5 PRELIMINARY ECONOMIC ANALYSIS

5.1 INTRODUCTION

A preliminary economic analysis of the proposed Northern Link has been completed by EY to inform the development of the Preliminary Assessment.

At this stage of the Preliminary Assessment, the economic analysis has focused on the development of preliminary quantification of benefits and costs and a qualitative assessment of benefits and impacts that are difficult to quantify. Based on Council's advice and in light of the provisional nature of available data inputs and assumptions at this stage, no formal quantification of the Project benefit-cost ratio (BCR) has been conducted. It is expected that current assumptions and data inputs will be reviewed and refined should the Project progress to the Business Case Development stage.

The following outlines the key findings from the report and provides a consideration of the strategic need to develop the Northern Link from an economic perspective.

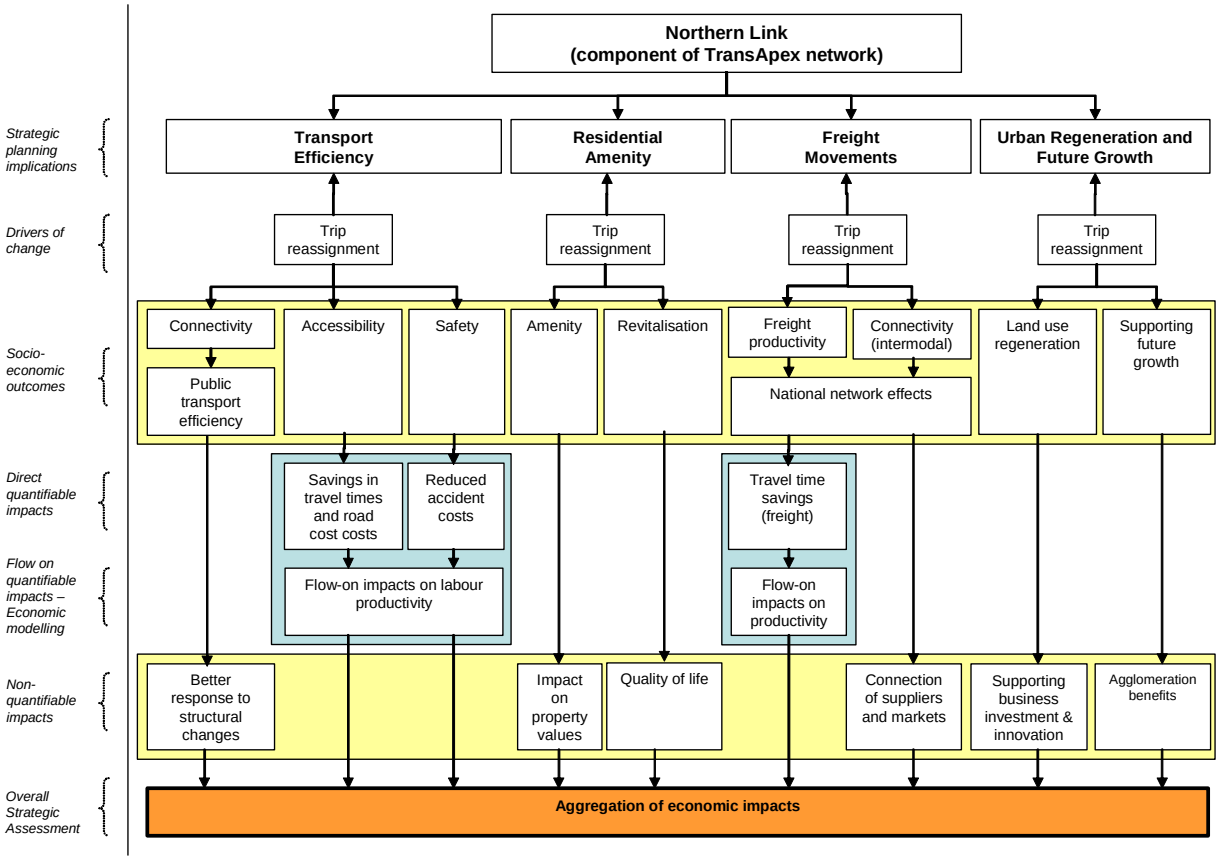
5.2 ECONOMIC CONTEXT

5.2.1 Critical Missing Link

As discussed in Sections 3 and 4, Northern Link is a critical fourth leg of the *TransApex* strategy to close the east west transport gap from the Western growth area to the CBD and the Australia TradeCoast, to ultimately improve the overall efficiency of Brisbane's transport system. Figure 1 on page 16 presents the *TransApex* system, including Northern Link.

The range of benefits and impacts of Northern Link is potentially substantial with the Project providing critical support for the continued economic development of Brisbane and Queensland. Figure 5 provides a high level depiction of the range of impacts on transport efficiency, residential amenity, freight movements and urban regeneration.

Figure 5 Mapping of Quantifiable and Critical Qualitative Aspects



Many of the benefits arising from Northern Link are difficult to quantify. These include its strategic fit with the broader SEQ transport planning needs and the impacts on improved responsiveness of the transport network to service urban liveability requirements. The benefits extend to achieving better connections between suppliers and markets and potential agglomeration benefits.

Section 5.3 below provides a consideration of the qualitative impacts of Northern Link, followed by the assessment of direct and flow-on quantifiable impacts in Section 5.4.

