2. Project Rationale

Northern Link

Phase 2 – Detailed Feasibility Study

CHAPTER 2

PROJECT RATIONALE

- September 2008

Contents

2. Project Rationale

The Terms of Reference (ToR) require the EIS to identify the strategic context for the project, including the circumstance leading to its conceptual development. The EIS should also state the objectives leading to the project, outline the events leading to the concept development and describe the alternatives considered to the reference design. The EIS is also required to present the need for the project and assess the project's benefits against alternate options[1].

In particular, Part B, Section 2.2 of the EIS Terms of Reference calls for an assessment of:

"the project benefit against alternate options that meet the identified project need and against the 'do nothing' option. In doing this, the EIS should consider at least two feasible alternatives to the project, including:

- *one scenario that seeks to optimise non-private motor vehicle modes of transport within the study corridor such as significant enhancements to public transport or active transport (eg: cycle and pedestrian) or implementation of other strategies aimed at reducing private vehicle usage; and*
- *one scenario that seeks to optimise surface road transport in the project corridor, without a tunnel (ie: the maximisation of the utility of the existing road network with limited upgrading)."*

2.1 Strategic Context

The strategic context for Northern Link is defined at the national level by the AusLink program being implemented by the Commonwealth Government, at the regional level by the South East Queensland Regional Plan[2] (SEQ Regional Plan) and the South East Queensland Infrastructure Plan and Program[3] (SEQIPP). At the metropolitan level, the strategic transport context is shaped by the findings of the Western Brisbane Transport Network Investigation[4] (WBTNI), which, while not yet a statement of government policy, is expected to inform government's decisions in relation to prioritising the provision of transport infrastructure in the study area.

At the local government level the strategic context for transport planning is established by City Plan 2000[5], the Brisbane Long Term Infrastructure Plan[6] (BLTIP) and the Draft Transport Plan for Brisbane[7].

2.1.1 National Transport Context

The Commonwealth Government seeks to achieve improvements in national land transport through the National Land Transport (AusLink) Network. The network is based on "… national and inter-regional transport corridors including connections through urban areas, links to ports and airports, rail, road and intermodal connections that together are of critical importance to national and regional economic growth development and connectivity."[8]

[1] Terms of Reference for the Northern Link project, section 2.2, p12

[2] Queensland Government, 2007b, *South East Queensland Regional Plan 2005 - 2026*, Department of Infrastructure and Planning, Brisbane

[3] Queensland Government, 2007c, *South East Queensland Infrastructure Plan and Program 2008 - 2026*, Department of Infrastructure and Planning, Brisbane

[4] Queensland Government, 2008, *Western Brisbane Transport Network Investigation – Options*, Queensland Transport, Brisbane

[5] Brisbane City Council, 2008a, *City Plan 2000 (amended)*, Council, Brisbane

[6] Brisbane City Council, 2007b, *Brisbane Long Term Infrastructure Plan*, Council, Brisbane

[7] Brisbane City Council, 2006a, *Draft Transport Plan for Brisbane 2006 – 2026*, Council, Brisbane

[8] http://www.auslink.gov.au/whatis/network/index.aspx

The network is intended to support national economic growth by development of sustainable transport solutions that, among other things, increase infrastructure handling capacity and efficiency, improve safety and security and improve transport productivity on nationally strategic and export-oriented freight corridors. In addition, the AusLink National Network seeks transport solutions that are consistent with viable, long-term economic and social outcomes and with the obligation to current and future generations to sustain the environment.

In South East Queensland, the AusLink Network includes the Brisbane Urban Corridor linking the Cunningham Highway and Warrego Highway via the Ipswich Motorway to the Gateway Motorway and the Port of Brisbane, and also includes the rail link between the Port of Brisbane, Acacia Ridge and the New South Wales border.[9] It is noted in the corridor strategy that all AusLink corridor roads are access-controlled except for the link between the Ipswich Motorway at Rocklea and the Gateway Motorway, and then the link between the Gateway Motorway and the Port of Brisbane.

The stated function of the Brisbane Urban Corridor (BUC), as part of the wider network of roads and rail links, is to provide access to jobs and services and to support economic growth by facilitating growth movement and connecting urban centres (Department of Transport and Regional Services, 2007a, p. 7). "The key priority for the Brisbane Urban Corridor is to provide a transport network that meets the needs of a rapidly growing population and economy" (Department of Transport and Regional Services, 2007a, p. 22).

Of the five strategic priorities for the Brisbane Urban Corridor, three are relevant to this EIS, as identified in **Table 2-1** below:

- east-west transport efficiency, safety and reliability from Ipswich to the CBD, the Australia TradeCoast and Pacific Motorway;
- improved freight distribution and travel within and around Brisbane including key links that support the AusLink National Network; and
- preparing for future passenger and freight transport needs for road development.

Table 2-1 Summary – Key AusLink Themes and Short-Term Priorities

AusLink Strategic Theme	Short-Term Response
East-west transport efficiency	Implement road safety improvements at high risk locations Investigate the transport network in Brisbane's inner-west for possible additional links to include the Centenary Highway and its connections to the network (for example Northern Link)
Improved freight distribution and travel around Brisbane	Improve traffic flows on congested arterial roads Reduce risks at high incident road safety locations Maintain and improve road pavements for the operation of high productivity freight vehicles
Future passenger and freight transport needs	Facilitate public transport operations and investigate demand management options for travel by private vehicles

Northern Link would provide an alternative connection from the Cunningham Highway and Warrego Highway in the west, to the Port of Brisbane and other areas of the Australia TradeCoast in the east. The project would also provide a connection from the AusLink National Network to the Brisbane CBD. The Brisbane CBD functions as an economic and administrative driver at the national, state, regional and local levels. By providing

[9] Department of Transport and Regional Services, 2007a, *Brisbane Urban Corridor Strategy – Building Our National Transport Future*, Commonwealth of Australia, Canberra

a connection to the CBD, Northern Link would support the strategic transport, social and economic intentions of the AusLink National Network.

By providing an alternative link from the west to the east, including the airport and sea port within the Australia TradeCoast, Northern Link would support the enhancement of the safety and reliability of the national network for the movement of freight and passengers. However, it is not intended that Northern Link would serve as a B-Double freight route, as it would connect with the Inner City Bypass (ICB), Airport Link and the local arterial road network, none of which are designated for such heavy transport.

Northern Link would also relieve congestion on key local arterials, such as Coronation Drive and Milton Road. Both roads are important public transport (bus) routes serving the inner western suburbs of Brisbane. Coronation Drive is a key public transport (bus) route connecting the inner western suburbs and the University of Queensland with the Brisbane CBD.

As a key element in the TransApex initiatives of motorway-standard routes for cross-city travel, and consistent with the AusLink strategic themes, Northern Link would improve the safety and efficiency of the local road network, and in doing so, would enhance connectivity across the metropolitan area as well as improving connectivity for people and business in the inner western suburbs.

2.1.2 Regional Transport Context

South East Queensland Regional Plan

The SEQ Regional Plan 2005-26 is intended to provide a framework for managing population growth, land use and economic development in the region for the planning period. A key strategy in the plan is to ensure that population growth and economic development are supported by a range of infrastructure, including transport infrastructure. The SEQ Regional Plan takes precedence over all other planning instruments in the region.

The population growth anticipated for the region through to 2026 is intended to be accommodated mostly within the urban footprint, with rural living areas providing a diversity of lifestyle choice. Investigation areas are also provided to maintain some flexibility in the structure and staging of growth.

Regional population growth since the 1980s has been strong and sustained, leading to present pressures on the infrastructure fabric, including transport infrastructure. In the medium growth scenario presented in the SEQ Regional Plan, the regional population will grow from approximately 2.46 million in 2001, to approximately 3.96 million in 2026, resulting in an average annual increase of about 60,000 people[10]. Over the same period, the population of the City of Brisbane is forecast to increase from nearly 850,000 in 2001 to approximately 1.15 million (Brisbane City Council, 2007, p. 9).

The Western Corridor extending from the City of Brisbane into the City of Ipswich is promoted as a key area for accommodating growth within the SEQ region and an area requiring support through the extension and delivery of necessary infrastructure.

Apart from managing population growth and economic development within the region, the SEQ Regional Plan is intended to provide for the timely delivery of transport infrastructure, among other things, to support such growth and the on-going development of activity centres. Specifically, desired regional outcome 10 proposes that "… regional infrastructure and services are planned, coordinated and delivered in a timely manner to

[10] OUM, 2006, *South East Queensland Regional Plan 2005 – 2026 Amendment 1*, Queensland Government, Office of Urban Management, Brisbane.

support existing and future settlement patterns and desired community outcomes." (Queensland Government 2007b, pp. 92)

The SEQ Regional Plan recognises that the region, while being the powerhouse of the Queensland economy, is a services-based economy in which the activity centres are key elements. (Queensland Government, 2007b, p. 82) The importance of transport infrastructure and freight networks to support economic growth, and the role of the activity centres, is reinforced in the SEQ Regional Plan through its stated principle for employment and economic activity centres: "Maximise job creation and employment diversity in centres of economic activity, including regional activity centres, major industrial areas, mixed-use developments and knowledge precincts" (Queensland Government, 2007b, p. 90).

The underlying theme in the SEQ Regional Plan is to provide employment opportunities in centres near growing communities, and conversely, encourage increases in residential densities in proximity to centres, as one of several measures mentioned above to reduce the demand for intra-regional travel to work and to access services. Major employment centres in the region will continue to include the Brisbane CBD, with strong employment growth proposed at both the Australia Trade Coast and the Western Corridor. In addition to the Brisbane CBD, Ipswich, Goodna, Indooroopilly and Toowong are economic activity centres at the regional level.

The SEQ Regional Plan intends to focus employment and community services in well-planned, vibrant and accessible regional activity centres. Regional economic activity and employment are to be focussed upon a conceptual network of activity centres supported with appropriate transport infrastructure. The conceptual network of centres consists of:

- *Primary activity centre*: the Brisbane CBD, accommodating the largest and most diverse concentration of activities, providing the highest concentration of employment, and attracting a large number of transport trips, is the centre of the region's radial public transport system;
- *Principal activity centres*: include Indooroopilly and Ipswich, serving catchments of regional significance, accommodating concentrations of employment in a diverse range of activities, are major trip generators serviced by multi-modal public transport services and comprise key nodes in the regional public transport system;
- *Major activity centres*: include Toowong and Redbank, serving catchments of sub-regional significance and accommodation concentrations of employment in a diverse range of activities, typically comprise key suburban or inter-urban notes in the regional public transport system;
- *Specialist activity centres*: include the University of Queensland as a precinct of regional economic significance, providing a primary focus for specialised economic activity, employment and education, result in high levels of trip generation;
- *Principal rural activity centres*; and
- *Major rural activity centres*.

(Queensland Government, 2007a, p. 72; OUM, 2006, p. 26)

The SEQ Regional Plan also intends to integrate development, economic activity and employment with transport infrastructure as a means of reducing the need to travel.

With the provision of Northern Link, the Brisbane CBD and activity centres such as Indooroopilly and Toowong, would be connected to the Western Corridor industrial and commercial areas and the Australia Trade Coast by a motorway-standard transport route comprising of the Ipswich Motorway, the Centenary Highway, Western Freeway, Northern Link, Inner City Bypass, Airport Link and the Gateway Upgrade.

The University of Queensland, as a specialist activity centre within the network of centres, is an important economic and educational driver for the SEQ economy. Linkages to the motorway network, via the Toowong connection in Northern Link, are strategically important in maintaining the role and function of this centre in the region.

Northern Link would complete a high-quality regional transport route and would complement other investment in transport infrastructure by the Queensland Government in Airport Link and the Airport Roundabout Upgrade, and by Brisbane City Council in the Clem Jones Tunnel (CLEM7)[11].

South East Queensland Infrastructure Plan and Program

The SEQ Infrastructure Plan and Program provides an expression of the Queensland Government's priorities and commitments toward expenditure on key infrastructure to support regional growth managed through the implementation of the SEQ Regional Plan. The SEQIPP recognises urban congestion as a major constraint arising from a combination of factors, including:

- population growth and associated economic activity driving increases in travel demand across the region;
- increasing reliance on private motor vehicles for movements;
- increasing use of road transport for the movement of freight into and through the region; and
- the dispersed nature of the urban settlement pattern in relation to housing and employment, dictating increasing lengths in journey's to work for the growing population.

The approach to congestion presented in SEQIPP (Queensland Government, 2007c) involves five key measures, including:

- land use and transport planning to reduce the need for travel within the region, through integrated corridor planning of major arterials and transit oriented development;
- pricing and travel demand management to reduce private vehicle use, especially during peak periods;
- providing a range of attractive alternatives to the private motor vehicle for travel in the region, such as public transport (all modes), and active transport (pedestrian and cycle use);
- maximising the efficiency of existing transport infrastructure, particularly road infrastructure; and
- building additional capacity in the transport infrastructure network, including public transport and road transport (ie: motorways, arterial roads).

SEQIPP presents a range of transport infrastructure proposals for the Greater Brisbane area which includes the local government areas of Brisbane, Logan, Redland and Moreton Bay. These transport infrastructure proposals include priority infrastructure projects (Queensland Government, 2007b, pp. 29-30), such as:

- providing quality public transport infrastructure and services to link activity centres with the CBD;
- building and maintaining a high-standard orbital road motorway system;
- managing congestion and travel demand
- accelerating development of the principal cycle network; and
- increasing road capacity to cater for growth.

[11] Formerly known as the North-South Bypass Tunnel (NSBT).

Furthermore, SEQIPP provides for a range of investigations for transport infrastructure to meet the future needs of Greater Brisbane. Such studies include among others, the Western Brisbane Transport Network Investigation and TransApex investigations (Northern Link detailed feasibility). SEQIPP anticipates that Northern Link would be delivered in the period 2008/09 to 2018/19, subject to Commonwealth funding support and the necessary State approvals.

Within this framework, Northern Link would satisfy the criteria for priority infrastructure by improving public bus services linking the Toowong activity centre with the Brisbane CBD, by reducing traffic flows on Coronation Drive, while also managing congestion and travel demand, and by increasing road capacity to cater for growth. Northern Link would enhance public transport capacity on Coronation Drive, with consequential strategic benefits in public transport connections and services to the University of Queensland at St Lucia.

The Brisbane City Council has embarked upon the detailed feasibility studies for Northern Link. The objectives for Northern Link, stated below, are consistent with the intentions of SEQIPP and other relevant planning and infrastructure.

Western Brisbane Transport Network Investigation

SEQIPP (Queensland Government 2007b, pp.20) also identified the role of the Western Brisbane Transport Network Investigation (WBTNI) in responding to the travel and transport demands of a growing population and economy. WBTNI proposes a range of transport options, flowing from the five key measures presented above, including new tunnels and road upgrades. SEQIPP notes that Brisbane City Council has commenced detailed feasibility studies into Northern Link, and that the Commonwealth Government has committed funds to the project should it proceed.

