted at the Wynnum Road / Bennetts Road intersection.

From the results in Appendix F it can be seen that benefits are varied between intersections for each upgrade. Factors affecting the calculated benefits included providing additional through lanes at intersections which increased the pedestrian crossing distance often requiring increased green times for side road phases, above the green time requirements for side road traffic.

It is noted that the benefits determined are likely to be underestimated at a number of intersections. As noted in the Traffic and Transport Report, the SIDRA analysis does not consider the effect of downstream queuing. Downstream queuing effects will affect the performance of a number of intersections including the Wellington Road / Shafston Avenue, Latrobe Street and Hawthorne Road intersections and the existing performance of these intersections will be worse than determined by SIDRA.
5.6.2.2. Public Transport Benefits

Service Frequency

Several bus services operate along the Lytton Road – Wynnum Road corridor. Details of weekday inbound and outbound service frequencies (as at May 2009) are listed in Table 5.6 and Table 5.7 respectively.

Table 5.6 - Inbound Bus Services on Lytton Road – Wynnum Road Corridor

<table>
<thead>
<tr>
<th>Operating Period</th>
<th>Service Type</th>
<th>Bus Service</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>216</td>
<td>221</td>
</tr>
<tr>
<td>0500 – 0700</td>
<td>Express</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>0700 – 0900</td>
<td>Express</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>0900 – 1600</td>
<td>Express</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>1600 – 1800</td>
<td>Express</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1800 – 2300</td>
<td>Express</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>Express</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>16</td>
<td>35</td>
</tr>
</tbody>
</table>
Table 5.7 - Outbound Bus Services on Lytton Road – Wynnum Road Corridor

<table>
<thead>
<tr>
<th>Operating Period</th>
<th>Service Type</th>
<th>Bus Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>216</td>
</tr>
<tr>
<td>0500 – 0700</td>
<td>Express</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>1</td>
</tr>
<tr>
<td>0700 – 0900</td>
<td>Express</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>2</td>
</tr>
<tr>
<td>0900 – 1600</td>
<td>Express</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>8</td>
</tr>
<tr>
<td>1600 – 1800</td>
<td>Express</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>6</td>
</tr>
<tr>
<td>1800 – 2300</td>
<td>Express</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>Express</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>All-stops</td>
<td>17</td>
</tr>
</tbody>
</table>

In addition to the above weekday services, 84 inbound and 85 outbound all-stops weekend services also operate on the corridor.

TransLink have advised their intention is to have high frequency bus services operating on the corridor with a minimum 15 minute frequency all day, seven days a week and a five minute peak period frequency. The intended implementation of high frequency services is by 2018.

An increase in services is required to meet this intent. Table 5.8 lists the daily increased service requirements to meet the above high frequency intents.

Table 5.8 - Outbound Bus Services on Lytton Road – Wynnum Road Corridor

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Weekday</th>
<th>Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inbound (Existing)</td>
<td>Inbound (New)</td>
</tr>
<tr>
<td>Express</td>
<td>90</td>
<td>141</td>
</tr>
<tr>
<td>All-stops</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

Increased frequencies are provided by all-stops services in order to provide direct service to the corridor.
5.6.2.3. Public Transport Travel Time Savings

A survey of existing bus travel times through the corridor was completed in April 2009 to provide an appreciation of existing bus travel times. Full survey results are included in the Public Transport Assessment Report however average travel times are listed in Table 5.9.

Table 5.9 – Average Travel Time

<table>
<thead>
<tr>
<th>Service Direction</th>
<th>Peak (min)</th>
<th>Off-peak (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound</td>
<td>16:00</td>
<td>4:37</td>
</tr>
<tr>
<td>Outbound</td>
<td>4:39</td>
<td>4:21</td>
</tr>
</tbody>
</table>

All upgrade options are expected to provide an improvement to bus travel times however upgrade which include bus priority measures are logically expected to offer the greatest improvement to bus travel times. For the purposes of this BCA the bus travel time savings were calculated as follows:

- For each option where the additional lane was considered as a bus only lane, the average travel time for the bus lane was determined from the Sidra Intersection delays and assumption of an average bus travel time of 30 km/hr along the bus lane;
- The calculated travel time from Sidra was compared to the surveyed average travel times (shown in Table 5.9 above) and the travel time savings determined.

The bus travel time savings for each option used in the BCA is summarized below:

- **Options 4A /4B / 4C**
  
  An inbound bus lane from Riding Road to Overend Street will provide a travel time saving of 4min for the AM peak period.

- **Option 5A (With Bus Lane)**
  
  The provision of the inbound bus lane will provide an 8min 15sec inbound travel time saving for the AM peak period

- **Option 5B (With Bus Lane)**
  
  The provision of inbound bus lane will provide an 8min 15sec inbound travel time saving for the AM peak period

- **Option 5B / 5C (No Bus Lane)**
  
  The provision of additional inbound general traffic lane is assumed to provide a 2min inbound travel time saving for the AM peak period
•  **Option 6A (With Bus Lane)**

   The provision of inbound bus lane will provide a 8min 15sec inbound travel time saving for the AM peak period and the outbound bus lane will provide a 30 sec outbound travel time saving for the PM peak period.