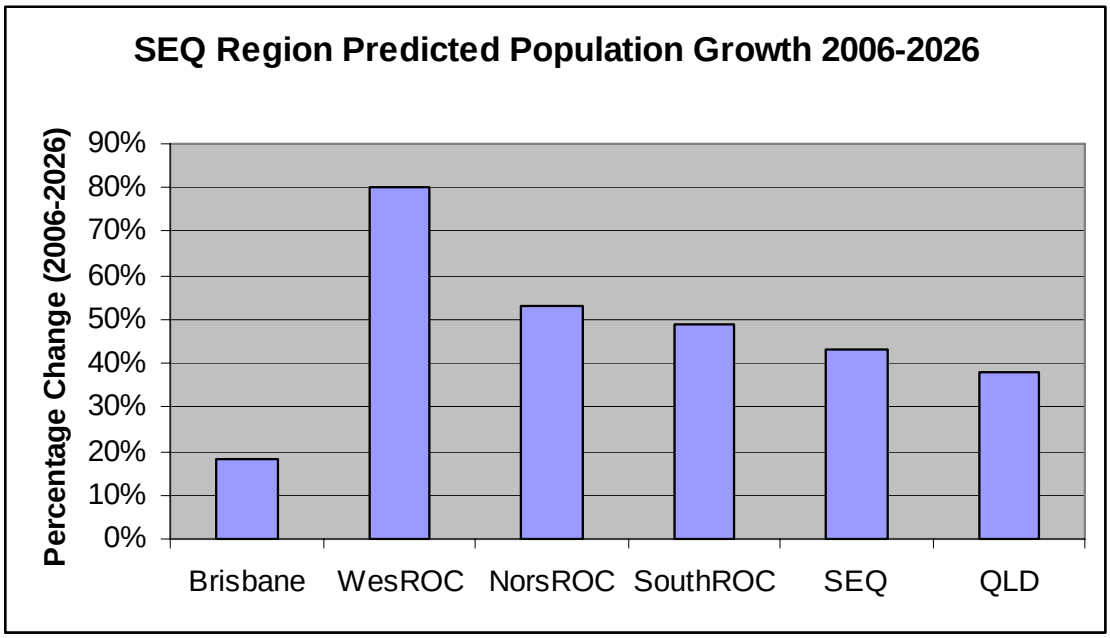
5.3 QUALITATIVE ECONOMIC IMPACTS

5.3.1 Strategic Alignment with SEQ Transport Planning Needs

To better understand the strategic fit of Northern Link, it is important to note the two crucial trends which have prominent influence on the region's future transport planning requirements:

- Rapid and sustained population and housing growth within the region, in particular the Western Corridor and inner west suburbs of Brisbane (see Figure 6).
- Growth in industrial activities and the development of significant economic hubs in the region, including the Western Corridor which includes Ipswich City and the emergence of the Australia TradeCoast which incorporates Brisbane Airport and the Port of Brisbane.

Figure 6 Population Growth Rates



Source Northern Link Planning Needs Assessment

The Western Corridor is a significant growth area for SEQ based on suitable land for large-scale industries and logistics, existing freight transport links to the state and national highways and rail networks, and a competitive employment and energy resource base. The manufacturing sector is a strong generator of sustainable future employment and economic growth in the area. The magnitude of future growth throughout the corridor has been recognized as a key feature in the SEQRP to encourage urban development away from the coast. However, this development will be constrained without the provision of effective transport systems. The timely development of transport infrastructure to lead this growth will be vital.

Considerable changes in land use, settlement, commerce and employment are therefore expected over the next 20 years for major urban growth corridors such as the Western Corridor, including development of regionally significant commercial and industrial parks, potential establishment of one or more major intermodal freight hubs and new master-planned communities. The expanding population settlement will further drive the revitalization of local activity centres such as the development of local trading precincts and shopping centres.

These activities will give rise to increased trip generation within and out of the regional centres to the metropolitan areas of Brisbane and beyond.

On another side of the CBD, the Australia TradeCoast is a key area of industrial development, transport and multimodal logistics, manufacturing and import/export activities in the north of SEQ. It is Queensland's export gateway to the world and a significant generator of employment.

It is imperative for critical economic infrastructure such as the Brisbane Airport, Port of Brisbane and the Australia TradeCoast to be easily accessible to cater to the input needs of the growing regional satellite centres. Given the forecast doubling of freight tonnage across all of Queensland by 2020[14], identifying a strategic transport and freight network that connects areas such as the Port of Brisbane and Australia TradeCoast to major manufacturing and interstate transport corridors will be vital to maintain and develop the strategic advantages of the logistics hub within the state and national economies. Northern Link presents a meaningful enhancement of Brisbane's road network, through providing a feasible alternative road freight route to redirect freight traffic going to the port via existing congested freight routes.

The implications of the improved efficiency in freight transport to/from regional activity hubs to the Port of Brisbane are significant for the SEQ economy and export profile. Port of Brisbane is Australia's fastest growing container port, generating an annual contribution to the Queensland economy of $770 million. In 2005/06, throughput at the port reached 26.7 million tonnes. Throughput for the period July to December 2006 was 13.6 million tonnes, which represented a strong growth of 9.6 percent, or 37,000 containers, compared to the same period in 2005-06. The growth in container trade is expected to continue, but the sustainability of this growth (and the economic contribution to the SEQ and the State) will require the necessary freight transit infrastructure including robust road networks. Over 80% of the containers handled at the port arrive and depart by road.[15]

In summary, the provision of an efficient transport link between satellite regional economic hubs to the Brisbane CBD and other significant commercial hubs will be important in facilitating a number of strategic needs:

- the need for Brisbane to service the business, retail and administrative requirements of the growing regional centres (including a growing employment base);
- the need to facilitate the safe and timely flow of input materials and final goods and services between key activity centres; and
- the need to support the efficient flow of freight goods to/from the relevant markets, including Brisbane CBD, the Port of Brisbane and the Australia TradeCoast.

5.3.2 Addressing Local Planning Issues

At the local level, the congestion issue is a significant weakness of the current western road network which affects travel efficiency, with impacts on amenity, environment, accessibility and overall, upon land use, and regeneration of older, established areas.

The challenge is to manage the increasing congestion issues along the regionally significant east-west route (eg. Milton Road and Coronation Drive), in order to improve accessibility for local and freight movements and to address the erosion of amenity and recreational values. As an indication:

- Even with the benefits to the eastern sector of the city associated with new infrastructure such as the Gateway Upgrade Project and Airport Link, traffic modelling indicates that travel speed along the east-west cross city route will decline by around 25% during the AM peak period and by 15% during the PM peak (which adversely impacts labour and business productivity);
- Traffic from the western approach to the CBD, Brisbane Airport and the Australia TradeCoast is currently along congested 'interrupted flow' urban arterial roads in the inner north-west suburbs, due to a lack of motorway standard routes on this natural desire line. The arterial roads directly abut and serve a range of local, urban land uses (which adversely impacts local amenity and restricts urban regeneration opportunities);

[14] *South East Queensland Infrastructure Plan and Program 2007 – 2026*, Queensland Department of Infrastructure, May 2007.