Northern Link is presented in WBTNI as one of a number of road tunnel proposals for conveying traffic through and around the WBTNI study area. The WBTNI study indicates that Northern Link might be a medium term project being delivered some time in the next 15 years. Similarly, WBTNI indicates that an upgrade of the Centenary Highway and Western Freeway to link Darra with Toowong would also be undertaken in the same period, consistent with the regional planning intention of linking economic activity centres and providing for motorway-standard transport routes for intra-regional and cross-city travel.

The transport planning intention, at the regional level as expressed in SEQIPP and the metropolitan level as expressed in WBTNI consultation material, is to provide a coordinated and integrated response to catering to increased travel demand. The upgrade of the Centenary Highway – Western Freeway, linking with the proposed Northern Link is an example of this coordinated approach. Consultation in relation to the WBTNI proposals concluded on 31May 2008 as the investigation moved into the reporting stage. The final report for the Western Brisbane Transport Network investigations is anticipated for release later in 2008.

2.1.3 Local Transport Context

The local transport context is expressed in a combination of *City Plan 2000*, the Transport Plan for Brisbane and the Brisbane Long Term Infrastructure Plan.

City Plan 2000

City Plan 2000 presents an integrated approach to land use and transport planning and infrastructure provision. In particular, City Plan seeks to concentrate employment and economic activity in the city centre and the designated major centres such as Toowong and Indooroopilly, as well as in areas supported by transport nodes. City Plan also seeks to maximise the efficiency of existing transport infrastructure through controls on the form, design and sitting of development on land fronting major roads. Through City Plan, Brisbane City Council sees the maintenance of access and mobility as keys to livability in Brisbane (Brisbane City Council 2008a, pp. 23).

The Council's corporate vision, as expressed in *Living in Brisbane 2026*[12], focuses on the themes of:

- friendly, safe city;
- well-designed, subtropical city;
- smart, prosperous city;
- vibrant, creative city;
- clean, green city;
- accessible, connected city;
- active, healthy city; and
- regional, world city.

These themes support the Council's integrated approach to achieving the vision's city-wide outcomes, including sustainability, as the city progresses towards 2026. The integrated approach is carried forward in its implementation through the Council's Corporate Plan 2007-11[13]. In terms of an accessible and connected city in 2026, the Council's vision includes:

- green and active transport through the delivery of a network of greenways for the movement of pedestrians, cyclists, wheel chairs, prams and micro-electric vehicles linking neighbourhoods to key destinations, such as activity centres;
- effective road networks providing safe, timely and efficient access for all users, delivering economic benefits to the community and business;
- effective growth management where activity is focussed on designated centres or community hubs within walking and cycling distances from residential areas, so that people can live closer to their work while maintaining a connection with their communities; and
- connected and engaged communities serviced by rapid public transport corridors and high-speed information and communications technology connecting people both physically and virtually with their places of employment and recreation.

Brisbane City Council's vision is consistent with and supportive of the key strategies underpinning the SEQ Regional Plan and SEQIPP. In this strategic context, Northern Link is one part of an integrated approach to responding to the anticipated growth in travel demand driven by a combination of population growth and economic activity.

The designated activity centres in Brisbane and the SEQ Region are forecast to grow in terms of economic activity and employment. As a key strategic element in the road network, Northern Link would link a number of these designated economic activity centres and employment nodes. Employment growth to 2026 for the Brisbane CBD and for the Australia TradeCoast (ATC) is strong, leading to anticipated levels of 190,000 jobs and 80,000 jobs respectively. Investment in infrastructure and business in these major centres also is predicted to be strong. For example, the Brisbane Airport is expected to attract more than $2 billion in infrastructure investment and $2 billion in business development over the next 10 years.

The Western Corridor, supported by the SEQ Regional Plan as the focus for much of the regional population growth, already accommodates 16,000 small businesses, with more than 30 businesses with an annual turnover in the range of $50 million to $200 million. As a major new urban growth area likely to double, or more, its

[12] Brisbane City Council, 2006, *Living in Brisbane 2026*, Brisbane City Council, Brisbane

[13] Brisbane City Council, 2007, *Brisbane City Council Corporate Plan 2007-11*, Brisbane City Council, Brisbane.

current population in the next 20 years, the Western Corridor requires the creation of a large number of jobs, through economic growth and investments in infrastructure and services. Aerospace, freight, training and education have been identified as industries with high growth potential due to the proximity to Amberley airbase and existing campuses.

At the local level, employment and business activity on a regional or metropolitan scale is concentrated in centres such as:

- Milton – commercial and business centre, including major activities such as the Milton Brewery and Suncorp Stadium;
- Auchenflower – including the Wesley Hospital;
- Toowong – including regional commercial and profession services, shopping, entertainment and leisure facilities;
- St Lucia – the University of Queensland and CSIRO;
- Kelvin Grove – Queensland University of Technology and Kelvin Grove Urban Village; and
- Herston – Royal Brisbane Hospital.

By completing part of a motorway route connecting the Western Corridor with the Brisbane CBD, Toowong major activity centre and the Australia TradeCoast, Northern Link would also support regional planning and infrastructure development in both the AusLink National Network and SEQ Regional Plan dimensions. At the city level, the linkage with the Toowong major centre would support the city structure, as well as supporting and enhancing the role of Toowong as a major employment and economic centre.

Links to the University of Queensland, via Coronation Drive, Benson Street and Sir Fred Schonell Drive, would also support Brisbane City Council's corporate vision of connected communities and the SEQ Regional Plan intention of maintaining specialist activity centres.

Transport Plan for Brisbane

In pursuing the outcome of high quality access to facilities and services while maintaining environmental quality and liveability, the *Draft Transport Plan for Brisbane 2006 – 2026* proposes six strategic objectives.[14]

- Quality public transport as the preferred mode serving the major centres.
- Managed travel demand to counter the growth in population and economic activity.
- Coordinated transport and land use to create an urban form that increases connectivity and accessibility and supports sustainable travel behaviour.
- A safe and efficient road network allowing people and goods to move safely on the road network with environmental impacts minimised.
- Delivering the goods on time to the right place while maintain Brisbane's liveability.
- More clean and green personal transport as a genuine alternative to driving.

By moving cross-city travel out of the inner city and the congested arterials of Coronation Drive and Milton Road, Northern Link would enhance the road network and would contribute to the safe and efficient movement of people and goods with and across the City.

[14] Brisbane City Council 2006a, 'Draft Transport Plan for Brisbane 2006 – 2026' in *Brisbane Long Term Infrastructure Plan*, Brisbane City Council, Brisbane

These objectives are to be achieved within the strategic context described in this chapter.

Brisbane Long Term Infrastructure Plan

Brisbane City Council recognised the need for a coordinated and timely approach to infrastructure delivery in order to meet the needs of rapid population growth and strong economic development over the 20 year period to 2026. The Brisbane Long Term Infrastructure Plan (BLTIP)[15] is one of Brisbane City Council's responses to the anticipated demands for infrastructure and integrated planning, and will be supported by a series of local growth management strategies as they are developed over time. In part, the BLTIP will support achievement of the strategies of the Transport Plan for Brisbane.

In terms of road transport, Brisbane City Council has identified a need for a range of significant improvements to the road network in the Greater Brisbane Area, with direct benefits to Brisbane, including more river crossings. Major road transport projects reflected in BLTIP include:

- Gateway Motorway Upgrade (Queensland Government) now under construction;
- TransApex projects including the CLEM7 now under construction, the Airport Link (Queensland Government) in which construction is about to commence, Hale Street Link now under construction, Northern Link (tunnel option 4 in WBTNI) and East-West Link (tunnel option 5 in WBTNI);
- Port of Brisbane Motorway (SEQIPP project) due for completion in 2014-15; and
- Kingsford Smith Drive to be upgraded to six lanes between Seymour Road to Links Avenue North by 2011.

In addition to these road initiatives, the BLTIP and Brisbane City Council continue to support and deliver enhancements to public transport, particularly for bus travel.

TransApex Initiatives

The *TransApex* initiatives have been incorporated into the Transport Plan for Brisbane. *TransApex* recognised that Brisbane is facing a transport challenge due to rapid population growth and consequent economic growth in SEQ, requiring investment in major transport infrastructure so as to meet travel demand requirements. *TransApex* aims to address this challenge and examines transport requirements for public, private and commercial vehicles as well as active transport such as pedestrian and cycle travel.

TransApex and earlier transport studies identified the need to remove through-traffic from the CBD and better manage traffic movement via quality orbital road systems. *TransApex* aims to address this need by providing new river crossings and directly connecting our existing motorways and major arterial roads so allowing cross-city traffic to bypass the CBD. Tunnels are the preferred road system so as to reduce the impact on the urban form and environment.

The *TransApex* Strategic Context Report evaluation found the following key network outcomes:

- a more balanced and appropriate use of the road system – redistribution of traffic from lower order arterial and suburban roads to the motorways;
- a reduction in traffic in residential areas and shorter trips for motorists;
- a reduction in travel times and distance leading to improved access to jobs and services;
- unlikely to induce significant increases in private vehicle travel;

[15] Brisbane City Council, 2007b, *Brisbane Long Term Infrastructure Plan*, Brisbane City Council, Brisbane

- benefit to the freight industry – easier access through the most congested parts of the road network reducing journey times and costs;
- improvement in local amenity within the study corridor; and
- opportunities for improved sustainable transport to the CBD through the allocation of freed road space to public transport initiatives, high occupancy vehicles, pedestrians and cyclists.

2.1.4 Summary – Strategic Context

The Commonwealth Government, the Queensland Government and the Brisbane City Council have recognised the pressures of continued rapid population growth in the South East Queensland region need to be managed if economic efficiency, quality of life and environmental conditions are to be sustained. All levels of government have recognised the importance of supporting economic activity centres and employment nodes with high-quality transport, including road transport. Northern Link would respond to this over-arching planning strategy by completing a missing link in the motorway network and providing opportunities for improvement in local public transport services for particular centres, including the Brisbane CBD, Toowong and the University of Queensland.

The Commonwealth Government has identified Northern Link as a possible extension of the Auslink National Network to be extended through the Brisbane Urban Corridor to enhance the road transport connections from the west (Ipswich and the Western Corridor) to the east (Brisbane Airport, Port of Brisbane and Australia TradeCoast generally). The Commonwealth Government has committed significant funding to the delivery of Northern Link in response to Brisbane City Council initiatives to deliver the project over the period 2010 - 2013.

The Queensland Government continues to plan for the delivery of infrastructure in time to meet the needs of population growth and economic development in South East Queensland through its implementation of the SEQ Regional Plan and delivery against the SEQIPP measures. A key strategy in the Government's planning is the integration of transport and land use planning to manage travel demand and to make efficient use of existing infrastructure.

The Queensland Government, through its planning, anticipates that Northern Link would be consistent with an overall, coordinated response to the transport challenges in the Western Brisbane corridor in the short term. The existing infrastructure network is already under pressure as a consequence of the population growth and economic development that has occurred to this point, such that the South East Queensland Infrastructure Plan and Program initiatives are being implemented as a matter of priority.

The Brisbane City Council has established a vision for a liveable Brisbane through to 2026 as it plans for meeting the challenges of population growth and economic development. The Council's planning is consistent with the Queensland Government's regional planning and infrastructure program, and at the local level, also proposes to integrate transport and land use planning. The Council's planning and infrastructure initiatives are consistent with regional planning strategies.

In this context, Northern Link is part of a much larger plan and program for establishing the physical and infrastructure framework necessary to meet the demands of rapid population growth in South East Queensland and the greater Brisbane Area.

2.2 Traffic and Transport Need for Northern Link

2.2.1 Background

Brisbane City Council and the Queensland Government have examined both transport policy and the need for improvements in transport infrastructure for all travel modes, over many years, within the Brisbane metropolitan area and also specifically within the western suburbs of Brisbane.

Northern Link is proposed by Brisbane City Council as part of its approach to addressing the city's transport needs, consistent with the *Draft Transport Plan for Brisbane*[16] and *TransApex*[17]. Northern Link is 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. In the Queensland Governments *South East Queensland Infrastructure Plan and Program* (SEQIPP) the Northern Link is seen as having potential to ease traffic congestion on the western city corridors of Coronation Drive and Milton Road.

Northern Link forms part of TransApex, Brisbane City Council's network of strategic road connections that would allow Brisbane's cross-city travel movements to bypass CBD and inner suburbs using a high quality toll-road alternative to the surface road system. The first component of TransApex is the Clem Jones Tunnel (CLEM7)[18] that is under construction and is due to open in 2010. The second component is Airport Link. BrisConnections were announced as the preferred bidder for Airport Link in May 2008 with construction due to commence in late 2008. Airport Link is due to be operational during 2012. Northern Link is the third component and is the subject of this EIS. If approved, Northern Link is planned to be operational by 2014.

This section reviews Northern Link in relation to the project objectives stated in Section 2.3 and is based upon:

- a review of the effect of changes in travel demand due to population, economic and land-use characteristics in the Brisbane Metropolitan Area and the Western Corridor;
- an assessment of the road network structure in terms of capacity, connectivity and performance for both now and the future to adequately serve communities and industry; and
- the strategic context for Northern Link.

2.2.2 Travel Demand

South East Queensland is Australia's fastest-growing region, having attracted on average 55,000 new residents each year over the past two decades. The Brisbane Metropolitan Area currently accounts for about two-thirds of the region's population and Brisbane population share of the region is currently 35% of the total. Brisbane also dominates as the major employment centre for the region.

The predicted population figures for the region and both Brisbane City Council and Ipswich City Council areas are shown in **Table 2-2**. The region will continue to experience rapid employment growth with Brisbane dominating as the major employment centre for the region.

[16] Brisbane City Council, 2006a. *Draft Transport Plan for Brisbane 2006 – 2026.* Brisbane City Council.

[17] Brisbane City Council (2005b) *TransApex Prefeasibility Report;* Brisbane.

[18] Formerly known as the North-South Bypass Tunnel (NSBT).

Table 2-2 Predicted Population for Brisbane and Ipswich to 2026

Area	2007	2014	2016	2021	2026	% Change 2007 - 2026
Brisbane	996,000	1,076,000	1,097,000	1,136,000	1,164,000	17%
Ipswich	154,000	210,000	229,000	286,000	348,000	126%
SEQ	2,840,000	3,255,000	3,377,000	3,677,000	3,960,000	39%

Table Notes:
[1] PIFU Medium Series from SEQ Economic and Forecasting Study (2007).

The SEQ Regional Plan[19] provides a sustainable framework for managing this rapid growth and development in the SEQ region to the year 2026. The SEQ Regional Plan identities a Preferred Pattern of Development (PPOD) to cater for future population and employment growth which incorporates some significant and deliberate changes to the current growth trend. It projects growth in the Western Corridor much higher than occurred in the past which is illustrated in **Table 2-2** through significant population growth in Ipswich. The plan also relies on infill development within Brisbane City, with much of the growth to be centred on public transport infrastructure.

Table 2-3 shows the population and employment projections for the Brisbane Metropolitan Area and indicates overall estimates of person trips for a medium future population projection. Employment is forecast to increase by over 500,000 in the Brisbane Metropolitan Area between 2007 and 2026. Such significant growth in population and employment if realised would lead to a sustained growth rate in trip making at an average of 1.6% per annum through to 2026. This would be an increase in over 2,000,000 total weekday person trips compared to 2007.