•  **Option 6B (With Bus Lane)**

   The provision of inbound bus lane will provide an 8min 15sec inbound travel time saving for the AM peak period. The provision of additional outbound bus lane is assumed to provide a 30sec inbound travel time saving for the PM peak period.

•  **Option 6B/6C (No Bus Lane)**

   The provision of additional inbound general traffic lane is assumed to provide a 2min inbound travel time saving for the AM peak period. The provision of outbound general traffic lane will provide a 30sec outbound travel time saving for the PM peak period.

**Value of Time**

Travel time savings in terms of cost are obtained from the *Australian Transport Council – National Guidelines for Transport System Management in Australia (2006)*. The value of travel time is given in Table 5.10.

**Table 5.10– Value of Bus Passenger Time**

<table>
<thead>
<tr>
<th>Period</th>
<th>Value (2005/06$)</th>
<th>Value (2010/11$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
<td>$9.35/hr</td>
<td>$11.16/hr</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$8.25/hr</td>
<td>$9.85/hr</td>
</tr>
</tbody>
</table>

It is noted values in Table 5.10 for the 2005/06 financial year are taken from the Australian Transport Council publication and 2010/11 values represent a 3%p.a. compounding inflation rate applied to 2005/06 values.

For this analysis weekday periods from 7:00am to 9:00am and 4:00pm to 6:00pm are considered to be peak periods with all periods outside these hours considered off-peak.

**Bus Patronage**

The standard capacity for planning purposes of non-articulated and articulated buses is 65 and 85 persons respectively. The assumed vehicle patronage is tabulated below and is taken to be average patronage level across all services and bus models within the periods identified. The patronage levels displayed good correlation with the patronage levels determined by the BSTM modelling. Table 5.11 outlines assumed bus patronage for this study.
Table 5.11 - Bus Patronage

<table>
<thead>
<tr>
<th>Day</th>
<th>Period</th>
<th>Direction</th>
<th>Patronage (passengers / bus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays</td>
<td>Peak (0700-0900)</td>
<td>Inbound</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Peak (0700-0900)</td>
<td>Outbound</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Peak (1600-1800)</td>
<td>Inbound</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Peak (1600-1800)</td>
<td>Outbound</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Off-peak</td>
<td>Both</td>
<td>20</td>
</tr>
<tr>
<td>Weekends</td>
<td>Off-peak</td>
<td>Both</td>
<td>20</td>
</tr>
</tbody>
</table>

5.6.2.4. Crash Reduction Benefits

A review of crash data at the intersection was completed for the corridor over a five (5) year period to 2008. The *Austroads Guide to Traffic Engineering Practice; Part 4 - Treatment of Crash Locations* prescribes a methodology for the assessment of benefits from reduced road crash costs. The methodology relies on applying a crash percentage for reduction or increase in crashes based on the treatment being implemented. Annual crash cost savings are given in Table 5.12.

Table 5.12 - Option Crash Cost Savings (Annual)

<table>
<thead>
<tr>
<th>Option</th>
<th>Saving ($2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 4A</td>
<td>$147,000</td>
</tr>
<tr>
<td>Option 4B</td>
<td>$110,000</td>
</tr>
<tr>
<td>Option 5A / 5B / 5C / 4C</td>
<td>$643,000</td>
</tr>
<tr>
<td>Option 6A / 6B / 6C</td>
<td>$860,000</td>
</tr>
</tbody>
</table>

5.6.2.5. Construction and Maintenance Costs

The total project costs for upgrade options are detailed in Section 5.4. The operation and maintenance cost is assumed to be 1.5% per annum of the capital cost of construction.
5.6.3 Calculation of Benefit Cost Ratio

5.6.3.1 Assumptions

A BCA has limitations that are set by assumptions and the range of factors that can be quantified. Table 5.5.1.2 listed the benefits and costs which were identified for the calculation of a BCR. Assumptions made for the calculation of a BCR are listed in Table 5.13.

Table 5.13 - BCA Model Assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Terms</td>
<td>BCR results are given in present day terms (2009$)</td>
</tr>
<tr>
<td>Benefit Assessment Period</td>
<td>30 years (2012 to 2041 inclusive)</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>6% p.a.</td>
</tr>
<tr>
<td>Inter Year Interpolation</td>
<td>Linear average annual growth between assignment years.</td>
</tr>
<tr>
<td>Inflation Growth</td>
<td>3% p.a.</td>
</tr>
<tr>
<td>Intersection Performance / Travel Time Savings</td>
<td>It has been assumed that beyond 2026, intersection operating costs would increase at 3% p.a. compounding</td>
</tr>
<tr>
<td>Daily Sidra Cost</td>
<td>Assumed that the daily Sidra cost would be five (5) times the average peak hour cost</td>
</tr>
</tbody>
</table>

5.6.3.2 Assumptions

BCR calculations are included in Appendix F. Summaries are shown in below.
### Table 5.14 - BCR Calculations Summary