[15] See www.portbris.com.au

- The risk of grid-lock and adverse impacts on freight productivity will only exacerbate with infill residential and commercial developments in the inner urban areas; and
- Suburban centres should attract shopping trips from local communities and need to be easily accessible to maintain the viability of businesses within them.

Traffic modelling undertaken by SKM/CW indicates that Northern Link will reduce travel times and traffic congestion on arterial and suburban roads across the Brisbane network.

5.3.3 National Perspective

Northern Link delivers the remaining missing link in the creation of the Brisbane North Urban Corridor within the AusLink National Road Network.

It could form part of the AusLink National Network in the future by completing a motorway standard east-west corridor extending from Ipswich and the western growth areas to the CBD, Australia TradeCoast and Gateway Motorway. This would occur via the route formed by Centenary Highway - Western Freeway - Northern Link – ICB - Airport Link. This will benefit freight movements along the Melbourne and Darwin to Brisbane routes and the Brisbane to Cairns route as well as freight transit to major intermodal hubs (rail, port and airport infrastructure) in the network.

5.3.4 In Summary - What Northern Link Delivers in the Context of Regional and Local Strategies

Northern Link will better connect the regional markets with the Brisbane CBD and will deliver strategic benefits and time savings in relation to the cross city movement of goods and services from/to the Western growth corridor to/from the CBD, the airport infrastructure in the Australia TradeCoast north and beyond (including the Port of Brisbane). This is important for maintaining the export gateway profile of the region on a national and international level.

Northern Link would ease traffic congestion on the western city corridors of Coronation Drive and Milton Road. The Reference Project will provide a natural desire route crucial to the redirection of traffic away from the arterial and suburban roads in the inner west suburbs to a new motorway standard link.

The resultant changes to the transport network removes freight traffic from inner city areas and will provide for reduced transport costs, improved air quality and general amenity to inner city areas, especially for those in proximity to major transport routes. Potentially, this will result in a more vibrant inner city better equipped to accommodate increased activity and populations.

5.4 QUANTIFIABLE ECONOMIC IMPACTS

Preliminary quantification of economic impacts has been completed from the perspective of the Northern Link component only of the wider *TransApex* network. It is important to note that the additional link will support the achievement of the benefits inherent in the other components of *TransApex*, including Airport Link.

5.4.1 Preliminary Cost-benefit Analysis

The economic analysis has estimated the values of travel time savings, vehicle operating cost savings, reduction in accident costs, project costs and externality impacts using parameter values consistent with those used for other road projects and Austroads project evaluation guidelines. On a conservative basis, the analysis has modelled Northern Link as a toll project. The analysis uses the traffic forecasts provided by the SKM/CW and project costs as advised by consultant burmanGriffiths. These inputs and assumptions are contained in Appendix 1.

The traffic modelling takes into account the changes to traffic flows and associated toll assumptions across the *TransApex* integrated network (Northern Link, NSBT, Airport Link, Hale Street Link and Gateway Bridge). The traffic forecasts indicate net improvements on vehicle hours travelled across the network and a slight increase in vehicle kilometres travelled from the rerouting of arterial and suburban traffic to Northern Link.

The economic modelling is conducted over the planning and construction period from 2008 to 2012 plus a 30-year operating period to 2045. The modelling shows that, in present value terms:

- Light and heavy vehicle users will reap slightly over $519 million in savings from reduced travel time as a result of the rerouting of traffic from arterial, suburban and local roads to the motorway quality Northern Link;
- Travelling on the motorway may generate environmental externality costs of around $10 million. This impact will be offset by an additional $37 million in cost savings from the smoother vehicle journey which minimizes fuel along with vehicle wear and tear (compared to a 'stop-start' model);
- The reduction in accident costs in the network will give rise to $26 million in benefits;
- Assets created by the tunnel link will have a residual value of $6 million at the end of the forecast period.

The net direct benefits from operation of the Northern Link total around $578 million in present value terms. In particular, the travel time savings is a significant component of benefits accruing to business, freight and private road users. This improved accessibility will lead to broader benefits to the efficient functioning of the labour market and business productivity:

- For workers, the shorter commuting times will widen the employer market opportunities by reducing travel time related frictions in the job search process.
- For businesses, this can expand the size and diversity of the labour catchment, and support the better matching of workers and skills to jobs.
- For freight and export sectors, the efficient connection of parts of the network which are acting as hubs, eg. airport, freight distribution centres, mainline train station interchanges and port infrastructure, is extremely important for the flow of goods from source to destination markets.

The generation of such network benefits (and others as identified further below) comes at a cost, being the funding of the construction and operation of the tunnel link. Capital costs including construction, land acquisition and client planning costs are estimated to be $1,198 million in present value terms, incurred at the front end of the forecast period. Operating costs including operating and maintenance, and repair and replacement costs are estimated to be $226 million spread out over the operating period to 2045. Determining the net cost of the Project to the State will require further examination of any funding shortfall between toll revenue and the capital and operating costs, and the approach to meeting any funding requirements.

5.4.2 Regional and State Impacts

While the dollar scale of direct travel time savings is significant, it is also important to recognize that time savings to businesses, workers and the freight sector will generate additional value-added benefits on productivity levels and investments. For example, the improved journey times and journey reliability reduces costs to the freight sector, which provides future opportunities for investment in expanding the load capacity of freight carriers. Freight movement more generally could be better managed through improved reliability, which would allow reductions in inventories and long run optimization of vehicle use. Economic modelling based on input-output (IO) analysis estimates that the value-added impacts to the State of improved labour, business and freight productivity is around $232 million in present value terms, with the majority of benefits accruing to the SEQ region.

In addition, the construction and operation of Northern Link will generate additional demand and employment in the steel, concrete, tunnelling equipment, utilities, labour and contractor sectors. The contribution to GRP and GSP from the flow-on industry activity is estimated to be $846 million and $962 million[16] respectively in value-added terms after allowing for the potential leakage of expenditure of inputs and expertise (eg. tunnelling equipment, contractor services) out of Queensland.

The IO analysis captures the sequences of demand effects which arise from linkages between industries in the chains of production and distribution of goods and services in response to shocks in industry activities. Note that, to the extent the funding structure for Northern Link results in a redirection of funding which may otherwise be spent on other projects within the region, the quantified outcomes may not be regarded as a net economic contribution; rather, they would represent a redistribution of activities from one area of the economy to another.