While there is forecast to be a significant growth in travel demand, there will also be changes to the distribution of trip ends. **Figure 2-1** depicts the change in trip ends forecast over the period between 2007 and 2026. These figures clearly depict the significant growth in travel demand forecast within the inner western suburbs of Brisbane. There is also a clear focus for increased road travel demand associated with the Western Corridor, Australia TradeCoast (ATC) including Brisbane Airport and the Port of Brisbane, and activity centres such as the CBD, Toowong and Indooroopilly.

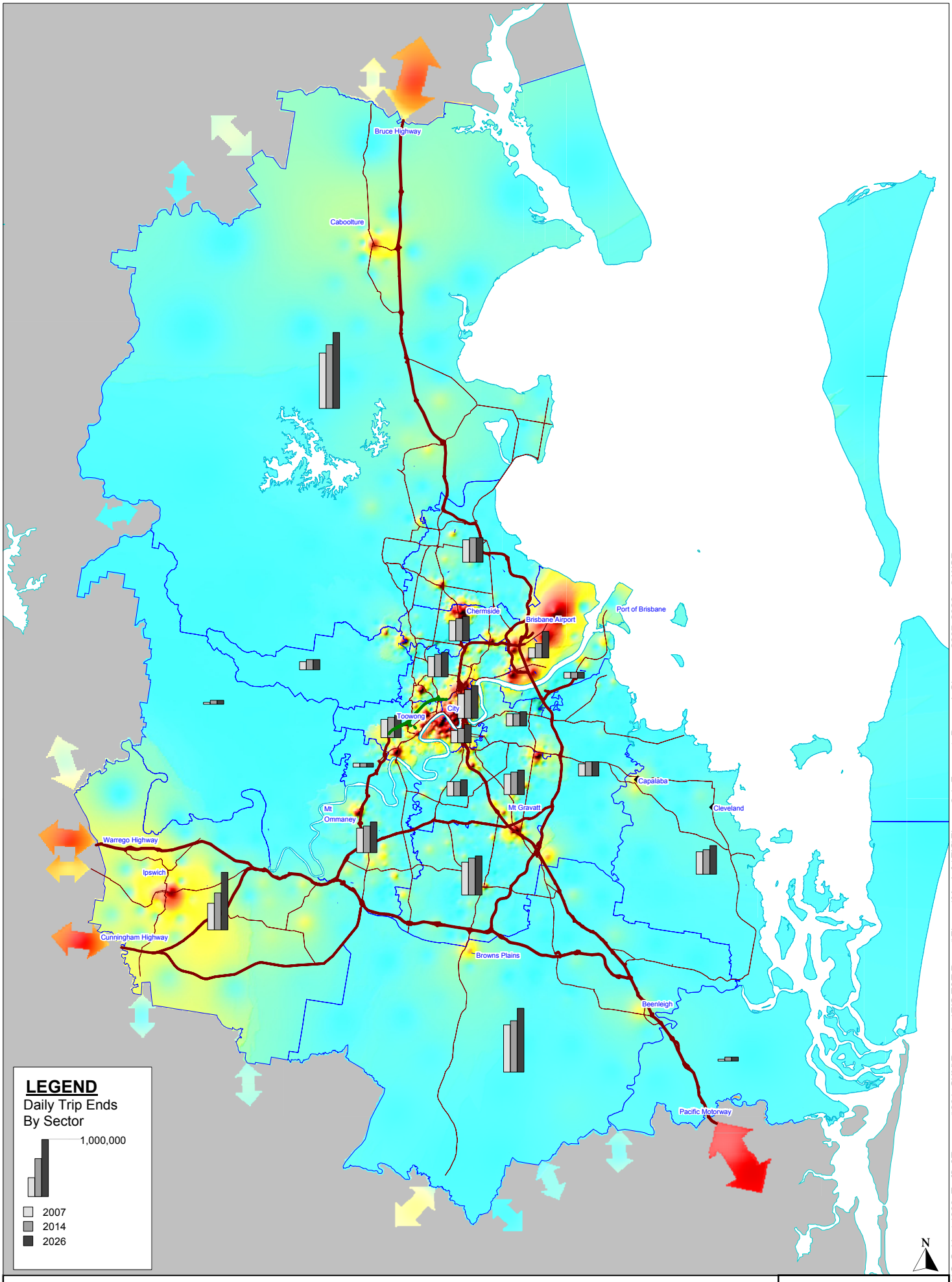
The resultant pattern of employment distribution for the metropolitan area and the Western Corridor will be more decentralised than the current situation, emphasising the importance of high-quality, high-speed transport connections between these major economic drivers to the regional, State and national economies.

Table 2-3 Brisbane Metropolitan Area Population Forecasts

Year	Population [1]	Employment [2]	Total Person Trips [3] (average weekday)
2007	1,880,000	964,000	6,529,000
2014	2,126,000	1,185,000	7,400,000
2016	2,197,000	1,237,000	7,637,000
2021	2,370,000	1,373,000	8,228,000
2026	2,533,000	1,484,000	8,783,000

Table Notes:
(1) PIFU Medium Series from SEQ Economic and Forecasting Study (2007).
(2) NIEIR employment opportunities SEQ Economic and Forecasting Study (2007).
(3) Trips by all modes including walk/cycle.

[19] Queensland Government, 2005, South East Queensland Regional Plan 2005 – 2026, Brisbane



LEGEND

Trip End Density Change
(2007 - 2026) Trip Ends per square km

25,000	5,000
10,000	0

- Northern Link
- State Strategic Road
- Radial/Ring Road
- Travel Sector Boundary

NORTHERN LINK
ENVIRONMENTAL IMPACT STATEMENT

Figure 2-1

Forecast Trip End Growth: 2007 to 2026

Northern Link
SKM Connell Wagner
JOINT VENTURE

G:\MPO\Northern Link\C_Subjects\300_Traffic&Transport\301_SKM\Reporting\EIS T&T Report\Figures\MapInfo\EIS\Figure_2-1_Forecast_Demand_Change_2007_2026_v2.WOR

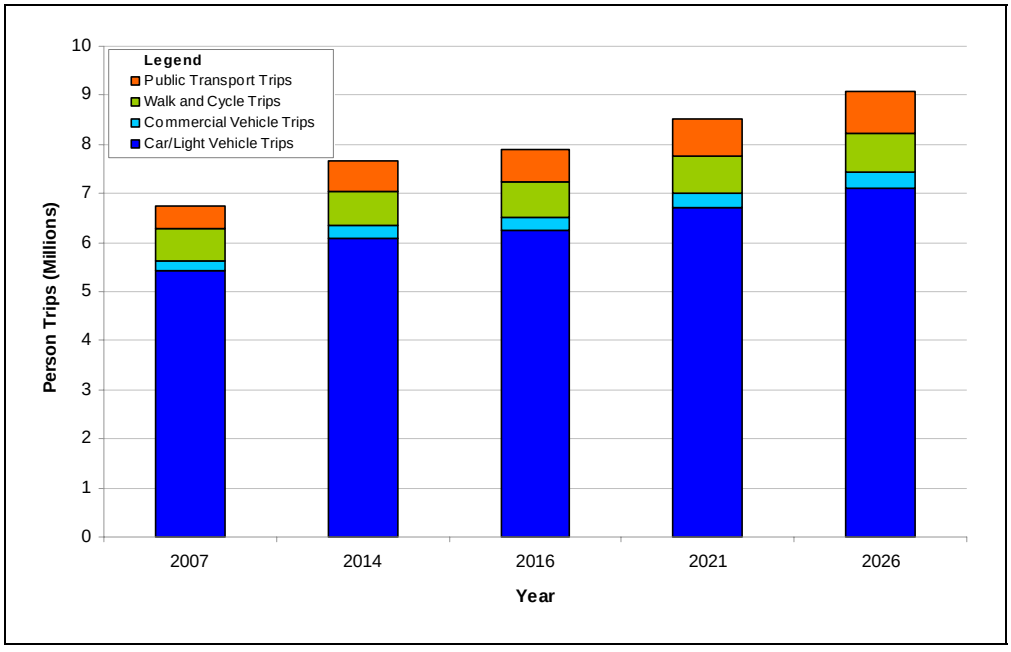
Growth in travel demand does not have to be accommodated by vehicle travel alone. The importance of sustainable transport planning, including increasing the number of trips made by walk/cycle and public transport modes, has been recognised by the Queensland Government and Brisbane City Council in their transport policy, transport infrastructure and investment programs. The South East Queensland Infrastructure Plan and Program (SEQIPP), Council's draft Transport Plan for Brisbane 2006-2026 and the TransLink Network Plan all incorporate a significant emphasis on promoting public transport use and active transport as core strategies catering for travel demand within a connected and accessible region.

Over the past 15 years there has been a concerted effort to significantly increase use of public and active transport. The current rate of patronage growth for weekday trips in the region is around 7.7% per annum[20]. Despite this substantial growth in public transport usage the majority of trips in the Brisbane Metropolitan Area are made by private and commercial vehicles.

As discussed in Chapter 5, Traffic and Transport in the EIS, in forecasting future travel demand the effect of proposed public transport initiatives, either planned or under consideration by Brisbane City Council and the Queensland Government, 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 associated with an enhanced mode share scenario, would represent a doubling of current levels to over 860,000 public transport trips per weekday. The reduction in vehicle trips in the network with enhanced public transport is estimated as 3% compared to a trend public transport situation, where public transport would account for approximately 8% of travel demand.

Figure 2-2 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 forecast, sustained growth in travel demand across all modes.

- **Figure 2-2 Forecast Growth in Average Weekday Travel Demand Within Brisbane Metropolitan Area (Person Trips)**



[20] Queensland Government, 2007e, TransLink Network Plan, Brisbane.

The estimated growth in the travel task is illustrated through the forecast future motorised travel demand in the network in **Table 2-4.** This information shows that, despite forecast gains in the public transport mode share, there will be significant growth in vehicle trips that will need to be catered for within the Brisbane Metropolitan Area from just over 4 million weekday vehicle trips in 2007 to almost 5.5 million in 2026. This forecast increase is equivalent to growth in vehicular trips of 34% from 2007 to 2026, which is equivalent to per annum growth of 1.5%. Over the same period, growth in commercial vehicle trips is forecasted to increase by 48% or 2.1% per annum.

Table 2-4 Forecast Growth in Weekday Travel Demand in Metropolitan Area

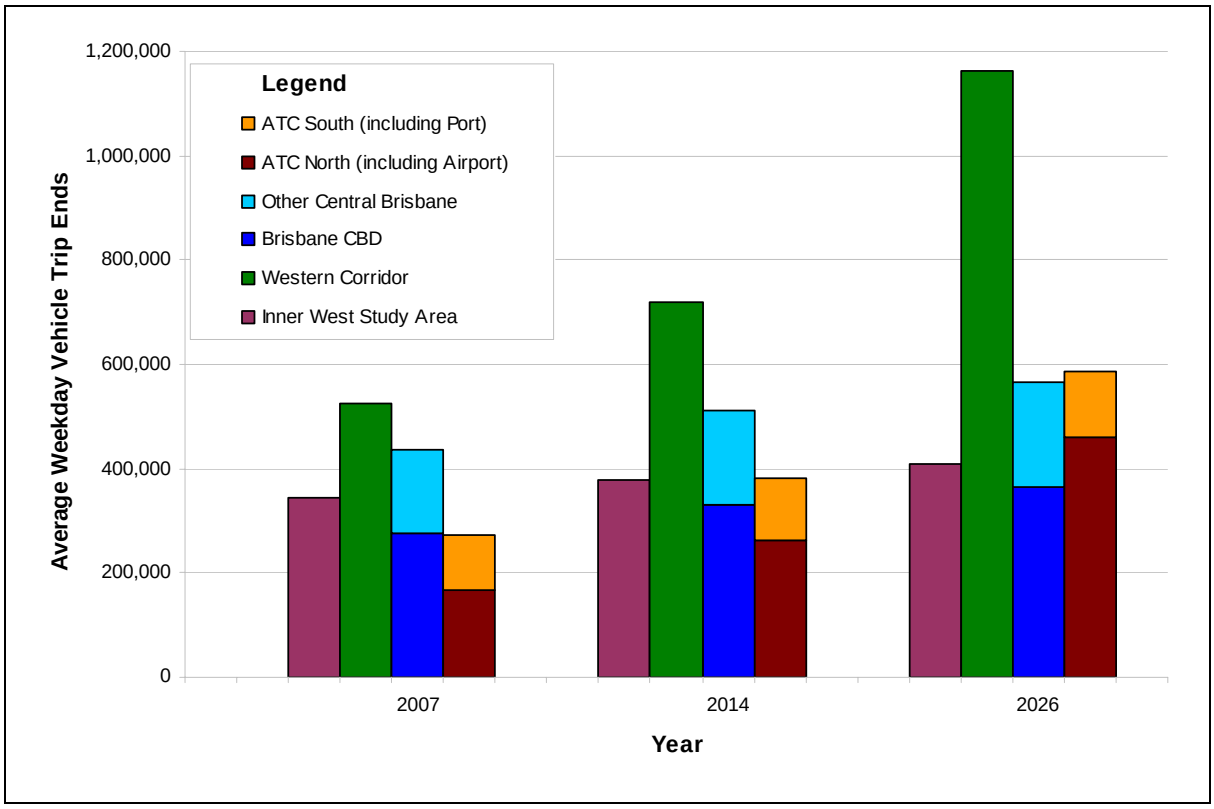
Parameter	2007	2014	2016	2021	2026
Total Person Trips by Motorised Travel Modes (includes public transport trips)[1]	5,884,000	6,690,000	6,910,000	7,464,000	7,986,000
Public Transport Trips	464,000	599,000	670,000	742,000	866,000
% PT Trips[2]	7.9%	9.0%	9.7%	9.9%	10.8%
Car/Light Vehicle Trips	3,879,000	4,385,000	4,498,000	4,855,000	5,150,000
Commercial Vehicle Trips (heavy vehicles)	210,000	251,000	261,000	288,000	310,000
Total Vehicle Trips	4,089,000	4,636,000	4,759,000	5,144,000	5,460,000
% Growth in Vehicle Trips compared to 2007		13%	16%	26%	34%

Table Notes:
Source : Northern Link Traffic Model
(1) Totals include travel from within area to and from locations outside the Brisbane metropolitan area.
(2) % Public Transport is expressed as a proportion of person trips by motorised modes

While the assessment provides a perspective on the significance of the increased quantum of vehicular travel demand to be catered for within the overall Brisbane CBD, a specific assessment has also been carried out of the forecast growth in travel demand to key travel generators that could benefit from Northern Link. **Figure 2-3** illustrates the growth in vehicle travel demand to Northern Link catchment areas. Growth in vehicle travel demand from 2007 to 2026 is expected to be:

- Inner West Transport Study Area – 18%;
- Brisbane CBD – 30%;
- Australia Trade Coast North – 178%; and
- Western Corridor – 122%.

