Airport Link

Environmental Impact Statement

TECHNICAL PAPER NO. 1

TRAFFIC AND TRANSPORT

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Executive Summary

The Project

This technical report presents an assessment of the traffic and transport effects of the proposed Airport Link Project. The project is a predominantly underground toll road proposed between Bowen Hills and Brisbane's northern suburbs.

Key traffic and transport features of the project include:

- The Project comprises a two (2) tunnel road system, approximately 6.65 km in length, comprising a pair of north-south parallel tunnels, each catering for three (3) lanes of general traffic, and a pair of parallel east-west tunnels. The eastbound and westbound traffic tunnels each include two (2) lanes of traffic flow.
- There are three regions for linking with the adjacent and surface road networks – the southern connection, the north-western connection and the north-eastern connection regions. The project provides a connection between key elements of the urban road network managed by the Brisbane City Council (BCC) and the Department of Main Roads (DMR).
- The southern connection provides connection to Council's road network: to the four (4) lane NSBT for cross-river movement; to O'Connell Terrace and Campbell Street for traffic movements to the Central City network; and to the Inner City Bypass, a high quality six (6) lane orbital connection, for east-west travel immediately to the north of the Central City.
- The north-western connection provides linkages from both the north-south and east-west tunnel systems to Gympie Road, an existing DMR-controlled six (6) lane major arterial route for north-south travel, and Stafford Road, an existing four (4) lane major arterial road which forms part of DMR's East-West Arterial Route.
- The north–east connection also joins to DMR road network. It connects to the four (4) lane East-West Arterial Road which links to the Gateway Motorway and Brisbane Airport access, and Sandgate Road, a predominantly four (4) lane north-south arterial road.
- The project will be operated as a toll road, with an electronic system used for toll collection. Journeys would be tolled as either a full trip (i.e. between the southern connection and either of the northern connection regions) or a partial trip (i.e. a journey between the north-eastern and north-western connections).
- A final decision on the tolls to be charged for use of Airport Link will be made by the State Government and Council following assessment of the Business Case for the project. For this EIS study, Airport Link traffic forecasts have been prepared assuming a toll of $3.64 (expressed in June 2006 dollars including GST) for a full (north-south) journey and a $2.43 toll for a part (east-west) journey. These toll levels are within the range under consideration within the Business Case. The full north-south journey toll on Airport Link equates to $3.30 expressed in 2002 dollars, which was the toll value used in the TransApex Prefeasibility Study (Brisbane City Council, 2005).
- If Airport Link is approved to proceed, construction could start in 2008 and finish in 2012.

Project Objectives

The primary objective of Airport Link is to provide relief to congested roads in Brisbane's northern suburbs, connect activity centres and provide a sound basis for future traffic management by linking to strategic road connections allowing cross-city travel movements to bypass the Central Business District and inner suburbs.

This objective is set in Council's on-going commitment to build a better, more liveable city. The project forms part of one of Council's key transport strategies, TransApex, a proposed tri-axis based framework of cross-river and orbital road links.

Airport Link is also identified in the South East Queensland Infrastructure Plan and Program (SEQIPP), developed to guide infrastructure planning and investment to support the preferred pattern of development in the South East Queensland Region. SEQIPP flags it as a potential road infrastructure improvement to serve the Brisbane metropolitan area.

Within SEQIPP, a major public transport improvement in northern Brisbane is also proposed. This initiative is the Northern Busway, proposed to connect the completed Inner Northern Busway at Herston with Kedron, and ultimately extend further north to Aspley then Bracken Ridge. A Northern Busway Concept Design and Impact Management Plan Study has been undertaken in parallel with the Airport Link EIS, to examine the potential to achieve a cost-effective design solution for the Northern Busway, with reduced community impacts, via integration with the Airport Link. The potential cumulative effects of the project with and without the proposed Northern Busway have therefore also been considered in this study.

Purpose of this Technical Paper

This technical paper describes, and documents the findings of, the traffic and transport studies undertaken to assess the effects of the project on the traffic and transport system. It addresses the issues raised in the *Airport Link Project - Terms of Reference for an Environmental Impact Statement (March 2006)* issued by the Co-ordinator General.

Study Approach

A well-established process for assessment of traffic and transport impacts was applied as follows:

- Areas likely to be affected by traffic and transport aspects of the project were defined;
- Suitable data relevant for use in the study was collated;
- Traffic and transport demand modelling and forecasting approaches were established, with model validation and sensitivity testing of the modelled results undertaken to ensure fitness for purpose;
- The existing status of the transport network was described;
- Forecast transport demands and conditions were derived for the transport network without, and with, the project. The differences between the derived forecast conditions for scenarios without, and with, the project were assessed;
- The effects of the project on traffic, public transport, cyclists and pedestrians were determined by examination of these differences; and
- Using a similar process, the cumulative effects of the project, if implemented in conjunction with the Northern Busway, were assessed.

Modelling and Forecasting

Traffic and transport modelling was used to forecast the traffic and transport effects of the project in the following ways:

- To describe and assess the existing traffic flows and transport system performance, supplementing traffic counts and other observed data to generate estimates of existing conditions via modelled data; and
- To forecast traffic conditions and network performance at specific years in the future.

The model used a range of inputs to predict transport and traffic demand including:

- Land use descriptors in the form of demographic projections of population, employment and education enrolments within small geographic areas termed traffic zones;
- Travel characteristics, such as trip making rates and vehicle occupancy for different trip purposes, from a survey undertaken in 2003/04 in Brisbane of the travel behaviour of a sample of Brisbane households;
- Data from a survey of over 800 residents of the Brisbane Metropolitan area, which was designed to obtain specific behaviour characteristics for potential toll road users. The information was used to model the trade-off between the payment of a monetary toll and the benefit of a travel time saving and greater journey time reliability on Airport Link.;
- Descriptions of existing and planned or likely future road infrastructure, and road tolls, for the various forecasting years;
- Descriptions of existing and likely future public transport services, their coverage and frequency, for the various forecasting years.

The modelling of future transport networks, both without and with the project, includes the scenario where the North-South Bypass Tunnel (NSBT), a major cross-river toll road, connecting Bowen Hills and Woolloongabba, with an intermediate link to the eastern suburbs, is implemented and operational.

Other major road projects included in all future transport network modelling are:

- The Gateway Upgrade Project (GUP), the planned duplication of the tolled Gateway Bridge and upgrading of the Gateway Motorway on each side of the Brisbane River.
- Brisbane Airport Northern Access, planned by the Brisbane Airport Corporation as a new access road connecting to the new northern deviation of the Gateway Motorway created with GUP, to primarily serve the domestic and international terminals at Brisbane Airport.

Modelling of a separate scenario which considers the cumulative effects of the proposed staged implementation of the Northern Busway, a major public transport improvement in northern Brisbane, has also been undertaken.

Future traffic and transport conditions were modelled and assessed at two levels:

1) At a strategic level covering the Brisbane Metropolitan Area, which extends beyond Brisbane City and encompasses some nearby local authorities within the Brisbane Statistical Division (BSD). This enabled consideration of city-wide transport network implications of the project as well as interaction with areas of influence outside the EIS study corridor, such as Brisbane's CBD and the Australia TradeCoast area, which includes Brisbane Airport.
2) At a more detailed local level, covering Inner North Brisbane, to consider localised traffic and transport effects of the project within the suburbs of Wooloowin, Clayfield, Kedron, Gordon Park, Lutwyche, Albion, Windsor and Bowen Hills.

At the city-wide level the model used in the study was based on the Brisbane Strategic Transport Model (BSTM), with specific enhancements incorporated for the Airport Link study to enable more accurate forecasting. Key improvements included using more up-to-date input data, and more sophisticated representation of the delays typically experienced at intersections along a route. At the detailed level, the effects of the project on local intersection performance were examined using the aaSIDRA software with data extracted from the city-wide model.

Future traffic and transport conditions with the project, such as travel demand, travel times, travel speeds and the operating level of service of the road network and intersections, were forecast for 2012 (the year of project opening), 2016, 2022 and 2026 for scenarios without, and with, the project.

Existing Transport System Performance

Existing traffic levels, movement patterns, road network performance and intersection operating characteristics were determined from a range of observed and modelled data for the Brisbane Metropolitan area and Inner North area. Key findings from the assessment were:

- Improvement in some types of sustainable travel behaviour were evident between 1992 and 2004. For example, at the metropolitan-wide level, public transport mode share has improved over time and overall person trip-making rates are stable or slightly declined. Overall, however, motorised travel has increased to 80% of total modal use at the Metropolitan Area level from 77% in 1992, indicating the dominance of vehicle demand.
- The typical weekday traffic volumes on Lutwyche Road of 60,000 vpd, and 40,000 to 50,000 vpd on Sandgate Road, represent a major proportion of the traffic task in Inner North Brisbane.
- Both roads carry a significant proportion, around 60%, of vehicles making cross-city travel movements, in addition to functioning as important routes for radial or CBD oriented traffic, and local traffic to land-uses along the routes. Sandgate Road also serves as a commonly utilised route for travel to the Airport/ATC area.
- Highly congested traffic conditions occur during peak periods at several locations along the Gympie Road-Lutwyche Road-Bowen Bridge Road corridor, where there are 23 sets of traffic signals and two signalised pedestrian crossings in the 5.8 km between Kedron and Herston.
- On the Sandgate Road-Abbottsford Road corridor, where there are 18 sets of traffic signals and two signalised pedestrian crossings in the 6.0km between Toombul and Bowen Hills, congestion also occurs and in particular, traffic conditions in the Albion area are problematic.
- Travel speed on both the Lutwyche Road and Sandgate Road corridors is significantly lower than the posted speed limit on these roads during typical peak periods. Travel speed fluctuates widely along the corridor due to traffic delays at numerous locations.
- Bus services in the Inner North area are affected by congestion on the road system. Most bus services run with longer travel times and slower speeds than general traffic, particularly on Sandgate Road. On Lutwyche Road the inbound transit lane offers some benefits to bus travel times in the AM peak, however no similar benefit is available for outbound travel in the evening peak.

Future Conditions Without the Project

Future traffic forecasts have been based a population outlook for the Brisbane Metropolitan area prepared by the Australian Bureau of Statistics (ABS) as their Medium Series projection. This provides a sound basis to examine the implications of a regionally significant road such as the Airport Link. This population scenario projects a metropolitan area population of 2.58 million persons in 2026, which would represent a growth rate in population, and also trip making, an average of 1.7% per annum between now and 2026.

The forecasts indicate that even with significant growth in public transport mode share (reaching 11.1% of motorised travel made by public transport in 2026), a sustained growth in vehicle travel demand would occur both within the Brisbane Metropolitan area level and in the Inner North area. Within the immediate project area, north-south travel movements within the Inner North area are forecast to increase by 49% between 2004 and 2026, and east-west demands are forecast to grow by between 55 and 65 % in a similar period.

Traffic growth and network performance characteristics that are evident from these assessments include:

- Due to increased travel demand on the road network, a progressive decrease in travel speeds due to increased congestion is forecast.
- Traffic through the Lutwyche shopping precinct would grow by over 30% from 60,000 vpd currently to 77,500 vpd by 2026, with congestion and journey time variability progressively increasing. Intersections along Lutwyche Road which provide key local traffic connectivity, such as Chalk Street, Maygar Street and Albion Road, will operate with very high delays for the side-road traffic movements.
- Sandgate Road would experience even greater pressure from growth, due to its proximity to the ATC North precinct, a major contributing influence, and the inter-connection it provides to the Brisbane CBD, the Metropolitan area's other major economic activity area. Almost a doubling of current traffic levels is likely, with a growth in demand from 36,000 vpd through the Albion area to over 71,000 vpd by 2026. Intersections in, and around, the Albion shopping and commercial area would become the most severely congested locations in the Inner North area.
- Roads through the local area would experience further pressure from unwanted through traffic, often termed "rat-runners", arising when commuters seek to avoid the highly congested arterial routes. As an example, on Shaw Road through the Wooloowin traffic is expected to grow by over 30% by 2026, further eroding residential amenity, and Junction Road has a 79% traffic increase compared to current levels forecast.

Traffic and Transport Need

Transport planning needs to encourage less reliance on private vehicle travel, and forecasting in this study has modelled growth in public transport demand due to infrastructure and service improvements. By 2026 the increased public transport patronage would represent a doubling of current levels to over 900,000 public transport trips per weekday. The reduction in vehicle trips in the network with enhanced public transport is estimated as 4% compared to a trend public transport situation (where public transport would account for between 7% and 8% of travel demand).

Under the pressure of population and employment growth, the estimated growth in the travel task (in terms of person trips) and vehicle travel demand in the network is significant. Even with enhanced mode share for public transport, an increase in vehicle trips is forecast. By 2026, with a forecast population of 2.58 million in the metropolitan area (compared to 1.77 million in 2004), total travel demand including commercial vehicles is forecast to be 45% higher than current levels, reaching 5.5 million vehicle trips on an average weekday.

Associated with this overall increase in vehicle travel will be very strong growth in demand to key trip generators within the immediate catchment of Airport Link. The Central City has a forecast increase of over 55% in vehicle demand due to the importance of the area as a Primary Activity Centre and employment node. Particularly strong growth is anticipated in the ATC North region, which currently produces approximately 40% as much traffic as the Central City. By 2026, the vehicle demand associated with this area is forecast to be over 300% higher than current levels, and almost 80% of the level of Central City vehicle traffic generation.

Under the pressure of catering for increases in vehicle travel demand within the metropolitan area network, and the key travel generators within and surrounding the Airport Link corridor, a general increase in congestion is predicted on the road network across the years. Peak period journey travel times are forecast to increase significantly compared to the current level. By 2026 for a southbound peak period trip from Chermside to Fortitude Valley, an average travel speed of 20 km/hr is forecast (compared to 31 km/hr currently), with a forecast 2026 northbound PM peak speed of only 14 km/hr. A similar decline in performance would occur on

Sandgate Road, which will experience even greater growth in demand due to its proximity to the ATC precinct and its connecting role to the Brisbane CBD.

Assessment of travel demand in Brisbane's inner north indicates that on the arterial roads currently about 60% of trips are cross-city, 35% are destined for the Central City and only 5% is local traffic. Much of the traffic congestion in the arterial network in the inner north Brisbane's radial road system is caused by traffic wanting to get "somewhere else" but being forced to use the roads through the suburbs.

Within the Inner North area a range of transport improvements have been implemented over many years as a result of past investigations by Brisbane City Council and the State Government in consultation with the community. Examples of key transport projects completed over the last 15 years include provision of an inbound T3 lane on parts of Lutwyche Road to improve public transport operations and the opening of Airtrain to provide high quality public transport access to Brisbane Airport. These transport infrastructure initiatives have benefited both the local community and the wider travelling public within the Brisbane area. However the pressures of growth in population and travel generation associated with activity centres (as identified in the SEQ Regional Plan) within, and adjacent to, the Inner North area is placing increasing pressure on the transport system, and in particular the area's road network.

The SEQ Regional Plan (OUM, 2005) identifies a number of Activity Centres to serve growth in the region. The Brisbane CBD, immediately to the south of the Airport Link corridor, is the SEQ Region's Primary Activity Centre. Other important Activity Centres examples near the project include Chermside, a Principal Activity Centre with a major regional shopping complex; the Royal Brisbane Hospital, a Specialist Activity Node; and the Toombul shopping complex, a Major Activity Centre. To the east, Brisbane Airport is a Specialist Activity Centre and the Australia TradeCoast precinct an area of major economic importance to the region.

Brisbane City Council's *Transport Plan for Brisbane 2002-2016* examined the challenges facing Council in keeping their transport network operating effectively into the future, and supporting the vision of *Living in Brisbane in 2010*. From this comprehensive strategic analysis of the transport system, the importance of addressing gaps in the strategic road network and strengthening the structure by creating an orbital road system in Brisbane (including additional cross river road capacity) emerged.

Airport Link can improve the road network and fill in gaps in the current structure by fulfilling important transport functions within the road network and various key movement roles, as follows:

- Airport Link will function as an intra-state road network connection, linking to other motorway standard connections, catering for long distance movements between major economic regions within South East Queensland, by linking the Brisbane CBD with the ATC precinct including Brisbane Airport. It will also provide a linkage between this major economic area and locations external to South East Queensland. It will provide connection alternatives to the Gateway Motorway for the ATC precinct from southern and western areas, via the Airport Link, NSBT, and the Pacific Motorway, or via the Airport Link, NSBT and the Ipswich Motorway.
- Airport Link will support the regional road network providing connections to urban arterial standard roads which link to the intra-state/motorway network. Specific examples of Airport Link's regional road network role include:
  - It will provide a connection to the Inner City Bypass and thus the western arterials of Coronation Drive and Milton Road, and via the NSBT to southern arterials such as Wynnum Road and Logan Road.

- It will provide an improved standard of arterial orbital route in the middle ring by improving the connectivity of Stafford Road and the East-West Arterial Road compared to the current route along Kedron Park Road-Rose Street- Junction Road, which has sensitive adjoining land-uses.
- It will supplement radial arterial road capacity, allowing public transport initiatives in the Lutwyche road corridor such as staged implementation of Northern Busway, and improving amenity and road safety for land-uses along the Sandgate Road corridor.

Operational Effects

Demand for Airport Link

Once operational, Airport Link is forecast to fulfil a traffic function of regional significance.

Use of the Airport Link north-south tunnel in 2012, prior to traffic ramping-up to full modelled forecast volumes, is estimated as 51,00 vpd. By 2026, the north-south tunnel would carry a forecast 93,150 vpd Forecast use of the East-West ramps is modelled as 25,900 vpd in 2026.

It would function as part of a network of cross-city connections between the northern and southern, and northern and western suburbs of Brisbane. It would also provide an important link between two major economic activity centres in the region, namely the ATC North precinct and the Brisbane CBD.

The forecast movement patterns of Airport Link users in 2026 illustrate these roles. For example:

- The north-south tunnel is forecast to carry predominantly cross-city traffic (50%), and also would cater for significant proportions of radial or CBD oriented trips (33%), Airport/ATC North precinct traffic (15%) and a small amount of local traffic (2%).
- The east-west ramps cater primarily for traffic use related to the ATC North precinct including Brisbane Airport (52%) and cross-city travel (43%), with a small amount of local traffic (5%).
- The overall proportion of daily project use related to the ATC North area, including Brisbane Airport, is 24%.

Traffic Volume Effects, Mitigations and Benefits

The effects of the project on feeder routes have been assessed by comparing the differences between the derived forecast conditions for scenarios without, and with, the project. Where appropriate, mitigative measures have been identified. Key findings of the assessment of the effect of the project on feeder roads include:

- At the southern end of the project a number of roads will experience increased traffic demands, however the range of Airport Link network connections provided disperses the level of impact and no significant adverse impacts are forecast.
- At the northern end of the project the most significant effect occurs on Stafford Road where over a 50% increase in demand is forecast compared to future traffic levels without the project. This is due to the combined role of this link catering for travel demand for both east-west and north-south movements. The resultant traffic volumes of 45,000 vpd in 2026 are within the mid-block traffic lane capacities of a well-managed four (4) lane arterial route. Satisfactory levels of service could be achieved with the implementation of traffic management measures along the route and these are recommended as a mitigative strategy.

  Examples of arterial traffic measures that should be investigated for implementation along Stafford Road, particularly between Webster Road and Gympie Road, in conjunction with the project to safely and efficiently cater for the forecast traffic increase would include:

- Parking management/restrictions at intersection approaches (potentially for longer periods of the day than are currently applied);
- Formalisation of turn lane pockets at side streets where signalised intersections are not provided;
- Construction of a raised median along stafford road where double centre line currently exists;
- Potential implementation of additional signalised intersections at side-streets;
- Facilities for public transport, such as indented bus bays; and
- Facilities for pedestrians and cyclists.

Note that not all measures may be required and that the best package of initiatives to manage the traffic flows on Stafford Road between Gympie Road and Webster Road would require scoping within an arterial corridor traffic management plan within the Traffic Management Plan (Operations) for the project.

- Impacts on Gympie Road diminish quite rapidly north of the project. The Traffic Management Plan (Operations) should address management measures such as signal co-ordination to accommodate increased traffic on the approaches of this arterial corridor connecting to the project.
- It is recommended that local area traffic management measures be implemented in conjunction with the project in the north-western precinct at the Stafford Road/Gympie Road intersection. Increased traffic levels on Gympie Road immediately north of the Airport Link northbound exit ramp may create pressure for traffic to use local streets such as Broughton Road in this precinct. Local area traffic management measures would minimise the potential for use of the local roads in this precinct by through traffic.
- Traffic volumes on Sandgate Road north reduce with the project, due to the re-distribution of travel movements from northern areas to the east-west toll road to access the East-West Arterial Road. This effect will reduce traffic congestion at the access to Centro Toombul Shopping Centre.

As the project has a wider effect on route choice within the network, a range of heavily trafficked north-south arterial roads in the broader northern network are forecast to experience traffic reductions and improved operations. Examples at 2026 include Kingsford Smith Drive (-3%), Nudgee Road (-19%), Enoggera Road (-13%) and South Pine Road (-12%).

The project will also yield improved amenity on many roads in the inner north suburbs due to forecast traffic reductions with the project. Examples of effects in 2026 include:

- Reduction in daily traffic of 25% on Lutwyche Road through the Lutwyche shopping area, and 28% on Sandgate Road at Albion.
- Reduced traffic levels on suburban and district roads, such as Shaw Road (-16%), Dawson Street (-8%) and Dickson Street (-28%), which currently experience strong peak travel demands from north-south commuter traffic seeking to avoid congestion on the arterials.
- Strong reductions (23-28%) in east-west traffic on the Junction Road-Rose Street route through residential areas.
- Traffic relief on key east-west links between Gympie and Sandgate Roads north of the project, such as Rode Road (-24%) and Hamilton Road (-16%).
- Reduction of 49% of commercial vehicle traffic from north-south surface routes from Webster Road across to Nudgee Road, by 2026.

Intersection Performance Effects

The effect of the project on the performance of intersections within the network has assessed. Locations have been selected to cover key signalised intersections on feeder routes to the facility, as well as intersections along the surface road network that will benefit due to diversion of traffic to Airport Link.

Findings included:

- An overall improvement in operating conditions along the Sandgate Road corridor is indicated with the project. This will enhance the operation of intersections both north of the project, such as the Sandgate Road/Centro Toombul Shopping Centre Access, and south of the project, such as the congested intersections in the Albion area, where both vehicular and pedestrian movements will benefit from reduced delays.
- In the Lutwyche Road corridor south of the Kedron Park Road intersection, the project will result in a improvements in intersection operations compared to the situation without the project. This creates opportunities for the use of some road capacity for pedestrian improvements and/or public transport priority.
- Intersections on roads through the local area, such as Albion Road and Junction Road-Rose Street-Park Road, will experience less congested operations during peak periods with the project.
- Along Stafford Road the level of service of operation at intersections will decline with the project due to the increase in traffic volumes. Some arterial corridor traffic management measures along Stafford Road, as highlighted previously, may be necessary to achieve greater traffic capacity and reduce delays.
- Where possible, grade separation has been incorporated within the project to ensure that traffic accessing or egressing the project tunnels can connect in an unimpeded manner to the connecting road network and not encounter a signalised intersection for a considerable distance. For other locations, where traffic exiting the tunnel will encounter a potential stop point, an analysis of the level of service and queuing at the exit has been undertaken. In all cases this was found to be satisfactory.
- A complex range of traffic movements will continue to need to be catered for at the surface road intersections in the vicinity of the access points to the project at the northern connections. As a result the level of service at these intersections will continue to remain very congested with the project. These effects are principally related to the increased concentration of east-west traffic movement. In the vicinity of the northern connections, traffic signal co-ordination should also be implemented though the Traffic Management Plan (Operations) for the facility to ensure that key movement streams using the surface road routes are not unduly delayed. It is noted that traffic using these northern connection intersections to proceed to the alternative un-tolled surface road routes, will find that intersections further along Lutwyche Road and Sandgate Road will be less congested, so the overall effect on travel time on the surface route will be improved.
- At the southern connection, changes to the traffic performance of intersections in the Bowen Hills and Fortitude Valley area affected by project traffic varies between peaks, and generally does not materially change the congestion levels on key commuter routes compared to intersection performance without the project. As Brisbane grows peak spreading influences will emerge as the mechanism by which travel on these commuter routes closest to the CBD are most appropriately managed.

East-West Arterial and Nudgee Road

An assessment of the effect of the project on the East-West Arterial intersections with Gateway Motorway and Nudgee Road has been undertaken. These intersections are on a key approach route to the Australia TradeCoast precinct, an area which is forecast to experience a substantial growth in traffic demand due to increased employment and economic activity.

- Both the East-West Arterial/Nudgee Road signalised intersection and the East-West Arterial/Gateway Motorway ramps/Airport Drive roundabout are currently highly congested and experience heavy delays and queuing during peak periods. Whilst the Gateway Upgrade Project when completed in 2011, will re-direct some traffic movements, continued travel growth will create pressure for capacity improvements at these locations. In the absence of improvements, operating conditions during peak periods would be poor in 2011 and continue to degrade, worsening significantly in terms of queuing and delay. A clear need for improvements to be undertaken is evident, regardless of Airport Link.
- In 2012 Airport Link adds 12% in the AM peak and 3% in the PM peak to total volumes at the Nudgee Road intersection, and 4% in the AM peak and 5% in the PM peak to volumes at roundabout. There are some traffic distribution changes through these intersections with Airport Link, which slightly improve forecast conditions, however the pressure for capacity improvements would still remain.
- A detailed investigation of the most suitable form of upgrading to be undertaken at this location in order to achieve a long-term solution for network operations in this area is warranted. This, however, is beyond the scope of the EIS, because the Airport Link Project itself does not trigger the need for improvement, or even bring forward in time the need for improvement to be undertaken at these intersections.
- Within this context, an analysis of two notional traffic management solutions, that would suffice to achieve satisfactory operations, has been undertaken for the purposes of EIS traffic assessment. These demonstrate that, whilst the Airport Link Project in itself is not a primary driver of the need for intersection improvements at this location, a satisfactory operational solution is available that would not compromise the project operation.
- A study, termed the Australia TradeCoast Transport Study, is programmed within SEQIPP 2006-2026 to examine the long-term transport access needs of the ATC precinct and this will incorporate investigation of long-term solutions to managing traffic on this important access route to the Australia TradeCoast precinct. This ATC Transport Study should build upon the notional upgrades assessed for the purposes of this EIS, and explore the merits of grade-separated treatments, and the relationship between other potential accesses to the precinct as well as land-use distribution/sequencing within ATC North, in the development of the most appropriate long-term strategy.

Network Performance Effects

The impact of the Airport Link Project on overall Metropolitan Area network performance indicates:

- The project reduces the amount of travel on lower order roads in the network (local district and suburban routes) and redistributes travel to Motorway routes. The Arterial road network is also benefited by travel distance and time reductions.
- A very small (<0.2%) increase in overall vehicle kilometres of travel in the network is forecast. An overall 1 to 2% reduction in the vehicle hours of travel within the overall Metropolitan Area is indicated, together with an increase in overall average network speed, reflecting a general lowering of congestion.
- A reduction in total vehicle hours of travel and vehicle kilometres of travel is expected for commercial vehicles with the project, providing important benefits to industry through reduced operating costs and improved travel time reliability.

Travel Time Benefits

The travel time benefits offered by Airport Link are significant. Key examples include:

- On cross-city routes an average saving of approximately 30% in the morning peak hour and 40% in the evening peak, a time saving of 7 minutes in the morning to 14 minutes in the evening in 2022.

- On radial routes, an average of over 40% saving in both AM and PM peak hours. This represents time savings from 7 to 9 minutes on a trip from Nundah to Fortitude Valley or Hendra to Fortitude Valley, and 11 minutes from Chermside to Fortitude Valley in the morning peak in 2022. Evening peak savings of up to 12 minutes are estimated by 2022.
- Benefits, although lesser, are also forecast for traffic choosing to use the un-tolled surface links instead of Airport Link. These travel time savings would be approximately 10% to 15% on cross-town routes and approximately 20% to 30% on radial routes. This represents average time savings of approximately 3 minutes for cross-town routes and 6 minutes for radial routes during peak periods.

Local Traffic Effects

The project would also require changes to local traffic arrangements through access restrictions or changes . Local access effects have been assessed in the following areas:

- Northern connections
  - Kedron East Precinct (east of Gympie Road) – small impact that can be suitably managed;
  - Gordon Park Precinct (south of Stafford Road) – moderate effects with project design shaped to minimise adverse impact;
  - Kedron West Precinct (north-western of Gympie Road/Stafford Road intersection) – small impact on local access, however implementation of local area traffic management measures recommended to address potential pressure from increased traffic on adjacent arterial roads on precinct;
  - Emergency Services Complex (at Kedron Brook) – satisfactory alternative access arrangements need to be established from Park Road with site re-configuration;
  - Lutwyche Precinct (west of Lutwyche Road) – moderate impacts on local traffic access with project design features to minimise adverse effects; and
  - Toombul precinct - overall beneficial effect on local traffic due to reduced traffic levels on Sandgate Road.
- Southern connection
  - Between Federation Street and O'Connell Terrace (east of Bowen Bridge Road) - moderate impacts on local traffic access with project design features to minimise adverse effects; and
  - Royal Brisbane Hospital complex (RBH) – overall beneficial effect on traffic access for RBH due to forecast traffic reductions near access and provision of high quality route via Airport Link for flexibility in emergency situations.

Benefits for Bus Travel

Airport Link will also be beneficial for bus travel, with the following key benefits identified:

- During peak hours Lutwyche Road and Sandgate Road will have significant traffic reductions and increased travel speeds on the surface road bus routes. These are the highest utilised corridors for bus services in the Inner North area, so the project will yield travel time savings and improved travel time reliability for bus passengers. An overall average travel time improvement of 37 to 40% in the peak hours in 2022 is forecast for a CBD trip, compared to the scenario without the project. This is equivalent to a travel time saving of approximately 6 minutes in travel time for bus commuters.
- The project creates the opportunity for a new bus route between the City and the growing employment and activity areas within ATC North precinct to utilise the east-west tunnel of the Airport Link and travel express to Nudgee Road. Services could gain access from Lutwyche Road at the north-western connection. This new route is under consideration in TransLink's forward planning.

There will only be minor effects to existing bus stops due to the project, all of which can be suitably accommodated within the design.

Effects on Pedestrians and Cyclists

Airport Link will have some effects on existing infrastructure for pedestrian and cycle movements around the tunnel portals and their connections to the surface road network. The project's design has ensured that connectivity will be maintained in those regions. Opportunities to improve local pedestrian and cyclist accessibility in conjunction with the project have been identified. Key changes that have been included in the design include:

- Southern connection - The Airport Link does not affect the ability to provide planned path relocations associated with the NSBT. Pedestrian crossings of major roads at signalised intersections provide a good range of opportunities for pedestrians for safe and efficient pedestrian movements.
- North-western connection - The Kedron Brook pathway and suitable connections to the surrounding area will be maintained with the project, ensuring that the good pedestrian and cyclist accessibility is preserved for local residents, school students, commuters and recreational users. At the Gympie Road and Stafford Road signalised intersection, pedestrian crossings of both Gympie Road (on the northern side) and Stafford Road will be provided with appropriate signal phasing.

  At the Lutwyche Road/Kedron Park Road signalised intersection, pedestrian crossings will be provided on the southern leg of Lutwyche Road and across Kedron Park Road. At both locations, due to the width of the intersection approach roads, staged pedestrian crossings are proposed. This will allow pedestrians to cross one traffic stream under a green pedestrian signal and then wait in safety on a wide median island before proceeding to cross the other traffic stream via a second green pedestrian signal. This will allow the safe movement of pedestrians across these roads to locations such as the Emergency Services Complex, the Kedron Park Hotel and the nearby schools.

- North-eastern connection - The project will require modifications and re-alignment of some sections of Kedron Brook pathway. A section of the path along the southern bank of Schulz Canal will be relocated to the northern bank. Connectivity between the Toombul precinct and residential areas south of Schulz Canal will be maintained by a new pedestrian/cycle path linking Parkland Street, on the north of the canal, to Stuckey Road, south of the tunnel. This path will provide for better connectivity to Toombul Rail Station.

  Pedestrian crossings will be provided via the signals at the intersection of Sandgate Road/East-West Arterial and the Airport Link ramps to cater for safe and efficient movement of pedestrians across Sandgate Road and for north-south pedestrian movement along Sandgate Road. There will be no effect on existing arrangements for pedestrians at the traffic signals at the nearby Centro Toombul Shopping Centre access on Sandgate Road.

Road Safety

The effects of Airport Link on road safety have been assessed and an overall improvement is forecast due to the project, although there are varied outcomes on individual routes. Key findings are:

- An overall reduction in crashes on major routes within the Inner North area (including the Airport Link) of 9 % by 2022.
- Forecast reduction in road crashes on the Bowen Bridge Road/Lutwyche Road/Gympie Road corridor, Sandgate Road/Abbotsford Road corridor and the Kedron Park Road-Park Road-Rose Street-Junction Road corridor of over 20% in 2022 with the project.

- Due to increased traffic volumes associated with its function as a feeder route for Airport Link, the need for mitigative works along Stafford Road has been identified previously.

Cumulative Impacts with Northern Busway

The traffic and transport conditions in a scenario where the proposed Northern Busway is implemented and operational in conjunction with Airport Link were assessed.

The features and timing of the proposed Northern Busway included within the traffic and transport model were based upon the proposed Northern Busway concepts publicly available in June 2006, and were :

- In 2012, to coincide with opening of Airport Link, operating up until around 2022, an Interim Northern Busway comprising:
  - Northern Busway from Inner Northern Busway at Royal Children's Hospital (RCH) to a new busway station at Royal Brisbane and Women's Hospital (RBWH);
  - Northern Busway to Enoggera Creek and busway connection to surface road network on Lutwyche Road via Victoria Street and Northey Street. Buses would operate in general traffic between Northey Street and Newmarket Road;
  - Bus lanes and bus priority measures in Lutwyche Road corridor between Newmarket Road and Stoneleigh Street. Introduction of these works are possible due to the reduction in surface road traffic on Lutwyche Road with the implementation of Airport Link and Northern Busway;
  - Northern Busway between Stoneleigh Street (Lutwyche) and Kedron; and
  - Busway stations at Lutwyche and Kedron Brook.
- By 2026:
  - Ultimate Northern Busway completed between RCH and Kedron, including Busway Stations at RBWH, Federation Street, Windsor, Albion, Lutwyche and Kedron.

In the 2026 scenario it has been assumed that the bus lanes on Lutwyche Road would be converted to T3 use, except on Truro Street which would remain as local access and buses only.

The staged implementation of the Northern Busway, as described above, and considered in this cumulative effects scenario, would involve changes to the surface road operation and lane provision on Lutwyche Road. The overall effect is that two general travel lanes in each direction would be available on Lutwyche Road between Newmarket Road and Stoneleigh Street with the Interim Busway, matching to the existing two general traffic lanes in each direction on Lutwyche Road between Stoneleigh Street and Bradshaw Street.

The Busway would a provide high quality public transport system in the inner northern suburbs, complementing the rail system and providing increased opportunities for interchanging between modes using TransLink's integrated ticketing system. This would enable convenient travel by public transport to a wide range of trip destinations both within and beyond the Central City. The Northern Busway service plan for 2012 would result in a daily total of approximately 1,400 services crossing Enoggera Creek rising to 3,300 by 2026 compared to 800 bus services currently. At Lutwyche, currently serviced by 660 buses per day, bus numbers would rise from over 900 daily in 2012 to 2,400 daily by 2026. The plan includes a new bus service between the City and ATC North area via the Northern Busway, diverting at the Kedron Brook Busway Station to use the Airport Link east-west tunnel to the East-West Arterial.

The overall benefits to bus users of the Northern Busway will be significant and an increase in bus patronage in the corridor is forecast due to the improved public transport services and the greater travel reliability, comfort, safety and convenience provided by a Busway system.

Key findings of the cumulative impacts assessment are:

- Weekday traffic flows on the Airport Link Project are marginally higher in the cumulative effects scenario with Northern Busway. Whilst public transport use increases with the Northern Busway reducing total private vehicle demand, the small change in overall forecast use of Airport Link occurs because the surface road changes along Lutwyche Road have some effect on overall traffic patterns. The perceived attractiveness of the surface road route changes compared to the Airport Link tolled route. There is also replacement of Airport Link trips to the Central City by cross-city and cross-river movements. Typically Central City travellers find use of improved public transport an attractive option.
- A very similar range and scale of traffic effects on connecting roads will occur in the cumulative scenario, compared to the effects of the project alone. Similar intersection performance will occur on feeder roads to the project and at surface road intersections in the vicinity of the connections.
- The scale of traffic reductions with the cumulative scenario on roads within the Inner North area is generally similar to the project only case, with the exception of Lutwyche Road, which experiences somewhat greater traffic reductions due to the Northern Busway effects. For example, on Lutwyche Road compared to a network without Airport Link, a decrease in traffic of 39% is forecast in 2026 with the combined projects, which is greater than the 25% reduction with Airport Link only.
- Along Lutwyche Road, intersections would operate at a similar Degree of Saturation and Level of Service with the Northern Busway modifications to the intersections. These changes are able to be accommodated without a significant adverse impact on performance as there is a lowering of vehicle demand along Lutwyche Road due to the combined influences of the public transport initiative and the diversion of vehicle trips to Airport Link.
- The overall effects on road network performance are quite similar to the Airport Link only scenario, with beneficial transfer of the some of the road travel task from lower to higher order roads in the network.
- The cumulative impact of the Airport Link and the Northern Busway on travel times and speeds shows similar benefits to the Airport Link project case. It is notable that the benefits forecast for Lutwyche Road are negligibly different from the Airport Link only scenario. This indicates that the allocation of some of the road space freed-up by traffic reductions due to the Airport Link to public transport use (as proposed in the Northern Busway interim staging) does not significantly affect travel time on this route for general traffic. The travel time along the alternative surface route remains substantially better than would prevail in the future scenario without Airport Link.
- Some additional effects on local access will occur in the Northern Busway if implemented in conjunction with Airport Link, as follows:
  - Kedron East, Kedron West and Emergency Services Precincts: No additional effects with Busway;
  - Gordon Park Precinct: Additional moderate impacts due to use of Swan Street for bus access/egress, albeit on a very low bus frequency basis. Arrangements proposed are not anticipated to encourage additional traffic use of the local streets such as Swan Street because through traffic movements out of Swan Street at Stafford Road will be signal controlled, and will not offer significant travel time benefits compared to use of the major road network;
  - Lutwyche Precinct: Some additional effects to Perry Street access with suitable alternative measures accommodated in the design;

- Southern Connection: Some impacts in the Edgar Street/Northey Street intersection due to interim busway connection which will have minor impacts on local traffic; and
- Effects on abutting precincts along Lutwyche Road: The Northern Busway will have some effects along Lutwyche Road for both the Interim and Ultimate Busway scenarios. Whilst these involve quite major changes to current roadway arrangements in some sections the design allows for suitable alternative arrangements for local access.

- The implementation of the Northern Busway in conjunction with the Airport Link will have additional beneficial effects on pedestrian and cyclists, such as :
  - A new pedestrian/cycle bridge, providing a connection from Swan Street north of Kedron Brook to Perry Street on the south, will further enhance the connectivity and accessibility of the Kedron Brook pedestrian/cycle path and provide convenient access to the proposed Kedron Brook Busway Station from the Gordon Park residential area; and
  - A range of improvements associated with the proposed Busway Stations will provide enhanced facilities for pedestrians and cyclists in the corridor.
- The Bowen Bridge Road-Lutwyche Road-Gympie Road corridor between Herston and Kedron would experience significant additional safety benefits with the inclusion of public transport initiatives and further reduction of surface traffic. In other areas, there are only minor differences in expected crash effects in the combined project scenario compared to the Airport Link only case.

Construction Effects

During construction, traffic and transport impacts may occur in the area surrounding the three connection areas, due to physical changes or temporary traffic management, or more widely due to construction traffic on haulage and delivery routes.

Detailed Traffic Management Plans (TMPs) will need to be prepared for each work area to describe the management and mitigation measures to be adopted, for approval by the relevant authorities. Preparation of these Plans will include detailed analysis of operational effects along affected routes and at affected intersections. The TMPs will consider the convenience and safety of all road users, including public transport, pedestrians and cyclists. During construction, conditions around the work sites and on the haulage routes will be monitored, and the TMPs modified as necessary to address any issues which arise.

- Construction works would be located in three areas: the southern connection in Bowen Hills, the north-western connection in Kedron near Kedron Brook, and the north-eastern connection in Toombul. Access to all of the work sites is available directly from the major road network.
- The operations of access points, including the East-West Arterial/Sandgate Road intersection, will be examined in detail in the TMPs for each site. If necessary, modification to the East-West Arterial/Sandgate Road intersection which form part of the Airport Link project may be brought forward to facilitate signalised access to the adjacent worksite.
- Over the 47 month construction period, an average total of 465 workers in all work areas will be on site during the daytime shift. Surface works would generally be carried out between 6.30am and 6.30pm, Monday to Saturday. Where required by the relevant approval sections within Brisbane City Council or the Queensland Department of Main Roads, or Queensland Rail, some works on major roads or rail crossings may need to be carried out outside these hours to minimise traffic and transport impacts. Underground work would continue 24 hours a day.
- Potential placement sites for tunnel spoil are at the TradeCoast Central site at the old Brisbane Airport, and at the Port of Brisbane. Spoil would be carried by road to these sites. Haulage traffic is likely to use

Lutwyche Road, Gregory Terrace, Breakfast Creek Road, Kingsford Smith Drive, the Gateway Motorway, the Port of Brisbane Motorway and the East-West Arterial.

- Haulage is proposed to be carried out 24 hours a day for the five working days, and 12 hours on Saturday to 6.30pm, in order to minimise impact on traffic flows. With this arrangement, a conservative scenario based on an average of 5 truck loads an hour from the north-western connection could be expected. This level of traffic is a very small compared to current traffic volumes, and is unlikely to significantly affect traffic flow on the haul routes. Delivery traffic is expected to be substantially lower than haulage volumes, and the delivery routes are, similarly, not expected to be adversely affected.
- Despite this, since a number of intersections on Lutwyche Road, Kingsford Smith Drive and the East-West Arterial currently experience peak period congestion, detailed analysis will be required during the preparation of the TMPs to ensure that the incremental change in performance due to the construction traffic is acceptable. If necessary, haulage and deliveries will be restricted to outside peak times.
- The construction phase TMPs would need to include consideration of the haulage traffic anticipated from the NSBT. Until the third quarter of 2009, background traffic flow on Kingsford Smith Drive will include trucks hauling spoil from the NSBT northern construction site. This is expected to overlap with lower intensity early works on Airport Link. During the peak construction period for total Airport Link and NSBT haulage on Kingsford Smith Drive, early in 2009, background traffic would include approximately 10 trucks per hour from the NSBT. At this time, the indicative scenario for Airport Link indicates an average of 4 trucks per hour would use this road. Although the incremental increase is small, if necessary to maintain network performance, Airport Link related haulage operations on this road could be limited to outside peak periods.
- Staging of works at all sites would allow the existing number of through lanes to be provided past the sites at most times, though temporary alignment changes would be required. As a result, the level of through traffic intrusion into adjacent areas is expected to be small. Occasional short duration partial closures are likely, for example for intersection works. These would be scheduled to minimise their impact.
- The indicative work sites are able to accommodate all construction related parking demand, as well as queuing haulage vehicles. Alternatives for management of parking at the southern connection could also include extending parking into Byrne Street, which would no longer cater for residential access, or bussing workers to the site from car parking areas within the RNA Exhibitions Grounds. Conditions on streets adjacent to the worksites should be monitored, but no safety or amenity impact due to construction parking or queuing is expected.
- Bus routes and schedules would not be affected by construction. A total of seven bus stops in the three construction areas would require temporary relocation during some stages of the works. Suitable interim locations close to the existing bus stops are available in each case.
- Construction of the cut and cover sections at the north-eastern connection would have some impact on the North Coast Railway Line, with some overnight closures and an expected four (4) weekend closures required. This will involve some inconvenience to passengers who will be conveyed by bus around the work area, and may result in rescheduling of some freight operations. A smaller number of overnight closures will also be required on the Airport Line nearby, and the Exhibition Line near Campbell Street at the southern connection. Although the Airport Link will pass beneath the Ferny Grove Line in Windsor, this section of works will be roadheader driven tunnel construction and no impacts on rail operations on this line are expected.
- Emergency vehicle access to the Royal Brisbane Hospital complex would not be significantly affected by the works. The Emergency Services Complex in Kedron would be relocated to an adjacent site before construction begins, and construction is not expected to significantly affect its access.

- Pedestrian and cyclist access, including pedestrian crossings, would be maintained around all work areas, though some temporary diversions will be required. A temporary pedestrian/cycle bridge over Shultz Canal would be provided near Sandgate Road. This could be retained permanently as part of an enhanced pedestrian and cycle network.

Conclusion

For the investigations undertaken for this study, it is evident that from a traffic and transport viewpoint the Airport Link would fulfil a range of important needs. These are:

- Airport Link would address strategic gaps in Brisbane's road network. It will provide an enhanced road connection to the intra-state road system and the regionally significant roads that provide for both radial and orbital functions with Brisbane. These improvements will facilitate cross-city travel movement in an environment where there is increasing travel demand to, and between, major economic activity and employment nodes serving the region, such as the Brisbane CBD and the Australia TradeCoast precinct, including Brisbane Airport.
- Opportunities to enhance public transport operations on surface roads would be created with Airport Link. Greater use of public transport can be supported by providing opportunities on Lutwyche Road for reclamation of freed up road space from general traffic use for either bus, or transit (high occupancy vehicle) lanes. In particular, potential for a cost-effective staging of the Northern Busway would be available. Potential for transit lanes on Sandgate Road is also created.
- Airport Link would relieve traffic congestion and improve travel time reliability. Both users of the toll road facility, and the un-tolled surface roads, would benefit from travel time savings, particularly freight vehicles. An effective integrated transport network supports competitiveness of industry and business.
- The environment for pedestrian and cyclist travel on the surface network would be improved with Airport Link, by reducing traffic demands on the local road system, particularly through activity centres and near public transport stations. Walking and cycling networks provide flexibility for travel as well as significant health and environmental benefits.
- Airport Link would generally improve the amenity of inner urban redevelopment areas such as Albion and Lutwyche, locations in close proximity to high quality public transport, by reduction in vehicular traffic. Consolidation of inner urban areas supports aspirations for a more compact urban form in South East Queensland.

While some adverse effects have been identified and assessed, the study shows clear support for the project as a key component in an overall strategy to improve the efficiency of Brisbane's road network.

1. Introduction

This technical report presents an assessment of the traffic and transport effects of the proposed Airport Link Project. The project is a predominantly underground toll road proposed between Brisbane's northern suburbs and Bowen Hills.

The primary objective of Airport Link is to provide relief to congested road links in Brisbane's northern suburbs, connect activity centres and provide a sound basis for future traffic management by linking to strategic road connections allowing cross-city travel movements to bypass the Central Business District and inner suburbs.

This objective is set in Council's on-going commitment to build a better, liveable city. Airport Link is part of Project TransApex, Brisbane City Council's proposed tri-axis based framework of strategic cross-river and orbital road links that would allow Brisbane's cross-city travel movements to bypass the Central Business District (CBD) and inner suburbs.

Airport Link is identified in the South East Queensland Infrastructure Plan and Program (SEQIPP), developed to guide infrastructure planning and investment to support the preferred pattern of development in the South East Queensland Region. It is flagged as a potential road infrastructure improvement that would provide relief to congested road links, connect activity centres and provide a sound basis for future traffic management within the Brisbane Metropolitan area (refer **Figure 1-1**).

Within SEQIPP, a major public transport improvement in northern Brisbane is also proposed in the form of the Northern Busway. This would connect the completed Inner Northern Busway at Herston with Kedron, and ultimately extend further north to Aspley then Bracken Ridge. A Northern Busway Concept Design and Impact Management Plan Study has been undertaken in parallel with the Airport Link EIS to examine the potential to achieve a cost-effective design solution for the Northern Busway, with reduced community impacts, via integration with the Airport Link. The potential cumulative effects of the project with and without the proposed Northern Busway are thus assessed in this study.

The project, as shown in **Figure 1-2**, is planned to connect between the North-South Bypass Tunnel (NSBT) and Inner City Bypass (ICB) at Bowen Hills, and the northern arterials of Gympie Road at Kedron and the East-West Arterial and Sandgate Road at Toombul. The project also includes the potential to provide a toll road connection between Stafford and Gympie Roads at Kedron, and Sandgate Road and the East West Arterial at Toombul.

Connections proposed within Project TransApex are shown schematically in **Figure 1-3**. They were examined in detail in the TransApex Pre-Feasibility Study (Brisbane City Council, 2005) and are:

- The North-South Bypass Tunnel – a cross-river tunnel linking the Pacific Motorway through to Lutwyche Road and the Inner City Bypass. Construction is due to commence on the NSBT in the latter half of 2006, with the facility open for traffic use by 2010.
- The proposed Airport Link representing a continuation northwards from the NSBT alignment and providing connectivity to Brisbane Airport. This project is the subject of this EIS investigation, and if approved to proceed, could open in 2012.
- The Northern Link – a cross-town tunnel linking the Western Freeway with the Inner City Bypass. The timing of this proposal is still subject to further investigation.
- The East West Distributor – a cross-river tunnel linking the Pacific Motorway and eastern suburbs to the Western Freeway and mid-west region. The timing of this proposal is still subject to further investigation.

- A Hale Street-South Brisbane Link - a cross-river connection between Milton and South Brisbane. A feasibility study on this proposed project is in progress during 2006.

Airport Link is proposed as a strategic solution that would provide:

- A more efficient and robust road network within Brisbane City to cater for regionally significant travel movements.
- A key connection between other elements of TransApex, such as the NSBT and the proposed Northern Link, aimed at taking traffic away from travelling on surface roads through Brisbane's CBD and inner and middle suburbs, to access Brisbane Airport and other key travel generators in the Australia TradeCoast precinct.
- Opportunities, via diversion of traffic to the Airport Link, to free up surface road space and thus provide for public transport initiatives such as the Northern Busway, transit oriented developments (TODs), improved pedestrian and cycling networks, and urban regeneration opportunities.

This technical report addresses the relevant traffic and transport matters raised in the *Terms of Reference for an Environmental Impact Statement* issued by the Co-ordinator General in accordance with the Queensland *State Development and Public Works Organisation Act 1971*. Chapter 4 of those Terms of Reference deals specifically with traffic and transport matters and is reproduced in **Appendix A**.

Whilst a detailed description of the project is contained in other specialist studies within the EIS, key features from a traffic and transport perspective are:

- The project comprises a two (2) tunnel road system, approximately 6 km in length, comprising a north-south and east-west tunnel.
- There are parallel northbound and southbound traffic tunnels, each catering for three (3) lanes of general traffic. The eastbound and westbound traffic tunnels each include two (2) lanes of traffic flow.
- The tunnels are designed for a speed of 90km/hr, although signposted to 80km/hr for consistency with the urban network.
- There are three regions for linking with the adjacent and surface road networks – the southern and city connection, the north-western connection and the north-eastern connection regions. The project provides connection between key elements of the urban road network managed by the Brisbane City Council (BCC) and the Department of Main Roads (DMR).
- The southern and city connection provides linkages to Council's road network - the four (4) lane NSBT for cross-river movement; to O'Connell Terrace and Campbell Street for traffic movements to the Central City network; and to the Inner City Bypass, a high quality six (6) lane orbital connection for east-west travel immediately to the north of the Central City.
- The north-western connection provides linkages from both the north-south and east-west tunnel systems to Gympie Road, an existing DMR-controlled six (6) lane major arterial route for north-south travel, and Stafford Road, an existing four (4) lane major arterial road which forms part of DMR's East-West Arterial Route.
- The north–eastern connection also joins to DMR road network. It connects to the four (4) lane East-West Arterial Road which links to the Gateway Motorway and Brisbane Airport access, and Sandgate Road, a predominantly four (4) lane north-south arterial road.

- The project will be operated as a toll road, with an electronic system used for toll collection. Journeys would be tolled as either a full trip (i.e. southern connection to either of the northern connection regions) or a partial trip (i.e. a journey between the North-eastern and North-western connections).
- If Airport Link is approved to proceed, construction could start in 2008 and finish in 2012.

Further information on the project features is contained in **Section 5**.

1.1 Disclaimer

The SKM-CW Joint Venture (JV) derived the data in this report primarily from inputs provided by Brisbane City Council and the Queensland State Government. The passage of time, manifestation of latent conditions or impacts of future events may require further and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

The traffic and transport assessment presented has also been based on available information from a number of sources including investigations by others and, in some cases, for other projects. Reports prepared by others (including those reports referred to in this Traffic and Transport report or specifically identified as having been used as input into the Traffic and Transport report) have not been subject to independent checking and may contain inaccuracies or be based on assumptions that are not applicable to the Airport Link.

This report has been prepared on behalf of and for the exclusive use of Council and the State, and is subject to, and issued in connection with, the provisions of the agreement between the JV and Council. The JV accepts no liability or responsibility whatsoever of, or in respect of any use of, or reliance upon, this report by any third party.

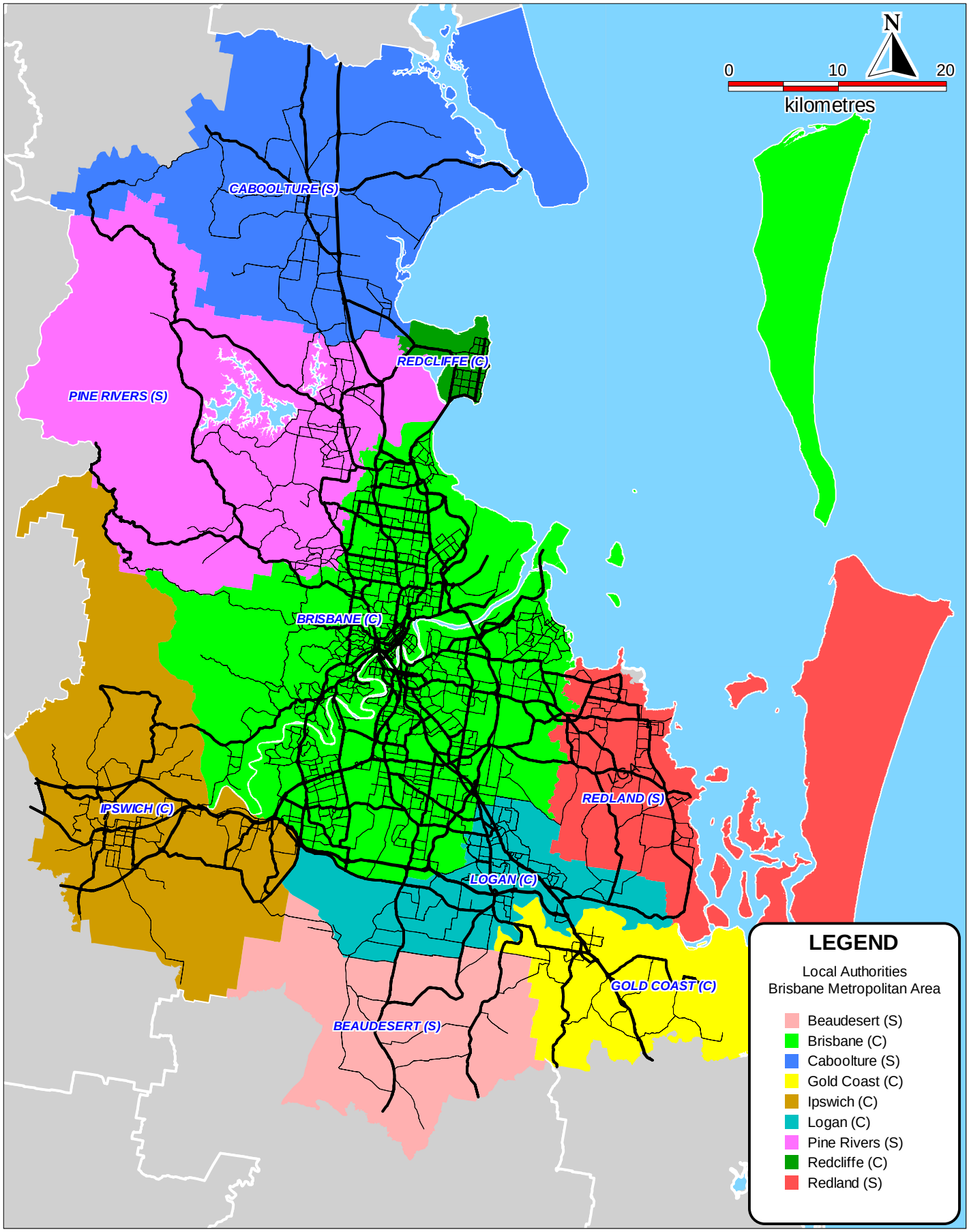

Figure 1-1
Brisbane Metropolitan Area

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

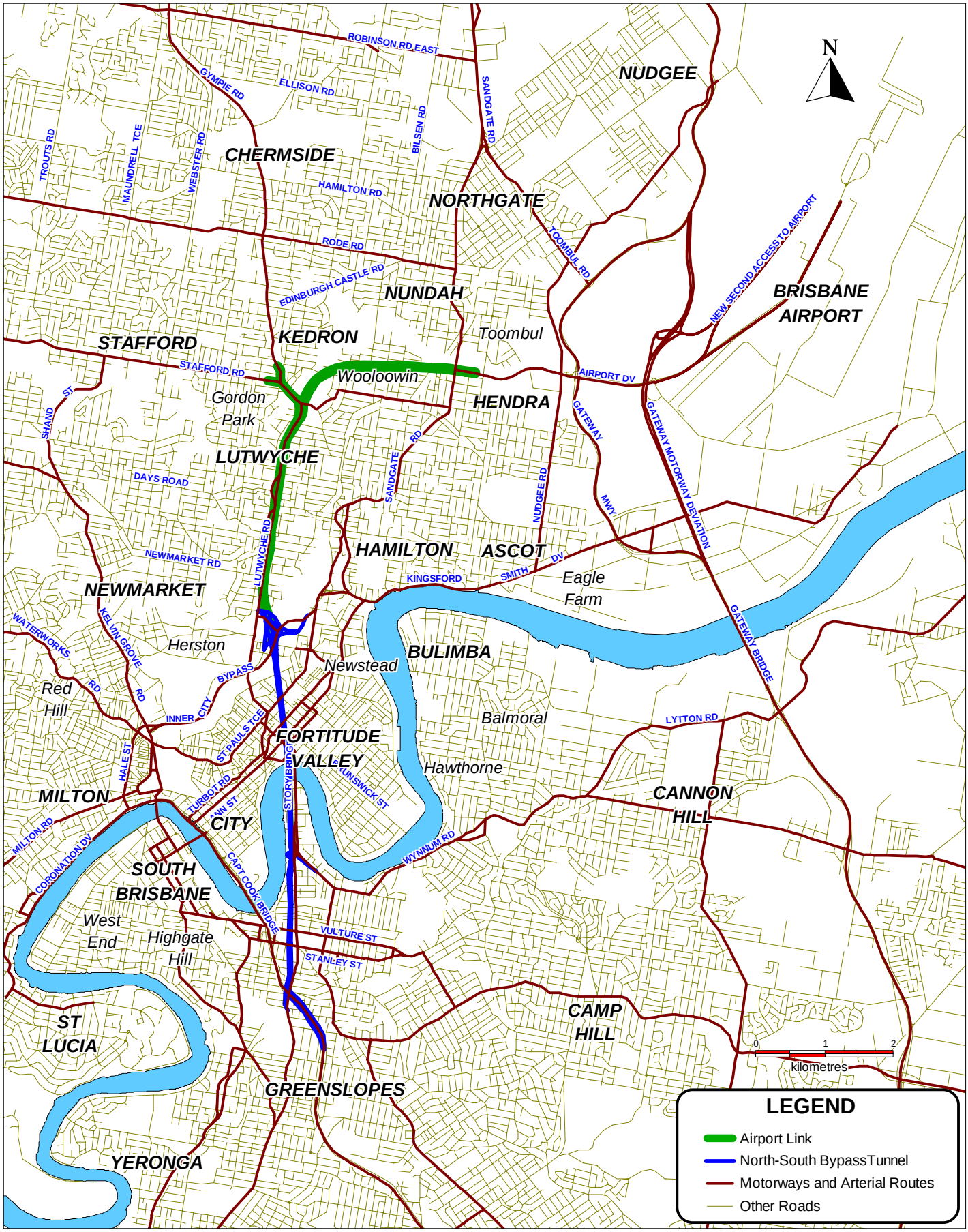

Figure 1-2
Project Location

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

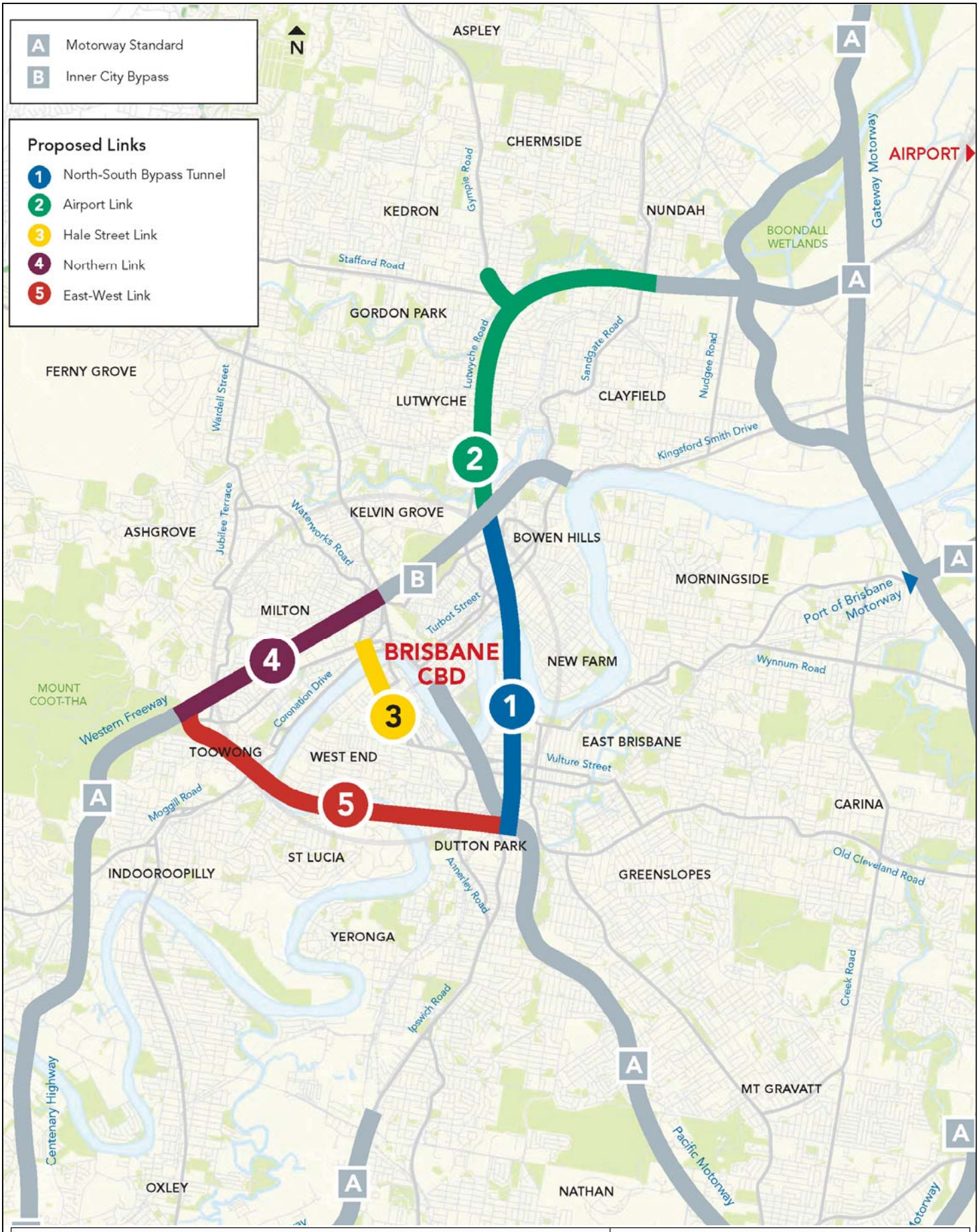

Figure 1-3
TransApex Projects

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

2. Study Methodology

2.1 Technical Approach

A consistent and clearly defined approach was used to examine the traffic and transport effects of the project. The following tasks were undertaken:

- Areas likely to be affected by traffic and transport aspects of the project were defined;
- Data relevant for use in the study was collated (via identification of available data or new surveys), and the relevance and accuracy of that data critiqued for application in the assessment of existing conditions and the project effects;
- Traffic and transport demand modelling and forecasting approaches were established (either undertaken as part of this assessment or adopted from previous studies considered reliable and relevant), including the processes of model validation and sensitivity testing of the modelled results to test their robustness;
- Using the compiled information and the validated and tested transport models, existing and forecast conditions were analysed and documented for the transport network without and with the project. The forecast conditions were considered for scenarios for the project without, and also with, the proposed Northern Busway; and
- The differences between the derived forecast conditions for scenarios without and with the project were assessed. These differences provided the measure of the effects of the project on traffic, public transport, cyclists and pedestrians. The cumulative effects of the project with the Northern Busway were assessed using a similar process.

The approach to key tasks is further detailed in the following sub-sections.

2.2 Areas of Interest

A study corridor was defined for the project and has been used consistently in the other Environmental Impact Study (EIS) documents. This term has also been used generically in the report, however to enable an examination of the breadth of traffic and transport effects a range of *areas of interest* has been established.

The following areas are considered in this report as shown on **Figure 2-1** and **Figure 2-2**:

- *Central Brisbane* - The zone of extensive commercial and other activity in the centre of Brisbane, for this study designated as coinciding with City, Fortitude Valley, New Farm, Newstead, Spring Hill and Bowen Hills South Statistical Local Areas (SLAs). This area includes the Central Business District (CBD).
- Inner North Study Area - An area defined initially for the purposes of examination of the localised effects on traffic and transport of corridor options for the project. It encompasses suburban areas to the north of the CBD where local effects of the project require consideration and includes the suburbs of Wooloowin, Clayfield, Kedron, Gordon Park, Lutwyche, Albion, Windsor and Bowen Hills. The boundaries of this area have been selected to coincide with zones within the Brisbane Strategic Transport Model (BSTM) and it covers an area of 25.6km2. Reference locations for reporting of traffic data in the Inner North area are shown in Figure 2-3.
- The *Brisbane Metropolitan Area* or Brisbane Statistical Division (BSD) - The City of Brisbane and the surrounding area extending to Caboolture in the north, Beenleigh in the south, Ipswich to the west and Redland Shire to the east. This enables consideration of strategic transport network implications of the project as well as areas of influence outside the EIS study corridor, such as the CBD and Brisbane Airport. It covers an area of 4,670 km^2.

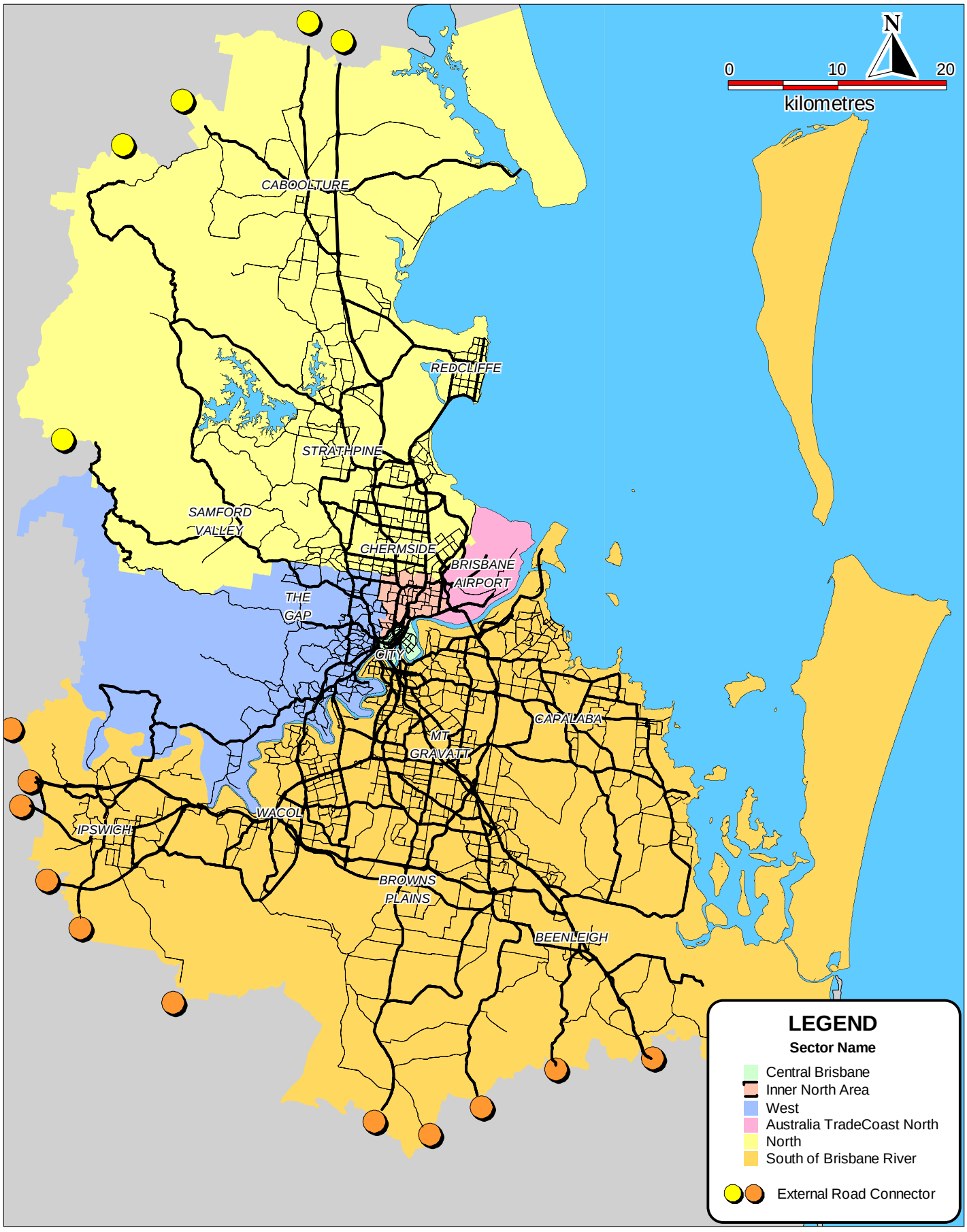

Figure 2-1
Areas of Interest & Travel Sectors

Airport Link

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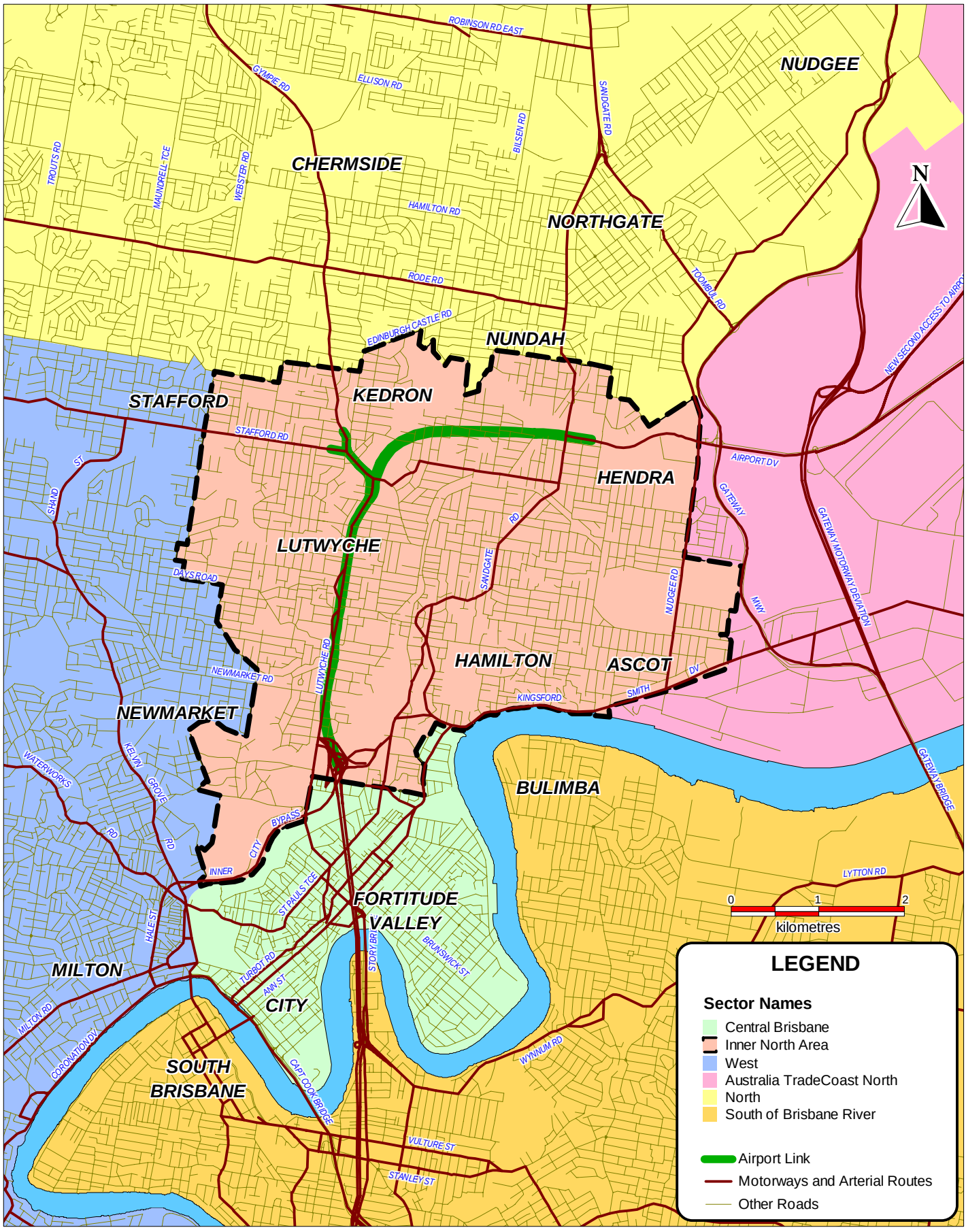

Figure 2-2
Inner North Study Area

Airport Link

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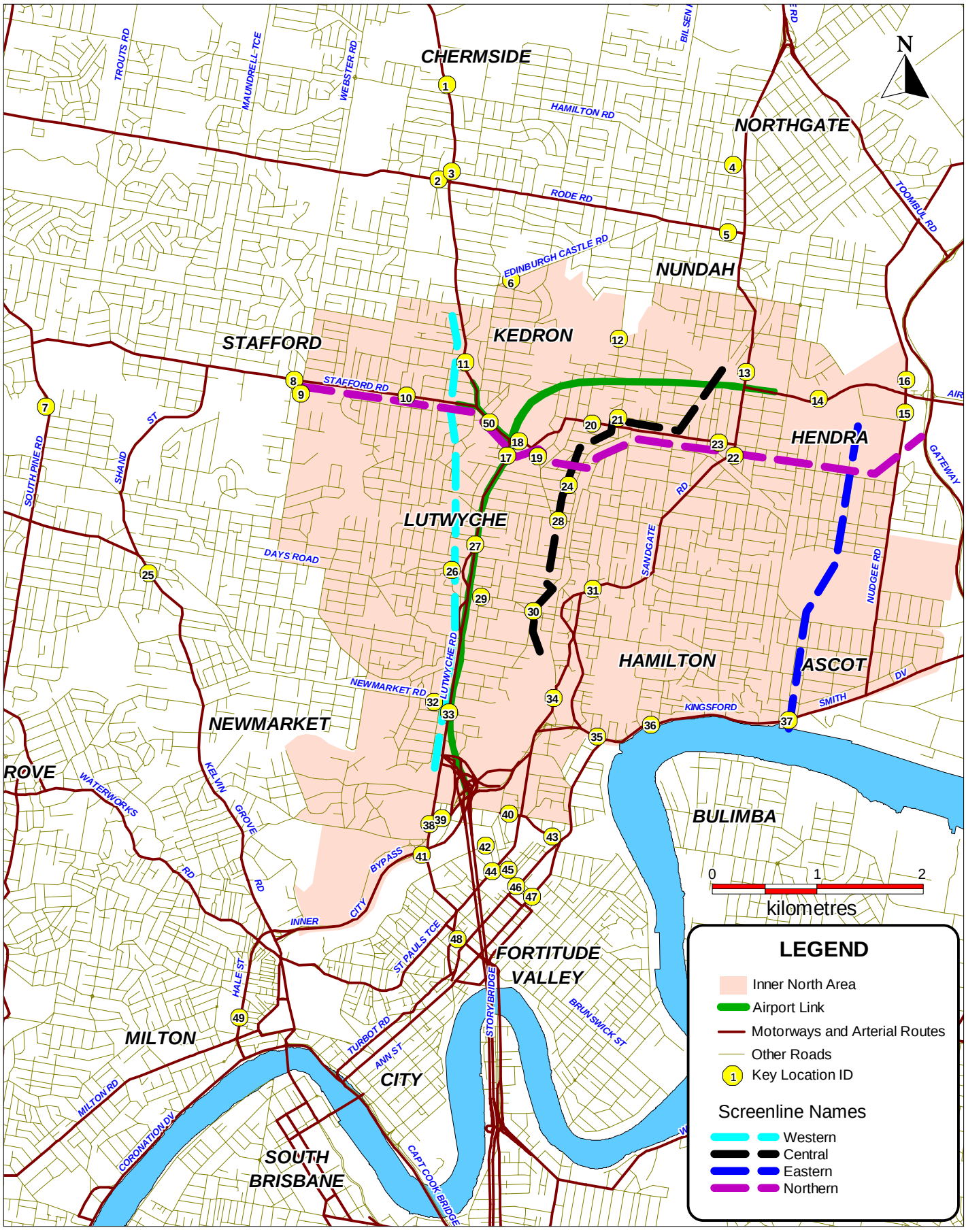

Figure 2-3
Inner North Study Area Reference Locations

Airport Link

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BRISBANE CITY

The Brisbane Metropolitan area represents a standard defined geographic area used for examination of traffic and transport issues in the Brisbane context. The Central Brisbane area, as defined here, represents a grouping of key activity areas including the CBD which enable the effects of the project, particularly at its southern connection, to be identified.

The Inner North area, as defined for this study, represents a project specific traffic investigation footprint that enables the existing conditions, future base conditions and the potential effects of the project to be more satisfactorily described.

2.3 Data Collection

In order to describe existing traffic and transport conditions, develop and validate the traffic forecasting model and analyse local traffic effects, a range of observed traffic and transport data was collected. Data was used in various assessments covering all modes of travel within the transport network. These included car drivers and passengers, commercial vehicles, public transport and pedestrians and cyclists, as described in subsequent sections of the report. Data included:

- Road Network Data: Number of lanes and lane types (including short lanes, transit/bus lanes), intersection location and type, key intersection geometric layouts, signal and phase timing data, banned turns, signalised pedestrian crossing locations and phasing, aerial photographs and kerb lines.
- Public Transport Service Data: Service routes, bus stops, infrastructure and operational frequencies for different time periods.
- Pedestrian and Cycle data: On and off road pedestrian facilities and observed count data at various locations.
- Traffic Counts: Recent historical count data for intersections and mid-block counts (minimum of one week) sourced from Main Roads, Council's Brisbane Linked Integrated Signal System (BLISS) and project specific surveys conducted in September/October 2005.
- Journey Time Data: Road travel journey time data collected in project specific surveys, conducted in October 2005, and bus travel times from BLISS for October 2005.
- Bus Patronage: Ticketing information supplied by TransLink and patronage data sourced from previous studies.
- Road Accident Data: A five-year historical accident data base (2000-2005) of the Brisbane local government area, supplied by BCC.
- Behavioural Driver Data: Project specific surveys, using both revealed and stated preference techniques, conducted to obtain information on driver route choice and the effect of tolls.

2.4 Transport Modelling, Validation and Forecasting

The study has used models to assist with the technical assessment of traffic and transport effects of the project, for example by:

- Supplementing observed data to describe existing traffic flows and traffic conditions, using information extracted from a validated base year model for which observed traffic volumes and travel speeds and public transport demands have been compared to modelled results;
- Using a strategic transport model to forecast traffic conditions at specific years in the future, by modelling transport and traffic demand based on land use (in the form of demographic descriptors), travel characteristics, road infrastructure, public transport services and road tolls. This model has been termed the Airport Link Traffic Model and is based on the Brisbane Strategic Transport Model (BSTM);

- Predicting changes in travel demand, travel times, speeds and the operating level of the service of the road network with the project, and comparing differences without and with the project, using the strategic model; and
- Undertaking local traffic modelling using the intersection analysis tool aaSIDRA with data extracted from the strategic transport model.

A detailed description of the traffic forecasting process is given in **Section 6**. Model validation details are provided in **Appendix C**.

3. Existing Transport System

3.1 Travel Demand

Travel demand by mode is influenced by a range of factors such as the demographic characteristics of the region and Inner North area, land-use distribution and the transport system itself. These characteristics are discussed in the context of the project.

3.1.1 Population and Employment

In 2004, the Brisbane Metropolitan area had a population of 1.77 million persons. Population growth rates in the region have been strong, averaging 2.0% pa over the last 10 years.

An estimated 57,000 persons lived within the Inner North area (**Table 3-1**) in 2004, with an overall population density of 2,230 persons/km^2. This is much higher than the Brisbane Metropolitan area average of 380 persons/km^2. The average household size of 2.05 persons in the inner north is much lower than the metropolitan area average.

Table 3-1 Existing Population and Employment

Parameter	Brisbane Metropolitan Area	Inner North Area
Total Persons	1,773,000	57,100
Area (km^2)	4,670	25.64
Density (persons/km^2)	380	2,230
Total Households	695,000	27,800
Person/Household	2.55	2.05
Total Employment	805,000	36,400
Central Brisbane Employment	150,000	N/a
ATC North Employment	22,000	N/a

Table Note: Source: PIFU (2005)

Employment in the area is summarised in **Table 3-1**. The Inner North area only accounted for 5% of the region's employment in 2004 whereas Central Brisbane (refer **Figure 2-2**) accounted for 19% of the 805 000 jobs within the Brisbane Metropolitan area. The Australia TradeCoast region is emerging as a significant future employment node for the region, particularly the ATC North precinct which includes Brisbane Airport.

3.1.2 Land Use and Trip Generators

A broad range of land uses within the local area and within the wider metropolitan area influence the demand for trip-making in the Inner North area. Overall demands are illustrated in **Figure 3-1**.

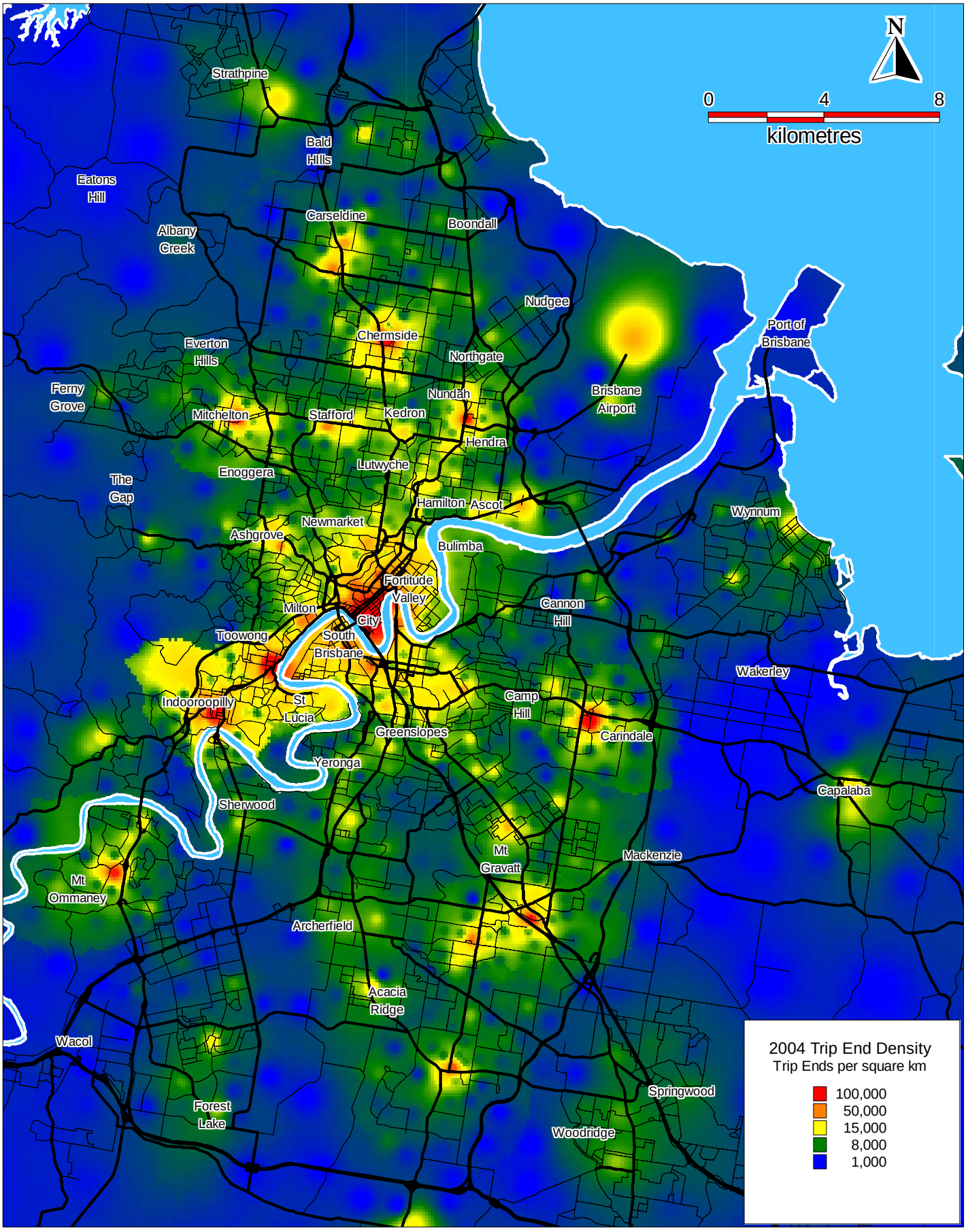


Figure 3-1
Existing Trip Generation

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Key land uses that generate travel demand within the Inner North area include:

- Residential land-uses. The Inner North area is predominantly residential, varying widely in density and character. Higher density residential complexes occur along arterials such as Sandgate Road, and in the vicinity of the rail line;
- Retail land-uses such as:
  - Centro Lutwyche, located on Lutwyche Road, providing supermarket and speciality shops within the general Lutwyche commercial district;
  - Centro Toombul, a sub-regional shopping complex, located adjacent to the East-West Arterial on Sandgate Road and opposite Toombul rail station;
  - Windsor Homemaker Centre, a bulky goods retail centre located on Lutwyche Road in Windsor;
  - The Albion Village on Sandgate Road, recently upgraded to promote an attractive pedestrian and commercial precinct within Albion;
- Industrial land use towards the south-eastern region, with pockets of light industrial in Albion, Newstead and Bowen Hills, as well as along Nudgee Road and Kingsford Smith Drive east of Nudgee Road;
- The Royal Brisbane Hospital complex (RBH), Brisbane's largest hospital, is located on the western side of Bowen Bridge Road at Herston;
- A major Emergency Services Complex, located at the northern end of Lutwyche Road at Kedron;
- Sport and recreation complexes including Downey Park, Crosby Park in Albion, Allan Border Cricket Oval at Albion, and the Albion Park Raceway; and
- Various local schools.

Key land uses that directly influence through traffic demands through the Inner North include:

- Central Brisbane, including the CBD, to the south;
- The Brisbane Airport and Australia TradeCoast region to the east and south-east;
- The Prince Charles Hospital, Queensland University of Technology (QUT) Carseldine Campus and Westfield Chermside Shopping Centre to the north;
- The RNA Exhibition grounds at Bowen Hills; and
- QUT Kelvin Grove and Gardens Point campuses and the University of Queensland (UQ) St Lucia campus to the south and west.

3.2 Brisbane Transport Network Overview

3.2.1 Transport Modes

The transport network in the Brisbane Metropolitan area comprises the following transport modes:

- Road network;
- Bus services, bus lanes, transit lanes and busways;
- Rail network;
- Ferry services;
- Cycle facilities; and
- Pedestrian facilities.

The existing road hierarchy for Brisbane is shown in **Figure 3-2** and within the Inner North Area in **Figure 3-3**. The system is characterised by a strong radial road network, with arterial roads operating radially from the CBD area to the outer Brisbane Suburbs. The radial links also connect to the CBD river crossings and thus also cater for cross-city travel. Lutwyche Road and Sandgate Road within the inner north are key radial links that cater for a mix of commuter, cross-city and local traffic.

Transport modes most affected by the project are the road based private vehicle, freight and bus services within the study area, which will experience improved travel times and reduced delays. Effects on the rail network are likely to be minor whilst ferry services are not expected to be impacted. In considering the cumulative impacts of the Northern Busway, the influence of changes in mode choice and travel patterns requires consideration.

3.2.2 Public Transport

The three main forms of public transport in Brisbane are bus, rail and ferry. All of these major forms of public transport exist within or close to the Inner North area. Bus routes, rail lines and stations are shown in **Figure 3-4**.

North-south rail services operate close to the Sandgate Road corridor, and an east-west service in the southern section of the corridor services the suburbs of Windsor and Wilston. Bus services operate on Lutwyche Road, filling the major corridor gap between the rail lines. Bus services run at a lower frequency on Sandgate Road and Kingsford Smith Drive. Feeder bus services join the Lutwyche Road corridor at Northey Street, Maygar Street, Bradshaw Street, Kedron Park Road and Stafford Road.

Bus Network

The Brisbane bus network is radially designed in nature, consistent with the road network. Bus services utilise major radial arterial routes as well as the South East Busway to reach the Brisbane CBD, with most services terminating in the Queen Street Bus Terminal or on Adelaide Street. A number of regional centres such as Garden City, Chermside, Indooroopilly and Toombul act as interchanging hubs for orbital, local and radial bus services. The two major bus corridors within the Inner North area are Lutwyche Road and Sandgate Road. The bus network within the area is described in detail in **Section 3.6.1**.

Rail Network

A predominantly radial rail network services Brisbane and its surrounding suburbs. All rail lines service the inner city stations of Roma Street, Central, Brunswick Street and Bowen Hills, which act as the four primary interchange points between services.

The Doomben, Airport and Shorncliffe lines service the northern suburbs, whilst the Caboolture line services the north coast. These services follow an alignment close to the Abbotsford Road/Sandgate Road corridor through the study area. The suburbs of Wilston and Windsor are serviced by the Ferny Grove rail line, which runs east – west through the southern section of the Inner North area.