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Option 3</th>
<th>Option 4A</th>
<th>Option 4B</th>
<th>Option 4C</th>
<th>Option 5A</th>
<th>Option 5B (GT)</th>
<th>Option 5B (BL)</th>
<th>Option 5C (GT)</th>
<th>Option 5C (BL)</th>
<th>Option 6A</th>
<th>Option 6B (GT)</th>
<th>Option 6B (BL)</th>
<th>Option 6C (GT)</th>
<th>Option 6C (BL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Benefits</td>
<td>$39.6M</td>
<td>$67.0M (86%)</td>
<td>$60.0M (85%)</td>
<td>$87.9M (78%)</td>
<td>$15.8M (35%)</td>
<td>$77.4M (83%)</td>
<td>$19.2M (37%)</td>
<td>$68.1M (81%)</td>
<td>$25.6M (45%)</td>
<td>$4.7M (13%)</td>
<td>$121.5M (87%)</td>
<td>-$8.5M (-32%)</td>
<td>$104.5M (86%)</td>
<td>$13.3M (28%)</td>
</tr>
<tr>
<td>Public Transport (Bus)</td>
<td>-</td>
<td>$8.5M (10%)</td>
<td>$8.5M (12%)</td>
<td>$9.3M (9%)</td>
<td>$17.8M (39%)</td>
<td>$4.3M (5%)</td>
<td>$20.8M (40%)</td>
<td>$4.3M (5%)</td>
<td>$20.2M (35%)</td>
<td>$18.6M (53%)</td>
<td>$5.4M (4%)</td>
<td>$23.0M (87%)</td>
<td>$5.4M (4%)</td>
<td>$22.5M (47%)</td>
</tr>
<tr>
<td>Crash Red. Benefits</td>
<td>-</td>
<td>$2.7M (4%)</td>
<td>$2.0M (3%)</td>
<td>$11.6M (2%)</td>
<td>$11.6M (26%)</td>
<td>$11.6M (12%)</td>
<td>$11.6M (23%)</td>
<td>$11.6M (14%)</td>
<td>$11.6M (20%)</td>
<td>$12.1M (34%)</td>
<td>$12.1M (9%)</td>
<td>$12.1M (45%)</td>
<td>$12.1M (10%)</td>
<td>$12.1M (25%)</td>
</tr>
<tr>
<td>TOTAL BENEFITS</td>
<td>$39.6M</td>
<td>$78.1M</td>
<td>$70.5M</td>
<td>$108.9M ($105.6M)</td>
<td>$45M</td>
<td>$93.3M</td>
<td>$51.5M</td>
<td>$84M</td>
<td>$57.4M</td>
<td>$35.4M</td>
<td>$139.0M</td>
<td>$26.6M</td>
<td>$122.0M</td>
<td>$47.9M</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Costs</td>
<td>$0.1M (43%)</td>
<td>$60.1M (95%)</td>
<td>$31.6M (92%)</td>
<td>$90.7M (96%)</td>
<td>($75.0M)</td>
<td>$170.7M (97%)</td>
<td>$170.9M (97%)</td>
<td>$149.8M (96%)</td>
<td>$199.5M (97%)</td>
<td>$202M (97%)</td>
<td>$186.5M (97%)</td>
<td>$186.5M (97%)</td>
<td>$186.5M (97%)</td>
<td>$186.5M (97%)</td>
</tr>
<tr>
<td>Operation and Maintenance</td>
<td>$0.13M (56%)</td>
<td>$3.1M (5%)</td>
<td>$2.8M (8%)</td>
<td>$3.5M (4%)</td>
<td>$3.5M (3%)</td>
<td>$5.8M (3%)</td>
<td>$5.8M (3%)</td>
<td>$5.7M (3%)</td>
<td>$5.7M (3%)</td>
<td>$6.6M (3%)</td>
<td>$6.8M (3%)</td>
<td>$6.8M (3%)</td>
<td>$6.4M (3%)</td>
<td>$6.4M (3%)</td>
</tr>
<tr>
<td>TOTAL COSTS</td>
<td>$0.23M</td>
<td>$63.2M</td>
<td>$34.4M</td>
<td>$94.2M ($78.5M)</td>
<td>$176.5M</td>
<td>$176.7M</td>
<td>$176.7M</td>
<td>$155.5M</td>
<td>$155.5M</td>
<td>$206.1M</td>
<td>$208.8M</td>
<td>$208.8M</td>
<td>$192.9M</td>
<td>$192.9M</td>
</tr>
<tr>
<td>BENEFIT COST RATIO (BCR)</td>
<td>172</td>
<td>1.24</td>
<td>2.05</td>
<td>1.15 (1.35)</td>
<td>0.25</td>
<td>0.53</td>
<td>0.29</td>
<td>0.54</td>
<td>0.37</td>
<td>0.17</td>
<td>0.67</td>
<td>0.13</td>
<td>0.63</td>
<td>0.25</td>
</tr>
</tbody>
</table>
With respect to the BCR results detailed in Table 5.16, we note the following:

- Option 3, which involved the coordination of the existing traffic signals along the corridor, provides the highest BCR of 172. This high BCR value is a function of the low cost of $0.23M to implement and maintain;
- Option 4B had the second highest BCR of 2.05 due to the relatively low capital cost;
- Option 4A and 4C had similar BCR’s of 1.24 and 1.15 respectively, with Option 4C having a lower BCR due to the significantly higher capital cost associated with the higher standard of upgrade;
- With respect to Option 4C, if the interim upgrade scheme at the Heidelberg Street curve was adopted, the BCR would increase from 1.15 to in the order of 1.35, due to the reduced capital costs associated with not acquiring / demolishing the existing commercial building on the northern side of the carriageway.
- The BCR’s for all Options 5 and 6 are all less than 1.0, a function of the significant capital cost associated with these options.

### 5.7 Urban Design

As an integral part of the overall feasibility study, Urban Space Design were engaged to review selected base options to determine the opportunities presented by each to enhance the existing urban landscape. Their full report is included as Volume 11 of this document.

The Urban Space Design report outlines the findings of a site and desktop analysis, raises relevant landscape design issues and proposes landscape urban design guidelines for any future detailed design of the corridor. The principles of these guidelines could also be considered for possible future upgrades further east beyond the current study limits.

The report establishes five distinct segments for the road corridor as identified below and illustrated on drawing SD002. These were characterised by particular landscape features/views. The report has been broken down into these segments outlining the analysis and guidelines for each.

**Shafston Avenue (O’Connell St to Wellington Rd)**

**Lytton Road (Wellington Rd to Heidelberg St)**

**Lytton Road (Heidelberg St to Canning Bridge)**

**Wynnum Road (Canning Bridge to Hawthorne Rd)**

**Wynnum Road & Balmoral Street (Hawthorne Rd to Riding Rd)**

The following key objectives were established as a result of the analysis of the road corridor. These objectives guide the Landscape Urban Design guidelines which can be found in the full report.

- Protect, enhance & reinforce the Story Bridge’s iconic status
• Reinforce the ‘water-side’ context of the corridor, recognising its proximity to the Brisbane River and its role as a primary access to the bay-side suburbs

• Protect and enhance features and ‘markers’ such as the distinct character segments, local landmarks, cultural heritage and significant vegetation

• Promote and reinforce the undulating topography of the corridor and its associated views and vistas

• Reinforce cross-suburb connectivity

• Enhance opportunities for users to physically and visually access the river
6. OPTION EVALUATION

6.1 Multi Criteria Analysis Process

Evaluation of the options generated during the study was undertaken using a multi criteria analysis approach. The methodology adopted followed a framework previously used by the City Council which provided an easy to understand objective assessment of the options.

The process is described in more detail below, but the key elements of the process were:

- Weighting of objectives using a Matched Pairs Process;
- Preliminary multi criteria analysis of the various options using a pre-determined scoring system;
- Workshop session to validate the preliminary scoring process;
- Use of the workshop output to define the option to be recommended to Council as the Preferred Option.

6.1.1 Evaluation Framework

The evaluation framework was based on the strategic project objectives and reflected key traffic and transport, engineering and construction, environment and social considerations and comparative costs. The framework included a number of sub-objectives and performance measures on which the project objectives could be assessed.

6.1.2 Weighting of Objectives

A weighting was given to each sub-objective based on its relative importance to the functionality of the project. As part of this process the relative rankings of each of the sub-objectives was considered. To assist in establishment the relative rankings, a 'matched pairs' assessment was carried out.

This process considered each objective, in turn, against all others and an assessment was made to determine which of these objectives was more important (Scored 2) or less important (Scored 0) than the objective against which it was being compared, or whether each of the objectives under consideration were equally important (scored 1).

Table 6.1 shows the results of this assessment.
### Table 6.1 “Matched Pairs” Assessment of Sub-Objectives

<table>
<thead>
<tr>
<th>Objectives and Sub-objectives</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
<th>1.6</th>
<th>2.1</th>
<th>2.2</th>
<th>3.1</th>
<th>3.2</th>
<th>3.3</th>
<th>3.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Traffic Congestion Relief for general traffic and freight</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1.2 Improved Road Safety for all modes</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1.3 Increased Capacity to Accommodate Existing and Future Traffic Demands</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1.4 Improved Reliability of Travel times for all modes</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1.5 Improved facilities for public transport, including bus priority measures</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1.6 Improved Active Transport</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.1 Value for Money / cost Benefit Ratio</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2.2 Minimised Property Acquisitions</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3.1 Maintain operations of corridor during construction and access to local community / roads</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
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<tr>
<td>3.2 Minimise adverse long term impacts on the community</td>
<td>2</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>
3.3 Minimise adverse environmental impacts

<table>
<thead>
<tr>
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<th>1</th>
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<th>1</th>
</tr>
</thead>
</table>

3.4 Minimise flood impacts

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
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<th>2</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
</table>

