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MEASURING BENEFITS OF THE SOUTH EAST BUSWAY: TOWARDS A NEW APPROACH FOR VALUING PUBLIC TRANSPORT PROJECTS

ABSTRACT

The much heralded South East Busway is a flagship public transport project for Brisbane and was the first busway delivered as part of Brisbane's busway strategy; which is now coming to fruition with parts of the northern and eastern busway under construction.

Less than 10 years after it was constructed, parts of the South East Busway are close to full capacity, with people cramming into buses and buses cramming into busway stations.

Why then, with its apparent success, is it still so difficult to prove the benefits of busway projects (and other public transport projects)?

This paper looks at the first comprehensive evaluation of the South East Busway since it opened in 2001. This included the first comprehensive passenger and bus survey completed since the South East Busway opened. Using the results of this survey, and blending it with a range of other data sources, alternative methods for quantifying the benefits of busways and potentially other public transport projects are presented.

Key conclusions are then drawn regarding how the findings can be used to establish support for future busway projects, as well as ways to build on this evaluation to assist in establishing more robust business cases for future projects.

BACKGROUND

In 2006, the Brisbane CBD provided employment for 78,000 people. This is expected to increase by 57% to over 121,000 by 2026. Whilst an urban footprint has been defined, there is significant urban "sprawl" which is being allowed for (or even catered for) at the northern, southern and south-western extremities of the city. In combination, these effects will inevitably mean greater pressure on the radial public transport system.

In recognition of these trends, the Brisbane busway strategy was conceived. It identified buses and busways as an effective means to capture this geographically dispersed public transport demand. As shown in the *Integrated Regional Transport Plan for South East Queensland* in 1997 (see Figure 1), this strategy is comprised of three primary busway "corridors": the South-East Busway, the Eastern Busway and the Northern Busway.

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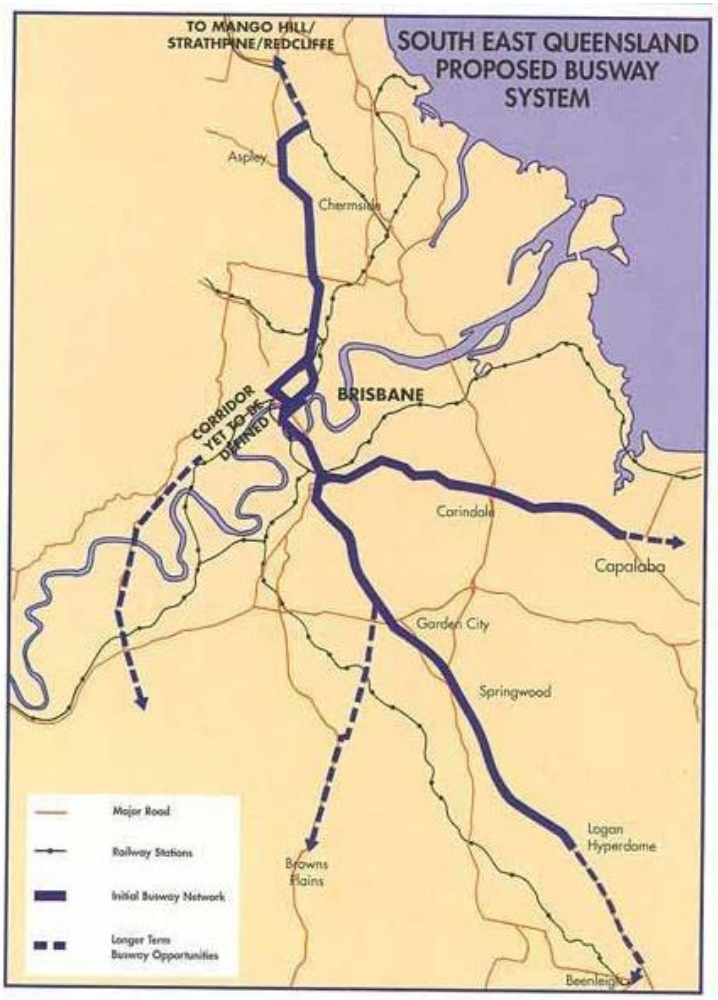
The South East Busway was the first of these projects to be progressed. It was opened in 2001 between the Brisbane CBD and Eight Mile Plains in the south.