5.5 DELIVERING WIDER NETWORK IMPACTS, AMENITY AND URBAN REGENERATION

The implications of Northern Link go significantly beyond the direct quantifiable impacts. The broader effects of fulfilling the gap in east-west connection in the greater Brisbane area include:

- **Enhancement to the economy's responsiveness to structural changes** - These changes come from the increasing demands on the factors of production (labour, materials etc) from growth in industries and trading as a result of sustained population growth, the need for business and labour mobility as a result of tight labour markets and new urban settlements around regional economic hubs, and the growing significance of the region's airport and port infrastructure and intermodal hubs. Northern Link will provide the critical enabling infrastructure to support an effective transport system that can help the regional economy better respond to these needs, helping to minimize bottlenecks and the risks of grid-lock on the function of markets.

- **Connection of suppliers and markets** - Improved connectivity of the road network not only allows quicker access to current destinations but will open up opportunities for new destinations or markets and new combinations of journeys, which may previously be too costly and/or lengthy.

- **Agglomeration benefits** - An effective transport system which clears bottlenecks and effectively links the productive capacity of firms with service and housing infrastructure is likely to support agglomerations of economic activity. It is intuitive, therefore, that agglomeration benefits may be an important network effect of the transport connections created through the *TransApex* system including Northern Link.

- **Business investment and innovation** - The productivity benefits to business from agglomeration and efficient transport links, as captured through improved returns, may encourage a higher rate of business investment and innovation at the local level which generates further economies of scale. Business investment and innovation extends to land use concepts, where the provision for appropriate use of roads in the system (or mitigation of inappropriate use such as freight traffic on arterial roads) may open up opportunities for the development and revitalization of local areas (eg. encourage tourism initiatives and other mixed use developments which to date have been affected by through traffic).

[16] The present value contribution to the rest of the State economy (outside of SEQ) is around $116 million in value-added terms.

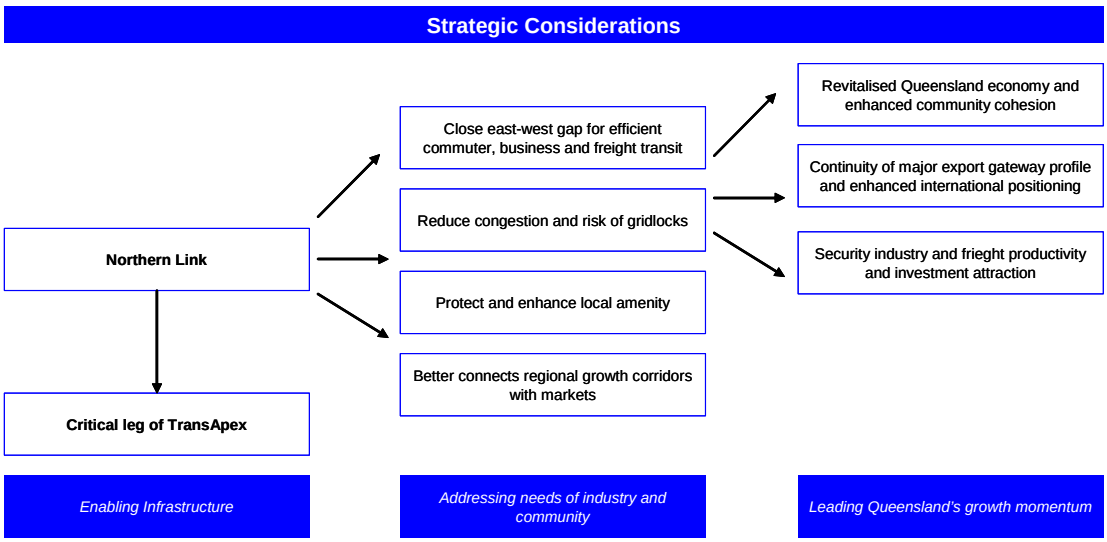
- **Improved residential amenity and quality of life** - Northern Link is expected to reduce traffic congestion and pollution in residential areas, and increase mobility of workers to employment in metropolitan and regional centres. By removing through traffic by heavy vehicles, it also creates better access to recreation, education and medical facilities and opportunities for improving local public transport system and pedestrian movement. These impacts will directly enhance amenity values, however measurement of amenity values is intrinsically difficult. Using property values as economic indicators, anecdotal research shows that the amenity benefits arising from new road infrastructure have a notable corresponding impact on real estate values. As a recent example, the 'Eastlink Effect' in Victorian has seen house prices rise in 14 of 20 neighbouring suburbs in two years. New roads can create value growth for residential areas and provide added incentive for securing new industrial development and private sector commercial investments.

- **A more efficient overall transport network for public and private transit by allowing direct SW/NE movements clear of the CBD that were never feasible previously**.

5.6 CONCLUSION

Northern Link delivers a critical aspect of the *TransApex* system - addressing the gap in east-west transport efficiency in the greater Brisbane area. It is important for any strategic evaluation of Northern Link to recognize that its implications are critical to the optimization of network benefits that are envisaged under the *TransApex* strategy where "the value of the whole is greater than the sum of parts", as illustrated below.

Figure 7 Economic Impacts



The benefits of Northern Link include:

- Direct time savings for commuters, businesses and freight worth slightly over $500 million in present value terms, which in turn lead to reduced costs to businesses and the freight sector, and future opportunities for investment in expanding production capacity or the load capacity of freight carriers;

- Additional value-added benefits on labour, business and freight productivity levels and business investments in SEQ, estimated at around $230 million in present value terms;

- Minimize bottlenecks and the risks of grid-lock**;**

- Improved residential amenity to inner city areas;

- Wider agglomeration benefits; and
- Better connection of regional markets to parts of the network which are acting as hubs, eg. airport, freight distribution centres, mainline train station interchanges and port infrastructure.

Potentially, this will result in a more vibrant Queensland economy and positioning as major export gateway which will provide additional security for future business investments in the region.

6 PROJECT OPTIONS

6.1 INTRODUCTION

Northern Link is one of the projects under *TransApex* and provides a direct connection from the Western Freeway near the Toowong roundabout to the ICB at Kelvin Grove. This section describes the strategic options considered in response to the Northern Link Planning Needs Assessment.