Total

<table>
<thead>
<tr>
<th></th>
<th>16</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>18</th>
<th>15</th>
<th>18</th>
<th>10</th>
<th>2</th>
<th>15</th>
<th>13</th>
<th>4</th>
</tr>
</thead>
</table>

Sub-Total

<table>
<thead>
<tr>
<th></th>
<th>82</th>
<th>28</th>
<th>34</th>
</tr>
</thead>
</table>

Overall Weighting

<table>
<thead>
<tr>
<th></th>
<th>11.1%</th>
<th>8.3%</th>
<th>7.6%</th>
<th>6.9%</th>
<th>12.5%</th>
<th>10.4%</th>
<th>12.5%</th>
<th>6.9%</th>
<th>1.4%</th>
<th>10.4%</th>
<th>9.0%</th>
<th>2.8%</th>
</tr>
</thead>
</table>

Sub-Objective Weighting

<table>
<thead>
<tr>
<th></th>
<th>19.5%</th>
<th>14.6%</th>
<th>13.4%</th>
<th>12.2%</th>
<th>22.0%</th>
<th>18.3%</th>
<th>64.3%</th>
<th>35.7%</th>
<th>5.9%</th>
<th>44.1%</th>
<th>38.2%</th>
<th>11.8%</th>
</tr>
</thead>
</table>

Primary Objective Weighting

<table>
<thead>
<tr>
<th></th>
<th>56.9%</th>
<th>19.4%</th>
<th>23.6%</th>
</tr>
</thead>
</table>
6.2 Evaluation Methodology

A three stage option evaluation process was then used to identify feasible options for further investigation and development as part of the Planning Study. This included:

- **Strategic Option Evaluation** - Each option was broadly assessed for ‘fatal flaws’. These were defined as outcomes which did not sufficiently meet one or more of the project objectives such that that option became unacceptable. Options which progress through this initial filter were considered to be viable.

- **Feasible Option Evaluation** - A high level evaluation of the viable options to identify a short list of feasible options for further evaluation.

- **Viable Option Evaluation** - A more detailed evaluation of the feasible options, to identify a recommended option for further investigation and concept design development.

This evaluation process was undertaken as an iterative process, involving key members of the project team, throughout the duration of the study. As a result those options presented at the MCA workshop were all considered to be free of ‘fatal flaws’ and therefore worthy of further investigation.

6.3 Option Evaluation Workshop

This section provides an overview of the evaluation process and outcomes for the multi criteria analysis workshop, held on 12th June 2009, which was attended by key members of the project team as shown below:
Table 6.2 – MCA Workshop Attendees

<table>
<thead>
<tr>
<th>Name</th>
<th>Representing</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diana Zagora</td>
<td>Brisbane City Council</td>
<td>Client Project Manager</td>
</tr>
<tr>
<td>Nikolaus Kahler</td>
<td>Brisbane City Council</td>
<td>Assistant Project Manager</td>
</tr>
<tr>
<td>John S Campbell</td>
<td>Brisbane City Council</td>
<td>Transport Planner</td>
</tr>
<tr>
<td>Craig Zillman</td>
<td>Brisbane City Council</td>
<td>Active Transport</td>
</tr>
<tr>
<td>Stephen Joughin</td>
<td>WorleyParsons</td>
<td>Project Director</td>
</tr>
<tr>
<td>Paul Tribley</td>
<td>WorleyParsons</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Paul Zlatkovic</td>
<td>WorleyParsons</td>
<td>Traffic Manager</td>
</tr>
<tr>
<td>David Freer</td>
<td>WorleyParsons</td>
<td>Transport Planner</td>
</tr>
<tr>
<td>Tristan Reyne</td>
<td>WorleyParsons</td>
<td>Civil Designer</td>
</tr>
<tr>
<td>Joel Davison</td>
<td>CGI</td>
<td>Cost Consultant</td>
</tr>
</tbody>
</table>

The purpose of the workshop was to evaluate the options developed and to identify the preferred option for further investigation and design.

6.3.1 Scoring Methodology

Options were evaluated against the evaluation framework and prioritized with a scoring system to determine how each option met the project objectives. The scoring system used for the workshop analysis was as follows:

- 5 = Exceeds objective
- 2 = Meets objective
- 1 = Partially satisfies objective
- -2 = Fails objective
- -5 = Works against objective

The evaluation matrix was populated prior to the workshop with scores placed against the objectives recorded for each option, along with comments against each score to explain the rating given.

This information was used as a starting point for workshop discussion, with the scores then moderated by the group as a whole.
6.3.2 Assumptions

The following assumptions were made for the purposes of option evaluation at the workshop:

- The limits of the study corridor were Main Street and Riding Road.
- The options tabled were detailed, and developed to a high level to enable the identification of a preferred option.
- That development of treatments such as intersections and turning lanes may change as a result of further option development following the workshop.

The pre-populated evaluation matrix showing the preliminary scoring for each option was issued at the workshop as a basis for discussion.