South of the Brisbane CBD rail services operate to Cleveland (Eastern Suburbs), Beenleigh/Nerang (Southern Suburbs and Gold Coast) and Ipswich (Western Suburbs and Ipswich Shire).

Ferry Network

The Brisbane City Cat catamaran ferry network operates between Brett's Wharf in Hamilton and the University of Queensland St Lucia campus. Key jetty locations include Southbank, University of Queensland St Lucia Campus, Brisbane City, and Toowong.

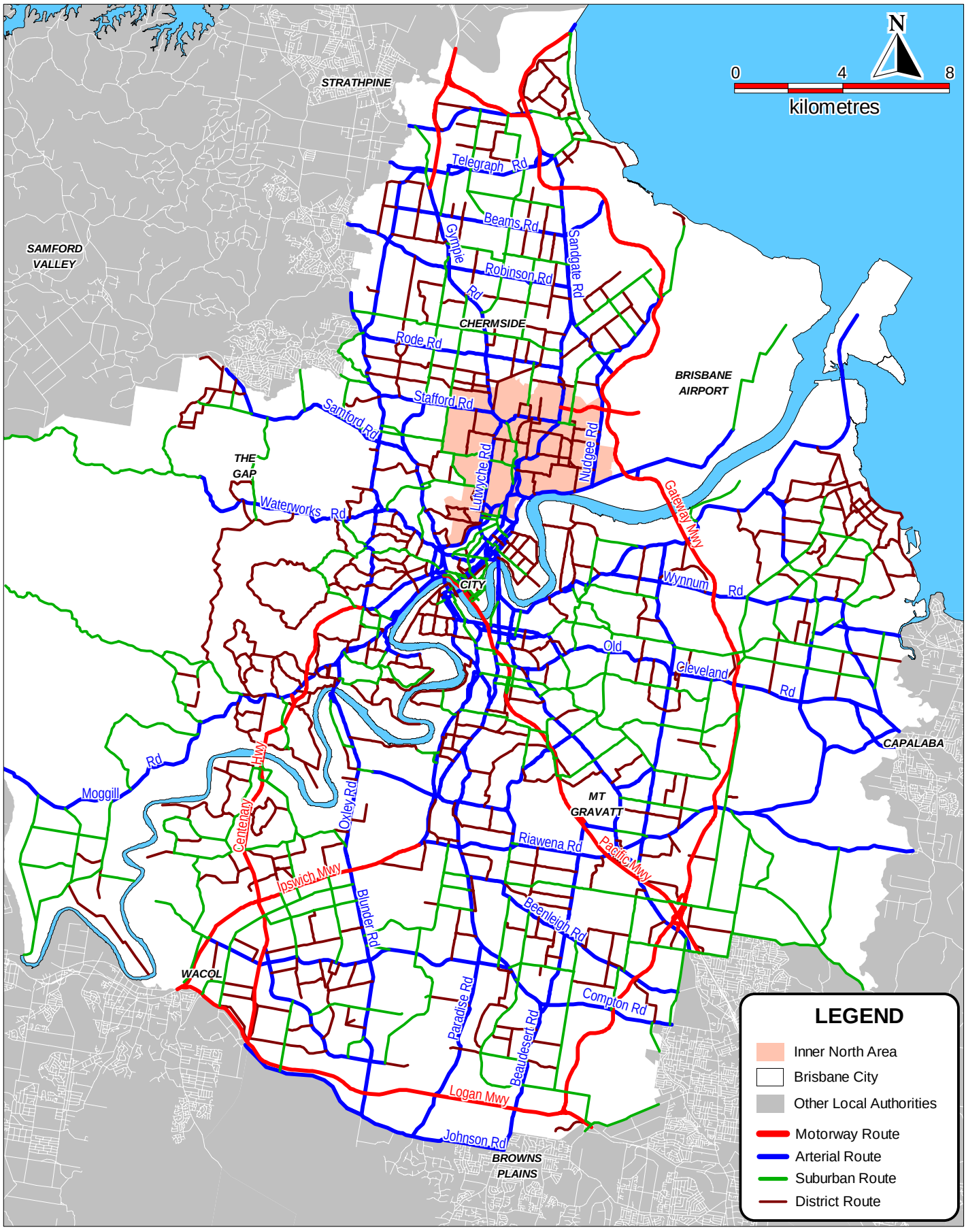


Figure 3-2
Existing Road Hierarchy

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

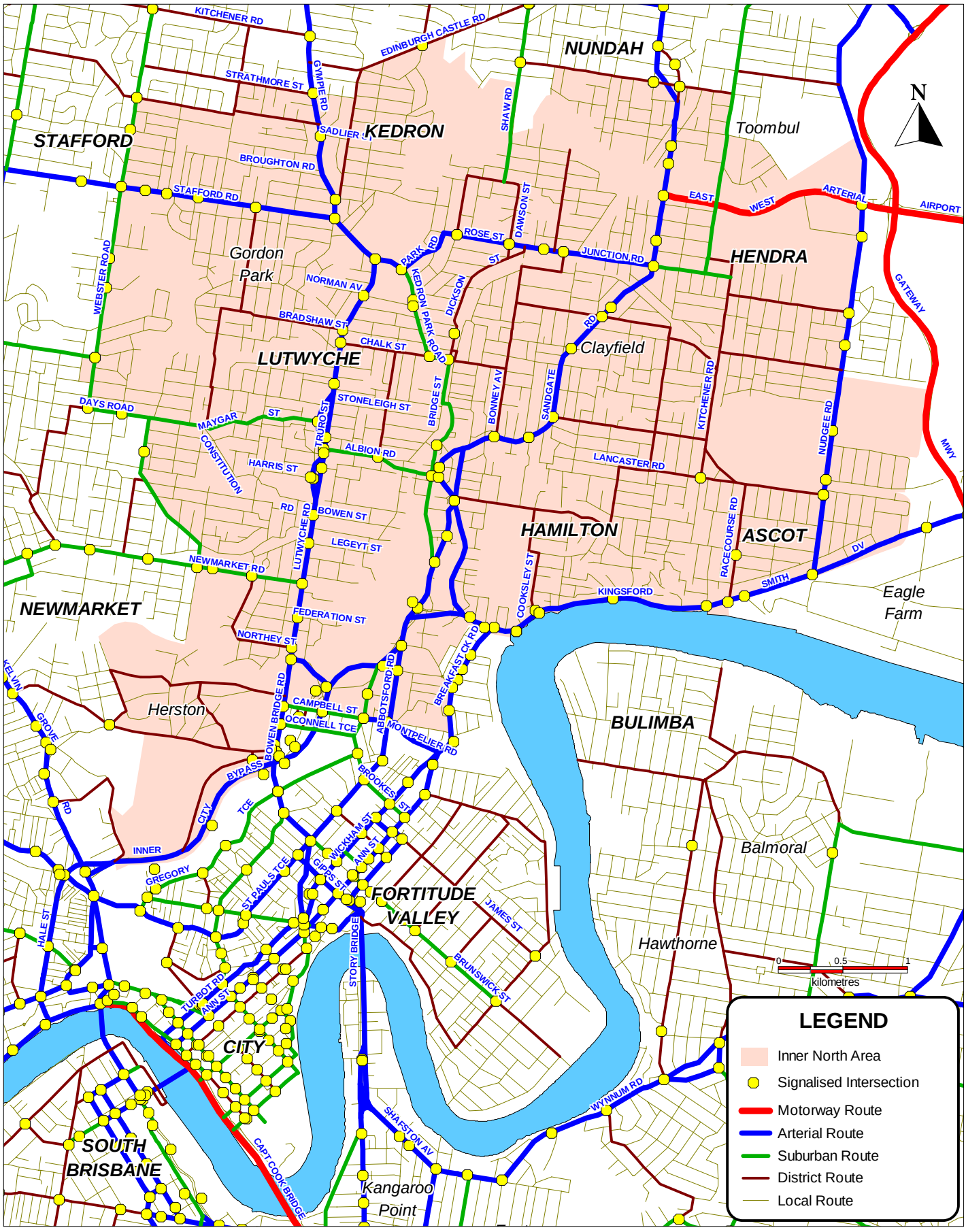


Figure 3-3
Inner North Road Network

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

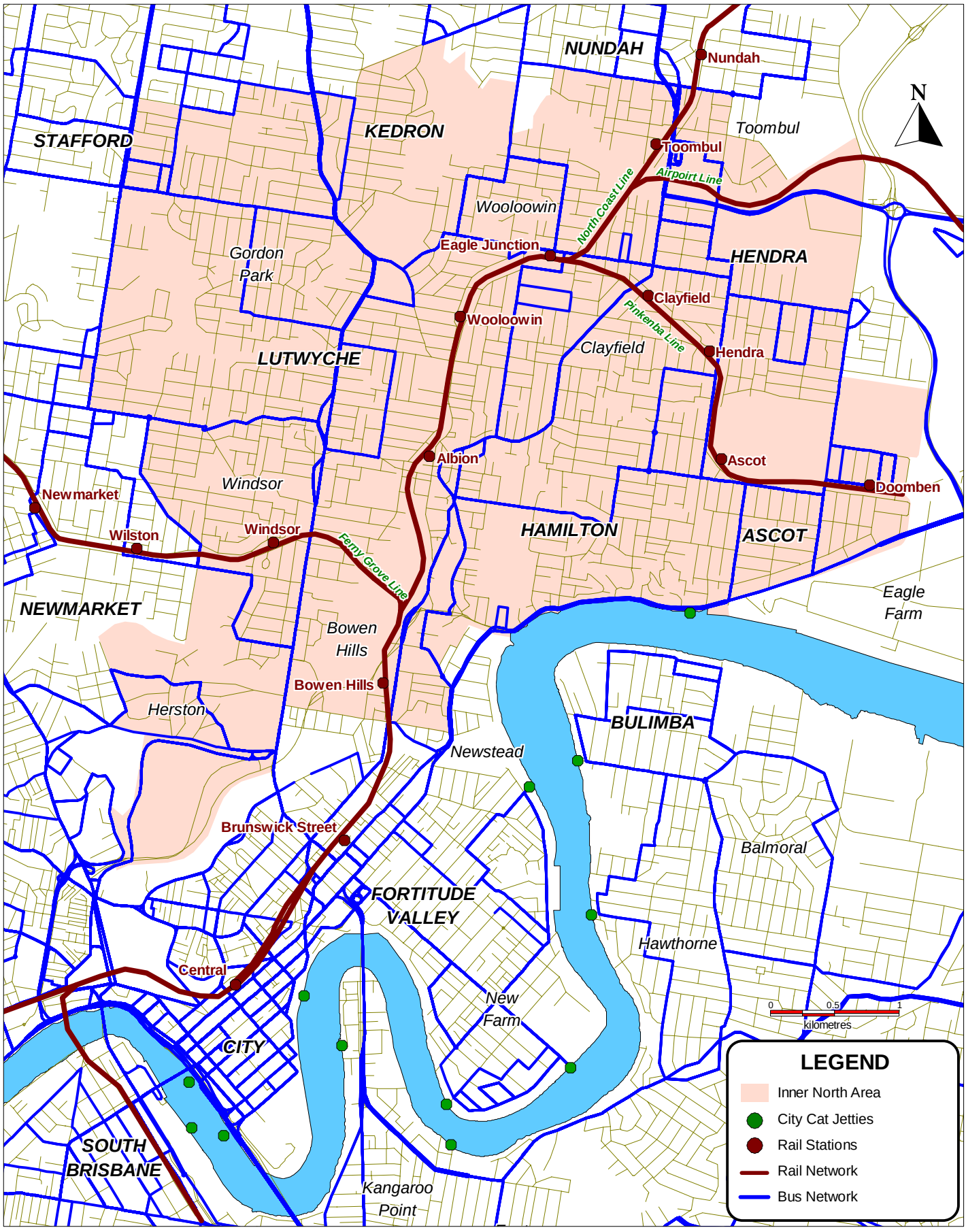


Figure 3-4
Existing Public Transport Network

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

3.3 Road Network

3.3.1 Road Hierarchy and Function

The current road hierarchy for the Inner North area is shown in **Figure 3-3**.

BCC's Transport Plan for Brisbane 2002-2016 (BCC, 2005) adopts a six-tier road hierarchy as follows:

- *(1) Motorways* – Serve inter and intra regional connections for high volumes of people and goods and direct longer distance traffic away from heavily developed areas. There is no direct property access and connections with lower order roads are limited.
- *(2) Arterial and (3) Suburban Routes* – Provide connections for the movement of people and goods between major activity centres and residential areas of the City.
- *(4) District Accesses* – Provide a transitional function between the movement of people and goods and local access functions. They are ideal bus routes and provide pedestrian and bicycle facilities.
- *(5) Neighbourhood/(6) Local Accesses* – Provide direct property access and are pedestrian and cyclist friendly.

A range of movement types (local, through, regional) occur on roads within the Inner North area broadly consistent with the functions served by the range of road hierarchy types represented in the area. Key examples of roads within each category are:

- Lutwyche Road and Sandgate Road are key north-south radial arterial routes. The East-West Arterial Road, a state-controlled DMR route comprising Stafford Road, part of Kedron Park Road, Park Road, Rose Street and Junction Road, linking to Sandgate Road and the East-West Arterial, is a cross-town arterial route.
- Suburban routes provide a direct east-west connection between the radial arterial routes or act as a major connection between an arterial route and nearby residential areas. They include Albion Road, Newmarket Road, Maygar Street, Kedron Park Road and Bridge Street.
- Bradshaw Street, Chalk Street and Northey Street-Green Terrace are district access routes connecting to Lutwyche Road, whilst Crosby Road, Oriel Road, Bonney Avenue and Bayview Terrace-Wagner Road are district access routes connecting to Sandgate Road.

3.3.2 Key Study Area Routes

Bowen Bridge Road-Lutwyche Road-Gympie Road

Bowen Bridge Road connects Lutwyche Road with the Brisbane CBD. The Royal Brisbane Hospital complex fronts Bowen Bridge Road at the southern end of the corridor, just north of the Inner City Bypass (ICB) and Inner Northern Busway (INB). Between Herston Road and Butterfield Street bus lanes operate northbound, and between O'Connell Terrace and Herston Road southbound, restricting general purpose traffic to two lanes in each direction, with turn lanes at intersections. The ICB (westbound) can be accessed from Lutwyche Road by southbound traffic only at the Horace Street intersection. Northbound traffic on Bowen Bridge Road can access the ICB, westbound via Campbell Street. Traffic conditions in this area will change with the North-South Bypass Tunnel's access intersection arrangements.

Lutwyche Road extends between Enoggera Creek and Kedron Park Road. It provides a key arterial connection between the Brisbane CBD and Brisbane's northern suburbs. Lutwyche Road is predominantly six (6) lanes of undivided road, with an inbound transit (T3) lane operating in the southbound kerbside lane during the morning commuter peak for a distance of 1.9 km between Stoneleigh Street and Horace Street. Lutwyche Road operates in conjunction with Roblane Street (southbound only) between the Constitution Road and Albion Road

intersections to provide both arterial and local access functions. Between these locations four (4) lanes operate southbound. Between Albion Road and Stoneleigh Street intersections Lutwyche Road operates in combination with Truro Street (southbound only), and between these intersections five (5) lanes operate southbound. North of the Stoneleigh Street intersection, through the Lutwyche centre, the road narrows to two (2) lanes in each direction, a result of the restrictions on road reserve created by the existing shop frontage, as shown in **Figure 3-5.** It returns to three (3) lanes in each direction north of the Bradshaw Street intersection.

- **Figure 3-5 Photo of Lutwyche Road near Centro Lutwyche**

North of the Kedron Park Road intersection, Lutwyche Road becomes Gympie Road, continuing as three (3) lanes in each direction to connect to the Bruce Highway.

The total length of the Bowen Bridge Road-Lutwyche Road-Gympie Road route between Herston (at Gregory Terrace) and Kedron (at Strathmore Street) is 5.8 km.

Campbell Street and O'Connell Terrace

Campbell Street and O'Connell Terrace are both one-way suburban roads, operating as an east-west couplet between the Lutwyche Road and the Abbotsford Road-Sandgate Road corridors. O'Connell Terrace also provides access to the Royal Brisbane and Women's Hospital. The ICB (westbound) can be accessed from Campbell Street via Horace Street. Traffic conditions in this area will change with the NSBT access intersection arrangements.

Sandgate Road-Abbotsford Road

The Sandgate Road arterial route connects the CBD to Brisbane's north-eastern suburbs. It also provides a link to the Brisbane International and Domestic Airports via the East-West Arterial Road which links to Sandgate Road at Toombul. Sandgate Road is predominantly a four (4) lane undivided road as shown in **Figure 3-6**. It has a narrow road reserve which restricts the ability to provide right turn pockets at a number of signalised intersections. This forces vehicles to make right turns from the right hand through lane, commonly resulting in queuing and delays for through traffic. Kerbside clearways are provided during peak periods in the peak direction to allow full use of both lanes. Outside of peak periods, most sections of Sandgate Road allow parking in the kerbside lane. Frodsham Street provides a three (3) lane southbound bypass of the Albion Village, with the left kerbside lane operating as a bus lane during the morning commuter peak.

- **Figure 3-6 Photo of Sandgate Road at Albion**

North of the East-West Arterial intersection, Sandgate Road is a six (6) lane divided roadway and links to a tunnel bypass of the Nundah commercial district.

South of the Albion five-ways intersection (of Sandgate Road, Abbotsford Road, Frodsham Street and Crosby Road), the majority of traffic diverts to Abbotsford Road, a six (6) lane undivided arterial route which provides access to the Brisbane CBD. The southern segment of Sandgate Road provides access to a light industrial and commercial precinct in Albion and ramp access to the ICB westbound.

Kingsford Smith Drive

Kingsford Smith Drive is an east-west arterial connection between the ICB and Brisbane CBD in the west and the Gateway Motorway, Brisbane Airport and Australia TradeCoast (ATC) in the east. Kingsford Smith Drive is

predominantly a four (4) lane undivided arterial road. East of the Nudgee Road intersection, Kingsford Smith Drive is gazetted for B-Double (long articulated heavy vehicle) usage. At the western end of Kingsford Smith Drive the road connects to the ICB. At this juncture, ramps from Kingsford Smith Drive provide access to Breakfast Creek Road and the Brisbane CBD. The majority of the intersections with Kingsford Smith Drive, within the Inner North area, are T-junctions with a northern approach, which is generally a local access/neighbourhood route. The Brisbane River parallels Kingsford Smith Drive on its southern side.

Newmarket Road

Newmarket Road is a four (4) lane undivided suburban route providing a direct east-west connection between the Lutwyche Road and Kelvin Grove Road corridors. The inner northern suburbs can be accessed from Newmarket Road via district and neighbourhood routes. A number of parks can also be accessed from Newmarket Road.

Northey Street-Green Terrace provides an alternative access to Newmarket Road to/from the CBD, bypassing two signalised intersections on Lutwyche Road. This route is used by bus services and also provides access to sporting facilities at Downey Park.

Albion Road

Albion Road is a four (4) lane undivided suburban route providing an east-west connection between the Lutwyche Road and Sandgate Road corridors. The Albion rail station and associated parking can be accessed from local access roads feeding onto Albion Road. Albion Road also provides access to Windsor Park and its associated recreational uses.

East–West Arterial Road

The East-West Arterial Road is a state-controlled (DMR) route consisting of East-West Arterial, Sandgate Road, Junction Road, Rose Street, Park Road, Kedron Park Road, Gympie Road and Stafford Road.

Stafford Road is a four (4) lane undivided road, providing an east-west connection between the Gympie Road and South Pine Road corridors. The Stafford City shopping centre and commercial shopping strip, as well as schools and parks, front Stafford Road.

The Kedron Park Road, Park Road and Junction Road section is a predominantly two (2) lane undivided road connecting the Lutwyche Road and Sandgate Road corridors. A large number of residential properties are located along the route. The Eagle Junction rail station fronts Junction Road. This route also provides access to the northern suburbs around Wooloowin.

The East-West Arterial is predominantly a four (4) lane divided road connecting Sandgate Road to the Gateway Motorway and Brisbane Airport. Nudgee Road is the only intersection with the East-West Arterial between Sandgate Road and the Gateway Motorway. East of the Nudgee Road intersection, the East-West Arterial is gazetted for use by B-Double vehicles.

Nudgee Road

Nudgee Road is an arterial route parallel to the Gateway Motorway which connects the major east-west routes of Kingsford Smith Drive, East-West Arterial and Toombul Road. Between Kingsford Smith Drive and Gadara Street, Nudgee Road is predominantly two (2) lanes undivided with on-street parking provisions and primarily residential land use. North of the Gadara Street intersection, Nudgee Road widens to four (4) lanes and land use is primarily industrial.

Inner City Bypass

The ICB is a circumferential inner city arterial connecting a number of radial arterial routes including Coronation Drive, Milton Road, Musgrave Road, Kelvin Grove Road, Lutwyche Road and Abbotsford Road. Connecting Coronation Drive at Milton to Kingsford Smith Drive at Breakfast Creek, the ICB is a six (6) lane divided arterial with speed limits varying between 60 and 80km/hr. The ICB provides a high speed uninterrupted connection between the western and the north-eastern suburbs of Brisbane, bypassing the CBD.

3.4 Travel Characteristics

Current household travel behaviour and historic trends have been examined by a comparative analysis of trip generation and modal use characteristics in the Inner North area using the results of the 1992 and the 2003/04 SEQ Travel Surveys. Results of the comparitive analysis are shown in **Table 3-2**.

- **Table 3-2 Travel Behaviour Trends from SEQ Household Travel Survey 2003/04 and 1992**

Parameter	2003/04		1992	
	Brisbane Metropolitan Area (BSD)	Inner North Area	Brisbane Metropolitan Area (BSD)	Inner North Area
General				
Total Persons	1.8 million	57,000	1.2 million	48,000
Total Households	0.7 million	27 800	0.5 million	21,400
Person/Household	2.6	2.1	2.7	2.2
Trips/Person	3.61	4.05	3.81	3.98
Trips/Household	9.44	8.46	10.41	8.89
Mode Choice				
Vehicle Driver	56.2%	56.6%	51.1%	51.0%
Vehicle Passenger	23.8%	19.3%	25.9%	22.8%
Walking	10.5%	12.4%	13.5%	15.1%
Cycling	1.1%	1.7%	2.0%	1.0%
Public Transport (1)	8.3%	10.0%	7.5%	10.1%
Vehicle Occupancy	1.42	1.34	1.51	1.45
Trip Purpose				
Home Based Work	18.1%	21.6%	15.3%	17.1%
Home Based Shopping	18.7%	21.7%	17.7%	21.5%
Home Based Education	15.6%	10.0%	13.8%	10.4%
Home Based Social	13.3%	12.2%	9.5%	13.4%
Home Based Other	5.3%	4.1%	11.1%	7.3%
Work Based Other	4.4%	6.1%	3.9%	3.2%
Work Based Shopping	4.1%	5.4%	5.0%	5.6%
Work Based Work	3.7%	3.2%	5.4%	5.2%
Non Home Based	16.9%	15.8%	18.2%	17.4%

Table Notes: Source: SEQ Travel Survey – 2003/04 and 1992

(1) Does not comprehensively cover public transport travel to external locations.

Key characteristics of travel behaviour and trends are:

- Existing household size in the Inner North area is lower than the overall Metropolitan Area average, and the resultant trip rate per household of 8.5 trips/day is slightly lower than the metropolitan average of 9.4 trips per day. This relativity is similar to what was evident in 1992.
- The trip generation rates per person in the Inner North area have remained quite stable over time, around 4 trips per person per day. Person trip making rates are higher than the Metropolitan area average, although household trip rates in Brisbane overall have declined with due to decreasing household size.
- The most dominant travel purposes in the Inner North area are work related travel and shopping travel, both of which are more important relative to other trip purposes than elsewhere in the metropolitan area. Education travel however in the Inner North area is of much lower significance than regionally, a relationship which has been stable over time.
- There is relatively sound use of public transport by Inner North area residents with a 10.0% public transport mode share compared to the metropolitan average of 8.3%. Compared to 1992, public transport mode share in the Inner North has remained quite stable, with a slight increase at the Metropolitan Area level.
- Walking and cycling is also proportionally higher in the local area compared to the wider metropolitan area (14.1% compared to 11.6%), a relativity that was also evident in 1992. By comparison to 1992, walking has declined in modal significance however cycling has increased in the Inner North area from 1.0% to 1.7% of travel. In contrast, in the metropolitan area overall, both walking and cycling have declined.
- For vehicle travel, average occupancy is 1.4 persons per vehicle, which has declined between 1992 and 2004.
- On an overall Metropolitan area basis, some sustainable travel indicators have improved between 1992 and 2004. For example, public transport mode share has improved over time and person trip-making rates are stable or slightly declined (at Metropolitan Area level). However, motorised travel has increased to 80% of total modal use at the Metropolitan Area level from 77% in 1992.
- The travel behaviour of Inner North area residents has shown mixed characteristics with regard to improved sustainability over the period 1992 to 2004. Whilst public transport and cycle use trends are sound, and motorised travel (76% of total modal use) has remained lower than the Metropolitan average, trip-making rates have increased and car-occupancy rates declined.

3.5 Road Traffic Flows

3.5.1 Daily Traffic Volumes

Daily traffic volumes for 2004/05 on key roads within the Inner North Area are shown in **Table 3-3**. Reference locations are annotated on **Figure 2-3**. Volumes have been collated from a number of sources including Brisbane City Council, Department of Main Roads 2004 Census and various surveys commissioned for this study. Data from 2004 and 2005 have been used.

Lutwyche Road carries approximately 60,000 vehicle trips per weekday whilst Sandgate Road, south of the East-West Arterial, caters for between 35,000 and 40,000 vehicle trips each weekday.

The flow profile for Lutwyche Road during a weekday is shown in **Figure 3-7** and the variation throughout the week is shown on **Figure 3-8**. Typical commuter peaks of 2,600 vph southbound in the AM peak and northbound in the PM peak are evident, with the PM peak outbound extending over a slightly longer duration.

■ **Table 3-3 Existing Traffic Volumes (Two-Way Totals)**

ID	Road	Location	AWDT	AADT
Motorway				
14	East – West Arterial	East of Widdop Street, Hendra	23,000	21,200
Arterial				
5	Rode Road	West of Sandgate Road, Wavell Heights	19,300	17,800
10	Stafford Road	West of Richmond Street, Kedron	22,500	21,200
11	Gympie Road	North of Broughton Road, Kedron	59,100	55,900
13	Sandgate Road	North of Schulz Canal, Toombul	52,200	48,100
16	Nudgee Road	North of East-West Arterial, Hendra	11,300	10,100
18	Kedron Park Road	East of Lutwyche Road, Kedron	17,600	16,200
20	Rose Street	Melrose Park, Wooloowin	10,700	10,000
23	Junction Road	West of Sandgate Road, Clayfield	18,200	17,000
22	Sandgate Road	South of Junction Road, Clayfield	37,000	34,100
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	59,600	56,400
31	Sandgate Road	South of Bonney Avenue, Albion	35,900	32,900
33	Lutwyche Road	South of Newmarket Road, Windsor	60,300	56,900
34	Abbotsford Road	South of Burrows Street, Bowen Hills	54,800	48,900
35	Inner City Bypass	West of Breakfast Creek Road, Hamilton	26,800	23,900
36	Kingsford Smith Drive	East of Cooksley Street, Hamilton	65,600	59,200
41	Inner City Bypass	West of Bowen Bridge Road, Herston	65,900	59,800
Suburban				
12	Shaw Road	At Kedron Brook, Wooloowin	14,100	12,500
26	Maygar Street	West of Lutwyche Road, Windsor	8,300	7,700
29	Albion Road	East of Lutwyche Road, Windsor	15,100	13,700
32	Newmarket Road	West of Lutwyche Road, Windsor	17,600	16,700
District Access				
24	Dickson Street	North of Wride Street, Wooloowin	10,400	8,400

Table Note: Source: BCC, DMR, 2005 Surveys

Hourly two-way volumes of over 3,500 vehicles are maintained on Lutwyche Road during the midday off peak. This limited peak to daily off peak variation of only 22% indicates the broad range of functions served by the route.

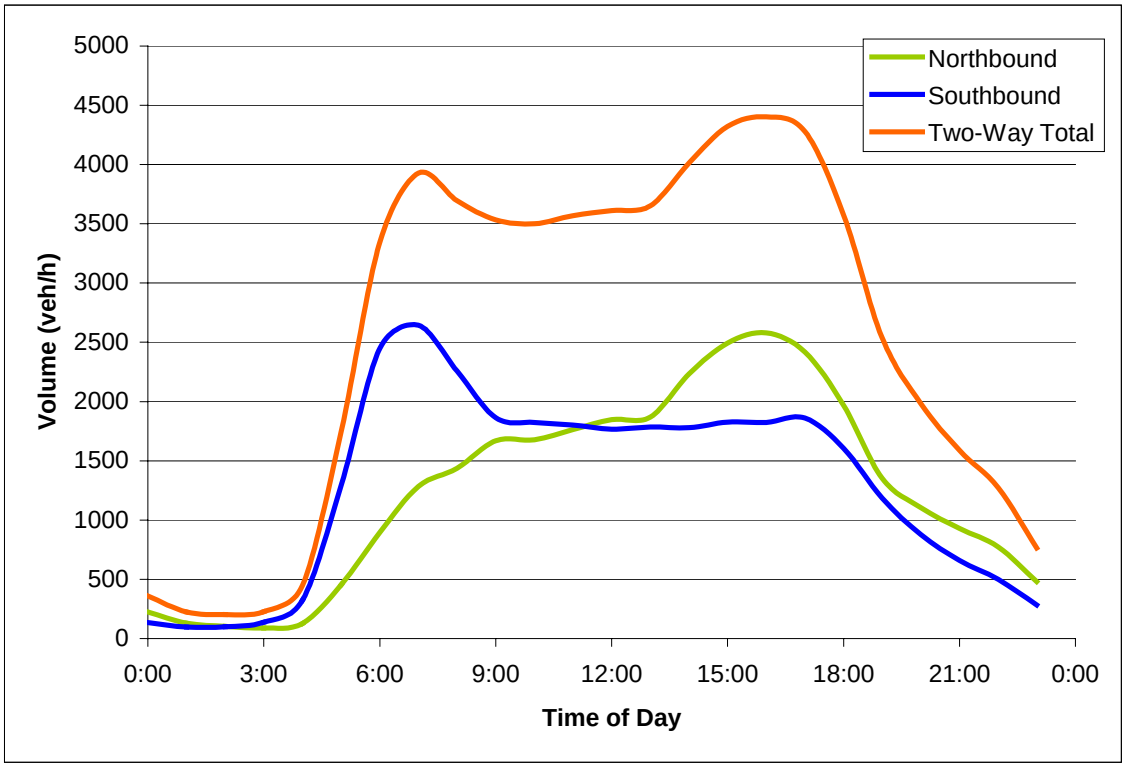
The weekly volume profile for Lutwyche Road indicates that weekend daily traffic levels only decline to 80% of daily traffic, indicating strong recreational traffic use on the weekends. This is because Lutwyche Road provides a key connection to routes to the Sunshine Coast.

A typical weekday traffic flow profile and daily variation for Sandgate Road are shown in **Figure 3-9** and **Figure 3-10.** Traffic patterns on Sandgate Road indicate a higher variation between the peak periods and the daytime off peak of between 33% and 43%. A larger decline in traffic volumes between weekday and the

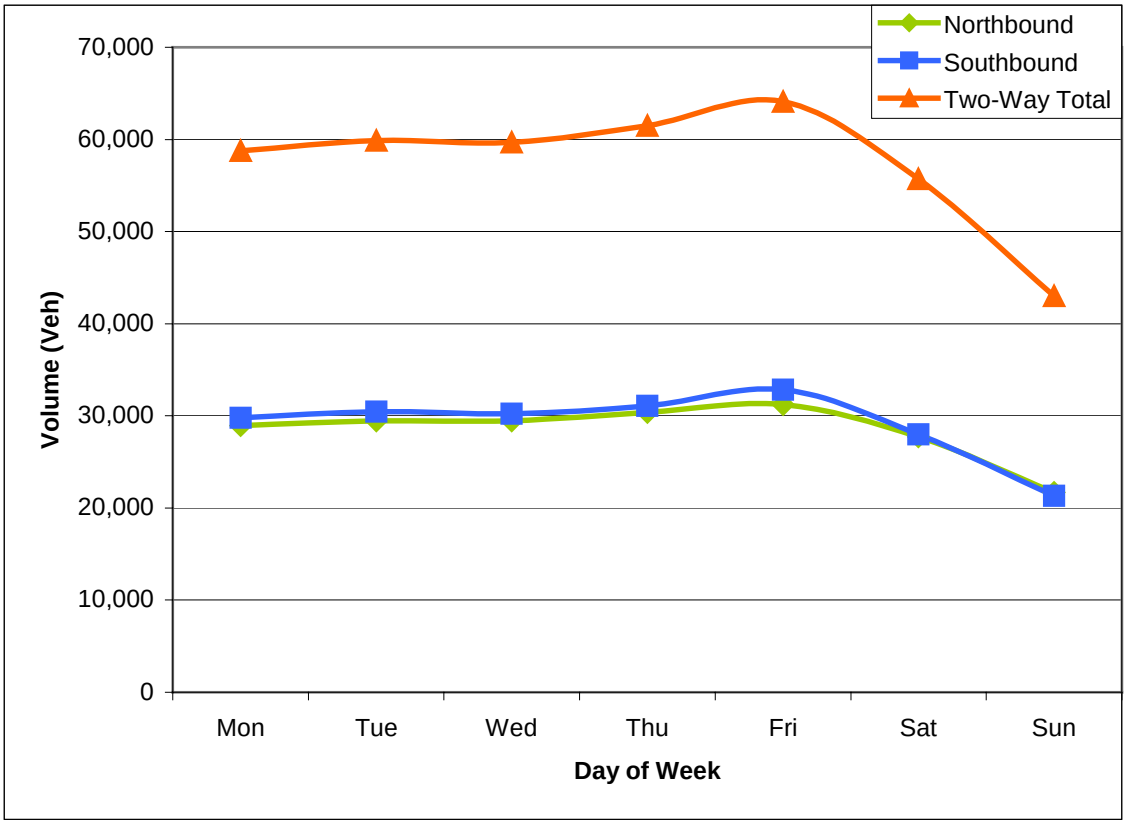
weekend is also evident. These are representative of an arterial roadway that is primarily used as a commuter route.

Dickson Street-Bridge Street forms part of a north-south district-suburban route though the local area. The flow profile shown in **Figure 3-11** reveals high peak hour volumes with peak to daily off peak variation of over 50% in hourly traffic volumes, indicative of a commuter route. This reinforces community views that suggest that increased traffic congestion on the Lutwyche and Sandgate Road north-south arterials in recent years has resulted in the increasing use of lower-order roads in the local area as "rat-runs" by commuters to Central Brisbane. Similarly the flow profile on the suburban east-west connector route provided by Albion Road shown in **Figure 3-12** indicates strong Central Brisbane orientated commuter use profiles.

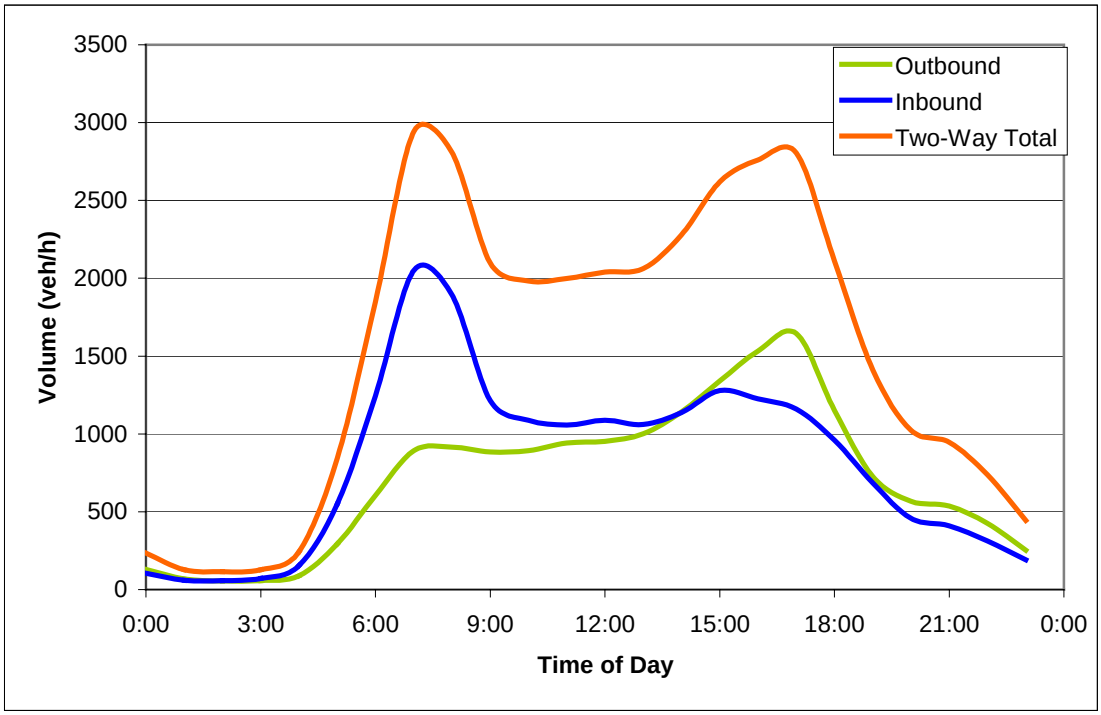
- **Figure 3-7 Lutwyche Road Weekday Temporal Traffic Profile**



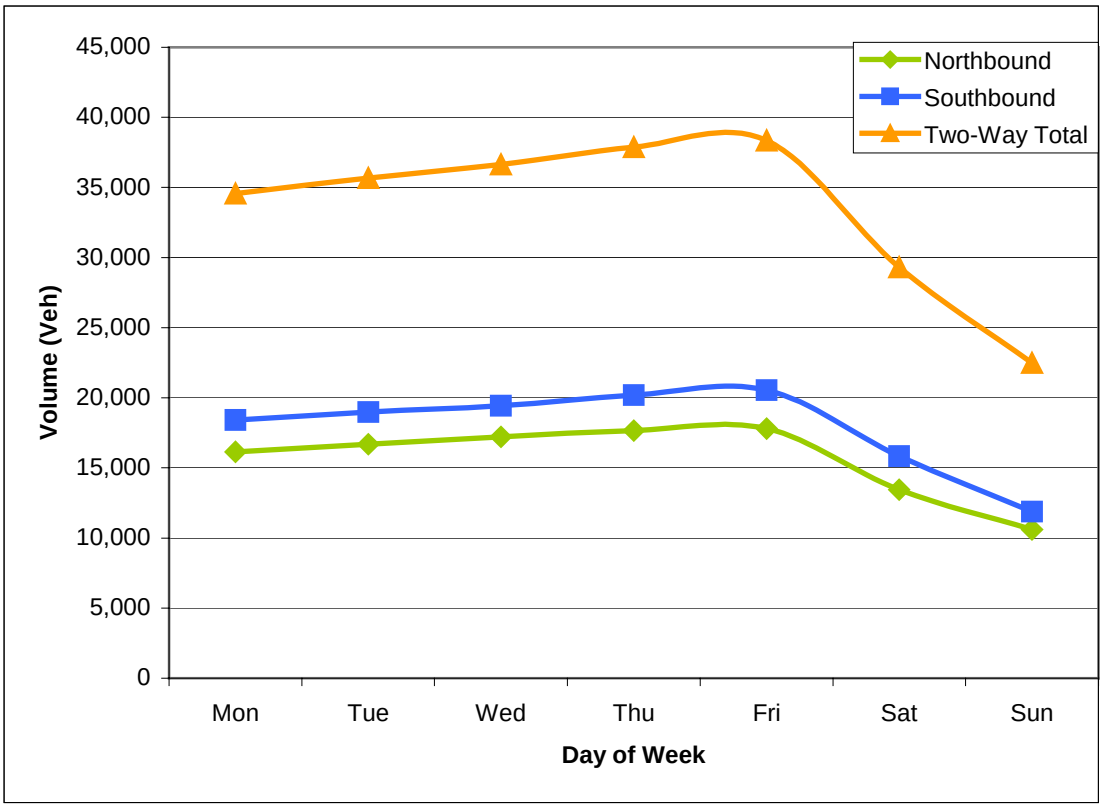
- **Figure 3-8 Lutwyche Road Weekly Traffic Flow Profile**



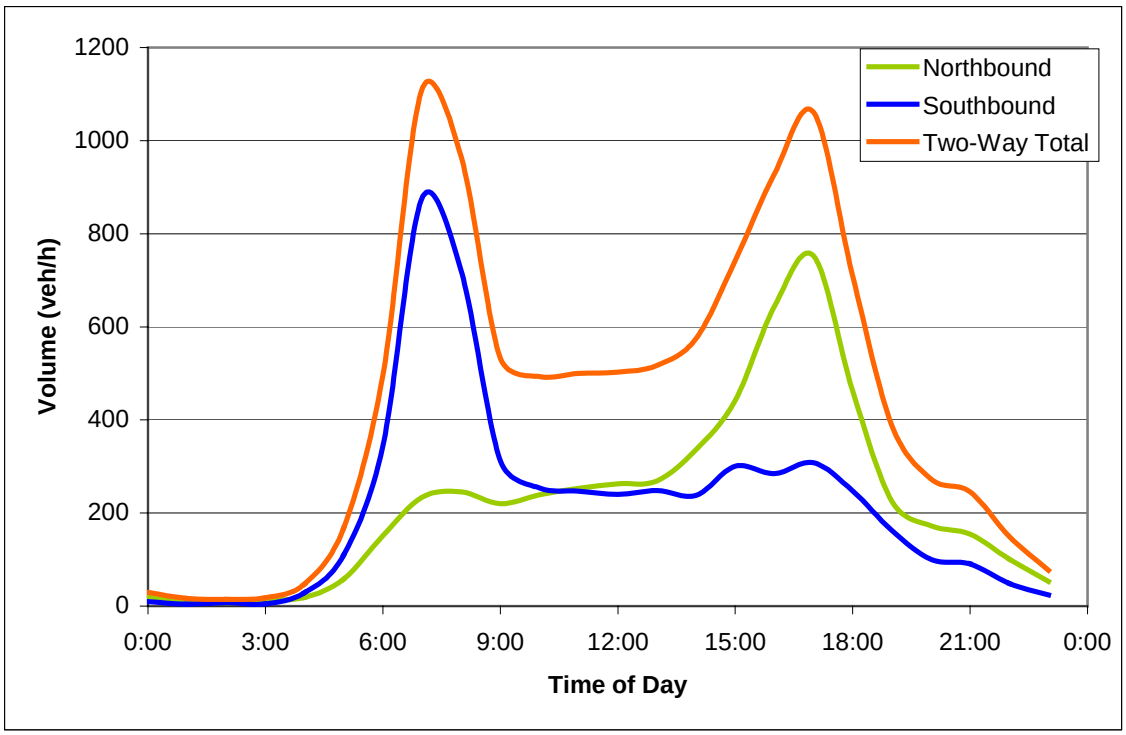
- **Figure 3-9 Sandgate Road Weekday Temporal Traffic Profile**



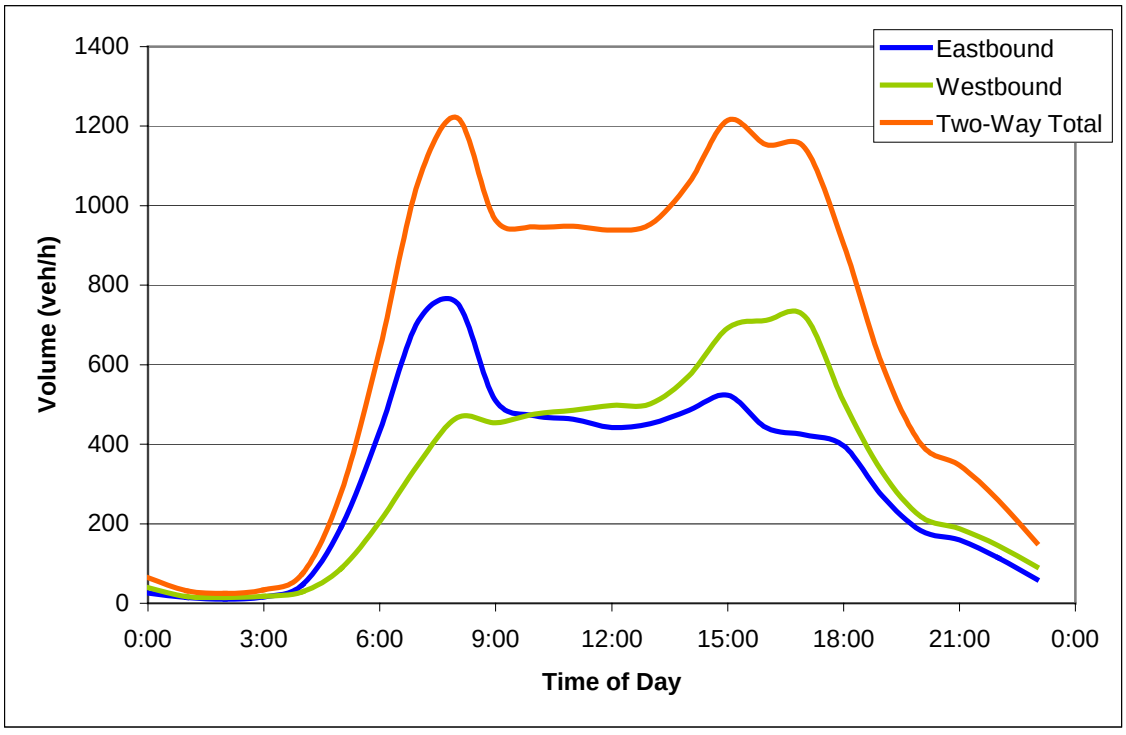
- **Figure 3-10 Sandgate Road Weekly Traffic Flow Profile**



- **Figure 3-11 Dickson Street Weekday Temporal Traffic Profile**



- **Figure 3-12 Albion Road Weekday Temporal Traffic Profile**



3.5.2 Traffic Composition

The composition of traffic or vehicle mix (cars, buses, commercial vehicles) has an effect on the performance and characteristics of the road network. Motorways and arterial routes typically carry the higher proportions of commercial and/or industrial traffic, whereas suburban and district roads cater for lower truck volumes.

The commercial vehicle percentages for a cross-section of roads within the Inner North area are tabulated in **Table 3-4**.

Lutwyche Road and Sandgate Road carry quite high proportions of commercial vehicles. Daily traffic flow by vehicle type on Lutwyche Road is shown in **Figure 3-13**. This indicates a consistent profile of commercial vehicle use throughout the morning then declining mid-afternoon.

Nudgee Road and Kingsford Smith Drive have higher commercial vehicle usage. Both these roads are, at least in part, gazetted for B-double vehicle use and directly serve industrial precincts.

3.5.3 Peak Hourly Traffic Volumes

Existing peak hour traffic volumes on major routes within the Inner North area are shown below in **Table 3-5**. These volumes are primarily sourced from recent surveys, Department of Main Roads count database and Brisbane City Council. Typically, the morning peak is found to be of a shorter time period whilst the evening peak is more extended.

3.5.4 Traffic Growth

Historic medium to long term traffic growth rates experienced within the Inner North area have been examined by comparing the average daily traffic volumes (AADT) for 1995, 2000 and 2005 at key locations as shown in **Figure 3-14**. This indicates sustained traffic growth in the range 1 to 2 % per annum has generally occurred over the last 10 years.

3.5.5 Parking

Lutwyche Road

Clearways extend for the majority of Lutwyche Road during peak periods, however in most sections on-street parking is permitted outside the peak periods. Inbound between East Street and Chalk Street, and between Felix Street and Norman Street, parking is permitted except in Lutwyche central during peak periods. In Windsor 24hr clearways exist between East Street and Le Geyt Street. During the AM Peak Le Geyt Street to Cedric Street acts as a clearway and from Cedric Street to the Royal Brisbane and Women's Hospital (RBWH) a 24hr clearway exists.

Outbound a 24hr clearway exists between the RBWH and Nicholas Street at Windsor. Between Nicholas Street and Kedron Park Road a clearway exists during the PM 2hr peak, except between Harris Street and Albion Road at Windsor, where a 24hr clearway is in place. In both directions, 24hr clearways exist between Kedron Park Road and Stafford Road.

On street parking is available on most local and district access streets near Lutwyche Road. There is a Park and Ride facility in Windsor south of Northey Street on Victoria Street, Edgar Street, Northey Street and Cullen Street, just west of Lutwyche Road. On-street parking occurs in streets around this facility. Local streets within the precinct bounded by Northey Street, Victoria Street, Newmarket Road and Green Terrace is regulated by a BCC resident parking scheme, requiring the display of a permit (identifying the vehicle owner as a local resident) to park on-street in this precinct.

Most commercial premises fronting Lutwyche Road provide off street parking.

Table 3-4 Existing Average Weekday Commercial Vehicle and Bus Percentages

ID	Road	Location	%Commercial Vehicle	%Bus
Motorway				
14	East – West Arterial	East of Widdop Street, Hendra	5.5%	<1%
Arterial				
5	Rode Road	West of Sandgate Road, Wavell Heights	5.2%	<1%
10	Stafford Road	West of Richmond Street, Kedron	5.5%	<1%
11	Gympie Road	North of Broughton Road, Kedron	6.0%	<1%
13	Sandgate Road	North of Schulz Canal, Toombul	6.5%	<1%
16	Nudgee Road	North of East-West Arterial, Hendra	15.0%	0%
18	Kedron Park Road	East of Lutwyche Road, Kedron	5.8%	<1%
20	Rose Street	Melrose Park, Wooloowin	4.7%	<1%
22	Sandgate Road	South of Junction Road, Clayfield	5.2%	<1%
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	6.5%	1%
31	Sandgate Road	South of Bonney Avenue, Albion	8.0%	<1%
33	Lutwyche Road	South of Newmarket Road, Windsor	9.4%	1.1%
34	Abbotsford Road	South of Burrows Street, Bowen Hills	8.0%	<1%
35	Inner City Bypass	West of Breakfast Creek Road, Hamilton	9.6%	0%
36	Kingsford Smith Drive	East of Cooksley Street, Hamilton	11.1%	<1%
41	Inner City Bypass	West of Bowen Bridge Road, Herston	9.6%	0%
Suburban				
12	Shaw Road	At Kedron Brook, Wooloowin	2.1%	<1%
26	Maygar Street	West of Lutwyche Road, Windsor	5.4%	<1%
29	Albion Road	East of Lutwyche Road, Windsor	6.3%	<1%
32	Newmarket Road	West of Lutwyche Road, Windsor	5.1%	0%
District Access				
24	Dickson Street	North of Wride Street, Wooloowin	2.5%	0%

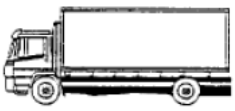
Table Notes: Source: BCC, DMR, 2005 Surveys

1) Vehicle type has been based on the AustRoads (2004) as follows:

Cars and light vehicles – Classes 1and 2

Commercial Vehicles – Classes 31 to 12.

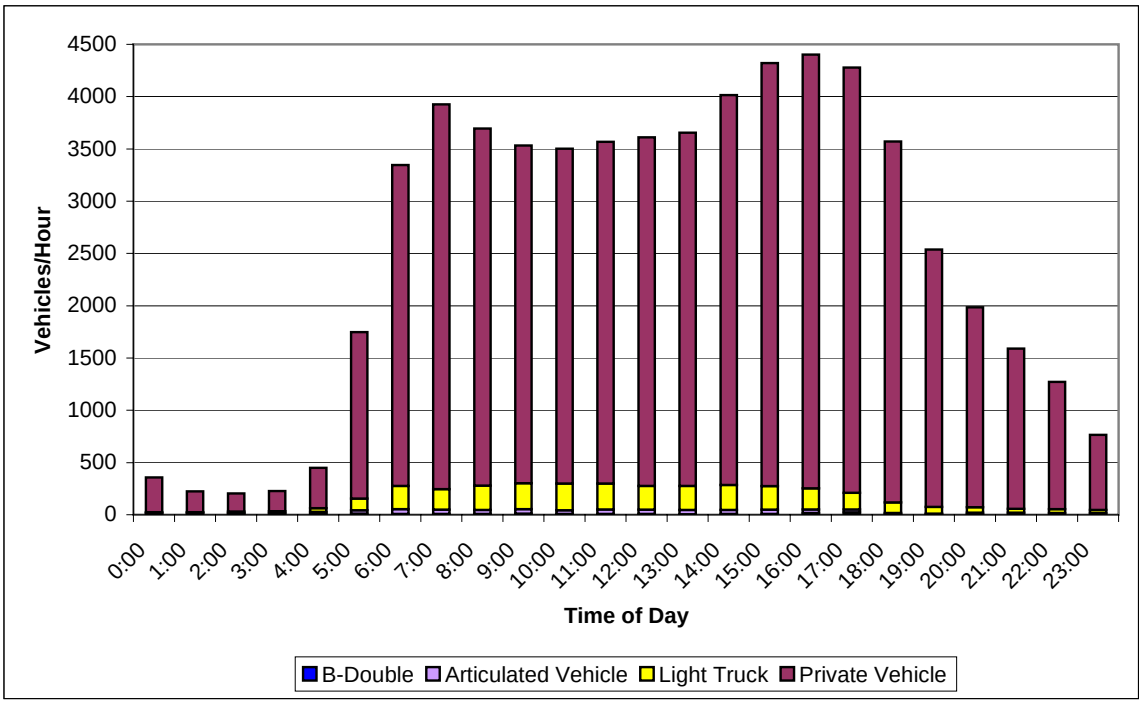
[1]



Class 3
Two Axle Truck

[1] The term CV in the context of this report refers to medium and heavy commercial vehicles (commonly referred to as trucks) and is equivalent to AustRoads vehicle classes 3 to 12. The AustRoads classification system is based on number and spacing of axles. Class 3 is specifically designated by AustRoads as a two-axle truck (depicted to the left). Classes 1 and 2 are short vehicles (axle spacing <=3.1m e.g. cars, 4WDs, standard utes etc with and without trailers). Classes 4 to 12 comprise multi-axle and articulated vehicles.

- **Figure 3-13 Lutwyche Road Traffic Flow Profile by Vehicle Type**



Sandgate Road

On Sandgate Road, a kerbside lane clearway operates during the AM Peak period inbound, and in the outbound kerbside lane during the PM Peak period. On street parking is permitted outside of peak periods in the kerbside lanes. In some segments, the clearway hours are extended throughout the day limiting the availability of kerbside parking.

Frontage to Sandgate Road is predominantly residential, however commercial precincts exist in Albion and Clayfield. The Albion Village has limited off street parking provisions and some on street parking occurs outside peak periods within this area. Southbound traffic through the Albion Village is relatively light due to the Frodsham Street bypass. Off street parking is supplied at most commercial and retail outlets fronting Sandgate Road in Clayfield.

Table 3-5 2005 Peak Hour Two-way Traffic Volumes

ID	Road	Location	AM Peak Volume	PM Peak Volume
Motorway				
14	East – West Arterial	East of Widdop Street, Hendra	1,700	1,900
Arterial				
5	Rode Road	West of Sandgate Road, Wavell Heights	1,400	1,600
10	Stafford Road	West of Richmond Street, Kedron	1,600	1,700
11	Gympie Road	North of Broughton Road, Kedron	4,700	4,300
13	Sandgate Road	North of Schulz Canal, Toombul	3,800	4,000
16	Nudgee Road	North of East-West Arterial, Hendra	800	1,000
18	Kedron Park Road	East of Lutwyche Road, Kedron	1,300	1,500
20	Rose Street	Melrose Park, Wooloowin	3,300	4,200
22	Sandgate Road	South of Junction Road, Clayfield	2,700	2,700
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	3,900	4,300
31	Sandgate Road	South of Bonney Avenue, Albion	2,900	2,700
33	Lutwyche Road	South of Newmarket Road, Windsor	4,100	4,300
34	Abbotsford Road	South of Burrows Street, Bowen Hills	4,900	4,500
35	Inner City Bypass	West of Breakfast Creek Road, Hamilton	2,100	2,000
36	Kingsford Smith Drive	East of Cooksley Street, Hamilton	4,500	4,600
41	Inner City Bypass	West of Bowen Bridge Road, Herston	2,100	2,000
Suburban				
12	Shaw Road	At Kedron Brook, Wooloowin	1,600	1,300
26	Maygar Street	West of Lutwyche Road, Windsor	700	900
29	Albion Road	East of Lutwyche Road, Windsor	1,000	1,100
32	Newmarket Road	West of Lutwyche Road, Windsor	900	1,400
District Access				
24	Dickson Street	North of Wride Street, Wooloowin	1,100	900

Table Note: Source: BCC, DMR, 2005 Surveys

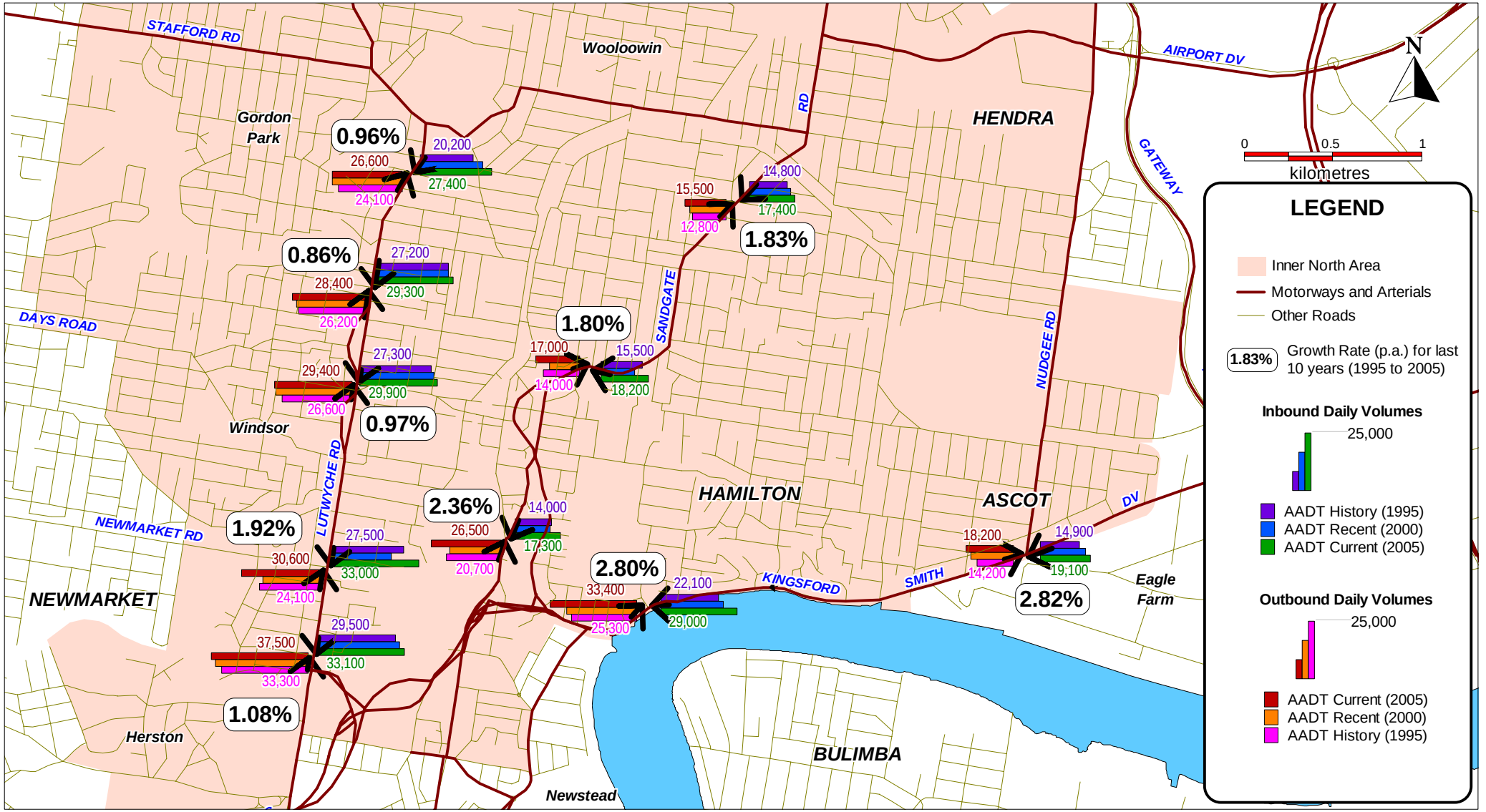


Figure 3-14
Historic Traffic Volume Growth

Airport Link

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Major Commercial Centres

Major commercial centres within the Inner North area, and their associated parking provisions are shown in **Table 3-6**.

Table 3-6 Retail Centre Parking Provisions

Centre	Retail Floor Space (m^2)	Office Floor Space (m^2)	Total Floor Space (m^2)	Parking Bays
Centro Lutwyche	12,088	6,645	18,733	812
Centro Toombul	45,969	768	46,737	2,474
Homemaker City Windsor	9,463	0	9,463	180

Table Note: Source: Queensland Shopping Centre Directory 2005, Property Council of Australia

Public Transport Parking

Off-street parking is provided at some rail stations within the Inner North area as summarised in **Table 3-10**.

Off-street parking provision at the Wooloowin rail station is inadequate for demand, with significant levels of on street parking on both Inwood Street and Ride Street. Similar to Wooloowin, significant levels of parking overflow are evident at the Windsor Rail Station, with overflow predominantly on Prospect Road, located on the opposite side of the rail line to the off street parking. Most rail stations provide only open-air parking, however an undercover car park is available at the Albion Rail Station. Some rail stations provide secure commuter parking, which is locked during the midday off peak period. Off street rail station parking is provided on both sides of the rail line at the Albion and Eagle Junction rail stations. Windsor, Wooloowin and Toombul rail stations provide off street parking on one side only, however on street parking also occurs on the opposite side.

3.6 Public Transport Services and Infrastructure

3.6.1 Bus Services and Infrastructure

The existing bus services within the Inner North area are shown in **Figure 3-4**. Most bus services within the area operate either in part or in full on the two major corridors of Lutwyche Road and Sandgate Road.

Lutwyche Road Bus Services

Lutwyche Road is traversed by a number of BCC bus services including Buz (high frequency all day), Rocket (very limited stops), City Express (limited stops) and City Bus (all stops) services. The majority of bus routes service the entire corridor whilst some bus routes enter and/or exit the Lutwyche Road corridor at Northey Street, Maygar Street, Albion Road, Bradshaw Street, Chalk Street, Norman Street or Kedron Park Road.

Two key generators of public transport trips located on Lutwyche Road are the Lutwyche shopping/commercial area and the Royal Brisbane Hospital complex. Existing bus services at each location are summarised in **Table 3-7** and **Table 3-8** respectively.

During the two hour AM Peak period (7am to 9am), forty-nine (49) buses pass the Lutwyche shopping centre towards the Brisbane CBD, an average of a bus every 2.5 minutes. At RBH, sixty-five (65) bus services operate inbound in the 2 hour AM Peak period, an average of 1.85 minutes per bus. The increase in services occurs as additional services join the corridor at Northey Street and Maygar Street.

Routes 335, 339, 346, and 353 run predominantly down Webster Road servicing the local residential catchments before joining Lutwyche Road at the Northey Street intersection. Route 379, servicing Stafford City Shopping Centre and the residential catchments located adjacent to Webster Road, joins the Lutwyche Road corridor at the Maygar Street intersection.

Total buses using Lutwyche Road range from 600 per day at Lutwyche to approximately 800 per day at RBWH.

- **Table 3-7 Existing Bus Services on Lutwyche Road at Lutwyche Shopping Centre (2005)**

Route	From	To	Service Type	AM peak freq (mins)	AM peak trips (2 hr)	Daily Inbound	Daily Outbound	Daily 2way
321	Toombul	City	All Stops	40	3	18	19	37
330	Bracken Ridge	City	City Xpress	60	2	26	27	53
331	Bracken Ridge	City	Rocket	24	5	10	10	20
333	Chermside	City	Buz	11	11	82	83	165
334	Chermside	City	All Stops	40	3	13	11	24
340	Carseldine	City	City Xpress	60	2	28	27	55
341	Carseldine	City	Rocket	24	5	7	8	15
370	Chermside	City	All Stops	15	8	52	54	106
375	Stafford	City	All Stops	12	10	56	61	117
376	Stafford	City	City Xpress	0	0	3	3	6
Total Bus Services					**49**	**295**	**303**	**598**

Table Note: Source: TransLink 2005

- **Table 3-8 Existing Bus Services on Lutwyche Road at Royal Brisbane and Women's Hospital (2005)**

Route	From	To	Service Type	AM peak freq (mins)	AM peak trips (2 hr)	Daily Inbound	Daily Outbound	Daily 2way
321	Toombul	City	All Stops	40	3	18	19	37
330	Bracken Ridge	City	City Xpress	60	2	26	27	53
331	Bracken Ridge	City	Rocket	24	5	10	10	20
333	Chermside	City	Buz	11	11	82	83	165
334	Chermside	City	All Stops	40	3	13	11	24
340	Carseldine	City	City Xpress	60	2	28	27	55
341	Carseldine	City	Rocket	24	5	7	8	15
370	Chermside	City	All Stops	15	8	52	54	106
335	Taigum	City	City Xpress	60	2	17	15	32
339	Taigum	City	Rocket	60	2	4	5	9
346	Aspley	City	All Stops	30	4	16	14	30
353	McDowall	City	All Stops	40	3	18	18	36
379	Grange	City	All Stops	24	5	31	34	65
375	Stafford	City	All Stops	12	10	56	61	117
376	Stafford	City	City Xpress	0	0	3	3	6
Total Bus Services					**65**	**381**	**389**	**770**

Table Note: Source: TransLink 2005

Sandgate Road Bus Services

Six bus routes utilise Sandgate Road and Abbotsford Road within the Inner North area. Four of these routes, designated 306, 310, 315 and 322, traverse the entire study area length of Sandgate Road and Abbotsford Road. Route 320 deviates from Sandgate Road at the Bonney Avenue intersection, servicing the residential suburbs of Clayfield and Wooloowin between the Sandgate and Lutwyche Road corridors before terminating at Chermside Shopping Centre. The sixth route, 301, deviates from Abbotsford Road-Sandgate Road at the Albion fiveways signalised intersection onto Crosby Road. This bus route services the residential suburbs of Albion, Ascot, Hamilton, Clayfield and Hendra before terminating at Toombul Shopping Centre.

Of the five bus routes that operate on Sandgate Road north of the Albion Fiveways at Crosby Street, three routes use the Frodsham Street bus lane to bypass the Albion Village when bound for the CBD whilst the other two routes follow Sandgate Road through the Albion Village. All of the five routes operate along Sandgate Road in the outbound direction.

A total of 100 buses per day use Sandgate Road.

Major Bus Infrastructure

The Inner Northern Busway (INB) provides a high quality connection for bus services between the Royal Children's Hospital at Herston and Roma Street. A number of bus services on Lutwyche Road use the INB for CBD access. Connectivity between Bowen Bridge Road and the INB is provided via Gilchrist Avenue and Herston Road. Construction is underway to connect the INB to the Queen Street Bus Station, Brisbane's major bus interchange.

The Toombul Bus Interchange is located on the western side of the Centro Toombul Shopping centre. The bus interchange can support up to eight buses at one time with lay over space available for approximately six additional buses. Access to the Bus Interchange is provided from the Centro Toombul Access/Sandgate Road signalised intersection. Bus egress is to Grace Street. The bus interchange is located less than 150m from the Toombul Rail Station providing a multi-modal interchange facility in Brisbane's northeast.

Bus Priority Measures

Bus priority measures are usually provided to improve travel times and/or increase reliability of travel times for bus services. Bus priority measures currently active in the Inner North area include:

- Bus lanes located on Bowen Bridge Road between Herston Road and Butterfield Street northbound, and between O'Connell Terrace and Herston Road southbound. A signalised bus jump from the left hand southbound lane of Bowen Bridge Road at the Bowen Bridge Road/Herston Street intersection has been discontinued in recent years.
- A T3 transit lane southbound on Lutwyche Road between Ada Street and Horace Street in the AM peak, used by buses, taxis and vehicles with at least three occupants. A review of BLISS (Brisbane Linked Intersection Signals System) data for September 2005 indicates that traffic volume in the T3 lane is approximately 15% of the total of the other two inbound lanes combined.
- A bus lane on Frodsham Street in the AM Peak. This bus lane allows buses to avoid the long queues associated with the Albion Fiveways signalised intersection at the southern end of Frodsham Street.
- Brisbane City Council's BLISS and RAPID (Real Time Advanced Priority and Information Delivery) information systems, monitored by BCC and used to update bus stop variable message signs (VMS) providing patrons with up to date information on bus arrival times and delays. This system can also be used to reduce bus travel times by providing buses with priority at signalised intersections. Due to heavy traffic

volumes constraining signalised intersection operation on Lutwyche Road and Sandgate Road , however, the RAPID system is not currently being used to provide real time bus priority on these roads.

3.6.2 Rail Services and Infrastructure

Rail stations and rail lines within the Inner North Area are shown in **Figure 3-4**.

The two major corridors are associated with the Ferny Grove Rail Line and the Caboolture Rail Line. The Ferny Grove corridor services the study area stations of Windsor and Bowen Hills. The Caboolture, Shorncliffe, Airport and Doomben rail services operate on the rail corridor between Bowen Hills and Eagle Junction stations. East of the Eagle Junction station the three corridors service different regions. The Doomben line services residential suburbs in the south-east of the study area. The Airtrain rail corridor runs elevated parallel to the East-West Arterial Road whilst the Caboolture and Shorncliffe lines service the Toombul Rail station before heading north.

Existing weekday services for rail stations within the Inner North Area are shown in **Table 3-9**.

Table 3-9 Existing Weekday Rail Services

Station	Period	To City		From City	
		Rail Services	Peak Hour Service Headway (min)	Rail Services	Peak Hour Service Headway (min)
Bowen Hills	6-8AM	34	3.5	38	3.2
	4-6PM	42	2.9	43	2.8
	Daily	246		262	
Windsor	6-8AM	5	24	7	17
	4-6PM	5	24	9	13
	Daily	41		47	
Albion	6-8AM	14	8.6	13	9.2
	4-6PM	10	12	16	7.5
	Daily	95		97	
Wooloowin	6-8AM	14	8.6	13	9.2
	4-6PM	10	12	16	7.5
	Daily	95		97	
Eagle Junction	6-8AM	24	5	18	6.7
	4-6PM	18	6.7	28	4.3
	Daily	138		138	
Toombul	6-8AM	13	9.2	14	8.6
	4-6PM	8	15	9	13.3
	Daily	82		82	
Clayfield, Hendra, Ascot, Doomben	6-8AM	4	30	4	30
	4-6PM	2	60	2	60
	Daily	15		15	
Brisbane Airport	6-8AM	5	24	6	20
	4-6PM	7	17	6	20
	Daily	35		36	

Table Note: Source: TransLink 2005

Bowen Hills rail station is one of the four major interchange stations in Brisbane (along with Brunswick Street, Central and Roma Street), and services on the Sandgate, Petrie, Ferny Grove, Airport and Doomben lines, operate via this station. Bowen Hills has an average peak service headway of under 4 minutes in each direction in both the morning and afternoon peaks.

Windsor station is located on the Ferny Grove rail line. This rail line services the north-westernern suburbs of Brisbane, and runs east-west crossing over Lutwyche Road just south of the Bowen Street signalised intersection. Windsor Station has services operating inbound at a headway of 24 minutes in the AM peak. In the PM peak, outbound from the city, services between Central Station and Windsor station operate at a headway of 13 minutes.

Albion station, located on the Caboolture/Shorncliffe Line south of the junctions with the other northern lines, has services operating in the commuter peak direction at a headway of 7 to 9 minutes.

Opened in 2002 as an alternative means of to/from airport travel, Airtrain provides a 22 minute service between Central rail station and the Domestic Airport at a cost of $12 per one-way trip. Services to the Airport depart Central between 5:30am and 7pm and services from the Airport depart between 6:15am and 7:30pm on weekdays. Typical peak headways are 15 to 20 minutes, with services operating every 30 minutes during off-peak times. With passenger flights operating twenty hours a day compared to the fourteen hours of rail operation, commuters must rely on private vehicle or taxi services for the balance of daily airport travel.

Rail infrastructure includes rail, vehicular and pedestrian bridges, tunnels and rail stations. The layout and design of stations varies predominantly due to constraints associated with geographical location and infrastructure and land-uses surrounding the station and the standards applicable in the period when they were built or upgraded. All stations provide wheel chair access to station platforms by either ramps or lifts. Pay phones are provided at all stations whilst toilet facilities are provided at all stations with exception of the Clayfield, Hendra and Doomben stations (all on the Doomben line). Some distinguishing features between stations are listed in **Table 3-10**.

Table 3-10 Rail Station Infrastructure

Station	Weekday Office	Saturday Office	Sunday Office	Parking Bays	Secure Parking Bays	Visual Displays	Bike Lockers
Bowen Hills	Provided	Provided	Provided	-	-	Provided	-
Albion	Provided	Provided	-	292	149	-	Provided
Wooloowin	Provided	Provided	-	189	-	-	Provided
Eagle Farm	Provided	Provided	Provided	123	-	Provided	Provided
Toombul	Provided	Provided	-	104	-	-	Provided
Clayfield	-	-	-	-	-	-	-
Hendra	-	-	-	-	-	-	-
Ascot	Race days only	Race days only	Race days only	Provided	-	-	-
Doomben	-	-	-	-	-	-	-
Windsor	Provided	-	-	64	-	-	-

Table Note: Source: Queensland Rail

3.6.3 Ferry Services

The Brett's Wharf City Cat ferry terminal in Hamilton on the southern side of Kingsford Smith Drive is the only ferry servicing point in the Inner North area. City Cat ferries to the City and St Lucia depart from this terminal every 15 to 20 minutes during peak periods, and 30 minutes off-peak, 18 hours per day.

3.7 Cycle and Pedestrian Movements and Facilities

A number of on-road cycle lanes and off road shared pedestrian/cycle facilities are present within the Inner North area as shown in **Figure 3-15**.

Major pedestrian/cycle shared use pathways connect the east and west regions of the study corridor as follows:

1) An off-road cycle path between Kelvin Grove Road and Albion Road.

   This link follows the natural curvature of Enoggera Creek on its northern bank. Three footbridge crossings have been provided across Enoggera Creek, between Kelvin Grove Road and Bowen Bridge Road, connecting the cycle path with local pedestrian and cyclist friendly roads south of Enoggera Creek. Connectivity of the pathway across Lutwyche Road is provided through a signalised pedestrian crossing at the Northey Street intersection. A southern connection from this cycle way to the shared path described in 3) is provided via a bridge over Enoggera Creek at Downey Street.

2) Kedron Brook Path.

   This link follows the natural curvature of Kedron Brook, primarily along its southern bank. For the most part, this is an off road path connecting the north-western corridor of the Inner North Area, to the north-eastern suburbs of Nudgee and Boondall. This cycle path has a total distance of approximately 25kms and services the Stafford City and Toombul Shopping Centres. The Kedron Brook shared path cycleway also forms an important element of the pedestrian network, with high levels of recreational pedestrian use.

3) A third shared use path, located south of the nearby Enoggera Creek path, follows Gilchrist Avenue through Victoria Park from Herston Road to the ICB.

   This predominantly commuter path, leads to a landbridge that has been constructed over the ICB to connect the cycleway to the suburb of Spring Hill and the Brisbane Grammar Schools. The Enoggera Creek pathway is connected to the Herston Road/Victoria Park path by the local road network.

Lutwyche Road and Sandgate Road are two main arterials in the study area and are both important commuter routes. There are no on-road cycle lane provisions along either of these roads in the Inner North area and conditions for on road cyclists are not conducive to shared lane travel. Lane widths are generally only 3 metres wide compared with recommended standards of 4.0 to 4.5 meters wide for cyclist use. Furthermore, the short segment of inbound transit lane on Lutwyche Road has strong bus usage, especially during peak periods.

The Lutwyche Road and Sandgate Road corridors are flanked on either side by pedestrian footpaths. Signalised intersections provide for pedestrian crossings at all intersections for both roads. However, due to heavy traffic demands and limited capacity most intersections on Lutwyche Road only provide pedestrian facilities across one of the Lutwyche Road approaches. The same applies for Sandgate Road where most of the intersections located south of Adelaide Street provide pedestrian facilities across one of the Sandgate Road approaches only.

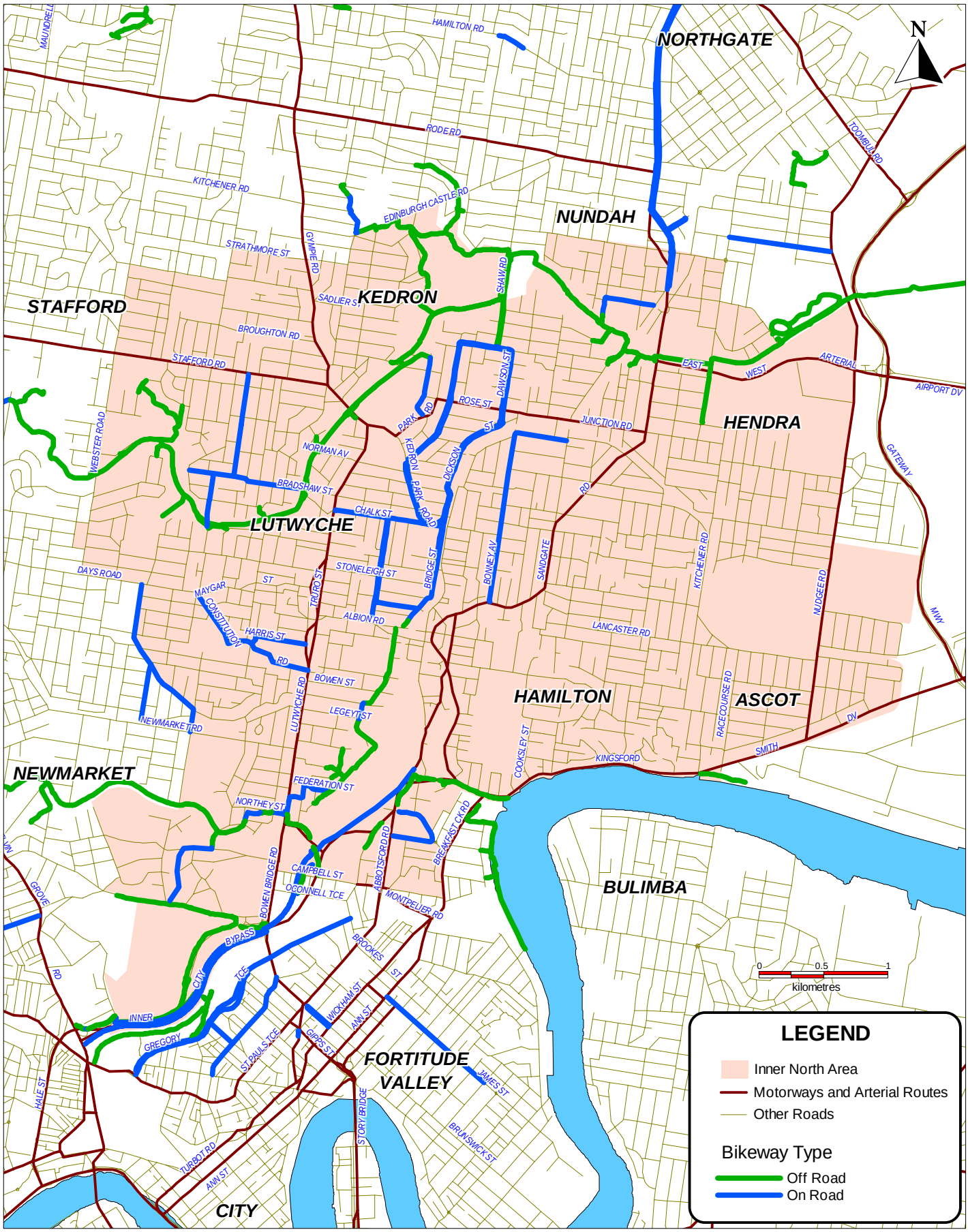

Figure 3-15
Existing Cycle Network

Airport Link

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3.8 Freight

The only routes gazetted for use by B-double vehicles within the Inner North area occur on the eastern fringe. Kingsford Smith Drive and Nudgee Road are both partially gazetted for B-Doubles. Kingsford Smith Drive is gazetted east of the Nudgee Road intersection. Nudgee Road is gazetted for B-Doubles from the Hedley Avenue intersection to north of the East-West Arterial Road. Hedley Avenue itself is also gazetted for B-doubles and serves at significant industrial precinct. The East-West Arterial Road is also gazetted for B-doubles between the Nudgee Road and Gateway Motorway intersections, allowing B-Double access to the Gateway Motorway.

Nudgee Road, between Kingsford Smith Drive and Lamington Avenue is gazetted for 23m access between 9am and 4pm on weekdays. Kingsford Smith Drive traffic recorded 660 B-Doubles on an average weekday in 2005.

Although not gazetted for B-doubles, surveys indicate that Lutwyche Road and Sandgate Road often experience use by some heavy articulated freight traffic.

Significant freight movements by rail on the Pinkenba Line, and other branches east of Doomben, travel through the Mayne Rail depot.

3.9 Emergency Services

Police stations within the study area are located at:

- Nudgee Road (Hendra) – all movements access to Nudgee Road;
- Corner Stafford Road and Webster Road (Stafford) with left-in left-out access from Webster Road; and
- Toombul Shopping Centre (Shop Front, Toombul).

Fire services within the study area are located at:

- Nudgee Road (Hendra); and
- Truro Street (Windsor).

The Nudgee Road fire station is located south of the Hedley Avenue intersection. Its main access directly fronts Nudgee Road and the lack of a centre median allows for both north and south movements to be made. A secondary access is provided from Navigator Place.

The Windsor fire station is located between Fosbery Street and Annie Street. The fire station has a main access onto Fosbery Street, just east of the signalised intersection with Lutwyche Road, and a secondary access from Truro Street.

The central office complex for the Queensland Department of Emergency Services is located at Kedron on the north-eastern corner of the Lutwyche Road/Kedron Park Road intersection. The complex provides integrated accommodation for Queensland Fire and Rescue Service, Queensland Ambulance Service, Emergency Management Queensland and the State Disaster Coordination Centre, providing communication and co-ordination across all the services. Around 600 persons work at the Kedron complex with an expected increase to 800 once it reaches operational capacity. Primary vehicular access is left-in left-out from Lutwyche Road, with movements constrained directionally by a central raised median. Another access point is located on Park Road near the neighbouring Kedron State High School.

Ambulance services operate from the Royal Brisbane Hospital with the main ambulance access onto Butterfield Street and a secondary access at the signalised intersection of Bowen Bridge Road with O'Connell Terrace.

4. Existing Network Performance

4.1 Introduction

The performance of the existing transport network is described in terms of:

- Traffic demands;
- Travel speeds and travel times;
- Road network performance;
- Intersection operations;
- Local accessibility;
- Tolling;
- Public transport;
- Pedestrian and cyclists; and
- Road safety.

4.2 Traffic Demands and Movement Patterns

Figure 4-1 shows the distribution of current traffic using both Lutwyche Road (north of Stoneleigh Street) and Sandgate Road (south of Bonney Avenue) and **Figure 4-2** shows traffic using Junction Road during an average weekday. Daily travel patterns are summarised in **Table 4-1**, **Table 4-2** and **Table 4-3**,based on travel sectors shown in **Figure 2-1** and **Figure 2-2**. These graphics and sector travel analysis illustrate the wide catchments served by the Sandgate Road and Lutwyche Road corridors. The catchment for east-west travel demands catered for on the East-West Arterial Road at Junction Road is also identified.

- **Table 4-1 Lutwyche Road Daily Travel Patterns**

To / From	Central Brisbane	Inner North	West Brisbane	North Brisbane including Airport	Brisbane South	Total
Central Brisbane	-	2%	-	15%	-	**17%**
Inner North	2%	4%	3%	4%	3%	**17%**
West Brisbane	-	2%	-	3%	-	**5%**
North Brisbane including Airport	18%	6%	3%	-	14%	**42%**
Brisbane South	-	3%	-	15%	-	**18%**
Total	**21%**	**17%**	**6%**	**38%**	**17%**	**100%**

- **Table 4-2 Sandgate Road Daily Travel Patterns**

To / From	Central Brisbane	Inner North	West Brisbane	North Brisbane including Airport	Brisbane South	Total
Central Brisbane	-	5%	1%	6%	-	**11%**
Inner North	5%	9%	7%	4%	6%	**30%**
West Brisbane	-	6%	-	7%	-	**13%**
North Brisbane including Airport	7%	5%	9%	-	9%	**30%**
Brisbane South	-	6%	1%	9%	-	**16%**
Total	**12%**	**31%**	**18%**	**26%**	**15%**	**100%**

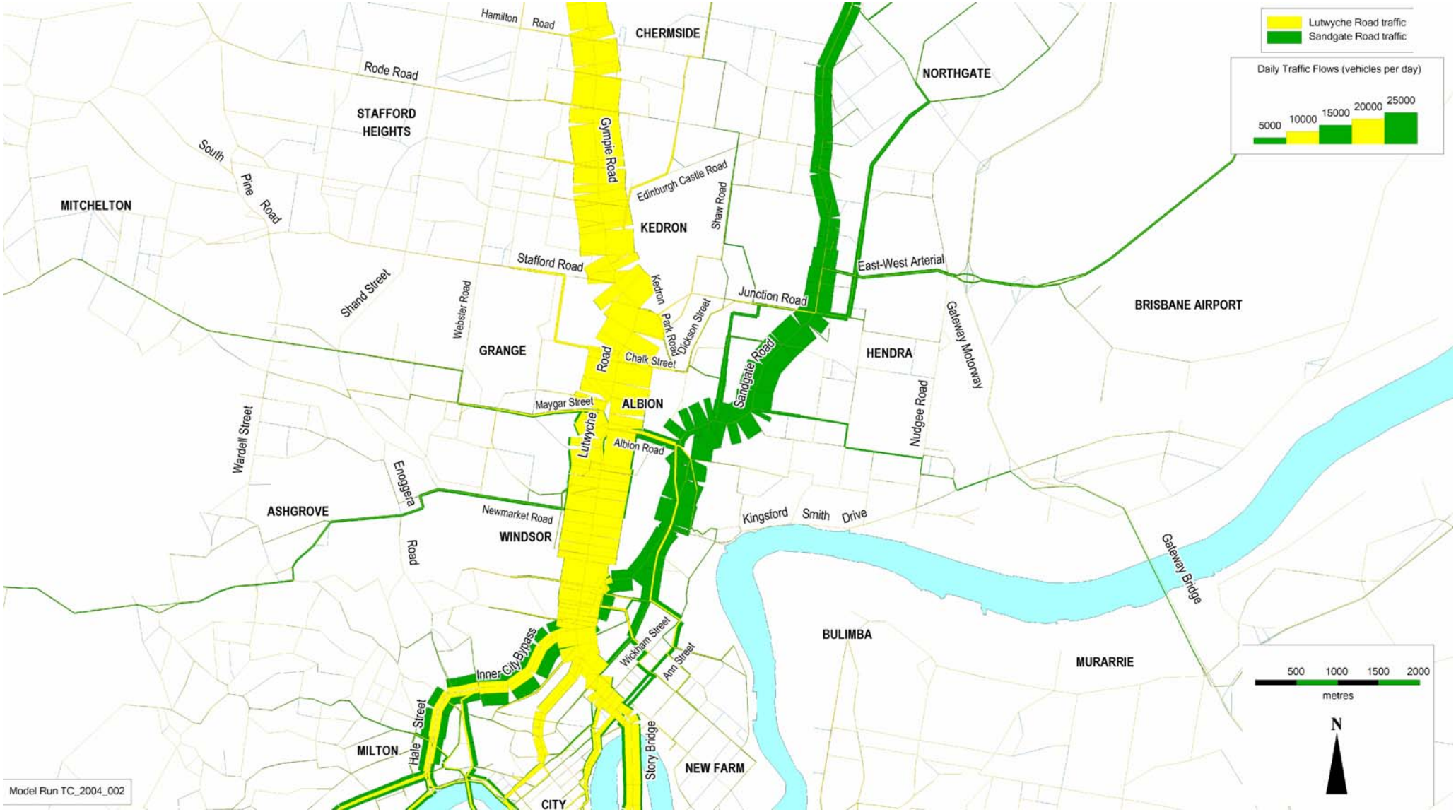

Figure 4-1
Existing Daily Travel Patterns
Lutwyche Road and Sandgate Road
(select links)

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Figure 4-2
Existing Daily Travel Patterns
Junction Road
(select links)

Airport Link

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- **Table 4-3 East-West Arterial Road at Junction Road Daily Travel Patterns**

From \ To	Central Brisbane	Inner North	West Brisbane	North Brisbane including Airport	Brisbane South	Total
Central Brisbane	-	0%	-	0%	-	**0%**
Inner North	0%	20%	5%	12%	4%	**41%**
West Brisbane	-	5%	-	10%	3%	**19%**
North Brisbane including Airport	0%	16%	9%	5%	2%	**32%**
Brisbane South	-	4%	2%	1%	-	**7%**
Total	**0%**	**45%**	**17%**	**28%**	**10%**	**100%**

On an overall basis Lutwyche Road typically carries a mix of local traffic (4%), radial or CBD oriented trips (38%) and cross-city traffic (58%). The component of peak period use (<1%) related to Airport travel is relatively small as alternative routes, particularly via Kingsford Smith Drive or Sandgate Road, offer more direct connectivity.

Sandgate Road similarly caters for local traffic (9%), radial or CBD oriented trips (23%) and has similar cross-city traffic role (63%) to Lutwyche Road. About 9% of traffic use on Sandgate Road during peak periods is related to the Airport/ATC area.

Whilst daily travel demand to Central Brisbane is strong on both routes, travel patterns between the north and south sectors, across the River, are also high for both Lutwyche and Sandgate Roads. This clearly demonstrates their function as part of a network of cross-city connections between the northern and southern, and northern and western suburbs of Brisbane.

On Junction Road, which forms part of the state-controlled East West Arterial Road, there is a strong mix of local use (20%) as well as cross-city travel movements. This route clearly plays an important east-west travel function, with 36% of travel related to the western catchment. Approximately 15% of total use is specifically associated with east-west travel to/from the Airport/ATC area.

Overall network daily traffic demands shown on **Figure 4-3** illustrate that the traffic volumes of 60,000 vpd on Lutwyche Road and 40,000 vpd on Sandgate Road represent a major proportion of the traffic task within the network in Inner North Brisbane. This demonstrates their significance within the broader network of the Metropolitan area. Junction Road on the East-West Arterial route carries a lower weekday traffic volume of less than 20,000 vpd, which as described previously is due to a mix of local traffic and east-west travel movements within the northern suburbs road network

4.3 Travel Speeds and Travel Times

Travel time surveys were conducted in November 2005 along the Lutwyche Road and Sandgate Road corridors. The study length extended for 5.5 km on Gympie Road-Lutwyche Road- Bowen Bridge Road between the Strathmore Street/Castle Street intersection at Kedron and the Herston Road intersection at Bowen Hills, and for 6.0 km on Sandgate Road between the Nundah by-pass tunnel at Toombul and the Campbell Street intersection at Bowen Hills. Data from previous travel time surveys on the East-West Arterial route was incorporated in transport model validation.