Source: Integrated Regional Transport Plan for South East Queensland (2001)

Figure 1: Proposed Brisbane Busway Network

OVERVIEW OF THE SOUTH EAST BUSWAY

The South East Busway is 16.5 km long and has ten stations between Eight Mile Plains in south and the Brisbane CBD in the north. Services from the south, south-east and south-west of Brisbane are mostly orientated towards the busway to make use of the excellent travel time and reliability benefits provided by the facility. It functions as the spine of Brisbane's bus network and has seen rapid patronage growth since its introduction. In fact, it has been so successful that parts of the busway are now "at capacity" with services being re-routed off the busway near the CBD to maintain effective levels of service for all passengers.

Figure 2 shows the busway stations and key connections.

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Figure 2: South East Busway Stations

PREVIOUS EVALUATIONS OF THE SOUTH EAST BUSWAY

Following the resounding success of the South East Busway, planning commenced for the Eastern and Northern Busways. Preliminary evaluations of these projects, however, were finding it difficult to generate traditional Benefit-Cost Ratios which were high enough to convince funding agencies that these projects were of greater benefit than competing road projects.

Part of the difficulty, was effectively quantifying all of the benefits associated with public transport projects in general, and particularly the relatively new busway concept. To overcome this issue, Queensland Transport commissioned a number of studies between 2002 and 2007 to determine what was apparent but could not be quantified; the value for money and long term sustainability provided by the South East Busway.

The evaluation subsequently undertaken showed a Nett Present Value for the project of -$309M and a Benefit-Cost Ratio of 0.35, which lead to the conclusion that the analysis results “show the project to be unviable in economic terms”, based on the evaluation tools commonly used to assess transport projects.

Similar preliminary evaluations undertaken for the proposed Eastern and Northern Busways also reported Benefit Cost Ratios less than 1.0, generating the need to consider alternative methods of valuing the benefits of busways in Brisbane.

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In 2007, Queensland Transport commissioned a study to prepare a "broader" evaluation methodology to value the benefits of the South East Busway.

EVALUATION FRAMEWORK

The evaluation framework was established to provide a more complete picture of the value and benefits that have been delivered by the South East Busway since it opened in 2001. A key driver used to inform the development was the need to present clear messages supported by data for key stakeholders with an interest in the busway. A list of the key stakeholders and the area of interest is listed in table 1.

Table 1: key stakeholders and area of interest

Stakeholder	Area of Interest
Political (Minister, Lord Mayor, MPs, LG Councillors)	• public perception of busway • transport system benefits • travelling public benefits • costs vs benefits
Main Roads	• role of busway in reducing congestion on the road network • how much traffic was removed from the road network as a result of the busway • delay in road upgrade requirements as a result of busway implementation
Queensland Transport	• role of busway in the public transport system • benefits delivered by busway
Queensland Treasury	• economic benefit of the busway • value for money of the busway • ongoing costs busway maintenance and benefits for bus operations
Travelling public	• role of busway • benefits delivered by busway • travel time savings • reliability • sustainability (eg pollution levels without busway)
Operators	• benefits • cost savings
TransLink	• meeting TransLink values • public transport performance • operator cost savings
Department of Infrastructure	• return on infrastructure investment • role of busways in the transport network

Instead of focusing on a comprehensive economic analysis of performance, the evaluation focused on using a range of simple indicators to gain an understanding of how the busway has performed across a range of categories including:

- Public transport attractiveness
- Public transport performance
- Transport network performance
- Economic

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- Environment

A number of indicators have been established across each of these categories. Indicators were chosen based on:

- Having tangible meaning to the key stakeholders
- Data availability for measurement or ability to acquire data as from the patronage survey
- Measurement being able to take place without use of transport modelling or other 'predictive' measurement tools (ie measurement of indicators had to use measured data).