- **Figure 2-3 Forecast growth in vehicle travel demand to Northern Link catchment areas**



In summary, significant growth in travel demand is forecast as a consequence of annual increases in the population and industry of the region. The distribution of growth is such that the demand for trips through the Inner West Transport Study Area will be great. Although the Queensland Government and Brisbane City Council have implemented measures to increase the use of public transport and active transport trips in the recent past, and have strong policies to continue to increase the use of these modes, the scale of the growth in travel demand associated with population growth and demographic trends is such that vehicular trips will continue to increase, placing increased pressure on travel corridors between key population growth areas, activity centres and employment nodes.

2.2.3 Road Network

The current road network structure and its current performance are reported in Chapter 5, Traffic and Transport. The key deficiencies of the current road network are related to gaps in the strategic network, system performance, the ability to cater for growth in travel, low and unreliable travel times and a lack of route choice and flexibility.

Transport Network Gaps

Much of Brisbane's major road network structure was shaped prior to and during the 1960s, and until the 1970s focus was on increasing road capacity and adding network flexibility to cater for the increases in population and car ownership, and significant consequential increases in vehicular travel demand. However, many of the recommended network schemes from the early planning that shaped the structure of Brisbane's transport network, and influenced growth patterns, were not completed. Strong community opposition to major surface road schemes also resulted in infrastructure improvements being shelved from the 1970s.

During the 1980s and 1990s, the transport planning focus evolved towards incrementally managing increases of traffic on the existing network, filling in selected missing surface network links within funding and community

constraints, and improving public transport, walking and cycling to encourage greater use of non-motorised travel modes.

Important road network improvement schemes that were identified to cater for needs that existed at the time and future growth (as forecast at that time) were not implemented, creating strategic gaps in the network. These deficiencies have been further exacerbated in recent years by the strong growth in population and economic activity in the SEQ region.

The gaps in the strategic transport network principally affect east-west transport efficiency, safety and reliability. From an AusLink National Network view there are network gaps such as between the western and northern approaches to Brisbane. A direct, high quality connection between the west and the ATC north region, which includes Brisbane Airport, is missing from the current network structure.

In relation to the regional network, the Western Freeway terminates at Toowong/Mt Coot-tha rather than extending a high-quality connection through to the eastern network elements. This results in congested urban arterial roads being used to complete journeys from the west to the CBD, to connect with the Inner City Bypass, Riverside Expressway, northern suburbs and beyond to the Gateway Motorway and ATC. This is particularly relevant for cross-city trips including freight traffic from the growing industries of the Western Corridor and long distance freight from west of Ipswich.

Provision of an alternative route is required to alleviate congestion on key road links that have a significant cross-city and freight transport role and have major future deficiencies such as:

- Milton Road - currently provides a freight route from the Western Freeway to the CBD, Inner City Bypass and Riverside Expressway;
- MetRoad 5 - currently provides a freight route to the northern suburbs and beyond; and
- Brisbane Urban Corridor (BUC)[21] - the primary freight route from the western corridor to the Gateway Motorway is a highly congested route comprised of interrupted flow urban arterial roads directly abutting and serving a range of local, urban land-uses.

The metropolitan network also suffers from a lack of direct cross-river connections to the eastern and southern suburbs, particularly to the west of William Jolly Bridge servicing the growth areas. The recent completion of the Eleanor Schonell Bridge between Dutton Park and the University of Queensland at St Lucia has improved accessibility for buses, cyclists and pedestrians only.

The strategic gap in the network from the Western Corridor and western suburbs for cross-city trips currently affects a significant proportion of trips through the Inner West Transport Study Area. In Chapter 5, Traffic and Transport, it was reported that the demand for cross-city trips on the inner west regional radial roads currently accounts for about 75% of traffic. Consequently, the majority of the traffic using the regional radial roads in the inner west is going elsewhere but is forced to use these roads through the inner urban area due to a lack of feasible alternatives.

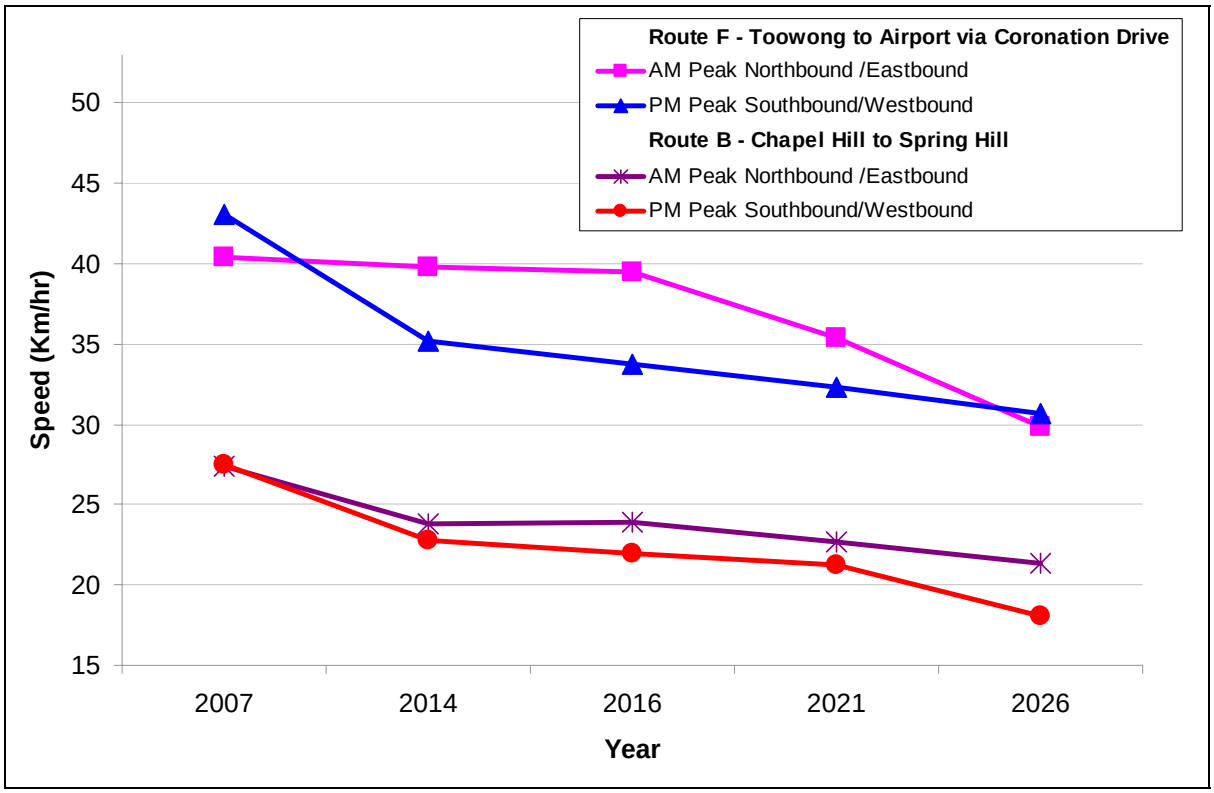
[21] Brisbane Urban Corridor – the road-based component extends from Ipswich at the Warrego Highway and Cunningham Highway and includes Granard Road, Riawena Road, Kessels Road, and Mt Gravatt-Capalaba Road, across to the Gateway Motorway and Pacific Highway (ref. AusLink National Network)

Improving System Performance

Congestion is currently experienced on the transport network within and through the Inner West Transport Study Area despite significant increases in the use of public transport over recent years. This congestion is forecast to worsen over time, resulting in longer travel times, diversion of strategic and through traffic to lower-order roads and low travel time reliability. Bus services are also delayed by peak period traffic congestion. These impacts are experienced particularly for trips from the south-west access corridors to the region, Western Corridor, western suburbs of Brisbane to the Gateway Motorway north of the river, Brisbane Airport, the CBD, northern suburbs and beyond.

Figure 2-4 provides examples of the forecast decline in travel speed for examples of typical journeys through the Inner West Transport Study Area.

- **Figure 2-4 Forecast Decline in travel speed on key routes without Northern Link**



By 2026 the average speed for a peak period trip for a trip between Chapel Hill and Spring Hill will decrease from 27km/h at present to 21km/h in the morning peak period and from 27km/h at present to 18km/h in the evening peak period for the return journey.

Significant reductions in travel time are also forecast for a regional cross city trip such as from Toowong to the Brisbane Airport. In the morning peak period the average speed is forecast to decrease from 41km/h at present to 30km/h in 2026. Similar reductions in average speed are forecast for the evening peak period with a current speed of 43km/h at present for the return journey decreasing to 31km/h in 2026.

Route Choice and Flexibility

There is a lack of routes providing a choice and flexibility for cross-city trips between the western suburbs and the CBD and cross-river locations. A degree of network choice and flexibility would provide alternative routes in the event of a major incident or event occurring on or close to a key arterial or motorway route.

Strategic routes with a lack of choice and flexibility include:

- the strategic road network to the CBD, Brisbane Airport and the northern access corridors independent from BUC, Gateway Motorway and the inner city cross-river links; and
- the inner urban arterials of Milton Road, Coronation Drive and MetRoad 5 for trips from the Western Freeway at Toowong to the CBD, the northern suburbs and beyond.

Traffic Growth

Increased travel demands in future years will create significant additional pressure in the metropolitan area transport network. The consequences of the road network deficiencies will worsen such that peak period journey travel times are forecast to increase compared to the current level. For example, without Northern Link, but with enhanced mode share to public transport, traffic conditions on the Milton Road, Coronation Drive and Moggill Road corridors are forecast to deteriorate over time. Traffic volume growth to 2026 is forecast to be almost 30% on Milton Road and 15% on Coronation Drive.

In summary, the traffic congestion that currently exists on the road network is forecast to deteriorate further over time. This will have a range of consequences such as:

- congested arterial roads resulting in excessive and unreliable travel times;
- increased and unreliable bus journey times;
- increased time for the road network to recover from an incident;
- traffic management to cater for regional radial traffic resulting in accessibility issues such as banned turns and one-way systems that create local network legibility and access problems;
- the creation of segregation due to road infrastructure and high traffic volumes;
- the diversion of trips to the local road network;
- inappropriate vehicles types (freight) using inner urban roads;
- a lack of road space for local functions such as parking, loading, public transport; and
- increased reliance on signalised intersections resulting in significant delay during congested times, in particularly for local traffic.

2.2.4 Summary - Strategic Transport Need for Northern Link

Northern Link would address regional transport strategic needs by:

- Supporting the preferred future development pattern, population and employment growth of SEQ in accordance with the SEQ Regional Plan by:
  - improving connectivity and transport system capacity to cater for major growth areas (eg: Western Corridor) and economic activity centres (eg: CBD, Toowong and Indooroopilly, ATC);
  - addressing the gaps in the road transport network in the Inner West Transport Area to support and optimise the benefits of Queensland Government investment in substantial road infrastructure schemes in the Western Corridor including major capacity upgrades to the Ipswich Motorway and capacity enhancements and extension of the Centenary Highway;
  - reducing congestion and through-traffic on the surface roads, which improve local amenity and liveability, and would support the designated activity centres; and
  - providing opportunities for improved bus transit services in the corridor.

- Improving east-west transport efficiency (eg: Western Corridor and western suburbs to ATC, the CBD and the regional roads in northern suburbs), by:
  - enhancing east-west regional road network and catering for future growth by providing a motorway standard link between the Western Freeway and the Inner City Bypass;
  - relieving forecast future capacity deficiency, reducing congestion and improving travel time reliability on regional routes;
  - redistributing travel to motorway standard routes and reducing travel on the local road system; and
  - providing an alternative route in event of a major incident.
- Improving freight distribution by:
  - completing an alternative, motorway-standard corridor for long distance freight from the south-west to the CBD, ATC and north Brisbane;
  - providing for alternative motorway-standard distribution between freight generators (Western Corridor, CBD and ATC) within the Brisbane Urban Corridor (BUC);
  - improving connectivity to proposed inter-modal terminals (eg: Ebenezer) and supporting new Western Corridor industrial development;
  - providing congestion relief and improved travel times and reliability for freight, leading to improved productivity via reduced transport costs; and
  - relieving traffic flow on (existing) secondary freight routes in the inner western suburbs.
- Providing additional public transport capacity by:
  - providing opportunities for express bus services from the Western Corridor to the CBD and other growth areas; and
  - relieving congestion on existing major bus routes (ie: Coronation Drive, Milton Road and Moggill Road).

Northern Link would address local strategic transport needs by:

- Supporting public transport and passenger travel needs by:
  - providing a high quality route for western suburbs to CBD for express bus service use;
  - improving public transport efficiency on major surface bus routes; and
  - providing opportunities to improve pedestrian and cycle environment in inner west suburbs and reducing existing barriers to pedestrian and cycle movements.
- Providing an efficient road network by:
  - removing through-traffic from Coronation Drive, Milton Road and Moggill Road which passes through major commercial and residential areas;
  - relieving rat-running pressures from local roads from reduced congestion; and
  - improving journey time and reliability by improved traffic flows.
- Improving freight movements through the local areas by:
  - providing a new higher order freight route to inappropriate routes through local areas;
  - removing freight movements from surface traffic routes; and
  - providing congestion relief for light freight carrying distribution and delivery tasks.

2.3 Project Objectives

The primary objective for Northern Link is to improve east-west cross-city movement of people and freight.

Secondary objectives for Northern Link are:

- **Transport network**
  - To address deficiencies in the national freight network to improve freight distribution in and around Brisbane.
  - To provide opportunities for additional public transport capacity.
- **Environment**
  - To protect and, where possible, enhance the environment.
- **Social**
  - To assist development of a sustainable urban environment for inner-western suburbs.
- **Value for money**
  - To deliver value-for-money over whole of project life.
- **Timeliness**
  - To deliver Northern Link by June 2013.

The project objectives are consistent with transport planning at the Commonwealth, State and local levels.

The 'identified project need' has been defined primarily as the need to provide for cross-city movements of people and goods, between Brisbane's growth areas and activity centres in the western suburbs and the northern suburbs. Northern Link could be regarded as a missing link in the national road network, as there is currently no high-standard direct road connection between these two strategically important regions, nor are there high-quality connections for the designated activity centres to the motorway network.

The existing transport infrastructure and services including road, rail and bus facilities, provide for predominantly radial movements within a network that focuses on the Brisbane CBD.

Projects under construction or about to commence construction, such as the CLEM7[22] and Airport Link, contribute to cross-city flows and relieve some of the pressure on existing infrastructure. However, these projects focus upon Brisbane's north-south axis, and will not provide any relief for the growing volume of trips to and from the west. Cross-city movements to and from the west are highly constrained by growing congestion on the existing radial transport network, which is at capacity, and on the capacity and distance constraints of the southern motorway links. It is this congestion and the lack of capacity to accommodate future traffic growth that are driving the need for Northern Link.

2.4 Sustainability

Brisbane City Council (BCC) recognises the need to ensure future infrastructure projects adequately consider sustainability. Council has proactively supported sustainability through a range of initiatives including:

- City Smart;
- Living in Brisbane 2026;
- Climate Change and Energy Taskforce; and
- Brisbane's Plan for Action on Climate Change and Energy.

[22] Formerly known as the North-South Bypass Tunnel (NSBT).

These initiatives ensure a sustainability focus for decision-making by Council including for the delivery of infrastructure.

This section provides a framework for achieving sustainability in the pre-design, design, environmental assessment and mitigation, construction and operation phases of the Project.