Table 4-4 shows the average travel speeds and times along the corridors in the northbound (outbound from the city) and southbound (inbound to the city) directions.

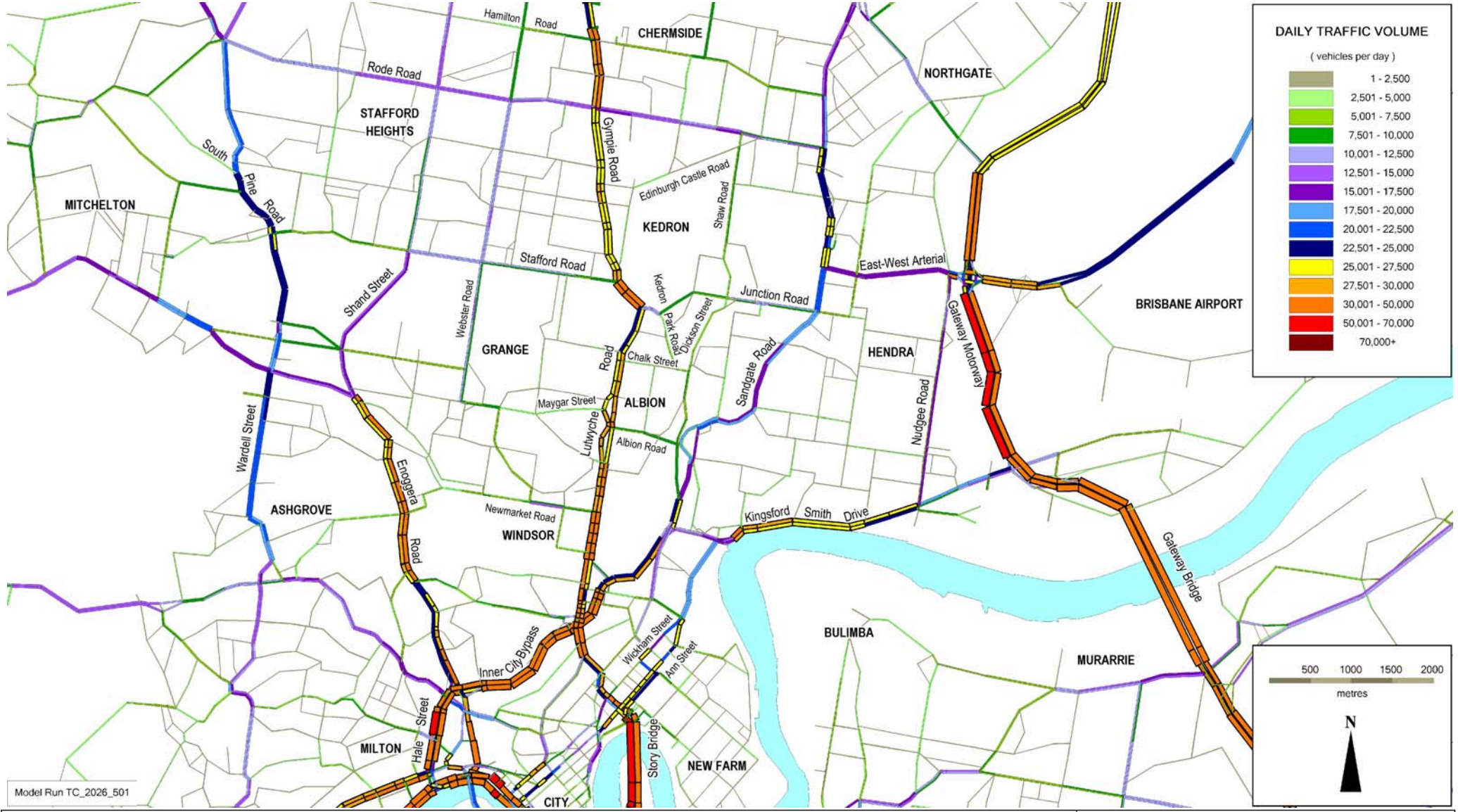

Figure 4-3
2004 Average Weekday Traffic Volumes

Airport Link

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Table 4-4 shows that the travel speed on both the Lutwyche and Sandgate corridor is significantly lower than the posted speed limit on these roads during the peak periods. The survey data demonstrates that the travel speed fluctuates highly between the sections along the corridor. This is caused by traffic delays at numerous locations.

- **Table 4-4 2005 Average Travel Times and Travel Speeds**

Parameter	Morning Peak (7-9 AM)				Evening Peak (4-6 PM)			
	Lutwyche Road		Sandgate Road		Lutwyche Road		Sandgate Road	
	North bound	South bound	North bound	South bound	North bound	South bound	North bound	South bound
Average Time (min)	9.26	11.10	10.97	11.62	10.69	9.80	11.52	12.97
Average Speed (km/h)	36	29	33	31	31	33	31	28

Table Note: Source: 2005 Travel Time Surveys

Table 4-5 also shows that the variability in the range of speed and travel time is particularly high in the southbound direction on both Lutwyche Road and Sandgate Road during the morning peak.

The survey data demonstrates that the travel speed fluctuates highly between the sections along the corridor. This is caused by traffic delays at numerous locations.

- **Table 4-5 2005 Travel Times and Travel Speed Variability**

Parameter	Morning Peak (7-9 AM)				Evening Peak (4-6 PM)			
	Lutwyche Road		Sandgate Road		Lutwyche Road		Sandgate Road	
	North bound	South bound	North bound	South bound	North bound	South bound	North bound	South bound
Time Range (min)	8.37-10.35	6.50-16.67	9.78-12.02	7.89-17.50	8.65-14.42	9.03-10.72	9.83-13.54	12.06-14.09
Speed Range (km/h)	39-32	50-20	37-30	45-20	38-23	36-30	37-27	30-25

Table Note: Source: 2005 Travel Time Surveys

On Lutwyche Road, the section between the Chalk Street and Newmarket Road intersections is problematic for delays for southbound commuter travel in the AM peak. In the PM peak period, severe northbound congestion is typically evident between the Albion Road and Chalk Street intersections through Lutwyche, and around the Stafford Road intersection at Kedron.

Along Sandgate Road in the morning peak delays for southbound traffic typically occur in the Albion area. The Clayfield section of the route near Junction Road is congested in the evening peak and causes delays.

4.4 Road Capacity and Level of Service

4.4.1 Level of Service Definition

Level of Service (LOS) is a key measure of the performance of the road network. It can be measured at a mid-block point or at an intersection, and provides an assessment of the operation as performance of the road network in terms of conditions experienced by drivers.

The LOS for roads within the study area has been determined for existing conditions for the base year 2004. The assessment uses the criteria in the AustRoads Guide to Traffic Engineering Practice Part 2 - Roadway Capacity

(1998). These criteria use travel speed as the defining measure for urban arterial roads with interrupted flow. As travel speeds decrease from the optimum free-flow condition, the LOS to road users deteriorates. The Level of Service range is from A (very good) to F (congested). **Table 4-6** describes the characteristics of each category.

Table 4-6 Roadway Mid-Block Level of Service Criteria

Level of Service	Criteria
Level of Service A	Generally free flow conditions with operating speeds usually about 90% of the free flow travel speed for the particular class of arterial. Vehicles are unhindered in manoeuvring in the traffic stream and stopped delay at junctions is minimal.
Level of Service B	Relatively unimpeded operation with average travel speeds about 70% of the free flow speed for the particular class. Manoeuvring in traffic stream is only slightly restricted and stopped delays are low.
Level of Service C	Stable operating conditions with manoeuvring becoming more restricted. Longer queues and/or adverse signal coordination may contribute to lower average travel speeds of about 50% of the free flow speed for that class.
Level of Service D	Conditions border on a range in which small increases in flow can significantly increase junction delay and reduce travel speed. Travel speeds are about 40% of the free flow speed.
Level of Service E	Conditions are characterised by significant junction delays and travel speeds of 33% of free flow speeds or lower. Contributing factors may be adverse signal progression, closely spaced signals and extensive queuing at critical junctions.
Level of Service F	Traffic flow at this level is very low speed for the road class, 25% to 33% of the free flow speed. Signalised junctions will be severely congested with extensive queuing and delay.

Table Note: Source: AustRoads (1998) Roadway Capacity

4.4.2 Network Performance

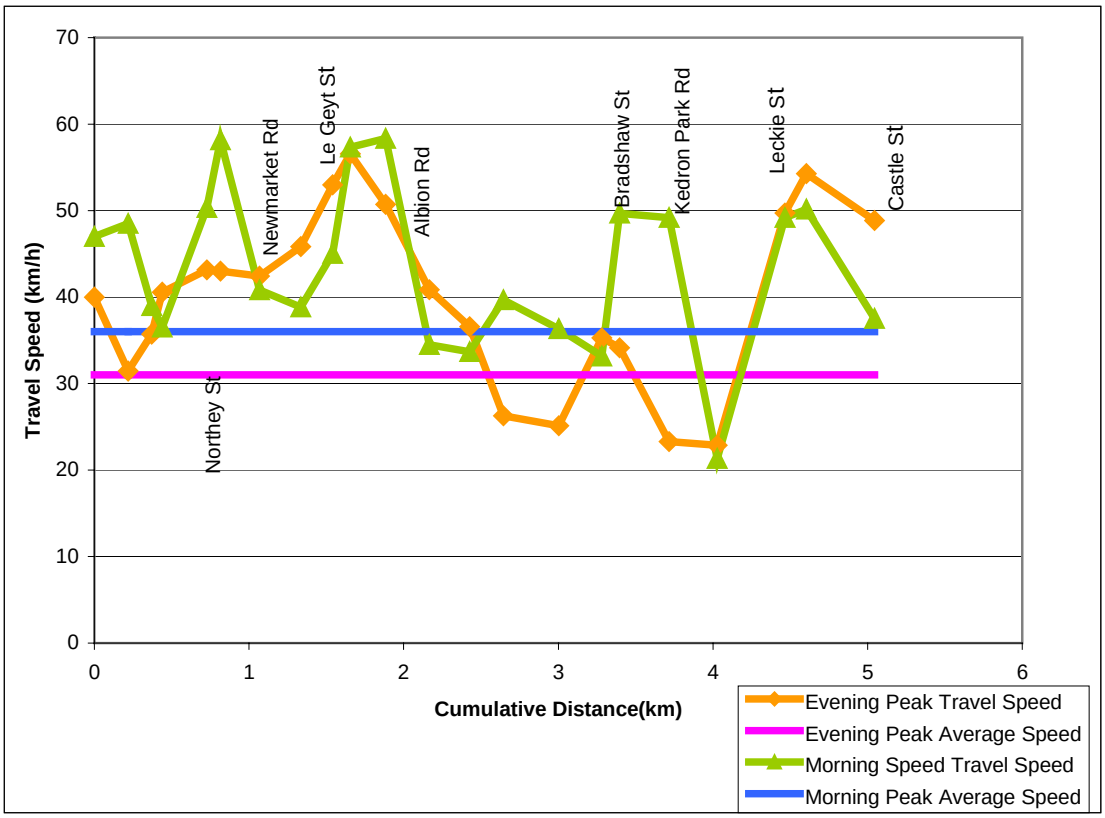
The existing mid-block level of service for the study area road network during the morning and afternoon peaks is shown in **Figure 4-8** and **Figure 4-9**.

Lutwyche Road in the inbound direction during the AM peak period and outbound direction in the PM peak period has many mid-block segments that operate at Level of Service E or F. Between Newmarket Road and Northey Street, Lutwyche Road is congested in the peak direction in both peaks. This implies that unstable flow conditions, low speeds and delays are likely. A transit lane operates inbound on Lutwyche Road during the morning peak benefiting public transport and high occupancy vehicle users. This benefit is not reciprocated in the evening peak outbound.

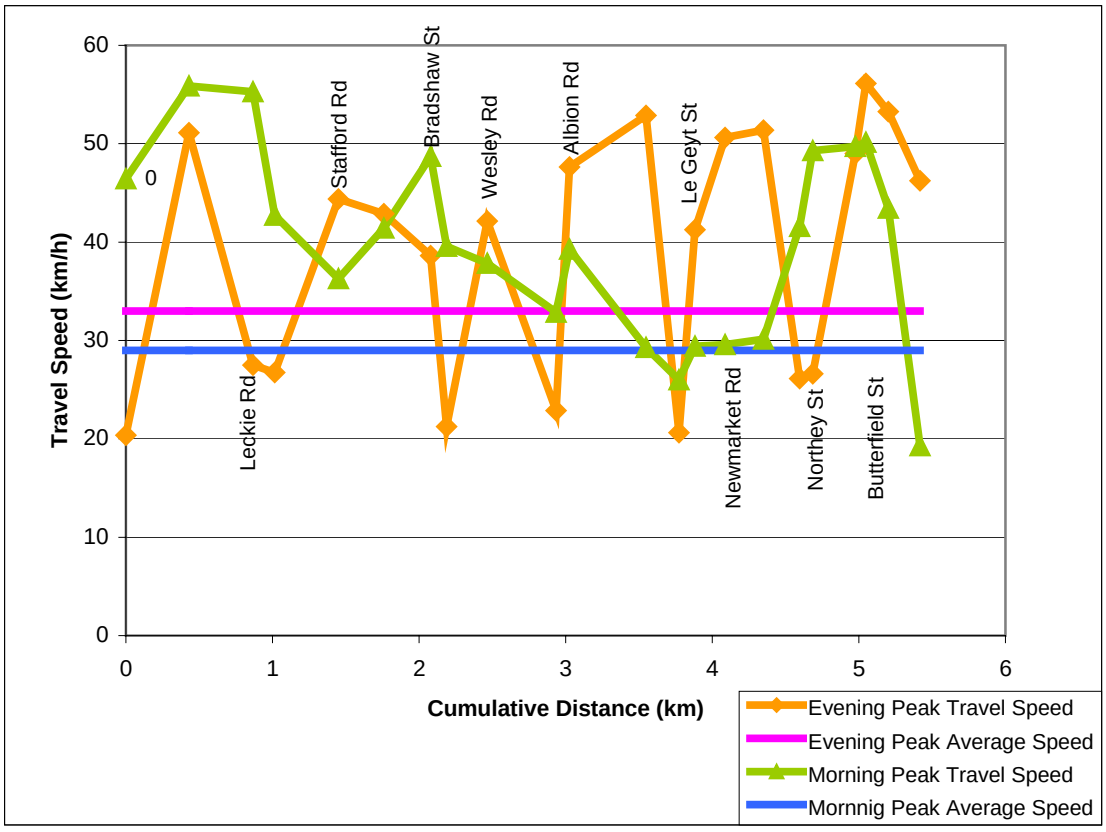
Various sections of Sandgate Road, Abbotsford Road and Hudson Road, between the ICB and the East-West Arterial Road, operate at low Level of Service during the AM peak. The inbound section of Sandgate Road between Bonney Avenue and Frodsham Street is also highly congested. Similarly during the PM peak Burrows Street, Hudson Road, Abbotsford Road and Sandgate Road are very congested in the Albion area.

Intersection capacity is discussed in **Section 4.5.**

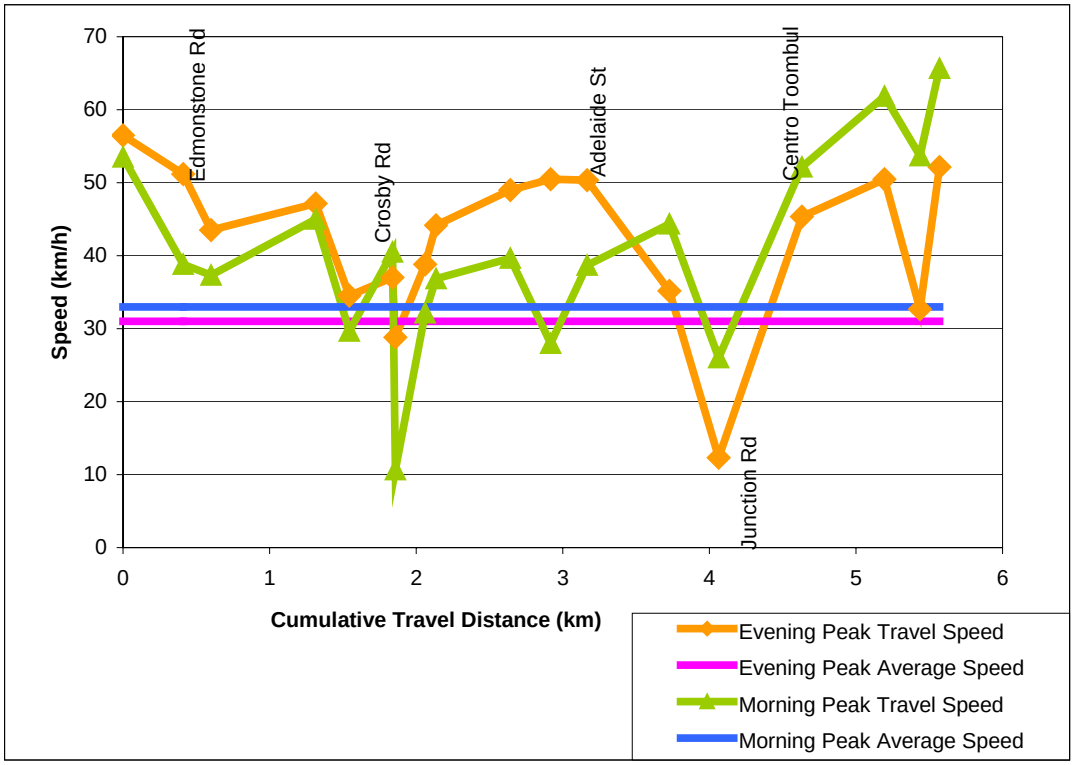
- **Figure 4-4 Existing Lutwyche Road Northbound Peak Period Travel Speeds**



- **Figure 4-5 Existing Lutwyche Road Southbound Peak Period Travel Speeds**



- **Figure 4-6 Sandgate Road Northbound Travel Speeds (AM & PM Peak)**



- **Figure 4-7 Sandgate Road Southbound Section & Average Speeds (AM & PM Peak)**

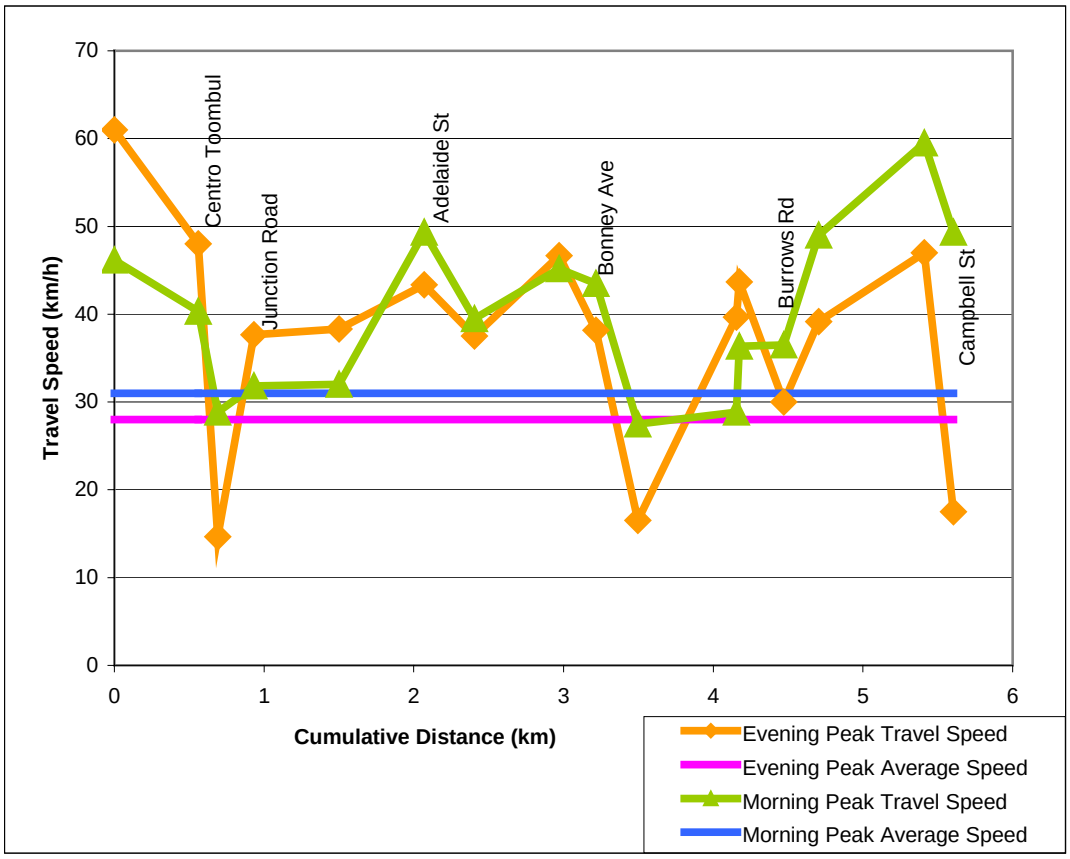


Figure 4-8
2004 AM Level of Service

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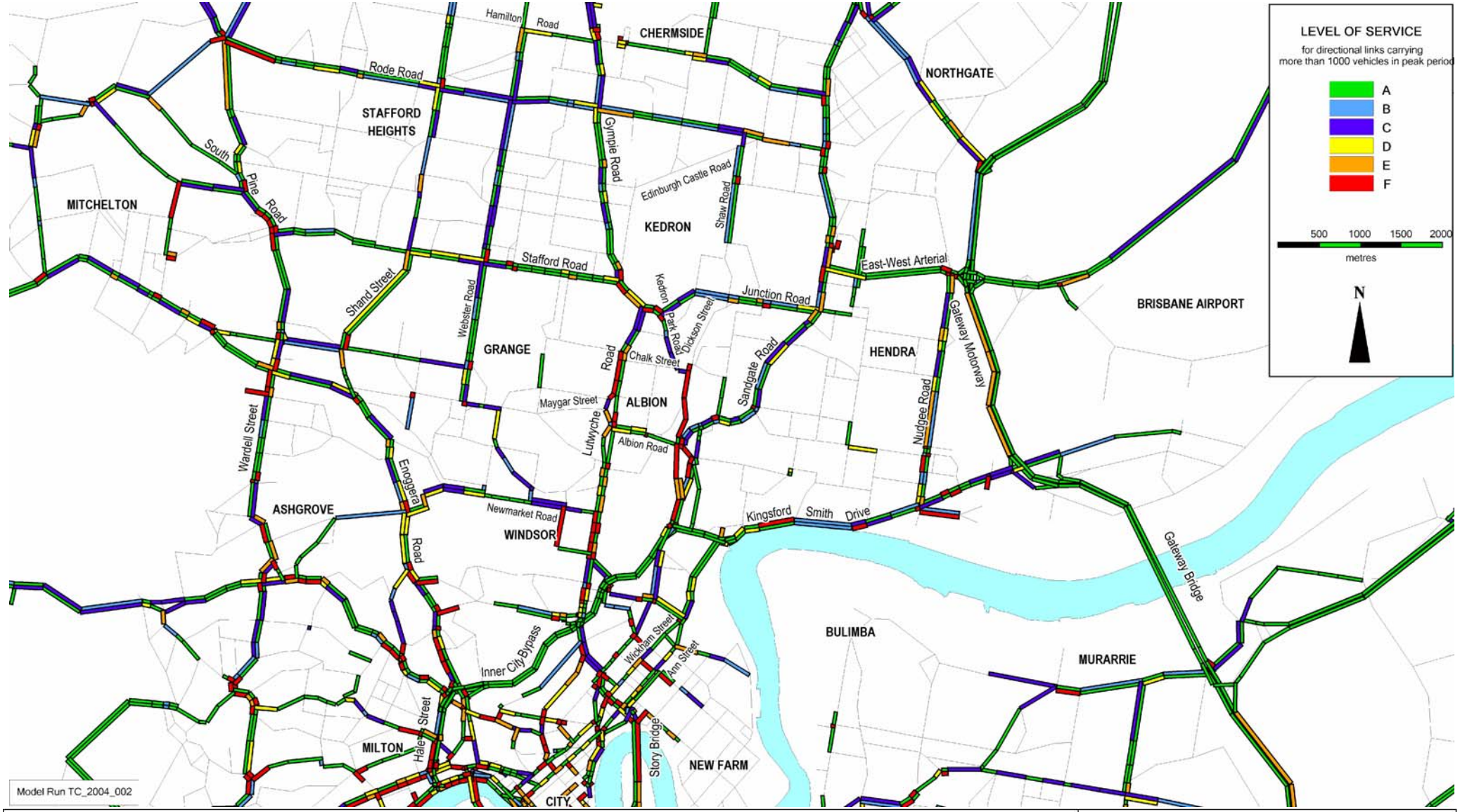

Figure 4-9
2004 PM Level of Service

Airport Link

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4.5 Toll Routes

No toll routes are currently located within the Inner North area. Within the Metropolitan area, the Gateway Motorway and Logan Motorway are the two main toll routes. A toll is also required to use the Moggill Ferry, which connects Brisbane's south-western suburbs situated north of the Brisbane River with Ipswich. The toll values for private vehicle and commercial vehicle use are shown in **Table 4-7**.

The North-South Bypass Tunnel due to open in late 2010 will have a toll (expressed in 2006 dollars including GST) of $3.64 for cars and $9.65 for commercial vehicles.

Table 4-7 Existing Toll Locations and Values (expressed June 2006 dollars including GST)

Toll Road (Location)	Cars and Light Vehicles	Commercial Vehicle (Classes 3 and above)
Gateway Bridge	$2.40	$6.00
Gateway (Kuraby)	$1.60	$3.90
Logan Motorway (Stapylton Road)	$1.70	$3.90
Logan Motorway (Loganlea Road)	$1.00	$2.80

4.6 Intersection Performance

4.6.1 Definitions

Within an urban road network, performance is strongly influenced by the operating conditions of intersections which are generally more constrained from a capacity viewpoint than the mid-block sections of roadway. An intersection performance assessment considers the interaction of vehicle demands (turning movements), pedestrians, lane capacity, form of intersection control and traffic signal phasing and co-ordination.

Key measures of intersection operation include the Level of Service (LOS) and Degree of Saturation (X). The Level of Service and Degree of Saturation for key intersections within the Inner North area have been calculated using the intersection modelling package aaSidra. This was done either using 2004 traffic count data or traffic flows derived from the validated model.

The intersection Level of Service criteria is shown in **Table 4-8** and is based on average delays for all vehicles using an intersection over a given time period, typically a two hour peak period.

The Degree of Saturation (or X value) is the calculated ratio between the demand flow rate and the capacity for each movement. When the maximum X value for any movement in the intersection is above 95%, then the intersection is regarded as over-saturated or operating above its practical capacity. This means that it will take more than one cycle of the signals to progress through the intersection. X values above 1.0 typically indicate higher congestion and delays with conditions more sensitive to small changes in demand.

Table 4-8 Intersection Level of Service Criteria

Level of Service (LOS)	Average Intersection Delay (seconds)
A	0-10
B	10-20
C	20-35
D	35-55
E	55-80
F	80+

Table Note: Source: Highway Capacity Manual , 2000.

4.6.2 Assessment

The performance of a selection of the key intersections within the study area with regard to the LOS and Degree of Saturation parameters during peak periods is tabulated in **Table 4-9**.

Key findings include:

- Over-saturated, congested traffic conditions occur during peak periods at several intersections along the Gympie Road-Lutwyche Road-Bowen Bridge Road corridor, where there are 23 sets of traffic signals and two signalised pedestrian crossings in the 5.8 km between Kedron (Strathmore Street) and Herston (Gregory Terrace). Examples of intersections with a Level of Service E or F, coupled with a very high degree of saturation, include the three closely spaced intersections of Gympie Road/Leckie Road, Gympie Road/Stafford Road and Lutwyche Road/Kedron Park Road. In this area congested conditions hamper the ability to provide good progression of travel through the co-ordinated signal system and delays to the side road traffic (e.g. Kedron Park Road) can be very high. In late 2005, changes were made to the intersection of Gympie Road/Leckie Road, and the right turn from Gympie Road into Leckie Road was discontinued.
- On the Sandgate Road corridor, where there are 18 sets of traffic signals and two signalised pedestrian crossings in the 6.0 km between Bowen Hills (Montpelier Road) and Toombul (Union Street), congestion occurs at several locations during peak periods. In particular, intersections in the Albion area typically require vehicles to wait more than one cycle at the signals.
- Stafford Road intersections generally operate well within capacity, although congestion occurs in the AM peak at the Webster Road intersection.
- Several key intersections used by Brisbane City Council bus services in the Inner North area operate close to, or above, nominal capacity in either or both the morning and evening peak periods. These include Gympie Road/Stafford Road, Lutwyche Road/Kedron Park Road, Lutwyche Road/Chalk Street, Lutwyche Road/Albion Road, Lutwyche Road/Newmarket Road, Lutwyche Road/Federation Street, Bowen Bridge Road/Butterfield Street and Bowen Bridge Road/Gregory Terrace.

Table 4-9 Existing Intersection Performance 2004/05

Intersection	Authority	Peak	Cycle Time (s)	Max DOS (x)	LOS
Gympie Road Intersections					
Gympie Road/Strathmore Street/Castle Street	DMR	AM	150	0.86	B
		PM	150	0.88	C
Gympie Road/Leckie Road	DMR	AM	150	1.00	A
		PM	150	1.24	F
Gympie Road/Stafford Road	DMR	AM	150	1.00	D
		PM	150	1.23	E
Stafford Road Intersections					
Stafford Road/Webster Road	DMR	AM	140	1.24	F
		PM	140	1.03	D
Stafford Road/Clifford Street	DMR	AM	130	1.00	A
		PM	120	1.00	A
Stafford Road/Lennon Street	DMR	AM	130	0.48	A
		PM	120	0.44	A
Stafford Road/Richmond Street	DMR	AM	130	0.62	A
		PM	120	0.47	B
Lutwyche Road Intersections					
Lutwyche Road/Kedron Park Road	DMR	AM	150	1.06	C
		PM	150	1.24	F
Lutwyche Road/Norman Avenue/ Norman Street	BCC	AM	150	0.73	A
		PM	150	0.61	A

Intersection	Authority	Peak	Cycle Time (s)	Max DOS (x)	LOS
Lutwyche Road/Bradshaw Street	BCC	AM	150	1.06	D
		PM	150	0.85	B
Lutwyche Road/Chalk Street/Thistle Street	BCC	AM	150	1.03	E
		PM	150	1.00	B
Lutwyche Road/Maygar Street	BCC	AM	150	0.67	C
		PM	150	1.26	D
Lutwyche Road/Fosbery Street	BCC	AM	150	0.72	C
		PM	150	0.53	B
Lutwyche Road/Albion Road	BCC	AM	150	1.00	B
		PM	150	0.80	B
Lutwyche Road/Bowen Street	BCC	AM	150	0.79	A
		PM	150	0.67	A
Lutwyche Road/Eildon Street/Le Geyt Street	BCC	AM	150	0.85	A
		PM	150	0.70	A
Lutwyche Road/Grantson Street	BCC	AM	150	0.92	A
		PM	150	0.74	A
Lutwyche Road/Newmarket Road	BCC	AM	150	0.96	D
		PM	150	1.00	C
Lutwyche Road/Federation Street	BCC	AM	150	1.12	F
		PM	150	0.68	A
Bowen Hills and Fortitude Valley Intersections					
Bowen Bridge Road/Butterfield Street	BCC	AM	150	1.07	E
		PM	150	0.96	D
Bowen Bridge Road/Campbell Street	BCC	AM	150	0.49	A
		PM	150	0.83	B
Bowen Bridge Road/O'Connell Terrace	BCC	AM	150	0.68	B
		PM	150	0.79	B
Bowen Bridge Road/Herston Road	BCC	AM	150	0.73	C
		PM	150	0.67	C
Bowen Bridge Road/Gregory Terrace/ Brunswick Street	BCC	AM	150	1.45	F
		PM	150	0.98	D
Brookes Street/Markwell Street/St Pauls Terrace	BCC	AM	120	0.61	C
		PM	120	0.97	C
Brookes Street/Gregory Terrace	BCC	AM	120	0.27	C
		PM	120	0.28	B
Brookes Street/Wickham Street	BCC	AM	120	0.48	B
		PM	120	0.60	B
Brookes Street/Ann Street	BCC	AM	120	0.43	B
		PM	120	0.47	B
Campbell Street/Mayne Road/ Hamilton Place	BCC	AM	120	0.44	D
		PM	120	0.74	D
Bridge Street/Chalk Street	BCC	AM	60	0.69	B
		PM	60	0.56	B
Sandgate Road Intersections					
Sandgate Road/Toombul Station (Parkland Street)/Union Street/Grace Street	DMR	AM	160	0.84	C
		PM	130	0.94	D
Sandgate Road/Centro Toombul	DMR	AM	160	0.80	B
		PM	130	0.87	B
Sandgate Road/East-West Arterial Road	DMR	AM	160	1.13	F
		PM	130	1.12	E
Sandgate Road/Junction Road	DMR	AM	160	1.69	F
		PM	130	1.00	E
Sandgate Road/Wagner Road/ Bayview Terrace	BCC	AM	100	1.07	F
		PM	120	0.72	A
Sandgate Road/Adelaide Street	BCC	AM	100	0.89	A
		PM	120	0.71	A

Intersection	Authority	Peak	Cycle Time (s)	Max DOS (x)	LOS
Sandgate Road/Oriel Road	BCC	AM	100	0.85	B
		PM	120	0.60	A
Sandgate Road/Lapraik Street	BCC	AM	100	0.75	A
		PM	120	0.58	A
Sandgate Road/Bonney Avenue	BCC	AM	100	0.88	C
		PM	120	1.00	A
Sandgate Road/Lever Street/Albion Road	BCC	AM	120	0.54	A
		PM	120	0.44	A
Sandgate Road/Albion Road	BCC	AM	120	1.57	F
		PM	120	1.30	E
Sandgate Road/Frodsham Street/ Crosby Road/Abbotsford Road (Albion Fiveways)	BCC	AM	120	1.27	F
		PM	120	1.01	D
Abbotsford Road/Gebbie Street	BCC	AM	120	1.15	F
		PM	120	1.15	F
Abbotsford Road/Burrows Street	BCC	AM	120	0.87	C
		PM	120	1.04	D
Abbotsford Road/Alison Street/ICB Off Ramp	BCC	AM	120	0.70	A
		PM	120	1.00	E
Abbotsford Road/Edmondstone Road/Mayne Road	BCC	AM	120	1.14	C
		PM	120	1.77	F
Abbotsford Road/Folkestone Street	BCC	AM	120	0.73	A
		PM	120	0.62	A
Abbotsford Road/Montpelier Road/ Markwell Street/Campbell Street	BCC	AM	120	1.00	C
		PM	120	1.00	C
Kingsford Smith Drive Intersections					
Kingsford Smith Drive/Amy Street/ Breakfast Creek Road	BCC	AM	120	0.70	B
		PM	120	0.78	B
Kingsford Smith Drive/Cooksley Street	BCC	AM	120	1.06	F
		PM	120	1.83	F
Kingsford Smith Drive/Nudgee Road/ Remora Road	BCC	AM	120	0.85	C
		PM	120	0.98	D
Local Area					
Albion Road/McLennan Street	BCC	AM	120	0.44	C
		PM	120	0.60	B
Albion Street/Hudson Road	BCC	AM	120	1.32	F
		PM	120	1.08	F
Junction Road/Morrison Road	BCC	AM	80	1.00	C
		PM	80	1.18	E
Dawson Street/Rose Street	BCC	AM	80	0.83	C
		PM	80	1.02	C
Kedron Park Road/Park Road	BCC	AM	75	0.68	C
		PM	75	0.85	C

4.7 Local Accessibility

4.7.1 Lutwyche Road Corridor

The road hierarchy around the Lutwyche Road corridor is shown in **Figure 3-3**. District and Suburban routes service the majority of residents in local catchments on either side of Lutwyche Road. Connecting the residential areas with Lutwyche Road at signalised intersections are Newmarket Road, Albion Road, Maygar Street, Chalk Street, Bradshaw Road, Kedron Park Road, Stafford Road and Leckie Road.

Due to the high volume of traffic on Lutwyche Road, as well as the continually changing grades, restrictions have been placed on local access at many priority (unsignalised) intersections. These restrictions are designed to optimise the performance of Lutwyche Road for commuter and through traffic. Almost all priority intersections

along the Lutwyche Road corridor are restricted to left in, left out only movements, either by a raised median or unbroken central line markings.

Right turns to and from Lutwyche Road are, with a few exceptions, only permitted at signalised intersections and priority intersections with right turn bays. Due to road reserve constraints a number of signalised intersections lack right turn bays, resulting in banned right turns at signalised intersections either permanently or during peak periods. Banned right turns are found at the following signalised intersections:

- Northey Street (AM Peak inbound);
- Eildon Street/Le Geyt Street (AM and PM peaks);
- Bowen Street (outbound);
- Bradshaw Street (outbound); and
- Kedron Park Road (outbound).

These banned movements further restrict local access to Lutwyche Road.

A recent (2005) change to the network on Gympie Road comprises a raised median converting the operation of Suez Street and Park Terrace, located just south of the Stafford Road, to left-in left-out operation. This was done on safety grounds due to a very high accident record (as described in **Section 4.10**). Similarly, a combination of safety grounds and operational reasons has lead to the recent closure of the right turn movement into Leckie Road from Gympie Road. Motorists from the south seeking to access the eastern precinct on Gympie Road at Kedron must use signals at the Gympie Road/ Sadlier Street intersection some 400 metres further to the north.

West of Lutwyche Road, on Victoria Street traffic calming devices have been installed to discourage rat running by motorists bypassing the congestion surrounding the Newmarket Road intersection. Traffic calming devices have also been constructed on Fuller Street, Bowen Street and Grafton Street. The disjointed road network within the study area close to Lutwyche Road, as well as the narrow road reserves, and generally short road segments on lower order roads, help to reduce speeds and discourage the use of these routes as rat runs when Lutwyche Road is impacted by congestion.

Most shop frontages on Lutwyche Road provide direct driveway access. The spacing and number of signalised intersections allow for easy left-in left-out merging of driveway by providing gaps in the traffic flow. Sight distances on Lutwyche Road are generally of a high standard, further aiding merging traffic.

4.7.2 Sandgate Road-Abbotsford Road Corridor

Priority intersections on Sandgate Road and Abbotsford Road within the Inner North area predominantly permit right turn movements to and from Sandgate Road. Priority intersections on Sandgate Road within the study area that are restricted to left-in left-out movements include Kedron Street, Reeve Street, Riverton Street, and Christian Street.

All movements at signalised intersections along Sandgate Road are generally permitted, however at the ICB off ramp intersection with Allison Street and Abbotsford Road, the right turn movement is banned from ICB to Abbotsford Road.

4.8 Public Transport Performance

Figure 4-10 shows existing public transport demands, and illustrates the strong role of rail in servicing public transport demands in the Inner North area. As discussed in **Section 3.4**, there is relatively sound use of public

transport by Inner North area residents with a 10.0% public transport mode share compared to the metropolitan average of 8.3%.

Figure 4-10
2004 Average Weekday
Public Transport Demands

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4.8.1 Rail System Performance

Daily station usage for the three major rail stations is shown in Error! Not a valid bookmark self-reference.. Observed 2005 daily rail patronage north of the Bowen Hills rail station is shown in **Table 4-11**. Indicative patronage on the segment between Bowen Hills and Fortitude Valley is 50,000 passengers per day. Patronage demands are within the capacity of the rail system.

Average travel times between key stations and Central Rail Station are shown in **Table 4-12**. Travel times vary by on average 1 minute depending on peak period and trip direction. Occasional services to some stations can take approximately 5 minutes longer than the average travel time.

- **Table 4-10 Daily Rail Station Usage**

Station	Persons Boarding	Persons Alighting
Albion Rail Station	1,400	1,100
Wooloowin Rail Station	1,350	1,200
Windsor Rail Station	600	550

Table Note: Source: Queensland Rail, 2002

- **Table 4-11 Daily Rail System Demand**

Rail System Segment	Persons To City	Persons From City
Albion – Bowen Hills	17,700	16,400
Windsor – Bowen Hills	7,000	6,800
Total	**24,700**	**23,200**

Table Note: Source: Queensland Transport, 2005

- **Table 4-12 Peak Period Average Travel Time between Station and Central**

Station	Average Travel Time (mins)
Bowen Hills	5
Windsor	8
Albion	8
Wooloowin	9
Eagle Junction	11
Toombul	14
Clayfield	12
Ascot	18
Doomben	20
Brisbane Airport	22

Table Note: Source: TransLink, 2005

4.8.2 Bus System Performance

Bus travel demands are illustrated on **Figure 4-10**, and whilst not as high as rail, indicate a strong use of this mode of public transport.

Lutwyche Road services are predominant, serving the northern suburbs and the major employment hubs of the Royal Brisbane Hospital complex and Westfield Chermside Shopping Centre. Sandgate Road bus services also service the north-eastern suburbs of Brisbane, however they compete for patronage with the parallel rail corridor.

Bus Patronage and Occupancy

Lutwyche Road bus occupancy surveys conducted in 2003 indicated sound levels of peak direction bus usage of 42 persons per bus in the AM peak period and 26 persons per bus in the PM peak period. These loads are within the capacity of the bus system.

The 2004 estimate of weekday patronage of bus services on Bowen Bridge Road at Enoggera Creek is 10,000 passengers per day.

Corridor Bus Running Times

Table 4-13 provides the average travel times and speed for bus services along the Lutwyche Road and Sandgate Road corridors. These data were retrieved from Brisbane City Council (BCC) Brisbane Linked Intersection Signals System (BLISS) and Real time Advanced Priority and Information Delivery (RAPID). The bus data were retrieved for the same day as a general travel time survey was conducted.

The bus travel time data were retrieved for all services that run along these two bus corridors in the AM and PM peak periods. The data were analysed for buses travelling in the peak direction only (southbound in the AM and northbound in the PM) as they run more frequently during these periods.

- **Table 4-13 Observed Average Travel Times and Travel Speeds for Bus Services**

	Morning Peak (7-9 AM) (Travelling Southbound)					Evening Peak (4-6 PM) (Travelling Northbound)				
	Lutwyche Road			Sandgate Road		Lutwyche Road			Sandgate Road	
Services	All Stops	Limited Stops	Rocket	All Stops	Limited Stops	All Stops	Limited Stops	Rocket	All Stops	Limited Stops
Average Time (min)	16.19	12.08	9.59	9.46	7.21	15.49	12.17	10.45	6.40	7.13
Average Speed (km/h)	20	27	34	23	31	21	27	31	35	31

Table Note: Source: BCC, 2005.

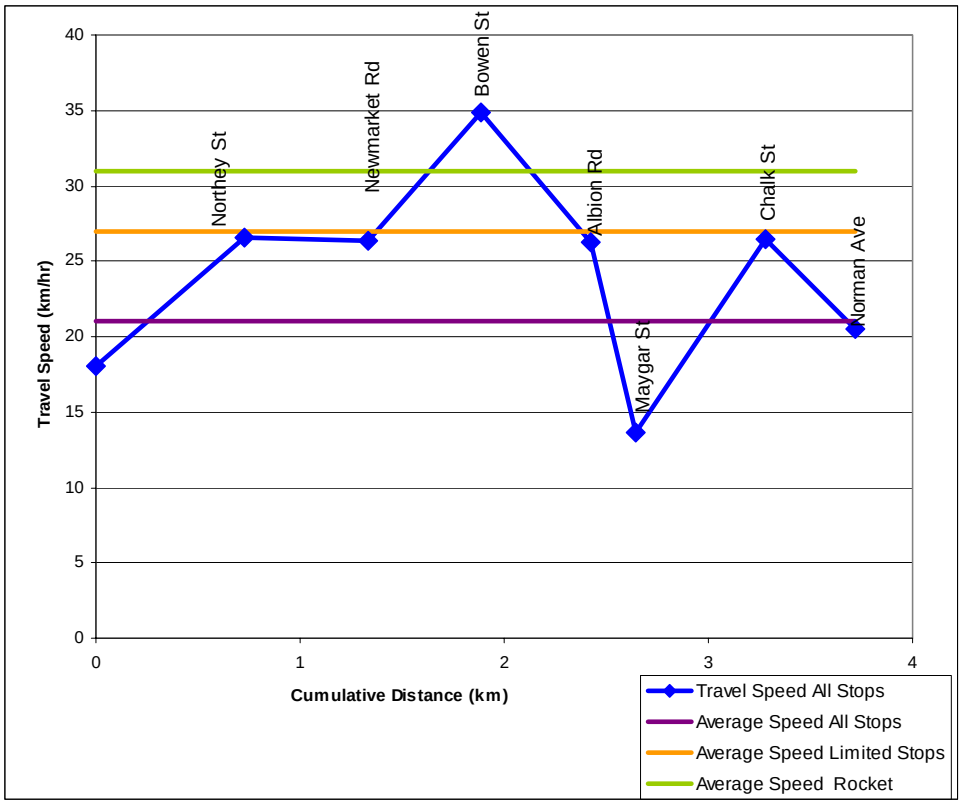
- **Table 4-14 Minimum and Maximum Travel Speed Variability for Bus Services**

	Morning Peak (7-9 AM) (Travelling Southbound)					Evening Peak (4-6 PM) (Travelling Northbound)				
	Lutwyche Road			Sandgate Road		Lutwyche Road			Sandgate Road	
Services	All Stops	Limited Stops	Rocket	All Stops	Limited Stops	All Stops	Limited Stops	Rocket	All Stops	Limited Stops
Time Range (min)	8.38-20.06	9.22-15.13	8.02-11.28	8.17-10.58	5.34-10.29	13.46-17.50	10.33-17.35	9.12-12.39	6.14-6.55	5.29-8.39
Speed Range (km/h)	39-16	35-21	41-29	27-21	42-22	24-19	32-19	36-26	36-34	42-37

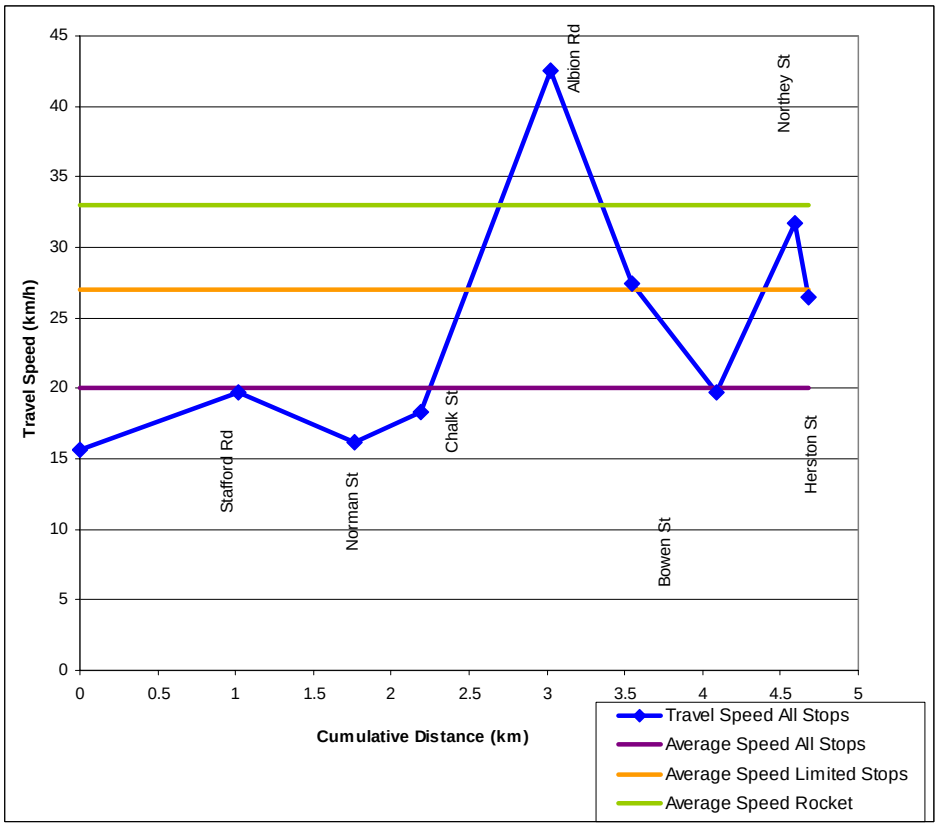
Table Note: Source: BCC, 2005.

Figure 4-11 and **Figure 4-12** illustrate the section speed for all stops bus services and the average speed for all three types of services along the Lutwyche corridor. As expected, the rocket bus services run at a faster speed as it is an express bus service compared to the all stops or limited stops services. There is high variability in travel times and speeds in both directions for all of the bus services.

- **Figure 4-11 Lutwyche Road Northbound Speeds for Bus Services (PM Peak)**



- **Figure 4-12 Lutwyche Road Southbound Speeds for Bus Services (AM Peak)**



Most bus services run at longer travel time and slower speeds than general traffic, particularly on Sandgate Road. On Lutwyche Road the inbound transit lane offers benefits to bus travel times in the AM peak, most specifically for rocket and limited stops services which do not need to repeatedly stop along the corridor.

4.9 Pedestrian and Cyclist System Performance

The existing on and off-road pedestrian and cycle facilities can be seen with reference to the existing road network in **Figure 3-15**.

Pedestrian and cycle surveys were conducted in 2005 to assess the level of usage of existing facilities. The results for the ICB landbridge, the Enoggera Creek path and the Kedron Brook path are shown below, for the average weekday and average weekend day use, in **Table 4-15** and **Table 4-16** respectively. Data for two other locations within the Inner North area, Breakfast Creek Bridge on Breakfast Creek Road and Bowen Bridge Road at Gregory Terrace, are presented for an average weekday.

- **Table 4-15 Pedestrian and Cyclist Activity - Average Weekday 2005**

Location	Cycle			Pedestrian			2 way Total
	Southbound/ Eastbound	Northbound/ Westbound	Total	Southbound/ Eastbound	Northbound/ Westbound	Total	
ICB Landbridge	134	96	230	164	157	321	551
Enoggera Creek	109	94	203	369	354	723	926
Kedron Brook	84	45	129	106	40	146	275
Breakfast Creek Bridge	43	25	68	36	37	73	141
Bowen Bridge Road	63	22	85	200	230	430	515

Table Note: Source: BCC surveys, 2005.

- **Table 4-16 Pedestrian and Cyclist Activity - Average Weekend Day 2005**

Location	Cycle			Pedestrian			2 way Total
	Southbound/ Eastbound	Northbound/ Westbound	Total	Southbound/ Eastbound	Northbound/ Westbound	Total	
ICB Landbridge	27	35	62	59	45	104	166
Enoggera Creek	38	36	74	94	122	216	290
Kedron Brook	343	59	402	338	49	387	789

Table Note: Source: BCC surveys, 2005.

The surveys show that all connections are well used by pedestrian and cyclist commuters, whilst significant recreational usage is also found on weekends. The ICB Landbridge and the Enoggera Creek path have a higher total two-way usage on the weekday than they do on the weekend. This indicates that these paths tend to act more as a commuter route rather than as a recreational facility.

In general there are more pedestrian than cycle users on all the paths, for both the average weekday and weekend. This however, does not apply to Kedron Brook where the number of cyclists surpasses the number of pedestrians on the weekend. Furthermore Kedron Brook has both more pedestrian and more cycle users on the

weekend than it does on weekdays. The result is contrary to the other two locations and reflects the predominantly recreational nature of Kedron Brook.

Heavy traffic and a narrow road reserve on Bowen Bridge Road present an unattractive pedestrian and cyclist environment. Despite this, usage on Bowen Bridge Road is similar to the ICB Landbridge during the same period. This can be attributed to its role in providing accessibility to the Royal Brisbane Hospital complex and Fortitude Valley.

4.10 Road Safety

4.10.1 Introduction

A five-year crash history for the Inner North area has been reviewed. The crash history contains all accidents that required a police presence and includes location, date, weather conditions, accident type, and severity. Crash severity is measured on a five level of consequences:

1) Property Damage;
2) Minor Injury;
3) Medical Treatment;
4) Hospitalisation; and
5) Fatal.

Some of the key statistics from the analysis are:

- 2,640 crashes occurred in the 5-year period in the Inner Northern area.
- A total of eleven fatal accidents occurred, of which two involved a pedestrian.
- Almost 25% of crashes occurred within the Lutwyche Road and Gympie Road corridor between Northey Street and Stafford Road. These include 383 crashes at intersections and 253 mid-block. Two fatal accidents occurred in this corridor, both at intersections.
- Intersection crashes accounted for 57% (1,512) of accidents.
- Almost 80% (2,082) of accidents within the area involved more than one vehicle.
- Within the Inner North area, 111 pedestrian related accidents have been recorded. This was only 4.2% of overall area accidents, which is quite similar to the Brisbane local government area average of 4.7%.

4.10.2 Intersection Accidents on Key Routes

Analysis of the five-year crash history was conducted for intersections on the motorway and arterial routes within the Inner North area.

Lutwyche Road

In the last five years 292 accidents have occurred at intersections on Lutwyche Road. Two accidents at intersections have resulted in fatalities, and 29 involved a collision with a pedestrian. Intersections with the highest annual average number of accidents on Lutwyche Road are Newmarket Road, Norman Avenue, Albion Road, Bradshaw Street, Chalk Street/Thistle Street, Grantson Street, Eildon Street/Le Geyt Street, Constitution Road and Maygar Street.

Due to the high pedestrian activity around the Lutwyche shopping area, in combination with congested traffic conditions, five incidents involving a pedestrian were recorded at the Chalk Street/Thistle Street signalised

intersection. Another three incidents involving a pedestrian were recorded at the nearby Bradshaw Street intersection, immediately north of Chalk Street.

Gympie Road

The 300m section of Gympie Road between the Suez Street/Park Terrace priority intersection and the Leckie Road signalised pedestrian crossing had 74 accidents occur at intersections in the five-year crash history, and 38 of these required some form of medical treatment (up to and including hospitalisation). The Leckie Road and Stafford Road intersections had eleven rear end collisions occur, whilst the Suez Street intersection had 41 accidents occur from a right turning vehicle being hit by a through vehicle from the opposite direction. Recent mitigation measures have been installed at these locations, as discussed in **Section 4.7.1**.

Bowen Bridge Road

Crash rates at intersections on Bowen Bridge Road have been quite low since 2000 with the highest rate, 16 in five years, at Butterfield Street.

Sandgate Road

No fatal accidents have occurred at Sandgate Road intersections in the last five years. However the Junction Road/Sandgate Road signalised intersection recorded over seven accidents per year, the worst average annual accident rate of any of the major corridor intersections.

Other intersections where more than two accidents per year occurred were East-West Arterial Road, Collins Street, Alexandra Road, Bayview Terrace and Oriel Road.

Abbotsford Road

Average annual incidents on Abbotsford Road are quite low in the five-year crash history, however two fatal accidents have occurred. The fatal accident at Burrows Street was the result of two vehicles moving at right angles to one another colliding. The fatal accident at the Allison Street intersection resulted from a vehicle losing control around a bend and colliding with a roadside object.

East-West Arterial Road

Three sections of the East West Arterial route have been considered separately as follows:

- Stafford Road from Webster Road to Gympie Road;
- The Kedron Park Road-Park Road-Rose Street-Junction Road segment between Lutwyche Road and Sandgate Road; and
- East West Arterial between Sandgate Road and Nudgee Road.

On Stafford Road, only the Webster Road and Gympie Road intersections had more than two accidents per year occur. Only four accidents involving a pedestrian have been recorded on Stafford Road, two of these occurred mid-block.

The Junction Road approach to the Junction Road/Sandgate Road intersection has experienced 33 crashes during the five year history, more than six per year. This combined with the seven crashes per year occurring on the Sandgate Road approach identifies this intersection as a significant trouble spot for crashes. The Kedron Park Road and Park Avenue intersections are the only other intersections with more than two crashes per year occurring on this route.

Both the Sandgate Road and Nudgee Road intersections on the East West Arterial road have more than three accidents per year occurring. At Sandgate Road, rear end collisions are the predominant accident type, whilst at Nudgee Road right turners colliding with opposing through movements is the common cause.

Nudgee Road

Nudgee Road has the lowest intersection crash rate with only one intersection accident recorded in the five-year crash history.

4.10.3 Mid-block Crashes

The number of mid-block crashes, by severity, on major arterial routes within the Inner North study area are shown below in **Table 4-17**.

Table 4-17 Mid-block Crashes on Major Routes in Inner North 2000 - 2005

Midblock Accidents	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total
Lutwyche Road		44	78	35	54	211
Gympie Road		9	21	15	15	60
Bowen Bridge Road		4	15	15	16	50
Sandgate Road	2	23	45	27	53	150
Abbotsford Road		15	11	3	14	43
East West Arterial (Webster Road to Gympie Road) i.e. Stafford Road		3	22	3	11	39
East West Arterial (Lutwyche Road to Sandgate Road) i.e. Park Road-Rose Street-Junction Road		7	13	9	10	39
East West Arterial Road (Sandgate Road to Nudgee Road)		3	3	2	5	13
Nudgee Road	0	9	5	5	6	25
Kingsford Smith Drive	1	20	21	15	34	91

Table Note: Source: BCC, 2005.

Of the two fatal accidents on Sandgate Road, one was the result of a collision with a pedestrian, the other involved a vehicle losing control on a straight section of roadway and colliding with an object off the carriageway. A rear end collision on Kingsford Smith Drive caused a fatality within the area.

The most common cause of a mid-block accidents was rear end collisions, contributing between 40% and 60% of all mid-block accidents on the tabulated routes. On Lutwyche Road more than 50% of all accidents were rear end collisions. Twenty-six (12%) mid-block accidents on Lutwyche Road involved a pedestrian, highlighting the difficulty and risks in crossing Lutwyche Road away from a formalised crossing location.

Over 50% of all mid-block accidents on Lutwyche Road required either medical treatment or hospitalisation. Abbottsford Road and Sandgate Road had similar characteristics.

Rear end collisions or collision with a roadside object were the predominant crash type on Nudgee Road.

4.10.4 Crash Rates

Crash rates (per million kilometres travelled) for each of the major corridors in the Inner North area are shown in **Table 4-18**.

The highest crash rates occur on Stafford Road, Lutwyche Road, Sandgate Road and the East-West Arterial route, between Gympie Road and Sandgate Road, formed by Kedron Park Road-Park Road-Rose Street-Junction Road.

Assessment of the high crash rates on these routes indicates the following features:

- On Lutwyche Road rear end collisions were the predominant crash type (37%), followed by right turning traffic colliding with opposing through traffic. These two accident types accounted for 65% of all accidents on Lutwyche Road. Two notable areas of accidents were near Centro Lutwyche Shopping Centre and the Lutwyche Homemaker Centre. A combination of congested traffic conditions and mix of user types (local, through movements etc) would be contributing influences.
- More than 25% of all the crash potential occurring on Gympie Road has been removed by the recent construction of a raised median at the Suez Street/Park Terrace intersection with Gympie Road.
- On Sandgate Road more than 20% of all accidents resulted from right turning traffic colliding with opposing through traffic. Similar to Lutwyche Road, rear end collisions were also another predominant accident type (a further 36% of crashes). The narrow road reserve with limited storage for turning vehicles along this route contributes to this occurrence.
- A major factor contributing to the high crash rate on Stafford Road is accidents recorded in the vicinity of the Gympie Road intersection. One-third of all accidents and 50% of all mid block accidents on Stafford Road occurred within 300m of this location. Rear end collisions were the predominant accident type near Gympie Road. Congested conditions at this intersection are likely to be a major contributing influence.
- On the section of East-West Arterial route through Wooloowin, between Lutwyche Road and Sandgate Road, formed by Kedron Park Road-Park Road-Rose Street-Junction Road the majority of crashes occurred at the Sandgate Road intersection or mid-block approaching the intersection. The intersection of Sandgate Road and Junction Road has the worst crash history of all intersections within the Inner North area.

- **Table 4-18 Crash Rates for Major Routes Within the Inner North Area 2000-2005**

Route	Total Accidents	Distance (km)	Annual VKT	Crash Rate (Crashes per million VKT)
Lutwyche Road	503	3.25	62,589,000	1.61
Gympie Road	173	1.45	29,192,000	1.19
Bowen Bridge Road	94	0.86	17,190,000	1.09
Sandgate Road	366	4.26	53,493,000	1.37
Abbotsford Road	90	1.85	19,771,000	0.91
East West Arterial (Webster Road to Gympie Road) i.e. Stafford Road	110	1.67	10,676,000	2.06
East West Arterial (Lutwyche Road to Sandgate Road) i.e. Park Road-Rose Street-Junction Road	121	1.59	18,325,000	1.32
East West Arterial Road (Sandgate Road to Nudgee Road)	54	2.33	15,089,000	0.72
Nudgee Road	26	2.88	20,334,000	0.26
Kingsford Smith Drive	165	3.41	52,161,000	0.63

Table Note: Source: BCC 2005 (accident data), BSTM (VKT, Distance)

5. The Project

5.1 Introduction

This project description has been based on the Airport Link Project Definition Report and the Addendum No 1 (SKM-CW, 2006), and **Chapter 4** of the EIS. It summarises those elements relevant to traffic and transport.

The proposed Airport Link Project is approximately 6.65km in length overall with approximately 5.66 km of that constructed as tunnel, mainly in rock. It will link the North-South Bypass Tunnel (NSBT), the Inner City Bypass (ICB), and Lutwyche Road in the south with Gympie and Stafford Road in the north and Sandgate Road and East-West arterial in the north-eastern. To allow connections with Stafford Road and Gympie Road at Kedron, elevated structures are proposed across Kedron Brook. The major features of the project are described in the following sub-sections.

5.2 Project Design and Operation

5.2.1 Design Standards and Criteria

The design objective for the main tunnels is to achieve a 90km/h design speed for a signposted speed of 80km/h. This would be consistent with the rest of the Brisbane urban road network and is a speed that is commonly adopted for urban tunnels elsewhere in Australia and overseas. Slower design speeds have been adopted for connections to the local road network at each connection.

Desirable maximum vehicle grades of 5% up and 7% down were adopted for the concept design. Due to surface constraints it was necessary to exceed these values in certain areas of the ramps outside of tunnel areas. A minimum grade in each tunnel of 0.5% was adopted to ensure adequate performance of the longitudinal drainage system.

5.2.2 Configuration

The project is a two tunnel road system comprising of a north-south tunnel and an east-west tunnel. The north-south tunnel's design provides for two parallel tunnels, the western tunnel dedicated to northbound traffic, and the other to southbound traffic. These tunnels are aligned next to each other, with a clear, minimum separation of approximately 10m between them. Each tunnel will have three running lanes flanked by shoulders on each side. The east-west tunnel also provides for two parallel tunnels, the northern tunnel dedicated to eastbound traffic, and the other to westbound traffic. Like the north-south pair, these tunnels are aligned next to each other, with a clear, minimum separation of approximately 10m between them. Each tunnel would have two running lanes, with varying shoulder widths on both sides to accommodate sight distance requirements. Dedicated break down bays are not provided in either case, as there is sufficient room to pass a broken down vehicle safely at an appropriate speed, with the configurations proposed. A posted height clearance of 4.9m is allowed, above which will be 0.7m of space for ducts, lighting and signage.

For northbound traffic, entry to the tunnel at the southern end may be gained from the North-South Bypass Tunnel, Inner City Bypass, O'Connell Terrace or Campbell Street. At Kedron, entry from the north-west (Gympie or Stafford Roads) will provide to the south, while access to the eastbound tunnel will be provided from Gympie and Lutwyche Roads at the Kedron Park Road intersection. Northbound traffic may exit at Kedron onto Gympie or Stafford Roads and at Toombul to Sandgate Road or the East-West Arterial Road.

For southbound traffic, entry to the tunnel is provided at Toombul from Sandgate Road or the East-West Arterial Road and at Kedron from Gympie, Stafford and Lutwyche Roads. Westbound traffic from Toombul may exit onto Gympie or Lutwyche Roads at Kedron. At the southern end southbound traffic can continue into

the NSBT, connect to the Inner City Bypass westbound or access the surface road system via O'Connell Terrace or Campbell Street.

The project will be constructed in rock below Lutwyche Road and the suburb of Wooloowin. To make the transition from tunnel to surface, cut and cover sections will be provided at tunnel portals at Bowen Hills, Kedron and Toombul. A section of near surface cut and cover roadway will be provided at Kedron to link the two driven tunnel sections in direct alignment.

5.2.3 Services

Tunnel Control Centre

A Tunnel Control Centre is proposed for a location close to the southern connection. Within this building will be the support workshops, the incident control room, the traffic control room and office space. All data collected by the in-tunnel monitoring systems will be processed and all the services will be controlled from this location. It is also from here that the water tankers will obtain water for the tunnel wash down operations and the pressure booster for use by the fire brigade will be installed. The site will provide parking and marshalling areas for maintenance and emergency vehicles.

Lighting

Roadway lighting in the tunnel is provided in zones. Lighting is brightest in the portal regions, with the intensity reducing progressively along the tunnel to a set minimum level. This gradation allows the driver's eyes to adjust to the dimmer environment. The intensity of the lighting in the portal region will be set automatically, based on the ambient light conditions on the surface.

The base lighting will be fluorescent, with high pressure sodium lamps in the portal areas. The lighting zones are interleaved, so that a failure in the distribution network will cause only a partial loss of lighting in the affected zone.

Other lighting elements provided in the tunnel include:

- Directional signage to guide pedestrians towards the cross passages in the event of an incident; and
- Exit signage and emergency lighting in cross passages and egress tunnels.

Traffic Management and Control System

The Traffic Management and Control System (TCMS) will enable the operators to monitor, control and respond to the traffic conditions within the tunnel and on the approaches. It will include:

- A Closed Circuit Television (CCTV) system providing real time visual information of the tunnels, approaches and ancillary structures, to the tunnel operators;
- Incident detection and alarm management to alert operators of possible traffic incidents and unauthorised pedestrian movements. The system will be able to initiate an alarm and automatically switch CCTV monitors to appropriate cameras;
- Interfacing with the BCC/DMR Road Management System; and
- Emergency operation of the TMCS by Tunnel Control Centre staff.

Technological features of the TMCS will include:

- Traffic signals;
- Variable Message Signs (VMS);

- Speed Limit Signs (SLS);
- Lane Usage Signs (LUS);
- Vehicle Over height Detection and Warning (VOW);
- Weigh in Motion System;
- Supervisory Control and Data Acquisition (SCADA) system as an operator and maintenance staff interface to the above systems and sub-systems; and
- High availability communications links and interfaces between elements of the TMCS and to other control systems.

Emergency Procedures

Access for emergency services proposed to be available by road from any of the connections. Cross passages will be constructed at 120 metre intervals along the tunnels, providing access to a fireproof place of safety in the event of an incident. People can be directed from these passages into the other tunnels determined as being safe for evacuation. Emergency services can also access an accident site from these cross-passages. Each tunnel will be equipped with fire and life safety measures, including a deluge sprinkler system and a zone-based smoke extraction system.

Electronic Tolling System

The tolling system would be electronic and no booths for cash payment would be provided. Payment of the toll is likely to be by E-Toll where motor vehicles using the tunnel would be expected to have transponders fitted. Transponders would be detected by transmitters and receive on overhead gantries inside the tunnel. Vehicles would be detected at high speed and at any lateral position across the carriageway. Classifiers on gantries would identify the size of vehicle and apply the appropriate toll amount. A process will be needed to handle casual users. Monitoring, operation and administration of the tolling system may be performed at the Tunnel Control Centre or off-site.

5.3 Surface Road Works

5.3.1 Southern and City Connection

The southern connection of the project is designed to tie in to the NSBT design planned by RiverCity Motorways. The connection from the Airport Link driven tunnel into NSBT (north of Enoggera Creek) is via a cut and cover, transition structure. A widening of the bridge over Enoggera Creek, to cater for the Lutwyche Road/NSBT on ramp merge, would be required. The Airport Link to ICB (west) connection is provided in much the same manner leading to the proposed bridge at Enoggera Creek. The ramp then connects to the NSBT and continues to the ICB (west).

The southbound connection to O'Connell Terrace from Airport Link is provided by an off ramp from the Airport Link driven tunnel, along the Airport Link-ICB (west) ramp before diverging to connect to O'Connell Terrace at the surface. Two right turn lanes are provided at this connection for the westbound movement along O'Connell Terrace where two lanes will provide a southbound movement into Bowen Bridge Road. There is no right turn provided to Bowen Bridge Road from O'Connell Terrace. The northbound connection commences with a northbound single right turn from Bowen Bridge Road to O'Connell Terrace before turning north onto the ramp. This single lane ramp runs above and adjacent to the ICB (west) to Lutwyche Road off ramp. It merges with the Campbell Street/Airport Link on ramp. There the ramp enters a cut and cover transition structure, and then the Airport Link driven tunnel.

The southbound connection from Airport Link to Campbell Street originates after the Airport Link driven tunnel. It commences with an off ramp over Enoggera Creek, parallel with the Airport Link to ICB (west) ramp,

before departing as a single lane elevated ramp over the ICB (east) to NSBT connection. The ramp then passes over the at grade railway crossing at Tufton Street before connecting to the existing road surface at the intersection with Hamilton Place and Mayne Road. It is from here that the northbound connection from Airport Link to Campbell Street also departs. It heads west over the at grade railway crossing at Tufton Street in elevated structure. It then continues west over the NSBT before turning north over the ICB and the O'Connell Terrace off ramp. The ramp connects to the O'Connell Terrace to Airport Link on ramp before connecting to the Airport Link driven tunnel.

A connection from Lutwyche Road (south) to the NSBT and ICB is provided via a right turn movement from Lutwyche Road opposite the Northey Street. The two turning lanes merge with the two left turn lanes from Lutwyche Road (north) to NSBT and ICB at a signalised intersection east of Northey Street. From this intersection two lanes continue to the NSBT and ICB (west) on ramps.

5.3.2 North-western Connection

This connection provides traffic access between the north-south (to Bowen Hills) and east-west (to Toombul) tunnels and Gympie and Stafford Roads in both directions. Unobstructed access to the Airport Link north-south tunnels is provided from Gympie Road starting adjacent to the Broughton Street intersection. Here the two southbound lanes lead onto an embankment which soon connects to an elevated structure, following the Gympie Road alignment and crossing Gympie Road at the Gympie/Lutwyche/Kedron Park Roads intersection. Once across Gympie Road a ramp descends through transition and cut and cover structures into the north-south tunnel.

Stafford Road traffic will access the Airport Link tunnels by crossing the signalised Stafford Road/Gympie Road junction before rising on an up ramp to merge with on-ramp traffic from Gympie Road on the elevated structure just before crossing Kedron Brook. Outbound traffic to Stafford Road from Airport Link will cross Kedron Brook with Gympie Road traffic before the elevated structure diverges at the Stafford Road/Gympie Road junction. The left lane descends on an off ramp to grade and become the inside westbound lane in Stafford Road.

Access from Gympie and Stafford Roads to the east-west tunnel, eastbound along Kedron Brook, is through the signalised at grade Stafford Road/Gympie Road intersection. Once through the intersection traffic diverges left into an auxiliary lane, which once over Kedron Brook enters to a down grade transition and cut & cover structure leading to the mainline cut and cover tunnel. Westbound traffic from the east-west tunnel diverges left in the cut and cover tunnel behind Kedron High School. It then passes through a transition structure to the signalised Gympie Road/Lutwyche Road/Kedron Park Road intersection. From here southbound traffic enters Lutwyche Road while north or westbound traffic turns right and continues at grade across Kedron Brook to diverge at the Stafford Road/Gympie Road intersection.

From the north-south tunnel a two-lane bridge structure will cross the northbound lanes of Gympie Road just north of Kedron Park Road and Kedron Brook. For outbound Gympie Road traffic a minor widening of the bridge over Kedron Brook will accommodate both the Northern Busway and the three surface traffic lanes. For inbound traffic from Gympie Road a new bridge structure will cross Kedron Brook. It will be four (4) lanes wide, with three (3) lanes for Gympie Road surface traffic and an additional lane for the left turn into eastbound tunnel to Toombul. A four metre wide footpath will be provided on the western side to suit the requirements of the Northern Busway.

5.3.3 North-eastern Connection

This connection provides access to the East-West Arterial and Sandgate Road. The design allows for all turning movements using a fast diamond layout. It includes structures to be constructed north of the East-West Arterial

in Schulz Canal to avoid property impact on the southern side. The Sandgate Road bridge over Schulz Canal would require widening on the eastern side for the left turn to the East West Arterial. An elevated structure to the west of Sandgate Road would be required for the left turn movement from Airport Link to Sandgate Road.

The Airport Link to Sandgate Road off ramp initially diverges into a single exit lane then widens to two lanes in the cut and cover section of the ramp. The two lanes from the cut and cover transition to four lanes in the transition structure, providing two left turn lanes to Sandgate Road (north) and two right turn lanes to Sandgate Road (south).

Approximately 330m of cut and cover structure is required from Lewis Street to east of Sandgate Road. This section is generally two lanes wide in each direction, widening to include single lane on and off ramps for Sandgate Road. The tunnel connection alignment has been chosen to avoid the Airtrain piers and bridge abutment.

The Airport Link (west) to Sandgate Road (northbound and southbound) connections will be provided as a fourth leg added to the existing signalised T-intersection. Access from Sandgate Road to Airport Link will be via transition structures that merge with the main carriageway in the cut and cover tunnel. The Airport Link (eastbound) to Sandgate Road connections require widening of the Sandgate Road Bridge over Schulz Canal in the same structural system as the existing structure. At Widdop Street widening of the existing bridge is required additional to that already required for the Airport Link to East-West Arterial eastbound through carriageway.

6. Transport and Traffic Demand Forecasting

Traffic demand forecasting was undertaken to quantify the effects on the transport network in terms of:

- Changes in travel demand;
- Changes in travel times, speeds and the operating level of the service of the road network; and
- Impacts of road tolls on travel patterns.

The traffic forecasting model developed and applied in the study uses computer-based models to forecast road traffic demand based on land use (in the form of demographic descriptors), travel characteristics, road infrastructure, public transport services and road tolls.

The following years were modelled:

- 2012 – the Airport Link opening year;
- 2016 – interim year corresponding to Council's Transport Plan horizon;
- 2022 – 10 year post-opening horizon; and
- 2026 – the maximum forecast year for which key inputs were available.

6.1 Description of the Airport Link Traffic Model

The model used in this study, termed the Airport Link Traffic Model, has been based on the Brisbane Strategic Transport Model (BSTM) which is widely accepted as the most up to date traffic-forecasting model for Brisbane. This model was originally developed by Brisbane City Council and the Queensland Government in 2000 using data from the 1992 Household Travel Survey. The BSTM was updated during 2005 using the findings of the 2003/04 South East Queensland Travel Survey on travel characteristics. The BSTM provides travel demand forecasts for the Brisbane Metropolitan Area up to and including the year 2026, and has been extensively used in planning for future traffic and transport infrastructure by all levels of government.

The customisation of the BSTM for use in this study was undertaken within a consultative framework with BCC, DMR and QT representatives. Extensive testing of the model application processes and reporting was undertaken, including the conduct of a professional peer review.

BSTM forms the core of the Airport Link Traffic Model, with the following further development undertaken:

- Modification of the standard BSTM to include specific intersection representation and provide improved estimation of road delays at intersections;
- Updating of existing road network database for the Airport Link study area;
- Auditing descriptions of future road infrastructure projects in consultation with BCC, DMR and QT;
- Collection of new toll choice behaviour data relating to potential Airport Link users;
- Development of a toll choice traffic assignment model using the new toll choice survey data;
- Validation of the base year model against observed 2004/2005 traffic count and journey time information;
- Upgrading the BSTM Mode Choice Model to allow future TransLink PT initiatives to be modelled;
- Incorporation of processes to calculate induced demand effects of major transport infrastructure; and
- Development of a module to allow testing of Brisbane Metropolitan area population scenarios.

A representation of the major components of the Airport Link Traffic Model is given in **Figure 6-1**, showing the primary model inputs and outputs. The various components are briefly discussed below with a more detailed discussion of the Airport Link Traffic Model development in **Appendix C**.

6.1.1 Demographic and Land Use Inputs

A key input to the Airport Link model is base and forecast demographics for the entire modelled area at traffic zone level. The zonal information used by the model includes population, education enrolments, and employment.

The Brisbane Long Term Infrastructure Plan (BLTIP), in-progress within Brisbane City Council during 2005/06, engaged specialists to produce a series of future development patterns for Brisbane within the context of the Queensland State Government's Regional Plan. The demographic data was prepared at the BSTM traffic zone level of detail of over 1 500 zones within the Metropolitan area.

Land use planning and demographics experts in both State and Commonwealth government agencies monitor and project trends on population growth. Recent projections by the Australian Bureau of Statistics (ABS) indicate a range of possible future population totals (Low, Medium and High) for the Brisbane Metropolitan area. For the Airport Link study the ABS Medium Series population projection for the Brisbane Metropolitan area has been adopted for assessing traffic and transport effects of the project.

The BLTIP population in 2026 most closely reflected an ABS Low Series forecast for the Metropolitan Area. A process has been applied in the Airport Link model to produce estimates of travel that align with the ABS Medium Series population. This is described further in **Section 6.1.7**.

Table 6-1 gives the population and employment projections for the Brisbane Metropolitan area with and the overall estimates of person trips for the ABS Medium Series population scenario.

Table 6-1 Brisbane Metropolitan Area Population Forecasts

Year	Population (1)	Employment (2)	Total Person Trips (3)
2004	1,773,000	804,800	6.1 million
2012	2,074,500	1,025,400	7.2 million
2016	2,221,500	1,130,900	7.7 million
2022	2,439,600	1,253,500	8.4 million
2026	2,583,700	1,320,500	8.8 million

Table Notes:

(1) Source: Australian Bureau of Statistics – Medium Series, 2005.

(2) Employment opportunities consistent with ABS Medium population projection.

(3) Trips by all modes including walk/cycle.

As land use and growth patterns vary across the Metropolitan Area, this will result in changes to travel demands. A representation of these changed travel demands as a result of land-use growth patterns is provided in **Figure 6-2** and shows clearly the distribution of land uses that will generate the greatest density of trip ends. To show the effects of forecast changes and growth in land use and travel demand generation, **Figure 6-3** depicts the change in trip ends forecast over the period between 2012 and 2026. This clearly depicts the significant growth in travel demand forecast at key locations served by the project, such as Brisbane Airport, the ATC North precinct and Chermside.

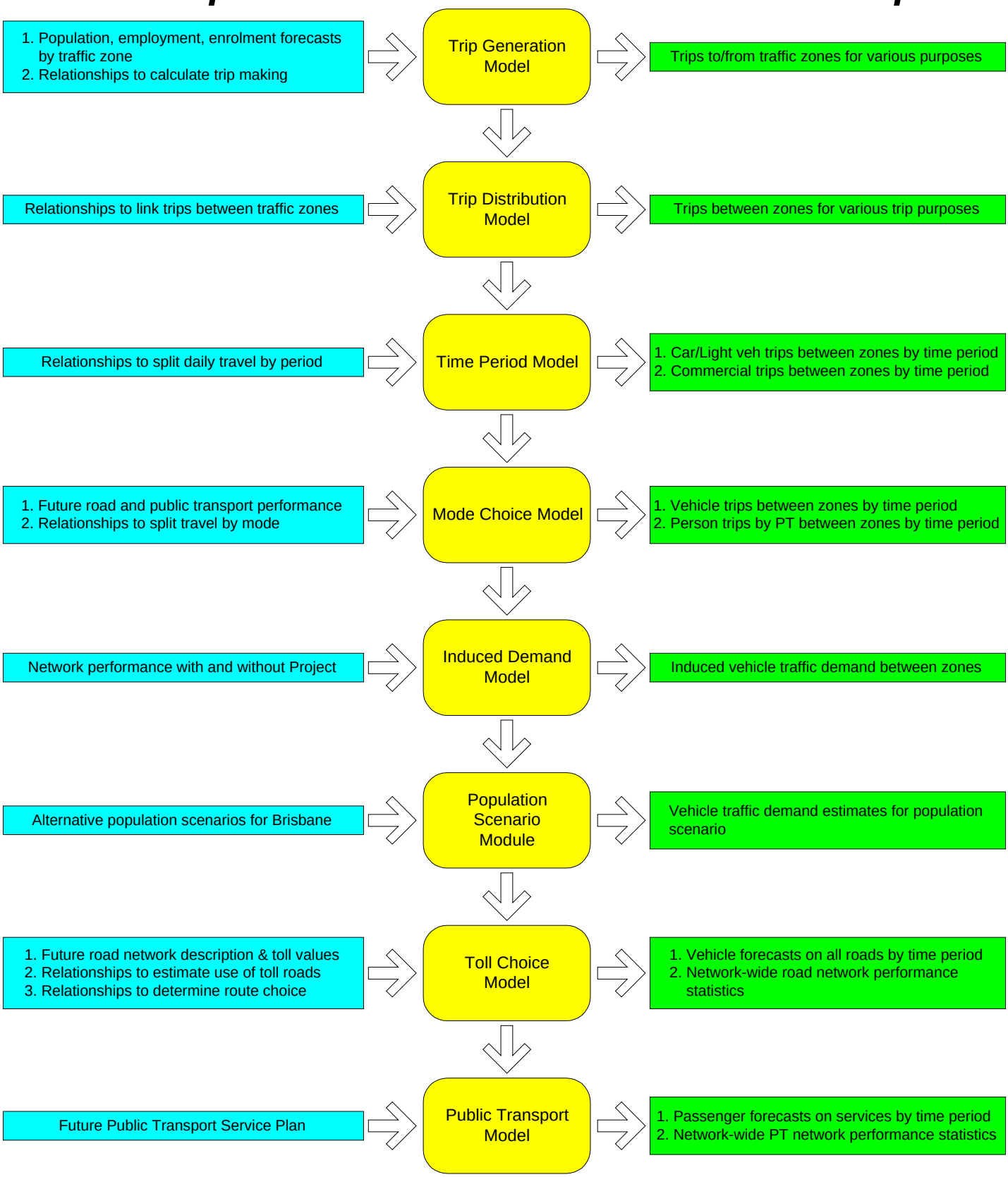


Figure 6-1
Airport Link Model Components

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

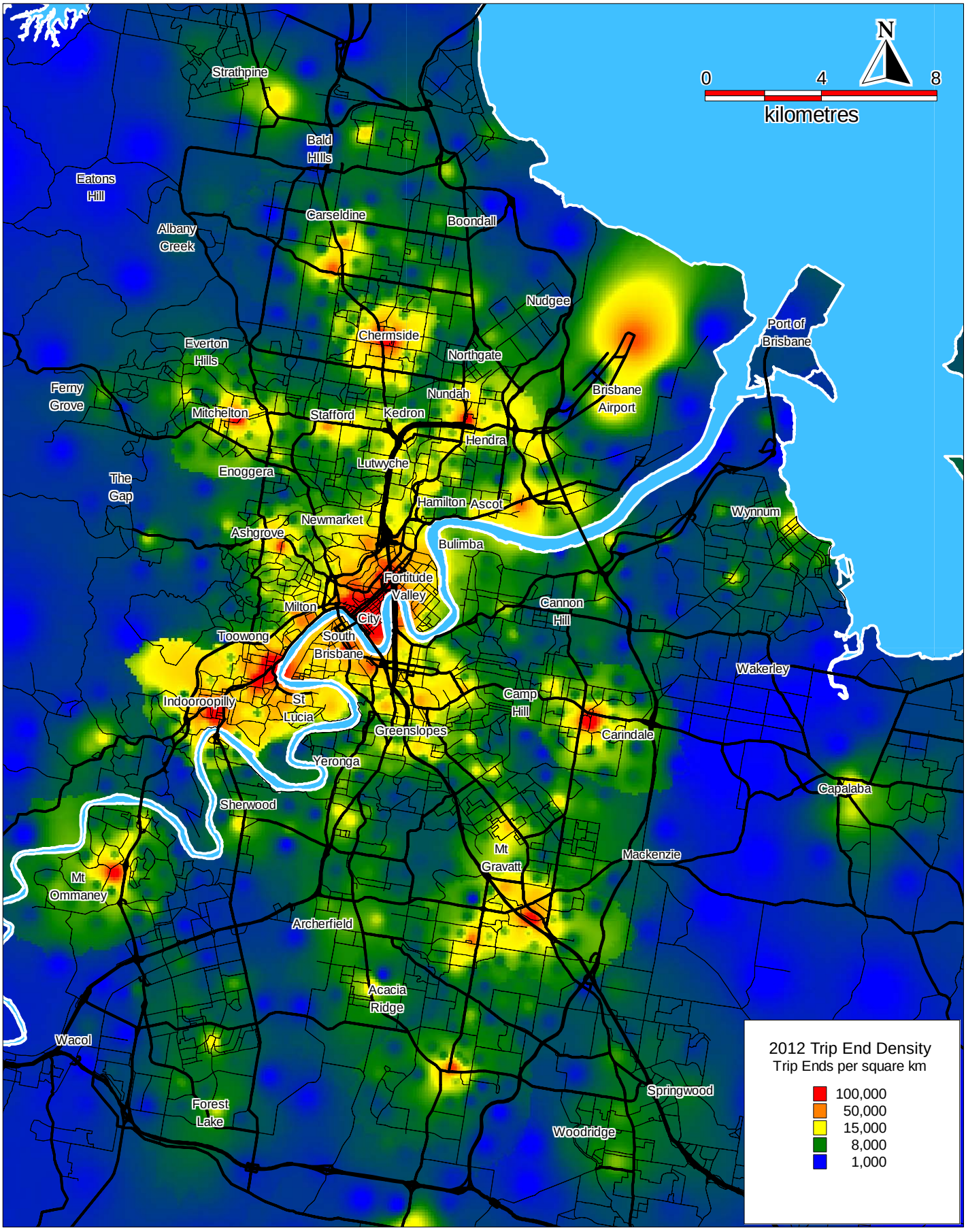


Figure 6-2
2012 Daily Vehicle Trip End Density

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

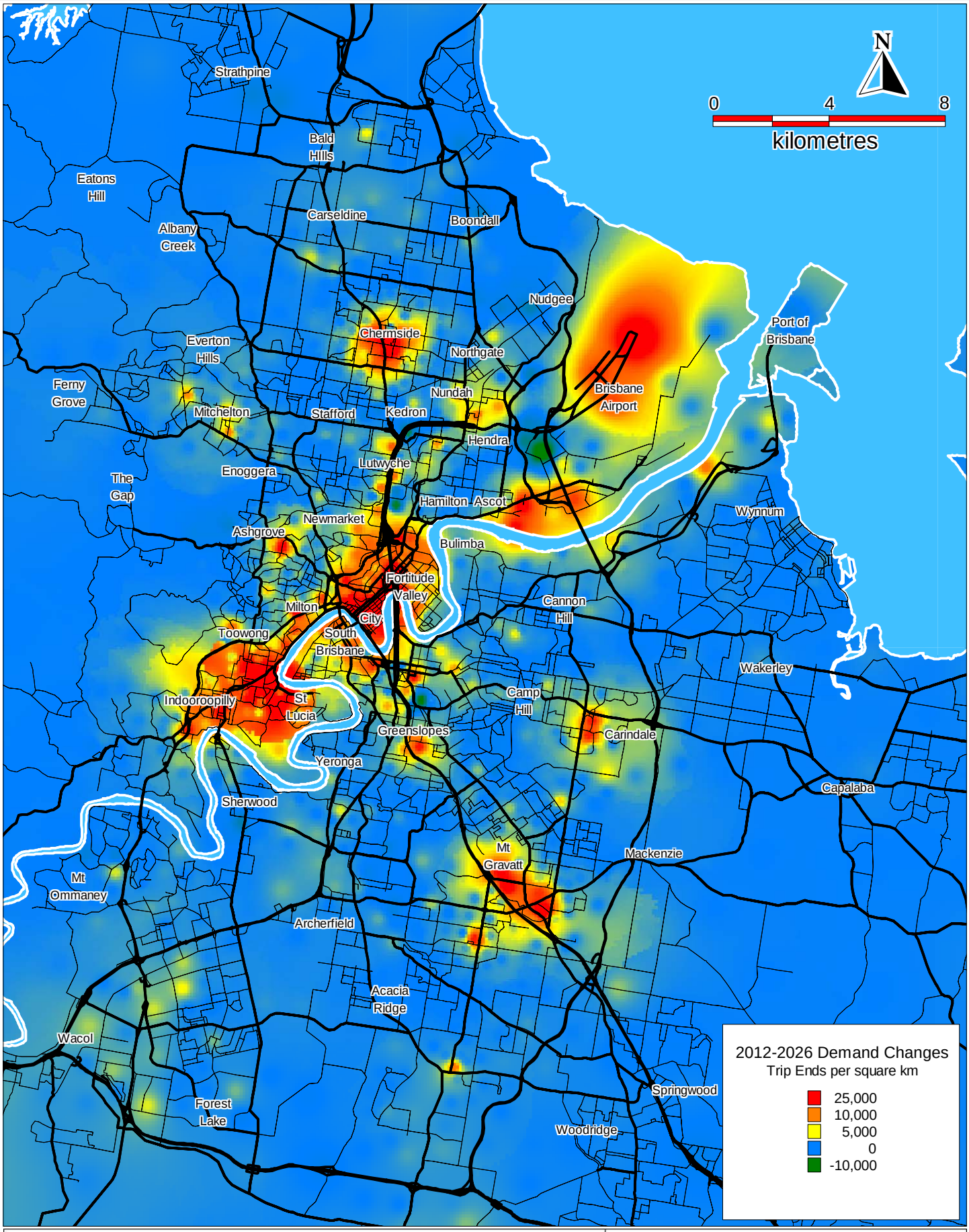


Figure 6-3
2012 to 2026 Daily Vehicle Trip End Changes

Airport Link

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BRISBANE CITY

6.1.2 Trip Generation Model

The trip generation model estimates the quantum and nature of average weekday travel associated with land use throughout the Brisbane Metropolitan Area. A trip within the model refers to travel from one location to another and is estimated within the model by deriving the number of trips produced and attracted to traffic zones. Data on Brisbane travel behaviour have been used to develop relationships that calculate the number of trips to and from zones for various purposes (e.g. shopping, work etc) based on zonal demographic descriptors.

Within the model, travel by all modes is calculated for an average weekday, including walk and cycle trips, public transport, private vehicle trips and commercial vehicle travel.

Some zones contain land uses that are focussed travel generators, examples being hospitals, shopping centres, universities and the Brisbane Airport. Forecast traffic demand for these special generators has been calculated outside the model from suitable data sources and applied as controls on the modelled trip generation for the relevant traffic zones.