6.4 Option Evaluation

6.4.1 Assessment Objective 1 – The corridor performs to its designated function within the road hierarchy

Prior to the option evaluation workshop, strategic traffic and intersection modelling was undertaken, with an evaluation year of 2026, for each option developed. This enabled the project team to score each option for its relative performance against Objective 1. Option performance against each sub-objective was also considered as follows:

- 1.1 Traffic congestion relief for general traffic and freight
- 1.2 Improved road safety for all modes
- 1.3 Increased Capacity to Accommodate Existing and Future Traffic Demands
- 1.4 Improved Reliability of Travel times for all modes
- 1.5 Improved facilities for public transport, including bus priority measures
- 1.6 Improved Active Transport

Those options that increased the mid-block capacity (i.e. reduced volume/capacity ratio) and resulted in improved intersection operation (DOS, Level of Service, reduced queue length) where deemed to meet this objective and reduce travel times for general traffic and freight (1.1). The options where the additional traffic lanes were general traffic lanes met the criteria to a higher level than the options where the additional lane was a bus only lane.

The "do nothing" and “non-asset” (Options 1, 2), were deemed not to meet this objective.

In terms of improved road safety (1.2), those options that provided an upgrade to the existing sub-standard vertical and horizontal elements along the road corridor scored at a higher level. Some options only partially achieved the objective, i.e. some substandard elements remained unaltered.
The evaluation took into account whether the option partially or fully achieved the road safety objective.

Increased capacity to accommodate existing and future traffic demands (1.3) was deemed to have been met if off road cycle facilities were provided and the option provided safe and efficient access across the corridor.

Improvement of travel times for all modes, (1.4), was deemed to have been provided by those options generating additional capacity along the corridor, although it should be noted that improvement of travel times does not necessarily provide improved journey time reliability. For those options which reserved the additional capacity for use as a bus lane the objective was partially met.

Considering improved public transport (1.5), those options that provided an increase in general road capacity and therefore an improvement in travel time for all users, including public transport users, were identified as partially meeting the objective. Options that met the objective were those that provided on road bus lanes along the corridor in one direction, with options that included bus lanes inbound and outbound exceeding the objective.

For improved active transport (1.6), options that met the needs of both commuter and recreational cyclists and pedestrians scored more highly than those that only provided either on-road or off-road facilities.

### 6.4.2 Assessment Objective 2 – The corridor upgrade provides a value for money transport solution

Prior to the option evaluation workshop, the following potential impacts and issues were considered for each option:

- Capital costs
- Property Acquisition costs
- Constructability
- Benefit Cost Ratio

This enabled the project team to score each option for its relative performance against Objective 2. Option performance against each sub-objective was also considered as follows:

- 2.1 Value for Money / cost Benefit Ratio
- 2.2 Minimised Property Acquisitions

In terms value for money (2.1), scoring was based on the benefit cost ratio achieved for a specific capital cost. Options that result in low benefit cost (less than 1.0) for a high capital cost (say greater than $100M) was deemed to fail the objective.
6.4.3 Assessment Objective 3 – Construction and operation of the upgrade maximises community and environmental benefits and minimises adverse impacts

Prior to the option evaluation workshop, assessment of each option was made in terms of constructability, environmental impact and social impacts. This enabled the project team to score each option for its relative performance against Objective 3. Option performance against each sub-objective was also considered as follows:

Option performance against each sub-objective was also considered as follows:

- 3.1 Maintain operations of corridor during construction and access to local community / roads
- 3.2 Minimise adverse long term impacts on the community
- 3.3 Minimise adverse environmental impacts
- 3.4 Minimise flood impacts

In terms of maintaining operations of the corridor during construction (3.1) options that are able to maintain four (4) traffic lanes during construction were deemed to meet the objective.

Long term impacts (3.2) for each option were scored by balancing the long term benefits of improved cross corridor connectivity, urban design and access to the impact of acquisitions and loss of open space / heritage values.

The impacts of each option on the surrounding environment (3.3) were assessed, although the options were generally deemed to have only limited impact on the existing environmental values of the corridor which is currently highly disturbed by existing development and infrastructure.

The impacts of the options on flooding of the Norman Creek crossing (3.4) and the potential for the option to increase flooding were assessed for each option. All options meet this criterion as no option was considered to have the potential to increase flooding.

6.4.4 Workshop Outcomes

The results of the workshop scoring are detailed in Table 6.3 below. It is noted that Option 4C was not initially presented at the workshop but was developed as an additional option following the workshop. In the week immediately following the workshop preliminary design work was carried out on Option 4C for the purpose of assessing the option by the project team.
Table 6.3 Workshop MCA Scoring of Options

<table>
<thead>
<tr>
<th>Rank</th>
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<th>Option</th>
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</table>

Note: (BL) – Bus Lane  
(GT) – General Traffic Lane

The workshop MCA spreadsheet is contained in Appendix D.

Subsequent to the workshop the project team further developed and refined the options particularly with respect to traffic performance, capital cost estimates and benefit cost ratios. The options were re-scored and the results of the re-evaluation are detailed in
Table 6.4 below. It is noted that the order of the first four (4) options was unchanged from the results of the workshop.
Table 6.4 – Final MCA Scoring of Options

<table>
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<th>Rank</th>
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</table>

The highest ranked option 4C results in an improved corridor and intersection performance. The performance of the intersections in the AM and PM peaks for this option is generally as high as any of the Options 5 and 6.