BCC has established a Corporate Vision for the future of Brisbane through the Living in Brisbane vision document. The vision is supported by a Sustainability Policy which provides Brisbane-specific guidance for achieving sustainability outcomes through the proposed Northern Link project.

2.4.1 Corporate Vision 2026

The BCC has outlined a number of key themes as part of its Living in Brisbane 2026 vision. BCC recognises that Brisbane needs to be:

> *'friendly, safe, clean, green, well designed, subtropical, accessible, connected, smart, prosperous, active, healthy, vibrant, creative, and regional'.*

2.4.2 Corporate Sustainability Policy

BCC has established a Corporate Sustainability Policy as part of Living in Brisbane. Four focus areas are identified in this policy, being:

- *Resource efficiency*: saving energy and water and reducing waste;
- *Sustainable places and urban form*: improving Brisbane's built environment, especially the interactions between land use, transport and the environment;
- *Biodiversity conservation*: protecting and enhancing biodiversity, natural areas and waterways; and
- *Health and wellbeing*: developing a city where our people and communities enjoy physical, mental and social wellbeing.

The policy also identifies principles from the National Strategy for Ecologically Sustainable Development:

1 *Integrated long and short-term economic, environmental and community consideration;*
2 *Provide for equity within and between generation*;
3 *Enhance and maintain biodiversity and natural environmental systems;*
4 *Act cautiously when there is a risk or serious or irreversible impacts on the environment of the community;*
5 *Recognise dimensions beyond our border while concentrating on issues we can influence; and*
6 *Provide for broad public involvement on issues that affect the community*.

2.4.3 Incorporating Sustainability into Major Infrastructure Projects

Seven stages within the life cycle of major infrastructure projects have been identified through which sustainability outcomes can be integrated into the Project:

1 *Project Planning* – developing a systemic view and deep understanding of a project, including the context within which it sits. The aim is to design a sustainable project from the outset, providing economic, environmental and social benefits and eliminating potential direct and flow-on negative impacts;
2 *Feasibility Assessment* –identifying technically feasible methods of achieving the project vision. Focus on realising financial, social and environmental opportunities in an integrated way, not just mitigating negative impacts. Conventional thinking around design, delivery and operations must be challenged;

3 *Project Design* – fulfilling the project purpose and meeting stretch goals through good integrated design. Aim for big reductions in resource use, materials with lower embodied energy and toxicity, more simple and efficient operations, and elimination of waste;

4 *Procurement* – sourcing people, services, finance, materials and other physical resources from suppliers that operate in a manner consistent with sustainability. The use of purchasing power can be effective at creating change in favour of sustainability throughout a supply chain, and where appropriate local supply arrangements may be encouraged;

5 *Construction* – focusing on minimising impacts on site, in adjacent communities and the watershed. Considerations include emissions (noise, dust, light), waste management, protection of watercourses, community movement patterns, seasonal events and vegetation and habitat protection;

6 *Operations* –delivering the product in the most efficient manner possible. Continuous performance improvement should be underpinned by monitoring, evaluation and reporting; and transparency in accounting for triple bottom line indicators; and

7 *Decommissioning* – what legacy do we want to leave, even when the project is no longer operating, and how does this contribute to inter-generational equity?

Community involvement and engagement is critical to all of the steps.

2.4.4 Sustainability Framework for Northern Link

Table 2-5 provides a sustainability framework for identifying relevant strategic and project specific areas for the development of sustainability measures. The framework provides the basis for a structured approach for integrating Council's Vision and Sustainability Policy into the proposed Northern Link Project, as well measuring the achievement of sustainability outcomes.

Table 2-5 Sustainability Framework and Northern Link

KEY INDICATORS	SUB-CATEGORIES	PROJECT PHASE[#]			
		Planning	Design	Const.	Operat.
STRATEGIC	***(how the project contributes to)***				
Resource efficiency	Regional/city freight movement	✓	✓		✓
	Regional/city transport network	✓	✓		✓
Sustainable places and urban form	Urban form, design, mixed use/TOD, connectivity	✓	✓		✓
	Public transport movement	✓	✓	✓	✓
Biodiversity conservation	Regional/city green corridors/spaces/waterways	✓	✓	✓	✓
Health and well-being	Amenity and community character	✓	✓	✓	✓
	Public spaces/facilities	✓	✓	✓	✓
PROJECT SPECIFIC	***(how the project addresses)***				
Economic					
Direct Cost	Construction, life cycle	✓	✓		✓
Indirect cost	Community, natural environment	✓	✓		✓
Environmental					
Land use	Project footprint	✓	✓	✓	✓
	Adjoining properties	✓	✓	✓	✓
Water	Impact/mitigation – water cycle	✓	✓	✓	✓
	Water capture/reuse	✓	✓	✓	✓
Air	Quality impact/mitigation	✓	✓	✓	✓
	Ventilation outlet	✓	✓	✓	✓
Noise	Impact/mitigation	✓	✓	✓	✓
Ecology	Impact/mitigation	✓	✓	✓	

KEY INDICATORS	SUB-CATEGORIES	PROJECT PHASE[#]			
		Planning	Design	Const.	Operat.
	Replacement/enhancement of habitat	✓	✓	✓	
Visual	Impact/mitigation/enhancement	✓	✓	✓	
Waste management	Extent of waste created		✓	✓	
	Reuse		✓	✓	
Social					
Social uses	Impact/mitigation/enhanced access or protection	✓	✓		
Public access and physical activity	Connectivity to employment, services and PT options changed access to open space and parks	✓	✓		✓
Public engagement	Perception	✓	✓	✓	✓
	Involvement and satisfaction with outcomes	✓	✓		
Resource utilisation					
Site access	Construction equipment, workforce, waste, material	✓	✓	✓	
Resource availability	Material, equipment, workforce	✓	✓	✓	
Material type		✓	✓	✓	
Reusability	Reusability of moulds, formwork	✓	✓	✓	
Quality assurance	Ease of quality control	✓	✓	✓	
Health and safety					
Occupational		✓	✓	✓	✓
Public	Pedestrian, vehicular and open space safety	✓	✓	✓	✓
Project administration					
Project requirements (EIS, contract)	Inclusion of sustainability-related clauses	✓	✓		
Procurement method	Assessment against sustainability	✓	✓		

Table Note: This table has been created from a range of sources including BCC Corporate Sustainability Policy, Kumaraswamy, 2004, Wong, 2003 and SKM 2007.

[#] Project Planning and Feasibility Assessment have been combined into 'Planning' and 'Decommissioning' has not been included at this time.

2.4.5 Sustainability Measures

Specific sustainability measures that have been applied in the development and refinement of the Reference Project have included:

- how the design process is undertaken:
  - minimise paper use and only use recycled paper;
  - coordinate and manage site visits and travel by Project Team to minimise emissions;
- achieving efficient transport network and traffic movement outcomes through the location and design of connections to surface roads;
- options for accommodating express bus movements;
- the capture of stormwater for use during construction;
- the reuse of tunnel spoil; and
- sustainable urban regeneration and mitigation initiatives.

It is the Proponent's intention to include sustainability measures in the Project procurement phase and throughout the detailed design, construction and operation of the Project. Specific sustainability measures that have been currently identified for inclusion into the next phase of project design and delivery following the evaluation of the EIS would include:

- maintaining construction equipment and haul trucks in good working order so fuel efficiency of equipment is maximised;
- vehicle management systems to reduce waiting e.g. spoil haulage;
- use of appropriately sized equipment for construction activities;
- minimising waste from construction, including reuse of tunnel spoil as a valuable resource;
- using low intensity lighting throughout the length of the tunnel without compromising user safety;
- energy efficient and effective lighting, fans and traffic management systems;
- automatic control of light intensity in the portal region as varying with ambient light conditions on the surface;
- ventilation system design which utilises the piston effect of traffic movement through the tunnels and with demand management of the ventilation system where ventilation (and associated electricity use) can be increased or decreased as necessary based on in-tunnel concentrations of air pollutants or in the event of fire or emergency situations.
- low energy design of project buildings;
- water sensitive construction practices; and
- sustainability objectives in urban design, landscape treatments and urban mitigation;

2.5 Assessment of Project Alternatives

The ToR require an evaluation of possible alternatives to Northern Link, including a public transport option and an upgraded surface road option.

Public transport options would not address all of the project objectives, whereas a surface road upgrade may partially address road transport functional objectives at the cost of urban amenity and environmental conditions. The 'do nothing' option would not satisfy any of the Northern Link project objectives.

2.5.1 'Do Minimum' Option

For the EIS, a 'do nothing' or 'do minimum' scenario has been adopted for comparison with the alternatives proposed in the terms of reference. However, the road transport network in South East Queensland and the Brisbane metropolitan area is changing as a consequence of projects presently under construction (eg: Gateway Motorway Upgrade, Ipswich Motorway – Logan Motorway interchange, Clem Jones Tunnel, Hale Street Link) and already committed and about to commence construction (eg: Airport Link, Airport Roundabout Upgrade, Northern Busway).

Both the South East Queensland Infrastructure Plan and Program (SEQIPP) and the Brisbane Long Term Infrastructure Plan, linked with the Transport Plan for Brisbane[23], have established priorities for investment in transport infrastructure at the regional and local levels respectively.

In the 'do minimum' scenario analysed in Chapter 5, Traffic and Transport, no upgrades are proposed to the land transport system in addition to those identified in the:

[23] Brisbane City Council, 2006a, *Draft Transport Plan for Brisbane 2006 – 2026*, Council, Brisbane

- South East Queensland Infrastructure Plan and Program 2008 – 2026 (SEQIPP); and
- Brisbane Long-Term Infrastructure Plan, including the Brisbane Road Action Plan 2008[24].

SEQIPP initiatives that would address some of the strategic gaps in the transport network include:

- Gateway Motorway Upgrade (Queensland Government - under construction);
- Clem Jones Tunnel (Brisbane City Council - under construction);
- Airport Link and Airport Roundabout Upgrade (Queensland Government, approved, due to commence operations in 2012);
- Hale Street Link (Brisbane City Council, under construction);
- Northern Busway (Queensland Government, section 1 under construction);
- Ipswich Motorway (Dinmore to Goodna) upgrade (under construction);
- Centenary Highway extension (under construction);
- Brisbane Urban Corridor intersection upgrades at Granard Road and Kessels Road;
- Metropolitan rail freight capacity upgrades;
- Darra to Springfield rail upgrade (under construction); and possibly
- Inner City Rail Capacity.

Brisbane Road Action Program initiatives that would address some of the strategic gaps in the transport network include:

- upgrade of Kingsford Smith Drive between the Gateway Motorway and the Gateway Upgrade Project from 4 lanes to 6 lanes; and
- intersection upgrades along Kingsford Smith Drive at Nudgee Road and Hants Road, and further capacity upgrades west to Riverview Terrace under consideration.

SEQIPP also proposes the implementation of the Subregional Cycle Network over the period 2008/09 to 2025/26. Of relevance to this EIS are the program grants and funding arrangements for:

- Bicentennial Cycleway upgrade to separated pedestrian and cycle paths between Hale Street and Park Road (Stage 1) with further upgrades to follow; and
- Victoria Park Bikeway upgrade (lighting).

The ‘do minimum’ option represents a balanced approach to road and public transport infrastructure in developing the regional and metropolitan transport network. However, forecast growth in population and economic activity (Chapter 5, Traffic and Transport) indicate that travel demand would exceed capacity enhancements proposed through regional and local planning measures in the ‘do minimum’ scenario.

2.5.2 Optimise Non-private Motor Vehicle Modes of Transport (PT option)

At both the regional level as presented in SEQIPP, and at the local level as presented in the Transport Plan for Brisbane, augmentation and continuing development of a high-quality public transport system is seen as an

[24] Brisbane City Council, 2008d, *Road Action Program 2008*, Council, Brisbane (*http://www.brisbane.qld.gov.au/Brisbane City Council:BASE:1182833713:pc=PC_3224*)

important measure for responding to the travel demand arising from sustained, rapid population growth and economic activity.

In SEQIPP, urban congestion and travel demand management are recognised as high priorities, with public transport and active transport seen as important components in an integrated response. In the Transport Plan for Brisbane (TP4B), public transport is seen as the preferred mode of transport to the city's major centres (Brisbane City Council, 2006a, p. 19).

As noted in SEQIPP, the public transport system in the Brisbane metropolitan area is principally a radial system focussed on the Brisbane city centre. The public transport strategy for CBD trips is to increase mode share from about 45% at present morning peak periods to about 75% in future morning peak periods (Brisbane City Council, 2006, p. 9). This is nearly doubling the present mode share and would require a significant change in travel behaviour, supported by equally significant upgrades in levels of service, capacity and flexibility offered by the public transport system, over present levels.

For the purpose of addressing the terms of reference, the public transport option would focus on bus transport for commuter travel and heavy rail for the movement of freight from the Western Corridor to the Australia TradeCoast. Possible upgrades to the transport network required for the public transport option include:

- development of a high-capacity busway, or dedicated bus lanes, connecting the Centenary suburbs at Mt Ommaney within the Centenary Highway – Western Freeway corridor to connect with dedicated, priority bus lanes on Milton Road, then via Hale Street to link into the Inner Northern Busway station at the Normanby for CBD trips and for north-bound trips on the Northern Busway;
- implement capacity enhancement schemes on local roads including:
  - dedicated, priority bus lanes on Milton Road, in addition to the existing 4 lanes for general traffic and also on Hale Street in addition to the existing 6 lanes for general traffic;
  - upgrade Kelvin Grove Road and the Normanby busway station to provide for north-bound, cross-city bus trips from the busway station;
  - provide dedicated, priority bus lanes along Moggill Road from Kenmore to Indooroopilly, including a connection with a new busway station at Indooroopilly to join with the rail corridor into the city;
- provide high-quality bus connections between Darra station and a possible future Mt Ommaney busway station;
- provide an extension of the Northern Busway to Toombul to provide a connection with Airtrain to Brisbane Airport and for the extension of services to Australia TradeCoast (North);
- bring forward the implementation of WBTNI option 11 from a medium term delivery (up to 15 years) to short-term delivery (within 5 years) – busway linking Kenmore and the CBD running generally in or adjacent to the rail corridor from Indooroopilly to Toowong, and then along Coronation Drive to the Riverside Expressway;
- upgrade the rail capacity on the Western Railway, if possible, between Darra and Bowen Hills for the movement of general freight to northern Brisbane and for distribution at Banyo / Toombul / Hendra for Brisbane Airport and Australia TradeCoast (North).

While CityCat ferry services provide an important linkage between the city and suburbs along the Brisbane River, and to the University of Queensland at St Lucia, ferry services have a limited catchment and therefore a limited demand for services. Ferries services are also disadvantaged by speed of travel, distances along the river, the need for connections to other modes, and lack of parking at existing ferry wharves. While there is some

potential for increased frequency of services, and an increase in the number of locations visited by river ferry services, ferry travel is not expected to shift mode shares.