6.1.3 Trip Distribution Model

The trip distribution model links the estimated trips produced at each traffic zone with trips attracted in other traffic zones, for a wide range of travel purposes (eg home to work, home to shopping, business travel). The model considers the balance between the location of these trip ends and the cost of travel (in terms of time, distance, parking charges, and tolls) between them, for all locations within Brisbane. The gravity model is the most common form of trip distribution model and is used in the BSTM to estimate the distribution of trips internal to the strategic model boundary. The number of trips between two traffic zones is estimated to be directly proportional to the number of trip productions in the production zone and attractions in the attraction zone, and inversely proportional to the cost of travel between the zones. The output of the distribution model is a set of travel demand matrices that detail the number of trips from each traffic zone to all other traffic zones for various trip purposes.

Commercial vehicle (CV)[2] travel is treated separately to reflect the specific travel patterns exhibited by trucks. Observed data on commercial-vehicle origins and destinations (Queensland Transport, 2004) forms the basis of this part of the model, and is factored to represent future travel demands using relationships based on employment quantum and distribution.

Travel to and from the outer extremities of the modelled area is estimated to match vehicle totals calculated from traffic count records and trend projections. The trips are distributed amongst the internal traffic zones.

6.1.4 Time Period Model

Trip generation and distribution are used to forecast total daily travel on an average weekday, however, the transport system performs differently during the peak periods compared to the other times of the day. The time period model splits the total daily travel into separate AM and PM peak periods and the off-peak period of the day. Time period proportions are based upon data from the 2003/04 SEQ Travel Survey and traffic counts.

Dividing the travel into these time periods allows more accurate estimation of travel behaviour changes throughout the day and the effects of traffic congestion during peak periods.

[2] CV refers to medium and heavy commercial vehicles as per the definition in **Section 3.5.2**.

6.1.5 Mode Choice Model

To enable assessment of the effects of the proposed Northern Busway and other planned public transport initiatives on travel behaviour within the Metropolitan Area, a mode choice modelling component was included within the Airport Link Model and integrated into the standard BSTM. A more detailed description of the Mode Choice Sub-Model is given in **Appendix C**.

The model uses a current estimate of public transport travel and comparisons of road network performance and public transport service changes to estimate changes in public transport patronage. Future improvements in public transport infrastructure and services planned by TransLink (QT) have been explicitly modelled. The changes to public transport services advised by TransLink and adopted within this study are given in **C.8**.

Person trips by private transport are further factored by vehicle occupancy averages by trip purpose (observed in SEQ travel surveys) to convert the total person private travel into private vehicle trips.

6.1.6 Induced and Suppressed Demand Model

The opening of a major transport infrastructure facility such as Airport Link can produce several responses from the travelling public. The responses of the travelling public to improvements in network connectivity or reduction in congestion are referred to as induced traffic demand and can result in increased vehicle kilometres on the road network. The responses that occur are discussed below and are documented extensively elsewhere (Scottish Executive, 1997).

Responses directly catered for within the Airport Link Model include:

- Changes in travel route – catered for in the trip assignment sub-model; and
- Travel to new destinations for the same trip purpose - catered for in the trip distribution sub-model.

Other responses catered for by separate processes are:

- Changes in journey start times – changes in travel start time to exploit improved peak travel times are separately accounted for within the induced demand sub-model;
- Changes from other modes (public transport, cycling and walking) to private vehicle - addressed via use of a separate mode choice sub-model;
- Changes in vehicle occupancy - changes in this characteristic are accounted for within the induced demand sub-model;
- Changes in the frequency of some journeys and making entirely new journeys - these suppressed demand effects are catered for within the induced demand sub-model; and
- Changes in the pattern of land use - land use patterns proposed by Brisbane City Council are used as fixed inputs, as these land use patterns reflect the desired vision for the City under the South East Queensland Regional Plan.

Many of these induced traffic effects are not catered for within standard strategic transport models. Research of techniques used in the UK and New Zealand was carried out to identify a suitable method to incorporate induced traffic effects within the Airport Link model. The method selected as most appropriate for this project has utilised (with some customisation) techniques documented in the New Zealand Project Evaluation Manual (Land Transport New Zealand, 2003). The methodology utilises an elasticity approach to estimate a new future travel private vehicle demand matrix using the following elasticity formula:

$$T_{ij}^{1} = T_{ij}^{F}\left(\frac{C_{ij}^{1}}{C_{ij}^{DM}}\right)^{E}$$

(Elasticity of demand, E, of -0.2 has been adopted based on the PEM and for consistency with previous NSBT EIS.)

The induced demand model has been applied as a standard inclusion when applying the Airport Link model, to give a consistent upper estimate of travel expected for all forecasting years.

Induced Traffic Assessment

The induced demand model has been run for each time period and forecast year to provide revised demand matrices ready for use in the toll choice model time period assignments. **Table 6-2** gives estimates of the change in total average weekday vehicle demand.

- **Table 6-2 Daily Induced Private Vehicle Demands**

	Original Analysis without Induced	Network with the Project
Year	Total Daily Demand Across Brisbane	Induced Demand Across Brisbane
2012	4,219,200	20,600 (0.49%)
2016	4,510,000	24,300 (0.54%)
2021	4,848,400	24,900 (0.51%)
2026	5,181,800	34,700 (0.67%)

The assessment demonstrates that low levels of induced demand across Brisbane in the order of 0.5% (2012) to 0.7% (2026) are forecast in a network that includes Airport Link and NSBT.

Results from the induced demand assessment indicate that traffic increases vary across Brisbane, with a concentration where the project has the most direct effect on congestion levels. Suburbs within and neighbouring the Inner North area such as Stafford, Kedron Lutwyche, Windsor, Clayfield, Ascot and Hamilton have 2026 daily induced vehicle demands in the order of 1.8% to 2.5%. Areas more distant from the study corridor that are forecast to produce induced demands include Nundah, Eagle Farm the Brisbane Airport, Brisbane CBD and Mt Gravatt.

Induced demands are also forecast to vary by time of day. The project provides most congestion relief within the peaks and, as such, the travel induced in these periods is greater than during off-peak periods. Overall induced demands within the Metropolitan Area in the AM peak across the forecast years is in the range 0.6% to 0.7% of the base demand. PM peak induced demand is in the range 1.0% to 1.3%, and the off-peak induced demand is in the range 0.3% to 0.5%.

6.1.7 Population Scenario Module

In its standard form, the BSTM uses demographic projections that most closely reflect an ABS Low Series forecast for the Metropolitan Area. A process has been developed within the Airport Link model to produce estimates of travel that align with other demographic scenarios, such as the ABS Medium Series population.

The process requires initial forecasting within the BSTM to be undertaken using the BLTIP data set, as this is the only data set available at the 1,500 traffic zone level. Time shifts are then applied to the forecast estimated traffic demand matrices to match the adopted demographic forecast series for the EIS (i.e. the ABS Medium

Projection for the Brisbane Metropolitan region).This methodology provides a sound basis to examine the implications of a range of population outlooks on traffic forecasts on a regionally significant road such as the Airport Link.

6.1.8 Trip Assignment including Toll Route Choice

The preceding components of the model determine the amount of vehicle travel between traffic zones by time of day. The remaining step is the assignment of the demand onto particular routes between trip origins and destinations. To do this, driver route choice behaviour is simulated as a trade off between time, distance and toll for the route alternatives between the start and end locations for a trip. Trips from all trip origins and destinations are accumulated on the most attractive routes, such that the total represents forecast traffic on all road segments.

The presence of multiple toll routes within a network requires application of a complex methodology for assigning traffic on road networks. The approach used in the Airport Link model gathers route cost information for the best tolled route and the best free alternative route, to allow a consumer choice comparison to be made.

A process has been developed to split traffic into toll users and non-toll users, taking into account travel distance, total time (including intersection delays) and the value of tolls along the route. The relationships applied are based on data obtained from a survey of the catchment areas where people make trips in the corridors that Airport Link is likely to serve. A cross-section of potential toll road users was surveyed, covering variations in home location, trip origin and destination, trip purpose, and whether tolls are regularly paid. The parameters applied in the model reflect average driver behaviour with respect to the willingness to pay a toll to improve travel time, avoid congestion and use higher quality roads during different periods of the day.

The total route costs on tolled and alternative routes are converted and aggregated into a total utility parameter. This process uses relative weights for each of the distance, time and toll components along the routes. A comparison is made between the best toll and best alternative routes for all trips that can potentially use the toll facilities. The demand between the relevant origin and destinations within Brisbane is split between toll users and non-toll users.

Both toll users and non-toll users are assigned to their identified best routes using the model in a process that balances demand with congestion delays. The resulting traffic estimates on the road network segments represent future traffic demands that can be critically compared on individual sections of the network or as a global total measure of network performance.

A more detailed description of the Toll Choice Assignment Model is given in **Appendix C**.

6.1.9 Public Assignment Transport Model

The model produces estimates of public transport trips in addition to the road vehicle demands and assigns this demand to a representation of the public transport (rail, bus, ferry) services to produce public transport patronage estimates. In a similar manner to the road traffic assignment, detailed and network-wide statistics are produced for use in assessment of project effects.

6.1.10 Model Validation and Sensitivity Testing

The entire model process, inclusive of the components described above, has been validated against a range of data sources, including 2004/2005 observed road traffic counts, road travel times and public transport ticketing data, to verify its accuracy. Results of the validation comparisons for the base year have been presented in **Appendix C**.

In addition to the base year model validation, a range of sensitivity tests were undertaken to check the model's predictive stability with respect to:

- Changes in road network description including new roads and changes in link and intersection details;
- Changes in public transport service provision and the effect on public transport patronage;
- Changes in toll charges, both for private and commercial vehicles ;
- Changes in toll and route choice behaviour parameters; and
- Changes in demographics (land use).

Findings from the sensitivity testing are presented in **Appendix C**.

The validation checks and sensitivity tests undertaken have verified that the model described above is capable of producing traffic estimates of sufficient accuracy and sensitivity for use in this study. Model Outputs

Outputs from the traffic and transport modelling for use in the assessment of project effects have been prepared using the Airport Link Model for scenarios without and with the project. They include:

- Estimates of future traffic volumes on individual roads within the network, for both untolled and tolled roads;
- Traffic volumes (total and commercial vehicles) for peak periods, off-peak times and aggregated to average weekday volumes;
- Intersection turning movements during peak periods for use in assessment of local traffic operations;
- Travel times and operating Level of Service on routes within the network;
- Additional specific traffic data requirements requested by the specialists preparing environmental assessments on air quality and noise. These included more detailed temporal traffic flow breakdowns, estimates of heavy vehicle proportions and bus estimates; and
- Network wide statistics, disaggregated by road type and vehicle class, including vehicle–kilometres of travel, vehicle hours of travel and network speed, for use in economic assessments.

6.2 Alternative Future Scenarios for Strategic Modelling

6.2.1 Future Road Network Improvements

In order to forecast future conditions within the project, assumptions need to be made regarding the traffic and transport network at future critical dates. Details of planned or potential future projects and their timing were compiled from anticipated capital works programs (including SEQIPP), and an agreed list for network modelling developed in consultation with DMR and BCC.

The agreed list of Do Minimum network projects (or projects to be included in the network both without and with the project) for forecasting years 2012, 2016, 2022 and 2026 is summarised in **C.7**.

The major road transport projects relevant to the project at the time of the study were the North-South Bypass Tunnel (NSBT), Gateway Upgrade Project and Brisbane Airport Northern Access. The incorporation of these projects within the traffic and transport analysis is described below. These projects were all included in both without, and with, the project traffic modelling.

Key features of these infrastructure projects and their timing are listed in **Table 6-3**. The table also provides information on other pertinent connections to the ATC North area agreed at the time of the study.

- **Table 6-3 Key Network Assumptions**

Project Title Project and Description	Network Year			
Network Year Key: ✓ = Include in Do Minimum Network (without project) & all tests including Airport Link; A = Include in a separate Cumulative Impact Test	2012	2016	2021	2026
North-South Bypass Tunnel New tolled river crossing (4 lanes, in two separate tunnels) approximately under Story Bridge alignment, with connections to ICB (east and west), Lutwyche Road, Shaftson Avenue, Ipswich Road and Pacific Motorway. Configuration from NSBT Changed Project, including surface road connections.	✓	✓	✓	✓
Gateway Upgrade Project				
Gateway Motorway Bridge Duplication New 6-lane toll bridge downstream of existing bridge providing a total of 12 lanes.	✓	✓	✓	✓
Gateway Northern Deviation (Nudgee Road to Gateway Bridge) New 4 lane motorway standard direct connection from Gateway Bridge to the existing Gateway Motorway south of Nudgee Road opposite Raubers Road. Includes interchange and new northern connection to Airport at Cannery Creek.	✓	✓	✓	✓
Gateway Motorway South (Port Of Brisbane Motorway to Wynnum Road) Upgrading to eight lanes (from four lanes) of the Gateway Motorway from Port Motorway to Lytton Road, and new ramp from Gateway Motorway S/B to Port of Brisbane Motorway E/B.	✓	✓	✓	✓
Gateway Motorway (Wynnum Road to Mt Gravatt-Capalaba Road) Upgrading from four lanes to six lanes.	✓	✓	✓	✓
Brisbane Airport Northern Access Road Northern Access Road connecting Airport Drive to Northern Access Interchange on Gateway Northern Deviation, plus new internal western roads within Airport site.	✓	✓	✓	✓
Airport Drive (Lomandra Drive to Domestic Terminal) Upgrading from 4 to 6 lanes.	✓	✓	✓	✓
Schneider Road Extension Extension over rail line to Lomandra Drive/Qantas Drive to provide additional access to ATC North area.	✓	✓	✓	✓
Northern Busway Staging Project – Interim Busway Road network design features of Northern Busway Interim works as per Concept Design at time of study include: + bus lanes on Lutwyche Road between Newmarket Road and Stoneleigh Street + two way bus and local traffic access only on Truro Street + bus and local traffic access only (southbound only) on Roblane Street. + Lutwyche Road re-configuration to provide two general traffic lanes in each direction between Stoneleigh Street and Newmarket Road.	A	A	A	
Northern Busway Staging Project – Full Busway Road network design change as per Concept Designs at time of study include: with the Full Northern Busway involves the conversion of the interim bus lanes on Lutwyche Road to T3 lanes between Fosbery Street and Newmarket Road.				A

Table Note:

(1) Network Year Key: = Include in Do Minimum Network and all tests including Airport Link; A = Include in a separate cumulative impact scenario.

North-South Bypass Tunnel

The traffic and transport effects of the project have included consideration of the scenario where the North-South Bypass Tunnel is implemented and operational.

The North-South Bypass Tunnel is a cross-river toll road, approximately 4.8km in length, connecting between the Inner City Bypass and Lutwyche Road at Bowen Hills and Ipswich Road and the Pacific Motorway at

Wooloongabba, with an intermediate link to Shafston Avenue to service the eastern suburbs. Most of the road will be in tunnel.

From a traffic and transport standpoint, Airport Link will expand the road network which allows cross-city travel movements to bypass the Brisbane Central Business District (CBD) and inner suburbs. In doing so, Airport Link creates a high quality connection between the NSBT, and the southern catchments within the Brisbane Metropolitan region served by that facility, and the middle orbital road formed by the East-West Arterial connecting to Brisbane Airport and the ATC North region.

Airport Link, by its connection to the NSBT, provides enhanced linkage to other motorway standard connections and caters for long distance movements between locations external to South East Queensland and major economic activity areas. Connection alternatives to the Gateway Motorway for the ATC precinct from southern and western areas are provided via the Airport Link, NSBT, and the Pacific Motorway, or via the Airport Link, NSBT and the Ipswich Motorway.

Construction is due to commence on the NSBT in the latter half of 2006. The facility is expected to be open for traffic use by 2010. In the transport modelling for Airport Link, it has therefore been assumed that the NSBT will be operational in 2012, prior to the opening of Airport Link.

An example of the service integration that would be available between the NSBT and Airport Link, would be inter-operability of the transponders used for the electronic tolling system by users of both facilities.

Gateway Upgrade Project

Two other key road projects that have been incorporated within future network scenarios, both without and with the project, are:

- The Gateway Upgrade Project - a planned duplication of the tolled Gateway Bridge and upgrading of the Gateway Arterial Road on each side of the Brisbane River. This project will alleviate pressures on the road network to the east of the CBD and in the Gateway Corridor, providing improved access to the Port of Brisbane and Brisbane Airport.
- Brisbane Airport Northern Access - a project planned by the Brisbane Airport Corporation that provides a new access road to primarily serve the domestic and international terminals at Brisbane Airport. The new road links to a new Airport access interchange on the northern deviation of the Gateway Motorway, planned as part of GUP. It will provide a more convenient, high quality route to the terminals. The new access road will alleviate traffic pressure on the existing Airport Drive link to the Gateway Motorway, particularly on the roundabout at the Gateway Motorway interchange.

6.2.2 Public Transport Services

The proposed Northern Busway, implemented in a staged form, has been considered in a cumulative impact scenario as described in **Section 10**. It represents a major public transport improvement in northern Brisbane proposed within SEQIPP. The Northern Busway would connect the completed Inner Northern Busway at Herston to Kedron, with ultimate extension further north to Bracken Ridge. The potential cumulative effects of the project with and without the proposed Northern Busway have been assessed in this study.

Improvements in public transport services for each of the forecasting years 2012, 2016, 2022 and 2026 have been incorporated into the Airport Link future scenarios. This was done based on advice from TransLink using their detailed forward planning being undertaken consistent with the draft TransLink Network Plan and SEQIPP initiatives.

A base future public transport scenario includes increased bus and rail service frequencies for existing routes and additional bus services on approximately 40 new bus routes, including seven (7) routes across the Green Bridge and two (2) new bus routes between Central Brisbane and the ATC North area.

For the Northern Busway cumulative impact scenario, bus routes running in the Northern Busway corridor have been transferred to an Interim Busway before 2026 and to a Full Busway in 2026. The impacts of the Northern Busway on road infrastructure have also been included.

Details of assumed future public transport service changes are contained in **C.8**.

6.2.3 Toll Value Assumptions

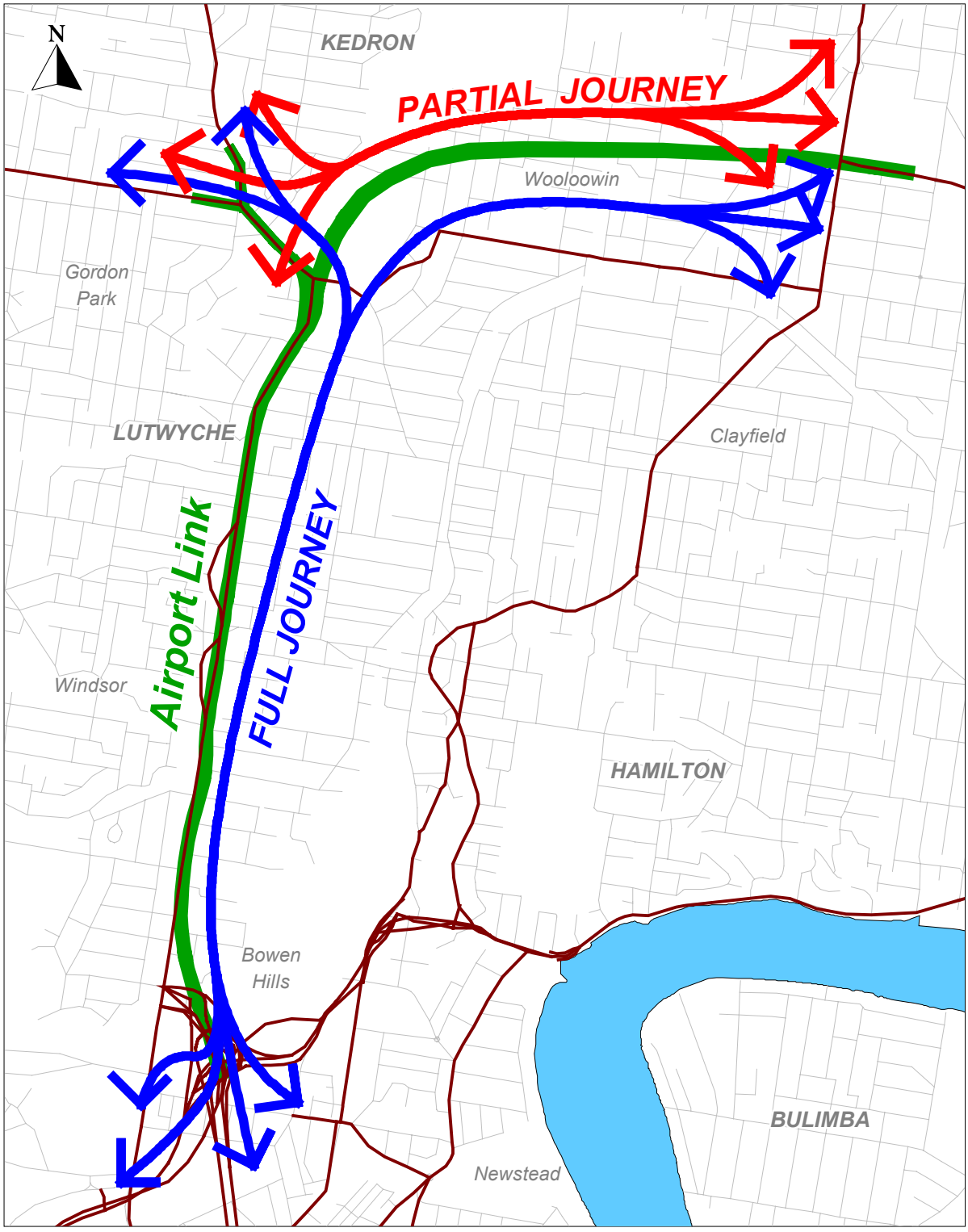
Toll values have been included in the road network description as a monetary charge on particular road segments representing existing or proposed toll collection points. The value of tolls on Airport Link and other toll facilities at the proposed year of opening, 2012, were modelled as:

- Airport Link tolls (2006 dollars including GST)
  - full (north-south) journey – $3.64 for light vehicles, $7.28 for commercial vehicles
  - partial (east-west) journey – $2.43 for light vehicles, $4.86 for commercial vehicles
- North-South Bypass Tunnel toll (2006 dollars including GST)
  - $3.64 for light vehicles, $9.65 for commercial vehicles
- Gateway Bridge toll (2006 dollars including GST)
  - $2.71 for light vehicles, $6.79 for heavy vehicles

A common basic perceived toll dollar value has been calculated for each year for use in the model. This calculated value takes into account the assumption that tolls will rise with CPI, and increases in average wages (spending power) slightly higher than CPI.

Figure 6-4 illustrates the types of trips on Airport Link that are classed as a full journey and partial journey for tolling purposes.

- **Figure 6-4 Types of Trips on Airport Link**



7. Future Scenario without Airport Link

7.1 Introduction

This chapter describes the forecast traffic demands and performance of the transport system on the basis that the proposed Airport Link is not constructed.

7.2 Strategic Traffic Network Performance

Average weekday traffic volumes have been forecast for roads in the Brisbane Metropolitan Area for the years 2012, 2016, 2022 and 2026, for a road network that does not included the proposed Airport Link. Estimated average weekday daily traffic volumes for 2004 have also been identified to allow comparison. The travel demand forecasts incorporate the effects of significant enhancements in public transport.

Table 7-1 summarises the growth in travel demand at the metropolitan level.

Table 7-1 Forecast Growth in Weekday Travel Demand in Metropolitan Area

Parameter	2004	2012	2016	2022	2026
Person Trips by Motorised Travel Modes	5,519,200	6,530,200	6,987,900	7,657,400	8,093,700
Public Transport Trips	415,400	607,100	677,000	807,200	895,600
% PT Trips	7.5%	9.3%	9.7%	10.5%	11.1%
Car/Light Vehicle Trips	3,611,000	4,239,800	4,534,300	4,940,700	5,216,500
Commercial Vehicle Trips	177,600	231,000	249,700	272,200	287,600
Total Vehicle Trips	3,788,600	4,470,900	4,783,900	5,212,900	5,504,100
% Growth in Vehicle Trips compared to 2004	-	18%	26%	38%	45%

Table Note: (1) Includes travel to and from locations outside the BSD

These forecasts show that even with significant growth in public transport mode share (to 11.1% of motorised travel in 2026), a sustained growth in vehicle travel demand is indicated both at the Brisbane Metropolitan area level and within the Inner North area. In the Metropolitan area 45% more vehicle trips are expected by 2026, even with the number of public transport trips more than doubled. Within the immediate project area, north-south travel movements within the Inner North area are forecast to increase by 49% between 2004 and 2026, a sustained growth rate of 1.8% pa. East-west demands are forecast to grow by 55% to 65% in a similar period, a growth rate of over 2.0% pa. These growth trends are similar for commercial vehicle movement, indicating that the adverse effects of truck travel through the surface network in the Inner North areas for access to the rapidly growing ATC precinct, will become even more significant over time.

Table 7-2 summarises the forecast growth in traffic volumes at a selection of key screenlines and locations in the network.

Table 7-2 Forecast Growth in Traffic Volumes at Screenlines

Average Weekday Traffic Without Airport Link									
Screenline	2004	2012	% Growth[1]	2016	% Growth[1]	2022	% Growth[1]	2026	% Growth[1]
Western	74,900	106,500	42%	112,900	51%	119,500	60%	123,700	65%
Central	60,500	81,600	35%	87,300	44%	91,400	51%	94,200	56%
Eastern	66,800	90,300	35%	96,600	45%	103,700	55%	109,600	64%
Northern	180,100	231,100	28%	243,600	35%	256,400	42%	269,000	49%

Commercial Vehicle Weekday Traffic Without Airport Link									
Screenline	2004	2012	% Growth(1)	2016	% Growth(1)	2022	% Growth(1)	2026	% Growth(1)
Western	4,300	5,600	30%	6,100	42%	6,300	47%	6,500	51%
Central	4,100	5,300	29%	5,800	42%	5,400	32%	5,200	27%
Eastern	7,500	9,400	25%	10,100	35%	10,700	43%	11,000	47%
Northern	9,500	11,900	25%	12,800	35%	13,200	39%	13,900	46%

Table Note: (1) Percentage growth compared to 2004.

Figure 7-1, Figure 7-2, Figure 7-3 and **Figure 7-4** show the resultant volumes on the road network for 2012, 2016, 2022 and 2026 due to the growth in demands for key travel movements. Traffic growths without the project at key locations are also summarised in **Table 7-3**.

The Level of Service (LOS) for the road network without Airport Link has been examined for roads within the Brisbane Metropolitan Area for the years 2012 and 2026 for both the AM and PM peak periods. **Figure 7-5**, **Figure 7-6**, **Figure 7-7** and **Figure 7-8** detail the LOS for the road system in the inner north for the two-hour peak periods in the morning and evening.

Traffic growth and network performance characteristics that are evident from these assessments include:

- Due to increased travel demand on the road network, there is a general decrease in LOS across the years on the road network generally, which reflects a decrease in travel speeds due to increased congestion.
- Within the Inner North area, significant sections of most arterial roads by 2012 are operating with poor LOS in both AM and PM peak periods. In these cases the LOS is typically forecast to progressively deteriorate over time indicating an increasing capacity deficiency.
- Examples where significant growth in demand is forecast on major north-south arterials north of the Central City without the project include:
  - Traffic through the Lutwyche shopping precinct would grow by over 30% from 60,000 vpd currently to 77,500 vpd by 2026. The LOS along the Lutwyche Road corridor progressively declines with over half of the 5.5 km corridor forecast to operated at LOS F (very congested) by 2026 in both AM and PM peaks.
  - Sandgate Road would experience even greater pressure from growth, due to its proximity to the ATC North precinct, a major contributing influence, and the inter-connection it provides to the Brisbane CBD, the Metropolitan area's other major economic activity area. Almost a doubling of current traffic levels is likely, with a growth in demand from 36,000 vpd through the Albion area to over 71,000 vpd by 2026. A sharp decline in LOS would be associated with this demand growth.
  - Similarly major traffic growth is forecast on Kingsford Smith Drive, another key arterial serving the ATC area and CBD, with a rise of 39% (to 76,000 vpd) indicated by 2026 without the project.
- East-west routes to the north of the Central City are also influenced by the significance of growth in travel demand in the ATC area without the project. Key examples are:
  - Traffic on the East-West Arterial Road, east of Sandgate Road, connecting to Nudgee Road and the Gateway Motorway is forecast to grow by 69% by 2012 and then by 113% at 2026. Even without the project this will place significant pressure on the congested East-West Arterial/Nudgee Road signalised intersection. High congestion is forecast at intersections, at East-West Arterial/Sandgate Road as well as on several approaches to the Nudgee Road intersection and the Gateway Motorway roundabout.

- On Junction Road, which forms part of the DMR controlled East-West Arterial route through the Wooloowin residential area, traffic is expected to grow by 79% by 2026. A decline in the LOS along this route would occur.
- In Albion, traffic growth of over 60% is estimated on Albion Road, connecting to Sandgate Road, which itself is forecast to operate at high congestion levels in the Albion precinct. Other suburban and district roads such as Dickson Street and Shaw Road would have forecast growth in demand of over 25% and 30% respectively by 2026 compared to 2004 traffic levels.

7.3 Local Traffic Network Performance

Traffic volumes on major roads within the Inner North area and surrounds, during peak periods without the project, have been forecast for 2012 and 2022. To estimate the performance of intersections, aaSIDRA models were constructed. Turning movements at each intersection, extracted from the strategic model, are inputs to these models. The strategic model does not contain a detailed representation of intersection operations, although it does incorporate a representation of intersection delays to enable a more accurate assignment of traffic to alternative routes. Some minor roads are not explicitly modelled in the strategic model, hence some adjustments to the strategic model volumes were required to create turning volume estimates that more accurately represented the observed turning pattern at each intersection approach. The traffic volumes from the strategic model represent demand for travel during the peak two hour period, but in some locations upstream intersection constraints may mean that the strategic model volumes cannot actually arrive at the downstream intersection in the modelled time period.

An assessment of the traffic performance of fifty-three (53) locations within the network has been carried out. The intersections include sixteen (16) signalised intersections in the Gympie Road-Lutwyche Road corridor, four (4) signalised intersections along the Stafford Road corridor, twelve (12) intersections in the Bowen Hills and Fortitude Valley area at the southern end of the project corridor, thirteen (13) intersections in the Sandgate Road-Abbotsford Road corridor, three (3) intersections along Kingsford Smith Drive and five (5) signalised intersections within the local road network between Lutwyche Road and Sandgate Road.

The intersection Degree of Saturation and LOS is provided in **Table 7-4**. Examples of highly congested intersections in the network include:

- The Gympie Road/Stafford Road intersection and the nearby Lutwyche Road/Kedron Park Road intersection, where a continuation of highly congested traffic operations, particularly in the PM peak is forecast. Delays at these two intersections create flow-on effects for inbound traffic on Gympie Road in the AM peak and outbound traffic on Lutwyche Road in the PM peak. To effectively manage queuing, signal settings are likely to need to be adjusted to allow priority for the major through movements on Gympie Road-Lutwyche Road, causing additional delay to local traffic movements on Kedron Park Road and Stafford Road.
- The Sandgate Road/East-West Arterial intersection and the Sandgate Road/Junction Road intersection, where deteriorating traffic operations are forecast in both peak periods, as both locations cater for increasing north-south and east-west travel demands.
- Several intersections along Lutwyche Road which provide key local traffic connectivity such as Chalk Street, Maygar Street and Albion Road. Congestion at these locations often has a flow-on effect to nearby intersections between the major access points, and delays to the side-road traffic can become quite severe.
- Major local traffic access roads along Sandgate Road, serving schools and residential precincts such as Lapraik Street and Bonney Avenue.

- Intersections in the Albion shopping and commercial area including the Albion Fiveways and the Sandgate Road/Albion Road intersection, which would be the most severely congested location in the Inner North area.

7.4 Public Transport Network Performance

Bus services in the Inner North area are affected by congestion on the road system. Both Lutwyche Road and Sandgate Road are important bus corridors serving commuters from both local, and wider catchment areas in Brisbane. The deterioration in performance of the road system, as described above, would result in similarly longer travel times and reduced travel time reliability for bus services during peak periods.

7.5 Road User Safety Performance

Increased traffic levels on the road network in the future will lead to an increase in the number of crashes on roads within the Inner North area which will affect all types of road users – motorists, pedestrians and cyclists. The forecast deterioration in road user safety without the project has been assessed by calculation of the forecast number of road crashes on key routes. These values are tabulated in **Table 9-17**. By 2012 an increase of annual crashes on key routes by 36% is forecast, and increase from 340 crashes in 2004 to 464 crashes in 2012. In 2026, the crash total would be over 50% greater than the current level.

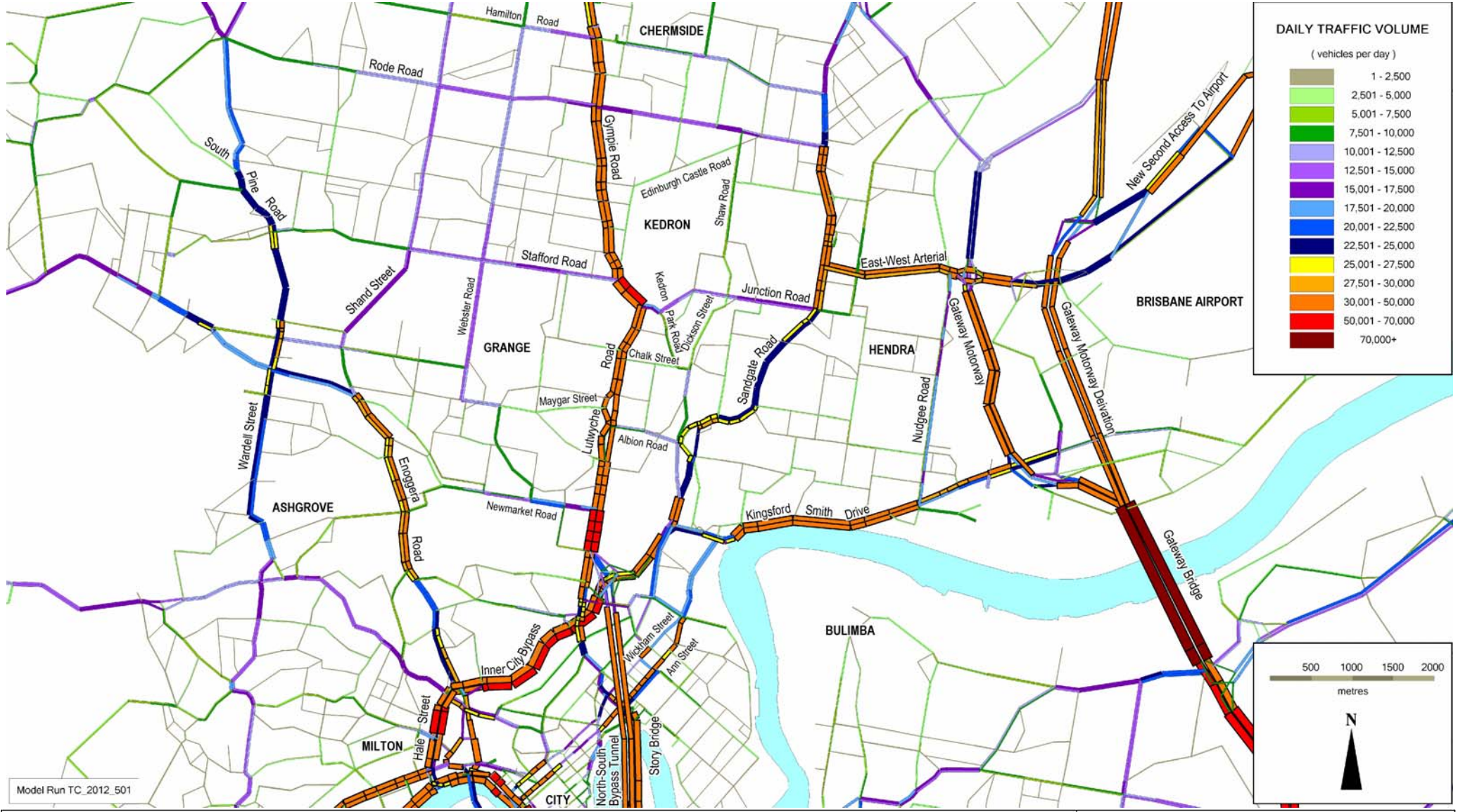


Figure 7-1
2012 Average Weekday Traffic Volumes
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

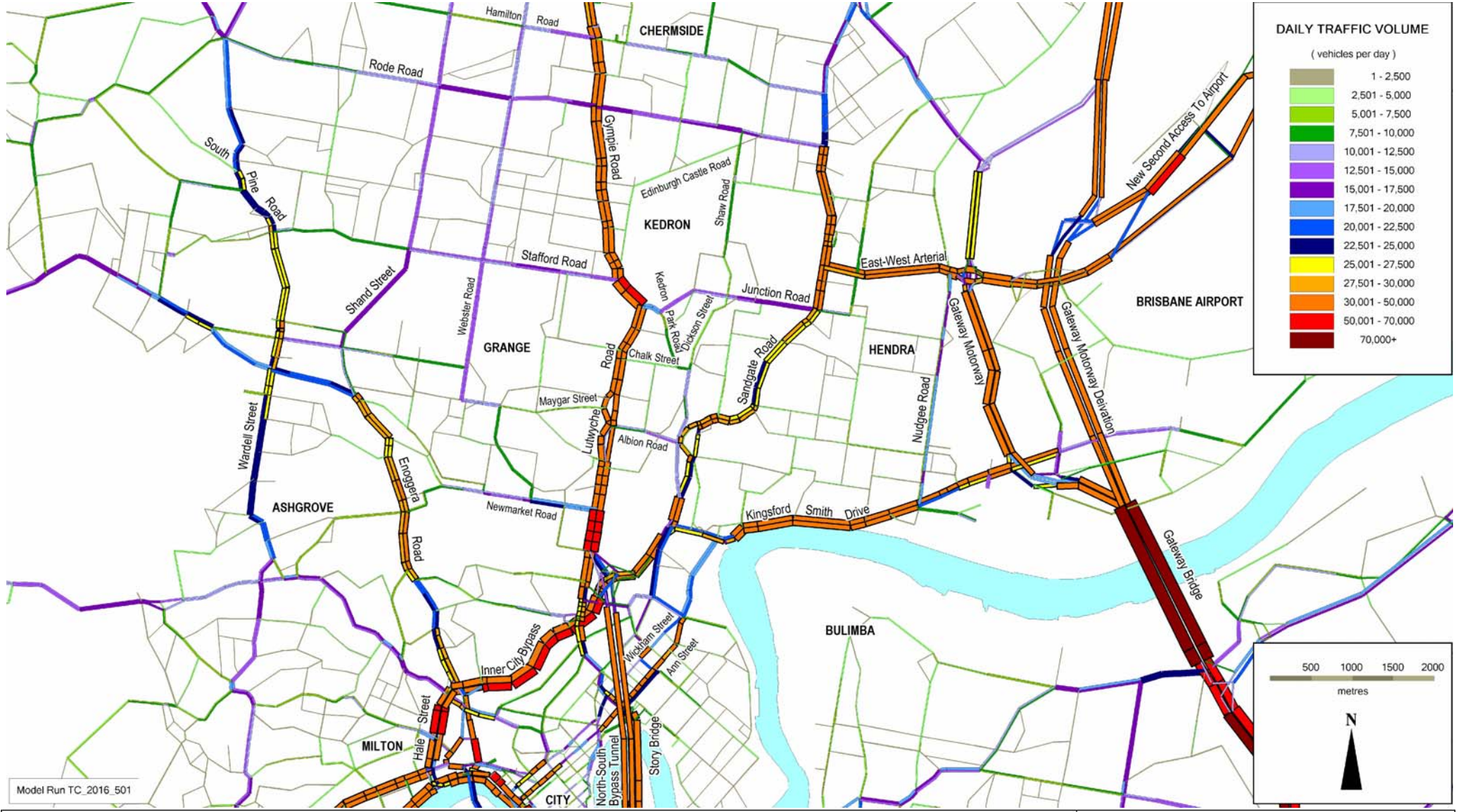


Figure 7-2
2016 Average Weekday Traffic Volumes
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 7-3
2022 Average Weekday Traffic Volumes
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 7-4
2026 Average Weekday Traffic Volumes
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Table 7-3 Forecast Traffic Growth on Key Roads Without Project

ID	Road	Location	2004	Average Weekday Traffic			
				2012		2026	
			Observed	Forecast Volume	% Growth (1)	Forecast Volume	% Growth (1)
Motorway							
14	East West Arterial	East of Widdop Street, Toombul	35,000	59,100	69%	74,500	113%
Arterials							
1	Gympie Road	North of Hamilton Road, Chermside	70,000	82,700	18%	90,200	29%
3	Gympie Road	North of Rode Road, Chermside	60,000	79,000	32%	86,600	44%
50	Gympie Road	Kedron Brook Bridge, Kedron	72,100	99,600	38%	107,500	49%
17	Lutwyche Road	South of Kedron Park Road, Kedron	54,600	68,200	25%	71,500	31%
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	59,600	74,250	25%	77,500	30%
38	Bowen Bridge Road	South of O'Connell Terrace, Herston	57,000	51,200	-10%	56,700	-1%
13	Sandgate Road	North of Schulz Canal, Toombul	52,000	66,800	28%	72,700	40%
22	Sandgate Road	South of Junction Road, Clayfield	37,000	51,150	38%	60,700	64%
31	Sandgate Road	South of Bonney Avenue, Albion	35,900	57,250	59%	71,000	98%
2	Rode Road	West of Gympie Road, Chermside	19,500	29,800	53%	33,200	70%
5	Rode Road	West of Sandgate Road, Wavell Heights	19,300	24,650	28%	28,100	46%
10	Stafford Road	West of Richmond Street, Kedron	23,000	26,700	16%	29,100	27%
8	Stafford Road	West of Webster Road, Stafford	22,000	24,600	12%	25,000	14%
18	Kedron Park Road	East of Lutwyche Road, Kedron	17,600	34,950	99%	39,900	127%
20	Rose Street	Melrose Park, Wooloowin	10,700	24,600	130%	26,700	150%
23	Junction Road	West of Sandgate Road, Clayfield	18,200	29,850	64%	32,600	79%
49	Hale Street	North of Milton Road, Petrie Terrace	78,000	84,200	8%	81,700	5%
41	ICB	West of Bowen Bridge Road, Herston	75,000	100,500	34%	111,200	48%
37	Kingsford Smith Drive	East of Racecourse Road, Hamilton	54,900	71,000	29%	76,400	39%
46	Wickham Street	West of Brookes Street, Fortitude Valley	26,000	30,300	17%	36,500	40%
47	Ann Street	West of Brookes Street, Fortitude Valley	25,000	30,900	24%	39,300	57%

ID	Road	Location	2004	Average Weekday Traffic			
				2012		2026	
			Observed	Forecast Volume	% Growth (1)	Forecast Volume	% Growth (1)
43	Montpelier Road	West of Breakfast Creek Road. Bowen Hills	15,000	28,600	91%	36,900	146%
48	Gipps Street	North of Wickham Street, Fortitude Valley	53,000	42,200	-20%	46,900	-12%
7	South Pine Road	Kedron Brook, Everton Park	33,800	49,300	46%	59,100	75%
25	Enoggera Road	South of South Pine Road, Alderley	50,400	57,900	15%	73,900	47%
Suburban and District Roads							
4	Hamilton Road	West of Sandgate Road, Wavell Heights	15,200	21,500	41%	24,100	59%
19	Kedron Park Road	South of Park Road, Wooloowin	9,500	11,800	24%	14,800	56%
29	Albion Road	East of Lutwyche Road, Windsor	15,100	19,900	32%	23,700	57%
30	Albion Road	At overpass, Albion	17,000	22,500	32%	27,500	62%
12	Shaw Road	Kedron Brook, Wooloowin	14,100	15,800	12%	18,500	31%
28	Chalk Street	West of Bridge Street, Wooloowin	10,700	14,400	35%	19,000	78%
26	Maygar Street	West of Lutwyche Road, Windsor	8,300	8,100	-2%	10,600	28%
9	Webster Road	South of Stafford Road, Stafford	25,100	26,600	6%	32,700	30%
24	Dickson Street	North of Wride Street, Wooloowin	10,400	11,700	13%	13,000	25%

Table Note: (1) Percentage growth compared to 2004.

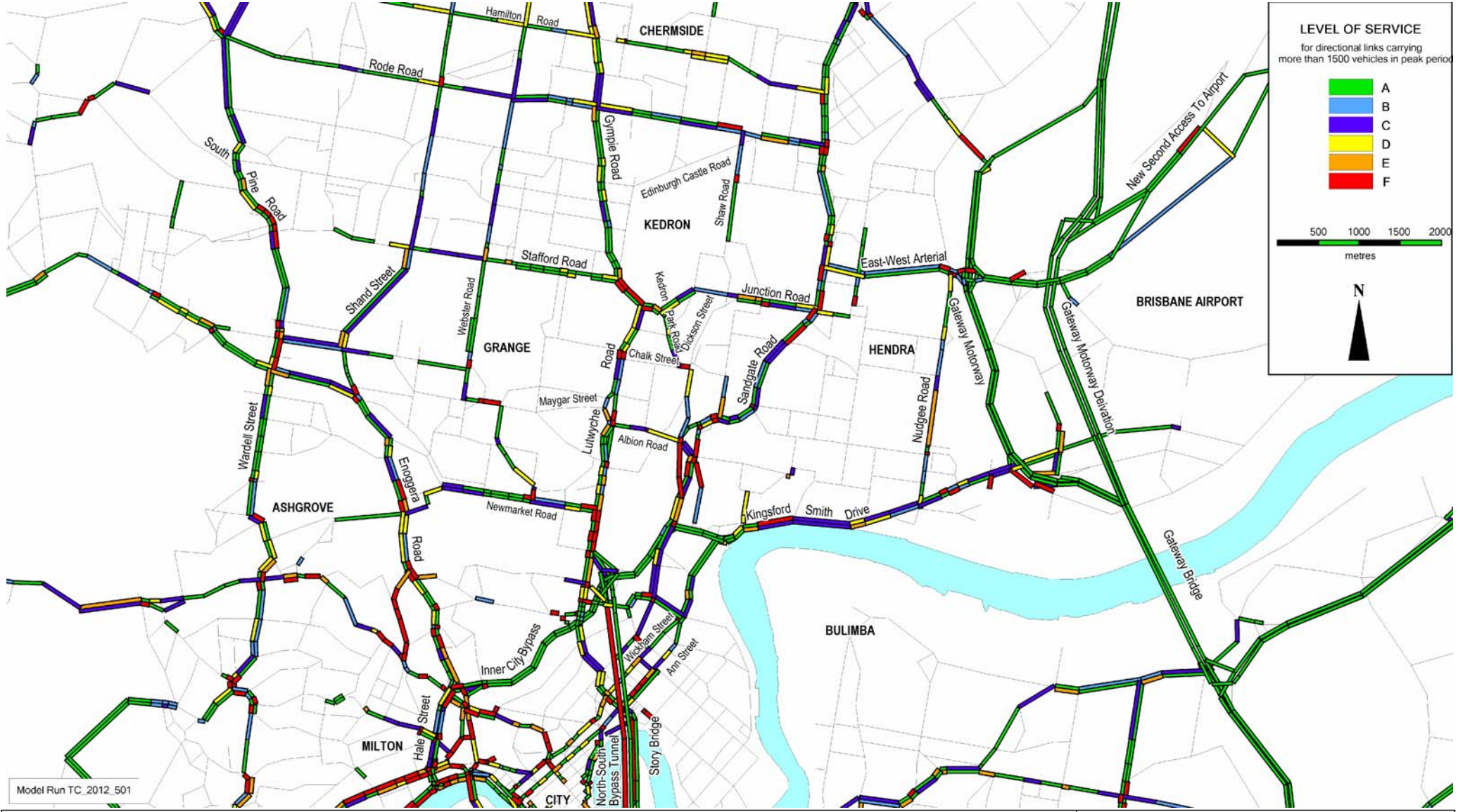


Figure 7-5
2012 AM Level of Service
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

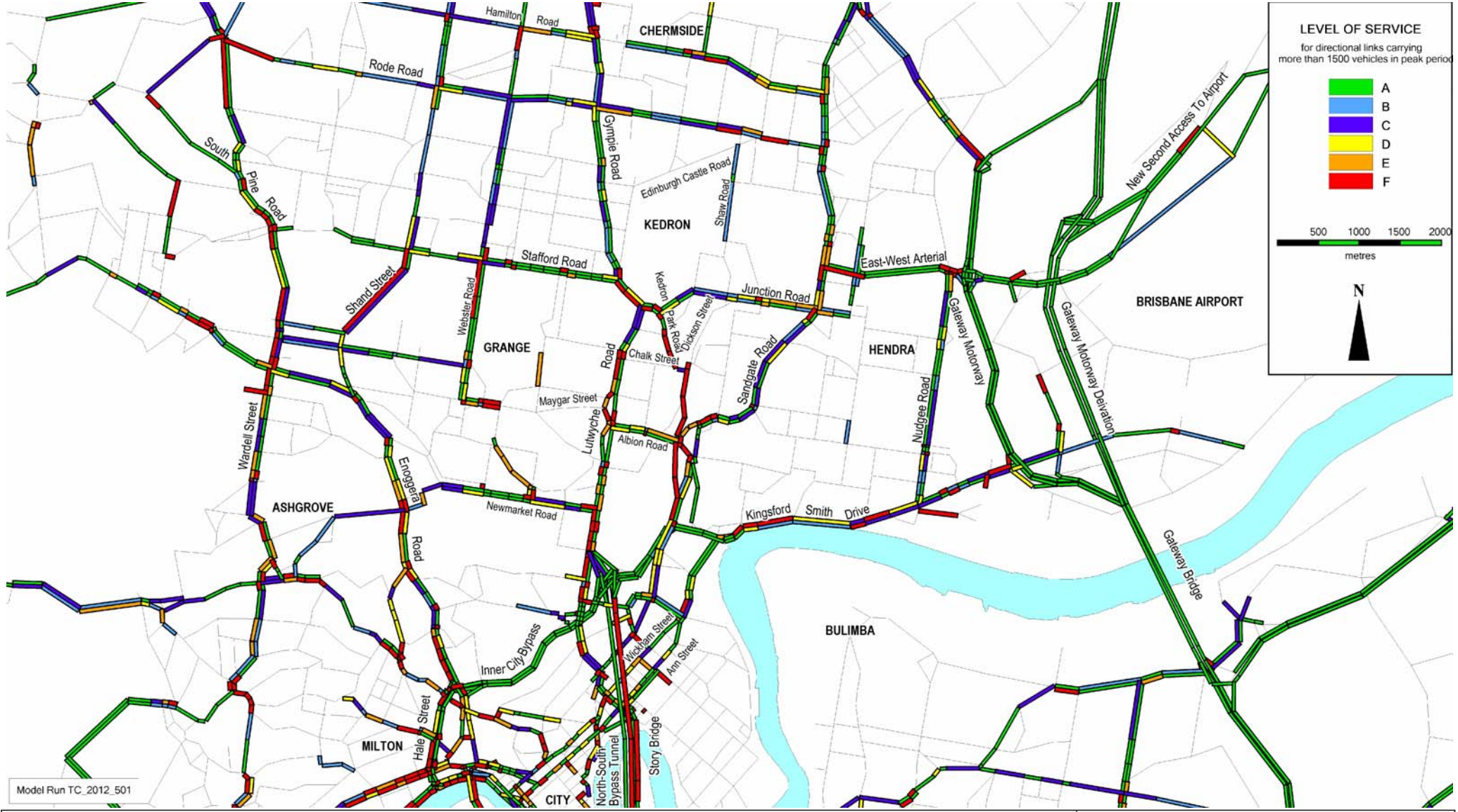


Figure 7-6
2012 PM Level of Service
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 7-7
2026 AM Level of Service
Without Airport Link

Airport Link

SKM Connell Wagner
JOINT VENTURE

BRISBANE CITY

Figure 7-8
2026 PM Level of Service
Without Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

- **Table 7-4 Intersection Performance without Airport Link – 2012 & 2022**

Intersection	Peak	2004 LOS	2012		2022	
			Max DOS (X)	LOS	Max DOS (X)	LOS
Gympie Road Intersections						
Gympie Road/Strathmore Street/Castle Street	AM	B	0.72	A	0.80	A
	PM	C	0.78	A	0.91	A
Gympie Road/Sadlier Street	AM	A	0.89	B	0.91	B
	PM	F	0.74	B	0.80	A
Gympie Road/Stafford Road	AM	D	1.00	C	1.00	D
	PM	E	1.14	F	1.20	F
Stafford Road Intersections						
Stafford Road/Webster Road	AM	F	1.13	F	1.19	F
	PM	D	1.06	F	1.17	F
Stafford Road/Clifford Street	AM	A	0.67	A	0.79	B
	PM	A	0.82	A	1.00	A
Stafford Road/Lennon Street	AM	A	0.51	A	0.57	A
	PM	A	0.52	A	0.62	A
Stafford Road/Richmond Street	AM	A	0.52	C	0.58	C
	PM	B	0.60	C	0.77	C
Lutwyche Road Intersections						
Lutwyche Road/Kedron Park Road	AM	C	0.99	D	1.12	F
	PM	F	1.12	F	1.09	F
Lutwyche Road/Norman Avenue/Norman Street	AM	A	0.59	A	0.84	C
	PM	A	0.66	B	0.89	C
Lutwyche Road/Bradshaw Street	AM	D	0.93	C	0.91	C
	PM	B	1.00	C	1.24	F
Lutwyche Road/Chalk Street/ Thistle Street	AM	E	1.13	E	1.13	F
	PM	B	1.01	C	1.00	E
Lutwyche Road/Maygar Street	AM	C	0.62	B	0.69	C
	PM	D	1.08	F	1.18	F
Lutwyche Road/Fosbery Street	AM	C	0.56	A	0.59	B
	PM	B	0.42	A	0.47	A
Lutwyche Road/Albion Road	AM	B	1.00	D	1.00	D
	PM	B	1.01	F	1.12	F
Lutwyche Road/Bowen Street	AM	A	0.79	A	0.83	A
	PM	A	0.89	A	0.99	C
Lutwyche Road/Eildon Street/ Le Geyt Street	AM	A	0.83	A	0.87	A
	PM	A	0.90	A	0.99	C
Lutwyche Road/Grantson Street	AM	A	0.91	A	0.97	B
	PM	A	0.99	C	1.09	F
Lutwyche Road/Newmarket Road	AM	D	1.00	E	1.07	F
	PM	C	1.28	F	1.42	F
Lutwyche Road/Federation Street	AM	F	0.99	D	1.13	F
	PM	A	1.09	E	1.04	E
Lutwyche Road/Northey Street	AM		1.03	E	1.17	F
	PM		1.33	F	1.34	F

Intersection	Peak	2004 LOS	2012		2022	
			Max DOS (X)	LOS	Max DOS (X)	LOS
Bowen Hills and Fortitude Valley Intersections						
Bowen Bridge Road/Butterfield Street	AM	E	0.97	D	1.03	E
	PM	D	1.45	F	1.54	F
Bowen Bridge Road/Campbell Street	AM	A	0.67	A	0.74	A
	PM	B	1.08	F	1.16	F
Bowen Bridge Road/O'Connell Terrace	AM	B	0.84	C	0.94	D
	PM	B	1.10	F	1.20	F
Bowen Bridge Road/Herston Road	AM	C	0.86	D	0.85	D
	PM	C	0.84	D	0.88	D
Bowen Bridge Road/Gregory Terrace/Brunswick Street	AM	F	1.00	D	1.00	D
	PM	D	1.00	E	1.00	E
Brookes Street/Markwell Street/St Pauls Terrace	AM	C	1.00	D	1.00	E
	PM	C	1.03	E	1.00	E
Brookes Street/Gregory Terrace	AM	C	0.42	C	0.52	C
	PM	B	0.69	C	0.73	C
Brookes Street/Wickham Street	AM	B	0.90	C	1.02	E
	PM	B	1.03	E	1.05	E
Campbell Street/Mayne Road/ Hamilton Place	AM	D	0.38	D	0.40	D
	PM	D	0.59	D	0.60	D
Brookes Street/Ann Street	AM	B	0.55	A	0.52	A
	PM	B	0.34	B	0.43	B
Breakfast Creek Road/ Montpelier Road	AM	E	1.27	F	1.24	F
	PM	E	1.01	F	1.11	F
Bridge Street/Chalk Street	AM	B	0.60	B	0.68	B
	PM	B	0.62	B	0.81	B
Sandgate Road Intersections						
Sandgate Road/Toombul Station (Parkland Street)/Union Street/Grace Street	AM	C	0.93	C	1.10	F
	PM	D	1.01	E	1.13	F
Sandgate Road/Centro Toombul	AM	B	1.00	D	1.00	D
	PM	B	1.00	D	1.08	F
Sandgate Road/East-West Arterial Road	AM	F	1.06	F	1.24	F
	PM	E	1.11	F	1.22	F
Sandgate Road/Junction Road	AM	F	1.28	F	1.39	F
	PM	E	1.33	F	1.36	F
Sandgate Road/Oriel Road	AM	B	0.88	B	0.88	B
	PM	A	0.70	B	0.86	B
Sandgate Road/Lapraik Street	AM	A	0.91	B	1.05	E
	PM	A	0.99	C	1.05	E
Sandgate Road/Bonney Avenue	AM	C	1.00	E	1.06	F
	PM	A	1.11	F	1.18	F

Intersection	Peak	2004 LOS	2012		2022	
			Max DOS (X)	LOS	Max DOS (X)	LOS
Sandgate Road/Albion Road	AM	F	0.99	F	1.52	F
	PM	E	1.86	F	2.16	F
Sandgate Road/FrodshamStreet/Crosby Road/Abbotsford Road (Albion Fiveways)	AM	F	1.01	E	1.12	F
	PM	D	1.32	F	1.43	F
Abbotsford Road Intersections						
Abbotsford Road/Burrows Street	AM	C	0.81	C	0.88	C
	PM	D	0.91	B	0.93	C
Abbotsford Road/ Edmondstone Road/Mayne Road	AM	C	0.88	B	0.89	B
	PM	F	1.46	F	1.50	F
Abbotsford Road/Folkestone Street	AM	A	0.88	A	1.05	A
	PM	A	0.91	B	1.02	E
Abbotsford Road/Montpelier Road/Markwell Street/ Campbell Street	AM	C	1.09	F	1.18	F
	PM	C	1.24	F	1.10	F
Kingsford Smith Drive Intersections						
Kingsford Smith Drive/Amy Street/Breakfast Creek Road	AM	B	0.95	D	1.17	F
	PM	B	1.03	F	0.94	D
Kingsford Smith Drive/ Cooksley Street	AM	F	0.88	B	0.95	C
	PM	F	1.18	F	1.27	F
Kingsford Smith Drive/Nudgee Road/Remora Road	AM	C	1.32	F	1.74	F
	PM	D	1.31	F	1.46	F
Local Area Intersections						
Albion Road/McLennan Street	AM	C	0.73	C	0.96	D
	PM	B	0.99	A	1.00	A
Albion Street/Hudson Road	AM	F	0.92	D	1.06	F
	PM	F	1.12	F	1.29	F
Junction Road/Morrison Road	AM	C	0.98	D	1.04	F
	PM	E	1.00	D	1.00	D
Dawson Street/Rose Street	AM	C	0.56	B	0.63	B
	PM	C	0.96	C	1.00	D
Kedron Park Road/Park Road	AM	C	0.86	C	0.95	D
	PM	C	1.11	F	1.12	F

Table Note: (1) Cycle times as per 2004 with optimum phase times calculated within aaSIDRA.

8. Traffic and Transport Need

8.1 Background

The agencies responsible for traffic and transport planning within Brisbane City are the Brisbane City Council and the transport portfolio within the Queensland Government, represented by the Department of Main Roads (DMR) and Queensland Transport (QT). These agencies have examined both transport policy and the need for improvements in transport infrastructure for all travel modes, over many years, within the overall Metropolitan area and also specifically within the inner northern suburbs.

Airport Link has been identified by both the Brisbane City Council and the State Government in recent planning as a key component in an overall strategy to improve the efficiency of Brisbane's road network, consistent with long-term regional and city wide transport planning objectives.

The project forms part of Project TransApex, Brisbane City Council's proposed tri-axis based framework of strategic road connections that would allow Brisbane's cross-city travel movements to bypass the Central Business District (CBD) and inner suburbs using a high quality toll-road alternative to the surface road system.

Airport Link is highlighted in the South East Queensland Infrastructure Plan and Program (SEQIPP) as a potential road infrastructure improvement that would provide relief to congested road links, connect activity centres and provide a sound basis for future traffic management within the Brisbane Metropolitan Area.

In summary, the primary objectives of Airport Link are to provide relief to congested roads in Brisbane's northern suburbs, connect activity centres and provide a sound basis for future traffic management by linking to strategic road connections allowing cross-city travel movements to bypass the Central Business District and inner suburbs.

This section reviews these primary objectives and the ability of Airport Link to meet these needs, using the findings of previous chapters, and is based upon:

- A review of the effect of changes in travel demand due to population, employment and land-use characteristics in the metropolitan area;
- An assessment of the capacity and performance of the existing transport network, now and in the future;
- The context of the project with regard to land-use, transport planning and policy initiatives being considered by Council and the State to cater for growth.

8.2 Demographic Factors

South East Queensland has experienced high and sustained population growth since the 1980's, averaging over 2.6% pa, and is Australia's fastest growing region. The South East Queensland Regional Plan 2005 – 2026 (OUM, 2005) was developed to provide a sustainable growth management strategy for SEQ to the year 2026.

The region's population is heavily urbanised and the Brisbane Metropolitan area (or BSD) currently accounts for approximately two-thirds of the population. Brisbane City's population share is 36% of the region's total and Brisbane City also dominates as the major employment centre for the region.

Population projections available for use in the traffic and transport modelling in this study are outlined in **Section 6.1.1**. Whilst population projections for three ranges of growth outcomes (low, medium and high) have been prepared, the transport demand forecasts in this study have been based a most likely recent outlook, provided by the ABS as a medium series projection for the Brisbane Metropolitan area. This projection is

summarised in **Table 8-1**, together with historic growth in the Metropolitan Area which has been over 2% pa. A sustained growth rate in population and trip making at an average of 1.7% per annum until 2026 is forecast for the future.

Table 8-1 Brisbane Metropolitan Area Population Growth

Year	Population (million) (1)	Average Weekday Total Person Trips (million) (2)	Growth Rate
1986	1.22	4.2 million	-
2004	1.77	6.1 million	1986 to 2004 2.1% pa
2026	2.58	8.8 million	2004 to 2026 1.7% pa

Table Notes:

(1) Source: Australian Bureau of Statistics population projection for the Medium Growth Series.

(2) Trips by all modes including walk/cycle.

The pattern of residential population growth forecast across the metropolitan area will be varied. The main influences will be growth due to new development in the outer areas, combined with increases in residential densities in inner areas where urban renewal occurs and transit-oriented developments emerge.

Over half a million additional jobs are forecast to be created in the Metropolitan area between 2004 and 2026. Brisbane City is expected to remain the major employment centre for SEQ, however the growth in new jobs will not be evenly distributed within the Metropolitan area. Many new jobs will be located on the fringe areas such Ipswich, Logan and Caboolture. There will however also be key employment nodes created, associated with the major proposed new industry and business development, for example in the Australia TradeCoast area, which includes Brisbane Airport. The resultant pattern of employment distribution in the Metropolitan area will be more decentralised than the current situation, however employment in the Central City area will also continue to grow and it will remain the sole largest employment area in South East Queensland.

8.3 Future Travel Demand

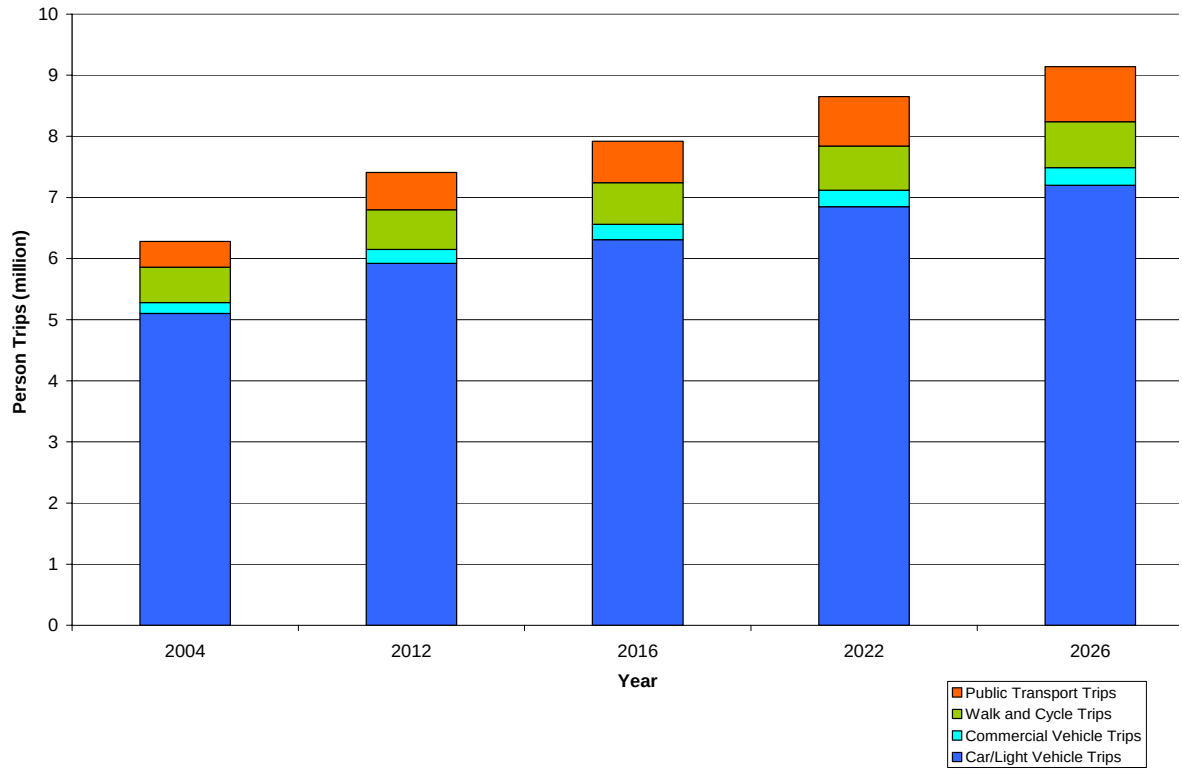
The key demographic growth characteristics as described in **Section 8.2** will manifest as a growth in the demand for trip making and changes in the pattern of trip distribution (the locations between which trips are made). Growth in travel demand does not have to be accommodated by vehicle travel alone. The importance of sustainable transport planning, including increasing the number of trips made by walk/cycle and public transport modes, has been recognised by the State Government and Council in their transport policy, transport infrastructure and investment programs. The Regional Plan, Council's Transport Plan for Brisbane 2002-2016 and the draft TransLink Public Transport Network Plan all incorporate a significant emphasis on promoting public transport use, walking and cycling as core strategies in catering for travel demand within a connected and accessible region.

Despite a concerted effort over the last 15 years to significantly increase use of public transport, walking and cycling modes, the majority of trips in the Brisbane Metropolitan area are made by private and commercial vehicle. The SEQ Travel Survey in 2003/04 indicated that motorised trip making accounted for 80% of all internal travel (increasing from 77% obtained from a similar survey in 1992), public transport trip use accounted for a further 8% of travel (slightly higher than in 2002), and around 12% of travel demand was represented by walk and cycle (decreased compared to the earlier survey). It should be noted that there has been an actual growth in the number of public transport trips in recent years, particularly with introduction of major infrastructure initiatives such as the South East Busway and Inner Northern Busway.

As discussed in **Section 6.2.2**, in forecasting future travel demand the effect of proposed public transport initiatives, either planned or under consideration by Council and State, has been incorporated in the estimation of future travel demand, as transport planning needs to encourage less reliance on private vehicle travel. The alternative approach, to assume a continuation of current trend of public transport use, was examined as a sensitivity test. By 2026 the increased public transport patronage, would represent a doubling of current levels to over 900,000 public transport trips per weekday. The reduction in vehicle trips in the network with enhanced public transport is estimated as 4% compared to a trend public transport situation (where public transport would account for between 7% and 8% of travel demand)

Figure 8-1 summarises the estimated growth in the travel task (in terms of person trips) by the various travel modes – vehicle, public transport, and walk/cycle travel. This demonstrates how travel demand is forecast to grow in a sustained manner across all modes. **Table 8-2** summarises the resultant increase in travel demand for vehicular travel on the road network. This indicates that even with enhanced mode share for public transport, an increase in vehicle trips is forecast (from 3.8 million trips per average weekday, including commercial vehicles in 2004 in the Brisbane Metropolitan area, population 1.77 million, to 4.8 million trips by 2016, an increase of 26%). By 2026, with a forecast population of 2.58 million in the metropolitan area, total travel demand including commercial vehicles is forecast to be 45% higher than current levels, reaching 5.5 million vehicle trips on an average weekday.

- **Figure 8-1 Forecast Growth in Average Weekday Travel Demand Within Brisbane Metropolitan Area (Person Trips)**



Whilst the assessment provides a perspective on the significance of the increased quantum of vehicular travel demand to be catered for within the overall Brisbane Metropolitan area, a specific assessment has also been carried out of the forecast growth in travel demand to key travel generators within the immediate catchment of Airport Link. Both regions will experience additional vehicle travel demand compared to 2004 levels, with the Central City forecast to increase by over 55%, and the ATC North region by over 300%.

Table 8-2 The Motorised Travel Task with Improved Public Transport within the Brisbane Metropolitan Area

Parameter	2004	2012	2016	2022	2026
Person Trips by Motorised Travel Modes(1) (million)	5.52	6.53	6.99	7.66	8.09
Estimated Public Transport Person Trips (million)	0.42	0.61	0.68	0.81	0.90
% PT Trips	7.5%	9.3%	9.7%	10.5%	11.1%
Car/Light Vehicle Trips (million)	3.61	4.24	4.53	4.94	5.22
Commercial Vehicle Trips (million)	0.18	0.23	0.25	0.27	0.29
Total Vehicle Trips	3.79	4.47	4.78	5.21	5.51
% increase in total vehicle travel compared to 2004	N/a	18%	26%	37%	45%

Table Note: (1) Includes travel to and from locations outside the BSD

Figure 8-2 illustrates the growth in vehicle demand within the Central City sector and the sector to the east of the study area which incorporates the ATC North area including Brisbane Airport. This highlights the fact that in that in relative terms the vehicle travel demand associated with the ATC North area will grow from a level of under 40% of the Central City generation to almost 80% of that associated with the Central City, and in absolute terms greater than the generation of that area as shown in 2004.

8.4 Road Network Structure

Under the pressure of catering for increases in vehicle travel demand within the metropolitan area network, and the key travel generators within and surrounding the Airport Link corridor, an assessment of travel on the road network has been carried out. This is described in detail in **Section 7**.

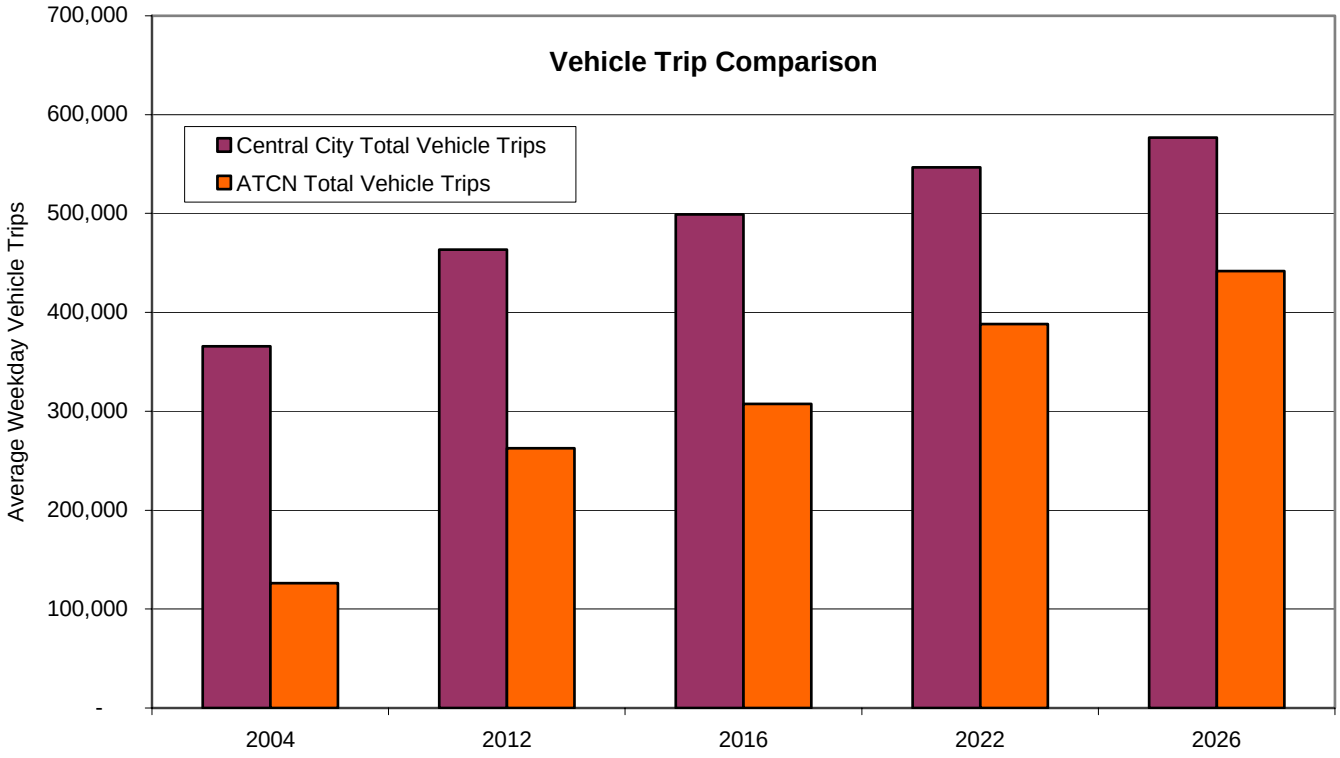
With increased demands and higher congestion levels, there is a general decline predicted in the level of service on the road network across the years. Peak period journey travel times are forecast to increase significantly compared to the current level.

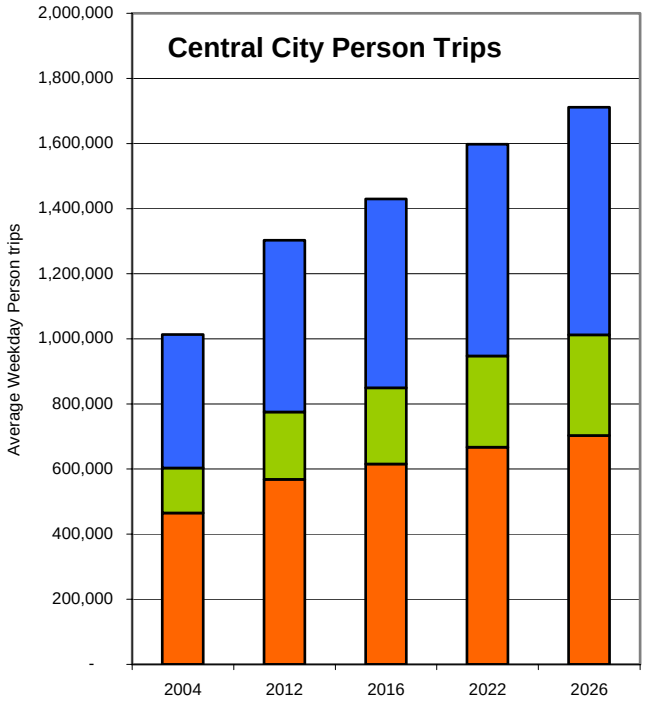
For example, without the project, even with enhanced mode share to public transport, traffic conditions on the Lutwyche Road/Gympie Road corridor are forecast to deteriorate over time. Traffic volumes through the Lutwyche shopping precinct would grow by over 30% by 2026.

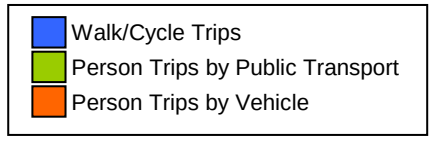
Figure 8-3 provides examples of the forecast decline in travel speed for two examples of typical journeys through the Inner North area. By 2016 for a peak period trip from Chermside to Fortitude Valley, an average travel speed of 25 km/hr is forecast (compared to 31 km/hr currently), declining to less than 20 km/hr by 2026. A more severe deterioration is forecast for the PM peak, with forecast 2026 northbound PM peak speed of only 14 km/hr.

Similarly on Sandgate Road even greater growth would occur due to its proximity to the ATC precinct and its connecting role to the Brisbane CBD, the Metropolitan area's other major economic activity area. Almost a doubling of current traffic levels is likely by 2026, and a sharp decline in level of service would be associated with this demand growth. A morning peak period southbound trip from Hendra to Milton in 2026 would experience an average travel speed of 27 km/hr (compared to 40 km/hr currently), with the PM peak speed of only 20 km/hr for the northbound trip.

Assessment of travel demand in Brisbane's inner north indicates that on the arterial roads currently about 60% of trips are cross-city, 35% are destined for the Central City with only 5% local traffic. Much of the traffic congestion in the arterial network in the inner north Brisbane's radial road system is caused by traffic wanting to get "somewhere else" but being forced to use the roads through the suburbs.







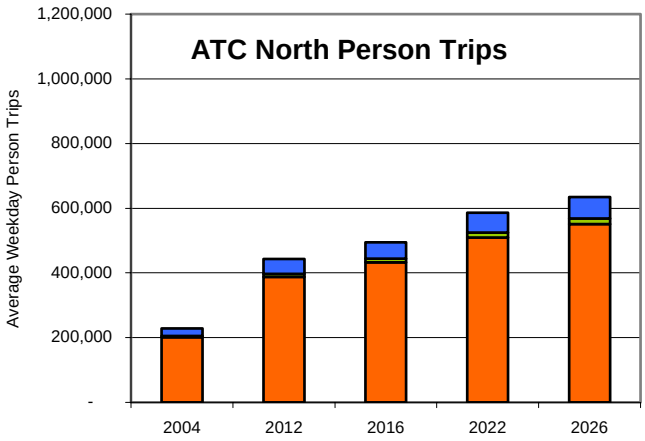


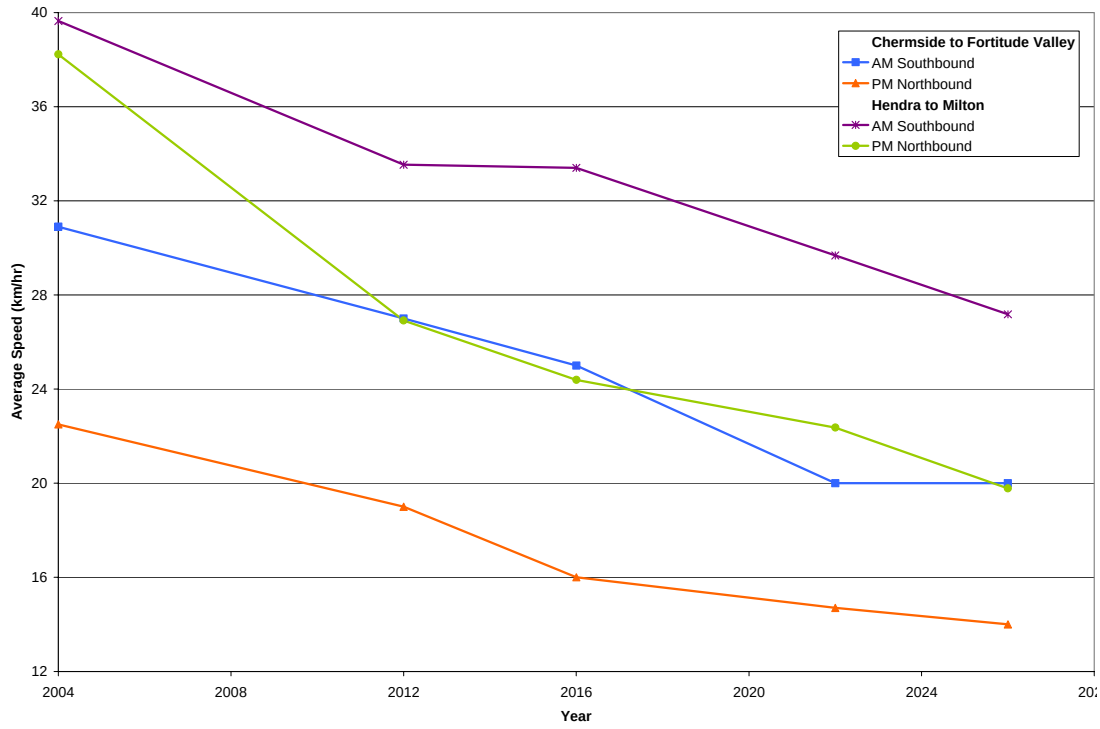
Figure 8-2
Comparison of Central City and ATC North Travel Demands

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 8-3 Forecast Decline in Travel Speed on Key Routes Without Airport Link



Increasing levels of congestion on the road network will have a range of consequences:

- People suffer due to wasted travel time and increased fuel costs;
- The environment is degraded due to emissions;
- Public transport users in buses suffer due to delays and unreliability;
- Local amenity and safety for street system users such as pedestrians and cyclists is diminished;
- Both industry and the community are impacted by higher transport costs for goods and services;
- Businesses and residents in inner areas served by the congested networks experience restrictions to their accessibility; and
- Community safety and security is compromised due to delays for emergency vehicles.

All modes of travel have a role to play in supporting the projected population and employment growth in South East Queensland within an urban form that minimises the incidence of transport disadvantage, and encourages people to make more walk, cycle and public transport trips.

8.5 Development of Airport Link as a Solution

Within the Inner North area a range of transport improvements have been implemented over many years as a result of past investigations by Brisbane City Council and the State Government in consultation with the community.

Examples of key transport projects completed over the last 15 years include provision of an inbound T3 lane on parts of Lutwyche Road to improve public transport operations, the opening of AirTrain to provide high quality public transport access to Brisbane Airport, the construction of the Nundah Bypass road tunnel to reduce traffic congestion and improve the amenity of the Nundah shopping and business precinct, the implementation of an

East-West Arterial road to connect Sandgate Road to the Gateway Arterial, and on-going enhancements to major pedestrian/cycle paths including those along Kedron Brook and Enoggera Creek. Arterial traffic management works have occurred on the north-south roads, Gympie-Lutwyche Road and Sandgate Road, including progressive increases in the number of signalised intersections with side-streets, signal co-ordination and road safety treatments. In various areas local area traffic management schemes have been implemented to protect local precincts from intrusion by through traffic seeking to avoid congestion on the arterial routes. Examples include the Windsor east and Ascot/Hamilton areas. South of the study corridor, the Inner City Bypass, opened in 2002, provides a strong orbital connection immediately north of the Central City to remove east-west through traffic from the CBD and Fortitude Valley.

These transport infrastructure initiatives have benefited both the local community and the wider travelling public within the Brisbane area. However the pressures of growth in population and travel generation associated with activity centres (as identified in the SEQ Regional Plan) within, and adjacent to, the Inner North area is placing increasing pressure on the transport system, and in particular the area's road network.

As defined in the SEQ Regional Plan (OUM, 2005), the Brisbane CBD, immediately to the south of the Airport Link corridor is the SEQ region's Primary Activity Centre. Chermside nearby to the north is a Principal Activity Centre with its major regional shopping complex. The Royal Brisbane Hospital is a Specialist Activity node and the retail complex at Toombul a Major Activity Centre. To the east, Brisbane Airport is a Specialist Activity Centre and the Australia TradeCoast precinct an area of major economic importance to the region.

Over 40 years ago when Brisbane's first major transport network planning study, the Brisbane Transportation Study (Wilbur Smith and Associates, 1965) was conducted, the metropolitan area's population was about one-third of the current level of 1.8 million people. Even then, a need to provide for a high quality road connection extending from Bowen Hills, via Windsor, Wavell Heights and Zillmere, to the City boundary was foreshadowed. Much of this route bisected the corridor between Lutwyche Road-Gympie Road and Sandgate Road, and the capacity limitations of these historic arterial road routes were recognised.

While some of the original major road network concepts identified for Brisbane in this 1960's study proceeded (such as the South East Freeway during the 1970's, parts of the Western Freeway in the early 1980's and the Gateway Bridge and Arterial in 1986), no implementation of major improvements to the north-south arterial road network in inner north Brisbane have occurred.

Brisbane City Council's Transport Plan for Brisbane 2002-2016 (BCC, 2003) examined the challenges facing Council in keeping their transport network operating effectively into the future, and supporting the Vision of Living in Brisbane in 2010. From this comprehensive strategic analysis of the transport system, the importance of addressing gaps in the strategic road network and strengthening the structure by creating an orbital road system in Brisbane (including additional cross river road capacity) emerged. Providing a safe and efficient road network was one strategic objective within the integrated plan. The Transport Plan 2002-2016 also included strategic improvements to public transport (bus and rail) and pedestrian/cycle initiatives to achieve desired outcomes, including greater public transport mode share, under the pressure of population growth in the metropolitan area.

Key road network improvements proposed in the Transport Plan were:

- A connection between the Inner City Bypass to South East Freeway, termed the North-South Bypass Tunnel Stage 1. This was a cross-river link to complete the inner city orbital road network by linking the Pacific Motorway through to Lutwyche Road and the Inner City Bypass; and

- Connections between the Inner City Bypass and Gympie Road, and Gympie Road and the East-West Arterial, referred to in that document as Stages 2 and 3. These road links were identified as necessary connections for a middle orbital road system.

Project TransApex, released in 2005, then further developed Council's aspiration of an enhanced road network structure for Brisbane to support economic and liveability outcomes. Connections proposed within Project TransApex are shown schematically in **Figure 1-3**. They were examined in detail in the TransApex Pre-Feasibility Study (Brisbane City Council, 2005) and are:

- The North-South Bypass Tunnel – Construction is due to commence on the NSBT in the latter half of 2006. The facility is expected to be open for traffic use by 2010;
- The proposed Airport Link – Connects to northern end of the NSBT, and provides connectivity to Brisbane Airport. This project is the subject of this EIS investigation, and if approved to proceed, could open in 2012;
- The Northern Link – a cross-town tunnel linking the Western Freeway with the Inner City Bypass. The timing of this proposal is still subject to further investigation;
- The East West Distributor – a cross-river tunnel linking the Pacific Motorway and eastern suburbs to the Western Freeway and mid-west region. The timing of this proposal is still subject to further investigation; and
- A Hale Street–South Brisbane Link - a cross-river connection between Milton and South Brisbane. A feasibility study on this proposed project is in progress during 2006.

Council's Transport Plan is currently being updated building upon the previous transport network strategies to incorporate TransApex and SEQIPP initiatives.

The State Government's SEQ Regional Plan and the associated SEQ Infrastructure Plan and Program describe infrastructure components that have been determined during the Regional Plan development to be supportive of compact urban form, connectivity and accessibility in South East Queensland. Managing traffic within Brisbane has been identified as vital, requiring quality orbital road systems to provide a bypass for cross-city traffic away from congested areas. This means that capacity on arterial routes can be freed up to allow enhanced public transport services and support for walking and cycling. New public transport corridors with a focus on linking activity centres and opening up new public transport markets are also important.

SEQIPP acknowledges the potential role of TransApex in supporting the regional plan objectives, with specific in-principle support for the NSBT, support for the Airport Link feasibility investigations and recognition of the potential for Northern Link to ease traffic congestion of the western city transport corridors.

SEQIPP also includes funding for the staged implementation of the Northern Busway, linking from the Inner Northern Busway at Herston to Aspley and Bracken Ridge, within the public transport connections program for the Greater Brisbane Area with full delivery by 2026. Airport Link provides the opportunity for staged implementation of the Northern Busway between Herston and Kedron. With Airport Link traffic volumes will be significantly reduced on Lutwyche Road, and sections of the corridor will have surplus road capacity which could cost-effectively be re-allocated to public transport priority use, prior to construction of the Ultimate Busway.

8.6 Strategic Need for Airport Link

Airport Link can improve the road network and fill in gaps in the current structure by fulfilling important transport functions within the road network and various key movement roles as follows:

- Airport Link will function as an intra-state road network connection, linking to other motorway standard connections, catering for long distance movements between major economic regions within South East Queensland, by linking the Brisbane CBD with the ATC precinct including Brisbane Airport. It will also provide a linkage between this major economic area and locations external to South East Queensland. It will provide connection alternatives to the Gateway Motorway for the ATC precinct from southern and western areas, via the Airport Link, NSBT, and the Pacific Motorway, or via the Airport Link, NSBT and the Ipswich Motorway.
- Airport Link will support the regional road network providing connections to urban arterial standard roads which link to the intra-state/motorway network. The movements catered for could be radial (providing access to the Inner City) or orbital (providing for movements within the metropolitan area that are not focussed on the CBD but connect significant employment areas and activity centres.)

  Specific examples of Airport Link's regional road network role include:

  - It will provide a connection to the Inner City Bypass and thus the western arterials of Coronation Drive and Milton Road, and the NSBT southern arterials such as Wynnum Road and Logan Road.
  - It will provide an improved standard of arterial orbital route in the middle ring by improving the connectivity of Stafford Road and the East-West Arterial Road compared to the current route along Kedron Park Road-Rose Street- Junction Road, which has sensitive adjoining land-uses.
  - It will supplement radial arterial road capacity, allowing public transport initiatives in the Lutwyche road corridor such as staged implementation of Northern Busway, and improving amenity and road safety for land-uses along the Sandgate Road corridor.

In summary, key transport planning factors underpinning the need for the project are:

- To address strategic gaps in Brisbane's road network. This factor is of increasing importance because the strategic gaps will be exacerbated by growth pressures in the South East Queensland region. There is a need to enhance road links that connect to the intra-state road system and the regionally significant roads that provide for both radial and orbital functions. These improvements are required to facilitate cross-city travel movement in an environment where there is increasing travel demand to major economic activity and employment nodes serving the region such as the Brisbane CBD. Accommodating the growing travel demands of the Australia TradeCoast precinct, including Brisbane Airport is a also a significant influence in shaping a road network structure which will be supportive of the region's economic development.
- To create opportunities to enhance public transport operations on surface roads. Greater use of public transport can be supported by providing opportunities on Lutwyche Road for reclamation of freed up road space from general traffic use for either bus (or HOV) lanes. In particular, potential for a cost-effective staging of the Northern Busway is available. Potential for HOV lanes on Sandgate Road is also created.
- To relieve traffic congestion and improve travel time reliability, particularly for freight vehicles and surface public transport. An effective integrated transport network supports competitiveness of industry and business.
- To improve the travel environment of pedestrians and cyclists on the surface network, by reducing traffic demands on the local road system, particularly through activity centres and near public transport stations. Walking and cycling networks provide flexibility for travel as well as significant health and environmental benefits.

- To protect the amenity of inner urban redevelopment areas, particularly those in close proximity to high quality public transport, from the adverse impacts of vehicular traffic. Consolidation of inner urban areas supports aspirations for a more compact urban form in South East Queensland.