As part of the Preliminary Assessment a broad range of technical options were considered, which included various connection options at both ends of the link as well as strategies to connect to a public transport link at Kelvin Grove. Ultimately, for the purposes of the Preliminary Assessment Report two options (Options A and B, outlined in more detail below) were selected for detailed analysis from this broad range of options. Figure 8 shows the indicative alignment for Northern Link.

However it is important to note that this broader range of technical options (including the public transport options) will be considered further at the Business Case stage.

6.2 OPTION A

Description

Option A is similar to the *TransApex* Prefeasibility 'Bored Option', a driven tunnel option investigated in the *Northern Link (Western Freeway, Toowong to Inner City Bypass) Options Investigation Report, SKM-CW 20 January 2005.* This option provides the direct connection from the Western Freeway near the Toowong roundabout to the ICB at Kelvin Grove. It also provides connectivity to the Toowong precinct and the Kelvin Grove precinct.

Option A would function as an inner-western Brisbane bypass that would also provide a regionally significant transport role by improving accessibility from the growth areas of the Western Corridor to key economic activity centres within the Brisbane region. It would be particularly beneficial for freight traffic, linking to the ICB and Airport Link, and providing a fast and efficient route to the Australia TradeCoast region north of the river (including Brisbane Airport). It also provides improved connectivity to key activity centres such as Indooroopilly and Toowong and key specialist centres such as Royal Brisbane Hospital and University of Queensland. Updated traffic modelling[17] indicates that the mainline would carry 60,500 vehicles per average annual weekday by 2026. Surface roads in Brisbane's inner west suburbs are forecast to experience widespread traffic reductions which will relieve congestion at key bottlenecks and improve urban amenity.

The surface connections are generally within existing road reserves, but would impact on some areas of open space, commercial and residential uses. The proposed surface footprint at the connections would impact on potential environmental issues including air quality and noise associated with the required ventilation infrastructure. Changes to traffic movements and volumes around the connections and on the surface road network would reduce vehicle emissions and traffic noise levels. Key traffic impacts on the surface network include:

- Increases in traffic on the Western Freeway by +4% and the ICB by +21%;
- A combined reduction in traffic on Milton Road/Coronation Drive of -21%; and

[17] Traffic modelling has been carried out using updated Brisbane Strategic Transport Model (BSTM) incorporating updated demographics and data on user's " willingness to pay" a monetary toll for use of proposed toll facilities based on consumer surveys. Forecasts quoted are for an ABS Medium Series demographic scenario, trend mode share and using surface network assumptions as per those applied in TransApex Prefeasibility Report (March 2005).

- The proposed tunnel will carry 6% commercial vehicles, of which 36% is regional[18] freight.

Option A supports the preferred pattern of development identified in Council's Local Growth Management Strategy (LGMS) through the reduction of traffic and local congestion on surface roads in the inner Western Corridor.

Figure 8 Indicative Northern Link Alignment

Option A carries significantly more traffic than Option B and therefore delivers more in terms of economic travel benefits.

[18] Regional freight involves freight with an origin or destination west of Ipswich travelling to Brisbane Airport, Australian Trade Coast North or to the North.

6.3 DIRECT CONNECTION - OPTION B

Description

Option B provides a direct connection from the Western Freeway west of the Toowong roundabout to the ICB east of Kelvin Grove Road. The mainline driven tunnel alignment is approximately 5.5km in length, two lanes each way and follows Option A alignment. No connectivity to local precincts is provided resulting in the least construction risk and impacts on existing infrastructure.

Whilst Option B caters for regional and western suburbs traffic movements it offers the least connectivity for travel associated with the inner west suburbs and key activity centres such as Toowong. Consequently, forecast mainline traffic volumes for Option B are the lowest at less than 39,500 vehicles per average annual weekday in 2026. This option would offer slightly less surface traffic relief in Brisbane's inner west suburbs, although there would be sound reductions in freight travel demand on urban roads.

Option B has the least impact on commercial and residential uses, as surface connections are generally within the existing road reserves of the Western Freeway and ICB. The reduction in surface footprint at the connections also provides the least potential environmental issues. Key traffic impacts on the surface network include:

- Increases in traffic on the Western Freeway by +7% and the ICB by +22%;
- A combined reduction in traffic on Milton Road/Coronation Drive of –18%; and
- The proposed tunnel will carry 7% commercial vehicles, of which 39% is regional[19] freight.

The potential for public transport options to be included in the project scope are being further investigated and will be presented at the Business Case Stage.

6.4 PUBLIC TRANSPORT NEEDS AND POTENTIAL BENEFITS PROVIDED BY NORTHERN LINK

Currently it is estimated that over 25,000 passenger trips per average weekday occur on buses accessing the CBD via Milton Road and Coronation Drive. Growth in bus travel, in combination with the strong use of train services on the Ipswich rail line, has lead to a strong increase in public transport mode share in the inner west suburbs from 9% in 1992 to 16% of travel in 2003/04.

Continued improvements in service frequency and provision of efficient travel times for bus services would be expected to contribute to continued growth in public transport use in the western suburbs. This will assist in catering for growth in population and economic activity, relieving pressure on the road network and catering for travel growth in a sustainable manner.

Currently bus services trips link the CBD with the major activity centres of Toowong and Indooroopilly, the University of Queensland and the western suburbs (including Brookfield, Chapel Hill, Kenmore, Moggill, Riverhills, Mt Ommaney, Forest Lakes and Inala). On an average weekday approximately 640 bus services operate on Coronation Drive and 140 on Milton Road. Service types include Buz (high frequency all day), Rocket (very limited stops), City Express (limited stops) and City Bus (all stops).

The majority of the Rocket bus services between the western suburbs and the CBD use the Western Freeway and then travel via Milton Road, with some routes using Coronation Drive to access the CBD. During the two-hour morning peak period there are 27 Rocket services that use the Western Freeway (ie a bus every 4-5 minutes).

Rocket services between the University of Queensland and the CBD travel via Coronation Drive, as well as City Express routes between the western suburbs and the CBD.

[19] Regional freight involves freight with an origin or destination west of Ipswich travelling to Brisbane Airport, Australian Trade Coast North or to the North.