Table 2 provides a detailed description of each of the indicators as well as the data source used to conduct calculations.

Table 2: evaluation framework

Category	Indicator	Description	Assumptions & data used
1. Public Transport Attractiveness	1.1 Customer satisfaction with busway services	• use results of customer satisfaction survey • it would be useful to compare to customer satisfaction across the rest of the network. However, TransLink customer satisfaction surveys are not able to offer this comparison.	• 2002, 2003 and 2004 Customer Satisfaction Surveys
2. Public Transport Performance	2.1 Travel times (with and without busway) implementation	• a comparative analysis of travel times between Mt Gravatt and the Brisbane CBD. This will be done by comparing travel times on the busway vs Logan Road (the route many buses used prior to the South East Busway being commissioned.)	• compare current timetabled bus travel time along Logan Road and South East Busway (for routes with the same number of stops
	2.2 Public transport patronage increase on busway catchment compared to bus patronage growth across Brisbane	• this will compare the annual patronage growth rate on the South East Busway to all BT services.	• data available from Brisbane Transport on patronage growth across the network 2004 to 2006 and patronage growth on the South East Busway 2005 to 2006.
	2.3 Current peak hour busway travel time vs car travel time.	• AM Peak hour bus travel time from Mt Gravatt to City, based on timetabled travel times for the 111, plus 10 minutes bus access time. This will be compared to AM peak hour car travel time on the South East Freeway and Logan Road between Mt Gravatt and the City + 5 minutes for car park access/egress time.	• timetabled travel time will be sourced from TransLink website. • car travel times collected by Bitzios Consulting.

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Category	Indicator	Description	Assumptions & data used
	2.4 Comparative AM peak hour public transport travel time for same distance from other areas of the city	• using a 12km straight line distance from the CBD (UBD 2008 edition) compare AM peak timetabled travel times of bus and train services from the north, east and west of Brisbane.	• TransLink website timetable information
	2.5 Accessibility	• assessment of busway catchment area • ability for people who did not previously make trips to travel with the busway in place	• TransLink market analysis prepared using GIS • people that previously did not travel available from previous survey
3. Economic	3.1 Cost savings for operators	• running and fleet cost savings as a result of the busway	• Bitzios Consulting has calculated this indicator, using survey results and travel time savings
	3.2 Value of peak hour travel time savings – daily and annualised ($ value)	• ***Public Transport***: Minutes saved per person on busway (Mt Gravatt to City) x value of travel time x AM+PM peak hour patronage • ***Car travel time savings:*** savings for cars using South East Freeway and Logan Road due to mode shift from vehicles to the busway	• minutes saved from TransLink • patronage volumes from busway survey • value of travel time $14.50 per hour • cost per kilometre of travel $0.28 • average vehicle occupancy on South East Freeway 1.1 • annualisation factor 253
	3.3 Cost per person of busway infrastructure vs cost per person of South East Freeway infrastructure	• base on value of busway and South East Freeway (Eight Mile Plains to City) in Queensland asset register • calculate annualised infrastructure cost based on 20 year life cycle • determine the cost per person carried in the peak hours on the busway vs freeway	• 2007 asset value of South East Busway • asset value for South East Freeway 2007 $ • patronage volumes busway passenger survey • daily AM + PM peak traffic volumes of South East Freeway • South East Freeway travel time peak and off peak
4. Transport System	4.1 Road network congestion – forecast congestion on roads without busway in place	• add the 13% removed as a result of the busway to the road network to calculate the increase in congestion on Logan Road and South East Freeway by calculating additional delay in minutes and change in Level of Service. • assumes the number of lanes remains fixed	• traffic volumes: current and forecast • busway patronage: current and forecast
	4.2 Safety/ accidents	• base on VKT factor and apply standard accident calculation methodology.	• use Austroads Project Evaluation Guidelines
	4.3 Number of peak hour vehicle trips removed from the road network	• (% modal shift from car trips as a result of the busway x AM peak hour patronage)/ Average vehicle occupancy • % modal shift from car trips as a result of the busway x PM peak hour patronage • Full details in Appendix E, Figure 25	• data on % mode shift as a result of busway available from 2003 Busway origin destination survey) • AM and PM peak busway patronage from busway survey