9. Operational Effects

9.1 Introduction

This chapter describes the traffic conditions likely to occur in the future with the project. The changes to traffic conditions in the transport network are assessed for the Brisbane Metropolitan Area and the Inner North area.

Traffic forecasts both without and with the project were prepared for the years 2012 (opening year), 2016, 2022 (10 years beyond opening) and 2026 using the traffic models described in **Section 6**.

The project and its connections, described in detail in **Section 5**, were included in the traffic model. Key elements of the project modelling include:

- A three (3) lane north-south tunnel for each direction of travel between Bowen Hills and Kedron;
- A two (2) lane east-west tunnel for each direction of travel between Toombul and Kedron;
- At the Southern Connection:
  - Two (2) lane connections in each direction between the NSBT and Airport Link;
  - Two (2) lane connections in each direction for travel to/from the ICB west of Bowen Hills;
  - West-facing one (1) lane on and off-ramps to O'Connell Terrace, connecting to an upgraded signalised intersection at Bowen Bridge Road/O'Connell Terrace. Northbound right turns currently permitted at O'Connell Terrace would be accommodated at a revised Bowen Bridge Road/Campbell Street intersection;
  - East-facing one (1) lane on and off-ramps to Campbell Street east, connecting to an upgraded signalised intersection at Campbell Street/Mayne Road/Hamilton Place;
- At the north-western connection:
  - Two (2) lane ramp connections in each direction of travel between Gympie Road north of Stafford Road and Airport Link;
  - One (1) lane ramp connection in each direction of travel between Airport Link and Stafford Road, with the exit ramp grade-separated over the Gympie Road/Stafford Road intersection;
  - An upgraded signalised intersection at Gympie Road and Stafford Road, with the existing number of lanes for surface through traffic movement on Gympie Road maintained;
  - One (1) lane ramp connection in each direction of travel between Gympie Road and the east-west tunnels of Airport Link connecting to an upgraded signalised intersection at Gympie Road/Lutwyche Road/Kedron Park Road. Signal phasing would permit access to and from these east-west ramps either from the north (for Gympie Road and Stafford Road users) or the south (for Lutwyche Road users) The existing number of lanes for surface through traffic movement on Lutwyche Road and Gympie Road at the intersection would be maintained;
- At the north-eastern connection:
  - One (1) lane on-ramp and one (1) lane off-ramp to Sandgate Road, connecting to an upgraded signalised intersection at Sandgate Road/ East-West Arterial. These ramps would cater for movements from north and south on Sandgate Road. The existing number of lanes for surface through traffic movement on Sandgate Road at the intersection would be maintained; and
  - Two (2) lane ramp connections between Airport Link and the East-West Arterial Road in each direction, matching to the existing road alignment following a merging section east of Sandgate Road.

In the Brisbane Metropolitan Area, no changes to the form or capacity of the alternative surface road network to Airport Link have been assumed in the traffic modelling for the base project scenario assessed in this Chapter. For clarity the existing number of lanes along the key surface roads are summarised in **Table 9-1**. The assumptions made about potential surface road changes with implementation of the Northern Busway are addressed separately when considering cumulative effects in **Section 10**.

Table 9-1 Airport Link Surface Road Assumptions

Surface Road Segment	Number of Lanes
Bowen Bridge Road, south of Northey Street: Northbound	3 lanes
Bowen Bridge Road, south of Northey Street: Southbound	3 lanes
Lutwyche Road, Northey St – Newmarket Road: Northbound	4 lanes
Lutwyche Road, Northey St – Newmarket Road: Southbound	4 lanes
Lutwyche Road, Newmarket Road – Fosbery Street: Northbound	3 lanes
Lutwyche Road, Newmarket Road – Fosbery Street: Southbound	2 lanes + T3[2]
Roblane Street: Northbound	Not applicable
Roblane Street: Southbound	1 lane + T3[2]
Lutwyche Road, Fosbery Street – Stoneleigh Street: Northbound	3 lanes
Lutwyche Road, Fosbery Street – Stoneleigh Street: Southbound	1 lane
Truro Street: Northbound	Not applicable
Truro Street: Southbound	3 lanes + T3[2]
Lutwyche Road, Stoneleigh Street – Bradshaw Street: Northbound	2 lanes
Lutwyche Road, Stoneleigh Street – Bradshaw Street: Southbound	2 lanes
Lutwyche Road/Gympie Road, north of Bradshaw Street: Northbound	3 lanes
Lutwyche Road/Gympie Road, north of Bradshaw Street: Southbound	3 lanes
Sandgate Road: Albion Overpass to East-West Arterial: Northbound	2 lanes
Sandgate Road: Albion Overpass to East-West Arterial: Southbound	2 lanes

Table Notes:

1) The lane numbers listed above are typical general traffic through lanes for each road segment. The figures do not include ancillary lanes at intersections (for example, turn pockets).

2) T3 lane on Lutwyche Road operates only in the AM Peak as per existing situation.

A final decision of the tolls to be charged for use of Airport Link will be made by the State Government and Council following assessment of the Business Case for the project. For this EIS study, Airport Link traffic forecasts have been prepared assuming a toll of $3.64 (expressed in June 2006 dollars including GST) for a full (north-south) journey and a $2.43 toll for a part (east-west) journey. These toll levels are within the range under consideration within the Business Case. The journey types are explained in **Section 0**. The full north-south journey toll on Airport Link equates to $3.30 expressed in 2002 dollars, which was the toll value used in the TransApex Prefeasibility Study (Brisbane City Council, 2005).

An enhanced mode share effect for public transport (of 11.1% of motorised trips by 2026) in the Brisbane Metropolitan area, consistent with the implementation of a range of public transport initiatives as described in **Section 6.2.2** has been incorporated in the traffic forecasting.

9.2 Effect on Brisbane Metropolitan Area

9.2.1 Demand for Airport Link

Table 9-2 summarises the forecast Airport Link traffic use. Weekday traffic flows on the Airport Link Project north-south tunnel are forecast as 93,150 vpd in 2026, with an additional 25,750 vpd using the east-west ramps.

Table 9-2 Airport Link Overall Traffic Use Summary – Average Weekday

Project Element	2012 Daily[2]	2026 Daily	2026 Peak Hour vph	% CV[3]
North-South Tunnel	72,850 (51,000)	93,150	4,400 AM S/B 5,700 PM N/B	8.8%
East-West Ramps	23,350 (16,400)	25,750	1,000 AM E/B 1,200 PM W/B	6.9%
Total Airport Link	96,200 (67,400)	118,900	-	8.3%

Table Notes:

(1) Average Weekday Traffic Volumes.

(2) 2012 model volumes exclude adjustment for ramp-up effects. At opening, volumes would be typically 70% of the traffic model forecast and these adjusted volumes are indicated in brackets below the modelled volume. Ramping up to the modelled 2012 volumes would typically occur over an 18 month to 2 year period.

(3) CV = medium and heavy commercial vehicles as per AustRoads Class 3 & above.

(4) Forecast based on full journey toll of $3.64 and partial journey toll of $2.43 expressed in $2006 including GST.

Overall network daily traffic demands with the Airport Link Project for 2012 and 2026 are shown in **Figure 9-1** and **Figure 9-2**. These illustrate that the Airport Link carries significant traffic volumes in the regional network context.

To examine the traffic function of the Airport Link Project an analysis of the travel patterns of forecast traffic has been undertaken. **Figure 9-3** shows the traffic routes vehicles using the Airport Link north-south tunnel and the east-west ramps. **Figure 9-4** and **Figure 9-5** illustrate the geographic distribution of travellers using the facility, clearly showing the wide catchment area spread over the Metropolitan area, particularly for travel in the north-south tunnels. A significant number of locations in the western corridor including University of Queensland, Toowong and the Indooroopilly Regional Centre are identified as important destinations within the user catchment. The significance of the project for travel to the ATC precinct, including Brisbane Airport is clearly shown, with a high density of trip ends associated with users of both the north-south tunnels and east-west ramps. There are a number of other key local travel generators that also emerge as important destinations for users of the project including Centro Toombul Shopping Centre and Chermside Shopping Centre. The role of the project in catering for Central City movements is also highlighted.

Daily travel patterns are summarised in **Table 9-3** and **Table 9-4** based on travel sectors illustrated previously in **Figure 2-1** and **Figure 2-2**. The select link and catchment area plots, in combination with the sector travel analysis presented in the tables highlight the function and major travel demands served by the project.

The north-south tunnel carries predominantly cross-city traffic (50%), and also has significant proportions of radial or CBD oriented trips (33%), Airport/ATC North precinct traffic (15%) and a small amount of local traffic (2%). This breakdown demonstrates that Airport Link fulfils an important function as part of a network of cross-city connections between the northern and southern, and northern and western suburbs of Brisbane. It also provides an important link between two major economic activity centres in the region, namely the ATC North precinct and the Brisbane CBD.

The east-west ramps cater primarily for traffic use related to the ATC North precinct including Brisbane Airport (52%) and cross-city travel (43%), with a small amount of local traffic (5%).

The overall proportion of daily project use related to the Airport/ATC North area is 24%, with the majority (20%) related to land-uses within the Brisbane Airport Corporation Master Plan area.

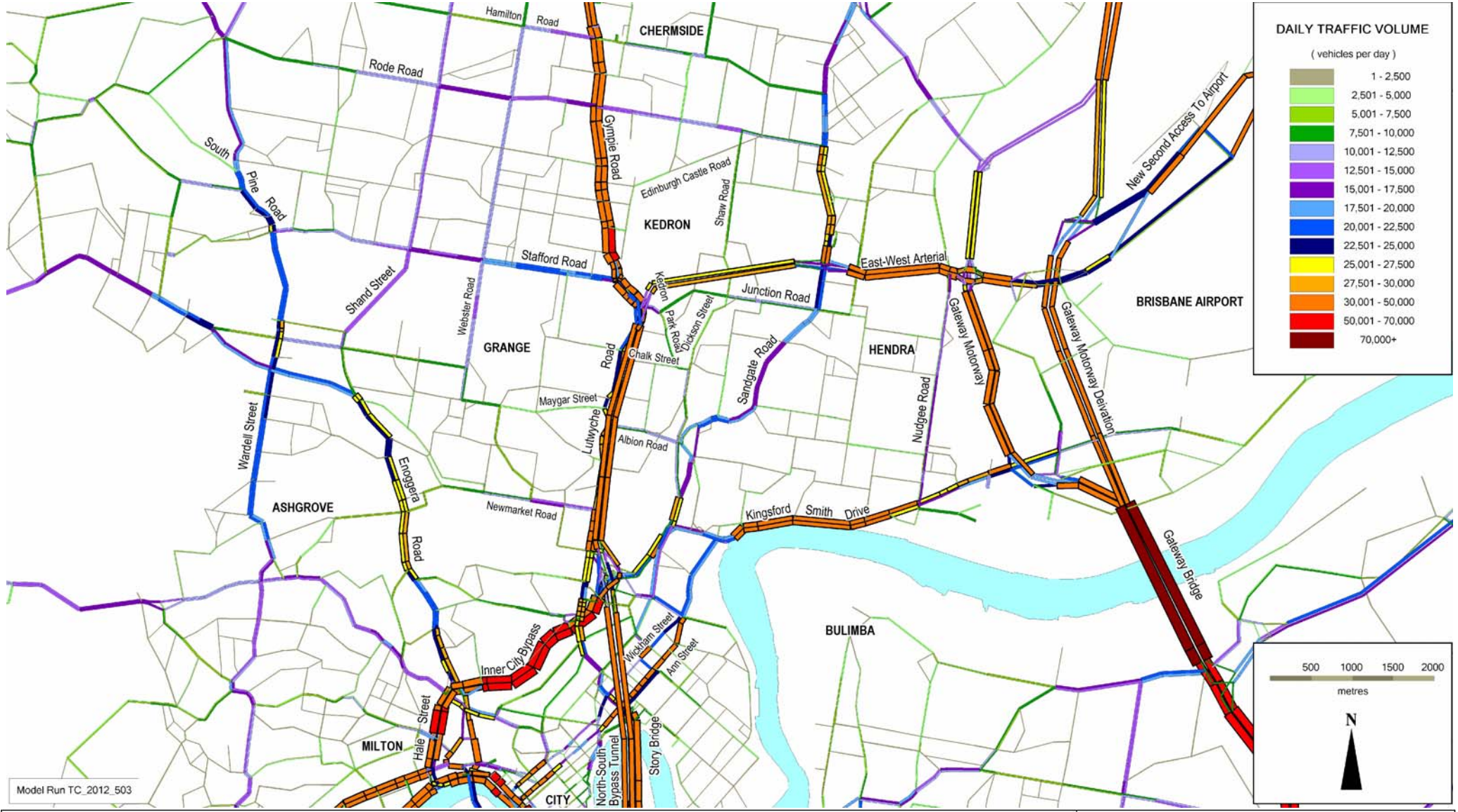


Figure 9-1
2012 Average Weekday Traffic Volumes
With Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

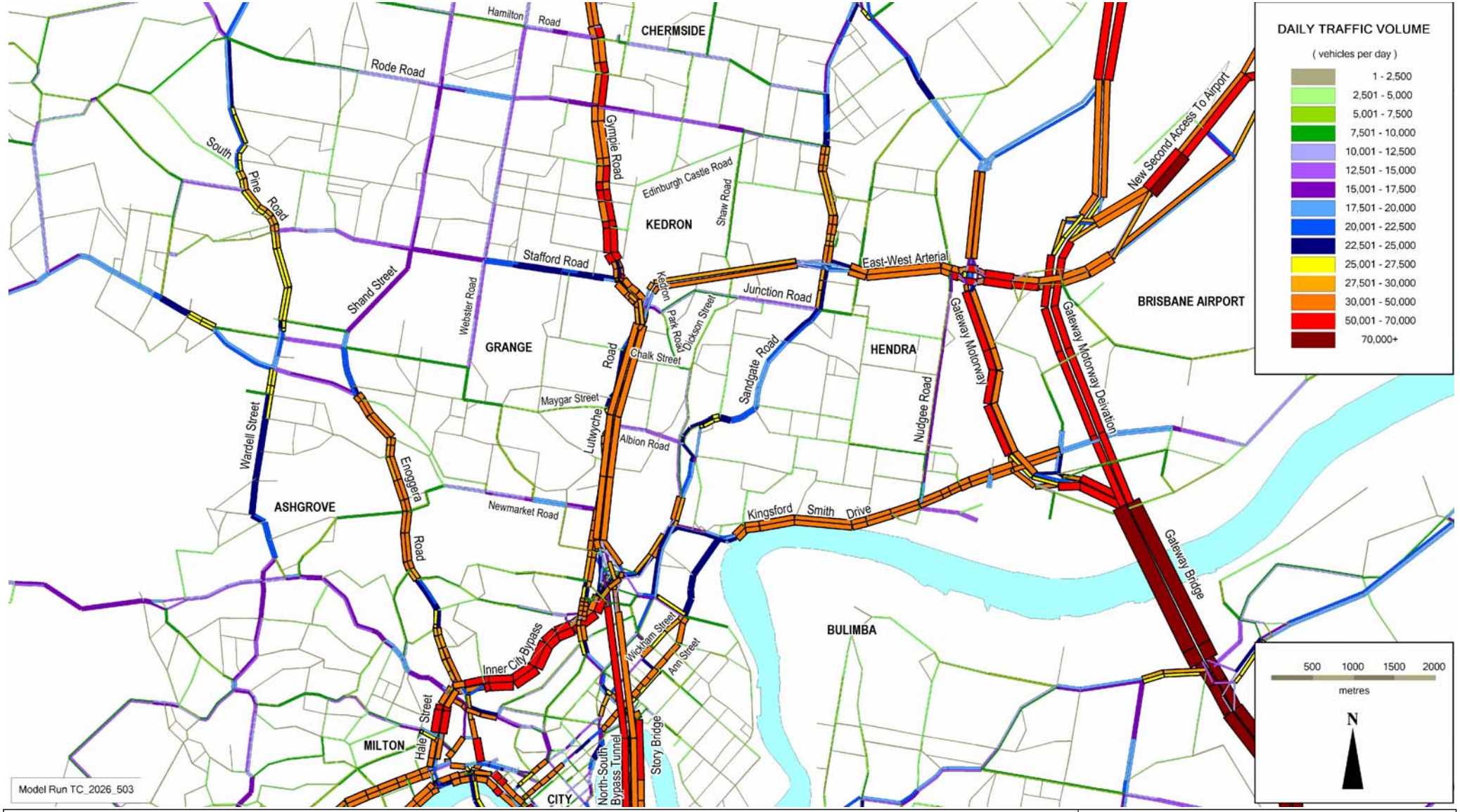


Figure 9-2
2026 Average Weekday Traffic Volumes
With Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 9-3
2026 Daily Travel Patterns
Airport Link North-South Tunnel
and Airport Link East-West Ramps
(select links)

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

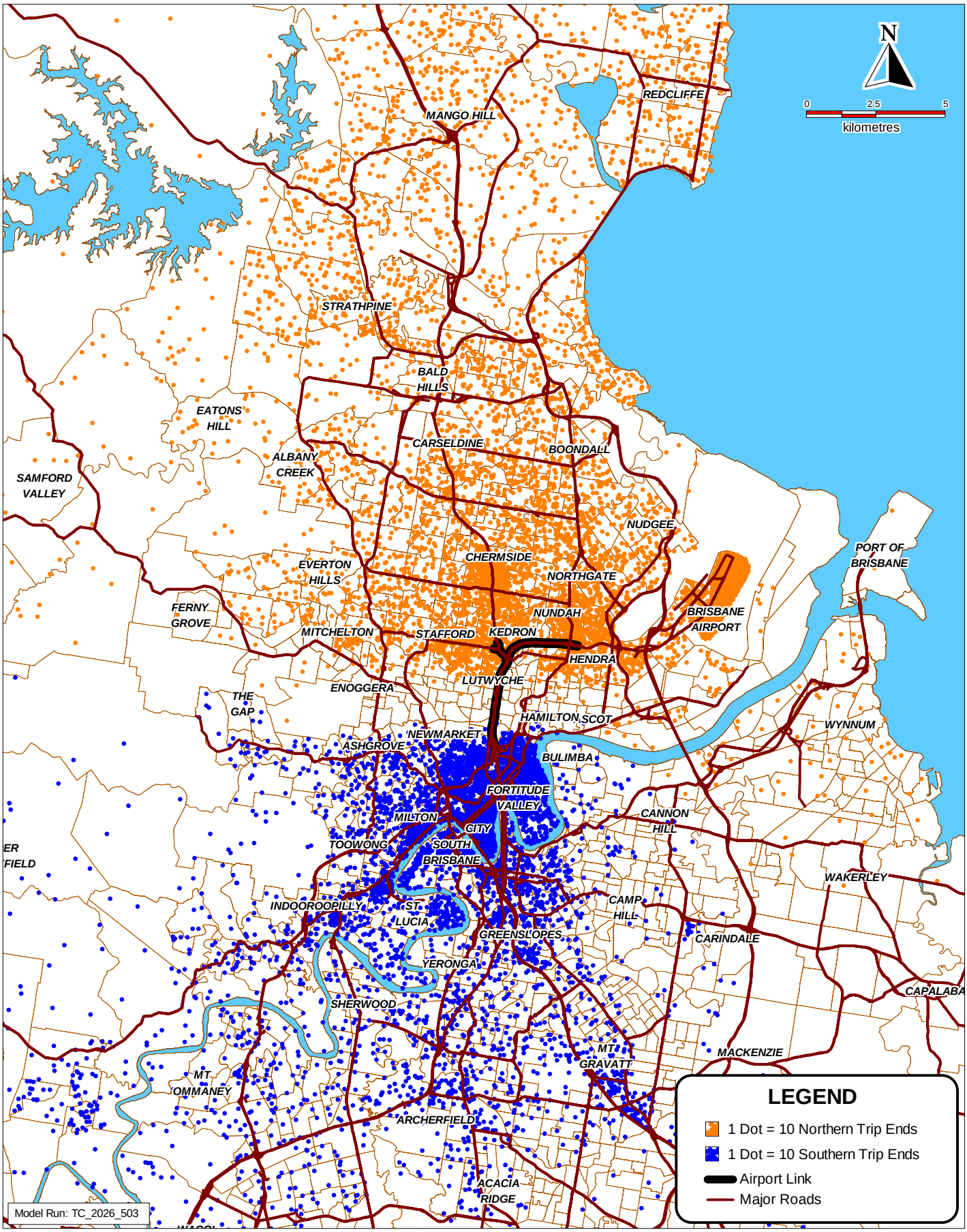


Figure 9-4
Airport Link North-South Catchment for Daily Travel (2026)

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

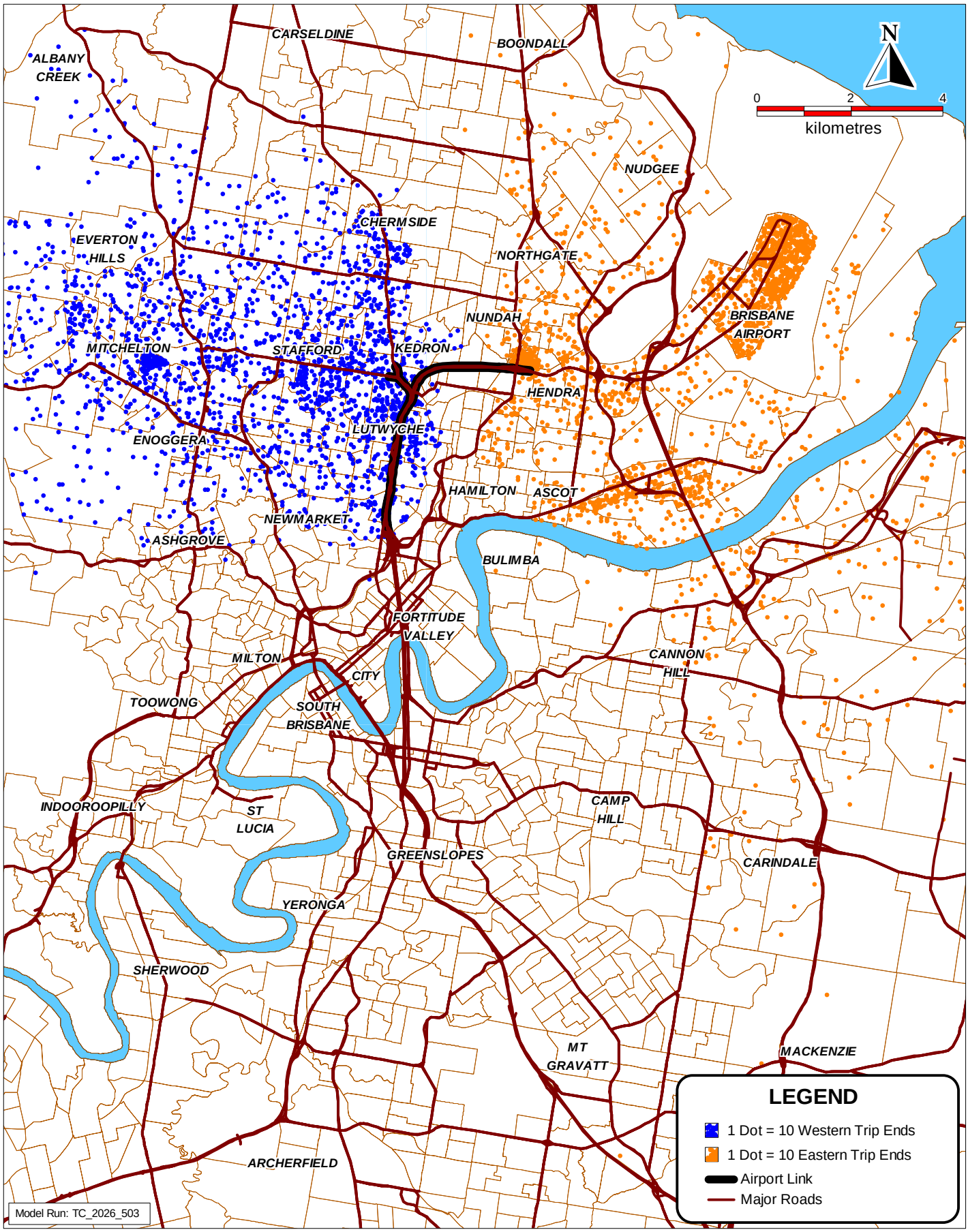


Figure 9-5
Airport Link East-West Catchment for Daily Travel (2026)

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

- **Table 9-3 Daily Travel Patterns for Airport Link North-South Tunnel Traffic (2026)**

From \ To	Central Brisbane	Inner North	West Brisbane	Airport/ATC North/Eagle Farm	North Brisbane	South of Brisbane River	Total
Central Brisbane	-	2%	-	1%	13%	-	**16%**
Inner North	2%	2%	1%	<1%	3%	2%	**10%**
West Brisbane	-	1%	-	4%	5%	1%	**13%**
Airport/ATC North/Eagle Farm	1%	<1%	4%	-	-	4%	**8%**
North Brisbane	14%	1%	6%	-	-	12%	**34%**
South of Brisbane River	-	2%	1%	4%	12%	-	**19%**
Total	**17%**	**9%**	**13%**	**8%**	**34%**	**19%**	**100%**

Table Key:

- Radial or CBD related travel
- Cross-City travel
- Airport/ATC North travel
- Local travel

- **Table 9-4 Daily Travel Patterns for Airport Link East-West Ramps Traffic (2026)**

From \ To	Central Brisbane	Inner North	West Brisbane	Airport/ATC North/Eagle Farm	North Brisbane	South of Brisbane River	Total
Central Brisbane	-	-	-	-	-	-	-
Inner North	-	5%	3%	4%	5%	2%	19%
West Brisbane	-	3%	-	10%	2%	4%	20%
Airport/ATC North/Eagle Farm	-	5%	11%	-	11%	-	27%
North Brisbane	-	5%	3%	10%	1%	3%	22%
South of Brisbane River	-	3%	5%	-	4%	-	12%
Total	**-**	**21%**	**22%**	**25%**	**23%**	**9%**	**100%**

Table Key:

- Cross-City travel
- Airport/ATC North travel
- Local travel

9.2.2 Traffic Volume Effects of Airport Link

Table 9-5 summarises the use of the Airport Link Project connections.

Of the daily traffic in the north-south tunnel, the NSBT is forecast to contribute 27%, with the remainder split evenly between the ICB west connection (36%) and the ramps at O'Connell Terrace and Campbell Street (37%).

At the northern end, approximately 60% of traffic from the north-south tunnel distributes to the Gympie Road/Stafford Road connection, with Gympie Road the major movement. The balance of north-south mainline tunnel traffic (just under 40%) proceeds to Sandgate Road/East-West Arterial.

- **Table 9-5 Airport Link Connections Traffic Summary – 2026 Average Weekday**

Project Element	Daily Traffic 2026	%	AM Peak S/B vph	PM Peak N/B vph
Northern Connections				
Gympie Road	46,100	56%	1,800	2,100
Stafford Road	10,300	13%	800	1,200
Total from North-South Tunnel	56,400	-	2,600	3,200
East – West Ramps	25,800	31%	900	900
Total North-Western Connection Traffic	82,200	100%	3,500	4,100
Sandgate Road	21,100	34%	900	1,600
East-West Arterial	41,400	66%	1,500	1,600
Total North-Eastern Connection Traffic	62,500	100%	2,400	3,200
Southern Connection				
NSBT	24,700	27%	1,100	1,300
ICB West	33,900	36%	1,300	1,800
Campbell/O'Connell Ramps	34,600	37%	1,900	2,400
Total Southern Connection Traffic	93,200	100%	4,300	5,600

Table Note:

(1) Forecast based on full journey toll of $3.64 and partial journey toll of $2.43 expressed in $2006 including GST.

Changes in weekday traffic volumes on the regional road network are illustrated in **Figure 9-6**. This supports the travel pattern assessment and again illustrates that a component of the traffic function of Airport Link is associated with intra-regional travel. Traffic volume effects are forecast beyond the corridor due to regional traffic re-distributing to alternative routes to access the facility, however these are minor in the context of total traffic use of regional routes. For example, forecast changes in weekday traffic volume in 2026 with the project compared to without the project are :

- Gateway Bridge – reduction of 2.5%;
- Pacific Motorway (M3) south of NSBT– increase of 1.1%;
- Ipswich Road, north of Beaudesert Road – increase of 0.9%; and
- Centenary Bridge – reduction of 2.1 %.

A more detailed assessment of the effects of the project on traffic changes on the corridor, approaches and local network has been undertaken. The effect of the project on traffic volumes on connecting roads is summarised in **Table 9-6** and **Table 9-7**. The traffic volume effects at a corridor level are illustrated in **Figure 9-7** and **Figure 9-8** for 2012 and 2026 respectively, while the Level of Service of operation on the network in the 2012 and 2026 peak periods is shown in **Figure 9-9**, **Figure 9-10**, **Figure 9-11** and **Figure 9-12**.

Table 9-6 Volumes on Key Connecting Roads to the Project - Comparison without and with the Project

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Southern Connections															
-	NBST	Brisbane River	-	70,800	73,700	4%	75,600	79500	5%	82,300	93,100	13%	89,800	96,600	8%
41	ICB	West of Bowen Bridge Road	75,000	100,500	104,600	4%	106,300	107,400	1%	106,500	112,000	5%	111,200	113,800	2%
49	Hale Street	North of Milton Road	78,000	84,200	84,200	0%	86,900	86,600	0%	82,700	82,900	0%	81,700	81,100	-1%
38	Bowen Bridge Road	South of O'Connell Terrace	57,000	51,200	54,700	7%	53,600	58,000	8%	55,200	60,800	10%	56,700	64,200	13%
40	Campbell Street	East of Mayne Road	12,000	21,700	26,000	20%	23,500	28,200	20%	26,300	32,200	22%	28,600	34,200	20%
39	O'Connell Terrace	East of Bowen Bridge Road	6,000	15,200	13,000	-14%	16,500	14,400	-13%	17,800	15,700	-12%	18,700	16,800	-10%
45	Brookes Street	South of St Pauls Terrace	18,000	20,500	22,800	11%	22,400	24,100	8%	23,300	24,900	7%	24,100	25,700	7%
44	St Pauls Terrace	South of Brookes Street	9,000	13,200	14,200	8%	15,000	16,300	9%	17,000	18,100	6%	19,900	20,200	2%
42	Gregory Terrace	West of Brookes Street	5,000	12,100	11,200	-7%	12,800	11,500	-10%	14,200	12,700	-11%	15,300	13,500	-12%
46	Wickham Street	West of Brookes Street	26,000	30,300	31,700	5%	32,100	33,000	3%	33,600	35,100	4%	36,500	37,100	2%
47	Ann Street	West of Brookes Street	25,000	30,900	34,100	10%	32,300	36,300	12%	36,800	40,600	10%	39,300	42,500	8%
43	Montpelier Road	West of Breakfast Creek Road	15,000	28,600	31,400	10%	31,000	33,900	9%	33,900	37,400	10%	36,900	39,000	6%
48	Gipps Street	North of Wickham Street	53,000	42,200	40,400	-4%	44,100	42,800	-3%	45,900	44,800	-2%	46,900	46,100	-2%
Northern Connections															
10	Stafford Road	West of Richmond Street	23,000	26,700	40,300	51%	27,100	42,000	55%	29,200	44,100	51%	29,100	45,500	56%
8	Stafford Road	West of Webster Road	22,000	24,600	30,700	25%	24,400	31,000	27%	25,300	33,700	33%	25,000	34,200	37%
11	Gympie Road	North of Broughton Road	59,000	76,800	97,200	27%	80,400	100,400	25%	81,700	104,600	28%	83,500	106,900	28%
3	Gympie Road	North of Rode Road	60,000	79,000	86,000	9%	81,700	87,400	7%	84,700	92,200	9%	86,600	96,100	11%
1	Gympie Road	North of Hamilton Road	70,000	82,700	88,600	7%	85,400	90,800	6%	88,500	94,600	7%	90,200	98,100	9%
2	Rode Road	West of Gympie Road	19,500	29,800	30,900	4%	31,000	31,200	1%	32,300	32,200	0%	33,200	32,400	-2%
13	Sandgate Road	North of Schulz Canal	52,000	66,800	60,800	-9%	67,600	61,400	-9%	71,600	63,800	-11%	72,700	66,000	-9%
14	East West Arterial	East of Widdop Street	35,000	59,100	74,900	27%	63,500	78,900	24%	72,000	83,600	16%	74,500	84,800	14%

Table 9-7 2022 Peak Period Volumes on Key Connecting Roads to the Project - Comparison without and with the Project

Reference	Road	Location	2 hour average weekday peak period volumes											
			AM Peak						PM Peak					
			Northbound/Eastbound			Southbound/Westbound			Northbound/Eastbound			Southbound/Westbound		
			Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Southern Connections														
-	NBST	Brisbane River	8,750	8,800	1%	5,650	7,050	25%	6,300	8,250	31%	9,200	9,200	0%
41	ICB	West of Bowen Bridge Road	6,350	6,200	-2%	9,100	9,400	3%	8,650	9,150	6%	7,650	7,300	-5%
49	Hale Street	North of Milton Road	5,100	5,100	0%	5,400	5,350	-1%	6,100	6,000	-2%	4,650	4,550	-2%
38	Bowen Bridge Road	South of O'Connell Terrace	2,750	3,000	9%	5,500	6,150	12%	3,600	5,800	61%	3,200	3,800	19%
40	Campbell Street	East of Mayne Road	2,200	2,700	23%	2,200	2,300	5%	2,350	2,250	-4%	2,250	3,300	47%
39	O'Connell Terrace	East of Bowen Bridge Road	N/A	550		2,450	1,800	-27%	N/A	550		4,100	1,650	-60%
45	Brookes Street	South of St Pauls Terrace	2,850	2,900	2%	850	1,450	71%	3,250	3,300	2%	850	1,450	71%
44	St Pauls Terrace	South of Brookes Street	450	550	22%	2,350	3,100	32%	3,400	3,450	1%	300	450	50%
42	Gregory Terrace	West of Brookes Street	1,350	1,050	-22%	650	750	15%	1,600	1,500	-6%	550	500	-9%
46	Wickham Street	West of Brookes Street	4,750	5,100	7%	-	-	-	7,650	8,400	10%	-	-	-
47	Ann Street	West of Brookes Street	-	-	-	6,400	6,700	5%	-	-	-	4,750	5,350	13%
43	Montpelier Road	West of Breakfast Creek Road	1,900	1,200	-37%	3,950	4,450	13%	2,300	3,650	59%	3,500	3,450	-1%
48	Gipps Street	North of Wickham Street	3,150	3,300	5%	3,550	3,800	7%	2,350	2,600	11%	4,100	3,850	-6%
Northern Connections														
10	Stafford Road	West of Richmond Street	2,450	4,200	71%	2,050	2,500	22%	2,100	2,550	21%	3,050	4,900	61%
8	Stafford Road	West of Webster Road	2,050	2,950	44%	1,250	1,600	28%	1,700	1,950	15%	2,750	3,900	42%
11	Gympie Road	North of Broughton Road	4,200	5,600	33%	6,600	7,600	15%	7,200	8,250	15%	4,500	6,150	37%
3	Gympie Road	North of Rode Road	3,750	4,300	15%	6,750	6,850	1%	7,200	7,300	1%	5,000	5,400	8%
1	Gympie Road	North of Hamilton Road	3,800	4,300	13%	6,800	6,950	2%	7,500	7,500	0%	5,400	5,750	6%
2	Rode Road	West of Gympie Road	2,150	2,100	-2%	2,000	1,900	-5%	2,150	2,100	-2%	2,300	2,250	-2%
13	Sandgate Road	North of Schulz Canal	4,200	3,250	-23%	6,700	6,350	-5%	6,100	6,200	2%	4,600	2,900	-37%
14	East West Arterial	East of Widdop Street	5,400	5,450	1%	4,100	5,200	27%	5,200	5,600	8%	5,200	5,600	8%

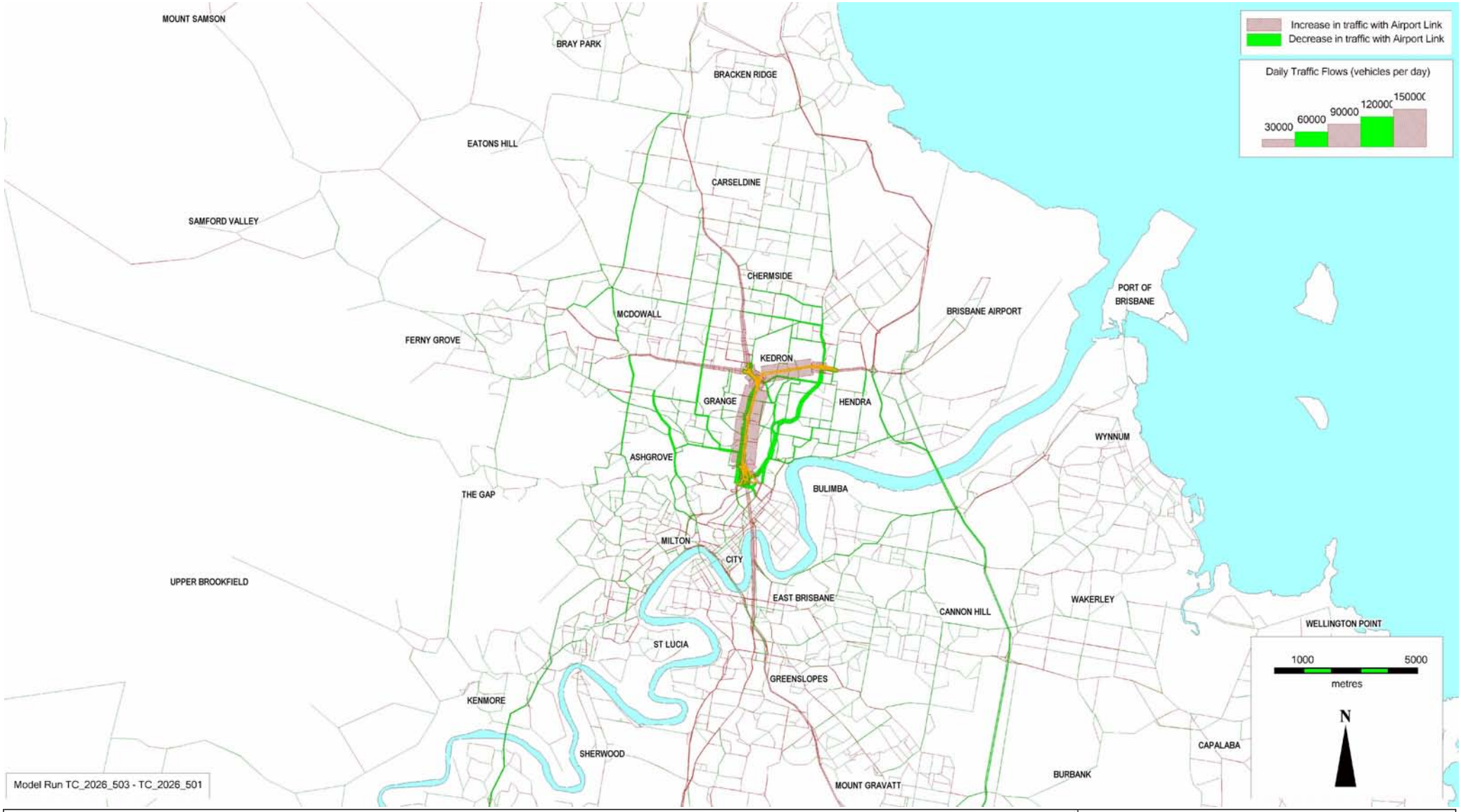


Figure 9-6
2026 Regional Traffic Volume Changes with Airport Link
ENIF Test 1

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 9.7
2012 Average Weekday Traffic Volumes - Changes Due to Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

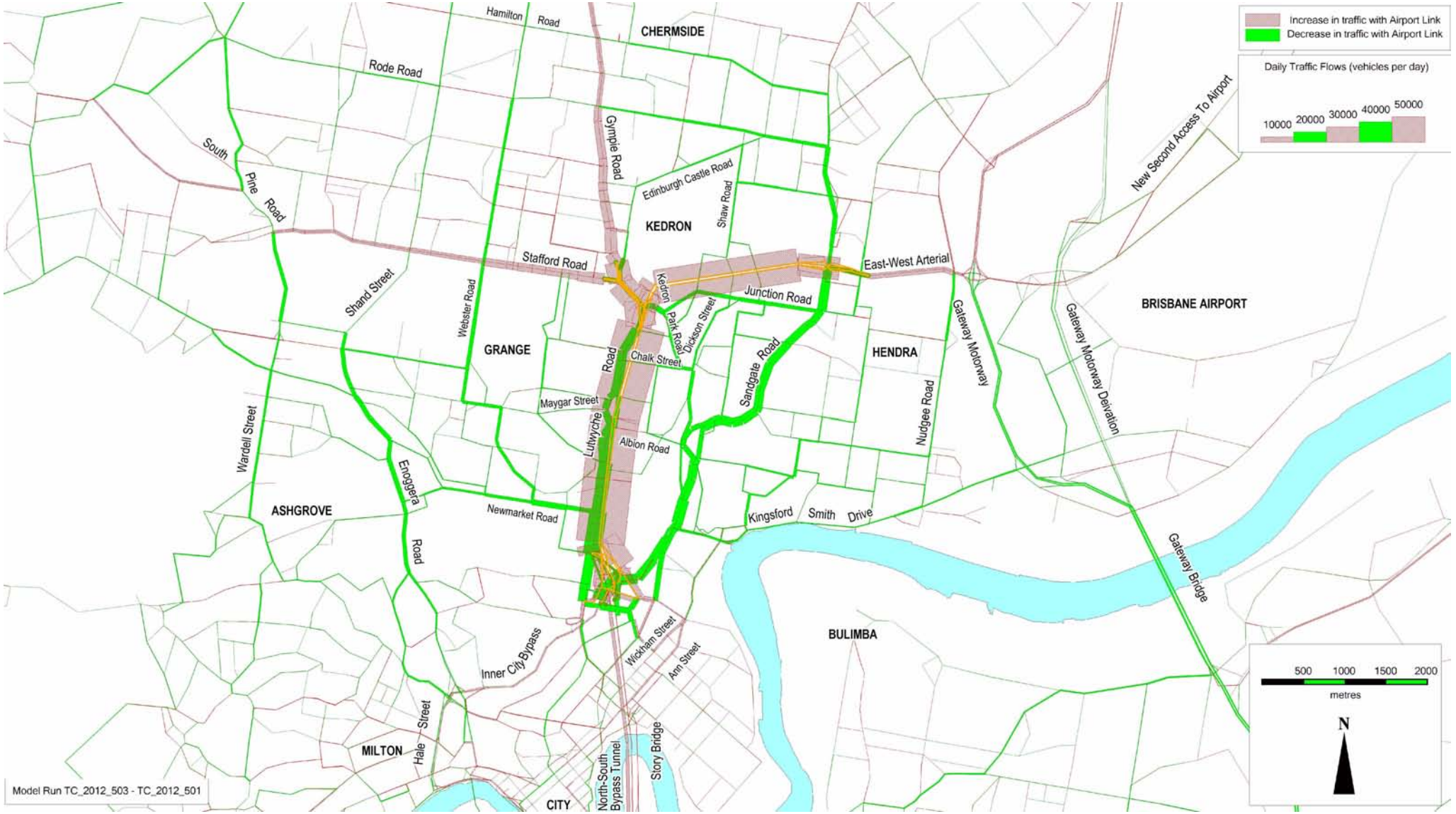


Figure 9.8
2026 Average Weekday Traffic Volumes -
Changes Due to Airport Link
ENIF Test 1

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

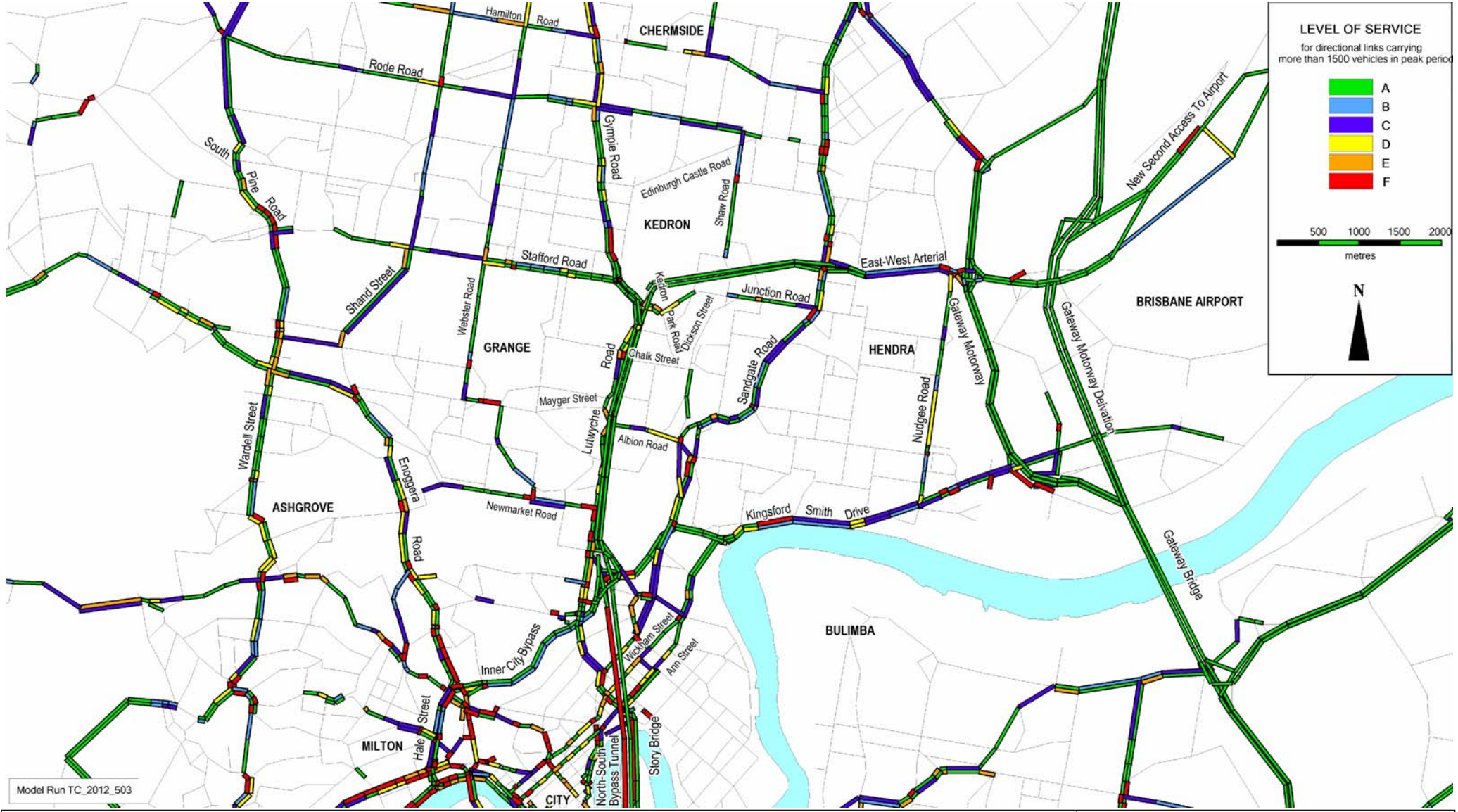


Figure 9-9
2012 AM Level of Service
With Airport Link

Airport Link

SKM Connell Wagner
JOINT VENTURE

BRISBANE CITY

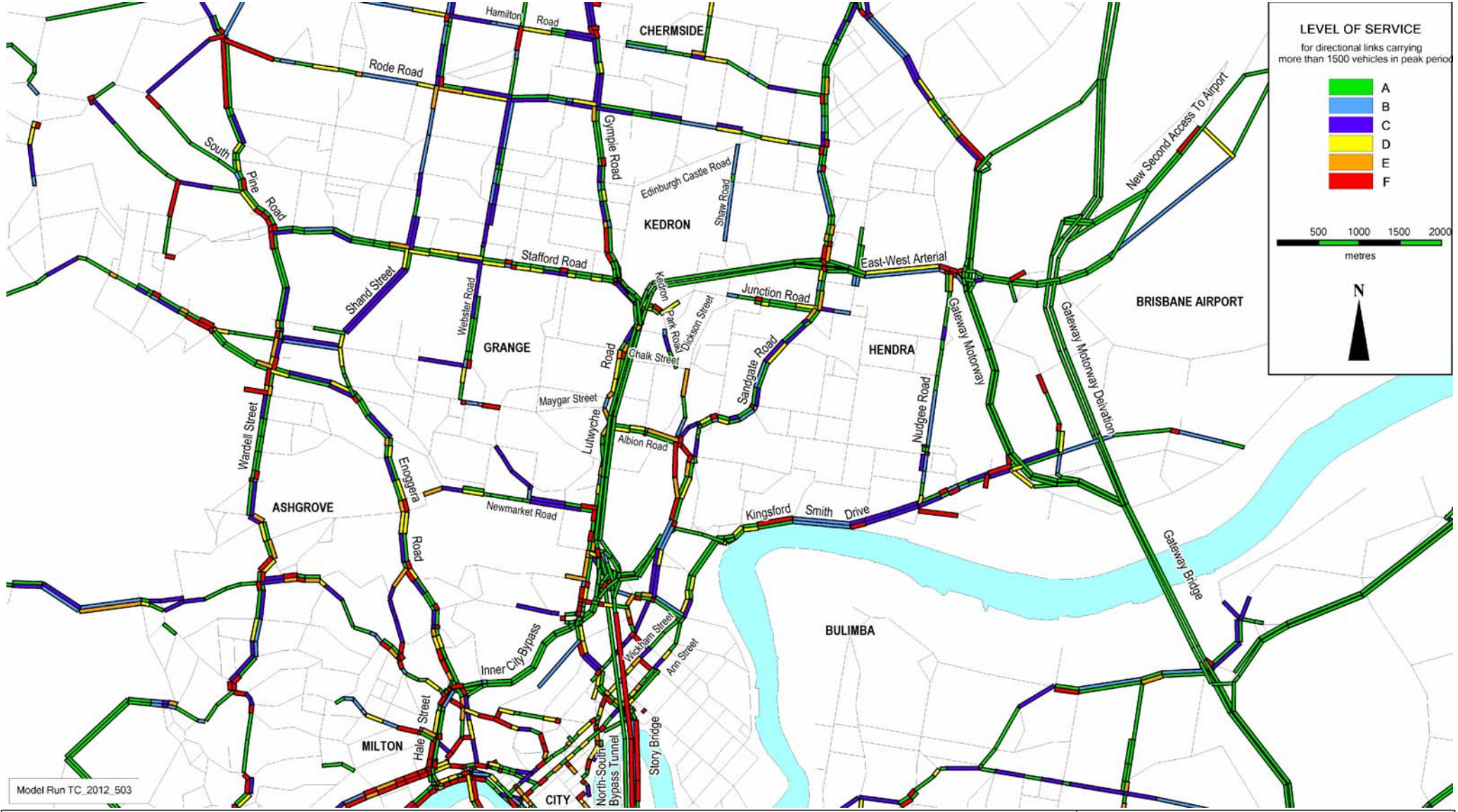


Figure 9-10
2012 PM Level of Service
With Airport Link

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

Figure 9-11
2026 AM Level of Service
With Airport Link

Airport Link

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Figure 9-12
2026 PM Level of Service
With Airport Link

Airport Link

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JOINT VENTURE

BRISBANE CITY

Key findings from this assessment are:

- At the southern end of the project a number of roads will experience increased traffic demands, however the range of Airport Link network connections provided disperses the level of impact. Increases are generally modest on individual roads (< 15%) and well within the network capacity with resultant levels of service acceptable. On the busiest links, where capacity issues are most critical, much smaller changes are forecast such as minor increases of 2-3% on the Inner City Bypass and 5-6% on Bowen Bridge Road.
- With the project the NSBT is forecast to be effectively operating at capacity in the peaks, particularly northbound in the AM peak and southbound in the PM peak.
- At the northern end of the project the most significant effect occurs on Stafford Road where over a 50% increase in demand is forecast compared to future traffic levels without the project. This increase is due to the combined role of this link catering for travel demand for both east-west and north-south movements. The resultant traffic volumes of 45,000 vpd in 2026 are within the mid-block traffic lane capacities of a well-managed four (4) lane arterial route. Satisfactory levels of service could be achieved with the implementation of traffic management measures along the route. aaSIDRA analysis of key signalised intersections (discussed in detail in Section 9.3.2) does not forecast a significant change in the level of service at key signalised intersections compared to scenario without the project. It is noted that at the Stafford Road/Webster Road intersection, east-west traffic increases on Stafford Road are somewhat balanced by north-south traffic decreases on Webster Road.

  Examples of arterial traffic measures that should be investigated for implementation along Stafford Road, particularly between Webster Road and Gympie Road, in conjunction with the project to safely and efficiently cater for the forecast traffic increase would include:

  - Parking management/restrictions at intersection approaches (potentially for longer periods of the day than are currently applied);
  - Formalisation of turn lane pockets at side streets where signalised intersections are not provided;
  - Construction of a raised median along Stafford road in segments where turn movements are currently prevented by a double centre-line, however where side-street traffic typically does not observe the restriction;
  - Potential implementation of additional signalised intersections at side-streets, a particular example being Clarence Road/Rose Lane;
  - Facilities for public transport, such as indented bus bays; and
  - Facilities for pedestrians and cyclists.

  Note that not all measures may be required and that the best package of initiatives to manage the traffic flows on Stafford Road between Gympie Road and Webster Road would require scoping within an arterial corridor traffic management plan for the project.

  From Stafford (west of Webster Road) to Appleby Road, significant upgrading of Stafford Road has already been undertaken in conjunction with abutting commercial/retail development access provisions. The effects of the project diminish in this region no specific mitigation is warranted. Further west the traffic increases on Stafford Road do not result in a congested Level of Service.

- Impacts on Gympie Road diminish quite rapidly north of the project and at Chermside represent only a 6-7% increase, with no significant impact on Level of Service. North of the project Gympie Road has a robust, wide cross-section , incorporating six (6) general traffic lanes, a wide median and parking lanes. The Traffic Management Plan (Operations) should address management measures such as signal co-

ordination to accommodate increased traffic on the approaches of this arterial corridor connecting to the project.

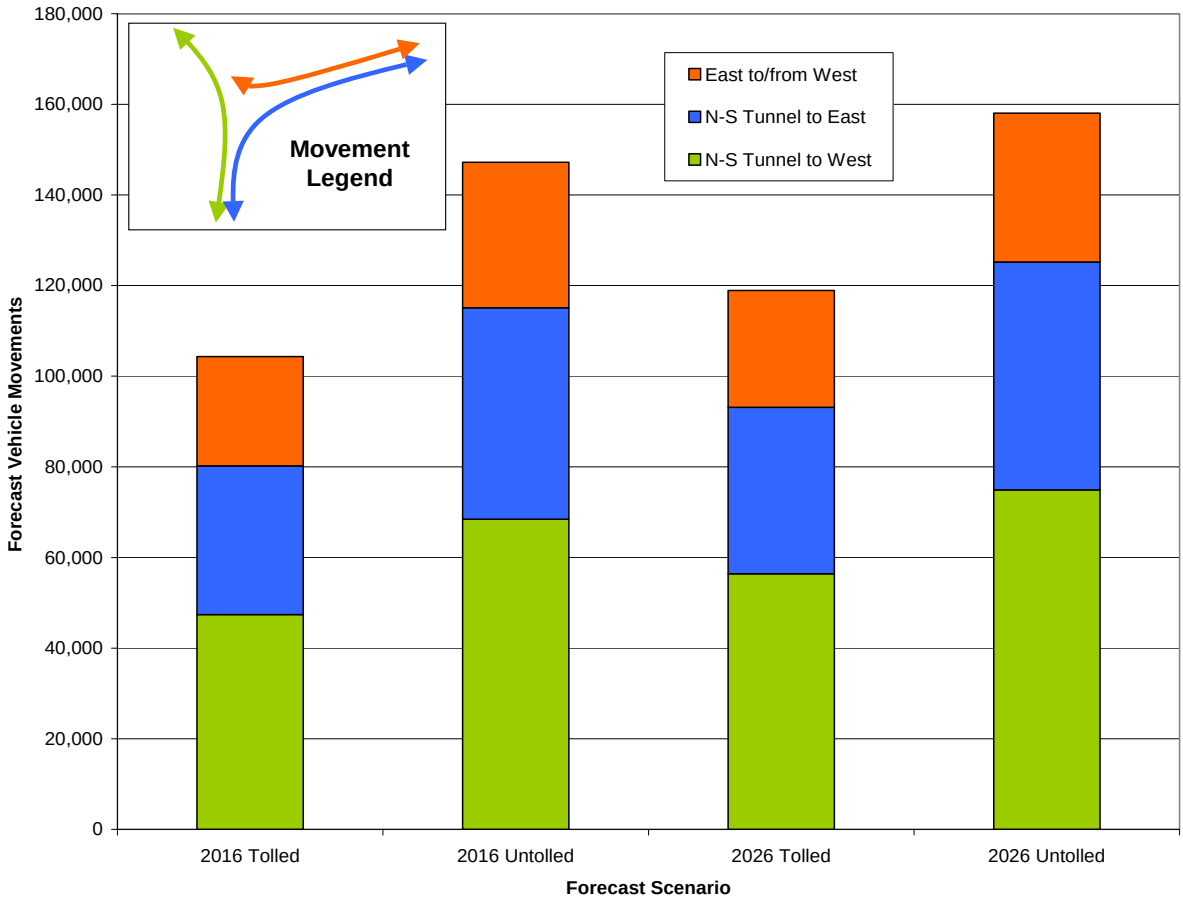
- Traffic volumes on Sandgate Road north reduce by 9-10% with the project, due to the re-distribution of travel movements from northern areas to the east-west toll road to access the East-West Arterial Road. This effect will reduce traffic congestion at the access to Centro Toombul Shopping Centre.

9.2.3 Effect of Toll on Demand for Airport Link

The implementation of a toll on Airport Link for either a full journey or partial journey will discourage some potential users who judge that the travel time savings and other benefits provided by the facility would not equal or exceed the cost of the toll. The extent of toll avoidance is directly related to the cost and attractiveness of alternate routes.

Figure 9-13 illustrates the effects of a $3.64 toll for a full journey (north-south) and a $2.43 toll for a partial journey (east-west) at two future years, 2016 and 2026. These toll amounts are expressed in 2006 dollars and include the Goods and Services Tax (GST). Future year tolls were indexed to rise in line with the Consumer Price Index. Comparing the diversion (i.e. the proportion of users not prepared to pay a toll) between 2016 and 2026 indicates that this decreases over time, as users perceive greater benefits in travel time savings can be realised by using the toll road facility as the overall road network becomes more congested over time.

- **Figure 9-13 Effect of Toll on Airport Link Traffic compared to No Toll**



For both types of journeys, the effect of no toll would be to increase traffic volumes on the facility and approaches. A resultant lowering of the level of service of operation and average travel speed on the facility

would occur. Increased traffic volumes on the feeder routes would also be evident compared to the tolled scenario.

9.2.4 Network Performance Statistics

The impact of the Airport Link Project on overall Metropolitan Area network performance is summarised in **Table 9-8**. This shows that the project reduces the amount of travel on lower order roads in the network (local district and suburban routes) and redistributes travel to Motorway routes. The Arterial road network is also benefited by travel distance and time reductions. A very small (<0.2%) increase in overall vehicle kilometres of travel in the network is forecast. These effects are shown graphically in **Figure 9-14**.

- **Table 9-8 Network Performance by Road Type without and With Airport Link**

Road Type	Without Airport Link			With Airport Link			Difference		% Difference	
	VHT[1]	VKT[2]	Speed km/h	VHT	VKT	Speed Km/h	VHT	VKT	VHT	VKT
2012										
Motorway	272,900	22,103,000		277,100[3]	22,290,000[4]		4,200	187,000	1.5%	0.8%
Motorway (AL Tunnel)	-	-		-	331,000		-	331,000	-	-
Arterial	464,300	20,819,000		452,600	20,550,000		-11,700	-269,000	-2.5%	-1.3%
Suburban	170,100	8,186,000		165,700	8,075,000		-4,400	-111,000	-2.6%	-1.4%
District	98,900	3,329,000		97,200	3,291,000		-1,700	-38,000	-1.7%	-1.1%
Local	53,800	1,317,000		53,000	1,295,000		-800	-22,000	-1.5%	-1.7%
Total	1,059,900	55,754,000	52.6	1,045,600	55,833,000	53.4	-14,300	79,000	-1.3%	0.1%
2022										
Motorway	358,000	27,777,000		362,600[3]	27,977,000[4]		4,600	200,000	1.3%	0.7%
Motorway (AL Tunnel)	-	-		-	397,000		-	397,000	-	-
Arterial	556,800	24,004,000		538,000	23,715,000		-18,800	-289,000	-3.4%	-1.2%
Suburban	204,700	9,581,000		198,200	9,429,000		-6,500	-152,000	-3.2%	-1.6%
District	120,600	3,873,000		116,000	3,803,000		-4,600	-70,000	-3.8%	-1.8%
Local	77,600	1,508,000		75,300	1,472,000		-2,300	-36,000	-3.0%	-2.4%
Total	1,317,600	66,742,000	50.7	1,290,200	66,793,000	51.8	-27,400	51,000	-2.1%	0.1%
2026										
Motorway	408,800	30,070,000		411,400[3]	30,255,000[4]		2,600	185,000	0.6%	0.6%
Motorway (AL Tunnel)	-	-		-	410,000		-	410,000	-	-
Arterial	608,000	25,238,000		588,000	24,932,000		-20,000	-306,000	-3.3%	-1.2%
Suburban	225,400	10,224,000		218,500	10,077,000		-6,900	-147,000	-3.1%	-1.4%
District	132,800	4,129,000		129,300	4,065,000		-3,500	-64,000	-2.6%	-1.6%
Local	93,100	1,608,000		91,400	1,577,000		-1,700	-31,000	-1.8%	-1.9%
Total	1,468,200	71,269,000	48.5	1,438,500	71,317,000	49.6	-29,700	48,000	-2.0%	0.1%

Table Notes:

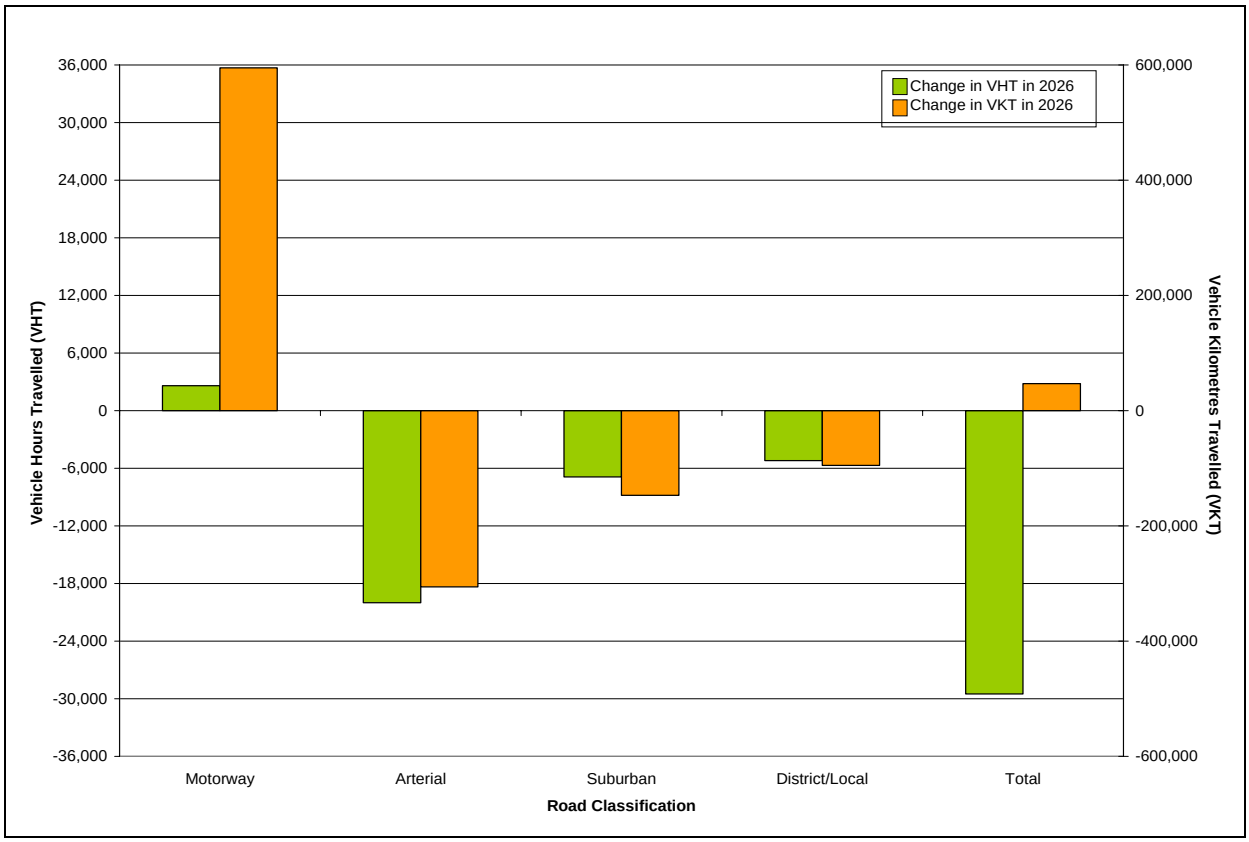
(1) VHT - Vehicle Hours Travelled on Average Weekday

(2) VKT - Vehicle Kilometres Travelled on Average Weekday

(3) Includes AL Tunnel VHT

(4) Excludes AL Tunnel VKT

- **Figure 9-14 Changes in Overall Vehicle Kilometres and Vehicle Hours of Travel With Airport Link**



An overall 1 to 2% reduction in the vehicle hours of travel within the overall Metropolitan Area is indicated, together with an increase in overall average network speed reflecting a general lowering of congestion.

The effects on network performance for commercial vehicle travel are provided in **Table 9-9** and illustrated in **Figure 9-15**. Overall reductions in truck use of local, district and suburban roads, at the Metropolitan area level, of over 2% are indicated in later years. A reduction in total vehicle hours of travel and vehicle kilometres of travel is estimated for commercial vehicles with the project, providing important benefits to industry through reduced operating costs and improved travel time reliability.

- **Table 9-9 Commercial Vehicles Network Performance by Road Type without and With Airport Link**

Road Type	Without Airport Link			With Airport Link			Difference		% Difference	
	VHT[1]	VKT[2]	Speed Km/h	VHT	VKT	Speed Km/h	VHT	VKT	VHT	VKT
2012										
Motorway	19,100	1,651,000		19,300[3]	1,655,000[3]		200	4,000	1.0%	0.2%
Motorway (AL Tunnel)	-	-		-	13,000		-	13,000	-	-
Arterial	29,200	1,324,000		28,700	1,309,000		-500	-15,000	-1.7%	-1.1%
Suburban	8,800	418,000		8,600	413,000		-200	-5,000	-2.3%	-1.2%
District	4,700	173,000		4,600	171,000		-100	-2,000	-2.1%	-1.2%
Local	2,900	71,000		2,900	70,000		0	-1,000	0.0%	-1.4%

Road Type	Without Airport Link			With Airport Link			Difference		% Difference	
	VHT[1]	VKT[2]	Speed Km/h	VHT	VKT	Speed Km/h	VHT	VKT	VHT	VKT
Total	64,700	3,636,000	56.2	64,100	3,631,000	56.6	-600	-5,000	-0.9%	-0.1%
2022										
Motorway	23,700	1,959,000		24,100[3]	1,966,000[3]		400	7,000	1.7%	0.4%
Motorway (AL Tunnel)	-	-		-	30,000		-	30,000	-	-
Arterial	34,200	1,494,000		33,100	1,465,000		-1,100	-29,000	-3.2%	-1.9%
Suburban	10,800	495,000		10,500	484,000		-300	-11,000	-2.8%	-2.2%
District	6,100	204,000		5,800	199,000		-300	-5,000	-4.9%	-2.5%
Local	4,700	83,000		4,600	81,000		-100	-2,000	-2.1%	-2.4%
Total	79,600	4,234,000	53.2	78,100	4,225,000	54.1	-1,500	-9,000	-1.9%	-0.2%
2026										
Motorway	26,200	2,063,000		26,500[3]	2,067,000[3]		300	4,000	1.1%	0.2%
Motorway (AL Tunnel)	-	-		-	34,000		-	34,000	-	-
Arterial	38,400	1,561,000		37,300	1,534,000		-1,100	-27,000	-2.9%	-1.7%
Suburban	12,000	527,000		11,600	514,000		-400	-13,000	-3.3%	-2.5%
District	7,000	215,000		6,900	211,000		-100	-4,000	-1.4%	-1.9%
Local	5,900	90,000		5,800	88,000		-100	-2,000	-1.7%	-2.2%
Total	89,500	4,455,000	49.8	88,100	4,448,000	50.5	-1,400	-7,000	-1.6%	-0.2%

Table Notes:

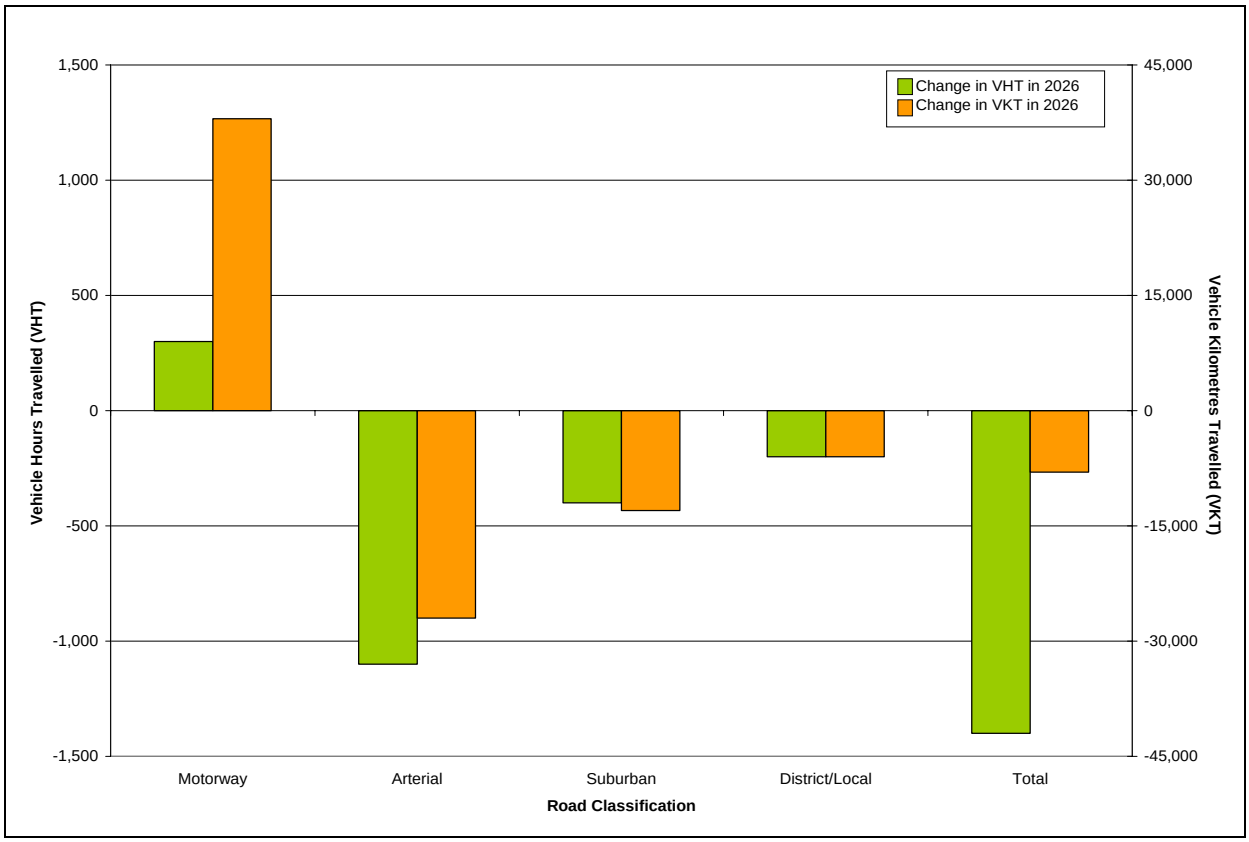
(1) VHT - Vehicle Hours Travelled on Average Weekday

(2) VKT - Vehicle Kilometres Travelled on Average Weekday

(3) Includes AL Tunnel VHT

(4) Excludes AL Tunnel VKT

- **Figure 9-15 Changes in Commercial Vehicle Kilometres and Commercial Vehicle Hours of Travel With Airport Link**



9.3 Effect on Local Area

9.3.1 Traffic Volume

Improved amenity on many roads in the inner north suburbs is likely, due to forecast traffic reductions with the project. Forecast effects are shown in **Table 9-10** and **Table 9-11** and graphically on **Figure 9-7** and **Figure 9-8**. Examples of effects in 2026 include:

- Reduction in daily traffic of 25% on Lutwyche Road through the Lutwyche shopping area, and 28% on Sandgate Road at Albion.
- Reduced traffic levels on suburban and district roads, such as Shaw Road (-16%), Dawson Street (-8%) and Dickson Street (-28%), which currently experience strong peak travel demands from north-south commuter traffic seeking to avoid congestion on the arterials.
- Strong reductions (23-28%) in east-west traffic on the Junction Road-Rose Street route through residential areas.
- Traffic relief on key east-west links between Gympie and Sandgate Roads north of the project, such as Rode Road (-24%) and Hamilton Road (-16%).

As the project has a wider effect on route choice within the network, a range of heavily trafficked north-south arterial roads in the broader northern network are forecast to experience traffic reductions and improved operations. Examples at 2026 include Kingsford Smith Drive (-3%), Nudgee Road (-19%), Enoggera Road (-13%) and South Pine Road (-12%).

The project has the effect of significantly reducing both overall traffic levels and commercial vehicles (medium and heavy trucks) on surface streets through the Inner North suburbs, in the vicinity of the project as demonstrated in **Table 9-11** compared to the situation without the project. Based on the reductions forecast on the Northern Screenline (location as shown in **Figure 2-3**), 22% of total traffic and 49% of truck traffic will be removed from north-south surface routes from Webster Road across to Nudgee Road, by 2026. Similarly on the Central Screenline (location as shown on **Figure 2-3**), which captures the reduction in east-west traffic movements on the local surface road network between Lutwyche Road and Sandgate Road, an overall reduction of 20% in total traffic and 35% in commercial vehicle traffic is estimated in 2026.

A local area where some likelihood for additional traffic increases associated with northbound traffic from the project is indicated is the north-western precinct at the Stafford Road/Gympie Road intersection. Increased traffic levels on Gympie Road immediately north of the Airport Link northbound exit ramp may create pressure for traffic to use local streets such as Broughton Road. To mitigate this potential effect, it is recommended that local area traffic management measures should be implemented in conjunction with the project in this precinct. This would minimise the potential for use of the local roads in this precinct by extraneous through traffic, sometimes referred to as “rat-running” traffic.

9.3.2 Intersection Performance

The effect of the project on the performance of intersections within the network has assessed. Locations have been selected to cover key signalised intersections on feeder routes to the facility, as well as intersections along the surface road network that will benefit due to diversion of traffic to Airport Link.

The intersections examined include:

- Key intersections in the Gympie Road-Lutwyche Road corridor;
- Intersections along the Stafford Road corridor;
- Locations along the Sandgate Road-Abbotsford Road corridor;
- Key intersections on the feeder roads in the Bowen Hills and Fortitude Valley area at the southern end of the project corridor;
- Selected intersections along Kingsford Smith Drive; and
- Intersections within the local road network between Lutwyche Road and Sandgate Road.

Intersection assessment has been carried out using modelled volumes for the two hour peak period in the morning, and assuming that half of these volumes occur in a one-hour time period within the peak. In practice, however, as travel demand builds-up over the entire network in Brisbane, peak spreading will occur. This means that the peak period in the morning will begin to spread over a longer period than two hours, for example between 6.45am and 9.15am, or 3.30pm and 6.00pm, consistent with an urban area with a larger population base. As transport demands increase as the population grows, some commuters who chose to travel to work by private vehicle, will adjust their time of trip-making within the peak period so as to avoid heavy congestion. Assuming all peak traffic occurs in the modelled two hour period is therefore conservative.

The intersection analysis provides an assessment of the relative effects of the project compared to the without project scenario using this conservative assumption in both cases. The intersection Degree of Saturation and Level of Service is provided in **Table 9-12** for both year of opening (2012) and a 10 year beyond opening horizon (2022), the standard practice for traffic impact assessment for intersection effects.

Key effects on intersection performance and LOS are:

- An overall improvement in operating conditions along the Sandgate Road corridor is indicated with the project. This will enhance the operation of intersections both north of the project, such as the Sandgate Road/Centro Toombul Shopping Centre Access, and south of the project, such as the congested intersections in the Albion area, where both vehicular and pedestrian movements will benefit from reduced delays.
- In the Lutwyche Road corridor south of the Kedron Park intersection, the project will result in a lessening of the degree of saturation and improvements in the level of service compared to the situation without the project. This creates opportunities for the use of some road capacity for pedestrian improvements and/or public transport priority, which is discussed further in **Section 10**.
- Intersections on roads through the local area, such as Albion Road and Junction Road-Rose Street-Park Road, will experience less congested operations during peak periods with the project, in many cases with an improved Level of Service compared to current conditions.
- Along Stafford Road the level of service of operation at intersections will decline with the project due to the increase in traffic volumes. At most locations however, Level of Service will remain within acceptable levels. At the Stafford Road/Webster Road intersection congested operations are forecast without the project and further deterioration in performance is indicated. Traffic volumes on Webster Road through the intersection will decline, although movements on Stafford Road increase. Forecast peak volumes may be accommodated by an increase in the duration of the peak period due to peak spreading effects. Alternatively, in the absence of provision of additional lanes, turn bans during peak periods for some movements may be necessary to achieve greater traffic capacity and reduce delays.

Where possible, grade separation has been incorporated within the project to ensure that traffic accessing or egressing the project tunnels can connect in an unimpeded manner to the connecting road network and not encounter a signalised intersection for a considerable distance. For exit traffic, this means that the potential for traffic exiting the tunnel to queue back from the first potential stop point upon egress would be minimised. Key examples of where the design has been shaped to ensure this occurs are for the following major movements:

- Exiting from the northbound tunnel onto Gympie Road;
- Exiting from the northbound tunnel onto Stafford Road; and
- Exiting from the eastbound tunnel onto the East-West Arterial.

For other locations, where traffic exiting the tunnel will encounter a potential stop point, an analysis of the level of service and queuing at the exit has been undertaken and is provided in **Table 9-13**.

Measures used were:

- Degree of Saturation: the ratio of the flow to the capacity of the movement; and
- Queue: the maximum queue length relative to the stop line, below which a nominated percentage of all queue lengths fall. The desirable standard is 95%, with 90% an absolute minimum.

Key Airport Link movements checked and found to be satisfactory were:

- The westbound off-ramp to the Lutwyche Road/Kedron Park Road signalised intersection;
- The eastbound off-ramp to the Sandgate Road/East-West Arterial signalised intersection;
- The southbound off-ramp to the Campbell Street/Mayne Road/Hamilton Place signalised intersection; and

- The southbound off-ramp to the O'Connell Terrace signalised intersection.

If excessive queuing were to develop on some occasions, the operational measures to be implemented to manage queues associated with traffic flows into and out of the tunnel system would be identified within the Traffic Management Plan (Operations) for the facility.

A complex range of traffic movements would continue to need to be catered for at the surface road intersections in the vicinity of the access points to the project at the north-western and north-eastern connections. As a result the level of service at these intersections would remain very congested with the project. At the Sandgate Road/East-West Arterial intersection, where AM peak conditions are forecast to improve compared to the situation without the project, with PM peak conditions similar. At the Gympie Road/Stafford Road intersection, AM peak conditions worsen, although they improve in the PM peak compared to the without project situation. At the Gympie Road/Kedron Park Road intersection, the opposite effect is likely to occur. These effects are principally related to the increased concentration of east-west traffic movement though the two intersections.

To manage these impacts, traffic signal co-ordination could be implemented though the Traffic Management Plan (Operations) for the facility to ensure that key movement streams using the surface road routes are not unduly delayed. It is noted that traffic using these northern connection intersections to proceed to the alternative un-tolled surface road routes, would find that intersections further along Lutwyche Road and Sandgate Road would be less congested so the overall effect on travel time on the surface route would be improved. This effect is discussed further in **Section 9.3.3**.

At the southern connection, changes to the traffic performance of intersections in the Bowen Hills and Fortitude Valley area affected by project traffic varies between peaks, and generally does not materially change the LOS on key commuter routes compared to intersection performance without the project. Along Abbotsford Road south of the Campbell Street ramps, increased use of intersections by users of the project with origins and destinations in the Central City area would increase the level of saturation of some intersections. These intersections are forecast to be congested without the project, and in peak periods have a high proportion of use associated with commuter travel. As Brisbane grows peak spreading influences will emerge as the mechanism by which travel on these commuter routes closest to the CBD are most appropriately managed.

- **Table 9-10 Volumes on Surface Roads within the Inner North Area - Comparison without and with the Project**

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Arterial Roads															
17	Lutwyche Road	South of Kedron Park Road, Kedron	54,600	68,200	53,400	-22%	70,200	53,700	-24%	70,800	53,300	-25%	71,500	54,200	-24%
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	59,600	74,200	56,900	-23%	76,200	57,200	-25%	77,000	56,800	-26%	77,500	57,800	-25%
33	Lutwyche Road	South of Newmarket Road, Windsor	60,300	105,100	77,400	-26%	110,800	79,000	-29%	113,400	79,900	-30%	116,300	82,100	-29%
22	Sandgate Road	South of Junction Road, Clayfield	37,000	51,100	38,100	-25%	55,800	39,300	-30%	59,300	41,800	-30%	60,700	45,100	-26%
31	Sandgate Road	South of Bonney Avenue, Albion	35,900	57,300	42,500	-26%	62,700	44,800	-29%	67,400	46,900	-30%	71,000	51,400	-28%
18	Kedron Park Road	East of Lutwyche Road, Kedron	17,600	35,000	26,600	-24%	37,000	27,600	-25%	38,700	28,300	-27%	39,900	29,300	-27%
20	Rose Street	Melrose Park, Wooloowin	10,700	24,600	16,700	-32%	25,500	17,700	-31%	26,700	18,600	-30%	26,700	19,100	-28%
23	Junction Road	West of Sandgate Road, Clayfield	18,200	29,800	21,800	-27%	30,700	22,900	-25%	32,000	24,200	-24%	32,600	25,200	-23%
5	Rode Road	West of Sandgate Road, Wavell Heights	19,300	24,700	19,100	-23%	25,600	19,100	-25%	27,500	20,700	-25%	28,100	21,400	-24%
15	Nudgee Road	North of E-W Arterial, Hendra	5,400	8,600	10,300	20%	10,200	12,700	25%	11,500	14,300	24%	12,800	15,300	20%
16	Nudgee Road	South of E-W Arterial, Hendra	24,600	21,800	17,800	-18%	22,200	19,200	-14%	23,900	20,900	-13%	25,600	20,700	-19%
36	Kingsford Smith Drive	East of Cooksley Street	65,600	73,500	66,900	-9%	76,500	71,000	-7%	77,200	74,100	-4%	78,000	75,900	-3%
37	Kingsford Smith Drive	East of Racecourse Road, Hamilton	54,900	71,000	64,700	-9%	74,300	69,100	-7%	75,300	72,600	-4%	76,400	74,600	-2%
7	South Pine Road	Kedron Brook, Everton Park	33,800	49,300	42,200	-14%	50,400	43,900	-13%	58,100	51,600	-11%	59,100	52,300	-12%
25	Enoggera Road	South of South Pine Road, Alderley	50,400	57,900	51,000	-12%	58,000	51,400	-11%	71,800	62,800	-13%	73,900	64,500	-13%

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Suburban Roads															
32	Newmarket Road	West of Lutwyche Road, Windsor	17,600	33,900	26,000	-23%	36,900	28,100	-24%	39,400	31,000	-21%	41,900	33,300	-21%
4	Hamilton Road	West of Sandgate Road, Wavell Heights	15,200	21,500	18,300	-15%	20,700	18,300	-12%	22,800	19,500	-14%	24,100	20,200	-16%
19	Kedron Park Road	South of Park Road, Wooloowin	7,300	11,800	9,600	-19%	13,400	10,100	-25%	13,700	9,900	-28%	14,800	10,200	-31%
29	Albion Road	East of Lutwyche Road, Windsor	15,100	19,900	19,600	-2%	21,800	21,900	0%	23,100	22,700	-2%	23,700	24,200	2%
30	Albion Road	At overpass, Albion	17,000	22,500	20,500	-9%	24,100	23,200	-4%	26,000	24,200	-7%	27,500	25,700	-7%
12	Shaw Road	Kedron Brook, Wooloowin	14,100	15,800	14,000	-11%	16,500	14,300	-13%	17,200	15,000	-13%	18,500	15,500	-16%
28	Chalk Street	West of Bridge Street, Wooloowin	10,700	14,400	10,800	-25%	16,600	11,700	-30%	17,700	12,000	-32%	19,000	12,600	-34%
26	Maygar Street	West of Lutwyche Road, Windsor	8,300	8,100	7,600	-6%	9,100	8,300	-9%	9,900	9,300	-6%	10,600	9,900	-7%
9	Webster Road	South of Stafford Road	25,100	26,600	24,000	-10%	27,400	24,800	-9%	30,000	25,200	-16%	32,700	26,200	-20%
District Roads															
6	Edinburgh Castle Road	North of Leckie Road, Kedron	10,600	7,500	6,200	-17%	7,800	6,500	-17%	8,400	6,900	-18%	9,200	7,100	-23%
21	Dawson Street	North of Rose Street, Wooloowin	10,400	10,000	9,000	-10%	10,300	9,000	-13%	10,500	9,400	-10%	10,600	9,800	-8%
24	Dickson Street	North of Wride Street, Wooloowin	13,000	11,700	9,200	-21%	11,800	9,200	-22%	12,400	9,100	-27%	13,000	9,300	-28%

- **Table 9-11 Surface Traffic Changes within the Inner North Area - Comparison without and with the Project**

Screenline	2004	Average Weekday Traffic											
		2012			2016			2022			2026		
		Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Western	74,900	106,500	109,800	3%	112,900	116,700	3%	119,500	124,700	4%	123,700	129,100	4%
Central	60,500	81,600	66,200	-19%	87,300	71,400	-18%	91,400	73,100	-20%	94,200	75,800	-20%
Eastern	66,800	90,300	81,900	-9%	96,600	89,300	-8%	103,700	98,100	-5%	109,600	104,000	-5%
Northern	180,100	231,100	187,400	-19%	243,600	193,500	-21%	256,400	201,100	-22%	269,000	208,600	-22%
Screenline	2004	Commercial Vehicle Weekday Traffic											
		2012			2016			2022			2026		
		Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change	Without AL	With AL	% Change
Western	4,300	5,600	5,500	-2%	6,100	6,200	2%	6,300	6,300	0%	6,500	6,400	-2%
Central	4,100	5,300	4,200	-21%	5,800	4,500	-22%	5,400	3,600	-33%	5,200	3,400	-35%
Eastern	7,500	9,400	9,200	-2%	10,100	9,800	-3%	10,700	10,300	-4%	11,000	10,400	-5%
Northern	9,500	11,900	9,600	-19%	12,800	8,300	-35%	13,200	7,400	-44%	13,900	7,100	-49%

Table 9-12 Intersection Performance without and with Airport Link – 2012 & 2022

Intersection	Peak	2004 LOS	2012				2022			
			Without AL		With AL		Without AL		With AL	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Gympie Road Intersections										
Gympie Road/ Strathmore Street/Castle Street	AM	B	0.72	A	0.81	A	0.80	A	0.87	A
	PM	C	0.78	A	0.86	A	0.91	A	0.95	B
Gympie Road/ Sadlier Street	AM	- (1)	0.89	B	1.00	B	0.91	B	1.00	C
	PM	- (1)	0.74	B	0.81	B	0.80	A	1.00	C
Gympie Road/ Stafford Road	AM	D	1.00	C	1.06	F	1.00	D	1.16	F
	PM	E	1.14	F	1.13	F	1.20	F	1.09	F
Stafford Road Intersections										
Stafford Road/ Webster Road	AM	F	1.13	F	1.14	F	1.19	F	1.24	F
	PM	D	1.06	F	1.33	F	1.17	F	1.39	F
Stafford Road/ Clifford Street	AM	A	0.67	A	0.97	A	0.79	B	1.00	B
	PM	A	0.82	A	0.80	A	1.00	A	1.00	B
Stafford Road/ Lennon Street	AM	A	0.51	A	0.75	A	0.57	A	0.80	A
	PM	A	0.52	A	0.87	A	0.62	A	0.96	C
Stafford Road/ Richmond Street	AM	A	0.52	C	0.84	C	0.58	C	0.90	D
	PM	B	0.60	C	0.94	D	0.77	C	0.98	E
Lutwyche Road Intersections										
Lutwyche Road/ Kedron Park Road	AM	C	0.99	D	1.02	F	1.12	F	1.03	F
	PM	F	1.12	F	1.44	F	1.09	F	1.38	F
Lutwyche Road/ Norman Avenue/ Norman Street	AM	A	0.59	A	0.60	A	0.84	C	0.81	D
	PM	A	0.66	B	0.62	B	0.89	C	0.84	D
Lutwyche Road/ Bradshaw Street	AM	D	0.93	C	0.79	C	0.91	C	0.83	C
	PM	B	1.00	C	1.00	B	1.24	F	0.99	B
Lutwyche Road/ Chalk Street/ Thistle Street	AM	E	1.13	E	0.90	B	1.13	F	0.92	B
	PM	B	1.01	C	0.90	B	1.00	E	1.00	C
Lutwyche Road/ Maygar Street	AM	C	0.62	B	0.49	C	0.69	C	0.54	C
	PM	D	1.08	F	0.87	B	1.18	F	1.04	F
Lutwyche Road/ Fosbery Street	AM	C	0.56	A	0.47	B	0.59	B	0.51	B
	PM	B	0.42	A	0.37	A	0.47	A	0.37	B
Lutwyche Road/ Albion Road	AM	B	1.00	D	1.00	D	1.00	D	1.00	D
	PM	B	1.01	F	1.00	D	1.12	F	1.02	E
Lutwyche Road/ Bowen Street	AM	A	0.79	A	0.69	A	0.83	A	0.70	A
	PM	A	0.89	A	0.75	A	0.99	C	0.74	A
Lutwyche Road/ Eildon Street/Le Geyt Street	AM	A	0.83	A	0.74	A	0.87	A	0.74	A
	PM	A	0.90	A	0.73	A	0.99	C	0.76	A

Intersection	Peak	2004 LOS	2012				2022			
			Without AL		With AL		Without AL		With AL	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Lutwyche Road/ Grantson Street	AM	A	0.91	A	0.80	A	0.97	B	0.82	A
	PM	A	0.99	C	0.77	A	1.09	F	0.80	A
Lutwyche Road/ Newmarket Road	AM	D	1.00	E	0.80	D	1.07	F	0.88	D
	PM	C	1.28	F	1.09	F	1.42	F	1.261	F
Lutwyche Road/ Federation Street	AM	F	0.99	D	0.78	B	1.13	F	0.85	B
	PM	A	1.09	E	0.80	B	1.04	E	0.83	B
Lutwyche Road/ Northey Street	AM	D	1.03	E	1.00	D	1.17	F	1.00	D
	PM	D	1.33	F	0.99	F	1.34	F	1.12	F
Bowen Hills and Fortitude Valley Intersections										
Bowen Bridge Road/Butterfield Street	AM	E	0.97	D	0.82	C	1.03	E	0.85	C
	PM	D	1.45	F	1.28	F	1.54	F	1.25	F
Bowen Bridge Road/ Campbell Street	AM	A	0.67	A	0.69	B	0.74	A	0.71	B
	PM	B	1.08	F	0.88	B	1.16	F	0.89	B
Bowen Bridge Road/O'Connell Terrace	AM	B	0.84	C	0.94	D	0.94	D	0.92	D
	PM	B	1.10	F	0.90	C	1.20	F	0.91	C
Bowen Bridge Road/Herston Road	AM	C	0.86	D	1.00	E	0.85	D	1.00	E
	PM	C	0.84	D	1.03	F	0.88	D	1.03	F
Bowen Bridge Road/Gregory Terrace/ Brunswick Street	AM	F	1.00	D	1.00	D	1.00	D	1.00	D
	PM	D	1.00	E	1.01	E	1.00	E	1.02	E
Brookes Street/ Markwell Street/ St Pauls Terrace	AM	C	1.00	D	1.03	F	1.00	E	1.05	F
	PM	C	1.03	E	1.00	E	1.00	E	1.01	E
Brookes Street/ Gregory Terrace	AM	C	0.42	C	0.67	C	0.52	C	0.70	C
	PM	B	0.69	C	0.54	C	0.73	C	0.57	C
Brookes Street/ Wickham Street	AM	B	0.90	C	0.89	C	1.02	E	1.09	F
	PM	B	1.03	E	1.06	F	1.05	E	1.13	F
Campbell Street/ Mayne Road/ Hamilton Place	AM	D	0.38	D	0.78	D	0.40	D	1.09	F
	PM	D	0.59	D	0.80	D	0.60	D	0.90	E
Brookes Street/ Ann Street	AM	B	0.55	A	0.56	B	0.52	A	0.56	B
	PM	B	0.34	B	0.41	B	0.43	B	0.50	B
Breakfast Creek Road/Montpelier Road	AM	E	1.27	F	1.36	F	1.24	F	1.36	F
	PM	E	1.01	F	1.12	F	1.11	F	1.12	F
Bridge Street/ Chalk Street	AM	B	0.60	B	0.43	B	0.68	B	0.42	B
	PM	B	0.62	B	0.56	B	0.81	B	0.51	B

Intersection	Peak	2004 LOS	2012				2022			
			Without AL		With AL		Without AL		With AL	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Sandgate Road Intersections										
Sandgate Road/ Toombul Station (Parkland Street)/Union Street/Grace Street	AM	C	0.93	C	0.93	C	1.10	F	1.00	D
	PM	D	1.01	E	0.98	D	1.13	F	1.05	F
Sandgate Road/ Centro Toombul	AM	B	1.00	D	1.00	D	1.00	D	1.00	D
	PM	B	1.00	D	0.66	B	1.08	F	0.66	B
Sandgate Road/ East-West Arterial Road	AM	F	1.06	F	1.05	F	1.24	F	1.03	F
	PM	E	1.11	F	1.00	E	1.22	F	1.27	F
Sandgate Road/ Junction Road	AM	F	1.28	F	1.09	F	1.39	F	1.19	F
	PM	E	1.33	F	1.14	F	1.36	F	1.23	F
Sandgate Road/ Oriel Road	AM	B	0.88	B	0.73	A	0.88	B	0.68	A
	PM	A	0.70	B	0.65	B	0.86	B	0.72	B
Sandgate Road/ Lapraik Street	AM	A	0.91	B	0.69	A	1.05	E	0.87	A
	PM	A	0.99	C	0.76	A	1.05	E	0.85	A
Sandgate Road/ Bonney Avenue	AM	C	1.00	E	0.92	C	1.06	F	0.91	C
	PM	A	1.11	F	1.04	F	1.18	F	1.05	F
Sandgate Road/ Albion Road	AM	F	0.99	F	0.60	C	1.52	F	0.72	D
	PM	E	1.86	F	1.14	F	2.16	F	1.75	F
Sandgate Road/ Frodsham Street/Crosby Road/Abbotsford Road	AM	F	1.01	E	0.70	B	1.12	F	0.73	C
	PM	D	1.32	F	1.13	F	1.43	F	1.21	F
Abbotsford Road Intersections										
Abbotsford Road/Burrows Street	AM	C	0.81	C	0.72	B	0.88	C	0.74	B
	PM	D	0.91	B	0.85	B	0.93	C	0.88	B
Abbotsford Road/ Edmondstone Road/Mayne Road	AM	C	0.88	B	0.86	B	0.89	B	0.85	A
	PM	F	1.46	F	1.41	F	1.50	F	1.40	F
Abbotsford Road/ Folkestone Street	AM	A	0.88	A	0.60	A	1.05	A	0.67	A
	PM	A	0.91	B	0.77	A	1.02	E	0.82	A
Abbotsford Road/Montpelier Road/Markwell Street/Campbell Street	AM	C	1.09	F	1.09	F	1.18	F	1.29	F
	PM	C	1.24	F	1.45	F	1.10	F	1.56	F
Kingsford Smith Drive Intersections										
Kingsford Smith Drive/Amy Street/Breakfast Creek Road	AM	B	0.95	D	0.73	C	1.17	F	0.84	C
	PM	B	1.03	F	0.99	D	0.94	D	1.02	E

Intersection	Peak	2004 LOS	2012				2022			
			Without AL		With AL		Without AL		With AL	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Kingsford Smith Drive/Cooksley Street	AM	F	0.88	B	0.86	B	0.95	C	0.89	B
	PM	F	1.18	F	1.01	D	1.27	F	1.08	E
Local Area Intersections										
Albion Road/ McLennan Street	AM	C	0.73	C	0.40	B	0.96	D	0.50	B
	PM	B	0.99	A	0.66	A	1.00	A	1.00	A
Albion Road/ Hudson Road	AM	F	0.92	D	0.71	D	1.06	F	0.85	D
	PM	F	1.12	F	0.99	E	1.29	F	0.99	E
Junction Road/ Morrison Road	AM	C	0.98	D	0.71	C	1.04	F	0.79	C
	PM	E	1.00	D	0.97	C	1.00	D	1.00	D
Dawson Street/ Rose Street	AM	C	0.56	B	0.49	B	0.63	B	0.62	C
	PM	C	0.96	C	0.73	C	1.00	D	0.68	C
Kedron Park Road/Park Road	AM	C	0.86	C	0.57	B	0.95	D	0.58	C
	PM	C	1.11	F	0.88	C	1.12	F	0.92	D

Table Note: (1) This intersection was not signalised until 2005.