While improvements to the existing pedestrian and cycleway network would aim to attract more pedestrian and bicycle traffic to the existing Bicentennial Cycleway, such upgrades would address radial, CBD-based trips, and would not address the identified need for cross-city movements. Cycling is not considered an attractive mode of transport for cross-city travel, except where it addresses short-haul trips within the inner city. For some people however, cycling will continue as their preferred mode for journeys to work.

2.5.3 Optimise Surface Road Transport (Existing Network Upgrade Option)

Apart from Northern Link, there are no additional measures to those identified in the 'do minimum' scenario, identified in either SEQIPP or TP4B, which support an optimised surface road transport option.

For the purpose of addressing the terms of reference, the existing network upgrade option would focus upon Milton Road as the key route for cross-city travel and Coronation Drive for CBD-destination travel. The existing network upgrade option is assumed to include the following road upgrade measures for cross-city travel (ie: Milton Road):

- increasing capacity at the Mt Coot-tha roundabout and Toowong roundabout;
- increasing lane capacity on Mt Coot-tha Road between the roundabouts;
- increasing lane capacity on Milton Road from 4 lanes to 8 lanes, including upgrading the capacity of all signalised intersections, between Frederick Street and Petrie Terrace;
- implementing a priority flow system in traffic signals for through lanes between the Toowong Roundabout and Hale Street;
- increasing capacity of the Milton Road – Hale Street intersection;
- increasing capacity of the Milton Road, Petrie Terrace, Ithaca Street and Roma Street circuit;
- increasing lane capacity on Hale Street from 6 lanes to 10 lanes plus merging and de-merging lanes;
- increasing the lane capacity of Croydon Street between Jephson Street and Milton Road, including upgrading the intersection of Croydon Street and Milton Road; and
- limiting access from local roads intersecting with Milton Road during peak periods (suggest 7.00am – 9.30am and 4.00pm – 7.00pm).

The following upgrade measures would be required for CBD-based travel on Coronation Drive:

- increasing lane capacity by two lanes from six through lanes to eight through lanes;
- implementing a priority flow system in traffic signals for through lanes between the Benson Street and the Riverside Expressway;
- integrating the priority flow signal system with the tidal flow lanes on Coronation Drive; and
- increasing the capacity of key intersections along Coronation Drive and other major intersections including High Street/Brisbane Street Toowong.

The existing network upgrade option would involve a range of property, community and environmental impacts, namely:

- extensive property acquisitions along Milton Road, mostly on the northern side to avoid the Western Railway corridor;

- property acquisitions would affect a combination of heritage places (Toowong Cemetery, Milton Brewery, St Francis monastery Milton, Christ Church Milton and Baroona Special School); residential properties in Toowong, Auchenflower, Milton and Paddington; significant commercial areas at Auchenflower and Milton; and recreation and open space areas at Toowong and Milton including Lang Park (ie: Suncorp Stadium);
- community impacts include the loss of connectivity across Milton Road and increased separation from the Brisbane River as a consequence of possible widening of Coronation Drive, loss of residential properties and local community centres (eg: Auchenflower shops, partial loss of Baroona Road businesses), impact on heritage places referred to above and impact on open space and recreation areas also referred to above; and
- Environmental impacts would include construction impacts (noise and vibration, dust, night lighting, drainage, water quality) and operational impacts (increased road traffic noise, surface release of motor vehicle emissions).

No estimates are provided with regards property acquisition costs owing to the significance of some of the key properties required, such as Milton brewery and Suncorp Stadium, and the numbers of residential and commercial properties required along the route. Similarly no estimates of construction costs are provided as this is a strategic analysis into function of each of the options presented.

A comparative assessment of each of the feasible options is presented in **Table 2-6**, having regard for the project objectives for Northern Link, and the strategies for both the South East Queensland Infrastructure Plan and Program, and the Transport Plan for Brisbane.

Table 2-6 Comparative Analysis – Alternatives to Northern Link

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Provide a convenient and effective bypass of Brisbane CBD for cross–city movement of people and goods by connecting the Western Freeway and the Inner City Bypass	Does not achieve objective	Partially achieves objective: ■ requires multi-modal trips for each cross-city journey; ■ does not provide for efficient movement of general freight; and ■ PT network focussed on CBD.	Partially achieves objective: ■ involves interrupted flow traffic movement from west to north; ■ requires priority phasing of traffic signals for high-flow efficiency on Milton Road; and ■ requires upgrading of Hale Street and Hale Street intersection with Milton Road adjacent to Suncorp Stadium.
Address, in part, deficiencies in national network for the movement and distribution of freight in and around Brisbane	Partially achieves objective	Partially achieves objective: ■ requires major shift to PT mode (ie: more than double trend) for journey to work in CBD (ie: freeing up congested arterials).	Partially achieves objective: ■ would allow the movement of freight into the Milton commercial precinct and the CBD; ■ does not complete motorway-standard link in regional network; and ■ involves interrupted flow traffic movement from west to north.
Improve safety and reliability of the regional road network and provide relief to congested roads in Brisbane's inner western suburbs	Partially achieves road network objective Does not achieve objective for inner western suburbs	Partially achieves objective: ■ focussed on CBD trips; ■ requires multi-modal trips for each cross-city journey; and ■ does not address needs for regional road network.	Does not achieve objective: ■ does not complete motorway-standard link in regional network; and ■ would not provide an attractive alternative to southern freight route (ie: Logan Motorway, Gateway Motorway).
Provide opportunities for additional public transport network capacity in inner western suburbs	Does not achieve objective	Achieves objective: ■ extensive works in road and rail corridors; ■ extensive property impacts; and ■ affects other infrastructure (eg: Western Railway, Riverside Expressway, Inner Northern Busway).	Does not achieve objective: ■ could be supplemented to include bus lanes as additional lanes on Milton Road; ■ PT capacity would require further property impacts, above those required for additional traffic lanes; and ■ management of local access to support cross-city travel movements would impede enhancement of PT capacity.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Enhance amenity and connectivity, including and pedestrian and cycle connectivity, for inner western suburbs	Does not achieve objective	Partially achieves objective: ■ requires multi-modal transport hubs in key locations; ■ relies on convenience of services and stations; ■ cross-city travel still infiltrates inner western suburbs; and ■ extensive property impacts.	Does not achieve objective: ■ increased traffic lanes for cross-city and possible PT travel would increase Milton Road from 4 lanes to 8 lanes; ■ impact exacerbated with addition of 2 bus lanes in Milton Road; ■ pedestrian/cyclist connectivity north – south of Milton Rd would be constrained, limiting access to Coronation Drive path and local path networks; and ■ similar impacts for Hale Street.
Support economic activity in designated centres including the Brisbane CBD, Toowong and Indooroopilly, and the Australia TradeCoast	Partially achieves objective for Australia TradeCoast (South) only	Partially achieves objective: ■ cross-city travel requires multi-modal transport; ■ high-frequency services required for ATC (North) including Brisbane Airport; and ■ would support role and function of designated centres (CBD, Toowong, Indooroopilly).	Partially achieves objective: ■ Toowong would benefit from improved capacity on Milton Road, but would be impacted by improved capacity at High Street intersection and at High Street; ■ no direct benefit for Indooroopilly, some indirect benefit for CBD; ■ quality of road service impacted by interrupted flow (signals); and ■ limited benefit, if any, for ATC (North).
Support urban renewal in inner western suburbs	Does not achieve objective	Partially achieves objective: ■ opportunity to focus renewal and redevelopment around multi-modal transport hubs (Toowong, Milton, Indooroopilly); ■ cross-city travel still infiltrates inner western suburbs; ■ extensive property impacts; and ■ requires significant increase in residential density and intensity of economic activity for patronage.	Does not achieve objective: ■ Milton Road, Coronation Drive and Hale Street become high-volume, surface arterials with low amenity and environmental quality (ie: high traffic noise, air emissions); and ■ Increased traffic capacity off-set by adverse environmental conditions, reducing potential for urban renewal.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Secondary Objectives			
Improve urban amenity along arterial roads and inner western suburbs	Does not achieve objective: ■ amenity would continue to degrade with increased congestion on key arterials; ■ Increased pressure for rat-running through inner western suburbs.	Partially achieves objective: ■ opportunity for urban design with new infrastructure works; ■ cross-city travel still infiltrates inner western suburbs along key arterials; ■ extensive property impacts for PT lanes, works in rail corridor; and ■ potential to reduce road traffic noise, air emissions.	Does not achieve objective: ■ adverse amenity along arterial roads (Milton, Coronation, Hale) with few opportunities for mitigation; ■ adverse conditions for pedestrian and cycle movements; ■ reduced accessibility into inner western suburbs during peak periods required to support cross-city travel; and ■ limited opportunities for landscaping and beautification works along arterial roads.
Minimises environmental impacts	Does not achieve objective: ■ environmental conditions would continue to degrade with increased congestion on key arterials; and ■ traffic noise and air quality impacts on key arterials, traffic noise along rat-runs in residential areas.	Partially achieves objective: ■ reduces road traffic noise and air emissions as traffic diverts off rat-runs; ■ reduces road traffic noise on key arterials with mode shift for CBD trips; and ■ possible noise impacts through Indooroopilly and Toowong.	Does not achieve objective: ■ adverse environmental conditions (traffic noise, traffic dust, air emissions) not readily mitigated along arterial road frontages.
Minimises community impacts	Does not achieve objective: ■ connectivity and convenience would continue to degrade along and across key arterials.	Partially achieves objective: ■ opportunity to focus renewal and redevelopment around multi-modal transport hubs (Toowong, Milton, Indooroopilly); ■ opportunity to increase residential densities and intensity of economic activity around transport stations; ■ extensive property impacts through Indooroopilly, Toowong and Milton; and ■ cross-city travel still infiltrates inner western suburbs.	Does not achieve objective: ■ extensive property impacts, especially along Milton Road and Hale Street, possibly property impacts along Coronation Drive; ■ connectivity and convenience would rapidly degrade along and across key arterials; ■ limited opportunities to establish places of human scale and amenity; and ■ community foci likely to be lost or relocated elsewhere.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Maintains opportunities for on-going network enhancements	Partially achieves objective. ▪ requires active management of land use decisions to maintain network opportunities.	Achieves objective: ▪ assumes significant upgrades to PT network and to road network; and ▪ opportunities for subsequent road network enhancements and PT network enhancements, with property acquisitions.	Achieves objective: ▪ would allow for future upgrades to PT network and to road network; and ▪ opportunities for subsequent road network enhancements and PT network enhancements, with property acquisitions.
National Network Strategies[25]			
East-west transport efficiency: ▪ implement road safety improvements at high risk locations; ▪ investigate the transport network in Brisbane's inner-west for possible additional links to include the Centenary Highway and its connections to the network (for example Northern Link).	Partially achieves objective: ▪ relies on intersection upgrades on BUC and upgrade of Logan Motorway; ▪ does not address network flexibility and reliability issues; and ▪ does not address additional links with Brisbane Urban Corridor.	Does not address objective	Partially achieves objective: ▪ may not resolve high risk locations in network; and ▪ does not preclude additional links to Centenary Highway.
Improved freight distribution and travel around Brisbane: ▪ improve traffic flows on congested arterial roads; ▪ reduce risks at high incident road safety locations; and ▪ maintain and improve road pavements for the operation of high productivity freight vehicles.	Partially achieves objective: ▪ relies on intersection upgrades on BUC and upgrade of Logan Motorway; ▪ does not address network flexibility and reliability issues; and ▪ does not address congestion on key arterials.	Does not address objective	Partially achieves objective: ▪ provide alternative route to Logan Motorway / Gateway Motorway to ATC (North); and ▪ increased heavy vehicle traffic on surface roads in inner western suburbs (traffic safety, environmental and community issues).

[25] Department of Transport and Regional Services, 2007b, *AusLink Brisbane Urban Corridor*, Commonwealth Government, Canberra, www.auslink.gov.au.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Future passenger and freight transport needs to facilitate public transport operations and investigate demand management options for travel by private vehicles	Partially achieves objective: ■ relies on intersection upgrades on BUC and upgrade of Logan Motorway; ■ does not address network flexibility and reliability issues; and ■ does not address congestion on key arterials.	Partially addresses objective: ■ relies on significant increase in mode share for PT; and ■ requires 'bring forward' of some SEQIPP initiatives.	Partially achieves objective: ■ provide alternative route for general freight to CBD and ATC (North); and ■ could facilitate PT(bus) on expanded surface road capacity.
Regional Strategies (SEQIPP[26])			
Integrate land use and transport planning to reduce the need for travel within the region, through integrated corridor planning of major arterials and transit oriented development	Partially achieves objective (with 'bring forward' of SEQIPP): ■ will support transit oriented development (eg: Bowen Hills, Milton); ■ needs to reinforce roles of major activity centres (Brisbane CBD, Indooroopilly and Toowong); and ■ needs greater clarity for integrated corridor planning outcomes.	Partially achieves objective: ■ opportunities for transit oriented development in key locations (eg: Bowen Hills, Milton); and ■ requires land use change around transport hubs to support services with patronage (eg: Toowong, Indooroopilly, Milton).	Does not achieve objective: ■ corridor planning has not occurred for required network upgrades; ■ extensive property and land use impacts; and ■ limited support for transit oriented development.
Pricing and travel demand management to reduce private vehicle use, especially during peak periods	Partially achieves objective: ■ effective on tolled motorways only (Gateway, CLEM7, Airport Link, Hale Street Link); ■ further strategy implementation anticipated.	Not addressed by option	Not addressed by option

[26] Queensland Government, 2007d, *South East Queensland Infrastructure Plan and Program 2008 – 2026*, Part B: Transport, p19, Queensland Government, Brisbane.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
Providing a range of attractive alternatives to the private motor vehicle for travel in the region, such as public transport (all modes), and active transport (pedestrian and cycle use)	Partially achieves objective: ■ successful and on-going implementation of busway projects; ■ CDB focus for investment in active transport; ■ further investigations into increasing PT mode share; and ■ private vehicle travel still preferred and required as a consequence of regional land use pattern.	Achieves objective: ■ requires significant shift in travel preference to public transport (ie: more than double trend); and ■ multiple public transport trips required to travel across region from Western Corridor to Brisbane CBD and to ATC.	Not addressed by option ■ option does provide opportunities for in-corridor development of public transport capacity, if property and land use impacts were considered acceptable.
Maximising the efficiency of existing transport infrastructure, particularly road infrastructure	Partially achieves objective: ■ upgrades to key regional motorways (eg: Gateway Motorway, Logan Motorway); ■ key intersection upgrades (eg: BUC, Airport Roundabout).	Not addressed by option: ■ would relieve congestion on key arterial roads (ie: Coronation Drive, Milton Road); and ■ requires use of road corridors and rail corridors for bus lanes and other forms of mass transit.	Not addressed by option:
Building additional capacity in the transport infrastructure network, including public transport and road transport (ie motorways, arterial roads)	Partially achieves objective: ■ requires implementation of all SEQIPP measures (Part 5, Table 3); and ■ consider timing for implementation of WBTNI initiatives.	Achieves objective: ■ requires 'bring forward' implementation of all SEQIPP measures (Part 5, Table 3); and ■ consider timing for implementation of WBTNI initiatives.	Achieves objective: ■ requires 'bring forward' implementation of all SEQIPP measures (Part 5, Table 3); ■ provides opportunity for shared use of road infrastructure for PT, if property and land use impacts are acceptable; and ■ consider timing for implementation of WBTNI initiatives.
Local Strategies (*Living in Brisbane 2026*)			
Friendly, safe city	Does not address objective	Does not address objective	Does not address objective
Well-designed, subtropical city	Partially achieves objective: ■ provides for movement of people and goods in designated corridor; ■ does not support more efficient	Partially achieves objective: ■ enhanced public transport requiring development focus on transport hubs.	Does not achieve objective: ■ urban form dominated by high volume surface arterial corridors.