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Category	Indicator	Description	Assumptions & data used
5. Environment	5.1 Carbon dioxide emissions per person per peak hour trip on busway compared to private vehicle trips between Mt Gravatt and the CBD	• calculate CO_2 emissions per person from a trip between Mt Gravatt and City on the busway compared to the South East Freeway	• use 1.1 for peak vehicle occupancy (South East Freeway) • do for 30 and 40 persons per bus for peak hour bus occupancy

THE KEY RESULTS

SOUTH EAST BUSWAY PATRONAGE SURVEY

Even though the South East Busway has been in operation since 2000/2001, somewhat surprisingly, no previous comprehensive survey of usage of the busway has been undertaken. There was little knowledge of the passenger-carrying capacity of the facility, even though it was at capacity at specific locations. Furthermore, the way ticket sales data is collected by zone does not allow meaningful estimates of usage on specific sections of the busway. It is considered important to know how many passengers and buses use the busway in which sectors.

An important part of the 2007-2008 South East Busway evaluation involved a comprehensive bus and passenger survey for all sections of the busway. The survey involved counting buses and passengers on each “link” on the busway, including at busway entry and exit locations between stations. This data was supplemented by boarding and alighting counts at each station to provide a robust estimate of patronage. The morning peak results of the survey are shown in Figure 3.

The peak patronage location was just south of Mater Hill Station where approximately 55% of buses are diverted off the busway onto the Riverside Expressway, because of busway congestion issues downstream towards the CBD. At this peak location (using a surveyed peak two hour to peak one hour ratio of 1.65) the busway is carrying the equivalent of almost 10,000 cars an hour inbound, or over five general purpose lanes-worth of traffic. This location also reported 410 buses in the peak hour or a bus every 8.8 seconds.

Any road project of a similar capital cost to the busway project would be expected to receive a very healthy Benefit Cost Ratio with these levels of patronage.