Table 9-13 Traffic Performance of Intersections at Surface Connections

Surface Connection Intersection & Distance to Tunnel Portal or Conflict Zone (where applicable)		AM PEAK					PM PEAK				
		2004	2012 Without AL	2012 With AL	2022 Without AL	2022 With AL	2004	2012 Without AL	2012 With AL	2022 Without AL	2022 With AL
Stafford Road/Gympie Road	LOS	B	C	F	D	F	C	F	F	F	F
	DOS (X)	1.00	1.00	1.06	1.00	1.16	1.23	1.14	1.13	1.20	1.09
Kedron Park Road/Lutwyche Road	LOS	C	F	F	F	F	F	F	F	F	F
	DOS (X)	1.06	0.99	1.02	1.12	1.03	1.24	1.12	1.14	1.19	1.38
AL Off Ramp	LOS[1]	-	-	E	-	E	-	-	D	-	D
- 200 metres to tunnel portal	DOS(X)[2]	-	-	0.81	-	0.79	-	-	0.67	-	0.74
	Queue[3]	-	-	201m	-	200m	-	-	203m	-	202m
Sandgate Road	LOS	F	F	F	F	F	E	F	E	F	F
	DOS (X)	1.13	1.06	1.05	1.24	1.03	1.12	1.11	1.00	1.22	1.27
AL Eastbound Off-ramp	LOS[1]	-	-	E	-	E	-	-	E	-	E
- 200 metres to tunnel portal	DOS (X)[2]	-	-	0.75	-	0.89	-	-	0.84	-	0.75
	Queue[3]	-	-	81m	-	96m	-	-	213m 200m[4]	-	213m 200m[4]
AL Westbound Off-ramp	LOS[1]	-	-	E	-	D	-	-	E	-	F
- 480 metres to ramp conflict zone	DOS (X)[2]	-	-	0.75	-	0.79	-	-	0.92	-	1.03
	Queue[3]	-	-	179m	-	169m	-	-	264m	-	472m
Campbell Street/Hamilton Place	LOS	D	D	D	D	F	D	D	D	D	E
	DOS (X)	0.44	0.38	0.78	0.40	1.09	0.74	0.59	0.80	0.60	0.90
AL Off-ramp	LOS[1]	-	-	C	-	F	-	-	D	-	E
- 700 metres to ramp conflict zone	DOS (X)[2]	-	-	0.77	-	1.09	-	-	0.77	-	0.89
	Queue[3]	-	-	293m	-	549m	-	-	236m	-	237m
O'Connell Terrace/AL Off-ramp	LOS	-	-	C	-	C	-	-	B	-	B
	DOS (X)	-	-	0.30	-	0.32	-	-	0.39	-	0.42
AL Off-ramp	LOS[1]	-	-	C	-	C	-	-	D	-	D
- 300 metres to ramp conflict zone	DOS (X)[2]	-	-	0.30	-	0.32	-	-	0.25	-	0.32
	Queue[3]	-	-	64m	-	56m	-	-	77m	-	37m

Table Notes: (1) Level of Service (LOS) for Airport Link Ramp (3) 95% queue on Airport Link Ramp unless otherwise noted

(2) Degree of Saturation (X) for Airport Link Ramp (4) 90% queue on Airport Link Ramp

East-West Arterial and Nudgee Road

An assessment of the effect of the project on the East-West Arterial intersections with Gateway Motorway and Nudgee Road has been undertaken. These intersections are on a key approach route to the Australia TradeCoast precinct, an area which, as discussed in **Section 8.3**, is forecast to experience a substantial growth in forecast traffic demand due to increased employment and economic activity.

The performance of the East-West Arterial/Nudgee Road intersection and the East-West Arterial/Gateway Motorway Ramps/Airport Drive roundabout have been analysed in aaSIDRA using peak period turning movements volumes extracted from the strategic transport model scenarios examined in the Airport Link EIS.

The findings are summarised in **Table 9-14** and the assessment shows:

- Both the East-West Arterial/Nudgee Road signalised intersection and the East-West Arterial/Gateway Motorway ramps/Airport Drive roundabout are highly congested and experience heavy delays and queuing during peak periods. The aaSIDRA results would suggest that there is currently a significant impact from the queue on the East-West Arterial at the roundabout, extending back to the Nudgee Road signals, a distance of only 170 metres. This would indicate that currently the throughput of the Nudgee Road signals is compromised by queuing from the roundabout at times during the peak.
- Traffic demand through both intersections following the completion of GUP is forecast to be equal, to or greater than, current levels, although changed traffic patterns occur due to GUP. The intersection analysis for 2012 without Airport Link indicates congested operations and significant queuing are forecast on most intersection approaches at both the East-West Arterial/Nudgee Road signalised intersection and the roundabout. The performance of the roundabout would be significantly worse than current operations.
- In 2012 Airport Link adds 12% in the AM peak and 3% in the PM peak to total volumes at the Nudgee Road intersection, and 4% in the AM peak and 5% in the PM peak to volumes at the roundabout.
- Traffic distribution changes through these intersections with Airport Link. Lower demands on the Nudgee Road south approach and reduction of some of the key demands through the roundabout occur (for example, a reduction in demand for movements between the East-West Arterial and the Gateway Motorway south). East-west through demands, however, would be increased.
- At the East-West Arterial/Nudgee Road intersection with the Airport Link in 2012, overall intersection performance is forecast to improve slightly in the AM peak, and reduce slightly in the PM peak, with some queuing pressures reduced. However, in terms of the critical queue for the Airport Link tunnel, (i.e. the queue extending west from Nudgee Road where a distance of 1.6km is available to the tunnel portal), a satisfactory situation would not occur unless some level of improvements were undertaken at the intersection. In conjunction with this it would be necessary to ensure that improvements at the nearby roundabout were also undertaken. This is to ensure that the queuing extending west from the roundabout to Nudgee Road (where only 170 metres is available) did not in turn affect the operation of the East-West Arterial/Nudgee Road signals (as is the current situation).
- Without intersection improvements, conditions at both intersections would continue to degrade, worsening significantly in terms of queuing and delay.
- A detailed investigation of the most suitable form of upgrading to be undertaken at this location in order to achieve a long-term solution for network operations in this area is warranted. This, however, is beyond the scope of the EIS, because the project itself is not the primary driver of the need for improvement. Various investigations have been undertaken in the past to assess the issue (Arup, 2005; GHD, 2003; CityDesign, 2005). A further study is now programmed to examine the long-term transport access needs of the ATC precinct (SEQIPP, 2006)

- Within this context, an analysis of two notional traffic management solutions, that would suffice to achieve satisfactory operations, has been undertaken for the purposes of EIS traffic assessment. This has been carried out to demonstrate that, whilst the Airport Link Project in itself does not trigger the need for intersection improvements at this location, a satisfactory operational solution is available that would not compromise the project operation.
- The notional upgrading assessed at East-West Arterial/Nudgee Road intersection involves:
  - An additional eastbound stand-up lane on the East-West Arterial;
  - Widening on the Nudgee Road north approach to achieve additional stand-up lane capacity; and
  - Removal of the pedestrian crossing on the eastern side of the East-West Arterial.
- The notional upgrading assessed at the roundabout is the intersection upgrading identified for 2011 in the Gateway Upgrade Project Traffic Modelling and Forecasting Report (MWT, 2004). It involves replacement of the roundabout with a signalised single point interchange. The indicative form analysed comprised three stand-up through lanes and double right turn lanes on both Airport Drive and the East-West Arterial, and additional flaring on the motorway off-ramps to provide three right turn lanes on the northbound off-ramp and two right-turn lanes on the southbound off-ramp. This notional arrangement for the Airport roundabout has been proposed as an interim measure pending the outcomes of a major Australia TradeCoast Transport Study.
- The analysis indicates that with these indicative upgrades intersection in 2012 a satisfactory situation with regard to queuing between the Nudgee Road intersection and the Airport Link tunnel could be achieved in 2012. A 95th percentile queue of 900 metres (compared to the available 1.6km) is indicated. Queuing between the Gateway Motorway Ramps signalised single point interchange and the East-West Arterial/Nudgee Road signals could be satisfactorily managed by signal co-ordination.
- A study, termed the Australia TradeCoast Transport Study, is programmed within SEQIPP 2006-2026 to examine the long-term transport access needs of the ATC precinct and this will incorporate investigation of long-term solutions to managing traffic on this important access route to the Australia TradeCoast precinct. This ATC Transport Study should build upon the notional upgrades assessed for the purposes of this EIS. It should explore the merits of grade-separated treatments, and the relationship between other potential accesses to the precinct, as identified in the ATC North Road Network Study (Arup, 2005),as well as land-use distribution/sequencing within ATC North in the development of the most appropriate long-term strategy.

9.3.3 Travel Time Benefits

An assessment of the effect of the project on travel times has been undertaken by comparing estimates of peak period travel times without the project to travel times, both on surface road routes and via the Airport Link itself, once the project is operational.

Estimated travel times for key routes during peak periods without and with Airport Link are summarised in **Table 9-15**. These have been extracted from the strategic model. The routes and timing points referred to in **Table 9-15** are shown in **Figure 9-16**. These routes have been selected to encompass examples of the key travel patterns within the area such as north-south travel associated with the Central City (Chermside to Fortitude Valley, Nundah to Fortitude Valley), cross-city movements (Chermside to East Brisbane, Stafford to Milton) and travel to the ATC/Brisbane Airport precinct (Hendra to Milton, Hendra to Fortitude Valley).

The travel times listed provide a reasonable guide to the relative change in travel times that would be expected to occur due to the project. Although they include indicative intersection delays, forecast by the strategic model, each intersection is operationally unique and the forecast delays will not fully reflect the complexities of all the intersections involved. It should be noted that improvements in travel time forecast in the strategic model

generally result from lower congestion levels, and reflect a more stable road network in terms of journey time variability. Associated with any forecast reductions in travel times there will thus also be reliability improvements in travel time provided by the project.

As expected, forecast travel times on all routes increase over time without the project, with peak period speeds declining substantially, reflecting the expected increases in demand and congestion. The travel time benefits during peak periods offered by Airport Link on most routes also increase over time.

In most cases, the forecast travel times are longer in the evening peak than the morning peak. The river crossing portion of the Chermside to East Brisbane (D) route, however, is forecast to have longer travel times in the morning peak hour. The relative contribution of the river crossing to this total route increases over time, reducing and in some cases reversing this difference between peak periods. On the northern east-west route between Hendra and Stafford (E), travel times via Airport Link are similar in both peaks.

The travel time benefits offered by Airport Link on the cross-city routes (routes D, E and F) are significant, averaging approximately 30% in the morning peak hour and 40% in the evening peak. The time savings for these routes range from 4 minutes to 14 minutes, with the greatest benefits on the east-west routes to the ATC/Brisbane Airport precinct (E and F) in the evening peak in 2022. The average travel time benefit on these routes is approximately 8 minutes.

Airport Link also provides significant travel time benefits on radial routes, averaging over 40% in both AM and PM peak hours. This represents time savings from 6 minutes on the Nundah to Fortitude Valley (B) route and the Hendra to Fortitude Valley (C) route and 7 minutes from Chermside to Fortitude Valley (A) in the morning peak in 2012, to 8 to 9 minutes savings by 2022. Evening peak savings of 10 to 12 minutes are estimated by 2022.

Traffic choosing to use the un-tolled surface links instead of Airport Link would also benefit from the project, though to a lesser degree. Average benefits of approximately 10% to 15% on cross-town routes and approximately 20% to 30% on radial routes are forecast for this traffic. This represents average time savings of approximately 3 minutes for cross-town routes and 6 minutes for radial routes. The most substantial surface route benefits are encountered on the Chermside to Fortitude Valley route (A) in 2022, while the cross-river route (D) gains the least advantage.

- **Table 9-14 East West Arterial Intersection Performance Without and With Airport Link in 2012**

Scenario	AM Peak			PM Peak		
	Total vph	Degree of Saturation (X)	LOS	Total vph	Degree of Saturation (X)	LOS
East-West Arterial/Nudgee Road Signalised Intersection						
Existing (2005) (1)	4,500	1.39	F	3,900	0.94	D
2012 without Airport Link	6,000	1.29	F	7,200	1.43	F
2012 with Airport Link	6,700	1.25	F	7,400	1.47	F
2012 with Airport Link & indicative upgrade of existing signalised intersection	6,700	1.09	F	7,400	1.08	F
East-West Arterial/Gateway Ramps/Airport Drive Roundabout						
Existing (2004)	6,900	1.78	F	7,000	1.96	F
2012 without Airport Link	6,900	2.12	F	8,000	2.60	F
2012 with Airport Link	7,300	1.80	F	8,400	2.46	F
2012 with Airport Link & indicative replacement of roundabout with single point signalised interchange	7,300	0.86	D	8,400	0.96	D

Table Notes: (1) Volumes used for this location from 2005 DMR Traffic Census.

Table 9-15 Effects of Airport Link on Travel Times and Speeds for Key Routes

Route		Direction	Without AL		With AL				AL Time Benefits			
					Via AL		On Surface		Via AL		On Surface	
			(min)	(km/h)	(min)	(km/h)	(min)	(km/h)	(min)	(%)	(min)	(%)
AM Peak Hour												
2004												
A	Chermside to Fortitude Valley	Southbound	14	31	-	-	-	-	-	-	-	-
B	Nundah to Fortitude Valley	Southbound	14	33	-	-	-	-	-	-	-	-
C	Hendra to Fortitude Valley	Southbound	14	34	-	-	-	-	-	-	-	-
D	East Brisbane to Chermside	Northbound	20	32	-	-	-	-	-	-	-	-
E	Stafford to Hendra	Eastbound	11	41	-	-	-	-	-	-	-	-
F	Hendra to Milton	Southbound	17	40	-	-	-	-	-	-	-	-
2012												
A	Chermside to Fortitude Valley	Southbound	17	27	9	50	14	32	7	44%	3	17%
B	Nundah to Fortitude Valley	Southbound	16	29	10	57	13	35	6	39%	2	16%
C	Hendra to Fortitude Valley	Southbound	15	31	9	59	14	35	6	39%	2	11%
D	East Brisbane to Chermside	Northbound	19	33	13	48	17	36	6	32%	1	8%
E	Stafford to Hendra	Eastbound	13	35	9	50	12	39	4	33%	1	9%
F	Hendra to Milton	Southbound	20	34	14	51	19	35	6	29%	1	5%
2022												
A	Chermside to Fortitude Valley	Southbound	22	20	11	42	16	28	11	49%	6	29%
B	Nundah to Fortitude Valley	Southbound	19	24	10	53	14	33	9	46%	5	27%
C	Hendra to Fortitude Valley	Southbound	18	27	11	52	15	32	7	40%	3	17%
D	East Brisbane to Chermside	Northbound	23	26	17	35	22	28	6	26%	1	6%
E	Stafford to Hendra	Eastbound	19	24	11	38	15	31	7	39%	4	23%
F	Hendra to Milton	Southbound	22	30	15	46	20	32	7	31%	2	9%

Route		Direction	Without AL		With AL				AL Time Benefits			
					Via AL		On Surface		Via AL		On Surface	
			(min)	(km/h)	(min)	(km/h)	(min)	(km/h)	(min)	(%)	(min)	(%)
PM Peak Hour												
2004												
A	Fortitude Valley to Chermside	Northbound	20	23	-	-	-	-	-	-	-	-
B	Fortitude Valley to Nundah	Northbound	15	30	-	-	-	-	-	-	-	-
C	Fortitude Valley to Hendra	Northbound	16	30	-	-	-	-	-	-	-	-
D	Chermside to East Brisbane	Southbound	21	30	-	-	-	-	-	-	-	-
E	Hendra to Stafford	Westbound	12	37	-	-	-	-	-	-	-	-
F	Milton to Hendra	Northbound	18	38	-	-	-	-	-	-	-	-
2012												
A	Fortitude Valley to Chermside	Northbound	23	19	14	33	17	26	9	41%	6	26%
B	Fortitude Valley to Nundah	Northbound	22	21	14	39	17	27	8	37%	5	22%
C	Fortitude Valley to Hendra	Northbound	21	23	14	40	18	28	8	36%	4	18%
D	Chermside to East Brisbane	Southbound	23	27	13	46	17	36	9	41%	5	23%
E	Hendra to Stafford	Westbound	15	31	10	44	13	36	5	33%	2	14%
F	Milton to Hendra	Northbound	25	27	14	49	23	30	11	43%	2	9%
2022												
A	Fortitude Valley to Chermside	Northbound	30	15	18	25	21	21	12	41%	9	29%
B	Fortitude Valley to Nundah	Northbound	27	18	15	35	19	25	12	43%	8	29%
C	Fortitude Valley to Hendra	Northbound	25	19	15	36	19	25	10	40%	6	24%
D	Chermside to East Brisbane	Southbound	22	29	17	36	21	29	4	21%	0	1%
E	Hendra to Stafford	Westbound	24	19	10	43	16	28	14	58%	8	32%
F	Milton to Hendra	Northbound	30	22	16	45	25	27	14	48%	5	17%

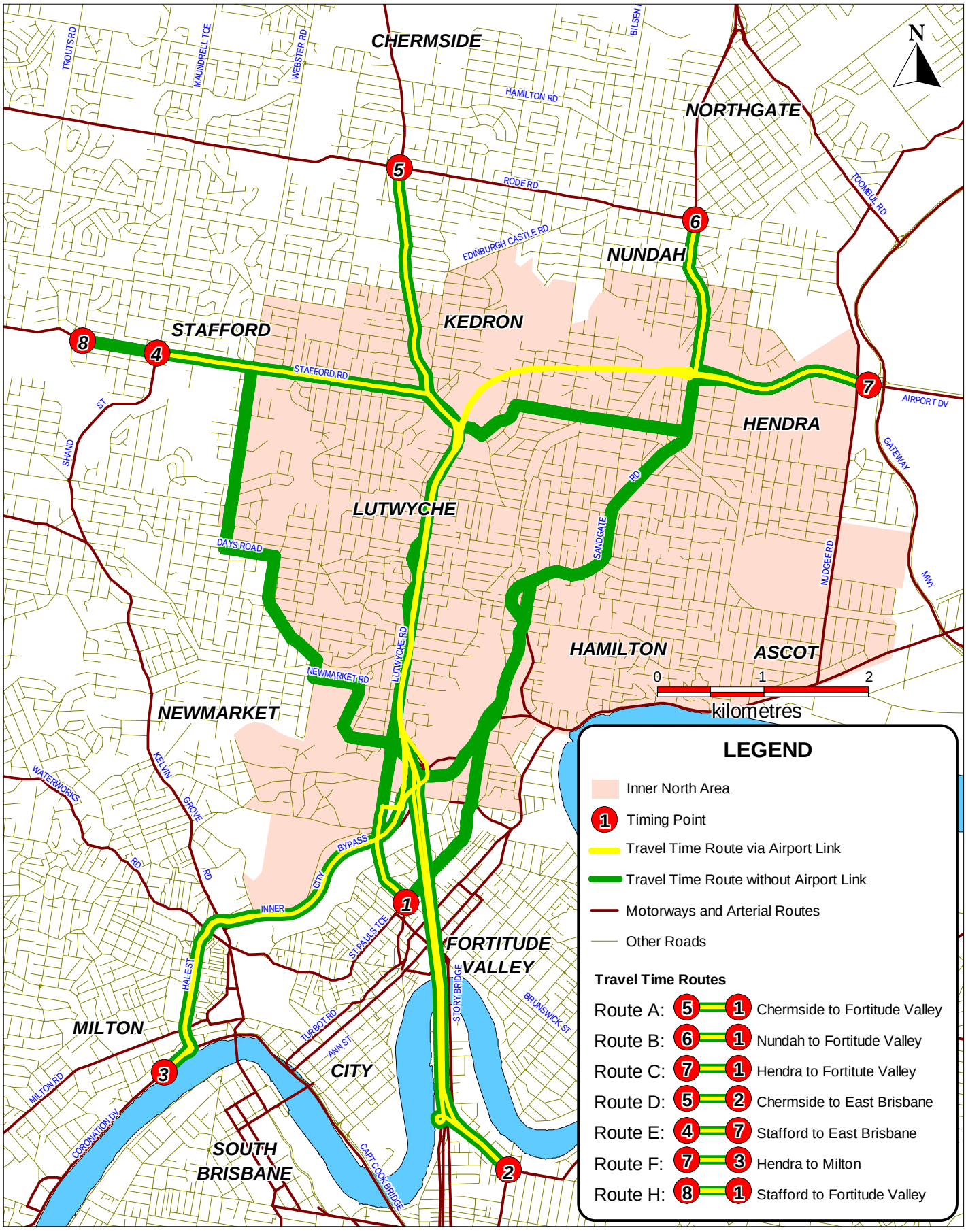


Figure 9-16
Travel Time Comparison Routes

Airport Link

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9.4 Local Access Effects

The main traffic impacts caused by the implementation of Airport Link would generally be confined to the tunnel portal areas and immediate approaches. Other effects would however extend for the entire route due to changes in traffic flows as a result of the project and these have been discussed previously in this Chapter. Local access impacts caused by the Northern Busway in combination with the project are considered in **Section 10**.

The key local effects have been considered in the following areas:

- Northern connections:
  - Kedron east precinct (east of Gympie Road);
  - Gordon Park precinct (south of Stafford Road);
  - Kedron west precinct (north-western of Gympie Road/Stafford Road intersection);
  - Emergency Services Complex (at Kedron Brook);
  - Lutwyche precinct (west of Lutwyche Road); and
  - Toombul precinct;
- Southern connection:
  - General area between Federation Street and O'Connell Terrace east of Bowen Bridge Road; and
  - Royal Brisbane and Women's Hospital (RBWH).

9.4.1 Kedron East Precinct

Left-in left-out access has been maintained at local street connections to Gympie Road southbound with the exception of Lassetter Street, where direct access to Gympie Road would no longer be provided due to its proximity to the signalised intersection between Gympie Road and Stafford Road. Alternative access remains available at Park Terrace and Arnott Street so the effect on local accessibility is considered to be minor.

The priority control of movements at the Arnott Street/Leckie Road intersection has been changed such that Leckie Road southbound traffic would be controlled by stop signs to eliminate the potential conflict with left turn traffic from Gympie Road into Arnott Street. The only impact this change would have on local access is that the right turn from Arnott Street into Leckie Road will be removed. Local traffic exiting from Arnott Street and Leckie Road would be able to proceed onto Gympie Road southbound in a dedicated lane to the Stafford Road signals, providing for convenient egress from the local area. Traffic exiting Arnott Street or Leckie Road cannot proceed directly to the right turn slot into Stafford Road due to the safety problems that would be associated with weaving over a short distance, this is consistent with the existing situation. Local traffic would be able use the signalised intersection at Gympie Road/Sadlier Street and then proceed southbound on Gympie Road to turn into Stafford Road.

The overall effect of the project on local traffic access to the Kedron east precinct is considered to be small and well managed within the project design.

9.4.2 Gordon Park Precinct

The Airport Link off-ramp for westbound traffic will enter Stafford Road in the median. Adjacent to this ramp, a restricted area would exist where one single through lane would now be provided from Gympie Road, instead of the current two through lane situation. Property access to residences along this section and kerbside parking would be impacted, as residents would need to enter/exit their properties from this single lane. Currently residents have access from a second kerb side lane allowing through traffic to pass when decelerating to turn left-in to property occurs. As turn movements into Stafford Road are controlled at the signals residents turning

left-out of their properties would be able to do so during gaps in the traffic stream created by the signal phasing. Provision for U-turns has been incorporated at the signals to enable access to local properties for traffic approaching from the west on Stafford Road.

The Airport Link project would retain a left-in left-out access to Suez Street at Gympie Road. With this in place, it is proposed to cul-de-sac Swan Street at its northern end so that access to Stafford Road would be prevented as this would improve conditions for pedestrian safety in this area. Right turn entry to Swan Street from the west (via the U-Turn slot on Stafford Road) could be provided to enhance accessibility for residents if required. It should be noted that these arrangements for Swan Street and Suez Street need to be modified with the implementation of the Northern Busway in this area. These modifications are discussed further in **Section 10.4**.

In summary, there are moderate effects of the project on local traffic access to the Gordon Park North precinct, however they have been suitably managed within the project design to minimise adverse impacts.

9.4.3 Kedron West Precinct

The residential precinct located to the north-western of the Stafford Road/Gympie Road intersection would continue to be serviced as existing by left-in left-out accesses to Gympie Road at Brookfield Road, Homebush Road, Broughton Road and Somerset Road. As discussed in **Section 9.3.1** the implementation of local area traffic management treatments, including entry thresholds, should be carried out. mitigate against any potential through traffic use of these local roads by northbound exit traffic.

Existing arrangements to the precinct for Stafford Road access via Clarence Road are proposed to remain, although the implementation of signals at this intersection should be considered as part of a management strategy for Stafford Road to cater for the increased traffic levels associated with the project. This has been previously discussed in **Section 9.2.2**.

In summary, the overall effect of the project on local traffic access to the Kedron west precinct is considered to be small although mitigative measures are recommended to address the potential pressure of increased traffic on Gympie Road and Stafford Road on traffic movements within the precinct.

9.4.4 Emergency Services Complex

The primary access to the complex is via left-in left- out movements onto Gympie Road, as well as secondary access onto Park Road via an oval owned by Emergency Services but used by Kedron State High School. The project would close the Gympie Road access and relocate some of the Emergency Services Complex. The oval has been identified as an alternative location for the site with a primary vehicle access onto Park Road. Traffic volumes on Park Road are forecast to be reduced with the project (as described in **Section 9.3.1**) and these revised access arrangements would provide sound accessibility to the site, with flexibility for entry and exit turns from both east and west.

In summary, the project affects access arrangements for the Emergency Services Complex, however a suitable alternative arrangement can be realised with the project design.

9.4.5 Lutwyche Precinct (West of Lutwyche Road)

The priority intersections on Lutwyche Road providing residential precinct access at Colton Avenue and Windsor Avenue allow for all turn movements. With the project both Colton Avenue and Windsor Avenue would no longer have direct access to Lutwyche Road. A service road will be constructed that will link these streets from Norman Avenue in the south to Perry Street in the north. Perry Street would maintain its left-out access to Gympie Road. The Norman Avenue signalised intersection with Lutwyche Road accommodates all movements and this revised access arrangement would provide residents with a safe and convenient

arrangement. Perry Street residents would also benefit from the new service road due to the improved southbound connectivity that it provides.

In summary, there are moderate effects of the project on local traffic access to the Gordon Park south precinct, however they have been suitably managed within the project design to minimise adverse impacts.

9.4.6 Toombul Precinct

Local accessibility to the Toombul Shopping Centre and suburbs north of Shulz Canal would improve with the project. A more direct route would be available by the east-west toll tunnel, and traffic reductions on the Junction Road-Rose Street-Park Road route are also forecast. Both factors would improve travel times and connectivity to this precinct. An additional northbound lane on Sandgate Road north of Schulz Canal the East-West Arterial Road and Toombul Road is incorporated in the design which improves capacity in this region. In addition the effects of reduced traffic volumes on Sandgate Road north due to changed traffic patterns with the east-west toll route (as described in **Section 9.2.2**) would benefit traffic operations in this road segment.

South of the East-West Arterial the project has no effect on the local street connections serving residential precincts on either side of Sandgate Road such as Kedron Street, Noble Street and Eliza Street. Forecast traffic reductions on Sandgate Road would allow for easier access compared to the situation without the project.

In summary, the project has an overall beneficial effect on local traffic access to the Toombul precinct.

9.4.7 Southern Connection

Significant changes to this area compared to the existing situation are to be carried out as part of the NSBT project and only the additional effects due to the connection of Airport Link are discussed.

With NSBT an additional traffic lane will be provided along Lutwyche Road in each direction between Northey Street and Newmarket Road and an access intersection will be created in the vicinity of Northey Street, however movements between Northey Street and the NSBT will not be provided for. The NSBT project also make changes to access to the precinct east of Lutwyche Road with the signalised intersection at Federation Street and Lutwyche Road retained as the major external network connection. These revised arrangements would continue with Airport Link although modifications to the Lutwyche Road/Northey Street/NSBT access intersection would occur.

NSBT provides for revised access arrangements to the Boral Concrete Plant (in Horace Street) via the Lutwyche Road/Northey Street/NSBT access intersection and access to this site is maintained with the Airport Link design features.

With the project O'Connell Terrace would be modified to two-way operation between Bowen Bridge Road and the Airport Link access ramp. As a result only left-out movements are proposed at O'Connell Terrace/Bowen Bridge Road signalised intersection. To allow for local movements, the Campbell Street/Bowen Bridge Road intersection would be modified to provide for right turn movements onto Bowen Bridge Road northbound. A protected right turn bay would be constructed on Bowen Bridge Road to allow for signalised turn movements into O'Connell Terrace for ramp frontage access. Wren Street will be cul-de-saced with access provided from Campbell Street. O'Connell Terrace would remain one-way between the signalised Airport Link off ramp intersection and Sneyd Street, and further east would remain two-way as per the NSBT arrangements.

The Mayne Road/Hamilton Road/Campbell Street intersection would be upgraded with the project, as Airport Link on and off ramps would be located at this position. It is noted that Campbell Street will already be discontinuous with the NSBT and local access is provided for within the design via a one-way westbound

service road alongside the Airport Link on ramp to join the intersection with Tufton Street, east of Hamilton Place. Tufton Street can then provide access to Bowen Bridge Road and Hamilton Place through O'Connell Terrace.

In summary, there are moderate effects of the project on local traffic access in the southern connection region. However, suitable alternative access arrangements have been incorporated into the project design to minimise adverse impacts.

9.4.8 Royal Brisbane and Women's Hospital

Access arrangements to the RBWH, which are primarily off Butterfield Street, would not be affected by the Airport Link project. The existing entry opposite O'Connell Terrace is also maintained. Traffic volumes on Butterfield Street are forecast to experience a small reduction with the project.

The project would also improve travel times on both surface routes and via the Airport Link tunnel itself for routine and emergency access to the hospital. The Airport Link route would be available for ambulance trips to the RBWH, Princess Alexandra (via NSBT) and Prince Charles Hospital at Chermside, which would be a significant benefit in an emergency situation at the Airport.

In summary, the project has an overall beneficial effect on traffic access for the RBWH.

9.5 Bus Travel Effects

Effects on bus travel due to the project would include:

- Changes in travel time and travel time reliability due to changed traffic conditions or traffic volumes on the road network;
- Potential for bus services to utilise sections of the Airport Link when operational;
- Changes to bus routes due to traffic management during the construction phases; and
- Changes in bus stop locations during construction or after the project is opened.

The effects on bus operations during construction are discussed specifically in **Section 11**.

9.5.1 Corridor Effects

Traffic reductions are forecast on a number of road corridors in the Inner North that cater for bus routes. Reduced traffic will improve travel times and travel time reliability, compared to the scenario without the project. In some instances on feeder routes to the north of the project such as Gympie Road and Stafford Road, and on the East-West Arterial Road east of the project increases in traffic volumes are forecast. These would have some adverse impact on bus travel times in these areas.

The three major north-south bus corridors in the Inner North area are Gympie Road-Lutwyche Road-Bowen Bridge Road, Sandgate Road and Webster Road-Grange Road-Days Road-Kedron Brook Road.

The most significant east-west link in the Inner North area that caters for bus movements is Stafford Road (west of Richmond Road). Lower bus volumes use Kingsford Smith Drive, East West Arterial Road and Rose Street-Junction Road.

To assess the effects on bus travel due to changes in traffic conditions with the project, an assessment of peak hour travel times along major bus routes on the surface road system, once the project is operational, has been undertaken. Estimated change in overall traffic volumes, the change in travel speed in the peak direction, and

the forecast bus use for key routes during peak periods are summarised in **Table 9-16**. These have been extracted from the strategic model. The travel time comparison routes are shown in **Figure 9-16**. These routes correspond to the key bus routes associated with the bus services that pass through each location.

Key findings from the assessment are:

- During peak hours Lutwyche Road and Sandgate Road will have significant traffic reductions and increased travel speeds on the surface road bus routes. These are the highest utilised corridors for bus services in the Inner North area, and the project will yield travel time savings of 6 minutes in the peak direction during both peaks and improved travel time reliability for bus passengers. An overall average travel time improvement of 37 to 40% in the peak hours in 2022 is forecast for a CBD trip, compared to the scenario without the project.
- Traffic on both the Stafford Road and Gympie Road approaches to north-western connection of the project increases. The Gympie Road-Lutwyche Road-Bowen Bridge Road corridor is the most prominent north south bus corridor in the Inner North area and **Table 9-16** shows that the overall effect of the traffic reductions on Lutwyche Road provides an overall benefit for CBD destined bus services, even taking into account the effects of increased traffic north of the connection.
- Stafford Road is commonly used by bus services that run north south on either the Webster Road - Kedron Brook Road corridor or connecting to the Lutwyche Road corridor to the CBD. **Table 9-16** shows that although traffic volumes will increase on Stafford Road, benefits on other segments of the route mean that Stafford Road bus services will experience either similar or slightly improved overall speed on a CBD trip, compared to the scenario without the project.

9.5.2 Bus Use of Airport Link

The project creates the opportunity for a new bus route between the City and the growing employment and activity areas within ATC North precinct to utilise the east- west tunnel of the Airport Link and travel express to Nudgee Road. Services could gain access from Lutwyche Road at the north-western connection. This new route is under consideration in TransLink's forward planning.

Another option exists for express services in the Gympie Road corridor to use the north-south tunnel between Kedron and Bowen Hills. This option is not preferred however because it would limit services at key intermediate destinations such as Lutwyche. It may represent an option for some services, should alternative bus priority initiatives such as the Northern Busway not proceed within the corridor, in the short-term post-Airport Link opening.

9.5.3 Bus Infrastructure

A total of four (4) bus stops would be affected by the project when operational. Construction affects on a further three (3) bus stops during construction. Bus stops affected by the project are shown in **Figure 9-17**.

Southern Connection

No operational bus stops are located on Campbell Street or O'Connell Terrace. There would be no additional effects on bus stops on Bowen Bridge Road and Lutwyche Road beyond those associated with the North-South Bypass Tunnel.

North-western Connection

Permanent relocation of the bus stop just north of the Gympie Road/Leckie Road intersection would be necessary due to corridor widening to accommodate Airport Link and Gympie Road. The land acquisition in this location is a full acquisition, allowing opportunity for the construction of an indented bus bay on the balance of

the claimed land. Due to construction staging the upgraded bus stop can be constructed prior to closure of the current bus stop. The 370 service is affected by the relocation of this bus stop.

The two bus stops on the western side of Gympie Road between Kedron Park Road and Stafford Road would be permanently relocated east of their current location. This is to provide for a future Northern Busway corridor along the existing kerb of Gympie Road between Kedron Park Road and Stafford Road. The reserved corridor provides opportunity for construction of indented bus bays on the reserved land. These changes affect services 358 and 370 at both stops, whilst the southern stop also affect routes 333, 334 and 338.

Corridor widening and intersection modifications to accommodate both Airport Link and Gympie Road affect the southbound bus stop located on Gympie Road south of Kedron Brook. Difficulties in pedestrian access following construction of the east-west connection would make this an unattractive bus stop location. A potential alternative location for the bus stop is between Lasseter Street and Park Terrace. Services 333, 334, 358 and 370 are affected.

North-eastern Connection

Northbound there are no bus stops affected by project works in this area. Southbound one bus stop located between the signalised Toombul Shopping Centre access and the rail over-bridge may require permanent relocation due to its closer proximity to the relocated Sandgate Road/Airport Link/East West Arterial Road intersection, affecting services 310 and 315. These services could instead utilise the Toombul Bus Interchange located 200m to the north of the bus stop outside Toombul Shopping Centre.

- **Table 9-16 Effect of Airport Link on Bus Routes in 2022**

Location Reference	Travel Time Route (refer Figure 9-16Figure 9-16)	Locations on Key Bus Routes		AM Peak Hour Inbound				PM Peak Hour Outbound			
				Bus Volume (veh)	% Change Total Traffic	Improvement in Bus Route Travel Speed		Bus Volume (veh)	% Change Total Traffic	Improvement in Bus Route Travel Speed	
						km/h	%			km/h	%
11	A	Gympie Road	Kedron	62	15%	8	40%	58	15%	7	37%
8	G	Stafford Road	Everton Park	21	44%	1	1%	18	42%	0	0%
9	G	Webster Road	Stafford	27	-9%	1	1%	24	-9%	0	0%
27	A	Lutwyche Road	Lutwyche	92	-18%	8	40%	86	-26%	7	37%
33	A	Lutwyche Road	Windsor	97	-15%	8	40%	92	-14%	7	37%
31	B	Sandgate Road	Albion	27	-17%	9	38%	22	-11%	7	39%
22	B	Sandgate Road	Clayfield	19	-5%	9	38%	16	-10%	7	39%

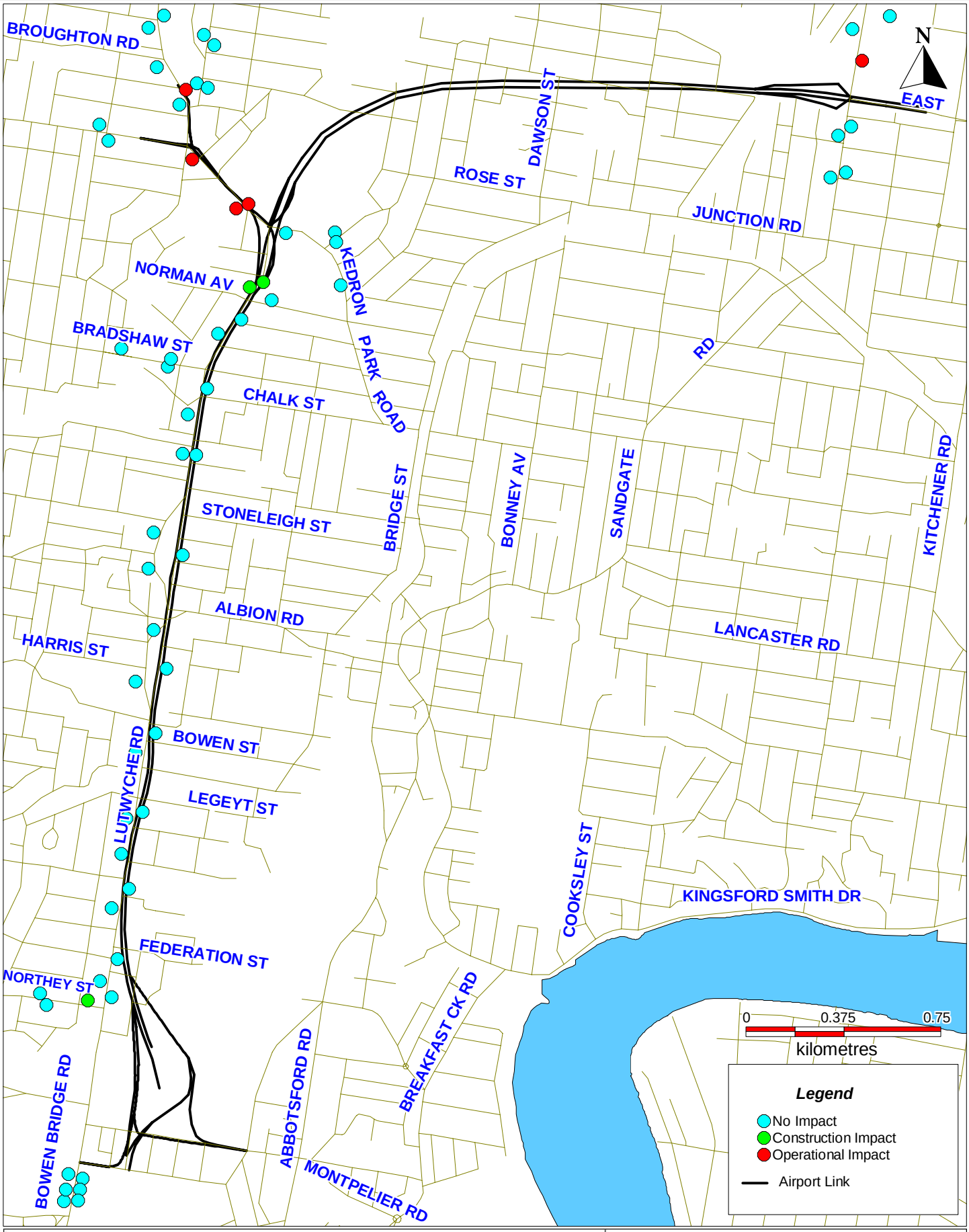

Figure 9-17
Project Impacts on Bus Infrastructure

Airport Link

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9.6 Pedestrian and Cyclist Effects

The potential effects of the Airport Link project on infrastructure for pedestrian and cycle movements are discussed below. The main changes to the pedestrian and cycle network will occur around the tunnel portals and their connections to the surface road network. The project's design has ensured that connectivity will be maintained in those regions. A description of relevant changes and the opportunities to improve local pedestrian and cyclist accessibility that have been included in the design are detailed in the following sections.

9.6.1 Southern Connection

The southern portal of Airport Link is located in the vicinity of the major pedestrian and cycle pathway connecting between Newmarket and Albion, mostly along Enoggera Creek. This path is relocated by the NSBT works, with full existing connectivity maintained. A further enhancement will occur with the NSBT works, providing a pedestrian/cycle crossing of Enoggera Creek to Campbell Street. The Airport Link does not affect the ability to provide these planned path relocations or new connection.

Pedestrian crossings of Lutwyche Road are maintained at the signalised intersections at Federation Street, Northey Street, Butterfield Street, Campbell Street and O'Connell Terrace, providing a good range of opportunities for pedestrians to safely and efficiently cross the major arterial road. Pedestrian movement across Campbell Street, Mayne Road and Hamilton Place is also suitably accommodated within the signalised intersection concept design.

9.6.2 North-western Connection

The Kedron Brook pedestrian and cycle path that follows the southern creek bank, is a major feature of the network in the vicinity of this part of the project. The route includes an underpass beneath the Gympie Road, bridge along the southern bank of Kedron Brook.

The Kedron Brook pathway is a highly used, predominantly recreational route. It would be maintained with the project. The existing pedestrian/cycle access bridge, which connects the northern and southern banks of Kedron Brook in the vicinity of Fifth Avenue would also be maintained. Immediately east of this bridge, a new path will be provided across the cut and cover structure of the project, linking the existing Kedron Brook pathway with the Kedron State High School oval. This ensures that the good pedestrian and cyclist accessibility is preserved for local residents, school students, commuters and recreational users.

Along the eastern side of the Gympie Road bridge across Kedron Brook a pedestrian path would be provided connecting to the footpath along the eastern side of Gympie Road . This would provide for convenient pedestrian and cycle access between the residential precinct north-eastern of Kedron Brook and the Kedron Brook pathway system.

At the Gympie Road and Stafford Road signalised intersection, pedestrian crossings of both Gympie Road (on the northern side) and Stafford Road would be provided with appropriate signal phasing. Due to the width of the intersection approach roads, staged pedestrian crossings are proposed. This will allow pedestrians to cross one traffic stream under a green pedestrian signal and then wait in safety on a wide median island before proceeding to cross the other traffic stream via a second green pedestrian signal.

At the Lutwyche Road/Kedron Park Road signalised intersection, pedestrian crossings would be provided on the southern leg of Lutwyche Road and across Kedron Park Road. Similar to the arrangements proposed for the Gympie Road/Stafford Road intersection, the Lutwyche Road pedestrian crossing would have a staged signal phasing. This will facilitate the safe movement of pedestrians across these roads to locations such as the Emergency Services Complex, the Kedron Park Hotel and the nearby schools.

9.6.3 North-eastern Connection

The Kedron Brook pedestrian and cycle path continues along Schulz Canal, with links and bridges provided along the way to connect it to the local road network and footpaths. The project would require modifications and re-alignment of some sections of the pathway. The section of pathway that runs between Jackson Street and Melton Road along the southern bank of Schulz Canal and the northern side of East-West Arterial would be affected by the project alignment. The section of the path along the southern bank of Schulz Canal, would be relocated to the northern bank. This path will connect up with the existing pathway on the other side of Melton Road which continues to the north-eastern suburbs of Nudgee and Boondall.

Connectivity between the Toombul precinct and residential areas south of Schulz Canal would be maintained by a new pedestrian/cycle path linking Parkland Street, on the north of the canal, to Stuckey Road, south of the tunnel. This pathway would be across a cut and cover section of the project, which after revegetation would provide a pleasant recreational and commuter route. From Parkland Street another path would be constructed that would traverse below the Airtrain structure and link to the new path that would be established along the northern bank of the Schulz Canal. The path at Stuckey Road would provide for better connectivity to Toombul Rail Station.

Pedestrian crossings would be provided via the signals at the intersection of Sandgate Road/East-West Arterial and the Airport Link ramps to cater for safe and efficient movement of pedestrians across Sandgate Road and for north-south pedestrian movement along Sandgate Road. There would be a crossing of Sandgate Road, on the southern leg of the intersection, and the East-West Arterial, on the eastern leg of the intersection. Both would connect to the pedestrian footpath along the eastern side of Sandgate Road. There will be no effect on existing arrangements for pedestrians at the traffic signals at the nearby Centro Toombul Shopping Centre access on Sandgate Road.

9.7 Road Safety Effects

The crash history of major routes in the Inner North area affected by the Airport Link project was analysed in **Section 4.10**. This assessment indicated that the highest crash rates had occurred on Lutwyche Road, Sandgate Road and parts of the East-West Arterial route.

Crash rates calculated for existing conditions in **Section 4.10**, with the exception of Gympie Road, have been used to determine the future number of accidents for 2012 and 2022, without and with the project, based on estimates of vehicle kilometres of travel (VKT). The crash rate applied for Gympie Road has been adjusted to take account of the disproportionate influence of the high crash history at the Park Terrace/Suez Street intersection, which has been recently addressed by mitigative works. No future major works are expected on any other route so it is reasonable to adopt existing crash rates for assessment.

A crash rate of 18 crashes per 100 million VKT has been applied for the Airport Link ramps and main tunnel, similar to that applied in the assessment of NSBT and based on historical data for the Sydney Harbour Tunnel. Minimal weaving and merging is required for the north-eastern and north-western connections, with long approaches for the major movement streams such as Gympie Road traffic, at the north-eastern connection, and East-West Arterial traffic at the north-eastern connection. At the southern connection the design provides for clear separation of movement streams entering and exiting the Airport Link.

Estimated crashes for 2012 and 2022 without and with the project are shown for the key arterial routes within the Inner North area and for the Airport Link in **Table 9-17**. **A**verage annual accidents from the crash history have been included for comparative purposes. The table shows that with Airport Link operational:

- An overall reduction on the key routes (including the Airport Link) of 33 crashes in 2012 and 44 crashes in 2022 is forecast, representing a 7 to 9 % crash reduction.
- An overall reduction in road crashes on the Bowen Bridge Road/Lutwyche Road/Gympie Road corridor of 36 accidents (18%) in 2012 and 44 accidents (21%) in 2022 is estimated with the project.
- Similar levels of crash reductions are also estimated for the Sandgate Road/Abbotsford Road corridor of 29 (22%) in 2022 and 40 (27%) in 2022.
- Road safety benefits on the Kedron Park Road-Park Road-Rose Street- Junction Road section of the East West Arterial route of the order of 28% in 2022 are forecast associated with crash reduction.
- A small increase in crashes on the East-West Arterial east of Sandgate Road (6% in 2022) is forecast.
- Stafford Road is the only route with a significant increase (>50%) in the number of expected accidents with Airport Link. The increase is attributed to increased traffic associated with its function as a feeder route for Airport Link, particularly for east-west travel. Whilst Stafford Road has a high historic crash rate (which has been applied in this assessment) it is noted that one third of all accidents on Stafford Road have occurred at or close to the Stafford Road/Gympie Road signalised intersection. This location will undergo a significant redesign as part of the north-western connection for Airport Link and the safety benefits of this are not directly incorporated in the analysis. It is thus likely that the calculated increase in crashes for Stafford Road is conservatively high.
- The Sandgate Road/Junction Road signalised intersection, identified in **Section 4.10** as the most significant individual trouble spot, would have improved operating conditions with Airport Link due to reductions on both Sandgate Road and Junction Road. This is expected to reduce the potential number of crashes at this intersection compared to the situation without the project.

- **Table 9-17 Estimated Crashes on Key Routes Without and With Airport Link**

Arterial	Section	2004	2012				2022			
		Average Annual Crashes	Without Project	With Project	Difference	% Change	Without Project	With Project	Difference	% Change
Airport Link	All	-	-	26	25.9	-	-	31	31.2	-
Lutwyche Road	All	101	142	107	-35.0	-25%	151	109	-42.3	-28%
Gympie Road	Kedron Park Road to Castle Street	35	37	39	2.0	5%	39	41	1.4	3%
Bowen Bridge Road	ICB Bridge to Lutwyche Road	19	20	17	-3.0	-15%	22	18	-3.4	-16%
Sandgate Road	Crosby Road to Nundah Tunnel	73	103	79	-23.7	-23%	118	86	-31.8	-27%
Abbotsford Road	Campbell Street to Crosby Road	18	27	22	-5.2	-19%	31	24	-7.8	-25%
East West Arterial	Webster Road to Gympie Road i.e. Stafford Road	22	31	47	15.5	49%	34	52	18	53%
East West Arterial	Lutwyche Road to Sandgate Road i.e. Park Road-Rose Street- Junction Road	24	29	21	-8.1	-28%	32	23	-8.4	-26%
East West Arterial	Sandgate Road to Nudgee Road	11	23	26	3.7	16%	28	29	1.8	6%
Nudgee Road	Kingsford Smith Drive to East West Arterial	5	6	5	-0.9	-16%	6	6	-0.6	-9%
Kingsford Smith Drive	ICB to Allison Street	33	46	42	-3.8	-8%	52	50	-1.9	-4%
Total		**340**	**464**	**432**	**-33**	**-7%**	**513**	**469**	**-44**	**-9%**

10. Cumulative Effects with Northern Busway

10.1 Introduction

This chapter describes traffic and transport conditions in a scenario where the proposed Northern Busway is implemented and operational in conjunction with Airport Link.

The same methodology applied in Chapter 9 to assess the operational effects of the project has been applied in the assessment of cumulative effects. Traffic forecasts with the project implemented in conjunction with the Northern Busway were prepared using the traffic models described in **Section 6**.

The features and timing of the proposed Northern Busway included within the traffic and transport model were based upon the proposed Northern Busway concepts publicly available in June 2006, and were:

- In 2012, to coincide with opening of Airport Link, operating up until around 2022, an Interim Northern Busway comprising:
  - Northern Busway from Inner Northern Busway at Royal Children's Hospital (RCH) to a new busway station at Royal Brisbane and Women's Hospital (RBWH);
  - Northern Busway to Enoggera Creek and busway connection to surface road network on Lutwyche Road via Victoria Street and Northey Street. Buses would operate in general traffic between Northey Street and Newmarket Road;
  - Bus lanes and bus priority measures in Lutwyche Road corridor between Newmarket Road and Stoneleigh Street. Introduction of these works are possible due to the reduction in surface road traffic on Lutwyche Road with the implementation of Airport Link and Northern Busway;
  - Northern Busway between Stoneleigh Street (Lutwyche) and Kedron; and
  - Busway stations at Lutwyche and Kedron Brook;
- By 2026:
  - Ultimate Northern Busway completed between RCH and Kedron, including Busway Stations at RBWH, Federation Street, Windsor, Albion, Lutwyche and Kedron.

In the 2026 scenario, it has been assumed that the bus lanes on Lutwyche Road would be converted to T3 use, except on Truro Street which would remain as local access and buses only.

The staged implementation of the Northern Busway, as described above, and considered in this cumulative effects scenario, involves changes to the surface road operation and lane provision on Lutwyche Road. These are tabulated in **Table 10-1**. The overall effect is that two general travel lanes in each direction will be available on Lutwyche Road between Newmarket Road and Stoneleigh Street with the Interim Busway, matching to the existing two general traffic lanes in each direction on Lutwyche Road between Stoneleigh Street and Bradshaw Street.

The Busway would provide a high quality public transport system in the inner northern suburbs, complementing the rail system and providing increased opportunities for interchanging between modes using TransLink's integrated ticketing system. This would enable convenient travel by public transport to a wide range of trip destinations both within and beyond the Central City. The public transport service plan and routes using the Northern Busway are described in **Appendix C**. The plan includes a new bus service between the City and ATC North area via the Northern Busway, diverting at the Kedron Brook Busway Station to use the Airport Link east-west tunnel to the East-West Arterial.

The Northern Busway service plan for 2012 would result in a daily total of approximately 1,400 services crossing Enoggera Creek rising to 3,300 by 2026 compared to 800 bus services currently. At Lutwyche, currently serviced by 600 buses per day, bus numbers would rise from over 900 daily in 2012 to 2,400 daily by 2026.

Table 10-1 Surface Road Lane Changes with Northern Busway

Description	No Busway[1]	Interim Busway[1]	Full Busway[1]
Bowen Bridge Road, south of Northey Street: Northbound	3 lanes	3 lanes	3 lanes
Bowen Bridge Road, south of Northey Street: Southbound	3 lanes	3 lanes	3 lanes
Lutwyche Road, Northey Street – Newmarket Road: Northbound	4 lanes	4 lanes	4 lanes
Lutwyche Road, Northey Street – Newmarket Road: Southbound	4 lanes	4 lanes	4 lanes
Lutwyche Road, Newmarket Road – Fosbery Street: Northbound	3 lanes	2 lanes +BL	2 lanes +T3[3]
Lutwyche Road, Newmarket Road – Fosbery Street: Southbound	2 lanes + T3[2]	2 lanes +BL	2 lanes +T3[3]
Roblane Street: Northbound	Not applicable	Not applicable	Not applicable
Roblane Street: Southbound	1 lane + T3[2]	BL + Local Traffic Lane	T3 + Local Traffic Lane
Lutwyche Road, Fosbery Street – Stoneleigh Street: Northbound	3 lanes	2 lanes	2 lanes
Lutwyche Road, Fosbery Street – Stoneleigh Street: Southbound	1 lane	2 lanes	2 lanes
Truro Street: Northbound	Not Applicable	BL	BL
Truro Street: Southbound	3 lanes + T3[2]	BL + Local Traffic Lane	T3 + Local Traffic Lane
Lutwyche Road, Stoneleigh Street – Bradshaw Street: Northbound	2 lanes	2 lanes	2 lanes
Lutwyche Road, Stoneleigh Street – Bradshaw Street: Southbound	2 lanes	2 lanes	2 lanes
Lutwyche Road/Gympie Road, north of Bradshaw Street: Northbound	3 lanes	3 lanes	3 lanes
Lutwyche Road/Gympie Road, north of Bradshaw Street: Southbound	3 lanes	3 lanes	3 lanes

Table Notes:

1) The lane numbers listed above are typical general traffic through lanes for each road segment. The figures do not include ancillary lanes at intersections (for example, turn pockets).

2) The T3 lane in the No Busway case is the existing AM Peak facility.

3) Conversion of bus lane to T3 lane assumed in 2026 for transport modelling purposes.

10.2 Effect on Brisbane Metropolitan Area

10.2.1 Demand for Airport Link

Weekday traffic flows on the Airport Link Project are marginally higher in the cumulative effects scenario with Northern Busway.

Use of the Airport Link north-south tunnel in 2012, prior to traffic ramping-up to full modelled forecast volumes, is estimated as 52,800 vpd (compared to 51,000 vpd without the Northern Busway). By 2026, the north-south tunnel would carry a forecast 95,800 vpd (compared to 93,150 vpd without the Northern Busway). Forecast use of the East-West ramps is largely unaffected, modelled as 25,900 vpd in 2026. Overall network

daily traffic volumes with the Airport Link and Northern Busway for 2012 and 2026 are shown in **Figure 10-1** and **Figure 10-2**.

Whilst public transport use increases with the Northern Busway, the small change in overall forecast use of Airport Link can be attributed to the following key factors:

- The surface road changes along Lutwyche Road due to the Busway itself have some effect on overall traffic patterns and the perceived attractiveness of the surface road route compared to the Airport Link tolled route; and
- While there is a forecast reduction in number of Airport Link trips using the Bowen Hills ramps (typically Central City travellers who find public transport use an attractive option), this is compensated for by an increased in use of Airport Link for cross-city and cross-river movements due to the effect described above.

It is noted that although the effects of surface road changes associated with the Northern Busway reduce traffic capacity on some parts of the corridor, with Airport Link operational the travel time along the alternative surface route remains substantially better than would prevail in the future scenario without Airport Link. This is discussed in more detail in **Section 10.3.3**.

10.2.2 Traffic Volume Effect

Changes in weekday traffic volumes on the road network in the scenario where the Northern Busway is implemented in conjunction with Airport Link are presented in **Figure 10-3** and **Figure 10-4** for 2012 and 2026 respectively. The effect of the combined projects on traffic volumes on connecting roads compared to the scenario without the Airport Link project has been examined and is tabulated in **Table 10-2.** The level of service of operation on the network in 2012 and 2026 during peak periods is shown in **Figure 10-5**, **Figure 10-6**, **Figure 10-7** and **Figure 10-8**.

This assessment indicates that a very similar range and scale of traffic effects on connecting roads will occur in the cumulative scenario, compared to the effects of the project alone.

10.2.3 Network Performance Statistics

The impact of the project in combination with the Northern Busway on overall Metropolitan area road network performance is summarised in **Table 10-3**. The overall effects on road network performance are quite similar to the Airport Link only scenario, with beneficial transfer of the some of the road travel task from lower to higher order roads in the network.

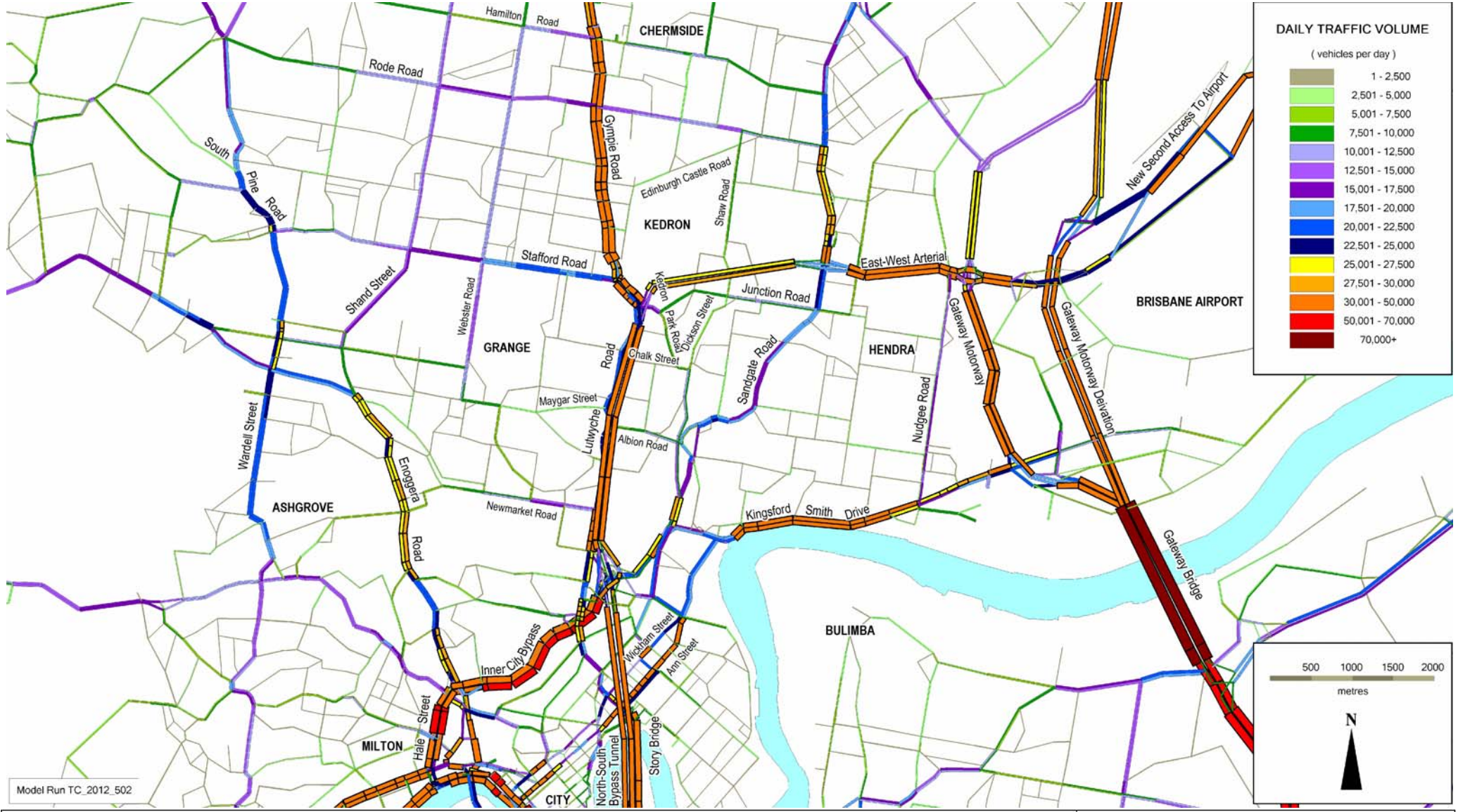

Figure 10-1
2012 Average Weekday Traffic Volumes
With Airport Link and Northern Busway

Airport Link

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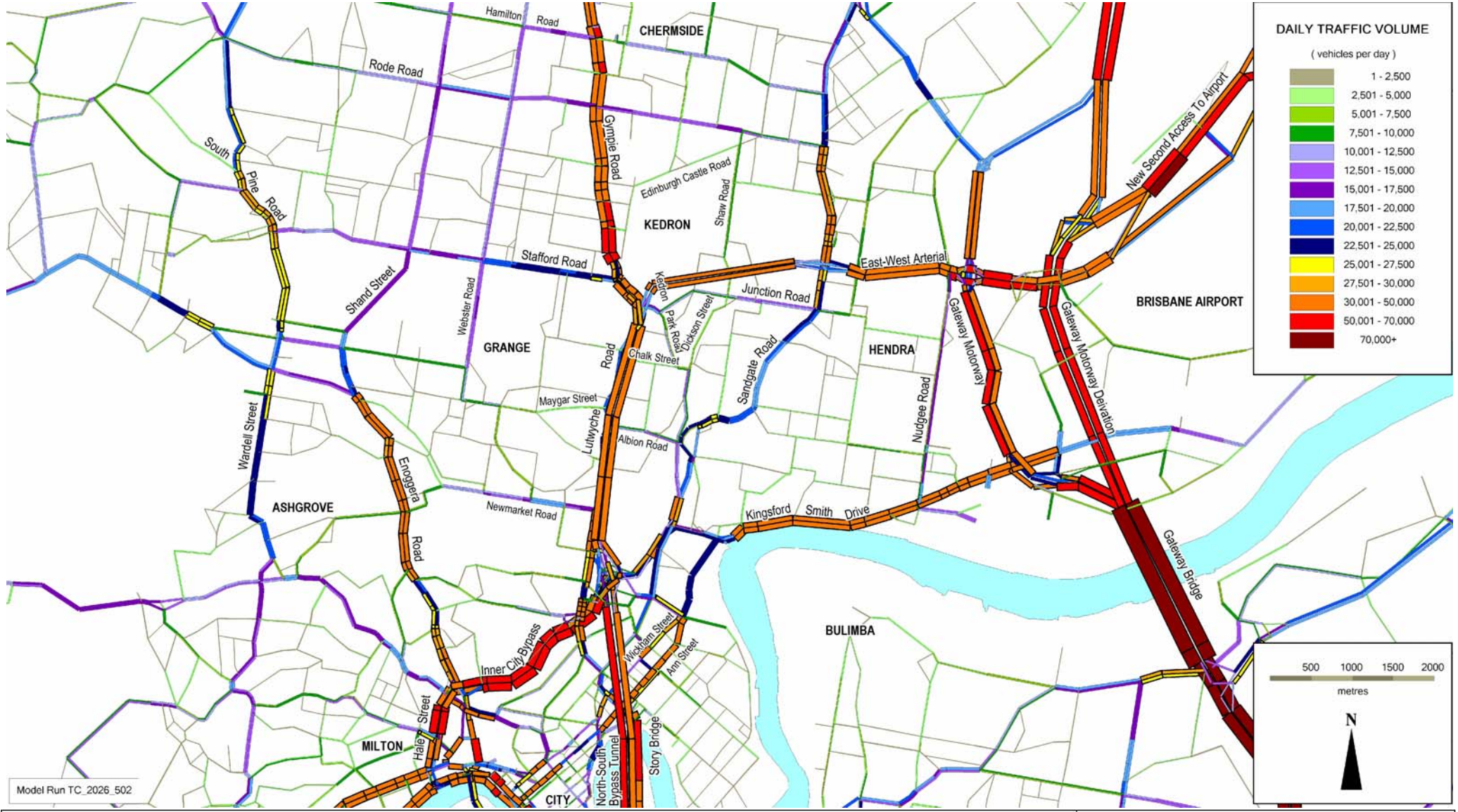

Figure 10-2
2026 Average Weekday Traffic Volumes
With Airport Link and Northern Busway

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

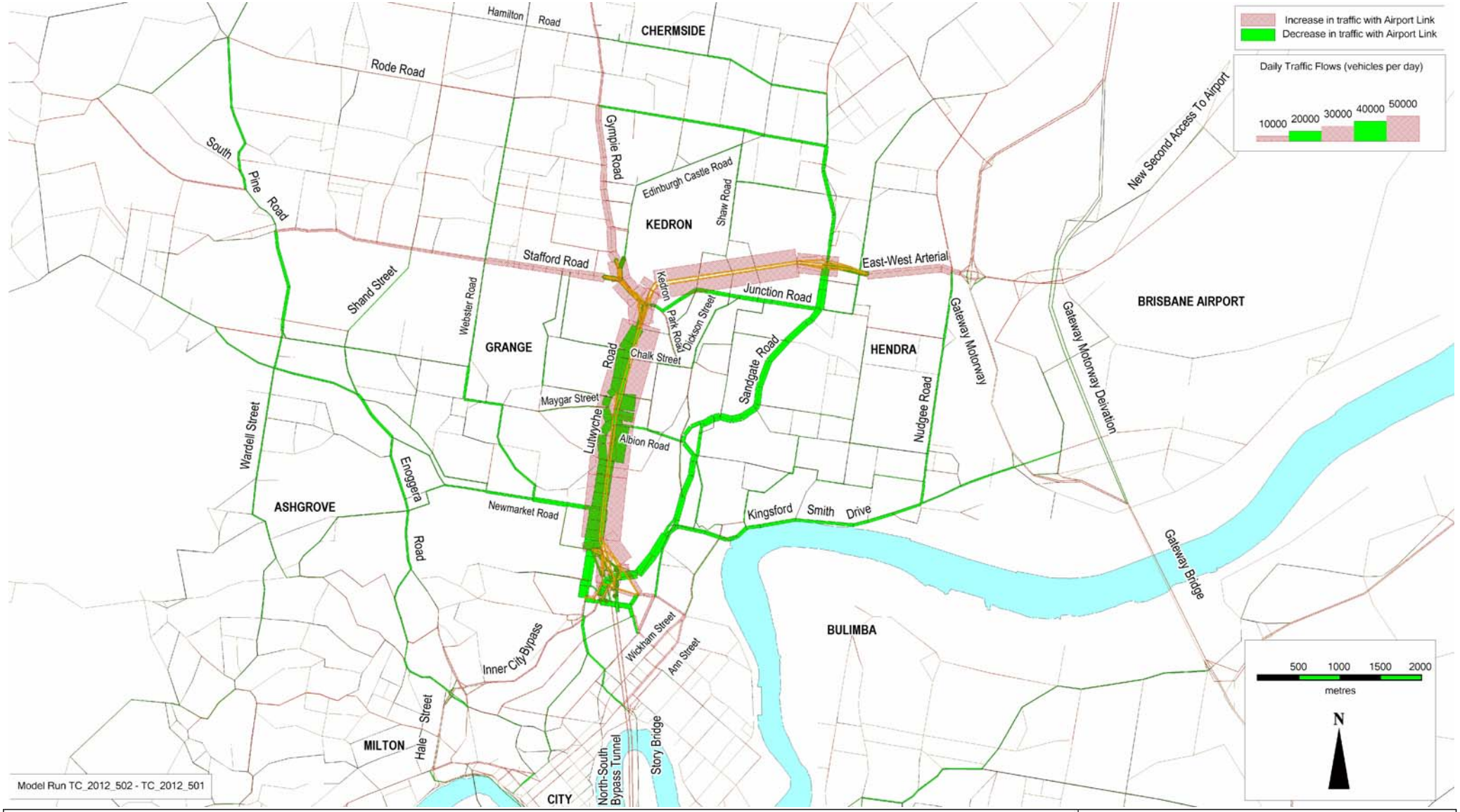

Figure 10-3
2012 Average Weekday Traffic Volumes –
Changes Due to Airport Link
and Northern Busway

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

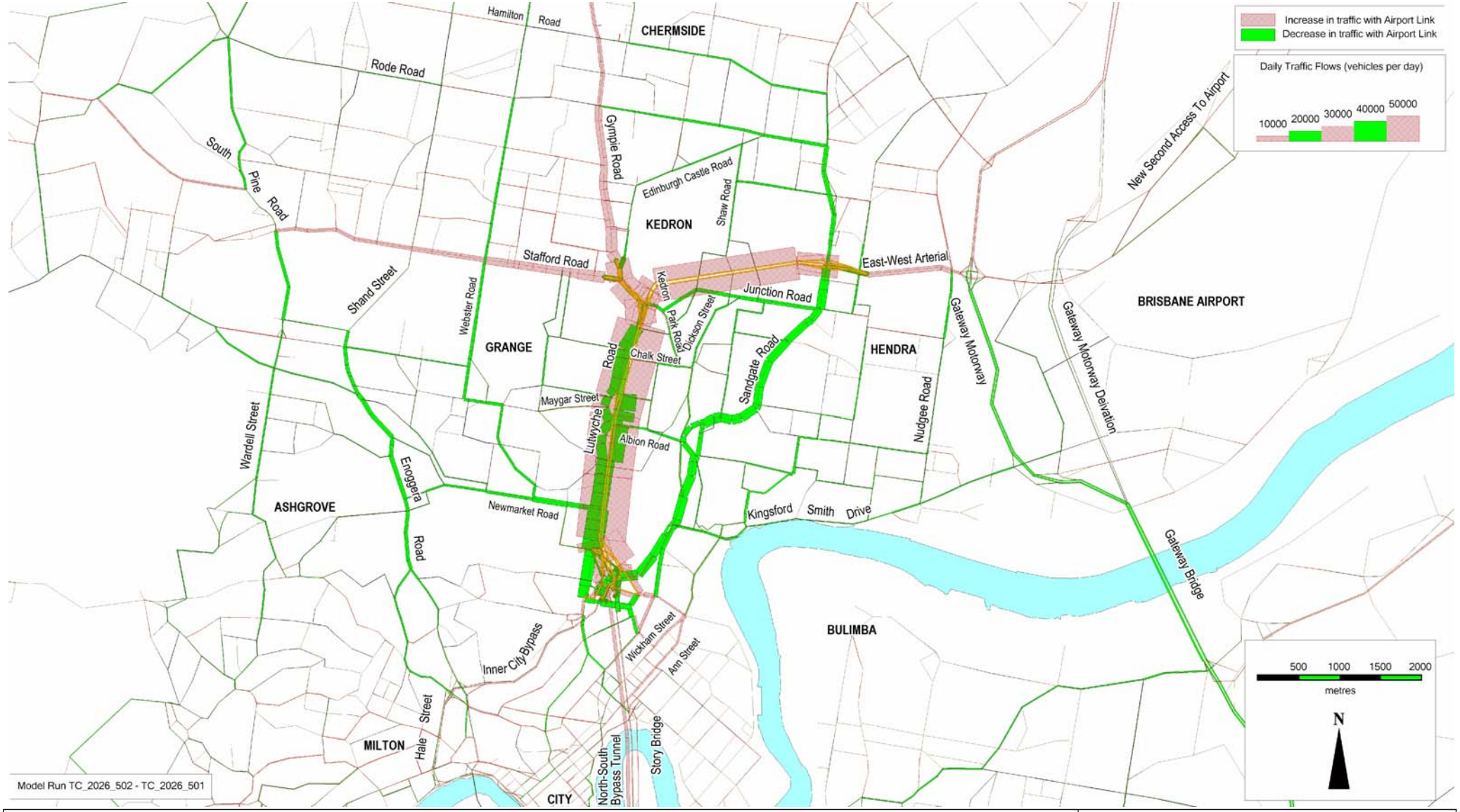

Figure 10-4
2026 Average Weekday Traffic Volumes –
Changes Due to Airport Link
and Northern Busway

Airport Link

SKM Connell Wagner JOINT VENTURE

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Table 10-2 Volumes on Key Connecting Roads to the Project - Comparison without and with the Project in combination with Northern Busway

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL+ NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL +NB	With AL +NB	% Change
Southern Connections															
-	NBST	Brisbane River	-	70,800	73,200	3%	75,600	78,700	4%	82,300	88,600	8%	89,800	97,800	9%
41	ICB	West of Bowen Bridge Road	75,000	100,500	102,800	2%	106,300	106,400	0%	106,500	110,100	3%	111,200	113,500	2%
49	Hale Street	North of Milton Road	78,000	84,200	84,400	0%	86,900	86,200	-1%	82,700	82,000	-1%	81,700	81,000	-1%
38	Bowen Bridge Road	South of O'Connell Terrace	57,000	51,200	52,000	2%	53,600	55,900	4%	55,200	58,400	6%	56,700	62,100	10%
40	Campbell Street	East of Mayne Road	12,000	21,700	26,100	20%	23,500	28,600	22%	26,300	32,000	22%	28,600	34,400	20%
39	O'Connell Terrace	East of Bowen Bridge Road	6,000	15,200	13,500	-11%	16,500	14,900	-10%	17,800	16,700	-6%	18,700	18,000	-4%
45	Brookes Street	South of St Pauls Terrace	18,000	20,500	23,200	13%	22,400	24,300	8%	23,300	25,400	9%	24,100	26,500	10%
44	St Pauls Terrace	South of Brookes Street	9,000	13,200	14,800	12%	15,000	16,900	13%	17,000	18,700	10%	19,900	20,700	4%
42	Gregory Terrace	West of Brookes Street	5,000	12,100	11,300	-7%	12,800	11,600	-9%	14,200	12,900	-9%	15,300	13,500	-12%
46	Wickham Street	West of Brookes Street	26,000	30,300	31,900	5%	32,100	33,600	5%	33,600	36,300	8%	36,500	38,000	4%
47	Ann Street	West of Brookes Street	25,000	30,900	34,700	12%	32,300	37,000	15%	36,800	40,800	11%	39,300	43,100	10%
43	Montpelier Road	West of Breakfast Creek Road	15,000	28,600	31,900	12%	31,000	34,900	13%	33,900	38,200	13%	36,900	39,800	8%
48	Gipps Street	North of Wickham Street	53,000	42,200	39,600	-6%	44,100	41,800	-5%	45,900	43,900	-4%	46,900	44,700	-5%
Northern Connections															
10	Stafford Road	West of Richmond Street	23,000	26,700	39,700	49%	27,100	41,600	54%	29,200	43,600	49%	29,100	45,200	55%
8	Stafford Road	West of Webster Road	22,000	24,600	30,800	25%	24,400	31,000	27%	25,300	33,900	34%	25,000	34,300	37%
11	Gympie Road	North of Broughton Road	59,000	76,800	93,800	22%	80,400	97,800	22%	81,700	102,600	26%	83,500	105,300	26%
3	Gympie Road	North of Rode Road	60,000	79,000	83,400	6%	81,700	85,600	5%	84,700	90,600	7%	86,600	94,900	10%
1	Gympie Road	North of Hamilton Road	70,000	82,700	86,600	5%	85,400	89,000	4%	88,500	93,900	6%	90,200	96,600	7%
2	Rode Road	West of Gympie Road	19,500	29,800	30,700	3%	31,000	31,000	0%	32,300	32,200	0%	33,200	32,600	-2%
13	Sandgate Road	North of Schulz Canal	52,000	66,800	61,000	-9%	67,600	61,700	-9%	71,600	64,200	-10%	72,700	66,300	-9%
14	East West Arterial	East of Widdop Street	35,000	59,100	75,000	27%	63,500	79,100	25%	72,000	83,600	16%	74,500	84,900	14%

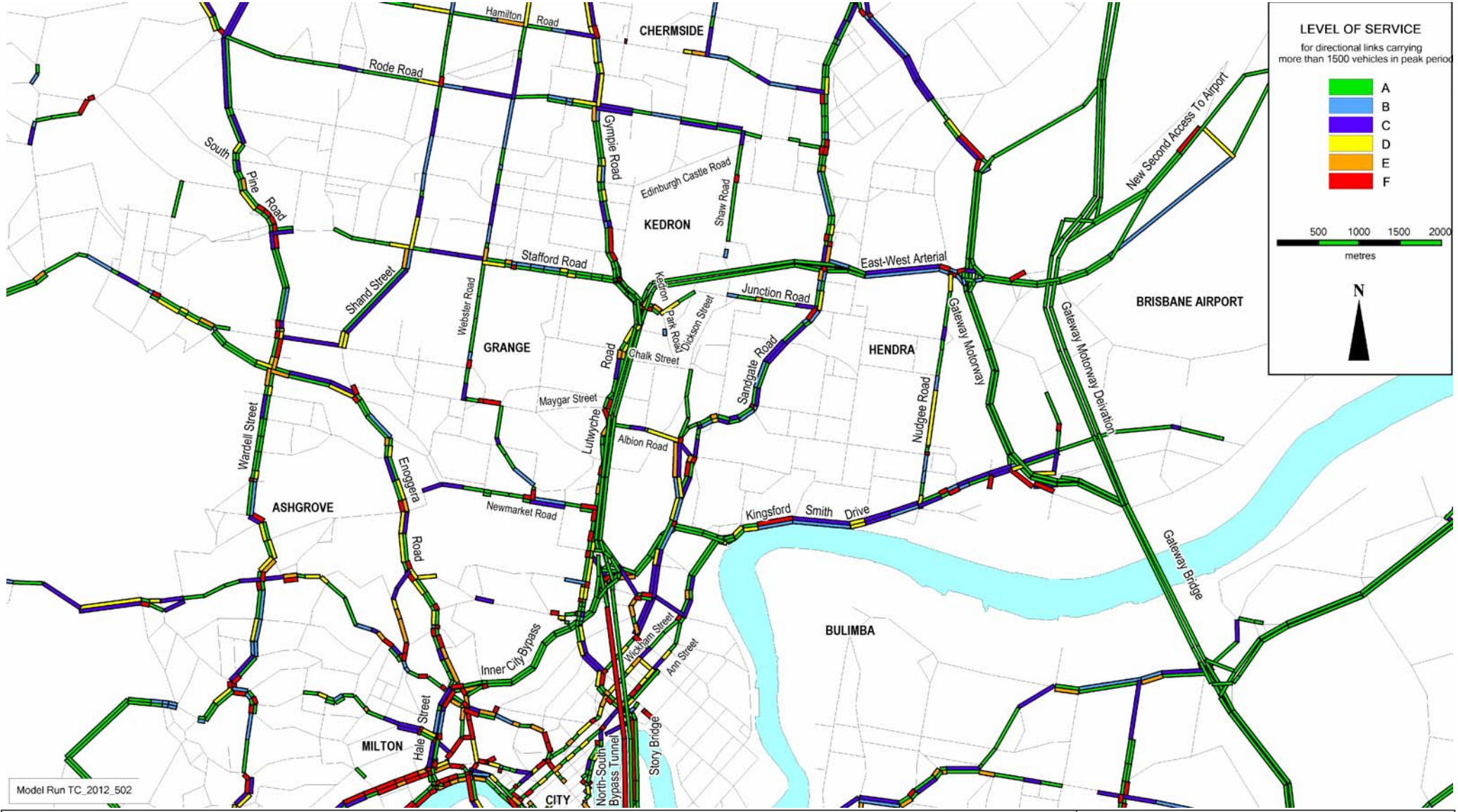

Figure 10-5
2012 AM Level of Service
With Airport Link and Northern Busway

Airport Link

SKM Connell Wagner JOINT VENTURE

BRISBANE CITY

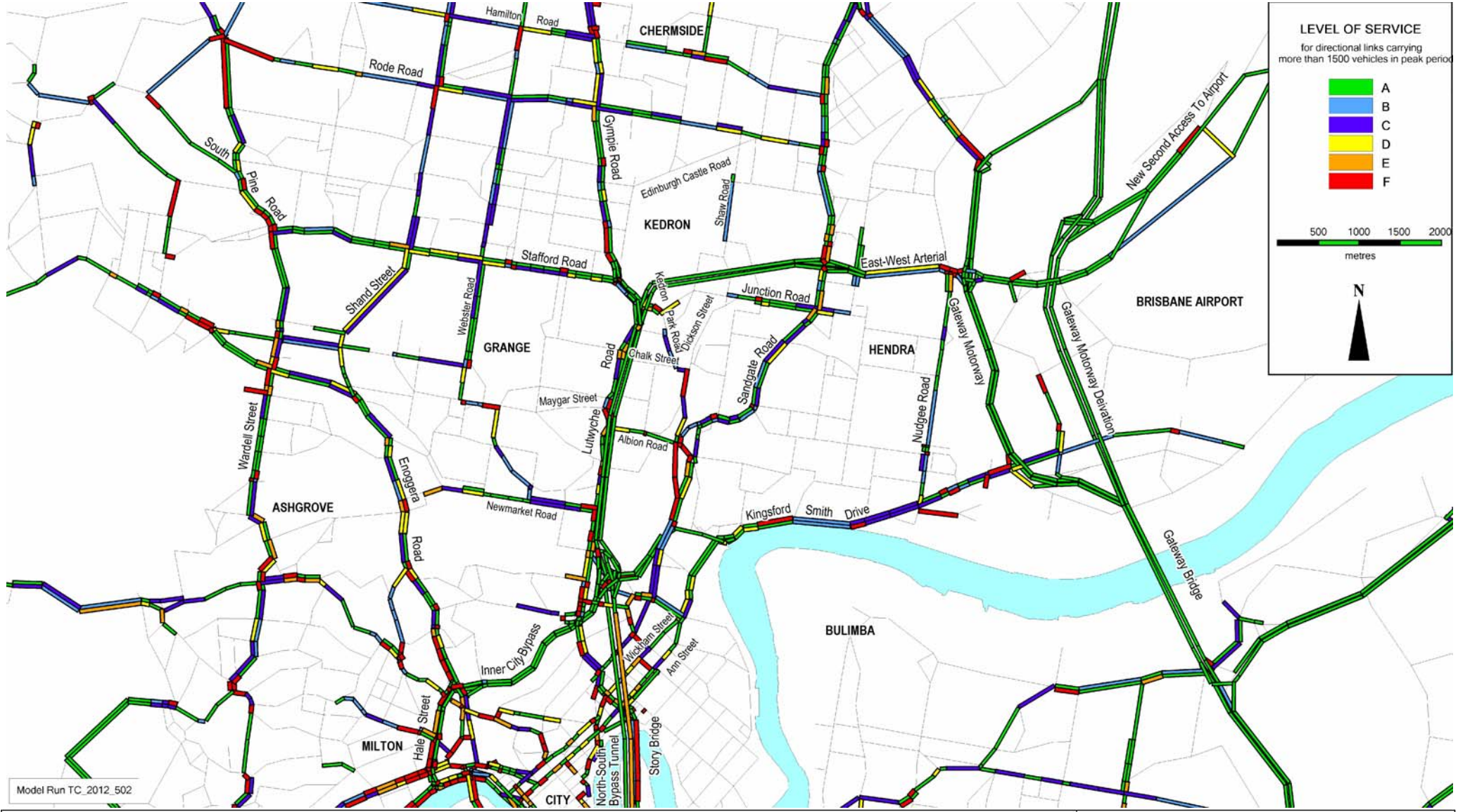

Figure 10-6
2012 PM Level of Service
With Airport Link and Northern Busway

Airport Link

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BRISBANE CITY

Figure 10-7
2026 AM Peak Level of Service
With Airport Link and Northern Busway

Airport Link

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BRISBANE CITY

Figure 10-8
2026 PM Level of Service
With Airport Link and Northern Busway

Airport Link

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BRISBANE CITY

Table 10-3 Network Performance by Road Type without and With Airport Link and Northern Busway

Road Hierarchy	Without Airport Link and Northern Busway			With Airport Link and Northern Busway			Difference		% Difference	
	VHT[1]	VKT[2]	Speed (km/h)	VHT	VKT	Speed (Km/h)	VHT	VKT	VHT	VKT
2012										
Motorway	272,900	22,103,000		277,700[3]	22,294,000[4]		4,800	191,000	1.8%	0.9%
Motorway (AL Tunnel)	-	-		-	339,000		-	339,000	-	-
Arterial	464,300	20,819,000		452,100	20,524,000		-12,200	-295,000	-2.6%	-1.4%
Suburban	170,100	8,186,000		166,100	8,090,000		-4,000	-96,000	-2.4%	-1.2%
District	98,900	3,329,000		97,100	3,293,000		-1,800	-36,000	-1.8%	-1.1%
Local	53,800	1,317,000		53,200	1,298,000		-600	-19,000	-1.1%	-1.4%
Total	1,059,900	55,754,000	52.6	1,046,100	55,838,000	53.4	-13,800	84,000	-1.3%	0.2%
2022										
Motorway	358,000	27,777,000		363,200[3]	27,961,000[4]		5,200	184,000	1.5%	0.7%
Motorway (AL Tunnel)	-	-		-	398,000		-	398,000	-	-
Arterial	556,900	24,004,000		538,800	23,698,000		-18,000	-306,000	-3.2%	-1.3%
Suburban	204,700	9,581,000		199,000	9,452,000		-5,700	-129,000	-2.8%	-1.3%
District	120,600	3,873,000		115,700	3,806,000		-4,900	-67,000	-4.1%	-1.7%
Local	77,600	1,508,000		75,700	1,478,000		-1,900	-30,000	-2.4%	-2.0%
Total	1,317,600	66,742,000	50.7	1,292,600	66,793,000	51.7	-25,000	51,000	-1.9%	0.1%
2026										
Motorway	408,800	30,070,000		413,000[3]	30,259,000[4]		4,200	189,000	1.0%	0.6%
Motorway (AL Tunnel)	-	-		-	419,000		-	419,000	-	-
Arterial	608,000	25,238,000		588,600	24,908,000		-19,400	-330,000	-3.2%	-1.3%
Suburban	225,400	10,224,000		218,900	10,093,000		-6,500	-131,000	-2.9%	-1.3%
District	132,800	4,129,000		129,500	4,070,000		-3,300	-59,000	-2.5%	-1.4%
Local	93,100	1,608,000		91,000	1,579,000		-2,100	-29,000	-2.3%	-1.8%
Total	1,468,200	71,269,000	48.5	1,441,000	71,328,000	49.5	-27,200	59,000	-1.9%	0.1%

Table Notes:

(1) VHT - Vehicle Hours Travelled on Average Weekday

(2) VKT - Vehicle Kilometres Travelled on Average Weekday

(3) Includes AL Tunnel VHT

(4) Excludes AL Tunnel VKT

10.3 Effect on Local Area

10.3.1 Traffic Volume

Traffic reductions on many roads within the Inner North area and beyond are forecast with the project in combination with the Northern Busway. Effects are tabulated in **Table 10-4** and **Table 10-5** and shown graphically on **Figure 10-3** and **Figure 10-4**.