Bus journey time and travel time reliability is influenced by traffic congestion. This is particularly the case on the arterial roads connecting to the CBD such as Coronation Drive, Moggill Road and Milton Road that are serviced by a high number of bus routes and also suffer from traffic congestion. There are limited bus priority measures in the inner west that reduce the impact of traffic congestion.

The *TransLink Network Plan*) (covering the period to 2014) provides some scope to improve public transport operations for the western suburbs of Brisbane. The Network Plan proposes implementation of high-frequency bus services and investigation of transit lanes on Moggill Road between Toowong and Kenmore, and on the Western Freeway between Milton Road and Moggill Road.

However these strategies within the TransLink Network Plan will not improve bus travel times in the more congested area within the road network between Toowong and the CBD. There are currently no State Government proposals to implement a Western Busway in the short-medium term in the west, as compared to other corridors such as the Eastern and Northern Busway corridors, where planning and implementation is well-advanced. Consequently over the next 10 years it is likely that bus services from the inner west and western suburbs will continue to suffer from worsening traffic congestion whilst attempting to service a rapidly increasing demand.

Northern Link however would provide the opportunity to create a new high quality, uncongested travel route for express bus services (such as Rocket and City Express routes) between the Western Freeway and the CBD via the Inner Northern Busway.

This could be achieved if connectivity were provided between Northern Link and the Inner Northern Busway at, say, the Kelvin Grove precinct via the Normanby Bus Station. Rocket services from the western suburbs to the CBD could then proceed via the 80 kph general traffic lanes in the Northern Link tunnel and avoid the surface level congestion between the end of the Western Freeway at Toowong and the CBD.

Preliminary modelling indicates considerable travel time savings throughout the day could be enjoyed by bus passengers travelling between the western suburbs and the CBD if express services were to use the Northern Link. For example:

- A bus commuter travelling in the peak period between Kenmore and the CBD would experience daily travel time savings in 2016 of 26 minutes, around 45% of their public transport journey time (excluding boarding/alighting time).
- Off-peak bus travel time savings in 2016 of 5 to 6 minutes in each direction are estimated for travel between Kenmore and the CBD.

Northern Link could also provide travel time benefits to bus travellers from Indooroopilly, Toowong and the University of Queensland if a precinct connection was provided in Toowong. This would allow buses from these locations to also avoid congested traffic conditions on Coronation Drive. Forecast indicative travel time savings for bus travel between Indooroopilly and the CBD would be between 7 and 8 minutes in each direction (just under 40% of journey time), a daily saving of 15 minutes for commuters.

By providing connectivity between the Northern Link and the Inner Northern Busway there would also be an opportunity to provide convenient, efficient cross-town bus connectivity for travel between the western suburbs and locations along the Inner Northern Busway and the planned Northern Busway such as the QUT Kelvin Grove precinct, Royal Brisbane Hospital at Herston, Lutwyche and Chermside.

7 PRELIMINARY RISK ANALYSIS

7.1 OVERVIEW

The purpose of this section is to provide an overview of:

- The key risk characteristics of a toll road asset;
- The approach taken for the preliminary risk analysis process;
- The key risks facing Northern Link and a high level risk allocation matrix; and
- The more detailed analysis that will be undertaken as part of the Northern Link Business Case.

The key outcome of the detailed risk analysis to be completed as part of the Northern Link Business Case will be an estimate of the expected cost of all material risks to be borne by the Council, a preferred allocation of those risks and mitigation strategies for those risks to be retained by the Council.

7.2 CHARACTERISTICS OF A TOLL ROAD ASSET

A long term asset such as a toll road typically has four stages during its asset life:

- Construction stage: This involves the design and building of the road as well as any associated works. It also includes the installation of systems for tolling and management. The stage ends when the road is ready for opening, normally 2-4 years from commencement.
- Ramp-up stage. This sees a rapid build-up in traffic as motorists begin to assess the value of using the new road. The ramp-up stage is impacted by the:
    - Scale of the ramp-up;
    - Duration of the ramp-up, normally 18 months to 3 years; and
    - Extent of 'catch-up' to later year forecasts.
- Growth stage: The growth of road and traffic levels following ramp-up.
- Maturity stage: The establishment of road and traffic levels.

The risk premium changes depending on the nature and stage of the project to reflect the increased risk levels in the early stages. Each of the project's life stages also provides an opportunity for 're-rating' of the asset, as the project risks diminish. This is where investors have traditionally benefited, through refinancing of debt and other financial enhancements.

Following a detailed assessment of potential delivery models, a key objective for the Council will be to strike the right balance between allocating risk appropriately, optimising the call on the Council's capital and accessing any re-rating and upside benefits.

7.3 Overview of Preliminary Risk Analysis Process

The objective of the risk assessment process for the Preliminary Assessment is to undertake a high level analysis of the likely project risks by:

- Identifying and describing the key risks associated with the Northern Link Project technical options;
- Preparing a high level risk matrix; and
- Preliminary quantifying the key planned and unplanned risks of the Project in order to develop the Project's construction and operating cost estimates.

The Business Case development stage will build on the preliminary analysis conducted and will undertake a more rigorous analysis of the Project risks and opportunities. Appropriate allocation of risks between the public and private sectors as well as potential mitigation strategies will also be considered during the Business Case development stage.

The risk assessment process adopts several key assumptions in order to meet these objectives, which are described in further detail in the following sections. A risk workshop was also conducted with the Project team to complete these objectives.

7.3.1 Planned and Unplanned Risks

There are two broad types of risk that are relevant to the assessment of any project: planned and unplanned risks.

Planned risks

These risks focus on the potential for the cost of the project's construction and operation phases to increase or decrease from the base cost estimates, by analysing the risks and opportunities in the project's scheduled activities. These risks are assessed by considering the likely ranges in quantity and unit rate or price for the construction and operation activities.

The assessment of these risks is conducted as part of the capital and operating cost estimates for the Project.

Unplanned risks

These risks focus on the risks and opportunities of unplanned or unforeseen occurrences, in addition to the planned risks. These risks are assessed by analysing the likely downside and upside ranges for unforeseen risks for the project, as well as the probability of occurrence of these risks and opportunities.