Northern Link Objectives and Transport Needs	Do Minimum	Optimise public transport	Upgrade surface road network
	urban form for inner city; and ■ needs to provide more effective support for designated centres.		
Smart, prosperous city	Does not address objective	Does not address objective	Does not address objective
Vibrant, creative city	Does not address objective	Does not address objective	Does not address objective
Clean, green city	Partially achieves objective: ■ enhanced public transport through implementation of SEQIPP initiatives leading to lower energy demand for transport.	Partially achieves objective: ■ enhanced public transport leading to lower energy demand for transport; and ■ requires development focus on transport hubs.	Does not achieve objective: ■ interrupted surface flow of high volumes of traffic; ■ reduced environmental quality (noise, emissions) without priority flow intervention; and ■ could facilitate increased PT (bus) capacity if delivered at the same time in corridors.
Accessible, connected city	Partially achieves objective: ■ requires 'bring forward' of SEQIPP initiatives to keep pace with growth; and ■ requires supplementary initiatives for inner western suburbs.	Partially achieves objective: ■ requires significant investment in infrastructure and property; and ■ requires development focus on transport hubs in inner western suburbs.	Partially achieves objective: ■ provides for cross-city movements in significant arterial corridors; ■ arterial corridors limit accessibility within and across neighbourhoods; and ■ reduced pedestrian/cyclist amenity for on-corridor travel.
Active, healthy city	Partially achieves objective: ■ provision of additional pedestrian/cyclist links to Brisbane CBD (eg: Tank Street, additional link)	Partially achieves objective: ■ could facilitate provision of additional pedestrian/cyclist links to transport hubs along key arterials and corridors.	Does not achieve objective
Regional, world city	Does not address objective	Does not address objective	Does not address objective

2.5.4 Summary – Alternatives to Northern Link

The comparative analysis of the alternatives to Northern Link advanced in the terms of reference was based upon a combination of:

- project objectives;
- national transport network objectives as expressed in the AusLink National Network strategy;
- regional transport planning objectives as expressed in the South East Queensland Infrastructure Plan and Program (SEQIPP);
- metropolitan transport planning objectives as expressed in the Transport Plan for Brisbane (TP4B); and
- objectives for *Living in Brisbane 2026*.

The options considered in the comparative analysis include the projects and initiatives in SEQIPP and TP4B, excluding Northern Link. None of them satisfied completely the project needs or the strategic objectives, demonstrating the need for a multi-layered response to transport planning at the regional and metropolitan levels. The impacts of implementing either the public transport option or the existing road network upgrade option are considered to be significant in terms of property, and impacts on community, environmental and economic attributes. For these reasons, neither of the options are likely to be supported either by government or by the community.

2.6 Oil Price Vulnerability and Oil Availability

An assessment of the vulnerability of the Project to global fluctuations in the price and availability of oil has been carried out, in response to the ToR. This assessment has covered the life of the Project, and investigated the potential impact of fuel price changes on:

- travel behaviour in the study area, including possible modal shift changes to public transport and non-motorised transport;
- traffic volumes using the project; and
- the commercial viability of the project over its life.

2.6.1 Peak Oil

Analyses of crude oil production data of the last 100+ years[27] generally conclude that the rate of discovery of crude oil has generally increased throughout the 20th century during which various peaks in production reflected geopolitical events such as World War II, major advances in technology such as offshore drilling techniques and major oil field discoveries such as the North Sea fields. Estimates of future global crude oil production indicate that production will plateau and decline based on assumptions that there are no known major fields left to be found on the globe, and no obvious technological improvements to extract significant volumes from resources not accessible at present.

Since the 'oil shock' of the 1970s, changing market conditions, further exploration and improved extraction technologies have contributed to maintaining production levels with some variations over time.

[27] Queensland Government, 2007a, *Queensland's Vulnerability to Rising Oil Prices*, (McNamara) TaskForce Report, Queensland Government, Brisbane

Regardless of the debate about whether the future outlook is optimistic or pessimistic, there is consensus that the world's crude oil resource is finite. There is a market expectation that technological advances would respond to the need for alternative energies for transportation and industry, just as steam-driven land transportation was largely and progressively replaced. While such technological advances are in development, governments are seeking practical steps to limit oil and petroleum usage wherever possible. Such actions include:

- efficient and attractive public transport systems – important but not the only solution to transport needs;
- promotion of more fuel-efficient engines;
- promotion of research into transportation based on alternative fuel sources;
- better integration of land use and transport planning to reduce dependence on private motor vehicles in the long term; and
- travel demand management (eg: economic incentives to change travel behaviours such as CBD cordon taxes).

Fuel consumption can be reduced by up to 30% and more for larger vehicles, by relieving congestion in urban streets to allow better traffic flow[28]. This avenue is being exploited throughout the world with road tunnels, ring roads and similar measures to reduce fuel waste in congested traffic. Public transport and travel demand management are among the Queensland Government initiatives aimed at reducing traffic congestion. For example, the Queensland Government has established an Urban Congestion Taskforce for this purpose (Queensland Government 2007c, p19).

Future Developments

Transport systems that rely on petroleum-derived fuels at present are expected to move progressively to development of alternative fuel sources. This transition has been foreshadowed in the Mc Namara report to the Queensland Government[29] and the Hirsch Report to the US Government[30] (Hirsch *et al.*, 2005).

Although the future is uncertain, it is likely that a number of criteria would drive the market development of these alternatives. One criterion likely to drive the consumer market is the flexibility of personal movement afforded currently by the private motor car and other forms of private motor vehicles. The freedom of movement afforded by private vehicles, combined with increased affordability, has been a major contributor to the global dominance of the internal combustion engine in personal and industrial land transport.

Whatever the future holds for land transportation, it is highly likely that road networks will continue to serve a critical function in society and in the economy for the movement of people and goods to places of common interest and commerce.

Personal Economics

The price of petrol and diesel fuel has risen steadily over the last 30 years, almost doubling between 1999 and 2006 (Queensland Government, 2007a) with a further 15-20% increase in the last two years. Throughout this period demand has steadily increased in line with increased motor vehicle registrations in all States and with

[28] Spalding, S., 2008, *RACQ Congested Roads Report: The Effects on Fuel Consumption and Vehicle Emissions*, Royal Automobile Club of Queensland, Brisbane.

[29] Queensland Government, 2007a, *Queensland's Vulnerability to Rising Oil Prices*, (McNamara) TaskForce Report, Queensland Government, Brisbane

[30] Hirsch R.L, Bezdek R. and Wendling R., 2005, *Peaking of World Oil Production: Impacts, Mitigation and Risk Management*, US Government, Washington DC.

increased population in Queensland in particular. There is no evidence that price increases have had any long term effect on motor vehicle use, especially in urban areas.

The convenience and flexibility provided by private motor vehicle travel appears to override other considerations, such as personal finances, for the majority of suburban residents in Australian capital cities. The demand for this mode of travel can be expected to continue in the future. Furthermore, the form and density of most Australian cities, including Brisbane and the other major centres in South East Queensland, demand a degree of reliance on private motor vehicle travel, at least to a public transport node. **Table 2-7** illustrates the low density of settlement in the Brisbane urban area compared with other Australian cities and international cities with arguably better public transport systems and a lower reliance on private motor vehicle travel.

Table 2-7: Comparative Population Densities – Australian & International Cities

City	Population (2008)	Urban Area (km^2)	Density (persons / km^2)
London	8,278,000	1,623	5,100
Paris	10,400,000	3,043	3,500
San Francisco	5,320,000	2,497	2,150
Vancouver	2,026,000	1,178	1,700
Sydney	3,641,000	1,788	2,100
Melbourne	3,372,000	2,152	1,500
Brisbane	1,676,000	1,826	900

Source: Demographia. (2008). *Demographia World Urban Areas: Population and Density*. Retrieved September 15, 2008, from Demographia: http://www.demographia.com/db-worldua.pdf

Whether there is a threshold price level at which a radical change in travel behaviour would occur and what that level might be cannot be determined with any rigour, having regard to the historic increases in fuel prices to date. Notwithstanding increases in fuel prices, measures are required to manage traffic congestion in urban areas in the short and medium term, in anticipation of the implementation of effective travel demand management. Market interventions to find viable alternatives for motor vehicle propulsion also will be necessary to extend the transition period to alternative fuel sources.

Government Policy Framework

The vulnerability of Queensland industry and way of life to rising fuel costs and ultimately declining fuel resources was comprehensively assessed by a Queensland Parliamentary Taskforce (Queensland Government, 2007a) with a series of far-reaching recommendations. The Queensland Government is yet to release its policy position in response to these recommendations and other factors. Consequently, there is no coordinated policy position against which this or any other infrastructure project could be meaningfully assessed.

In the interim, the proposed investment in road and other transport infrastructure contained in the SEQ Regional Plan and SEQIPP, may be taken as the formal policy position of the Queensland Government with regards travel demand management, public transport and other measures to address the impact of rising fuel prices on SEQ society and economic activity.

Transport Technology Development

The history of the development of motor vehicles illustrates the effectiveness of market forces on choice and technological advances. For example, steam-driven external combustion engines were used in motor vehicles from the late 1800s until the 1920s. The internal combustion engine only gained market superiority over steam when the Ford Corporation began mass production of large numbers of cheap motor cars. Advantages of the

steam-driven vehicle such as low pollution have not been sufficient to see it re-enter the motor vehicle market despite many highly significant technological improvements in its design.

Dramatic improvements have marked the design and performance of internal combustion engines and motor vehicles throughout the 20th century and up to the present day (eg: the recent trend towards hybrid-powered motor vehicles and small, highly efficient vehicles for urban travel). Following the 1973 spike in oil prices a worldwide trend was observed to smaller, more fuel-efficient vehicles for personal use, including the introduction of highly efficient diesel engines in both small private vehicles and large commercial vehicles. During this period the emergence of small electric vehicles for urban use, development of hybrid vehicles, research on hydrogen powered vehicles and conversion of internal combustion engines from petrol-driven to gas-driven mode have all occurred. For example, commercial production of a hydrogen fuel-cell powered motor car commenced in Japan in mid-2008. The technology exists to provide personal transport using renewable energy resources. As the incentive (loss or cost of fossil fuel sources) for such transport units increases, so the market share that they occupy will increase. There is good evidence to suggest that the need would remain for a road network in the urban environment well into the future. As with the existing network, the need to avoid congestion to minimise energy usage and thus cost, will be a high priority.

These improvements have been driven by a number of factors including cost, reliability, comfort, ease of maintenance and fuel efficiency, but the attraction and flexibility of independent travel has driven the overriding demand from consumers. This has not changed and is not expected to change over the life of Northern Link.

There is no realistic basis upon which forecasts about technological advancements in motor vehicle design and construction can be made, other than to anticipate that such advancements would continue and would certainly address alternatives forms of propulsion.

Alternative Energy Sources for Transport

The Queensland Government Taskforce Report (2007a) cites three "potential pathways currently emerging for passenger/freight transport [in Queensland]. These include:

- diesel hybrid, moving into electric vehicles;
- hydrogen fuel cells, either with internal fuel reformation on board (including gas, ethanol) or hydrogen supply networks; and
- CNG/LPG gas, moving into gas-electric hybrids."[31]

A discussion on the constraints of each of these technologies follows below.

Diesel Hybrid

As fuel prices increase, it is expected the demand for diesel powered vehicles would also increase. Diesel cars consume 30% less fuel than petrol engines and emit 25% less carbon dioxide emissions (Renner, 2008).[32]

In Europe, diesel powered cars account for 50% of total sales and worldwide, demand for diesel vehicles is projected to increase from 16 million in 2007 to 29 million in 2017, resulting in an increase in market share from a current 23.6 percent to 31.5 percent (Renner, 2008).

[31] Queensland Government, 2007a, *Queensland's Vulnerability to Rising Oil Prices*, Taskforce Report 'McNamara Report', Brisbane

[32] Vehicle Production Rises, But Few Cars Are 'Green' Michael Renner - http://www.worldwatch.org/node/5461#notes accessed 3 June 2008.

The transition from a majority of petrol engines to diesel is unconstrained by technology or delivery infrastructure and therefore small diesel powered vehicles are considered the first stepping stone in the pathway to lower oil reliance.

Electric Vehicles

The current limitation of electric vehicles is battery technology. Battery storage capacity limits the distance a vehicle can travel before it needs to be recharged and with current technologies, pure electric cars are limited to short travel distances. A hybrid vehicle allows the battery to be recharged as it travels, increasing the distance a hybrid vehicle can travel with the benefit of lower petrol consumption. Batteries also have a finite lifetime, and their charge capacity diminishes over time and with use.

Electric vehicles are also reliant on current stationary electricity generation. Uptake/increase in the number of electric vehicles would increase the load on current networks requiring the generation of more electricity.

However, electricity in Australia is also largely generated by the burning of non-renewable fossil fuels which produce considerable greenhouse gas emissions. A transition to a more renewable energy economy would therefore need to occur in parallel with the development of hybrid electric and electric cars.

Notwithstanding the above constraints, electric vehicles are considered to be the most feasible long-term solution to oil-reliant transport. Battery technology is constantly improving and the largest advantage is the well developed electricity transmission network and generation efficiency which exceeds smaller scale generation efficiency.

Natural Gas

Compressed Natural Gas (CNG) is currently being used by Brisbane City Council in its bus fleet. The distribution network for natural gas is well developed, however to be transformed into CNG it requires compression. Individual compression units are available but the use of CNG for passenger vehicles is constrained by the lack of refuelling capability at service stations.

The dominant use for natural gas in motor vehicles is in fuel cells. This would make use of the well-developed distribution infrastructure. An Australian company[33] is currently developing a fuel cell that converts natural gas into electricity. These fuel cells are highly efficient in electricity production and are considered a viable alternative to petrol engines (Queensland Government, 2007a).

The main limitation associated with natural gas is that it is a finite resource and is being increasingly used in gas fired power stations. The Queensland Government Taskforce report suggests there is "insufficient gas for the resource to fulfil all roles at the exclusion of others."

Biofuels – Ethanol and Biodiesel

Ethanol

Ethanol is characterised as a fuel extender, being used to blend with petrol. Ethanol is used in Australia and extensively in Brazil with up to 80% ethanol blend and only requires slight modification of petrol engines. The use of ethanol in Australia is limited by the capacity to economically grow the ethanol crops (sugarcane, sorghum and otherwise), but with imported crops, ethanol use has potential to increase in the future.

[33] Ceramic Fuel Cells

Biodiesel

Biodiesel has more potential than ethanol as it can be manufactured from a wider range of crops and waste materials such as cooking oils. However, despite the diversity and like ethanol, biodiesel is limited by availability of feedstock and a constrained distribution network. Biodiesel has a high potential to be a substitute for oil and its use would become more widespread with government support.