The option will provide improved public transport outcomes though the extension of the inbound AM peak hour bus only lane from Bennetts Road to immediately east of Overend Street. This will provide public transport travel time savings of four minutes (4). This will be in addition to the travel time savings resulting from the additional inbound lane from Scanlan Street to Wellington Road.

Option 4C results in a high level of road safety improvements through the upgrade of the Heidelberg Street horizontal alignment to a 60km/hr design speed, improvement of the Hawthorne Road vertical alignment for 60 km/hr and upgrading of the Balmoral Street horizontal alignment to 60 km/hr. All of these sub-standard elements were highlighted in the road safety audit.

The option provides good active transport outcomes though the provision of a 4.5m wide inbound lane from Riding Road and Overend Street, an inbound on road bike lane from Overend Street to
Laidlaw Parade and an outbound on road bike lane from Laidlaw Parade to Riding Road, except for a discontinuity between Norman Avenue and Hawthorne Road. Additionally a 3.0 metre off road cycle path on the northern verge from Riding Road to Laidlaw Parade within a widened verge is provided. The signalisation of Laidlaw Parade will allow good access for cyclists and pedestrians to the Laidlaw Parade bike link.

The option has the advantage of permitting possible future upgrade to an Option 5 solution, i.e. additional inbound lane for the full length of the corridor.

The total capital cost of the option is estimated at $90.7M, with a significant portion of the cost allocated to property acquisition costs ($37.7M). The Benefit Cost Ratio achieved with the option is 1.15, with the majority of the benefit achieved through vehicle operating savings.

The second highest ranked option, Option 4B, is the lowest capital cost option ($31.6M) with the second highest Benefit Cost Ratio of 2.05. With respect to Option 4C it is considered inferior for the following reasons:

- The intersections upgraded at the western end of the corridor, particularly the Latrobe Street and Heidelberg Street intersections will operate at a lower level due to the short upstream and downstream additional lane.
- The additional inbound lane is commenced at Scanlan Street, is ceased downstream of Heidelberg Street and then reintroduced at Latrobe Street. From a traffic perspective this is considered an inefficient arrangement and is reflected in the performance of the adjacent intersections.
- The option does not achieve upgrading of a number of the existing sub-standard elements within the corridor including the Hawthorne Road vertical geometry and the Balmoral Street horizontal geometry. The upgrade to the Heidelberg Street horizontal curve provides curve widening but does not improve the design speed above the current 40 km/hr design speed.
- The active transport outcome is poor, with the only improvement provided the wide inbound kerbside lane from Bennetts Road to immediately west of Overend Street.

For these reasons, despite the fact that the option is a low cost option with a good benefit cost ratio, the option is not considered to be a one that fully meets the project objectives.

The third highest ranked option, Option 4A, has relatively low capital cost option ($60.1M) with a Benefit Cost Ratio of 1.24. With respect to Option 4C it is considered inferior as the option does not achieve upgrading of a number of the existing sub-standard elements within the corridor including the Hawthorne Road vertical geometry and the Balmoral Street horizontal geometry. The upgrade to the Heidelberg Street horizontal curve provides curve widening but does not improve the design speed above the current 40 km/hr design speed.

The option does not provide an improved performance for the intersections at the eastern end of the corridor.
The fourth ranked option, Option 3, is the co-ordination of the existing signals within the corridor which will be a low capital cost option ($100,000) which should deliver a very high benefit cost ratio. It is understood that Council has commenced the design of this option.

The next highest ranked options, Options 5A, 5B and 5C with the additional inbound lane as a bus only lane, will provide excellent public transport outcomes and active transport outcomes and will fully address the road safety issues within the corridor. The options however all have a high capital cost but not deliver a cost benefit ratio any higher than Option 4C.

All of the Option 6 solutions would achieve potentially the highest public transport or traffic outcomes, but the high capital costs do not provide any higher benefit cost ratios than Option 4C.

6.5 Preferred Option Elements

The preferred option 4C will incorporate the following intersection and corridor improvements:

- Additional inbound traffic lane at the Lytton Road / Wellington Road/ Shafston Avenue intersection;
- Additional inbound traffic lane at the Lytton Road / Latrobe Street intersection;
- Additional inbound lane at the Lytton Road / Heidelberg Street intersection;
- Signalisation of the Wynnum Road / Laidlaw Parade intersection, incorporating a protected right turn lane into Laidlaw Parade;
- Improvements at the Wynnum Road / Norman Avenue intersection including the addition of a short inbound traffic lane and lengthening of the right turn lane into Norman Avenue.
- Additional inbound lane on the Wynnum Road / Riding Road / Balmoral Street intersection.
- Provision of an additional general traffic lane from Scanlan Street to Wellington Street. At the Lytton Road / Shafston Avenue / Wellington Street intersection, the additional lane is achieved by conversion of the existing right turn lane into a through lane and the removal of the right turns into Wellington Street. Right turns to access the Wellington Street precinct can be undertaken further to the west at the recently constructed Shafston Avenue / O’Connell Street intersection. It is noted that the intersection works at the Lytton Road / Shafston Avenue / Wellington Street intersection are being undertaken as part of the Clem 7 tunnel project.