These risks are listed in the high level risk matrix and assessed by the Project Team. It is important that during this assessment, the unplanned risks identified do not create any overlap with the planned risks identified during the capital and operating cost estimation.

7.3.2 State Government VfM Framework

The State Government's VfM Framework risk management guidance outlines the following requirements for a Preliminary Assessment risk analysis:

- All potential risks for project options are to be identified; and
- Some initial consideration of parties likely to be best able to manage risk is required.

To address this second requirement, the State's preferred position identified in the VfM Framework guidance is adopted to identify the parties best able to manage risk.

The associated VfM Framework risk management guidance material outlines the State's proposed approach to the identification, assessment and allocation of risks. This guidance also outlines the following risk categories, which were adopted in assessing the project risks:

Figure 9 Risk Categories

Site Risk	**Design Risk**
Construction Risk	**Sponsor & Financial Risk**
Operating Risk	**Commissioning Risk**
Industrial Relations Risk	**Legislative & Government Policy Risk**
Force Majeure Risk	**Asset Ownership Risk**
Network & Interface Risk	**Market Risk**

7.3.3 Risk Workshop Outcomes

The Project Team completed the following key tasks as part of the risk workshop:

- Identified the key unplanned project risks, ensuring no overlap with the planned risks calculated as part of the capital and operating cost estimates; and
- Agreed the likelihood of an occurrence, the likely cost of these risks and the consequence of an occurrence under a Best Case, Most Likely Case and Worst Case scenario.

A high level risk matrix was then compiled to reflect these outcomes. A summary of the key risks identified is provided in Section 7.4.

7.4 RISK IDENTIFICATION

7.4.1 Overview

This section outlines, at a high level, the key risks inherent in the Northern Link Project, consistent with the VfM Framework risk categories. The focus of this section is to highlight the key material risks identified at the Preliminary Assessment stage. Further risk analysis conducted during the Business Case stage will focus on:

- Detailed risk identification;
- Risk quantification. This will involve reviewing the likelihood of identified risks materialising and the magnitude of their consequences should they arise and ensuring an appropriate value is allocated for each risk in the PSC;
- Risk allocation. Allocating responsibility for dealing with the consequences of each risk to one of the contracted parties, or agreeing to deal with the risk through a specified mechanism which may involve sharing the risk;
- Risk mitigation. Attempting to reduce the likelihood of the risk occurring and the degree of its consequences for the risk-taker; and
- Monitoring and Review. Monitoring and reviewing identified risks and new risks as the project develops and its environment changes. This process continues during the life of the contract.

A key objective of the Northern Link Business Case will be to ensure that the final risk allocation matrix and resultant delivery model leaves Council with risks it is able to manage. The allocation of risks should reflect how Council considers risks can be best managed, with this decision supported by rigorous analysis as part of the Business Case. Council will also need to be cognisant of the State's preferred risk allocation as per the VfM Framework guidance.

7.4.2 Site Risk

The following table summarises the key site risks anticipated for Northern Link. As the Project develops, the conditions of the proposed site will be further investigated. These investigations will occur prior to and during the Business Case development stage and the site risks identified will be revised during this process to reflect the investigation outcomes.

Table 6 Key Site Risks

Risk	Description	Potential Impact	State's Preferred Position[20]
Technical construction	Known or unknown site conditions that affect the construction of the works (i.e. below ground geotechnics, water, machine performance, settlement (in alluvial channels), vibration, collapse etc.)	Construction time and cost	Private Sector
Land Acquisition and Ownership	The acquisition of the land needed for the solution and any temporary land needed for the construction phase.	Increased land acquisition costs	Public Sector where government seeks to become the land owner (e.g. toll roads)
Environmental compliance	Achieving environmental compliance for the solution both during construction and operations. Examples include known or unknown ecology on the site and air quality.	Construction time and cost	Private Sector
Planning and other approvals	Achieving known or unknown approvals for the solution and different elements of construction and commissioning.	Construction time and cost	Private Sector unless government assumes some or all of risk due to complexity or sensitivity of particular project
Community Action	Community imposed requirements and/or community action over the proposed solution and its impact (excluding community action such as protests during construction).	Construction time and cost	Public Sector

7.4.3 Design, Construction and Commissioning Risk

The following table summarises the key design, construction and commissioning risks for Northern Link. As Council has developed extensive experience in managing D&C risks for major projects in various ways, it is critical that this experience is reflected into the detailed risk analysis to be undertaken for the Business Case. This includes Council's ability to manage and potentially mitigate design, construction and commissioning risks through a range of contractual mechanisms, which will impact the appropriate allocation and quantification of these risks.

[20] *Public Private Partnerships Guidance Material: Supporting Documents – Risk Management*, Queensland Department of State Development, August 2002. This assumes the State's position under a PPP delivery model as per the State's guidance material.

Table 7 Key Design, Construction and Commissioning Risks

Risk	Description	Potential Impact	State's Preferred Position[11]
Design	Design does not meet Project objectives, technical specifications and/or performance requirements. Design prevents achievement of traffic flows required to realise revenue requirements. Also, includes risk that the detailed design uncovers the need for extensive variations.	Construction time and cost	Private Sector
Changes in standards	Changes in design codes and relevant standards. Changes in service requirements.	Construction time and cost	Private Sector
Programme	Program overruns, logic, task durations.	Construction time and cost	Private Sector
Commissioning	Ability to successfully commission the Works on completion. Includes the risk that commissioning plans are inadequate and the risk that commissioning tests might fail.	Construction time and cost	Private Sector

7.4.4 Sponsor and Financial Risk

The key sponsor and financial risks relate to the source and structure of the finance provided for Northern Link. As the delivery options to be assessed include a range of possible traditional and private financed models (refer Section 10), the financing parameters adopted during the Business Case development will be robustly tested to ensure they represent realistic and achievable estimates of finance cost and conditions.

The following table summarises the main sponsor and financial risks for Northern Link:

Table 8 Main Sponsor and Financial Risks

Risk	Description	Potential Impact	State's Preferred Position[11]
Availability of funding	Debt/equity is unavailable on the conditions anticipated	No funding to complete construction	Private sector
Refinancing benefit	Re-rating of Project or changes in financial markets enable favourable refinancing	Beneficial change in financing cost structure	Shared
Interest rates	Increases in interest rates, above forecast used to make investment decision	Debt service cost increase	Public Sector pre-financial close Private sector post financial close

7.4.5 Operating Risk

Key operational risks, such as maintenance risk, are typically tied into the Project's construction. This ensures that the contractor is incentivised to take a whole-life approach to the design and costing of the asset.