The scale of traffic reductions with the cumulative scenario is generally similar to the project only case, with the exception of Lutwyche Road, which experiences somewhat greater traffic reductions due to the Northern Busway effects.

For example, on Lutwyche Road compared to a network without Airport Link, a decrease in traffic of 39% is forecast in 2026 with the combined projects, which is greater than the 25% reduction with Airport Link only.

On some local roads, such as Chalk Street and Kedron Park Road south of Park Road, a lessening of the traffic reduction effect occurs due to some local road network changes along Lutwyche Road associated with the Busway alignment and station locations (these are described further in **Section 10.4**). For example on Chalk Street, compared to a network without Airport Link, a decrease in traffic of 10% is forecast in 2026 with the combined projects, which is less than the 34% reduction with Airport Link only.

10.3.2 Intersection Performance

The effect of the combined Airport Link and Northern Busway projects on the performance of intersections within the network has been carried out in a similar manner to the intersection performance assessment for the project, described in **Section 9.3.2**. For intersections along Lutwyche Road, the impact of incorporation of bus lanes and bus priority measures as proposed with the staged implementation of the Northern Busway has been incorporated in the aaSIDRA analysis. Bus volumes anticipated with the Northern Busway service plan have also been included in the analysis.

The intersection performance assessment indicates that for the cumulative scenario with the Northern Busway compared to the Airport Link only:

- Similar intersection performance will occur on feeder roads to the project and at surface road intersections in the vicinity of the connections; and
- Along Lutwyche Road, intersections would operate at a similar Degree of Saturation and Level of Service with the Northern Busway modifications to the intersections. These changes are able to be accommodated without a significant adverse impact on performance as there is a lowering of vehicle demand along Lutwyche Road due to the combined influences of the public transport initiative and the diversion of vehicle trips to Airport Link.

10.3.3 Travel Times

The cumulative impact of the Airport Link and the Northern Busway on travel times and speeds has been analysed using the same methodology as for the project, as previously described in **Section 9.3.3**. Peak period travel times for key routes without and with the combined project are summarised in **Table 10-7**. The scenario assessed for both 2012 and 2022 includes bus lanes in the section between Stoneleigh Street at Lutwyche and Newmarket Road at Windsor as per the proposed Northern Busway interim staging.

The benefits observed in this case are similar to the Airport Link project case, and follow similar patterns across routes and times. It is notable that the benefits forecast for Lutwyche Road are negligibly different from the Airport Link only scenario. This indicates that the allocation of some of the road space freed-up by traffic reductions due to the Airport Link to public transport use (as proposed in the Northern Busway interim staging) does not significantly affect travel time on this route for general traffic.

- **Table 10-4 Volumes on Surface Roads within the Inner North Area - Comparison without and with the Project in Combination with Northern Busway**

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL+ NB	With AL +NB	% Change	Without AL+ NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change
Arterial Roads															
17	Lutwyche Road	South of Kedron Park Road, Kedron	54,600	68,200	43,400	-36%	70,200	45,300	-35%	70,800	44,600	-37%	71,500	45,500	-36%
27	Lutwyche Road	North of Stoneleigh Street, Lutwyche	59,600	74,200	45,300	-39%	76,200	47,300	-38%	77,000	46,400	-40%	77,500	47,400	-39%
33	Lutwyche Road	South of Newmarket Road, Windsor	60,300	105,100	68,500	-35%	110,800	71,700	-35%	113,400	72,400	-36%	116,300	74,700	-36%
22	Sandgate Road	South of Junction Road, Clayfield	37,000	51,100	38,400	-25%	55,800	39,600	-29%	59,300	42,300	-29%	60,700	45,300	-25%
31	Sandgate Road	South of Bonney Avenue, Albion	35,900	57,300	43,000	-25%	62,700	45,100	-28%	67,400	47,500	-30%	71,000	51,500	-27%
18	Kedron Park Road	East of Lutwyche Road, Kedron	17,600	35,000	29,700	-15%	37,000	31,400	-15%	38,700	32,700	-16%	39,900	33,700	-16%
20	Rose Street	Melrose Park, Wooloowin	10,700	24,600	16,800	-32%	25,500	17,900	-30%	26,700	18,800	-30%	26,700	19,500	-27%
23	Junction Road	West of Sandgate Road, Clayfield	18,200	29,800	21,700	-27%	30,700	23,000	-25%	32,000	24,200	-24%	32,600	25,200	-23%
5	Rode Road	West of Sandgate Road, Wavell Heights	19,300	24,700	19,100	-23%	25,600	19,000	-26%	27,500	20,800	-24%	28,100	21,400	-24%
15	Nudgee Road	North of E-W Arterial, Hendra	5,400	8,600	10,200	19%	10,200	12,600	24%	11,500	14,500	26%	12,800	15,500	21%
16	Nudgee Road	South of E-W Arterial, Hendra	24,600	21,800	17,800	-18%	22,200	19,100	-14%	23,900	20,700	-13%	25,600	21,300	-17%
36	Kingsford Smith Drive	East of Cooksley Street	65,600	73,500	66,900	-9%	76,500	71,000	-7%	77,200	73,900	-4%	78,000	75,900	-3%
37	Kingsford Smith Drive	East of Racecourse Road, Hamilton	54,900	71,000	64,800	-9%	74,300	69,100	-7%	75,300	72,300	-4%	76,400	74,500	-2%
7	South Pine Road	Kedron Brook, Everton Park	33,800	49,300	43,000	-13%	50,400	44,200	-12%	58,100	51,700	-11%	59,100	52,500	-11%
25	Enoggera Road	South of South Pine Road, Alderley	50,400	57,900	52,400	-10%	57,952	52,623	-9%	71,800	63,300	-12%	73,900	65,100	-12%
Suburban Roads															
32	Newmarket Road	West of Lutwyche Road,	17,600	33,900	25,500	-25%	36,900	27,400	-26%	39,400	30,200	-23%	41,900	32,200	-23%

Reference	Road	Location	2004	Average Weekday Traffic											
				2012			2016			2022			2026		
				Without AL+ NB	With AL +NB	% Change	Without AL+ NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change
		Windsor													
4	Hamilton Road	West of Sandgate Road, Wavell Heights	15,200	21,500	18,300	-15%	20,700	18,300	-12%	22,800	19,700	-14%	24,100	20,100	-17%
19	Kedron Park Road	South of Park Road, Wooloowin	7,300	11,800	13,200	12%	13,400	14,100	5%	13,700	14,500	6%	14,800	14,900	1%
29	Albion Road	East of Lutwyche Road, Windsor	15,100	19,900	15,600	-22%	21,800	17,900	-18%	23,100	19,400	-16%	23,700	20,700	-13%
30	Albion Road	At overpass, Albion	17,000	22,500	18,300	-19%	24,100	20,800	-14%	26,000	21,700	-17%	27,500	22,900	-17%
12	Shaw Road	Kedron Brook, Wooloowin	14,100	15,800	14,200	-10%	16,500	14,700	-11%	17,200	15,100	-12%	18,500	15,700	-15%
28	Chalk Street	West of Bridge Street, Wooloowin	10,700	14,400	14,600	1%	16,600	15,900	-4%	17,700	16,700	-6%	19,000	17,100	-10%
26	Maygar Street	West of Lutwyche Road, Windsor	8,300	8,100	7,200	-11%	9,100	8,000	-12%	9,900	9,300	-6%	10,600	9,800	-8%
9	Webster Road	South of Stafford Road	25,100	26,600	24,800	-7%	27,400	25,800	-6%	30,000	26,200	-13%	32,700	27,400	-16%
District Roads															
6	Edinburgh Castle Road	North of Leckie Road, Kedron	10,600	7,500	5,900	-21%	7,800	6,100	-22%	8,400	6,700	-20%	9,200	6,900	-25%
21	Dawson Street	North of Rose Street, Wooloowin	10,400	10,000	9,400	-6%	10,300	9,400	-9%	10,500	9,700	-8%	10,600	10,300	-3%
24	Dickson Street	North of Wride Street, Wooloowin	13,000	11,700	9,400	-20%	11,800	9,400	-20%	12,400	9,300	-25%	13,000	9,500	-27%

Table 10-5 Surface Traffic Changes within the Inner North Area - Comparison without and with the Project in Combination with Northern Busway

Screenline	Average Weekday Traffic											
	2012			2016			2022			2026		
	Without AL + NB	With AL +NB	% Change	Without AL +NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change
Western	106,500	110,100	3%	112,900	116,900	4%	119,500	125,000	5%	123,700	129,100	4%
Central	81,600	68,600	-16%	87,300	73,900	-15%	91,400	76,300	-17%	94,200	78,700	-16%
Eastern	90,300	81,900	-9%	96,600	89,200	-8%	103,700	97,800	-6%	109,600	104,400	-5%
Northern	231,100	181,800	-21%	243,600	190,300	-22%	256,400	198,500	-23%	269,000	206,500	-23%
Screenline	**Commercial Vehicle Weekday Traffic**											
	2012			2016			2022			2026		
	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL + NB	With AL +NB	% Change	Without AL+ NB	With AL +NB	% Change
Western	5,600	5,500	-2%	6,100	6,200	2%	6,300	6,300	0%	6,500	6,400	-2%
Central	5,300	4,300	-19%	5,800	4,600	-21%	5,400	3,700	-31%	5,200	3,500	-33%
Eastern	9,400	9,200	-2%	10,100	9,800	-3%	10,700	10,300	-4%	11,000	10,400	-5%
Northern	11,900	7,900	-34%	12,800	7,800	-39%	13,200	7,100	-46%	13,900	6,900	-50%

Table 10-6 Intersection Performance without and with Airport Link and Northern Busway – 2012 & 2022

Intersection	Peak	2004 LOS	2012				2022			
			Without AL & NB		With AL & NB		Without AL & NB		With AL & NB	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Gympie Road Intersections										
Gympie Road/ Strathmore Street/ Castle Street	AM	B	0.72	A	0.81	A	0.80	A	0.87	A
	PM	C	0.78	A	0.87	A	0.91	A	0.96	B
Gympie Road/Sadlier Street	AM	-	0.89	B	1.00	C	0.91	B	1.00	C
	PM	-	0.74	B	0.83	B	0.80	A	1.00	C
Gympie Road/Stafford Road	AM	D	1.00	C	0.99	E	1.00	D	1.07	F
	PM	E	1.14	F	1.12	F	1.20	F	1.04	F
Stafford Road Intersections										
Stafford Road/Webster Road	AM	F	1.13	F	1.17	F	1.19	F	1.26	F
	PM	D	1.06	F	1.30	F	1.17	F	1.35	F
Stafford Road/Clifford Street	AM	A	0.67	A	0.95	A	0.79	B	1.00	B
	PM	A	0.82	A	0.89	A	1.00	A	1.00	B
Stafford Road/Lennon Street	AM	A	0.51	A	0.76	A	0.57	A	0.80	A
	PM	A	0.52	A	0.86	A	0.62	A	0.95	C
Stafford Road/ Richmond Street	AM	A	0.52	C	0.85	C	0.58	C	0.87	C
	PM	B	0.60	C	0.92	D	0.77	C	1.00	E
Lutwyche Road Intersections										
Lutwyche Road/ Kedron Park Road	AM	C	0.99	D	1.06	F	1.12	F	1.08	F
	PM	F	1.12	F	1.48	F	1.09	F	1.32	F

Intersection	Peak	2004 LOS	2012				2022			
			Without AL & NB		With AL & NB		Without AL & NB		With AL & NB	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Lutwyche Road/ Norman Avenue/Norman Street	AM	A	0.59	A	0.62	B	0.84	C	0.83	D
	PM	A	0.66	B	0.58	B	0.89	C	0.80	D
Lutwyche Road/ Bradshaw Street	AM	D	0.93	C	0.65	B	0.91	C	0.81	B
	PM	B	1.00	C	0.83	A	1.24	F	0.83	A
Lutwyche Road/Chalk Street/Thistle Street	AM	E	1.13	E	0.86	A	1.13	F	0.89	B
	PM	B	1.01	C	0.74	B	1.00	E	0.80	B
Lutwyche Road/ Maygar Street	AM	C	0.62	B	0.63	B	0.69	C	0.66	C
	PM	D	1.08	F	0.88	B	1.18	F	1.00	B
Lutwyche Road/ Fosbery Street	AM	C	0.56	A	0.54	A	0.59	B	0.60	A
	PM	B	0.42	A	0.72	A	0.47	A	0.79	A
Lutwyche Road/Albion Road	AM	B	1.00	D	1.00	D	1.00	D	1.00	D
	PM	B	1.01	F	1.00	E	1.12	F	1.06	F
Lutwyche Road/Bowen Street	AM	A	0.79	A	0.76	A	0.83	A	0.77	A
	PM	A	0.89	A	0.84	A	0.99	C	0.85	A
Lutwyche Road/Eildon Street/Le Geyt Street	AM	A	0.83	A	0.82	A	0.87	A	0.83	A
	PM	A	0.90	A	0.82	A	0.99	C	0.83	A
Lutwyche Road/ Grantson Street	AM	A	0.91	A	0.92	B	0.97	B	0.93	B
	PM	A	0.99	C	0.88	A	1.09	F	0.90	A
Lutwyche Road/ Newmarket Road	AM	D	1.00	E	1.09	F	1.07	F	1.13	F
	PM	C	1.28	F	1.07	D	1.42	F	1.16	F
Lutwyche Road/ Federation Street	AM	F	0.99	D	0.78	B	1.13	F	0.87	B
	PM	A	1.09	E	0.73	B	1.04	E	0.70	B
Lutwyche Road/ Northey Street	AM	D	1.03	E	1.00	D	1.17	F	1.00	D
	PM	D	1.33	F	0.92	D	1.34	F	1.03	F
Bowen Hills and Fortitude Valley Intersections										
Bowen Bridge Road/ Butterfield Street	AM	E	0.97	D	0.75	B	1.03	E	0.77	C
	PM	D	1.45	F	0.95	C	1.54	F	1.00	D
Lutwyche Road/ Campbell Street	AM	A	0.67	A	0.68	B	0.74	A	0.73	B
	PM	B	1.08	F	0.56	B	1.16	F	0.58	B
Bowen Bridge Road/ O'Connell Terrace	AM	B	0.84	C	0.92	D	0.94	D	1.00	E
	PM	B	1.10	F	0.58	C	1.20	F	0.62	C
Bowen Bridge Road/ Herston Road	AM	C	0.86	D	1.00	D	0.85	D	1.00	D
	PM	C	0.84	D	1.02	F	0.88	D	1.04	F
Bowen Bridge Road/ Gregory Terrace/ Brunswick Street	AM	F	1.00	D	1.00	D	1.00	D	1.00	D
	PM	D	1.00	E	1.00	E	1.00	E	1.00	E
Bowen Bridge Road/ Busway Access Ramp	AM	-	-	-	0.62	A	-	-	0.62	A
	PM	-	-	-	0.53	A	-	-	0.52	A
Brookes Street/ Markwell Street/St Pauls Terrace	AM	C	1.00	D	1.03	F	1.00	E	1.06	F
	PM	C	1.03	E	1.03	E	1.00	E	1.04	E

Intersection	Peak	2004 LOS	2012				2022			
			Without AL & NB		With AL & NB		Without AL & NB		With AL & NB	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Brookes Street/ Gregory Terrace	AM	C	0.42	C	0.69	C	0.52	C	0.69	C
	PM	B	0.69	C	0.54	C	0.73	C	0.57	C
Brookes Street/ Wickham Street	AM	B	0.90	C	0.98	E	1.02	E	1.07	F
	PM	B	1.03	E	1.10	F	1.05	E	1.10	F
Brookes Street/Ann Street	AM	B	0.55	A	0.56	B	0.52	A	0.59	B
	PM	B	0.34	B	0.42	B	0.43	B	0.50	B
Campbell Street/ Mayne Road/Hamilton Place	AM	D	0.38	D	0.80	D	0.40	D	0.95	E
	PM	D	0.59	D	0.80	D	0.60	D	0.93	E
Breakfast Creek Road/Montpelier Road	AM	E	1.27	F	1.32	F	1.24	F	1.34	F
	PM	E	1.01	F	1.12	F	1.11	F	1.26	F
Bridge Street/Chalk Street	AM	B	0.60	B	0.43	B	0.68	B	0.43	B
	PM	B	0.62	B	0.50	B	0.81	B	0.49	B
Sandgate Road Intersections										
Sandgate Road/ Toombul Station (Parkland Street)/ Union Street/Grace Street	AM	C	0.93	C	0.93	C	1.10	F	1.01	E
	PM	D	1.01	E	0.99	E	1.13	F	1.08	F
Sandgate Road/Centro Toombul	AM	B	1.00	D	1.00	D	1.00	D	1.00	D
	PM	B	1.00	D	0.67	B	1.08	F	0.84	C
Sandgate Road/East-West Arterial Road	AM	F	1.06	F	1.04	F	1.24	F	1.04	F
	PM	E	1.11	F	1.00	E	1.22	F	1.30	F
Sandgate Road/ Junction Road	AM	F	1.28	F	1.11	F	1.39	F	1.22	F
	PM	E	1.33	F	1.15	F	1.36	F	1.24	F
Sandgate Road/Oriel Road	AM	B	0.88	B	0.73	A	0.88	B	0.68	A
	PM	A	0.70	B	0.63	B	0.86	B	0.70	B
Sandgate Road/ Lapraik Street	AM	A	0.91	B	0.68	A	1.05	E	0.87	A
	PM	A	0.99	C	0.78	A	1.05	E	0.84	A
Sandgate Road/ Bonney Avenue	AM	C	1.00	E	0.92	C	1.06	F	0.94	D
	PM	A	1.11	F	1.02	E	1.18	F	1.07	F
Sandgate Road/Albion Road	AM	F	0.99	F	0.61	C	1.52	F	0.74	D
	PM	E	1.86	F	1.26	F	2.16	F	1.64	F
Sandgate Road/ Frodsham Street/ Crosby Road/ Abbotsford Road (Albion Fiveways)	AM	F	1.01	E	0.69	B	1.12	F	0.74	C
	PM	D	1.32	F	1.17	F	1.43	F	1.28	F
Abbotsford Road Intersections										
Abbotsford Road/ Burrows Street	AM	C	0.81	C	0.73	B	0.88	C	0.75	B
	PM	D	0.91	B	0.87	B	0.93	C	0.90	B
Abbotsford Road/ Edmondstone Road/Mayne Road	AM	C	0.88	B	0.91	B	0.89	B	0.95	B
	PM	F	1.46	F	1.41	F	1.50	F	1.40	F

Intersection	Peak	2004 LOS	2012				2022			
			Without AL & NB		With AL & NB		Without AL & NB		With AL & NB	
			Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS	Max DOS (x)	LOS
Abbotsford Road/ Folkestone Street	AM	A	0.88	A	0.70	A	1.05	A	0.67	A
	PM	A	0.91	B	0.77	A	1.02	E	0.86	A
Abbotsford Road/ Montpelier Road/ Markwell Street/ Campbell Street	AM	C	1.09	F	1.09	F	1.18	F	1.33	F
	PM	C	1.24	F	1.45	F	1.10	F	1.64	F
Kingsford Smith Drive Intersections										
Kingsford Smith Drive/ Amy Street/Breakfast Creek Road	AM	B	0.95	D	0.73	C	1.17	F	0.84	C
	PM	B	1.03	F	0.97	D	0.94	D	1.03	F
Kingsford Smith Drive/ Cooksley Street	AM	F	0.88	B	0.87	B	0.95	C	0.90	B
	PM	F	1.18	F	1.02	D	1.27	F	1.09	F
Local Area Intersections										
Albion Road/ McLennan Street	AM	C	0.73	C	0.46	C	0.96	D	0.55	C
	PM	B	0.99	A	0.74	B	1.00	A	0.77	A
Albion Street/Hudson Road	AM	F	0.92	D	0.79	D	1.06	F	0.92	D
	PM	F	1.12	F	1.02	F	1.29	F	1.14	F
Junction Road/ Morrison Road	AM	C	0.98	D	0.70	C	1.04	F	0.85	C
	PM	E	1.00	D	0.94	C	1.00	D	1.00	D
Dawson Street/Rose Street	AM	C	0.56	B	0.48	B	0.63	B	0.67	C
	PM	C	0.96	C	0.70	C	1.00	D	0.64	C
Kedron Park Road/ Park Road	AM	C	0.86	C	0.57	C	0.95	D	0.61	C
	PM	C	1.11	F	0.86	C	1.12	F	0.91	D

Table 10-7 Effects of Airport Link and Northern Busway Combined Scenario on Travel Times and Speeds for Key Routes

Route		Direction	Without AL		With AL and NB				AL and NB Time Benefits			
					Via AL		On Surface		Via AL		On Surface	
			(min)	(km/h)	(min)	(km/h)	(min)	(km/h)	(min)	(%)	(min)	(%)
AM Peak Hour												
2004												
A	Chermside to Fortitude Valley	Southbound	14	31	-	-	-	-	-	-	-	-
B	Nundah to Fortitude Valley	Southbound	14	33	-	-	-	-	-	-	-	-
C	Hendra to Fortitude Valley	Southbound	14	34	-	-	-	-	-	-	-	-
D	East Brisbane to Chermside	Northbound	20	32	-	-	-	-	-	-	-	-
E	Stafford to Hendra	Eastbound	11	41	-	-	-	-	-	-	-	-
F	Hendra to Milton	Southbound	17	40	-	-	-	-	-	-	-	-
2012												
A	Chermside to Fortitude Valley	Southbound	17	27	9	50	14	32	7	44%	3	17%
B	Nundah to Fortitude Valley	Southbound	16	29	9	57	13	35	6	40%	2	15%
C	Hendra to Fortitude Valley	Southbound	15	31	9	60	14	35	6	39%	2	11%
D	East Brisbane to Chermside	Northbound	19	33	12	51	17	36	7	36%	2	9%
E	Stafford to Hendra	Eastbound	13	35	9	49	12	39	4	32%	1	9%
F	Hendra to Milton	Southbound	20	34	14	52	19	36	6	30%	1	6%
2022												
A	Chermside to Fortitude Valley	Southbound	22	20	11	42	16	28	11	50%	6	29%
B	Nundah to Fortitude Valley	Southbound	19	24	10	54	14	33	9	47%	5	27%
C	Hendra to Fortitude Valley	Southbound	18	27	10	54	15	33	7	42%	3	18%
D	East Brisbane to Chermside	Northbound	23	26	15	39	20	30	8	33%	3	11%
E	Stafford to Hendra	Eastbound	19	24	11	38	15	31	7	40%	4	21%
F	Hendra to Milton	Southbound	22	30	15	46	20	32	7	31%	2	9%

Route		Direction	Without AL		With AL and NB				AL and NB Time Benefits			
					Via AL		On Surface		Via AL		On Surface	
			(min)	(km/h)	(min)	(km/h)	(min)	(km/h)	(min)	(%)	(min)	(%)
PM Peak Hour												
2004												
A	Fortitude Valley to Chermside	Northbound	20	23	-	-	-	-	-	-	-	-
B	Fortitude Valley to Nundah	Northbound	15	30	-	-	-	-	-	-	-	-
C	Fortitude Valley to Hendra	Northbound	16	30	-	-	-	-	-	-	-	-
D	Chermside to East Brisbane	Southbound	21	30	-	-	-	-	-	-	-	-
E	Hendra to Stafford	Westbound	12	37	-	-	-	-	-	-	-	-
F	Milton to Hendra	Northbound	18	38	-	-	-	-	-	-	-	-
2012												
A	Fortitude Valley to Chermside	Northbound	23	19	14	33	17	26	9	40%	6	26%
B	Fortitude Valley to Nundah	Northbound	22	21	14	39	18	26	8	38%	4	16%
C	Fortitude Valley to Hendra	Northbound	21	23	14	40	19	26	8	36%	2	12%
D	Chermside to East Brisbane	Southbound	23	27	14	45	19	34	9	40%	4	19%
E	Hendra to Stafford	Westbound	15	31	10	45	12	37	5	35%	2	16%
F	Milton to Hendra	Northbound	25	27	14	49	24	28	11	43%	1	4%
2022												
A	Fortitude Valley to Chermside	Northbound	30	15	17	26	21	21	13	43%	9	30%
B	Fortitude Valley to Nundah	Northbound	27	18	16	34	20	23	11	41%	6	24%
C	Fortitude Valley to Hendra	Northbound	25	19	16	35	21	23	10	39%	5	19%
D	Chermside to East Brisbane	Southbound	22	29	18	35	23	28	4	18%	-1	-4%
E	Hendra to Stafford	Westbound	24	19	10	42	17	27	14	57%	7	31%
F	Milton to Hendra	Northbound	30	22	16	44	26	26	14	46%	4	13%

Table Note: Route A 2022 PM peak time manually determined, considering 2012, 2016 and 2026 model results, to replace model time affected by local anomaly.

10.4 Local Access Effects

Some additional effects on local access would occur if the Northern Busway is implemented in conjunction with Airport Link. The effect of the combined Airport Link and Northern Busway on the various precincts has been assessed as follows:

- Kedron East Precinct -No additional effects with Busway
- Gordon Park Precinct - Suez Street would be closed off from Gympie Road due to the Busway. To provide local accessibility, a left-turn would be provided at Swan Street for movements from the south. Movements from the north are prevented in the intersection design for safety reasons. A right turn for buses only would be provided to Swan Street from Stafford Road via the signals. Left-turn out travel from Swan Street to Stafford Road would be provided for buses and local traffic. The expected bus use of Swan Street is very minor (anticipated to be a maximum of 3 services per hour in each direction by 2026). The proposed Busway service plans continue to direct almost all Stafford Road bus services via Richmond Street and Bradshaw Street to Lutwyche as per the current routes. These arrangements are not anticipated to encourage additional traffic use of the local streets such as Swan Street because traffic movements out of Swan Street at Stafford Road will be signal controlled, and will not offer significant travel time benefits compared to use of the major road network.
- Kedron West - No additional effects with Busway.
- Emergency Services - No additional effects with Busway
- Lutwyche Precinct - Perry Street would lose its connectivity to Lutwyche Road due to the Northern Busway's alignment. Traffic would be able to satisfactorily use the new local street connecting to Norman Avenue.
- Southern connection – To allow for the Busway connection to the road network at the Edgar Street/Northey Street intersection, Edgar Street would be closed to general traffic just east of its connection with Edmund Street. Local access for Edmund Street can be suitably gained via Allom Street. There would be a need to signalise the Victoria Street/Northey Street intersection to allow bus priority access to Northey Street in the Interim Busway scenario, which may cause a small inconvenience to users of Victoria Street due to additional delays.
- Effects on abutting precincts along Lutwyche Road - The introduction of the Northern Busway would have some effects along Lutwyche Road for both the Interim and Ultimate Busway scenarios. Whilst these involve quite major changes to current roadway arrangements in some sections, as described below, the design allows for suitable alternative arrangements for local access. Intersection performance under the revised traffic layout is assessed in **Section 10.3.2**. Key changes are summarised as follows:
  - Bradshaw Street on the eastern side of Lutwyche Road would be closed to through traffic due to the Lutwyche Busway Station. This would result in a moderate impact for through traffic travelling between to/from the western section of Bradshaw Street (a district access road), which would need to divert to Chalk Street. However it is noted that eastern side of Bradshaw Street is only a local road and it is preferable for such traffic to use Chalk Street which is a district access route.
  - Changes to the local network road network in the vicinity of Truro Street occur due to the Northern Busway. Changes directly occur on Lutwyche Road itself, as the section of Lutwyche Road between Stoneleigh Street and Albion Road would be widened to provide two through lanes in each direction. Truro Street would be converted to bus use with a one-way street provided for local access. Properties in Fosbery Street, Anna Street, Adie Street and Stoneleigh Street would need to travel via Albion Road to egress southbound.
  - Roblane Street would be similarly converted for bus use with a one-way local street for local access.

- Lutwyche Road between Albion Road and Constitution Road would be modified to provide two through lanes in each direction around the western side of Memorial Park.

10.5 Bus Effects

The overall benefits to bus users of the Northern Busway would be significant and an increase in bus patronage in the corridor is forecast due to the improved public transport services and the greater travel reliability, comfort, safety and convenience provided by a Busway system.

The overall effect of the Northern Busway on public transport use is illustrated in **Figure 10-9**, which highlights that the Northern Busway will fulfil a significant public transport task, comparable to the rail corridor and the South-East Busway.

Implementation of the Northern Busway would incorporate Busway Stations at Kedron Brook, on the western side of Lutwyche Road and within the Lutwyche shopping and business precinct near Bradshaw Street. The affected bus stop locations with the Airport Link north-eastern connection, as previously shown in **Figure 9-16**Figure 9-16, would be replaced by the new high quality dedicated facilities. A major Busway Station would also be provided at the Royal Brisbane and Women's Hospital, a key travel generator in the corridor.

The Ultimate Busway, when implemented post 2020, would provide for high frequency, fast and reliable services on a completely off-road bus corridor between the Inner Northern Busway and Gympie Road north of Stafford Road. Additional high quality bus stations to those provided with the Interim Busway would be provided within the corridor at Federation Street, Windsor and Albion Road.

10.6 Pedestrian and Cyclist Effects

The implementation of the Northern Busway in conjunction with the Airport Link would have additional beneficial effects on pedestrian and cyclists are described below :

- North-western connection - A new pedestrian/cycle bridge, providing a connection from Swan Street north of Kedron Brook, to Perry Street on the south, is proposed for the Northern Busway. This would further enhance the connectivity and accessibility of the Kedron Brook pedestrian/cycle path as well as providing convenient access to the proposed Kedron Brook Busway Station from the Gordon Park residential area.
- Lutwyche Road – a range of improvements associated with the proposed Busway would provide enhanced facilities for pedestrians and cyclists in the corridor. These include provision of cycle storage facilities at Busway stations, design to ensure that stations are fully accessible for all people, and creation of safe, attractive environments for passengers though use of architecturally designed stations with 24-hour security and real-time electronic bus information. With the Ultimate Busway, a grade-separated pedestrian connection is proposed across Lutwyche Road linking between the Windsor Busway Station and the train station. This would also improve general east-west pedestrian accessibility as well as provide for good connectivity for passengers transferring between public transport modes.

Figure 10-9
2026 Average Weekday
Public Transport Demands
With Airport Link and Northern Busway

Airport Link

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10.7 Road Safety

Crash analysis for the cumulative scenario of Airport Link with the Northern Busway has been conducted using the methodology outlined in **Section 9.7**. The results are shown in **Table 10-8**.

The Bowen Bridge Road/Lutwyche Road/Gympie Road corridor between Herston and Kedron would experience significant additional safety benefits with the inclusion of public transport initiatives and further reduction of surface traffic. An increase in crash reduction in 2012 from 18% (AL only) to 28% (combined AL and Northern Busway) is estimated, increasing to 21% and 29% respectively in 2022. The Lutwyche Road section of the corridor has the greatest additional benefits, where overall accident reduction reaches 60% with Northern Busway.

In other areas, there are only minor differences in expected crash effects in the combined project scenario compared to the Airport Link only case.

- **Table 10-8 Estimated Crashes on Key Routes Without and With Airport Link and Northern Busway**

Arterial	Section	2004	2012				2022			
		Average Annual Crashes	Without AL & NB	With AL & NB	Difference	% Change	Without AL & NB	With AL & NB	Difference	% Change
Airport Link	All	-	-	27	26.6	-	-	31	31.3	-
Lutwyche Road	All	101	142	90	-52.5	-37%	151	93	-57.8	-38%
Gympie Road	Kedron Park Road to Castle Street	35	37	37	0.0	0%	39	40	0.2	1%
Bowen Bridge Road	ICB Bridge to Lutwyche Road	19	20	16	-4.0	-20%	22	17	-4.4	-20%
Sandgate Road	Crosby Road to Nundah Tunnel	73	103	80	-23.2	-23%	118	87	-30.8	-26%
Abbotsford Road	Campbell Street to Crosby Road	18	27	22	-4.5	-17%	31	25	-6.7	-21%
East West Arterial	Webster Road to Gympie Road i.e. Stafford Road	22	31	47	15.5	49%	34	52	17.9	53%
East West Arterial	Lutwyche Road to Sandgate Road i.e. Park Road-Rose Street- Junction Road	24	29	22	-7.8	-27%	32	24	-7.9	-25%
East West Arterial	Sandgate Road to Nudgee Road	11	23	26	3.7	16%	28	29	1.8	7%
Nudgee Road	Kingsford Smith Drive to East West Arterial	5	6	5	-0.9	-16%	6	6	-0.6	-10%
Kingsford Smith Drive	ICB to Allison Street	33	46	42	-3.8	-8%	52	50	-2.0	-4%
Total		**340**	**464**	**414**	**-51**	**-11%**	**513**	**454**	**-59**	**-11%**

11. Construction Impacts

The construction of a major infrastructure project such as the Airport Link may affect transport and traffic in the area, as a result of traffic generated by the project, physical changes to transport networks, and disturbance of traffic flows due to lane closures or distractions.

The construction contractor would be required to prepare a detailed transport management plan for all elements of the works, to minimise adverse effects. The preparation of this plan would have to include performance analysis for lane closures and other disruptions. The safety and convenience of all road users would need to be addressed by the plan.

Measures often adopted to reduce construction effects include location of work sites with access to major roads, controlling working hours, providing designated parking areas with bus transport to work sites, and staging works to minimise traffic impacts (for example, using lane by lane rather than full road closures). All of these measures are likely to be used for the Airport Link project.

11.1 Construction Site Traffic Generation and Access

11.1.1 Work Sites and Working Hours

The construction of the project would be organised around the three connection areas. Indicative worksite layouts have been identified for the reference project and these are described below.

Southern Connection

The southern connection is located in the Bowen Hills area. In the indicative worksite layouts, one construction site would be created, between Lutwyche Road and Byrne Street, south of Federation Street. Works at this site would include the construction of access ramps, bridges, cut and cover tunnels, transition structures, and surface works. The site would also provide access for the north-south tunnel construction.

North-western Connection

The North-western connection is located in the Kedron Brook area. In the indicative layouts, three construction sites would be situated at this connection. The first worksite would be west of Lutwyche Road between Norman Avenue and Kedron Park Road. This site would provide access for the main line tunnel construction and adjacent surface works. The second worksite would be located on the Emergency Services Complex site on the northern side of Gympie Road close to Kedron Brook. This site would house the main project site offices as well as the tunnel worksite for the east-west connection. The third worksite would be located on the eastern side of Gympie Road just south of Broughton Road, and would support surface works associated with the Gympie Road and Stafford Road ramp connections.

Surface works at these construction sites would include the construction of access ramps, cut and cover tunnel, transition structures, widening and duplication of the existing Kedron Brook Bridge, elevated structures over Kedron Brook and provision of a service road.

North-eastern Connection

The north-eastern connection is located in the Toombul area. In the indicative layouts, one worksite would be located here, spanning from the eastern side of Kalinga Street to the western side of Melton Road. Works at this site would include the construction of access ramps, cut and cover tunnel, transition structures, widening of the existing Schulz Canal bridge and new bridge structures connecting to the East-West Arterial.

Working hours for surface works at these sites would typically be between 6.30 am and 6.30 pm Monday to Saturday with no works expected to be carried out on Sundays and public holidays. In some cases, works on major roads or rail crossings may have to be carried out at other times, if the impacts of daytime works are considered unacceptable by the relevant approval sections of Council or the Queensland Department of Main Roads, or Queensland Rail. These cases would be specified in the Traffic Management Plans. Underground works would continue 24 hours a day. Spoil haulage is also proposed to continue 24 hours a day for the five working days, and 12 hours on Saturday to 6.30pm, subject to approval conditions and any time limitations required to manage impacts on congestion or residential amenity.

11.1.2 Construction Site Access

Potential access arrangements during construction for each of the worksites have been identified on the indicative worksite layouts. These are described below.

Southern Connection

Access to the southern connection worksite would be via Federation Street near Earle Street. Federation Street provides signalised access to Lutwyche Road with all turns permitted.

North-western Connection

Access to the north-western connection worksite west of Lutwyche Road would be via the new service road that would be built to link Norman Avenue with Perry Street. Initially the site access road would continue along the northern perimeter of the site before turning west to provide an exit to Gympie Road opposite Kedron Park Road. From Phase 2, when the northbound lanes of Lutwyche Road are proposed to be diverted to the western side of the worksite, the site exit would be relocated to Lutwyche Road south of Colton Avenue.

Access to the worksite within the Emergency Services Complex site would likely be directly to and from Gympie Road. This entry would provide access to both the main site offices within the Emergency Services Complex and the cut and cover construction area parallel to Kedron Brook. After the realignment of the northbound lanes of Lutwyche Road, an access road through the Lutwyche Road construction site would be provided to allow northbound vehicles to use this entry to the Emergency Services Complex site.

An additional exit point would be provided for vehicles exiting from the Kedron Brook cut and cover area, located at the connection of Gympie and Kedron Park Roads and providing direct access to Lutwyche Road southbound. This is the exit point that is likely to be used by spoil haulage trucks. After completion of the cut and cover works in this area, it is likely that the northern site exit would be closed and the Gympie Road/Kedron Park Road exit would serve the main site offices as well as the tunnelling operations.

Access to the Gympie Road surface works site south of Broughton Road would be directly to and from Gympie Road.

North-eastern Connection

Two separate access points would be provided to the north-eastern connection construction site in Toombul. Entry to the eastern part of the site, which includes the parking areas and site offices, would be likely to be from Widdop Street near the existing East-West Arterial off-ramp. An exit is likely to be provided directly onto the East-West Arterial.

Construction workers would be able to move freely between the two parts of the site by passing under Sandgate Road adjacent to the Shultz Canal, but clearance is insufficient for heavy vehicles. A second access would therefore be required for the part of the site west of Sandgate Road. This would be provided to and from the East-West Arterial by modifying the signal phasing at its intersection with Sandgate Road. Left in access would

also be available from the southern Sandgate Road approach, although this route would not be used for spoil haulage.

11.1.3 Traffic Generation

Construction traffic would include:

- Workforce Transportation;
- Haulage of excavated material;
- Deliveries of materials, machinery, etc;
- Servicing and repairs to construction equipment; and
- Site Visitors.

It is anticipated that the workforce would consist of around 465 people working on-site over a 47 month construction period. An estimate of the division of the workforce during the daytime shift over the three work sites is shown in **Table 11-1** below. The evening shift would be likely to involve a smaller workforce for tunnelling operations only.

Table 11-1 Construction Workforce

Site Location	Tunnel/Portals(1)	Surface(1)
South	80	80
North-western	80	80
North-eastern	-	80
Project Management (various)	-	65

Table Note: (1) Based on FTEs from cost estimate.

The major traffic flows would occur during shift changes, with low volumes of deliveries, visitors and maintenance workers throughout the day.

The haulage of excavated material would involve approximately 1,610,000 bank cubic metres of spoil produced by the project. Two potential locations have been identified for the placement of this excavated material:

- TradeCoast Central site at the old Brisbane Airport, within the northern area of ATC, which would take approximately 460,000 bank cubic metres; and
- Sites at the Port of Brisbane, which would take approximately 1,150,000 bank cubic metres.

Road is considered to be the only practical form of transportation for spoil haulage for this project. Although two of the connection areas are close to rail lines, the lack of infrastructure to allow loading close to the work sites and unloading close to the spoil placement sites, the need for double handling of spoil material, the long indirect route for trains to the Port of Brisbane sites via the City, and the potential for disruption of existing rail services led to this option being ruled out. Access to waterways and bridge heights are also not sufficient to allow barge transport.

The spoil haulage scenario is based upon road haulage to the Airport and the Port of Brisbane sites using trucks, most likely tip truck and quad dog combinations with a 22m^3 capacity. **Table 11-2** shows the approximate amount of spoil conservatively estimated at the three main worksites for the reference design, and the resulting overall average truck haulage movements for these sites.

Table 11-2 Estimated Average Truck Generation for Excavated Material

Site Location	Estimated Volume of Spoil Generated (m^3)	Duration of Operation (months)	Average Rate of Spoil Removal Per Day	Average Number of Truck Loads Per Day	Hours of Spoil Removal (Weekdays)	Average Hourly Loaded Truck Movements
South	450,000m^3	32	1,100	50	24	2
North-western	975,000m^3	30	2,630	115	24	5
North-eastern	185,000m^3	16	870	40	24	2

At the north-western connection, tunnel construction is expected to begin with lower intensity works. The indicative schedule for the reference project indicates that higher intensity tunnelling would not begin until late in the fourth quarter of 2009. Spoil haulage from the north-western connection would thus expected to begin at an average level of 50 trucks per day (2 per hour), rising to an average of just over 140 trucks per day (6 per hour) when the tunnel construction equipment is fully operational.

Spoil from the south connection worksite scenario would be taken to the Port of Brisbane sites while spoil from the north-eastern connection site scenario would be placed within the northern area of the ATC. Spoil from the North-western site could be split between the two spoil placement sites.

An alternative site for the placement of EPB (Equal Pressure Balancing machine) excavated tunnel material could be at Swanbank near Ipswich. This site would be used if the excavated material contained a significant amount of poor quality coal.

Some of this spoil may be reused in the construction of embankments at the connection sites, particularly the north-western site where there are significant embankments planned. Spoil could also be used to create a new parkland/feature near the south connection.

11.1.4 Truck Routes

Spoil haulage would have to be managed appropriately to minimise any adverse impact on the road network. The haulage operations would need to be detailed in the Transport Management Plan, and would need to be based on detailed analysis that looks at any potential impact that the operation may have on the road users and the community.

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

- Minimising truck traffic in local streets, by providing direct access to major roads and specifying haulage routes on the major road network;
- Minimising the effect on residential communities, by using routes through residential areas only where there is no practical alternative and preferably not operating after hours on these routes;
- Minimising congestion effects, by avoiding congested roads if a suitable alternative exists, or operating off peak only on these roads if possible, and also by analysing the capacity of intersections along the route to identify and mitigate against any operational impacts;
- Minimising the effect on businesses and conflicts with pedestrians, by avoiding busy commercial areas if a suitable alternative exists, or operating after work hours only on these routes if possible;
- Minimising the perceived impact of additional trucks, by using routes already used by heavy vehicles; and

- Avoiding conflicts with major events, for example at the RNA Exhibition Grounds, by limiting haulage times or using alternative routes during these events.

These principles would need to be followed in developing the Transport Management Plan for construction of the project. The likely traffic impacts would vary depending on the time of the day and the chosen route.

The five worksites identified for the Airport Link project all provide direct access to major roads. Preliminary investigation has identified potential haulage routes between the three connection areas and the potential designated spoil sites, as described below.

Southern Connection Worksite

The haul route from the South worksite would be likely to follow Bowen Bridge Road, Gregory Terrace (or Campbell Street once the new Airport Link ramps were constructed) onto Breakfast Creek Road, Kingsford Smith Drive and the Gateway Arterial to the Port of Brisbane.

North-western Connection Worksites

Spoil from these sites would include all material from the excavation of the east-west connection. The haulage route would be likely to be straight down Lutwyche Road to the south connection. It would then follow the same route as for spoil haulage from the south connection site to Kingsford Smith Drive, then to TradeCoast Central or across the Gateway Bridge to the Port of Brisbane.

If EPB excavated tunnel material contained a significant amount of poor quality coal and needed to be disposed of at Swanbank, then the haulage route would be likely to be straight down Lutwyche Road to the Inner City Bypass, Hale Street and down the Pacific Motorway. The likely route would then follow the Gateway Motorway and Logan Motorway to the Ipswich Motorway before using the Cunningham Highway to get to Swanbank. The haul route could use the NSBT once it is open to provide a direct connection between Lutwyche Road and the Pacific Motorway.

North-eastern Connection Worksite

Spoil from this site would be limited to material from the cut and cover road construction. This would be likely to be taken along the East-West Arterial Road to the TradeCoast Central site.

The routes identified utilise major roads that are already used by heavy vehicles. Both Lutwyche Road and Kingsford Smith Drive are major arterials with mixed use frontage activities, although some residential properties remain on these roads. The route through Bowen Hills between these arterials avoids residential areas and passes through generally lower intensity commercial areas. An alternative route through Bowen Hills, or alternative scheduling or traffic control, may be required during major events at the RNA Showgrounds. This would need to be investigated during preparation of the Transport Management Plan.

Many of the major roads on the haulage routes experience peak period congestion. Truck haulage mixed with peak hour traffic would create inefficiency for the trucks and may have unacceptable impacts on general traffic. Intersection operations along these routes would need to be analysed and consideration given to limiting haulage to off-peak periods.

11.2 Local Traffic Flow Impacts

Temporary construction works that may affect traffic flow in the area surrounding the work sites during the construction period would include the following:

- Temporary traffic diversions;

- Realignment of traffic lanes;
- Partial road closures, for works staged to minimise any disruptions to traffic flow or property access; and
- Intersection operational changes.

A Traffic Management Plan (TMP) outlining strategies to minimise any likely impact of these works would be produced for each of the construction sites. The TMPs would consider the convenience and safety of all road users, including public transport, pedestrians and cyclists. Access to properties would need to be maintained at all times wherever possible.

The TMPs would include, but not be limited to, a detailed description and plans for:

- Staging and timing of works on roads;
- Signage and delineation past the work site, including any diversion routes;
- Other measures to help ensure safety and manage the change in traffic flows, for example, traffic controllers, traffic signal operational changes using Council's BLISS system, dynamic advance warning using variable message signage (VMS), and real time monitoring of traffic conditions using closed circuit television (CCTV); and
- Identification of any alternative routes with sufficient capacity to accommodate additional traffic, with measures to encourage drivers to use these routes.

In preparing the TMPs, it would be necessary to model the existing traffic conditions on the road network especially on major roads and in vicinity of the site and predict the effect of the likely traffic redistribution as a result of proposed temporary traffic arrangements.

Conditions surrounding the worksite would need to be monitored throughout the construction period, and the TMPs reviewed as appropriate to address any negative impacts which developed. This would include regular monitoring of traffic flows against the modelled traffic volumes.

11.2.1 Traffic Diversions

There would be traffic diversions at all three connection areas, as described below.

Southern Connection

The proposed Airport Link connection from O'Connell Terrace to Lutwyche Road at Northey Street involves the construction of an elevated structure over Campbell Street. Appropriate staging and diversions would be required to maintain local access to properties in this area, including the NSBT northern construction site which will be located between Lanham Street and the Inner City Bypass during the initial years of Airport Link works. Intersection works on O'Connell Terrace would then be phased to minimise impact.

Traffic diversions would also be required for the new bridge across Enoggera Creek to near Earle Street which is proposed as part of the NSBT. Traffic flows on this connection would be affected by the construction of the proposed second level bridge above, for Airport Link.

Realignment of traffic at the Lutwyche Road/Northey Street intersection would be required during the relocation of the NSBT connection.

North-western Connection

A service road is proposed between Norman Avenue and Perry Street to provide access to properties in this area. Windsor Avenue, Colton Avenue and Perry Street would then be closed at Lutwyche Road to allow the development of the Lutwyche Road worksite. These changes would be permanent.

Some short-term closures of Norman Street would be required during construction. During these periods, local traffic would be diverted to Lamington Street.

The northbound lanes of Lutwyche Road between Isedale Street and Kedron Brook would be diverted to the western side of the Lutwyche Road worksite, to allow the tunnel construction to take place. This diversion would remain in place for most of the construction period.

The southbound lanes of Lutwyche Road would also be diverted to the east between Norman Street and Isedale Street during construction of the southern section of cut and cover tunnel in this area. The southbound lanes would then return to their existing alignment.

Temporary closures of Park Terrace, Lasseter Street, Arnott Street and Leckie Road would be required during construction of the new southbound carriageway of Gympie Road. During this period local traffic would be diverted to Sadlier Street.

After completion of the permanent realigned southbound lanes of Gympie Road between Leckie Road and Kedron Brook, Gympie Road traffic would be switched to this alignment. Northbound traffic would be diverted to a similar alignment between Suez Street and Leckie Road to allow for road widening and viaduct construction.

Short-term lane closures would be required on Stafford Road to allow intersection works and ramp connections. These would be scheduled to minimise their impact on traffic flows.

North-eastern Connection

Modification of the Sandgate Road/East-West Arterial intersection would be required to provide access to the worksite.

Early construction would include the northern elevated structure to provide ramp access to the East-West Arterial east of Sandgate Road. Traffic from the East-West Arterial would be realigned onto this structure during later stages of construction. The Sandgate Road/East-West Arterial intersection would be temporarily modified to suit the new alignment.

Realignment of traffic through the Sandgate Road/East-West Arterial intersection would be required during intersection works. Short-term lane closures are also likely to be required. These would be scheduled to minimise their impact on traffic flows.

Construction of the cut & cover tunnel to achieve the required crossings below the existing North Coast Railway lines will cause some unavoidable disruption to rail operations.

11.2.2 Traffic Operations

The Traffic Management Plans for each area would identify, where diversions were required, temporary traffic arrangements to be put in place that would maintain capacity through the work area. Partial road closures would be scheduled so that the remaining capacity would be sufficient for the traffic demand, in consultation with the relevant road authorities.

As a result, local traffic impacts are expected to be small. However, a reduction in mid-block capacity may be expected due to drivers being distracted by the construction works. There is also a risk of traffic incidents due to unfamiliar geometry, which would be less easily managed due to the reduced capacity. In order to address these issues, close attention must be given to geometry, signage and delineation to guide drivers through the work area, and screening of works to avoid distractions, in the TMPs.

The slow speed of trucks turning into and out of the worksites would also affect passing traffic. This factor would be most significant in the north-western connection area, since access to the major roads from the south connection site and the western section of the north-eastern connection site would be signal controlled. While the access to the East-West Arterial from the eastern section of the north-eastern connection site is likely to be via a stand up lane, conflicting traffic would be controlled by the Sandgate Road/East-West Arterial signalised intersections, so exiting trucks would be able to easily pick gaps to exit the site without affecting through traffic.

Reducing traffic speed past the worksite would minimise the disturbance the trucks would cause to the traffic flow, as well as increasing safety in the affected area. Temporary speed restrictions could be reinforced by construction warning signage (fixed and VMS). Worksite delineation and protection such as crash barriers would also help to lower the perceived speed environment.

11.2.3 Traffic Intrusion into Local Streets

The TMPs would be designed to provide sufficient capacity on the major traffic routes at all times, reducing the desire of drivers to seek alternative routes. The road network surrounding the work sites generally does not provide convenient alternative routes via local streets. Thus, the effect on local streets is expected to be small.

On middle order roads, there is some potential for drivers to divert around the north-western connection sites via Richmond Street and Bradshaw Street, and around the north-eastern connection via Melton Road. Use of these routes should be able to be managed by control of the traffic signal timings at each end. Traffic volumes on these routes should be monitored during construction and counter measures adopted if necessary.

11.2.4 Trucks Queuing

Trucks queuing to enter the site are not expected to be a problem during the day when loading operations are proceeding. The critical time for truck queue space requirements would be at the start of a shift, when several trucks arrive early and queue to wait for their first load.

Each of the worksites should provide a significant length of access road within the site which would provide space for trucks to queue. This distance within the reference design ranges from approximately 50 m at the Lutwyche Road site during Phase 3 to over 200 m at the north-eastern connection site.

The most haulage traffic would be generated by the two north-western connection sites at Lutwyche Road and the Emergency Services Complex, which would together generate approximately 6 trucks per hour during the more intense tunnel excavation phase. It is therefore unlikely that that queuing issues will arise, even at the Lutwyche Road site during Phase 3. (During other construction periods, the available queuing distance at this site within the reference design would be over 90 m, which would be more than adequate for a full hour's worth of trucks to queue if necessary.)

If more than 4 trucks could arrive at the Lutwyche Road site at the start of the day during Phase 3, management measures would be required to ensure the queuing vehicles did not affect Lutwyche Road's northbound through lanes. Allocating the first round of trips the day before or arranging staggered starts could both be possible ways of managing this issue.

The South and North-eastern sites as proposed in the reference design would involve fewer trucks (approximately 2 per hour for spoil haulage), which should be able to be accommodated on site. Thus queuing is not expected to be a problem in these areas.

At all sites, the scheduling of both spoil haulage and delivery trucks will need to be monitored during construction, and modified if necessary to avoid excessive queuing.

11.2.5 Construction Workforce Parking

The identified workforce is expected to generate a parking demand of approximately 345 vehicles. Shift changeovers for underground workers are expected to occur outside working hours for surface workers, providing ample parking for the short term double demand of the shift workers' vehicles. It is desirable that all construction related parking be contained within the worksites to avoid adverse impacts on adjacent businesses or residential amenity. Each work site would also have to provide a small number of parking spaces for visitors and deliveries.

The indicative worksite layouts include sufficient space for this parking demand. In particular, the north-eastern connection worksite has sufficient space for a large number of car parks. Early in the project the public car park south of Schulz Canal, directly across from the Toombul shopping centre, would become part of the worksite, and would provide considerable extra parking. When this is affected by construction, parking would be available along the northern side of the side, clear of the future East-West Arterial on ramp.

The main site office at Kedron Brook should also be able to accommodate approximately 50 additional parking spaces. It should therefore be possible for all construction related parking demand to be accommodated within the construction sites eliminating any need for on street parking.

Space for parking is more limited at the south connection site. There may be opportunities to extend workforce parking into Byrne Street, which will not be used for residential access after construction begins. There may also be scope for workers from this area to park within the RNA Exhibition Grounds and be transferred by shuttle bus to the south connection site.

Temporary on street parking restrictions may be required in streets close to the south connection site, such as Federation Street and Gallway Street, to ensure that safety and amenity are not affected by construction related parking. Streets on the other side of Lutwyche Road in this area are already covered by a parking scheme due to high demands from the Royal Brisbane and Women's Hospital. Conditions should also be monitored on streets surrounding the other work sites, particularly Windsor Avenue, Colton Avenue and Perry Street near the Lutwyche Road site. Countermeasures from reminding staff of the parking policy to temporary on street parking restrictions could be applied if excessive parking was detected.

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

11.3 Regional Traffic Flow Impacts

Impacts on regional traffic flow would be concentrated along the haulage and delivery routes. These are discussed below.

11.3.1 Haul Routes

South Connection

Haul routes from this area would be likely to follow Bowen Bridge Road, Gregory Terrace, Montpelier Road, Breakfast Creek Road, Kingsford Smith Drive, the Gateway Arterial and the Port of Brisbane Motorway to the potential spoil sites at the Port of Brisbane.

An indicative scenario has been assessed based on an average of approximately 2 trucks per hour from the south connection. This scenario also includes approximately 5 truck loads per hour from the north-western connection. Thus, in this scenario, an average of approximately 7 trucks per hour would use this route as far as Kingsford Smith Drive in each direction, giving a two way total of 320 haulage vehicle trips per day generated by Airport Link construction. This would vary over time: early in the construction sequence an average of 4 trucks per hour (a two way total of 200 truck trips per day) would use this route, rising to an average of 8 trucks per hour (a two way total of approximately 380 truck trips per day) near the end of 2009. Approximately 80% of these trips (averaging 5 trucks per hour) could be expected to cross the Gateway Bridge en route to the Port of Brisbane sites, with the remainder destined for the northern ATC area.

This additional traffic volume is small, particularly compared to existing traffic volumes on these roads, but may impact on performance in areas which are already heavily congested.

The effects of this additional traffic on the haulage routes may include:

- Bowen Bridge Road past the Royal Brisbane and Women's Hospital is operating at close to capacity during peak hours. The performance impact of the additional traffic volume would need to be analysed during preparation of the TMPs, and haulage operations managed accordingly (e.g. being restricted to outside peak hours if necessary).
- Following the construction of the Airport Link ramps linking to Campbell Street, haulage trucks would be able to use a more direct route via Campbell Street that would avoid eight signalised intersections. This would greatly reduce impacts on Bowen Bridge Road and be more efficient for the haulage trucks.
- There are several intersections along Kingsford Smith Drive which are currently operating at close to their nominal capacity during peak periods. The haulage traffic would represent a small increase (averaging less than 5%) in the 2009 background daily heavy vehicle volumes, and an average increase of less than approximately 0.5% in total daily traffic volume. Although the incremental volume increase would be small, the impact of the Airport Link haulage traffic on performance of key intersections during peak periods would need to be examined during preparation of the TMPs, since several are significant capacity constraints on the route and are already congested.
- The analysis required for the TMPs would need to examine the performance of key intersections with and without the Airport Link haulage traffic, and would include the haulage traffic anticipated from the NSBT in both cases. Until the third quarter of 2009, background traffic flow on Kingsford Smith Drive will include trucks hauling spoil from the NSBT northern construction site. The number of haulage truck loads expected from the NSBT northern construction site during the expected Airport Link construction period ranges from approximately 110 to 270 trucks per day. This would overlap with early works on the Airport Link, but not with the anticipated main tunnel excavation, which is likely to begin late in the fourth quarter of 2009. The expected combined haulage traffic from AL and NSBT on Kingsford Smith Drive would reach approximately 350 trucks per day – just over 14 trucks per hour – in each direction during the highest combined month, in early 2009. This would include approximately 10 trucks per hour from the NBST and just over 4 per hour from Airport Link. The combined peak two way total of approximately 700 truck trips per day would represent just under 10% of 2009 background truck traffic and approximately 1% of total traffic.

- If the increase in truck volumes on the road adversely affects performance, some of the other users of the road who are familiar with the area may be tempted to use lower order roads such as Lancaster and Crosby Roads. Local area traffic management schemes have already been implemented in these areas, which will help to discourage traffic intrusion, but the operation of these roads should be monitored during construction.
- The haulage traffic is not expected to have significant safety or amenity impacts on this route, since the route is already carrying a high volume of traffic including a large number of heavy vehicles. The incremental impact of the haulage traffic is expected to be small.
- The haulage traffic is not expected to adversely affect the performance of the Gateway Motorway or Port of Brisbane Motorway.

North-western Connection

Haul routes from this area would be likely to follow Lutwyche Road south to Bowen Bridge Road before joining the south connection haul route to Kingsford Smith Drive.

The volume of haulage trucks expected is relatively low with a conservative scenario based on 5 trucks per hour each way, a daily two way total of 230 truck trips.

The effects of this additional traffic on the haulage routes may include:

- The haulage vehicle volumes represent only a small increase (approximately 6%) in the 2009 background heavy vehicle volume on Lutwyche Road north of Stoneleigh Street, and an increase of less than 0.5% in total traffic. However, some intersections on this road currently experience congestion in peak periods, so the incremental effect of these trips may be significant. Key intersections along the route will need to be analysed as part of the preparation of the TMPs, and restrictions on haulage times imposed if necessary.
- The Schneider Road Extension across the Pinkenba rail line into the Australia TradeCoast site, anticipated to be constructed by 2008 as part of the TradeCoast development, would provide the most direct route to the spoil placement site from Kingsford Smith Drive. This would avoid potential capacity issues due to extra turning traffic at either Kingsford Smith Drive/Nudgee Road or East-West Arterial/Gateway Motorway roundabout, both of which are congested at peak times.

North-eastern Connection

Haul routes from this area would be likely to follow the East-West Arterial , Airport Drive and Lomandra Drive to the TradeCoast Central site.

This connection area would generate the smallest number of haulage trips, since only spoil from the cut and cover works would be removed from these sites, with the spoil from the driven tunnel being removed from the north-western connection. An average haulage rate of 2 trucks per hour in each direction, or a two way total of 80 trips per day, is expected.

The effects of this additional traffic on the haulage routes may include:

- The East-West Arterial and Airport Drive are high standard divided roads with ample mid block capacity to absorb the haulage traffic. Lomandra Drive would also have sufficient capacity for the haulage flow.
- However, several intersections on the East-West Arterial are at or close to capacity at peak times, and may be sensitive even to such small volume changes. In particular, the East-West Arterial/Gateway Motorway roundabout is a significant bottleneck. The TMPs will need to analyse these intersections and impose restrictions on haulage times if necessary. As this haulage route passes through industrial areas, more intense operations at night time only may be appropriate.

- The intersection of the East-West Arterial and Sandgate Road is also under pressure, and its operation will need to be modified to provide access to the western part of the worksite. This will need to be analysed for the TMP. If necessary, some intersection improvements may be brought forward to ensure acceptable operation of the intersection with the site access arrangements.

11.3.2 Deliveries

Materials would be delivered to the five work sites, or directly to the tunnel portals or road works areas, depending on the nature of the work and material. The delivery routes would vary with the sources of materials and equipment, which are not known at this stage of the planning process. Deliveries would, however, be confined to major roads. For this reason similar effects would apply to those discussed in the previous section of this report (Haul Routes).

In general, truck numbers required for deliveries are expected to be lower than those required for spoil haulage. Therefore the effect of the deliveries would be expected to be relatively small, except at intersections which are already close to capacity and significantly congested. At these locations, deliveries in peak periods may have to be avoided. This issue would be investigated in detail during the preparation of the TMPs.

Some deliveries would need to be made using oversize vehicles. These deliveries would need to follow the guidelines set out by Queensland Transport, including loading, safety measures, and time of transport. The number of such deliveries and the routes required are not yet known. Planning for these deliveries would need to be examined in detail during the preparation of the TMPs.

In general, delivery times would be restricted to daytime hours Monday to Saturday, unless the TMPs determined that further restrictions should apply (for example, limiting deliveries to off peak periods).

11.4 Impacts on Bus Routes and Operations

Acceptable traffic flow would be maintained past the worksites on all major roads throughout construction, using the management measures to be detailed in the TMPs. Bus routings would therefore not be affected. Also, the road sections affected by construction zone speed restrictions are likely to be too short to require schedule changes. However, some bus stops would be affected by construction works, as described below.

11.4.1 South Connection

Additional works on Northey Street during construction of the Airport Link elements of the NSBT connection to Lutwyche Road may require a temporary relocation of the Northey Street bus stop east of Victoria Street to west of the Victoria Street intersection affecting services 346 and 353.

11.4.2 North-western Connection

The two bus stops near Norman Avenue are above a cut and cover section of the project reference design tunnel and would need to be relocated during construction of this segment. During different stages of construction the northbound traffic would either follow its existing alignment or be redirected west of its current alignment. When Lutwyche Road follows its existing alignment, interim bus stops could be constructed south of the Windsor Avenue intersection (northbound) and between Colton Avenue and Windsor Avenue (southbound). When Lutwyche Road northbound is realigned, an interim bus stop could be constructed south of Norman Avenue. Both bus stops would be reinstated following construction in their current locations. Services affected by this disruption would be the 334 and 370 service northbound and the 321, 334 and 370 services southbound.

The location of the two bus stops on the western side of Gympie Road between Kedron Park Road and Stafford Road would vary during construction stages as different lanes on Gympie Road were opened and closed.

However, both stops should remain operational throughout construction. These changes would affect services 358 and 370 at both stops, whilst the South stop would also affect routes 333, 334 and 338.

Corridor widening to accommodate both Airport Link and Gympie Road would affect the bus stop located on Gympie Road south-east of Kedron Brook. Construction staging would allow for construction at the potential alternate bus stop location prior to discontinuation of the current bus stop. Services 333, 334, 358 and 370 would be affected.

11.4.3 North-eastern Connection

The southbound bus stop located between the signalised Toombul Shopping Centre access and the rail over bridge on Sandgate Road requires relocation during some stages of construction to the Toombul Bus Interchange, this may become a permanent relocation. This affects services 310 and 315.

11.5 Emergency Service Vehicle Movements

The primary impact of the project on Emergency Services traffic would be the relocation of the Emergency Services Complex (ESC) from its current location at the intersection of Gympie Road and Kedron Park Road to an adjacent site further east along Kedron Park Road. Access to the site would be from Kedron Park Road, rather than its current location on Gympie Road. This would allow for easier exit to the north, although entry from the south would not be improved.

The other main concentration of Emergency Services vehicles in the area affected by the project is the Royal Brisbane and Women's Hospital on Bowen Bridge Road. The main effect on access to the Hospital would be from works on O'Connell Terrace and Campbell Street associated with the city connection ramps. Campbell Street would already have been severed by the NSBT, but access to Sneyd Street would be affected by bridge construction and an alternative route may need to be provided via Wren Street. Access along O'Connell Terrace would need to be maintained during the intersection works required for the new ramp connections. During 2008 and 2009, management measures identified in the TMP for this area will need to allow for construction traffic associated with the NSBT northern construction site between Lanham Street and the Inner City Bypass.

Emergency vehicles approaching the Hospital from the north would be affected by any increase in congestion resulting from haulage activities or from intersection works at Northey Street. However, the volume of trucks involved, averaging 7 vehicles per hour in each direction, are quite small relative to the existing traffic volumes. The effect on congestion is therefore likely to be small. The TMPs will examine the effect of haulage traffic in more detail and recommend counter measures, such as avoiding haulage in peak periods, if necessary. The TMPs will also need to ensure that the Northey Street intersection continues to operate acceptably, changing work times or staging if necessary. Therefore, the effect on emergency services vehicles is expected to be small.

11.6 Construction Impacts on Pedestrian/Cyclist Movements

Pedestrian and cyclist routes will be provided through all work areas, though temporary diversions will be required. All pedestrian crossings will be maintained throughout construction. Specific impacts in each area are discussed below.

11.6.1 South Connection

Pedestrian movement in this area would generally not be affected except for loss of access to resumed properties surrounding Earle Street. As Earle Street would already have been closed for the NSBT works this would not affect access to other areas. The cycle route to Enoggera Creek via Cedric Street and Earle Street would already have been relocated for the NSBT works. There may be a need for temporary pedestrian rerouting through

Lutwyche Road/Northey Street during intersection works, but pedestrian crossings would be provided at all times.

11.6.2 North-western Connection

Pedestrian access would be maintained along both sides of Lutwyche Road and Gympie Road throughout construction. The current pedestrian crossing points, which are at Gympie Road/Stafford Road, Gympie Road/Kedron Park Road and Lutwyche Road/Norman Avenue, would also be maintained.

Following the separation of the northbound lanes of Lutwyche Road from the southbound lanes by the Lutwyche Road worksite, it would be necessary to provide a pedestrian route along the eastern side of the worksite. Alternatively, advance signage could be provided at Norman Avenue, advising pedestrians to cross to the eastern side of Lutwyche Road before continuing north, in order to access Kedron Park Road. Pedestrian access to the western side of Gympie Road may be provided via the Norman Avenue – Perry Street service road until the northbound lanes are realigned to their permanent position. This service road would also provide access to the Kedron Brook bike path and to the eastern side of Gympie Road via the bike path.

Potential safety hazards for pedestrians and cyclists alike may be created by construction traffic leaving and entering the construction sites on Gympie Road. To increase safety at these locations, a traffic control system may need to be set up (either manual control by people or flashing/audible alarms).

The existing bike path along the southern side of Kedron Brook would not be relocated, but temporary closures may be necessary during the construction of new road bridges. Alternative bicycle arrangements would need to be put in place at these times. This would be addressed in the relevant TMPs.

11.6.3 North-eastern Connection

Pedestrian access would be maintained around the worksite between Sandgate Road and the North Coast Railway embankment. The location and the arrangement of this access may change several times during the construction period to suit the works, however, the access would remain open at all times. Pedestrian access along Sandgate Road would not be affected.

The current pedestrian/bicycle path on the southern side of Schulz Canal would need to be relocated to the northern bank to keep it clear of the works. Therefore a temporary bridge would need to be provided to connect the relocated path to the existing path further west. This bridge may be retained permanently as part of an enhanced pedestrian and cycle network.

11.7 Impacts on Rail Infrastructure and Operations

The Airport Link infrastructure will cross railway lines at four points:

- In the southern connection area, the Campbell Street on and off ramps will cross over the Exhibition Line near Tufton Street;
- North of the south connection area, the north-south tunnels will pass under the Ferny Grove Line near Somerset Street;
- In the north-eastern connection area, the east-west tunnels will pass under the North Coast Line near Jackson Street; and
- In the north-eastern connection area, the east-west tunnels will pass under the Airtrain near Elliot Street.

The North Coast Line and Airport Line crossings of Airport Link will occur in the cut and cover tunnel sections of the north-eastern connection. To achieve this, limited closures of the rail lines would be required during

construction of the cut and cover sections. The most significant effect would be on the North Coast Line, where a series of overnight closures as well as an expected four weekend closures would be required. During the closures, passengers may be bussed around the works area, as is often done during Queensland Rail track works. Freight operations on this line would need to be rescheduled.

The project design largely avoids the Airtrain piers and bridge abutment. The impact on the Airtrain is thus expected to be more limited, with only a small number of overnight closures required. The Exhibition Line would also experience only a small impact with a small number of short duration closures required to put the overpass elements in place.

At the Ferny Grove Line crossing, the Airport Link will be in driven tunnels well beneath the surface. No surface works would be required in this area, and construction would not be expected to affect rail operations on this line.

12. Conclusions

12.1 The Transport Task

Airport Link will provide a motorway standard, predominantly underground, toll road linking Bowen Hills with Brisbane's northern suburbs and the Australia TradeCoast precinct including Brisbane Airport.

The primary objective of Airport Link is to provide relief to congested roads in Brisbane's northern suburbs, connect activity centres and provide a sound basis for future traffic management by linking to strategic road connections allowing cross-city travel movements to bypass the Central Business District and inner suburbs.

This objective is set in Council's on-going commitment to build a better, more liveable city. The project forms part of one of Council's key transport strategies, TransApex, a proposed tri-axis based framework of cross-river and orbital road links.

Airport Link is also identified in the South East Queensland Infrastructure Plan and Program (SEQIPP), developed to guide infrastructure planning and investment to support the preferred pattern of development in the South East Queensland Region. SEQIPP flags it as a potential road infrastructure improvement, along with Northern Busway, a major public transport initiative, to serve the Brisbane metropolitan area.

12.2 Investigations and Analysis

The investigations undertaken in this traffic and transport study have yielded a range of findings that demonstrate that the project is of merit and supportive of its stated objectives.

The analysis of existing traffic and transport system performance for the Brisbane Metropolitan area and Inner North area showed that:

- Motorised travel has increased to 80% of total modal use at the Metropolitan Area level from 77% in 1992, indicating the dominance of vehicle demand;
- The key north-south arterial routes, Gympie Road-Lutwyche Road-Bowen Bridge Road and Sandgate Road, cater for a major proportion of the traffic task within the network in inner North Brisbane;
- Highly congested traffic conditions occur during peak periods along both Lutwyche Road and Sandgate Road, which have traffic signals located at an average spacing of between 250 and 300 metres. This affects the amenity of sensitive abutting land-uses including the local shopping and commercial precincts at Lutwyche and Albion;
- Travel speed on both the Lutwyche and Sandgate corridor fluctuates widely along the corridor due to traffic delays at numerous locations resulting in unreliability of journey time; and
- Bus services in the Inner North area are affected by congestion on the road system. Both Lutwyche Road and Sandgate Road are important bus corridors serving commuters from both a local, and wider catchment areas in Brisbane.

A key finding from the project viewpoint was that both Lutwyche Road and Sandgate Roads carry a significant proportion, around 60%, of vehicles making cross-city travel movements, in addition to functioning as important routes for radial or CBD oriented traffic, and for local traffic to land-uses along the routes. Sandgate Road also serves as a commonly utilised route for travel to the Airport/ATC area.

This provided a clear indication that if traffic making cross-city movements, and indeed some CBD related traffic were removed from these routes then there would be significant benefits through relief of traffic congestion and improved amenity on surface roads in the Inner North area.

The assessment of forecast future traffic and transport patterns also provided support for the project because:

- Due to the forecast population and employment growth in South East Queensland and the Brisbane area, the estimated growth in the travel task (in terms of person trips) and vehicle travel demand in the network is significant. Despite the enhanced mode share for public transport forecast to result from TransLink's planned public transport initiatives, an increase in vehicle trips is forecast. By 2026, with a forecast population of 2.58 million in the metropolitan area (compared to 1.77 million in 2004), total travel demand (including commercial vehicles) is forecast to be 45% higher than current levels, reaching 5.5 million vehicle trips on an average weekday.
- There will be a very strong growth in demand to key trip generators that affect travel demand through the project corridor. The Central City has a forecast increase of over 55% in vehicle demand due to its significance as a Primary Activity Centre and employment node, and the ATC North region will grow by over 300% compared to 2004 levels.

The effects of these additional demands on the road network, without the project, were found to be:

- A general increase in congestion on the road network and significant decline in peak period journey times across the years, under the pressure of catering for increases in vehicle travel demand within the metropolitan area network, and the key travel generators within and surrounding the Airport Link corridor.
- Much of the traffic congestion that would occur in the inner north Brisbane's road system would be caused by traffic wanting to get "somewhere else" but being forced to use the roads through the suburbs.

From the analysis of the existing traffic and transport system, and the future enhanced public transport mode share scenario without the project, it is evident that there is considerable support for further investment in the existing road network.

The studies undertaken have found that the proposed project would:

- Fulfil a traffic function of regional significance by functioning as part of a network of cross-city connections between the northern and southern, and northern and western areas of Brisbane. It would also provide an important link between two major economic activity centres in the region, namely the ATC North precinct and the Brisbane CBD.
- Reduce traffic volumes on many roads in the inner northern suburbs, providing amenity benefits to residential precincts, and local shopping and business areas.
- Reduce congestion and improve operating conditions on major roads in the Inner North.
- Reduces the amount of travel on lower order roads in the network (local district and suburban routes) and redistribute travel to higher order (e.g. Motorway) routes.
- Reduce total vehicle hours of travel and vehicle kilometres of travel for commercial vehicles, providing important benefits to industry through reduced operating costs and improved travel time reliability.
- Provide strong travel time savings on both cross-city routes and routes to the CBD for toll route users.
- Provide benefits, albeit smaller, for traffic choosing to use the un-tolled surface links instead of Airport Link.

- Improve traffic operations via traffic reductions and increased travel speeds on the surface road bus routes on Lutwyche and Sandgate Roads, the highest utilised corridors for bus services in the Inner North area.
- Provide an overall reduction in forecast crashes on major routes within the Inner North area.

The investigations of the effect of the project have indicated some adverse effects, and to address these, mitigative actions are recommended. These are:

- Stafford Road is forecast to experience a significant increase in traffic demand, over a 50% increase, with the project. This is due to the combined role of this link catering for travel demand for both east-west and north-south movements. The resultant traffic volumes of 45,000 vpd in 2026 are within the mid-block traffic lane capacities of a well-managed four (4) lane arterial route. It is recommended that a range of arterial traffic management measures along the route be implemented as a mitigative strategy within the Traffic Management Plan. Examples of arterial corridor traffic management measures that should be investigated for implementation along Stafford Road, particularly between Webster Road and Gympie Road, in conjunction with the project to safely and efficiently cater for the forecast traffic increase would include:
  - Parking management/restrictions at intersection approaches (potentially for longer periods of the day than are currently applied);
  - Formalisation of turn lane pockets at side streets where signalised intersections are not provided, with priority given to formalising right turn pockets;
  - Construction of a raised median along Stafford road where double centre line currently exists;
  - Potential implementation of additional signalised intersections at side-streets;
  - Facilities for public transport, such as indented bus bays; and
  - Facilities for pedestrians and cyclists.

  Note that not all measures may be required and that the best package of initiatives to manage the traffic flows on Stafford Road between Gympie Road and Webster Road would require scoping within an arterial corridor traffic management plan within the Traffic Management Plan (Operations) for the project.

- Impacts on Gympie Road diminish quite rapidly north of the project. The Traffic Management Plan (Operations) should address management measures such as signal co-ordination to accommodate increased traffic on the approaches of this arterial corridor connecting to the project.
- In the vicinity of the northern connections, traffic signal co-ordination should also be implemented though the Traffic Management Plan (Operations) for the facility to ensure that key movement streams using the surface road routes are not unduly delayed.
- It is recommended that local area traffic management measures be implemented in conjunction with the project in the north-western precinct at the Stafford Road/Gympie Road intersection. Increased traffic levels on Gympie Road immediately north of the Airport Link northbound exit ramp may create pressure for traffic to use local streets such as Broughton Road in this precinct. Local area traffic management measures would minimise the potential for use of the local roads in this precinct by through traffic.
- The project would also require changes to local traffic arrangements through access restrictions or changes in precincts adjacent to the connections to the surface road network. These effects are generally minor to moderate and the project design has been shaped so as to minimise adverse impact.

12.3 Support for the Project

For the investigations undertaken for this study, it is evident that from a traffic and transport viewpoint the Airport Link would fulfil a range of important needs. These are:

- Airport Link would address strategic gaps in Brisbane's road network. It will provide an enhanced road connection to the intra-state road system and the regionally significant roads that provide for both radial and orbital functions with Brisbane. These improvements will facilitate cross-city travel movement in an environment where there is increasing travel demand to, and between, major economic activity and employment nodes serving the region, such as the Brisbane CBD and the Australia TradeCoast precinct, including Brisbane Airport.
- Opportunities to enhance public transport operations on surface roads would be created with Airport Link. Greater use of public transport can be supported by providing opportunities on Lutwyche Road for reclamation of freed up road space from general traffic use for either bus, or transit (high occupancy vehicle) lanes. In particular, potential for a cost-effective staging of the Northern Busway would be available. Potential for transit lanes on Sandgate Road is also created.
- Airport Link would relieve traffic congestion and improve travel time reliability. Both users of the toll road facility, and the un-tolled surface roads, would benefit from travel time savings, particularly freight vehicles. An effective integrated transport network supports competitiveness of industry and business.
- The environment for pedestrian and cyclist travel on the surface network would be improved with Airport Link, by reducing traffic demands on the local road system, particularly through activity centres and near public transport stations. Walking and cycling networks provide flexibility for travel as well as significant health and environmental benefits.
- Airport Link would generally improve the amenity of inner urban redevelopment areas such as Albion and Lutwyche, locations in close proximity to high quality public transport, by reduction in vehicular traffic. Consolidation of inner urban areas supports aspirations for a more compact urban form in South East Queensland.

While some adverse effects have been identified and assessed, the study shows clear support for the project as a key component in an overall strategy to improve the efficiency of Brisbane's road network.

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Appendix A Extract from Terms of Reference

This chapter provides an outline of the traffic and transport studies undertaken to demonstrate the need for the project and the provision of data for other aspects of the impact assessment.

A.1 Description of Existing Transport Network

The existing transport operations should be described in terms of:

- The road network, broadly for the regional network and in more detail for the local road system, including travel speeds and times;
- Road traffic composition and movement patterns, including the source and destination of such traffic;
- Traffic flows – peak, daily, composition;
- Public transport services (bus, ferry and rail) – existing service details and facilities;
- Rail corridors and associated rail infrastructure;
- Bicycle movements and facilities;
- Freight services;
- Emergency services vehicle flows; and
- Pedestrian movements and facilities.

A.2 Transport Network Performance

The performance of the existing road network should be described in terms of:

- Traffic demands (through, local and regional context);
- Local access requirements, both for properties and local streets;
- Travel speeds and travel times;
- Road capacity (level of service);
- Intersection operation including operating level of service (delays and queues);
- Interaction with public transport (including reference to public passenger transport demand, capacity, level of service and mode share);
- Tolling; and
- Road user safety.

A.3 Description of Traffic Forecasting Methodology

A description of the studies undertaken for the project should be provided, with particular emphasis on:

- Land use patterns – a description of the population and demographic forecasts used and assumed generation rates;
- The scope and validity of the transport models used;
- The provision of year forecasts for relevant design years to 2026;
- An analysis of trends in household travel behaviour (by comparison of 1992 and 2004 household travel surveys) and assessment of the sustainability as reflected by those trends;
- Network improvements – which upgrades have been included and at what time (e.g. Gateway Upgrade Project, North-South Bypass Tunnel Project, the proposed Northern Busway);

- An explanation of how and what alternative future scenarios, including tolling effects and vehicle operating costs were considered;
- Effects of major public transport infrastructure and/or services within the corridor;
- An explanation of how induced and suppressed traffic demand has been incorporated; and
- Sensitivity of the model outputs to changes in key parameters and assumptions.

A.4 Future Base Traffic Conditions

Future conditions on the road network should be outlined from appropriate models for relevant design years such as the anticipated opening year 2012, and relevant design years up to 2026, without the project in place, in terms of:

- Transport and traffic future demand, including traffic volumes and speeds;
- Through traffic demands and accessibility;
- Network performance within the local and broader network surrounding the project – intersection operation (e.g. degrees of saturation, delays and queues);
- Public passenger transport services (including levels of service, and utilisation of bus and rail passenger transport capacity); and
- Road user safety assessment (including consideration of pedestrian and cycle users).

A.5 Effects of the Proposal

The effects of the proposed works on the transport network should be demonstrated for future model years, as follows:

- Traffic volumes – changes from the anticipated opening year 2012, and other relevant years up to 2026 with the project;
- Traffic flow on major and minor roads (e.g. East-West Arterial and Nudgee Road);
- Regional route traffic implications;
- Effects of the project in the immediate area and extending along the main feeder and exit routes to and from the project;
- Intersection and road capacity performance (Levels of Service);
- Car movements (e.g. travel times, vehicle kilometres travelled (VKT), trip diversions, reliability);
- Commercial vehicle movements (e.g. travel times, VKT and trip diversions);
- Aggregate road network performance – VKT, Vehicle Hours Travelled (VHT), average vehicle speeds;
- Impacts on access to properties and existing roads;
- Impacts on pedestrian and bicycle movements within the transport system;
- Accidents and severity of accidents;
- Incident management;
- Bus services (e.g. travel times and new bus priorities);
- Rail services and infrastructure;
- Emergency service vehicle movements (in consultation with DES); and
- Implications of tolling on untolled route alternatives.

Traffic changes on the local road network to provide for potential local improvements, such and urban regeneration opportunities, community benefits and public transport benefits, should be identified and their

implications provided. Any changes to the local traffic network are to consider the range of users, including emergency vehicles accessing hospitals within the catchment and pedestrians and cyclists, particularly in the vicinity of major land uses or public transport facilities (e.g. bus stops, train stations, and busway stations).

A.6 Construction Impacts

The transport implications for both impacts and mitigation measures of construction activities should be described, in terms of:

- Construction site traffic generation and access;
- Impacts on local and regional traffic flows from temporary and permanent traffic changes;
- Impacts on bus routes and rail infrastructure and operations in the study area;
- Emergency service vehicle movements;
- Construction impacts on pedestrians and cyclists;
- Construction impacts on the provision of adequate access to businesses, public facilities, including schools, churches and parks and private residences;
- Construction workforce parking and impacts on existing parking; and
- Effects of construction traffic (deliveries and haulage of spoil) on the road network or rail/waterway systems if appropriate.

A.7 Pedestrian and Cyclist Issues

A.7.1 Description of Environment

Describe the existing and planned future infrastructure, including usage levels, for pedestrian and bicycle movements and facilities within the environs of the project.

A.7.2 Potential Impacts and Mitigation Measures

This section should describe the potential impacts of the project on existing and planned infrastructure for pedestrian and cyclist movements and facilities affected by the proposal and identify opportunities for walking and cycling network improvements.

A.8 Proposed Northern Busway

The traffic and transport analysis should include a scenario where the proposed Northern Busway Project, or part of, is implemented and operational. The analysis must also address:

- The functional relationship between the proposed Northern Busway and the project, from a traffic and transport standpoint;
- Timing implications; and
- Opportunities for service integration.

A.9 Proposed North-South Bypass Tunnel

The traffic and transport analysis should include a scenario where the proposed North-South Bypass Tunnel, or part of, is implemented and operational. The analysis must also address the underlying assumptions such as:

- The functional relationship between the proposed North-South Bypass Tunnel and the project from a traffic and transport standpoint;
- Timing implications; and
- Opportunities for service integration.