Hydrogen

Hydrogen is not found naturally in high quantities. The main sources of hydrogen are from steam reformation of gas, capture of hydrogen as a by-product of crude oil refining and steam reformation of coal. Hydrogen can also be formed by stripping from water but this is highly energy intensive.

The expected pathway in the use of hydrogen as the main transport propulsion source is electric hybrid to hydrogen electric to hydrogen fuel cell.

A viable hydrogen economy would require significant investment in distribution infrastructure and considerable advancement in production and storage technology. However hydrogen has the potential as a green, renewable fuel. The McNamara report suggests this is about at least 30 years away.

Car Technology Advances

In the ten years since launching its first generation Prius in 1997, Toyota has sold over one million hybrid vehicles worldwide (Toyota, 2008[34]). The success of the first and second generation of Japanese hybrid cars is driving the development of alternative engine and fuel technology. At present, there are approximately 40 different hybrid models (including sedans, sport cars, 4WD's and light trucks) in various stages of development worldwide. Toyota is currently in the process of introducing hybrids for its entire product line, while Ford is planning on doing the same. Estimated forecasts on worldwide uptake of hybrid vehicles vary, with figures ranging from approximately 3% to 30% of all motor vehicles sales by 2012 (Halal, 2008[35]).

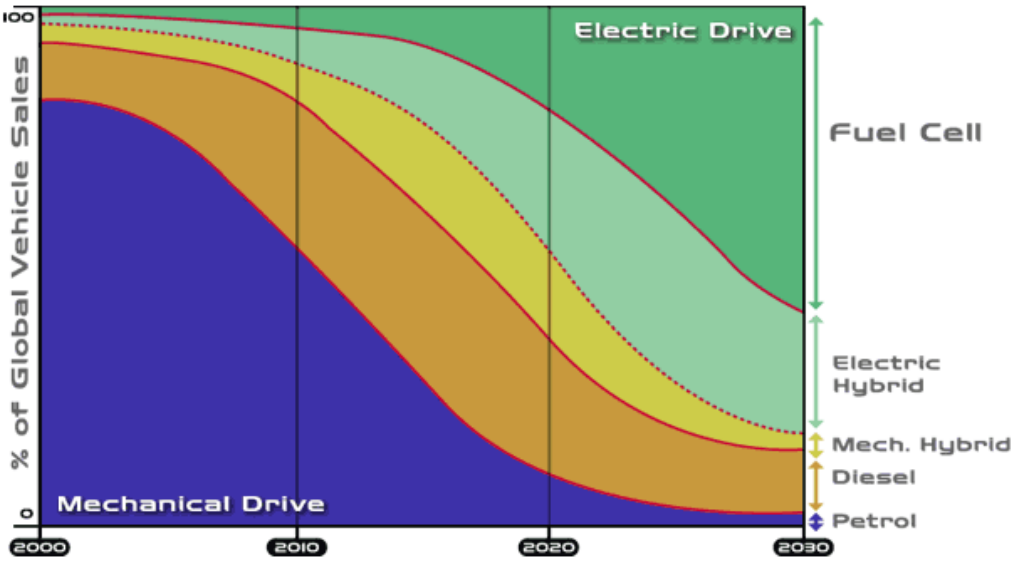
According to Holden (2008[36]), electrical and hybrid drive engines would account for over three quarters of all global vehicle sales by 2030 (**Figure 2-5**).

[34] Klose, Steane, 2008, *Toyota sells one millionth Prius*, article in 'The Motor Report', http://www.themotorreport.com.au/4689/toyota-sells-one-millionth-prius/

[35] Halal, W, 2008, *Hybrid Cars*, Techcast, http://www.techcast.org/BreakthroughAnalysis.aspx?ID=80, viewed on 15 August 2008.

[36] Holden Australia, 2008, *Holden Hybrid Technology*, http://www.holden.com.au//images/downloads/holden_hybrid_2.pdf, pg 1-4.

- **Figure 2-5 Predicted Evolution of Vehicle Engine Types.**



The vertical axis is total world sales and the horizontal axis covers the next thirty years.
source: Holden Advanced Engineering

Hybrid cars use battery powered electric motors to drive wheels, regenerative breaking to store energy in the battery and small gasoline engines to power the vehicle at higher speeds. Recent advances in hybrid technology include the development of larger capacity batteries, better drive trains and lighter materials. Apart from hybrid technology, car manufacturers are also developing 'plug-in' electric cars (recharged through a standard power socket) and making further advances in diesel engine and hydrogen fuel cell technology.

Technological developments are also occurring within the Australian automotive market. A brief summary of technological advances from key car manufacturers is provided below.

Toyota

In August 2008, sales of the Prius in Australia passed 10,000 vehicles (O'Kane, 2008). Along with the success of the Prius, Toyota continues to move forward with the development of hybrid motor vehicles. In June 2008, the Australian Government announced plans to begin construction of a hybrid Camry at the Altona plant in Melbourne by 2010 (Toyota, 2008). Toyota is also modifying engines to run on alternative fuels, including natural gas, as well as developing electric vehicles and fuel-cell hybrid vehicles.

Honda

Honda's third-generation Civic Hybrid continues to gain popularity within the Australian market. In 2008, the Queensland Government purchased fifty new Civic Hybrids expanding its existing fleet. The Civic Hybrid is powered by a small 1.3L engine, using only 4.6L/100km, and delivers similar performance to a two-litre sedan (Honda 2008a). In addition to hybrid technology, Honda continue to refine its i-VTEC fuel efficient gasoline engine, devising a new combination of variable valve timing and precision that pumps fuel only as required (Honda 2008b).

Holden

Holden does not currently sell hybrid vehicles, but is researching potential hybrid technologies. In partnership with CSIRO, Holden is developing an electric hybrid prototype of the Commodore that uses a small four-cylinder engine and electric motor to drive the front wheels. According to researchers, the hybrid will attain comparable performance levels with significant reductions in fuel consumption and emission (Holden Australia

2008:1-4). Holden anticipates that the hybrid Commodore will be released in Australian by 2010 (Dowling 2008).

Ford

Within the Australian market, Ford has focused on improving existing gasoline engines. However, within the international market, Ford is developing a range of new technologies including 'Flexible' Fuel Vehicles that can run on 85% ethanol, and combining hybrid and hydrogen fuel cell technology (Ford Motor Company 2008).

All major car manufacturers are researching, building and testing motor vehicles that are powered by alternatives to conventional gasoline engines. The following list in **Table 2-8** shows a selection of vehicles that are either at market, soon to be released or at concept stage.

Table 2-8 Current and future cars with alternative fuel and engine technology

2008	
Hyundai Accent/ Kia Rio Hybrid (5 seat hatchback)	Could be the first hybrids to have a retail price under US$20 000. Currently 'real-world' testing 4,000 Rio Hybrids with the Korean Ministry of the Environment.
Mercedes S-Class Hybrid (Luxury Sedan)	'Direct hybrid' boasts 33% improvement in fuel economy to conventional S-class.
Audi Q7 Hybrid (Midsize SUV)	23% less fuel use than conventional Q7.
2009-2011	
Toyota Prius Generation 3 (5 seat sedan)	Increased fuel savings coming from drive train redesign and simplification.
Smart Hybrid (2-seat hatchback)	System employs belt-driven starter/generator, switches engine off when idling to conserve fuel and reduce emissions.
Honda Fit or CRX Hybrid (5 seat hatchback):	Outfitted with the Insight's hybrid drive train (the Insight was discontinued in September 2006).
Concepts:	
Audi A1 Metroproject Quattro:	Four-seat plugin hybrid, up to 60 miles on battery power alone. Fuel economy is said to be approximately 57mpg, and carbon emissions a low 112g/km.
Ford: reflex concept car.	The two-seat car is equipped with a diesel-electric drivetrain. Second electric motor attached to the rear axle, giving all-wheel-drive capability. Uses advanced technology lithium-ion battery pack to store energy. Solar panels on the Reflex convert sunlight to electricity to power the headlights and taillights.
Mitsubishi Concept-CT MIEV:	The four door car has all-wheel drive and a 1.1-litre gasoline engine. Each wheel has its own electric motor.
Peugeot 308 Hybrid concept:	Hybrid diesel system, 1.6 litre diesel engine is combined with an electric motor giving it a total 132 hp. Plans to have diesel hybrids in production by 2010.

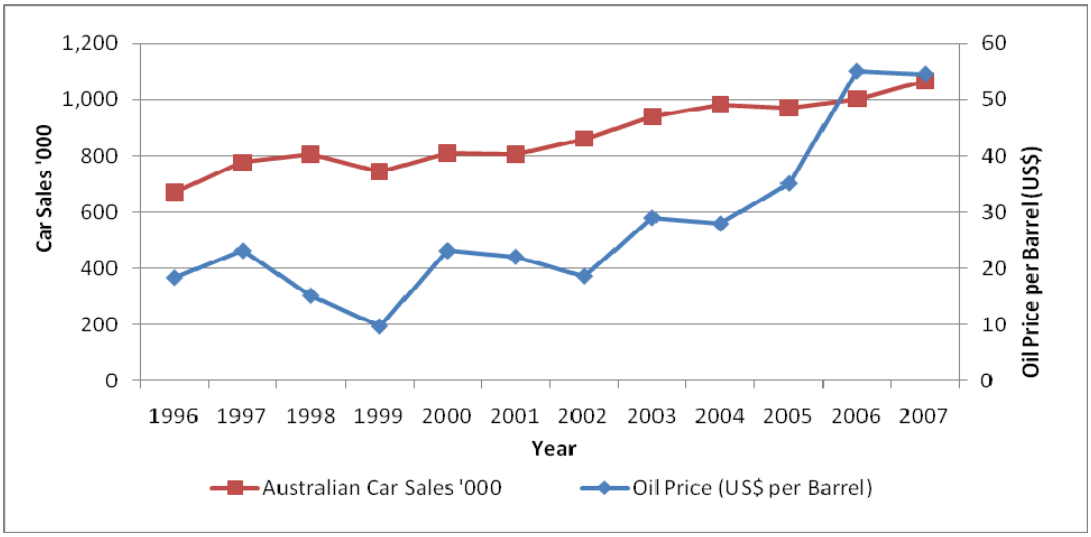
Source: HybridCentre, 2008, *Hybrid Vehicle Timeline*, http://www.hybridcenter.org/hybrid-timeline.html, August 2008.

Trends in Motor Car Ownership

A comparison of the global oil price (US$) per barrel with Australian car sales between 1996 and 2007 is presented in **Figure 2-6**. The comparison indicates that car sales have continued to grow despite sharp increases in the price of oil. Between 2005 and 2006, the oil price jumped $19.47, increasing by approximately 36% over

the year. However, car sales continued to grow over the same period, with 33,000 more new cars sold than the previous year, topping one million new car sales for the first time in Australian history[37].

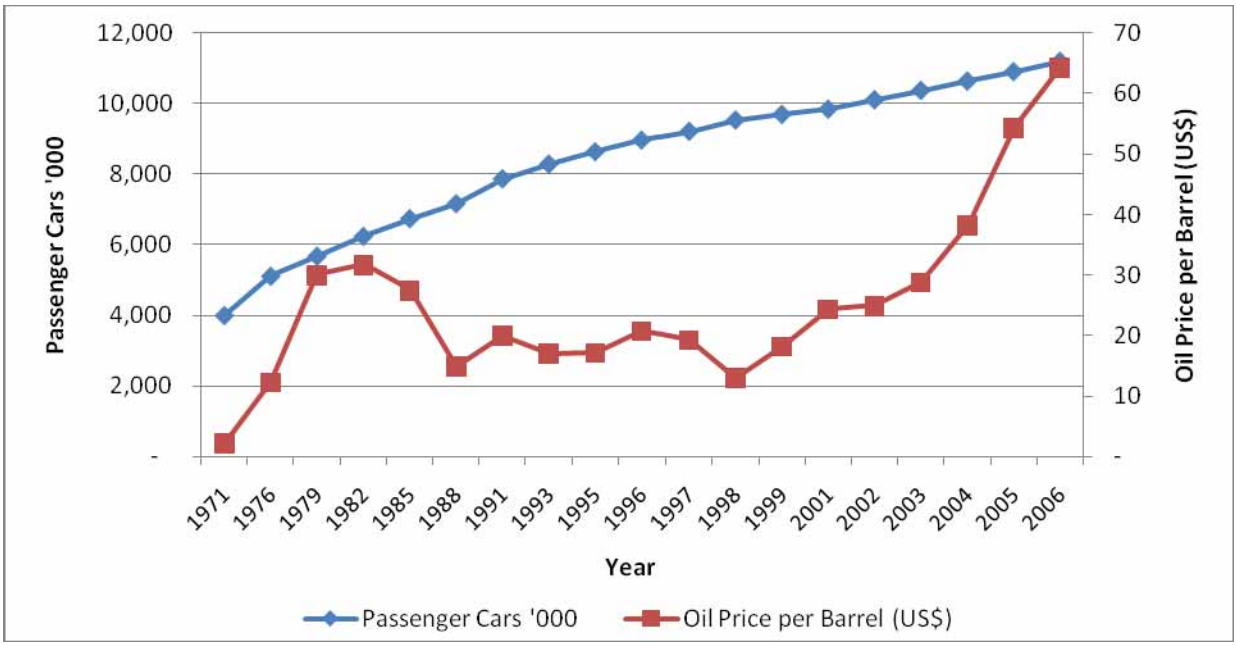
- **Figure 2-6 Australian New Car Sales Compared to Global Oil Price**



Source: ABS 2008, US Energy Administration 2008.

Australian car registrations have grown steadily between 1971 and 2006, despite significant oil price fluctuations over the same period, including the high prices experienced during the 1970s oil crisis, as demonstrated in **Figure 2-7**.

- **Figure 2-7 Australian Car Registrations compared to Global Oil Price**



Source: US Energy Administration, 2008a; 2008b, BITRE 2008:62.

[37] The Age, 2007, *Aussie car sales top seven figures*, http://www.theage.com.au/news/Business/Aussie-car-sales-top-seven-figures/2007/07/04/1183351264102.html, July 04 2007.

2.6.2 Summary – Oil Price Vulnerability

While there is agreement in the literature that global oil resources are finite, there is no consensus regarding the potential impacts on travel behaviours and travel demand. There is evidence that the motor vehicle industry is moving towards alternative fuel sources, reinforcing the view that for most people, some form of motorised personal transport is necessary to the extent of not being impacted completely by rising fuel prices.

While the Queensland Government is yet to determine a policy position with regard to oil price vulnerability for transportation and economic development, the SEQ Regional Plan and SEQIPP are taken to reflect current policy on transport planning and travel demand management.

A sensitivity test was carried out using the Northern Link Traffic Model to explore a potential response to rise in fuel prices (see Section 5.4.5 in Chapter 5, Traffic and Transport for detail). 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 (eg: Gateway Motorway) in favour of more direct routes such as via CLEM7 and Airport Link. The overall forecast traffic volumes on Northern Link were found to be similar to those forecast with standard operating cost assumptions.