As per the Design, Construction and Commissioning risks, Council has developed extensive experience managing operations risks for major projects and this experience will be reflected in the detailed risk analysis to be undertaken for the Business Case.

The following table summarises the main operating risks for Northern Link:

Table 9 Main Operating Risks

Risk	Description	Potential Impact	State's Preferred Position[11]
Availability	Costs associated with failure to provide the required service provision.	Decreased toll revenue, increased operating costs	Private Sector
Lifecycle	Design and/or construction quality is inadequate.	Increased operating and maintenance costs	Private Sector
Maintenance	Variations in the cost of maintenance required throughout the operational period.	Increased maintenance costs	Private Sector

While a contractor can readily manage the road and tunnel maintenance elements, the elements of operation associated with toll technology and toll collection are likely to require a specialist operator. This may create additional interface risk or market risk depending on how the tolling elements are managed. The Business Case will undertake specific market sounding and risk assessment to ensure that these risks are well understood and managed appropriately.

7.4.6 Market Risk

Traffic risk is typically seen as the most significant market risk in the development of major toll roads. Traffic risk, across all PPP delivery models, typically rests with and is therefore priced by, the financiers of the project as it is a risk that is difficult to sub-contract. Council should obtain the market's views on these risks during the Business Case stage, to adequately assess the impact of these risks on the Project.

The following table summarises the key market risks associated with Northern Link:

Table 10 Key Market Risks

Risk	Description	Potential Impact	State's Preferred Position[11]
Demand and Revenue	Demand for road usage is different from forecasts.	Change in toll revenue generated	Private Sector
Changes in demographics	Changes in demographics cause demand to differ from forecasts.	Change in toll revenue generated	Private Sector
General economic downturn	A general economic downturn causes demand to differ from forecasts.	Change in toll revenue generated	Private Sector

It is important to note that during the risk analysis process, many of these risks were not quantified as they are accounted for by way of adjustment to the discount rate, rather than making an adjustment to the Project's capital and operating cost estimates. Further analysis of the adjustment to the discount rate for the PSC to reflect the impact of these risks will be conducted during the Business Case stage. At this stage the discount rate used at the *TransApex Prefeasibility* has been used (9.6%).

7.4.7 Other Risks

The following risks were also assessed to be important unplanned risks for Northern Link, consistent with the VfM Framework risk categories:

Table 11 Unplanned Risks

Risk Category	Risk	Description	Potential Impact	State's Preferred Position[11]
Network and Interface risk	Infrastructure network changes	Changes to the roads network locally that affects traffic on the Project roads and/or requires changes to the works.	Increased construction time and cost and/or reduced toll revenue	Private Sector except to the extent that government provides redress for appropriate, discriminatory changes
Industrial Relations	Dispute and Industrial Action	Dispute between the parties to the contract.	Construction time and cost	Private Sector
Legislative and Government Policy	Change in law or government policy (incl. toll regulation)	Changes in law, regulation and/or policy that affects the working requirements or tolling of the scheme.	Impact on operating costs and/or toll revenue	Private Sector for non-discriminatory changes
Force Majeure	Force Majeure	Event(s) that arise that could not have reasonably been foreseen or insured against (i.e. 'acts of God', war etc.) that will cause suspension of the Project.	Project suspended or terminated	Shared
Asset Ownership	Residual value/asset condition at hand back	There is a negative residual value or the asset fails to meet the minimum condition requirements at hand back	Reduced asset value or cost of upgrade	Public Sector

7.5 RISK ADJUSTMENT TO CAPITAL AND OPERATING EXPENDITURE

The risk workshop conducted as part of the risk analysis process identified the expected impact of each risk occurring under a Best Case, Most Likely Case and Worst Case scenario.

The costings for the capital, operating and maintenance expenditure are based on a raw estimate (i.e. exclusive of any risk allowance). The risk adjustment was then modelled using @Risk® software by SKM/CW following the conclusion of the risk workshop. This software uses a Monte Carlo analysis to conduct the risk quantification at the different confidence intervals for each scenario (Best Case = P10, Most Likely Case = P50, Worst Case = P90).

7.6 OPPORTUNITIES

Having identified the key risks associated with the project, the project team has also identified a number of opportunities which could reduce the cost of the project. These are outlined in the table below:

Opportunity	Description	Potential Project Benefit
Brisbane's Project Pipeline	As a result of the projects already underway in Brisbane (NSBT, Airport Link, etc.) there is an active bidding market ready for Northern Link who understand the risks associated with this type of project	• Pipeline of projects likely to encourage more bidders resulting in more competitive bids, thus driving down project cost • Council and their advisors experiences on NSBT and Airport Link should result in a more efficient procurement process, resulting in savings in procurement costs and greater market confidence, resulting in greater competition
Deposit of spoil materials at Mount Cootha quarry	Mount Cootha is located very close to the western portal of Northern Link. Spoil material generated from the tunnelling could be easily deposited at the quarry.	• Savings in transportation costs relating to the spoil disposal due to the close proximity of the quarry, which would reduce the construction costs
Re-use of plant including the Tunnel Boring Machine (TBM)	Council could use the TBM and other plant developed for Northern Link for other uses, e.g. at the Mount Cootha Quarry.	• Following completion of its use on Northern Link the TBM could be used to generate savings on other Council activities at Mount Cootha
Reduce construction period length	Recent toll road projects (M7, NSBT) have seen a significant reduction in construction periods as a result of PPP delivery.	• There is potential to reduce the Council contribution by requiring bidders to share some of the benefit of any early completion through a reduction in the Council contribution

7.7 SUMMARY

The preliminary risk analysis process has identified a number of high level risks for the Project. These risks have been quantified and used as an input into the Preliminary PSC, to allow a risk-adjusted assessment of the likely Project costs to be undertaken. Section 8 provides further detail on the outcomes of the risk quantification process.

During the Business Case stage, further analysis of the Project's unplanned risks, particularly the allocation of risks under different delivery models, will be required to refine the Project costings and discount rate.