The option incorporates the following public transport elements;

- Provision of a bus only stand up lane at the Wynnum Road / Bennetts Road intersection.
- Extension to the east of the existing a.m. peak hour Wynnum Road inbound bus lane from the current starting point adjacent to Hipwood Street to the Wynnum Road / Bennetts Road intersection. This benefit would require the prohibition between 0700 and 0900 of the currently unrestricted on street residential parking along the south side of Wynnum Road.
• Extension to the west of the existing a.m. peak hour Wynnum Road inbound bus lane from the termination point at the Hawthorne Road intersection to a point immediately west of Overend Street.

• Rationalisation of bus stops and indentation of bus stops at Norman Avenue.

Active Transport improvements associated with Option 4C include:

• Provision of a wide 4.5 m wide inbound kerbside lane between Riding Road and Overend Street. This wide kerbside lane will provide for inbound on road cyclists. During off peak periods on street parking could be permitted in this lane as is provided for currently.

• Provision of inbound on road bike lane from Overend Street to Laidlaw Parade.

• Provision of outbound on road bike lane from Laidlaw Parade to Riding Road, except the bike lane is discontinuous between Norman Avenue and Hawthorne Road.

• Provision of a 3.0 m wide off road cycle path on the northern verge from Riding Road to Laidlaw Parade.

Road geometry upgrades to improve road safety incorporated into the option include:

• Upgrade of the Wynnum Road curve around the perimeter of the cemetery at the Riding Road intersection to 60km/h.

• Upgrade of the Wynnum Road inbound curve at Bennetts Road to 50km/h design speed with curve widening for semi trailers.

• Improvement of the vertical alignment at the Hawthorne Road intersection to provide Safe Stopping Distance (SSD), Minimum Gap Sight distance (MGSD) and Manoeuvring Sight Distance (MSD) for a for a 1.15m driver height to 0.6 m (indicator at rear of vehicle) for a 60 km/hr . This is considered a minimum design standard and can be achieved for a relatively low cost by filling to the east of the existing crest.

• Upgrade of the inbound horizontal alignment approaching the Hawthorne Road intersection to a design speed of 60km/h.

• Upgrade of the Balmoral Street horizontal geometry to a 60 km/h design speed.

• Upgrade of the horizontal curve at Heidelberg Street to a 60km/h design speed, with provision of a central median and curve widening for semi trailer vehicles.

• Cul-de-sacing of Eskgrove Street intersection with Lytton Road.

The option will result in improved AM peak hour intersection performance along the corridor and will achieve travel time savings for bus passengers in the order of 4 minutes during the AM Peak.

The option has the ability to accommodate future upgrade to an Option 5 solution. In fact the option could be considered as a staged Option 5 solution.
The feasibility study total capital cost has been estimated at $90.7M with property acquisition costs of $37.7M, with seventy eight (78) properties requiring resumption.

The Option 4C could be constructed in six (6) distinct stages. The recommend stages would be:

- **Stage 1** - Construction of additional inbound general traffic lane from Scanlan Street to Wellington Road including the upgrade to the Heidelberg Street curve to achieve a 60 km/hr design speed. The total capital cost for this stage has been estimated at $34M;

- **Stage 2** - Upgrade to Norman Avenue intersection incorporating the addition of a short inbound traffic lane and lengthening of the right turn lane into Norman Avenue. The total capital cost for this stage has been estimated at $21.3M;

- **Stage 3** - Extension of inbound am peak bus only lane from Riding Road to immediately west of Overend Street including improvements to Riding Road, Bennett Road and Hawthorne Road intersections including vertical geometry improvement at Hawthorne Road intersection. The total capital cost for this stage has been estimated at $16.9M;

- **Stage 4** - Upgrade to Balmoral Street horizontal geometry and incorporation of on road bike lanes. The total capital cost for this stage has been estimated at $2.3M;

- **Stage 5** - Widening between Overend Street and Laidlaw Parade, and incorporating on road bike lanes and widened off road bike path. The total capital cost for this stage has been estimated at $15.9M. This stage includes an estimated allowance of $4.2M for the rehabilitation of the Canning Bridge;

- **Stage 6** - Signalisation of Laidlaw Parade Intersection. The total capital cost for this stage has been estimated at $0.3M;

Option 4C could be upgraded to the five (5) lane option 5C by construction of the following works:

- An additional inbound lane from Overend Street to Norman Crescent and from Bodalla Street to Scanlan Street;

- Widening of the Canning Bridge;

The additional feasibility study total capital cost to upgrade Option 4C to Option 5C has been estimated at $59.1M, with additional property acquisition costs of $28.3M. The upgrade includes an estimated allowance of $4.2M for the widening of the Canning Bridge.