Appendix B Crash Record Analysis

- **Table B - 1 Sandgate Road/Abbotsford Road Corridor Intersection Accidents 2000-2005**

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
Abbotsford Road							
Allison Street	1		2	1	6	10	RT Sideswipe
Burrows Street	1	1	1	1	1	5	RT hits opposite thru
Campbell Street			1		1	2	Rear End/Hit Object
Edmondstone Road		3	3	1	2	9	Rear End/Hit Object
Folkestone Street		4	5	1	4	14	Rear End
Inner City Bypass On Ramp (S/Bound)				1		1	Rear End
Sandgate Road		2	1	2	1	6	RT hits opposite thru
Section Total	2	10	13	7	15	47	
Sandgate Road							
Abbotsford Road		2	1	2	1	6	RT hits opposite thru
Adelaide Street		1	2	3	3	9	RT hits opposite thru
Albion overpass		2	1	1	4	8	RT hits opposite thru
Alexandra Road		4	4	1	4	13	RT hits opposite thru
Anstey Street			3			3	Thru hits thru Adjacent
Argyle Street					1	1	UT hit by thru
Bayview Terrace		4	1		6	11	RT hits opposite thru
Birkbeck Street			2			2	Rear End
Bonney Avenue					1	1	RT hit by adjacent thru
Botany Street		1	1	1	1	4	UT hit by thru
Buckland Road		2	2	4		8	RT hits opposite thru
Butler Street		1	2	1	1	5	Rear End
Camden Street		1		1		2	RT hits opposite thru
Christian Street					1	1	Hit Object
Collins Street		3	4	1	6	14	RT hits opposite thru
Creswick Street		1		1	3	5	Rear End
East-West Arterial Road		1	4	6	5	16	Rear End
Eliza Street			2	1	1	4	Rear End
Frodsham Street/ Crosby Road			2	3	4	9	Rear End

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
Gellibrand Street		1	2	1	3	7	Rear End
Gore Street		1				1	Head On Collision
Grace Street		3	4		1	8	RT hits adjacent thru
Higgs Street			1			1	RT hits opposite thru
Hutton Street			1			1	Hit Pedestrian
Junction Road		5	6	6	18	35	RT hits opposite thru
Lapraik Street			1			1	Rear End (Reversing in Traffic)
Lever Street		1	1	1	1	4	Rear End
London Road					2	2	RT hits opposite thru
Marsden Street		1				1	Hit Parked Car
Nariel Street		1				1	Hit Object
Noble Street		2		1		3	RT hits adjacent thru
Oriel Road		1	3	2	4	10	RT hits opposite thru
Reeve Street					1	1	Rear End
Riverton Street			1		1	2	Hit Pedestrian
Whytecliffe Street			3	2		5	Rear End
Section Total	0	39	54	39	73	205	
Corridor Total	**2**	**49**	**67**	**46**	**88**	**252**	

Table Note: Source: BCC 2005

- **Table B - 2 Gympie Road/Lutwyche Road/Bowen Bridge Road Corridor Intersection Accidents 2000-2005**

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
Gympie Road							
Homebush Road		1			2	3	Rear End
Howell Street					1	1	Rear End
Kedron Park Road		2	4	4	2	12	Hit Object
Lasseter Street		1		1		2	Hit Object
Leckie Road		1	5	3	3	12	Rear End
Sadlier Street					2	2	RT hits opposite thru
Seabrook Street					1	1	Rear End
Somerset Road		1	1	3	2	7	RT hits opposite thru
Stafford Road		3	6	4	2	15	Rear End
Strathmore Street		4	1	3	2	10	RT hits

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
							opposite thru
Suez Street/Park Terrace		5	17	6	18	47	RT hits opposite thru
Broughton Road			1			1	UT hit by thru
Section Total	0	18	35	24	35	113	
Lutwyche Road							
Albion Road		3	5	7	9	24	RT hits opposite thru
Bowen Street		1			3	4	RT hits thru adjacent
Bradshaw Street		6	6	4	6	22	Rear End
Bryden Street		3	5	1	2	11	RT hits opposite thru
Cedric Street		1	1	1	2	5	Hit Object
Chalk Street		7	6	5	2	20	Rear End
Chapel Street		1				1	Fell from Vehicle
Colton Avenue		2		2	3	7	RT hits opposite thru
Constitution Road	1	4	3		2	10	LT hit by adjacent thru
East Street			1			1	Rear End
Eildon Road	1	3	2	1	9	16	Rear End
Federation Street		1	3	1	6	11	RT hits opposite thru
Felix Street		1		1	2	4	Rear End
Fosbery Street		1	3	1	1	6	Rear End
Fuller Street		2	3	2	1	8	RT hits opposite thru
Gallway Street			1			1	Rear End
Grantson Street		5	8	3	11	27	RT hits opposite thru
Harris Street			1		5	6	RT hits opposite thru
High Street					1	1	Rear End
Horace Street		1	4	1	4	10	Rear End
Isedale Street				1		1	Rear End
Kedron Park Road		1	3	1	3	8	Rear End
Lowerson Street			1			1	Hit Pedestrian
Maygar Street		4	3	2	6	15	RT hits opposite thru
Newmarket Road		8	8	3	8	27	RT hits opposite thru
Nicholas Street		1		1		2	Rear End
Norman Avenue		3	3	1	12	19	RT hits opposite thru
Northey Street			3	4	3	10	Rear End
Roblane Street					1	1	Undescribed

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
							(other)
Stoneleigh Street				1	1	2	RT hits opposite thru
Swinburne Street		1	1		1	3	RT hits opposite thru
Thorne Street		1	1		1	3	Hit object
Wesley Street		1	1			2	Rear End
Windsor Avenue			1		2	3	RT hits opposite thru
Section Total	2	62	77	44	107	292	
Bowen Bridge Road							
Butterfield Street		2	7	1	6	16	Rear End
Campbell Street		2		1		3	Hit Pedestrian
Gilchrist Avenue			4	1	1	6	RT hits opposite thru/ Rear End
Herston Road		1	3	1	5	10	Sideswipe
Horace Street		1	1	1	1	4	RT hits opposite thru
Northey Street					1	1	RT hits thru adjacent
O'Connell Terrace			1	2	1	4	Rear End
Section Total	0	6	16	7	15	44	
Corridor Total	**2**	**86**	**128**	**75**	**157**	**449**	

Table Note: Source: BCC 2005

Table B - 3 East West Arterial Road Intersection Accidents 2000-2005

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
Webster Road to Gympie Road							
Bradley Avenue					1	1	RT hits opposite thru
Beaconsfield Terrace			2		2	4	Turning Vehicles Colliding
Brockman Street					2	2	Rear End
Buddina Street			2	2	2	6	RT hits adjacent thru
Clarence Road					2	2	RT hits adjacent thru
Clifford Street				1		1	RT hits adjacent thru
Crawford Avenue					1	1	Sideswipe
Figgis Street			1			1	Rear End
Gamelin Crescent				1		1	RT hits opposite thru
Glenfern Avenue		1			2	3	RT hits opposite thru
Gordon Street			1	1	2	4	RT hits

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
							adjacent thru
Gympie Road		3	7	4	2	16	Rear End
Lennon Street			3			3	RT hits adjacent thru
Richmond Street		1	2	3	2	8	Rear End
Silvester Street				1	1	2	RT hits adjacent thru
Webster Road		5	2	5	4	16	Hit Kerbside Object
Section Total	0	10	20	18	23	71	
Lutwyche Road to Sandgate Road							
Lutwyche Road		1	8	3	4	16	Rear End
Park Road/Kedron Park Road		3	2	1	1	7	Hit Kerbside Object
Kieth					1	1	Merging Right turn rear ended by thru
Morrison Road				1	1	2	Rear End
Sandgate Road		3	6	6	18	33	RT hits opposite thru
Stuckey			1			1	Side Swipe
Roseliegh			1			1	Head On
Park/Rose		1	2	1	2	6	Angled Collision
Kedron Street				1		1	Rear End
Park Avenue		3	1	1	8	13	RT hits opposite thru
Gorman Street				1		1	Rear End
Section Total	0	11	21	15	35	82	
Sandgate Road to Nudgee Road							
Sandgate Road		1	4	6	6	17	Rear End
Nudgee Road		7	4	4	9	24	RT hits opposite thru
Section Total	0	8	8	10	15	41	
Corridor Total	**0**	**29**	**49**	**43**	**73**	**194**	

Table Note: Source: BCC 2005

- **Table B - 4 Nudgee Road (Kingsford Smith Drive to East West Arterial) Intersection Accidents 2000-2005**

Intersection	Fatal	Hospitalisation	Medical treatment	Minor injury	Property damage	Total	Major Cause
Raceview Avenue		0	0	0	1	1	Adjacent Through Vehicles Colliding
Section Total	0	0	0	0	1	1	

Table Note: Source: BCC 2005

Appendix C Airport Link Traffic Model Development and Network Assumptions

C.1 Introduction

This section provides supplementary explanation of some of the key features of the Airport Link Traffic Model development, validation and application processes.

It also includes a comprehensive listing of the road network and public transport service assumptions adopted for future transport network modelling.

C.2 Overview of the Traffic Forecasting Process

A traffic forecasting process has been developed for use in the Airport Link Feasibility Study to provide forecasts of traffic demands on the proposed Airport Link facility and surrounding roads. It employs a combination of computer based models responsive to forecast demographics, travel characteristics and transport infrastructure supply. The overall process is represented graphically in **Figure C - 1**.

The Brisbane Strategic Transport Model (BSTM) forms the core of the Airport Link Traffic Model. BSTM is a strategic transport model that has been widely used by Brisbane City Council (BCC), Queensland Department of Main Roads (DMR) and Queensland Transport (QT) over many years to assess transport projects within the Brisbane Metropolitan Area. The modelling for this project has been undertaken using the EMME/2 software, a transport modelling package that is utilised widely for travel demand forecasting both in Australia and internationally. In addition to the standard BSTM model, additional components have been developed or refined as part of the Airport Link model development to cover all the major influences on traffic demand.

In particular, additional models have been utilised to address public transport mode choice and induced traffic effects in an integrated manner. A more complex route choice model (compared to that which is applied in the standard BSTM) has been applied to the road traffic market to forecast private and commercial vehicle use of the Airport Link in a network that includes other toll roads such as the Gateway Bridge and NSBT. The model produces average weekday forecasts by combining forecast traffic for four separate time-periods (AM and PM peaks, daytime and night-time off-peaks).

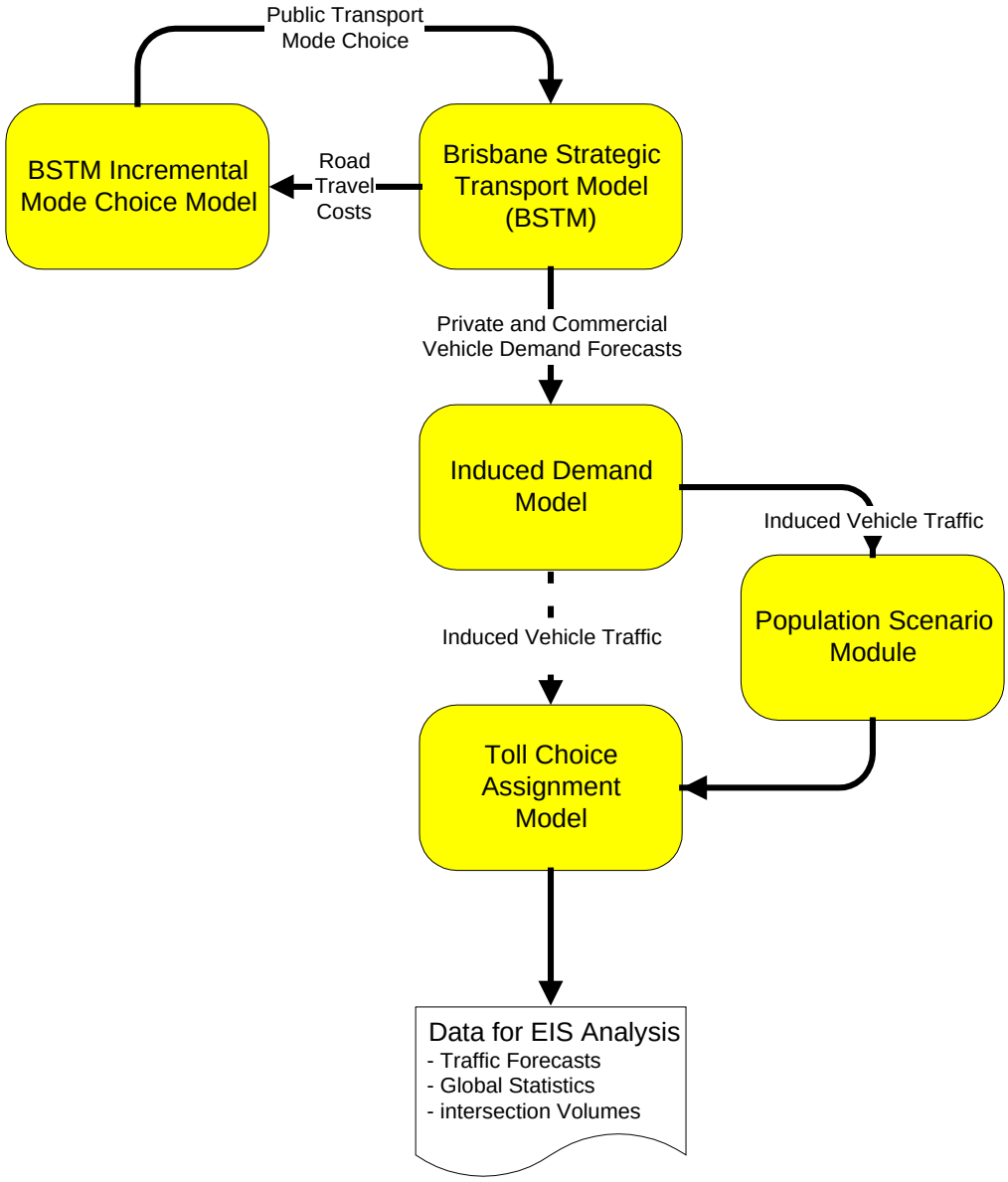
The development of the Airport Link model was undertaken between June 2005 and December 2005 with the JV team members working in-house in Brisbane City Council's Major Infrastructure Project Office (MIPO). Following completion of the model development in December 2005, extensive testing of the model application processes and reporting was carried out, including the conduct of a Peer Review in February 2006. Model development occurred within a consultative framework with agency representatives. A Technical Modelling Liaison Group comprising officers of BCC, DMR and QT met at regular intervals in the period July 2005 (Inception Phase) through to February 2006 (presentation of Peer Review findings).

C.3 Base Demand Model - BSTM

The Brisbane Strategic Transport Model (BSTM) was developed by BCC and DMR in 2000. The BSTM methodology, as implemented in the EMME/2 transport modelling suite, is shown in **Figure C - 2**. An update calibration of the BSTM parameters and validation of its performance for a 2004 base year was undertaken in 2005 for BCC resulting in Version 5.2 of the BSTM. While the general structure of the model was retained unchanged from its original 2000 form, some features of the model were improved and the various BSTM model parameters updated using new travel characteristics information from the 2003/04 South East Queensland

Travel Surveys (SEQTS). Revised road network GIS data and land use databases were also used in the BSTM update.

- **Figure C - 1 Airport Link Model Structure**

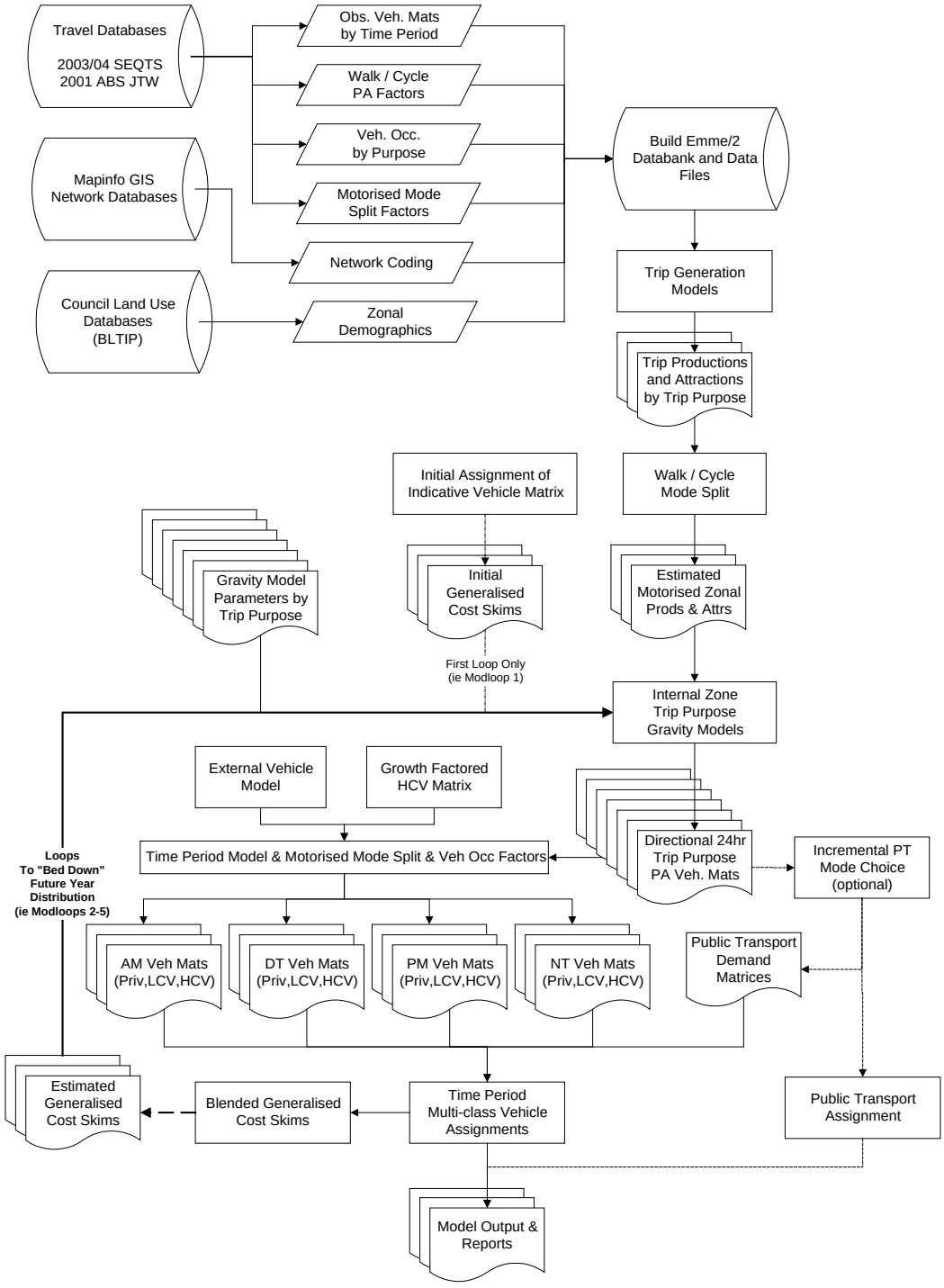


C.3.1 Incremental Mode Choice Model

Originally developed by Brisbane City Council, the incremental choice model consists of a logit mode choice function to forecast change in PT patronage and a subsequent PT assignment within EMME/2. The term incremental model, or pivot model, refers to the methodology that forecasts the PT patronage change compared to an observed base PT demand, as opposed to a full mode choice process that forecasts the absolute quantum of PT patronage.

The mode choice methodology has been adapted slightly for use in the Airport Link model to provide revised public transport mode choice factors for direct use in the BSTM Base Demand Model. Road costs taken from the standard BSTM multi-class equilibrium assignment are extracted and compared to public transport cost skims from a PT assignment for the same forecast year.

- **Figure C - 2 BSTM Model Structure**



The relative shift in times for zone-to-zone movements by time period is used to calculate the proportional shift in PT patronage using a logit (or binary choice) function. Travel times are expressed in minutes and are calculated for private and public transport by combining (with suitable weights) all components of travel time (e.g. access/egress, waiting, in-vehicle, and parking access times), fares, toll and parking costs

Improvements to the base model PT coding and assignment process were undertaken to improve validation against available base year observed PT boarding counts (bus) and link patronage (rail).

Future service plans for 2012, 2016, 2022 and 2026 were coded using data provided by TransLink on headways for existing and new services from the Bus Rail Assessment Tool (BRAT) Version 1.2 (i.e. typically a 6% pa service increase from 2006 to 2016 then a 4.4% pa increase from 2016 to 2026). The Northern Busway (Interim for 2012, 2016 and 2022; and Full Busway in 2026) was coding using route/service plan data provided by TransLink. These future PT network initiatives reflect the draft TransLink Network Plan and SEQIPP projects. Further details are provided in **Section C.8**.

Inspection of the results and iterative refinements of the PT service plan was undertaken in the Northern Busway and Airport Link corridor. The revised public transport mode choice proportions emergent from the incremental mode choice model, were then used in revised runs of the BSTM model to produce consistent private vehicle road demand matrices for an enhanced PT scenario.

An assessment of the motorised person and PT trips resultant from the incremental mode choice model process for the base and future year modelling indicates the overall reduction in vehicle trips within the BSTM demand matrices for the enhanced mode choice scenario rises from 1.8% in 2012 to 4.0% in 2026, with public transport patronage rising by 20% to 43% over the trend scenario for that same period.

C.4 Intersection Delay

A clear requirement recognised for the accurate assignment of traffic with the context of toll choice was the need to represent travel time accurately, particularly in the context of inner city congestion delays. Improvement of the calculation of delays on competing road infrastructure was therefore implemented within the Airport Link Traffic Model. The changes to the existing BSTM delay calculation procedure included:

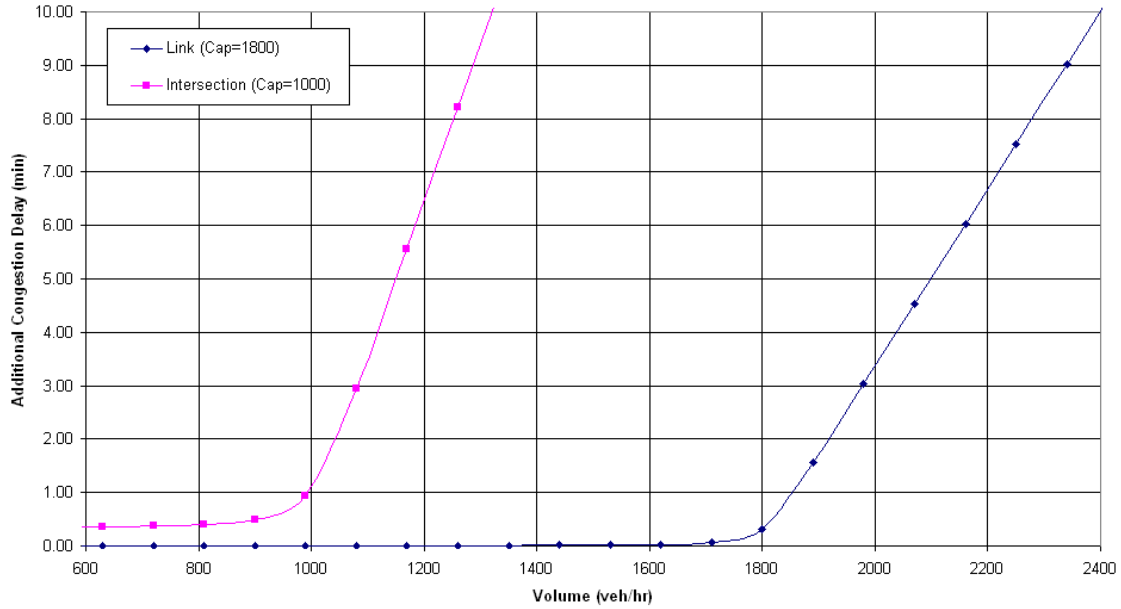
- Coding of intersection types and lane allocations into the network representation;
- Calculation of intersection approach capacities based on available lanes by turns, hierarchy of intersecting links, and intersection control;
- Modification of the BSTM “volume delay function” to allow separate calculation of intersection delays parameters and link mid-block travel times; and
- Adjustment of the parameters to refine the model’s performance relative to observed delay data.

Figure C - 3 depicts the two components of additional delay (over free flow travel times) as applied in model, one for a notional intersection delay and another for a notional link travel time. The figure shows additional delay so the link free flow time has been removed.

Guiding principles for the delay function and associated assignment as used in the model are as follows:

- Link delays have been calculated using a standard Akcelik function as per BSTM currently, although posted speed was found to be appropriate instead of the (somewhat arbitrary) lower “impedance” based free flow speeds. The link delay is to include all time associated with travelling the entire length of the link, exclusive of intersection delays but inclusive of any mid-block capacity delays.
- Intersection delays are calculated as an average per vehicle for each link approaching an intersection. The intersection delay component nominally includes all deceleration, queuing, gap acceptance, geometric and acceleration delays associated with passing through the intersection at the end of the link. Essentially, the intersection delay is all time spent over and above the time spent traversing the link (at the speed calculated by the link component of the delay curve).
- The capacity to calculate the intersection delays is a combined capacity of all turns on the approach link of the intersection. Some modification of the capacities was undertaken to match observed delays from available BCC data (travel time runs and/or signal delay data).

- **Figure C - 3 Delay Curves**



Application of the intersection delay, as a modification of the BSTM link delay function, provided an appropriate level of sophistication consistent with scope and function of the Airport Link model. More detailed intersection delay processes are implemented in dedicated traffic simulation models (e.g. Paramics) and are relatively computationally intense methodologies. The approach used within the Airport Link model, described briefly above, improved assignment sensitivity and provided the delay components for the toll choice process without unduly slowing down the normal model operation.

C.5 Toll Choice Model

The Toll Choice Model is essentially a sophisticated assignment model. Demands in the form of time period private and commercial vehicle demand matrices are transferred directly from a given base demand or induced demand model that has been previously run within EMME/2. The toll choice process splits the vehicle matrices for a given time period (AM Peak, Off-peak and PM Peak all run separately) into toll route users or alternative route users and assigns them accordingly to their chosen paths.

The critical element of this model is the simulation of route choice and specifically the decision as to whether to pay a toll to secure additional time savings. This decision is included as the toll choice module within the overall process.

As part of the Airport Link model development, the potential methodologies for the toll choice were reviewed. The logit methodology was chosen to build on the previous work in the NSBT and TransApex studies, to allow testing of more complex toll strategies, and the likelihood that the alternative method (as critiqued in the GUP study) would be overly sensitive to tolls in a network with multiple facilities.

The final process used in the toll choice model is complex to cater for the possible variations in toll route choice. The model structure is depicted in **Figure C - 4**. Key features of the approach are:

- An initial multi-class equilibrium generalised warm-up assignment is performed to provide a representative starting point for the main model iterations. A factor of 0.5 toll is used as a 'proxy' to get starting tolled/untolled matrices close to final network conditions.
- Volume delays were modified and data coded relating to intersection capacity to include congestion delays separate to link delays, to allow weighting of these separate components of travel time. This is consistent with the BSTM base demand model described above.
- Commercial Vehicles are assigned as a separate class, alongside the non-tolled private vehicles in the multi-class equilibrium assignment during each iteration, with access to tolled routes at 50% of the actual toll. This approach was sensitivity tested and gave a reasonable estimate of CV volumes on toll roads.
- Investigation into the possible toll route combinations was undertaken. Three primary toll route combinations are specifically tested (i.e. combinations of NSBT and/or Airport Link) with the Gateway Bridge considered on the alternative route path (albeit being tolled) to ensure direct competition was possible.
- Convergence testing to check toll utility changes are small before exiting for a final multi-class equilibrium of further split toll markets, alternative route traffic and commercial vehicle traffic.

C.5.1 Logit Model Form

The form of the logit function implemented within the Airport Link Traffic Model includes sensitivity to quality of travel time measures by directly modelling intersection delays and including these in the route/toll choice trade-off. In the logit choice model, the probability of choosing a particular route R, from one of K route alternatives is:

$$P_R = \frac{e^{U_R}}{\sum_{k=1}^{K} e^{U_k}}$$ where U_k is the utility of route k

The components of the route utility can be expressed in terms of:

- attributes of the route such as travel time and cost;
- the relative importance (weighting) of these attributes to the individual; and
- attributes of the route that the individual does not account for explicitly, but are implicitly included in the decision (e.g. driving environment, safety).

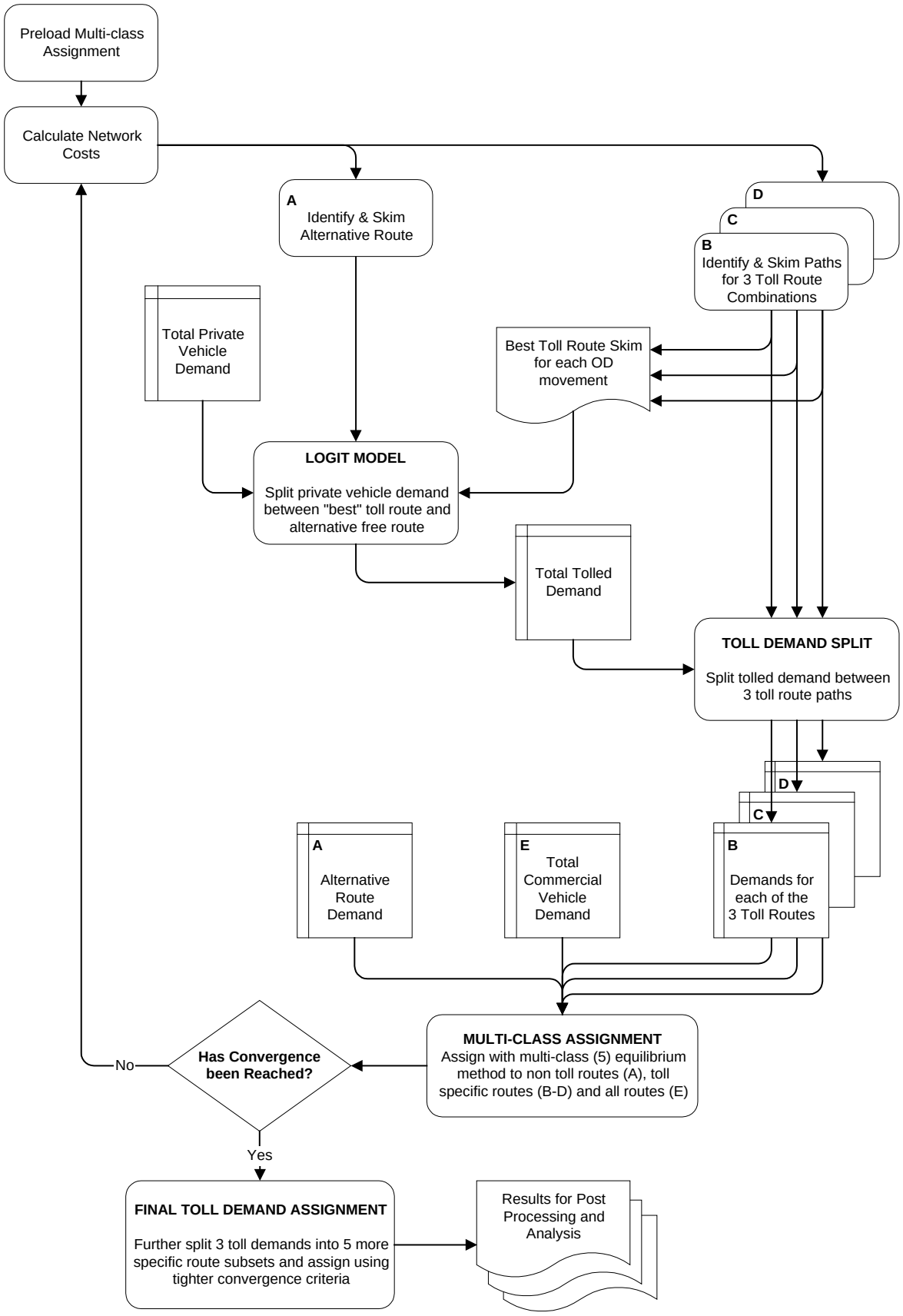
In application, the utility function in the corridor assessment model takes the following form:

$$U_k = \beta_1 * Toll + \beta_2 * TravelTime + \beta_3 * DelayTime + ASC$$

where $\beta_1, \beta_2, \beta_3$ are the relative weights for each of the toll, travel time and delay time attributes of each route (tolled route and alternate free route); and

ASC is the alternative specific constant and reflects both individual's bias towards a particular route (i.e. other than that explained by the other parameters) and model accuracy.

Figure C - 4 Toll Choice Model Structure



C.5.2 Stated and Revealed Preference Surveys

Stated preference and revealed preference surveys were collected in 2005 to gain an understanding of route choices in the Airport Link corridor, particularly with regards to values of travel time savings and willingness to pay toll, and to explore the factors influencing the route choice. This allowed estimation of the parameters for use in the travel forecasting model. Design of the survey and analysis of the data was supervised by Dr John Bates (UK), a widely published and internationally recognised specialist in the field of stated and revealed preference surveys.

A local professional survey firm was engaged to collect a target 750 face-to-face surveys using a survey questionnaire and survey instrument designed by the study team. The face-to-face survey, using a computer aided personal interview (CAPI) approach, included both stated preference (SP) and revealed preference (RP) components. The RP component sought details about any recent trip made on the Gateway Bridge or logical alternative routes, while the SP experiments (two sets of 10 experiments) were collected to test sensitivity to toll cost and travel time savings. Person and household socio-economic data and trip data (trip purpose, origin/destination) were also collected for a reference trip to allow categorisation of the SP/RP data.

Survey quota segmentation was designed to capture samples of different movements deemed relevant to future Airport Link route choice, and allow testing sensitivity to directly related alternatives on the proposed facilities. Quotas were set to achieve respondents across the full range of trip times and purposes, in sufficient numbers for conclusions within the segment to be drawn with statistical significance. The pilot conducted was successful (i.e. no changes to survey design were required) so the data from both surveys were combined, leading to a sample size of 842 for analysis.

The analysis of the SP/RP data demonstrated a willingness-to-pay for travel time and drive quality benefits and provided data on toll choice parameters for application in the Airport Link Model.

C.6 Model Validation

A key step in traffic modelling is validation of the modelled traffic flows against known traffic conditions .Accurate traffic modelling of the Airport Link requires a reasonable representation of trip distribution patterns in order for the modelling results to be reliable.

The Airport Link base year model (with intersection/link delay function incorporated) was validated by undertaking a detailed comparison of the base demand forecast traffic volumes and travel time for 2004/2005.

C.6.1 2004 Count Validation Comparison

Council supplied the original count data to be used for validation of the 2004 base year, derived from traffic counts as used for the NSBT studies. Much of the data as supplied was factored from earlier year counts (some dating from 2001) with some sourced via data capture from detector loops within BLISS (Council's Traffic Signal Control System). Extensive updating of the screenline data was undertaken for use in the Airport Link model using more recent data.

A series of sixteen screenlines were developed for validation of the 2004 model, most of which are identical in location to those used for the original BSTM calibration in 2000. A summary of the count validation is given in **Table C - 1** for daily and peak (2 hour) comparisons.

- **Table C - 1 2004 Traffic Count Validation Comparison**

ID	Screenline Name	AM Peak (2hr total 7am-9am)			PM Peak (2hr total 4pm-6pm)			Weekday Daily Average (24 hr)		
		Count	Model	% Diff	Count	Model	% Diff	Count	Model	% Diff
1	South Pine River	32,000	35,000	9.4%	36,400	39,100	7.4%	223,900	219,200	-2.1%
2	Cabbage Tree Creek	47,700	45,300	-5.0%	52,300	50,800	-2.9%	287,000	281,100	-2.1%
3	Kedron Brook	66,800	61,900	-7.3%	67,000	68,400	2.1%	416,500	385,800	-7.4%
4	Brisbane River	81,600	89,000	9.1%	82,100	90,400	10.1%	522,100	548,100	5.0%
5	East of Gateway Motorway	34,900	35,100	0.6%	38,200	34,800	-8.9%	209,100	210,800	0.8%
6	CBD Circle	121,200	119,200	-1.7%	122,400	133,100	8.7%	783,100	786,000	0.4%
7	South Brisbane Bypass	55,100	59,900	8.7%	60,350	57,900	-4.1%	347,500	366,400	5.4%
8	Underwood-Rochedale South	48,400	44,400	-8.3%	46,300	42,100	-9.1%	293,100	272,600	-7.0%
9	Granard Road-Kessels Road	62,900	62,400	-0.8%	64,800	62,000	-4.3%	413,000	382,500	-7.4%
10	Dutton Park to Bulimba	64,200	58,900	-8.3%	59,500	57,200	-3.9%	400,800	357,600	-10.8%
11	Enoggera Creek-Breakfast Creek	56,100	53,200	-5.2%	55,500	59,900	7.9%	341,800	333,900	-2.3%
12	Western	25,300	25,300	0.0%	26,300	26,500	0.8%	152,600	165,600	8.5%
13	St Lucia	7,600	7,400	-2.6%	7,600	7,800	2.6%	47,900	46,600	-2.7%
14	Mt Cotton Road-Ricketts Road	17,000	17,200	1.2%	19,400	17,300	-10.8%	105,300	105,500	0.2%
15	Oxley Creek	40,000	42,000	5.0%	41,300	43,200	4.6%	249,900	262,000	4.8%
16	Kangaroo Point	21,100	20,200	-4.3%	23,100	21,400	-7.4%	144,400	132,500	-8.2%
Total All Screenlines		**781,900**	**776,400**	**-0.7%**	**802,550**	**811,900**	**1.2%**	**4,938,000**	**4,856,200**	**-1.7%**

General daily flow comparison results show that the model is giving total crossing volumes across all screenlines approximately 1.7% lower than the observed daily flows, 0.7% lower in the AM peak and 1.2% higher in the PM peak. The majority of individual screenlines modelled are at or below 10% difference compared to observed daily volumes, a commonly accepted validation benchmark.

The AM and PM peak period screenline comparisons also give good statistics with total screenline crossing modelled volumes approximately 0.7% lower and 1.2% higher than the AM and PM observed screenline crossings peak counts respectively. The majority of screenlines modelled are at or below 10% difference compared to observed daily volumes, although screenline 4 (Brisbane River) is 10.1% higher in the PM and screenline 14 (Mt Cotton Road–Ricketts Road) is 10.8% higher also in the PM peak.

These validation statistics for the Airport Link Model are acceptable and represent an improvement in the forecasting results, particularly in the peak periods, compared to the standard BSTM model without the improved link/intersection delay function.

C.6.2 Journey Time Validation Comparison

A series of journey time surveys were also compared with model predicted travel times. Journey time surveys were collected during 2005 for this study in and around the Airport Link study area.

A comparison of the AM peak travel times is given below in **Table C - 2** and shown graphically in **Figure C - 5**. The model is performing reasonably well with respect to the travel time ranges collected during the AM peak surveys. The model tends to slightly underestimate the travel time in the non-peak direction, however this does not appear to have a major effect on route choice in the non-peak direction. Routes in the contra-peak direction appear on inspection to be logical. PM peak comparisons are less favourable with respect to surveyed time ranges for the various routes although they are considered to be sufficiently accurate.

C.6.3 Conclusion

The Airport Link Traffic model is sufficiently accurate to represent base traffic conditions within the Brisbane Metropolitan Area road network as well as in the environs of the Airport Link corridor and Inner North area of Brisbane. As such it is an appropriate tool to be used in the assessment of future traffic conditions.

C.7 Base Road Network Assumptions

Planned or potential future projects and their timing were listed from anticipated capital works programs (including SEQIPP) in consultation with DMR and BCC. The agreed list of Do Minimum network projects for forecasting years 2012, 2016, 2022 and 2026 is provided in **Table C - 4**.

C.8 Public Transport Service Assumptions

Future service plans for use in the Airport Link model were supplied by TransLink. These were based on detailed forward planning being undertaken by their Bus Route and Rail Assessment Team based on the draft TransLink Network Plan and SEQIPP initiatives.

Key service planning assumptions incorporated in the Airport Link mode choice model are as follows:

- Frequencies for all existing bus services frequencies are to increase by 6% up to 2016 and by 4.4% from 2016 to 2026.
- New bus service route details were provided with frequency information for 2016 and 2026. Services in place by 2012 used 2016 frequencies. Service frequencies between 2016 and 2026 have been interpolated.
- For the new future year bus services, the Green Bridge services and the Capalaba-City services are assumed to be in place by 2012, with all services in place by 2016.
- New 2016 rail frequencies for existing rail services were applied based on data provided by TransLink from the Metro Rail Capacity Study (in progress). Services prior to 2016 were interpolated, while frequencies beyond 2016 were taken as per 2016.
- The proposed Springfield rail services have not been included as part of the study model, due to uncertainty about the service details. However, they would have negligible influence on the travel behaviour in the project corridor.
- A summary of the new services included for future year PT service coding is tabulated in **Table C - 5**.

C.9 Model Sensitivity Testing

Sensitivity testing was undertaken using the model to test the changes in model outputs to changes in key parameters and assumptions. Key findings of this testing is summarised as follows :

- Effect of Public Transport Initiatives and Change in Mode Share. These were examined by implementing changes to the road system to reflect reallocation of some road space to public transport infrastructure (e.g. as proposed with the Interim Northern Busway). In conjunction, the effect of improved public transport services on shift in mode share to public transport was incorporated. Due to changes in surface road capacity on Lutwyche Road the model responded reliably by assigning traffic to alternative routes,

including the Airport Link. The model's mode share forecasting processes estimated an increased patronage on public transport and an associated reduction in private vehicle demand in the affected corridors. The combined effects of road network capacity changes and increased public transport service frequency within the Airport Link corridor were found to have a range of effects which are discussed and analysed in **Section 10.2** of the report.

- Effect of Changes in Airport Link Tolls. These were tested rigorously within the toll choice model development and application. Changes in toll were tested for independent movements on the facility across a range of toll levels. As expected, as toll was increased Airport Link forecast volumes decreased with the sensitivity declining over time, as congestion impacts on route choice are widespread. The model's elasticity to toll for the north-south Airport Link journeys in the 2026 peak period, for example, is between 0.22 and 0.33 (i.e. increase toll by 10% results in a forecast of between 2.2% and 3.3% less traffic on Airport Link). Toll sensitivity in the off-peak periods was greater due to the reduced congestion on competing routes. Tests were carried out to check the elasticity to toll for all major movements, and the basic vehicle classes, and these found that the model reacted reliably.
- Effect of Airport Link Capacity and Connectivity. By independent tests reducing the number of traffic lanes within the tunnel segments, and removal of various access ramps, these effects were examined. The testing showed logical response. Reduced capacity in the main line tunnel (for example, 2 lanes in each direction instead of 3 lanes in the north-south tunnel) reduced demand by a small amount (by 4% in 2026). Provision of reduced connectivity resulted in logical restrictions of movements, however it also has the effect of releasing tunnel capacity for other independent movements to increase.
- Effect of other Major Road Infrastructure. Examination of the potential effects of additional TransApex facilities (in combination with Airport Link and NSBT) was conducted. A scenario which included both Hale Street Link and Northern Link within the modelled networks showed that these facilities would complement the functionality of Airport Link. The resultant increases in demand on Airport Link ranged between 1% in early years and 6% by 2026.
- Effect of Land Use & Demographic Changes. These effects were checked by using the model to prepare forecasts with both the ABS Low Series and ABS High Series population projections, and compare these to those prepared using the adopted ABS Medium projections used for the EIS forecasting. Overall traffic demand logically increased with high series population projections and decreased with low series population projections. Traffic on Airport Link in the period 2012 to 2026 also followed this trend with between 3% and 8% increases with the ABS high series population projections, and between 3% and 7% reductions in traffic with the ABS low series population projections.
- Effect of Increased Vehicle Operating Costs. These effects were simulated in a model test by doubling the weight applied to route distance within the toll choice assignment model path cost calculation. This explores a potential response to rise in fuel prices. The effect generally across the study area was a consolidation of traffic on the more direct routes. As a result, traffic transferred from longer bypass routes (e.g. Gateway Motorway) in favour of more direct routes such as Airport Link and NSBT.

Table C - 2 AM Peak Journey Time Comparisons

Route Description		AM Peak Travel Time Comparison (Minutes)					
		Survey Runs	Mean Time	Min Time	Max Time	Std Dev	Model Time
1	Ipswich Road NB	6	8.61	5.62	12.93	2.97	8.37
4	Ipswich Road SB	6	7.08	5.47	9.48	1.79	6.44
2	Sandgate Road NB	6	16.40	14.60	17.33	0.99	16.00
3	Sandgate Road SB	6	17.48	11.70	24.80	5.07	14.95
5	ICB EB	6	5.44	5.23	5.83	0.37	6.44
8	ICB WB	6	8.44	6.40	9.43	1.31	5.26
6	Kingsford Smith Drive EB	6	7.77	5.10	10.35	1.74	6.37
7	Kingsford Smith Drive WB	6	6.88	6.60	7.18	0.21	5.93
9	SE Freeway NB	7	6.93	5.07	8.05	1.13	7.70
12	SE Freeway SB	6	4.14	3.20	5.38	0.88	4.62
10	Coronation Drive WB	7	6.06	4.25	8.07	1.48	6.18
11	Coronation Drive EB	7	7.47	3.62	11.05	3.09	7.94
13	Milton Road EB	9	6.05	3.55	8.67	1.68	7.42
14	Milton Road WB	7	7.07	6.33	8.90	0.86	6.21
15	Nudgee Road NB	8	5.17	4.72	5.60	0.34	4.63
16	Nudgee Road SB	7	7.24	4.47	14.18	3.19	6.67
17	East-West Arterial EB	8	3.75	2.58	4.52	0.69	1.75
18	East-West Arterial WB	8	2.72	1.67	3.53	0.63	2.13
19	Lutwyche Road NB	7	16.98	16.38	17.87	0.52	12.78
20	Rode Road EB	6	4.37	3.83	4.78	0.36	4.37
21	Rode Road WB	8	4.56	3.32	5.42	0.70	4.11
22	Lutwyche Road SB	7	14.97	10.57	19.82	3.95	18.14
23	Kelvin Grove Road NB	7	10.08	8.67	12.85	2.51	8.99
24	Kelvin Grove Road SB	7	12.22	7.40	19.52	4.42	10.09
25	Stafford Road EB	7	7.89	5.73	9.68	2.00	5.76
26	Stafford Road WB	8	8.72	6.52	11.85	2.08	6.19
27	Gateway Motorway NB	10	5.51	4.90	6.27	0.43	5.81
28	Gateway Motorway SB	10	8.14	5.42	11.73	2.21	8.17
29	Turbot Street	7	4.11	3.10	5.08	0.68	3.02
30	Ann Street	8	3.87	2.32	5.43	0.91	3.03
31	South Brisbane to Kelvin Grove Road via Southbank	3	16.40	11.37	22.95	5.94	14.44
32	Kelvin Grove Road to South Brisbane via Southbank	3	14.34	9.98	21.45	6.21	13.87
33	Stanley Street to Musgrave Road via Riverside Expressway and ICB	3	14.49	9.32	22.87	7.32	14.55
34	Musgrave Road to Stanley Street via Riverside Expressway and ICB	3	12.01	9.75	14.03	2.15	11.40
35	South Brisbane to Coronation Drive via Southbank	3	18.26	10.70	24.88	7.14	16.43
36	Coronation Drive to South Brisbane via Southbank	3	12.61	11.60	13.48	0.95	11.93
37	South Brisbane to Coronation Drive via Riverside Expressway	3	12.52	8.38	18.42	5.24	12.28

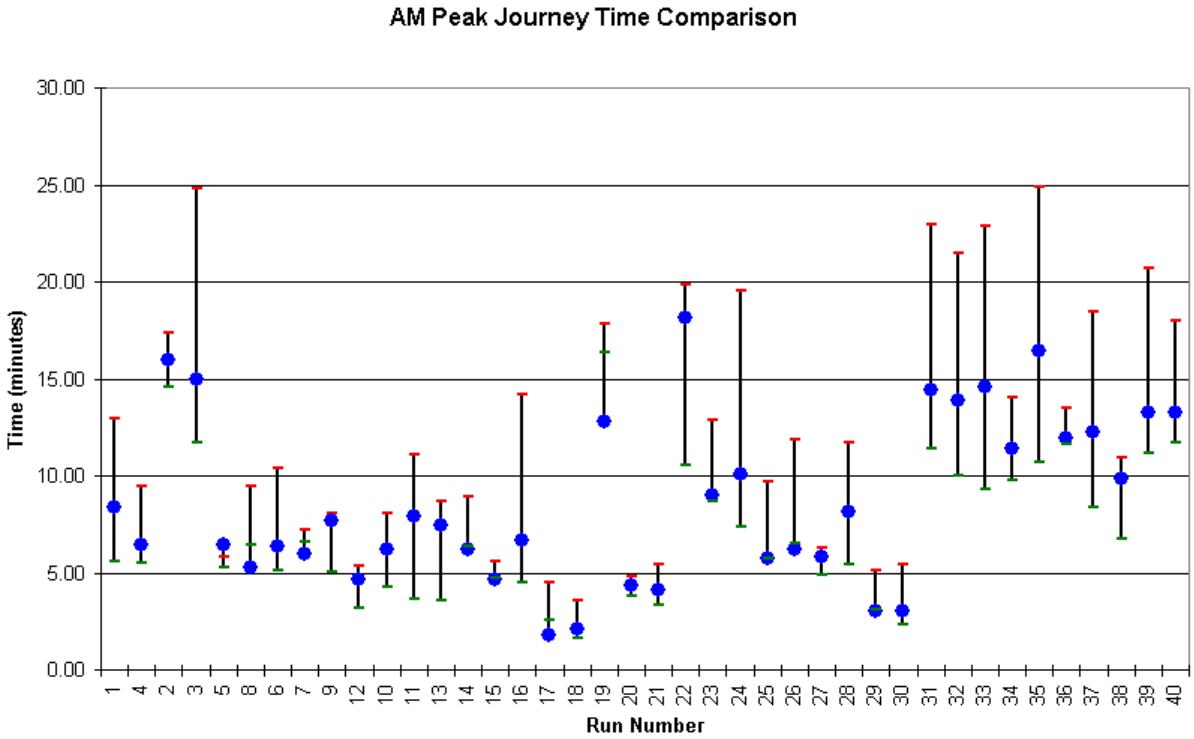
Route Description		AM Peak Travel Time Comparison (Minutes)					
		Survey Runs	Mean Time	Min Time	Max Time	Std Dev	Model Time
38	Coronation Drive to South Brisbane via Riverside Expressway	3	8.37	6.75	10.92	2.23	9.81
39	Annerley Road to Milton Road via William Jolly Bridge	3	15.61	11.13	20.73	4.83	13.28
40	Milton Road to Annerley Road via William Jolly Bridge	3	15.06	11.72	17.98	3.15	13.27

Table C - 3 PM Peak Journey Time Comparisons

Route Description		PM Peak Travel Time Comparison (Minutes)					
		Survey Runs	Mean Time	Min Time	Max Time	Std Dev	Model Time
1	Ipswich Road NB	6	7.44	6.50	8.88	1.73	5.50
4	Ipswich Road SB	6	5.77	4.78	6.62	0.63	9.44
2	Sandgate Road NB	6	16.15	14.02	18.30	1.87	18.93
3	Sandgate Road SB	6	19.13	17.93	21.72	1.41	14.97
5	ICB EB	7	5.66	5.38	5.93	0.19	7.03
8	ICB WB	7	6.90	5.60	7.83	0.87	5.24
6	Kingsford Smith Drive EB	7	6.08	5.33	6.93	0.63	8.96
7	Kingsford Smith Drive WB	7	6.76	5.83	7.98	0.92	6.15
9	SE Freeway NB	8	4.97	3.75	10.05	2.11	3.24
12	SE Freeway SB	7	4.44	3.32	6.57	1.15	10.50
10	Coronation Drive WB	7	4.56	3.82	6.18	0.73	9.94
11	Coronation Drive EB	8	4.88	3.45	7.17	1.39	5.42
13	Milton Road EB	7	9.83	6.42	16.28	3.89	4.88
14	Milton Road WB	6	6.83	4.80	10.77	2.07	8.96
15	Nudgee Road NB	8	5.08	4.82	6.15	0.60	4.96
16	Nudgee Road SB	8	4.98	4.28	6.38	0.78	4.55
17	East-West Arterial EB	7	7.06	2.87	15.75	4.60	1.85
18	East-West Arterial WB	7	2.89	2.20	4.48	0.76	2.13
19	Lutwyche Road NB	7	16.30	14.33	18.82	1.61	18.33
20	Rode Road EB	6	3.56	3.37	4.00	0.22	4.39
21	Rode Road WB	8	5.67	3.87	7.33	1.10	4.12
22	Lutwyche Road SB	8	14.25	12.88	16.62	1.30	12.70
23	Kelvin Grove Road NB	6	10.88	9.73	12.43	1.05	11.08
24	Kelvin Grove Road SB	7	8.64	7.57	9.72	0.73	8.51
25	Stafford Road EB	7	8.92	7.77	10.23	0.90	6.26
26	Stafford Road WB	6	9.16	7.52	13.37	2.12	5.84
27	Gateway Motorway NB	8	5.33	4.78	5.83	0.38	8.95
28	Gateway Motorway SB	7	5.72	5.52	5.87	0.13	5.15
29	Turbot Street	10	5.16	3.80	7.30	1.00	3.07
30	Ann Street	7	4.49	2.48	10.83	2.88	2.92
31	South Brisbane to Kelvin Grove Road via Southbank	3	18.57	15.40	23.93	4.67	17.52
32	Kelvin Grove Road to South Brisbane via Southbank	3	14.47	13.13	17.02	2.21	13.29

Route Description		PM Peak Travel Time Comparison (Minutes)					
		Survey Runs	Mean Time	Min Time	Max Time	Std Dev	Model Time
33	Stanley Street to Musgrave Road via Riverside Expressway and ICB	3	15.86	12.42	18.53	3.13	14.17
34	Musgrave Road to Stanley Street via Riverside Expressway and ICB	3	17.98	13.42	25.43	6.51	14.79
35	South Brisbane to Coronation Drive via Southbank	3	21.19	13.87	29.17	7.67	19.14
36	Coronation Drive to South Brisbane via Southbank	3	12.14	11.88	12.32	0.23	12.85
37	South Brisbane to Coronation Drive via Riverside Expressway	3	14.44	11.88	19.53	4.41	11.17
38	Coronation Drive to South Brisbane via Riverside Expressway	3	9.36	6.47	10.85	2.51	13.01
39	Annerley Road to Milton Road via William Jolly Bridge	3	16.80	13.02	23.45	5.78	16.61
40	Milton Road to Annerley Road via William Jolly Bridge	3	13.59	12.55	14.82	1.15	13.38

- **Figure C - 5 AM and PM Journey Time Comparisons**



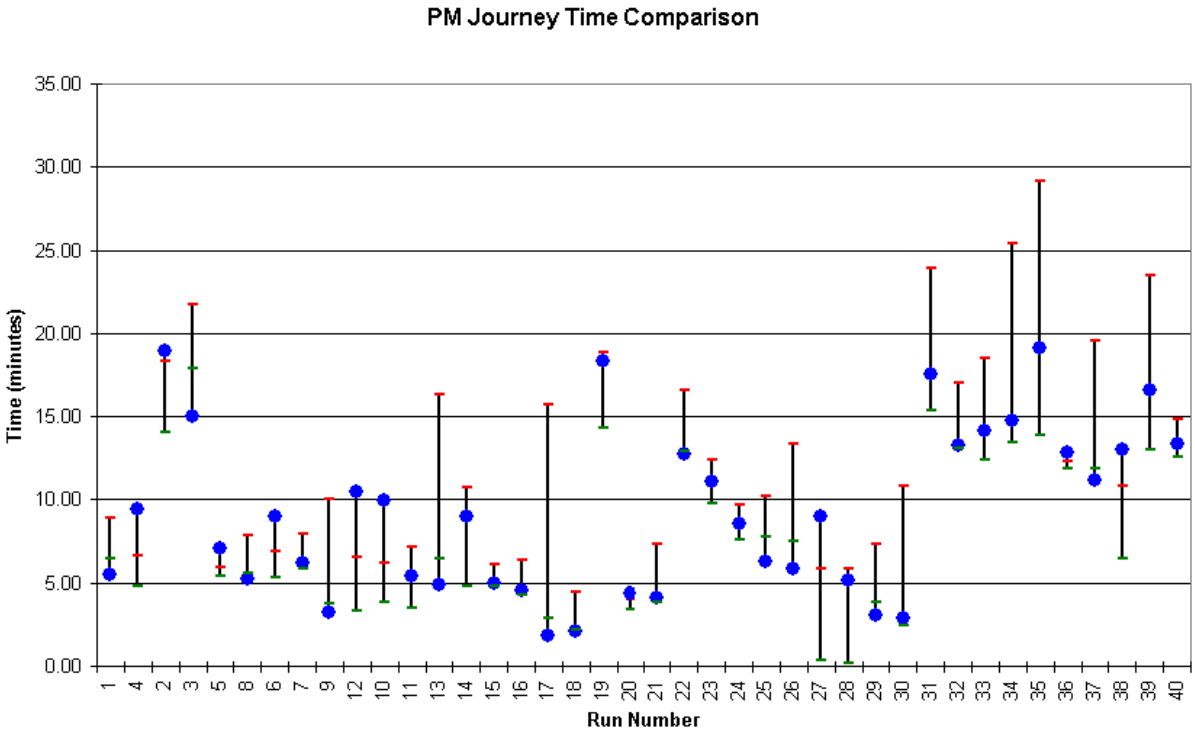


Table C - 4 Base Road Network Assumptions

Source	Project Title Project Coding Description	Network Year			
		2012	2016	2022	2026
Network Year Key: ✓ = Include in Do Minimum Network; A = Also include in Airport Link Tests					
DMR (existing)	**Port of Brisbane Motorway (Stage 1)** New 2 lane motorway standard from Gateway Motorway to Lytton Road north of Lindum Road. Interchanges at Gateway Motorway, Lytton Road at Paringa Road, and Lytton Road/Inghams Place near Lindum Road. No left turn from Paringa onramp to Motorway e/b, no left turn from Gateway s/b to Motorway. Includes closure of south facing Gateway/Lytton Road ramps, realignment of coded Lytton Road near Paringa, and split links north of Lindum Road.	✓	✓	✓	✓
DMR (existing)	**Bruce Highway (Gateway Motorway to Dohles Rocks Road)** Upgrade to 8 lanes.	✓	✓	✓	✓
DMR (existing)	**Springfield-Greenbank Arterial E14 (Springfield Pkwy to Goodna Road)** New 2 lane undivided suburban route from Springfield Parkway to Goodna Road.	✓	✓	✓	✓
DMR (existing)	**Nundah Bypass** New alignment of Sandgate Road Nundah, connecting to Bage Street north of Boyd Road, 6 lanes divided. Sandgate Road also upgraded to 6 lanes divided between Toombul shopping centre and Rode Road, excluding 100m southbound south of Rode Road which remains 4 lanes. Bypassed section of Sandgate Road reduced to 2 lane district access.	✓	✓	✓	✓
BCC (existing)	**Coronation Drive Tidal Flow** Upgrade to provide additional lane (tidal flow BL) between Hale Street and Archer Street.	✓	✓	✓	✓
BCC (existing)	**Inner City Bypass** Provide new divided expressway between Kelvin Grove Road and Breakfast Creek Road (6 lanes S of Campbell Street, 4 lanes N). Includes upgrading Hale Street and Ithaca Street ramps, closing Gilchrist Avenue S end, off-ramp to RBH roundabout, Horace Street connection between Campbell Street and Lutwyche Road with west facing ramps to ICB, closing Mayne Road at N end, W facing ramps to Abbotsford Road, local access changes in Breakfast Creek including increased connectivity for Allison Street and Yulestar Street, and reducing Sandgate Road S of Collingwood Street to 2 lanes.	✓	✓	✓	✓
BCC (existing)	**Blunder Road (Inala Road to Crossacres Street)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
BCC (existing)	**Hoyland Street Connection** New 2 lane divided arterial between Gympie Road and Bracken Ridge Road.	✓	✓	✓	✓
BCC (existing)	**Waterworks Road Transit Lanes** Upgrade to 4 lanes (including 1 peak period T2 lane each direction) between Windsor Road and Settlement Road. Excludes 800 m section in Jubilee between Dolton Street and Betheden Terrace. Inbound between Monoplane Street and Coopers Camp Road upgraded to 6 lanes (including peak period T2 lane in each direction).	✓	✓	✓	✓
BCC (existing)	**Muriel Avenue (Fairfield Road to Beaudesert Road)** Upgrade to 4 lanes, except between Anson Street and Gladstone Street, which remains 2 lanes.	✓	✓	✓	✓
BCC (existing)	**Monier Road (Westcombe Road to Cardiff Road)** New 2 lane undivided 50 kph suburban route connection between Bellwood Road and Cardiff Road.	✓	✓	✓	✓
Other (existing)	**Airport Drive** (Gateway Motorway to Lomandra Drive) Upgrade to 6 lanes.	✓	✓	✓	✓

Source	Project Title Project Coding Description	Network Year			
		2012	2016	2022	2026
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DMR	**Brisbane-Beenleigh Road (Church Road to Crest Street)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Redland Bay Road (Windermere Road to Vienna Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Mt Lindsay Highway (Johnson Road to Chambers Flat Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Bruce Highway (Dohles Rocks Road to Boundary Road)** Upgrade to 6 lanes.	✓	✓	✓	✓
DMR	**Augusta Parkway (Jones Road to Springfield Parkway)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Moggill Road (Kenmore Road to Pinjarra Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Samford Road (Cobalt Street to England Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Pacific Motorway (Gateway Motorway to Loganlea Interchange)** Upgrade to 8 lanes (including 1 T2 lane each way).	✓	✓	✓	✓
DMR	**Gateway Northern Deviation (Nudgee Road to Gateway Bridge)** New 4 lane motorway standard more direct connection from Gateway Bridge to opposite Raubers Road (100 km/hr). Includes interchange and new Airport connection at Cannery Creek. Reduce posted speed on bypassed section of existing Gateway Motorway to 80 km/hr. Upgrade Gateway Motorway from Raubers Road to Nudgee Road to 3 lanes.	✓	✓	✓	✓
DMR	**Gateway Motorway South (Port Of Brisbane Motorway to Wynnum Road)** Upgrade to 8 lanes. Includes upgrading of Gateway Motorway from Port Motorway to Lytton Road to 6 lanes, and new ramp from Gateway Motorway S/B to Port of Brisbane Motorway E/B.	✓	✓	✓	✓
DMR	**Gateway Motorway (Wynnum Road to Mt Gravatt-Capalaba Road)** Upgrade to 6 lanes.	✓	✓	✓	✓
DMR	**Gateway Motorway Bridge Duplication** Upgrade to 12 lanes.	✓	✓	✓	✓
DMR	**Houghton Highway** Upgrade to 6 lanes (including 1 BL each way).	✓	✓	✓	✓
DMR	**Port of Brisbane Motorway (Stage 2a-Gateway Motorway to Lytton Road)** Upgrade to 4 lanes east of Paringa Road west facing ramps. Includes upgrading Lytton Road between Port Motorway and Pritchard Street, and Pritchard Street between Lytton Road and Port Drive, to 2 lanes divided.	✓	✓	✓	✓
DMR	**Mt Cotton Road (Mt Gravatt-Capalaba Road to Lyndon Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
DMR	**Bruce Highway (Boundary Road to Morayfield Road)** Upgrade to 6 lanes.	✓	✓	✓	✓
DMR	**Bruce Highway (Morayfield Road to Bribie Island Road)** Upgrade to 6 lanes.	✓	✓	✓	✓

Source	Project Title Project Coding Description	Network Year			
		2012	2016	2022	2026
Network Year Key: ✓ = Include in Do Minimum Network; A = Also include in Airport Link Tests					
DMR	**Linkfield Road Connection (Lemke Road)** New 4 lane divided arterial from South Pine Road to Linkfield Road (joining Nolan Road and Millar Road). Includes realignment of Carseldine Road to connect to new link, and closure of Millar Road between Carseldine Road and Gympie Road.	✓	✓	✓	✓
DMR	**Gympie Road/Leckie Road** Ban right turn from Gympie Road N/B into Leckie Road (allows turn lane extension for Gympie/Stafford)	✓	✓	✓	✓
DMR	**Logan Motorway/Ipswich Motorway** Interchange Grade Separation, ramp changes, overpass Brisbane Terrace-Old Logan Road.	✓	✓	✓	✓
DMR	**Centenary Highway (Springfield-Ripley, Ripley-Yamanto)** New 2 lane 80 kph motorway with connections at Ripley Road and Cunningham Hwy, Yamanto.	✓	✓	✓	✓
DMR	**Pacific Motorway/Loganlea Road Interchange** Interchange upgrade, service roads, and associated surface road upgrades. Includes changes to Old Chatswood Road, Paradise Road, Winnets Road/Village Drive, Loganlea Road and Centenary Road motorway ramps, and motorway widening to 8 lanes including T2 lanes in project area.	✓	✓	✓	✓
BCC	**Learoyd Road (Watson Road to Beaudesert Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
BCC	**Hamilton Road Connection (Old Northern Road to Gympie Road)** New 2 lane undivided suburban route connecting Hamilton Road past The Chermside Hills. Upgrade existing sections of Hamilton Road between Old Northern Road and Maundrell Terrace to 60 kph suburban route.	✓	✓	✓	✓
BCC	**Nudgee Road (Gerler Road to East-West Arterial)** Upgrade intersections.	✓	✓	✓	✓
BCC	**Compton Road Upgrade (Gateway Motorway to BCC Boundary)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
BCC	**Progress Road (Centenary Hwy to Inala Avenue)** Upgrade to 4 lanes divided. Already at this standard between Mira Street and Inala Avenue. Includes closure of Tamarind Street and Progress Road E of Orchard Road, and new connection from Orchard Road to Poinsettia Street.	✓	✓	✓	✓
BCC	**Beckett Road (Rode Road to Albany Creek Road)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
BCC	**Beenleigh Road (Persse Road to BCC Boundary)** Upgrade to 4 lanes divided. Includes grade separation of Beenleigh Road Rail Crossing.	✓	✓	✓	✓
BCC	**Telegraph Road** Upgrade to 4 lanes (divided E of Lacey Road). Includes new alignment between Linkfield Road and Norris Road, with grade separation at railway, and closure of existing Telegraph Road at railway level crossing.	✓	✓	✓	✓
BCC	**Boundary Road (Skepper Street to Blunder Road)** New 2 lane connection through Wacol Army Barracks between Bukulla Street and Fulcrum Street.	✓	✓	✓	✓

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BCC	**Wynnum Road (Gateway Motorway to Cranston Street)** Upgrade to 4 lanes divided between Gateway Motorway and Plaza Street, and upgrade to 6 lanes divided between Plaza Street and Cranston Street.	✓	✓	✓	✓
BCC	**Manly Road (Wynnum Road to Preston Road)** Upgrade to 4 lanes divided between Wynnum Road and Amberjack Street, and upgrade to 2 lane divided between Amberjack Street and Preston Road.	✓	✓	✓	✓
BCC	**Appleby Road (Albany Creek Road to Stafford Road)** Provide an additional lane in each direction at major intersections.	✓	✓	✓	✓
BCC	**Blunder Road (Crossacres to Stapylton)** New 2 lane alignment between Blunder Creek and Stapylton Road.	✓	✓	✓	✓
BCC	**Shand Street (Stafford Road to Pickering Street)** Signalise and upgrade Sicklefield/Pickering intersection. Close South Pine Road at Pickering Street and signalise Sicklefield/Shand intersection. Upgrade Shand Street approach to Stafford Road intersection.	✓	✓	✓	✓
BCC	**Tilley Road Extension (Lytton Road to Old Cleveland Road)** New 2 lane sections connecting Tilley Road, Hargreaves Road, Kianawah Road and Lindum Road.	✓	✓	✓	✓
BCC	**Meadowlands Road (Belmont Road to midway Epala Street & Hilltop Court)** Upgrade to 4 lanes divided.	✓	✓	✓	✓
BCC	**Goggs Road (Sinnamon Road to Seventeen Mile Rocks Road)** Upgrade to divided (remains 2 lanes).	✓	✓	✓	✓
BCC	**Chermside Shoppingtown Access** New links N and E of Chermside Shoppingtown, including new access to Gympie Road and Murphy Road. Includes reduction of Kingsmill Street, Kuran Street and Barker Street to 40 kph, and upgrading of Kittyhawk Street to 60 kph divided district access.	✓	✓	✓	✓
BCC	**Ropely Road (Kianawah Road to Wynnum Road)** Extend Ropley Road E-W section to Wynnum Road, bypassing Beverley Road, as 2 lane undivided local access (50kph). Reduce Beverley Road and N-S section of Ropley Road to 40 kph.	✓	✓	✓	✓
BCC	**Grade Separation of Airport Drive/Lomandra Drive**	✓	✓	✓	✓
BCC	**Lomandra Drive (Qantas Drive to Boronia Road)** Upgrade to 4 lanes.	✓	✓	✓	✓
BCC	**Airport Northern Roads** Northern Access Road connecting Airport Drive to Northern Access Interchange on Gateway Northern Deviation, plus new internal western roads within Airport site.	✓	✓	✓	✓
BCC	**Montpelier Road Signals** Upgrade and signalise Ann/Breakfast Creek/Montpelier/Wickham intersection.	✓	✓	✓	✓
BCC	**Skyring Terrace Extension** New 2 lane local connection from Montpellier Road to Skyring Terrace.	✓	✓	✓	✓
TransApex	**RCM NSBT** New tolled river crossing approximately on Story Bridge alignment, with connections to ICB, Lutwyche Road, Shaftson Avenue, Ipswich Road and Pacific Motorway. Configuration from RiverCity Motorway plans.	✓	✓	✓	✓

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		2012	2016	2022	2026
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TransApex	**NSBT Ancillary Projects for RCM** Surface Road connections and modifications to accompany RCM NSBT.	✓	✓	✓	✓
TransApex	**Airport Link** New tolled motorway connection from NSBT/ICB to Stafford Road/Gympie Road and Sandgate Road/East-West Arterial. Alignment and interchange details as per AL PDR.	A	A	A	A
TransApex	**Airport Link East-West Connection** New tolled motorway connection from Stafford Road/Gympie Road to Sandgate Road/East-West Arterial. Alignment and interchange details as per AL Reference Design.	A	A	A	A
TransLink	**Northern Busway Staging Project – Interim** Auto network impacts of Northern Busway Interim works, including bus lanes on Lutwyche Road between Newmarket Road and Stoneleigh Street, two way bus and local traffic access only on Truro Street, and bus and local traffic access only (southbound only) on Roblane Street. Lutwyche Road improvements to provide 2 general traffic lanes in each direction in the affected sections.	A	A	A	
TransLink	**Northern Busway Staging Project – Ultimate** Auto network impacts of Northern Busway Ultimate works, modifying Interim works: primarily the conversion of bus lanes to T3 lanes between Fosbery Street and Newmarket Road.				A
OTHER	**Airport Drive (Lomandra Drive to Domestic Terminal)** Upgrade to 6 lanes.	✓	✓	✓	✓
OTHER	**Schneider Road Extension** Extension over rail line to Lomandra Drive/Qantas Drive	✓	✓	✓	✓
OTHER	**Hercules Street Link** Connection to Kingsford Smith Drive	✓	✓	✓	✓
OTHER	**Paradise Road/Logan Motorway Interchange** New motorway interchange, east and west facing ramps.	✓	✓	✓	✓
DMR	**Centenary Highway (Ipswich Motorway to Logan Motorway)** Upgrade to 6 lanes divided, including grade separation at Boundary Road with north facing ramps.		✓	✓	✓
DMR	**Bruce Highway (Bribie Island Road to External)** Upgrade to 6 lanes.		✓	✓	✓
DMR	**Redbank Plains Road (Krueger Parade to Collingwood Drive)** Upgrade to 4 lanes divided.		✓	✓	✓
DMR	**Ipswich Motorway (Rocklea to Riverview)** Upgrade to 6 lanes from Fairfield Road to McEwan Street. Includes upgrading of Centenary Hwy interchange (to low impedance), deletion of Archerfield Road W/B onramp (replaced by overpass to Scotts Road), deletion of Rudd Street ramps (replaced by service road to Kimberley Street), and upgrading of W/B onramp at Granard Road to 2 lanes. Note 4 lane section W/B between Archerfield Road and Kelliher Road.		✓	✓	✓
DMR	**Centenary Highway (Logan Motorway to Springfield Parkway)** Upgrade to 4 lanes divided.		✓	✓	✓

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		2012	2016	2022	2026
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DMR	**Centenary Highway/Western Freeway HOV** Upgrade to 6 lanes (including 1 T2 lane each way) between Mount Coot-tha Road and approx Warrender Street, and 8 lanes (including 1 T2 lane each way) between Frederick Street and Mount Coot-tha Road. No change on Brisbane River bridge.		✓	✓	✓
DMR	**Pacific Motorway (Loganlea Interchange to Logan Hyperdome)** Upgrade to 8 lanes (including 1 T2 lane each way).		✓	✓	✓
DMR	**Gateway Motorway South (Mt Gravatt-Capalaba Road to Pacific Motorway)** Upgrade to 6 lanes (south facing Pacific Motorway ramps 2 lanes).		✓	✓	✓
DMR	**Port of Brisbane Motorway (Stage 2b-Lytton Road to Tanker Street)** Extend 4 lane divided motorway. Includes realignment of Pritchard Road.		✓	✓	✓
DMR	**North-South Arterial (Mango Hill)** New 4 lane divided arterial from Gateway Motorway at Bruce Hwy to Anzac Avenue at Kinsellas Road. Includes new 1 lane undivided arterial connection to Lawnton Pocket Road.		✓	✓	✓
DMR	**Cleveland-Redland Bay Road** Upgrade to 4 lanes divided between South Street and Boundary Road. Includes new 1 lane undivided arterial connection to Lawnton Pocket Road. Excludes 130 m south of Beveridge Road and 190 m north of Thornlands Road, which both remain 1 lane undivided.		✓	✓	✓
DMR	**Beaudesert Road (Johnson Road to Granard Road)** Upgrade to 6 lanes (including 1 T2 lane each way).		✓	✓	✓
DMR	**Duncan Road-Boundary Road (Lyndon Road to New Cleveland Road)** Upgrade to 4 lanes divided.		✓	✓	✓
DMR	**Petrie-Kippa-Ring Bus Corridor** Anzac Avenue widened to add bus lanes between North Lakes (Kinsellas Drive) and Kippa-Ring (Kroll Street).		✓	✓	✓
DMR	**Redlands Bus Priority Upgrade** Finucane Road/Shore Street to add T2 lanes between Capalaba (Redland Bay Road) and Cleveland (Waterloo Street) ; upgrade Redland Bay Road/Boundary Road to 6 lanes including T2 lanes between Capalaba (Old Cleveland Road) and Victoria Point (Cleveland-Redland Bay Road).		✓	✓	✓
DMR	**Warrego Highway to Cunningham Highway Connection** New 2 lane 60 kph urban limited access connection road.		✓	✓	✓
DMR	**Cunningham Highway (Ripley-Yamanto, Yamanto-Ebenezer)** Duplication - upgrade to 4 lanes divided.		✓	✓	✓
DMR	**Brisbane Urban Corridor (Griffith Arterial)** New grade separated interchange at Kessels/Mains.		✓	✓	✓
DMR	**Deception Bay Road (Bruce Hwy to Lipscombe Road)** Upgrade to 4 lanes divided.		✓	✓	✓
DMR	**Burpengary-Caboolture Road** Upgrade to 4 lanes (undivided).		✓	✓	✓
BCC	**Robinson Road East + Robinson Road West (Murphy Road to Bilsen Road)** Upgrade to 4 lanes divided. Includes connection of Robinson Road West and Robinson Road East over Geebung Station, and closure of Newman Road at railway level crossing.		✓	✓	✓

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		2012	2016	2022	2026
Network Year Key: ✓ = Include in Do Minimum Network; A = Also include in Airport Link Tests					
BCC	**Sherwood Road (Oxley Road to Oxley Creek)** Upgrade to 4 lanes.		✓	✓	✓
BCC	**Progress Road (Ipswich Motorway to Centenary Hwy)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Inala Avenue (Blunder Road to Watson Road)** Upgrade to 4 lanes divided (Inala Avenue & King Avenue).		✓	✓	✓
BCC	**Newnham Road (Creek Road to Logan Road)** Intersection upgrades.		✓	✓	✓
BCC	**Coonan Street (Westminster Street to Radnor Street)** Upgrade to 4 lanes divided (from 4 lanes undivided).		✓	✓	✓
BCC	**Boundary Road (Beenleigh Road to Troughton Road)** Upgrade to 4 lanes. Includes grade separation of Boundary Road Rail Crossing.		✓	✓	✓
BCC	**Wadeville Street (Stapylton Road to Forest Lake Boulevard)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Wondall Road (Manly Road to Bonniebrae Street)** Upgrade to 4 lanes.		✓	✓	✓
BCC	**Beams Road (Gympie Road to Sandgate Road)** Upgrade to 4 lanes. Includes grade separation of Beams Road Rail Crossing.		✓	✓	✓
BCC	**Kingsford Smith Drive/Eagle Farm Road (Links Avenue Nth to Eagle Farm Road)** Upgrade to 6 lanes divided between Links Avenue North and Tingiria Street.		✓	✓	✓
BCC	**Hanford Road (Depot Road to Gympie Road)** Upgrade to 4 lanes.		✓	✓	✓
BCC	**Wacol Station Road (Ipswich Motorway to Sumners Road)** Upgrade to 4 lanes divided. Includes upgrade to 2 lanes on Sumners Road from Wacol Station Road E to existing section of this standard (700 m).		✓	✓	✓
BCC	**Illaweena Street (Beaudesert Road to Wembley Road)** Upgrade to 4 lanes, divided W of Gowan Road.		✓	✓	✓
BCC	**New Cleveland Road (Manly Road to Greencamp Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Freeman Road (Garden Road to Blunder Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**New Cleveland Road (Greencamp Road to Old Cleveland Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Ermelo Road-Dairy Swamp Road (Belmont Road to New Cleveland Road)** Upgrade Ermelo Road and Dairy Swamp Road N of Formosa Road to 4 lanes divided suburban route. New connection from Meadowlands Road to Dairy Swamp Road and connection of Ermelo Road sections.		✓	✓	✓
BCC	**Stapylton Road (Wadeville Street to Johnson Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Toombul Road (Nudgee Road to Melton Road)** Upgrade to 6 lanes divided.		✓	✓	✓

Source	Project Title Project Coding Description	Network Year			
		2012	2016	2022	2026
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BCC	**Rode Road (Old Northern Road to Edinburgh Castle Road)** Upgrade to 4 lanes between Glenrowan Street and Hilltop Avenue. Sections between Old Northern Road and Glenrowan Street (2.54 km) or between Hilltop Avenue and Edinburgh Castle Road (2.7 km) remain 1 lane		✓	✓	✓
BCC	**Hellawell Road (Beaudesert Road to Gowan Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Cavendish Road (Rail Grade Separation)** Upgrade to low impedance between Clarence Street and Temple Street. Includes grade separation of Cavendish Road Rail Crossing.		✓	✓	✓
BCC	**Nottingham Road (Algester Road to Beaudesert Road)** Upgrade to 4 lanes.		✓	✓	✓
BCC	**Seventeen Mile Rocks Road (Goggs Road to Kingsgate Street)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Pannard Street Extension** New 2 lane connection from Pannard Street/Darra Avenue to Douglas Street/Blivest Street.		✓	✓	✓
BCC	**Underwood Road (Warrigal Road to Millers Road)** Upgrade to 4 lanes divided.		✓	✓	✓
BCC	**Kingsford Smith Drive (Seymour Road to Links Avenue North)** Upgrade to 6 lanes.		✓	✓	✓
DMR	**Pacific Motorway (Logan Hyperdome to Logan Motorway)** Upgrade to 8 lanes (including 1 T2 lane each way).			✓	✓
BCC	**Muriel Avenue (Fairfield Road to Beaudesert Road)** Upgrade to 4 lanes in remaining section, between Anson Street and Gladstone Street.			✓	✓
BCC	**Bracken Ridge Road (Hoyland Street to Deagon Deviation)** Upgrade to 4 lanes divided. Includes upgrading of Hoyland Street to 4 lanes divided.			✓	✓
BCC	**Green Camp Road (Manly Road to New Cleveland Road)** Upgrade to 4 lanes divided.			✓	✓
BCC	**Johnson Road (Mt Lindesay Hwy to Woogaroo Road)** Upgrade to 4 lanes divided.			✓	✓
BCC	**Boundary Road (Skepper Street to Blunder Road)** Upgrade to 4 lanes.			✓	✓
BCC	**Beatty Road/Sherbrooke Road (Granard Road to King Avenue)** Upgrade to 4 lanes.			✓	✓
BCC	**Bridgman Road (Albany Creek Road to Millar Road)** Upgrade to 70 kph 4 lane divided arterial, including new connection from Beams Road to Roghan Road. Includes upgrading of sections of Roghan Road and Carseldine Road.			✓	✓
BCC	**Pickering Street/Sicklefield Street (Grade Separation of Rail)** Upgrade to divided between Enoggera Road and Pickering **Street**, including grade separation of Enoggera Road Rail Crossing. (Remains 4 lanes)			✓	✓

Source	Project Title Project Coding Description	Network Year			
		2012	2016	2022	2026
Network Year Key: ✓ = Include in Do Minimum Network; A = Also include in Airport Link Tests					
BCC	**Blunder Road (Crossacres to Stapylton)** Upgrade to 4 lanes divided. Bypassed western section of Blunder Road reduced to 50 kph district access.			✓	✓
BCC	**Beams Road (Bridgman Road to Gympie Road)** Upgrade to 4 lanes.			✓	✓
BCC	**Archerfield Road (Ipswich Motorway to Poinsettia Street)** Upgrade to 4 lanes.			✓	✓
BCC	**Trouts Road** New 2 lane undivided 50 kph district access connection between northern and southern sections of Trouts Road (adjacent to the Chermside Hills).			✓	✓
DMR	**Gateway Motorway North (Bridge to Raubers Road) (existing alignment)** Upgrade to 6 lanes.				✓
DMR	**Gateway Motorway North (Nudgee Road to approx Woodcroft Street)** Upgrade to 6 lanes.				✓
DMR	**Gateway Motorway North (Deagon Deviation to Bruce Highway)** Upgrade to 6 lanes. Also includes upgrading Depot Road onramp to Deagon Deviation off ramp N/B to 4 lanes.				✓
DMR	**Gateway Motorway (Pacific Motorway to Logan Motorway** Upgrade to 6 lanes.				✓
DMR	**Logan Motorway Upgrade (Ipswich Motorway to Pacific Motorway)** Upgrade to 6 lanes.				✓
BCC	**Oxley Road (Ipswich Motorway to Sherwood Road)** Upgrade to 4 lanes.				✓
BCC	**Rickertt Road (Thorneside Road to Green Camp Road)** Upgrade to 80 kph 4 lanes divided.				✓
BCC	**Dawson Parade (Samford Road)** Upgrade to 4 lanes between Samford Road and Patricks Road, including grade separation of Dawson Parade Rail Crossing.				✓
BCC	**Mt Gravatt-Capalaba Road (Mt Cotton Road to Old Cleveland Road)** Upgrade to 4 lanes divided.				✓
BCC	**Belmont Road (Manly Road to Meadowlands Road)** Upgrade to 4 lanes divided.				✓
BCC	**Eagle Farm Road (Tingiria Street to Main Myrtletown Road)** Upgrade to 4 lanes.				✓

Table C - 5 Public Transport Service Assumptions – New Services

Route Number	Sub-Region	Origin	Destination	Service Type	Included at 2012	Included at 2016+
1000	Brisbane South	Rochedale	City	Bus	N	Y
1010	Brisbane South	Loganlea	Springfield	Bus	N	Y
1200	Brisbane South	Yarrabilba	City	Bus	N	Y
1300	Brisbane South	Logan Reserve	City	Bus	N	Y
1400	Brisbane South	Park Ridge	City	Bus	N	Y

Route Number	Sub-Region	Origin	Destination	Service Type	Included at 2012	Included at 2016+
1500	Brisbane South	Loganlea	Darra	Bus	N	Y
1600	Brisbane South	Oxley Wedge	City	Bus	N	Y
2010	Brisbane East	Loganlea	Cleveland	Bus	N	Y
2150	Brisbane East	Cannon Hill	City	Bus	N	Y
2601	Brisbane East	Capalaba	City	Bus	Y	Y
2600	Brisbane East	Capalaba	City	Bus	Y	Y
3000	Brisbane North	Scarborough	City	Bus	N	Y
3005	Brisbane North	Redcliffe	City	Bus	N	Y
3010	Brisbane North	Petrie	Redcliffe	Bus	N	Y
3020	Brisbane North	Sandgate	Strathpine	Bus	N	Y
3040	Brisbane West	Ferny Grove	Darra	Bus	N	Y
3100	Brisbane North	North Lakes	City	Bus	N	Y
3150	Brisbane North	Mango Hill/Griffin	City	Bus	N	Y
3200	Brisbane North	Strathpine	City	Bus	N	Y
3310	Brisbane North	Cashmere	City	Bus	N	Y
3320	Brisbane North	Clear Mountain	City	Bus	N	Y
3330	Brisbane North	Closeburn	City	Bus	N	Y
3345	Brisbane North	Prince Charles	City	Bus	N	Y
3400	Brisbane North	Highvale	Ferny Grove	Bus	N	Y
3410	Brisbane North	Upper Kedron	Ferny Grove	Bus	N	Y
5000	Brisbane West	Springfield	Ipswich	Bus	N	Y
5100	Brisbane West	Ripley	Ipswich	Bus	N	Y
5200	Brisbane West	Swanbank	Dinmore	Bus	N	N
5300	Brisbane West	Springfield Lakes	Goodna	Bus	N	Y
ATC1	Brisbane North	Airport	City	Bus	N	Y
ATC2	Brisbane North	Airport	POB	Bus	N	Y
Green Bridge Services						
109	Brisbane South	Upper Mt Gravatt	UQ	Bus	Y	Y
139	Brisbane South	Sunnybank Hills	UQ	Bus	Y	Y
199	Brisbane South	UQ	City	Bus	Y	Y
209	Brisbane East	Carindale	UQ	Bus	Y	Y
259	Brisbane East	Capalaba	City	Bus	Y	Y
479	Brisbane City	RBH	UQ	Bus	Y	Y
539	Brisbane South	Browns Plains	UQ	Bus	Y	Y
New Rail Services						
-	Brisbane West	Springfield	City	Rail	N	N

Appendix D Technical Terms

AaSIDRA: A computer analysis package that is a widely accepted tool for specifically assessing the operation of intersections.

Australia TradeCoast: A joint marketing initiative by the Queensland Department of State Development, Brisbane Airport Corporation, Port of Brisbane Corporation and Brisbane City Council. A primary purpose of the Australia TradeCoast is to market the 2,200 ha of vacant land north and south of the Brisbane River for general and transport-related industry purposes.

Australia TradeCoast North: The area north of the Brisbane River and bounded by the Gateway Motorway and Nudgee Road to the east. ATC North includes the Brisbane Airport and associated developments, Hamilton Lands, Eagle Farm, Pinkenba, Myrtleown and the proposed TradeCoast Central.

B-Double: A long articulated heavy vehicle.

Brisbane Metropolitan Area: Brisbane and the surrounding area extending to Caboolture in the north, Beenleigh in the south, Ipswich in the west and Redland Shire in the east. Also known as the Brisbane Statistical Division (BSD).

Brisbane Strategic Transport Model (BSTM): A computerised, calibrated transport planning model that forecasts travel demand and traffic flows based on demographic and land use parameters and transport network characteristics.

Busway: A busway provides a high level of service characterised by bus stations and dedicated right of way for buses.

Central Brisbane: The zone of extensively commercial and other activity in the centre of Brisbane, for this study designated as coinciding with City, Fortitude Valley, New Farm, Newstead, Spring Hill and Bowen Hills south. This area includes the Central Business District (CBD)

Central Business District (CBD): An area of extensive commercial, retail, finance and government activity located within an area that extends from Eagle Terrace (near William Jolly Bridge) to Kemp Place (near the Story Bridge) including all land to the south and east of Ann and Turbot Streets.

Commercial Vehicle (CV): Medium or heavy commercial vehicle commonly referred to as a truck, and specifically equivalent to an AustRoads Class 3 to Class 12 vehicle.

Cost Skims: The process within the Airport Link Traffic model to extract travel costs (in terms of time, distance and toll) from each zone to every other zone.

Cycle Time: The time taken for one complete sequence of signal phases at an intersection.

Degree of Saturation (X value): This is the calculated ratio between the demand flow rate and the capacity for each movement. When the maximum X value for any movement is above 95% then the intersection is regarded as over saturated or operating above its practical capacity. This means that it will take more than one cycle of the signals to progress through the intersection. X values above 1.0 typically indicate that several movements will fall within this category.

Demographics: Results from the study of the characteristics of human populations, such as size, growth, density, distribution, vital statistics and land use

Elasticity: Elasticity is the ratio of the incremental percentage change in one variable with respect to an incremental percentage change in another variable; for example, change in demand with change in toll.

EMME/2: A software transport-modelling package that is used widely for travel demand forecasting both in Australia and internationally

Full journey: A full journey for tolling purposes includes all movements between the north and south ends of Airport Link. That is, movements from the southern connection to either the north-eastern connection, or the north-western connection, or the respective return journeys.

High Occupancy Vehicle (HOV): Vehicle carrying more than one occupant (generally two or more occupants), taxis or motorbike.

Induced Traffic Demand: The responses of the travelling public to improvements in network connectivity or reduced congestion. This can result in increased vehicle kilometres on the road network

Inner North Area: A study specific area encompassing suburbs to the north of the CBD where local effects of the project require consideration. It includes the suburbs of Wooloowin, Clayfield, Kedron, Gordon Park, Lutwyche, Albion, Windsor and Bowen Hills. The boundaries of this area coincide with zones of the BSTM.

Integrated ticketing: One ticket than can be used on multiple public transport modes.

Level of Service (LOS): Traffic conditions as perceived by drivers. A key measure of the performance of the road network, it can be measured at a mid-block point or at an intersection.

Major Activity Centre: Major activity centres accommodate key district concentrations of employment, services, limited comparison and major convenience retail.

Network volume difference plots: Identify the increase or decrease in total vehicles on each link of a road network as the result of a new road project.

Orbital or ring road network: Part of the overall road system that allows people to travel around rather than through a city centre.

Partial Journey: A part journey for tolling purposes includes movements on the east–west section of the Airport Link toll road between the north-eastern connection and the north-western connection in either direction.

Principal Activity Centre: Principal activity centres accommodate key concentrations of employment, business, major comparison and convenience retail, government regional offices, regional health, education, cultural and entertainment facilities.

Priority Intersection: Un-signalised intersection.

Road Hierarchy: The classification of roads into major and minor routes to safely and efficiently manage the movement of people and goods while maintaining the liveability of urban areas. Council's Transport Plan and the BSTM use a six level hierarchy.

Select link plots: Highlight the distribution of origin and destinations of users of a particular road link selected for examination.

Signal Phase: A phase is the part of a signal cycle which commences at the start of the green time for a specific pattern of traffic movement and ends at the start of the green time for another specific pattern of traffic

movement, of which some individual movements may be common to both traffic movement patterns. Signal Phasing is the complete sequence of these patterns which apply in a repeating cycle at a specific intersection.

South East Queensland: The geographical region comprising the local government areas of Beaudesert, Boonah, Brisbane, Caboolture, Caloundra, Esk, Gatton, Gold Coast, Ipswich, Kilcoy, Laidley, Logan, Maroochy, Noosa, Pine Rivers, Redcliffe, Redland and Toowoomba.

Specialist Activity Centre: Specialist activity centres have a primary non-retail or commercial function, such as specialised economic activity, employment and/or education.

Traffic Zone: A traffic analysis zone is the unit of geography used in conventional transportation planning models. The size of a zone and the spatial extent of zones can vary ranging from very large areas such as suburbs to small city blocks or buildings.

Traffic zones in the Airport Link model are based on Census Collection Districts, the smallest level at which census demographic data is available, further sub-divided in some locations where more detailed investigation was relevant and data was available.

TransApex: Brisbane City Council's proposed tri-axis based framework of strategic road connections that would allow Brisbane's cross-city travel movements to bypass the CBD and inner suburbs

TransLink: Co-ordination and marketing body developed to integrate public transport services, fares and ticketing throughout South-East Queensland.

Trip: A one-way journey by an individual using one or many transport modes.

Appendix E Acronyms and Abbreviations

AADT	Annual average daily traffic
aaSIDRA	Signalised & un-signalised Intersection Design and Research Aid
AAWT	Annual average weekday traffic
ABS	Australian Bureau of Statistics
AL	Airport Link
AM	Before Noon
ATC	Australian Trade Coast
ATS	Australasian Traffic surveys
AWDT	Average Weekday Daily Traffic
BCC	Brisbane City Council
BL	Bus Lane
BLISS	Brisbane Linked Intersection Signal System
BLTIP	Brisbane Long Term Infrastructure Plan
BRAT	Bus Rail Assessment Tool
BSD	Brisbane Statistical Division
BSTM	Brisbane Strategic Transport Model
CAPI	Computer Aided Personal Interview
CBD	Central Business District
CCTV	Closed Circuit Television
CDIMP	(Northern Busway) Concept Design and Impact Management Plan
CPI	Consumer Price Index
CV	Commercial Vehicle
DMR	Queensland Department of Main Roads
E/B	East bound
EIS	Environmental Impact Statement
GIS	Geographic Information Systems

GST	Goods and Services Tax
GUP	Gateway Upgrade Project
ICB	Inner City Bypass
INB	Inner Northern Busway
ISD	Intersection Data Sheets
JV	Joint Venture
Km/h	Kilometres per hour
LGA	Local Government Area
LOS	Level of Service
MIPO	Brisbane City Council's Major Infrastructure Project Office
N/B	North Bound
NB	Northern Busway
NSBT	North-South Bypass Tunnel
PA Hospital	Princess Alexandra Hospital
PEM	Land Transport New Zealand Project Evaluation Manual
PDR	Project Definition Report
PIFU	Planning, Information and Forecasting Unit
PM	Afternoon
PT	Public Transport
QT	Queensland Transport
RAPID	Real Time Advanced Priority and Information Delivery
RB&WH	Royal Brisbane and Women's Hospital
RCM	RiverCity Motorways
RP	Revealed Preference
RTA	New South Wales Road and Traffic Authority
S/B	South bound
SEB	South-East Busway

SEQ	South East Queensland
SEQIPP	South East Queensland Infrastructure Plan and Program
SEQTS	South East Queensland Travel Surveys
SP	Stated Preference
T3	Transit Lane
TBM	Tunnel Boring Machine
TOD	Transit Oriented Development
UPS	Uninterruptible Power Supply
VMS	Variable Message System
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VOC	Vehicle operating costs
VPH	Vehicles per hour
W/B	West Bound