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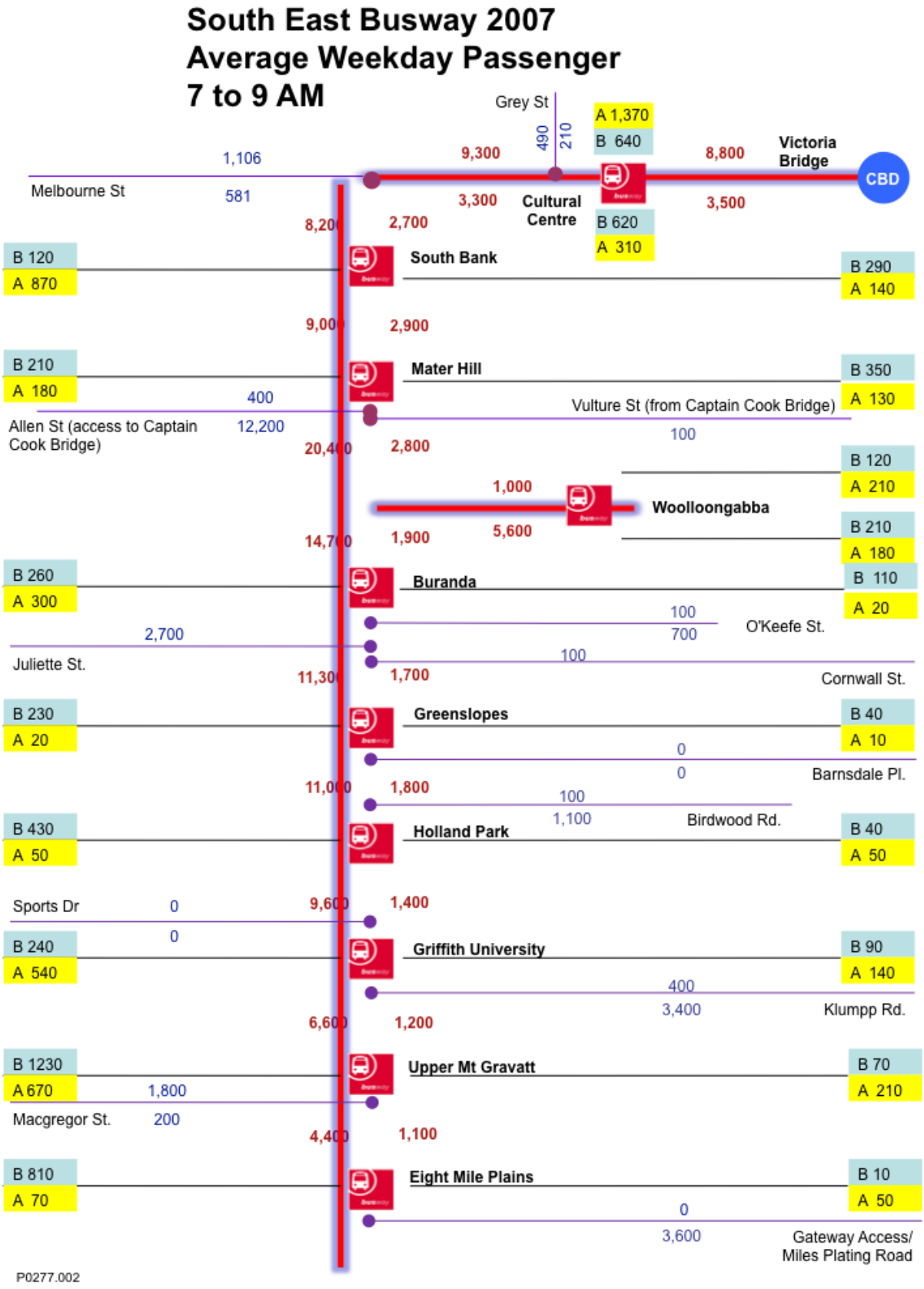

Figure 3: 2007 South East Busway Passengers, 7AM to 9AM

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EVALUATION RESULTS

Table 2 presents results of the evaluation.

Table 2: Evaluation Results

Category	Indicator	Measurement
1. Public Transport Attractiveness	1.1 Customer satisfaction with busway services	• main advantages of the busway perceived to be speed and convenience of travel • busway passengers report a positive overall experience • 40% of respondents stated they now choose to use the busway for trips they previously made by private car • two-thirds of people who have access to a company car have use it less, instead choosing to use the busway for some trips • approximately half of the respondents stated they have increased their travel on the busway in the last year
2. Public Transport Performance	2.1 Travel times (with and without busway) implementation	• average travel time between Mt Gravatt and City via busway 15.6 minutes, via Logan Road 33.7 minutes • represents a travel time saving of 18.1 minutes for bus trips via the South East Busway
	2.2 PT patronage increase on busway catchment compared to bus patronage growth across Brisbane	• Brisbane Transport patronage increased an average of 12.2% pa between 2004 and 2006. • public transport patronage on the South East Busway increased by 20% between 2005 and 2006, 64% higher than the average growth across the rest of the Brisbane Transport network.
	2.3 Current peak hour busway travel time and car travel time.	• 31 minutes from Eight Mile Plains to City via the South East Freeway in a private car • 22 minutes from Eight Mile Plans to City (King George Square) on the 111 service which stops at all busway stations • 19 minutes from Eight Mile Plains to City Elizabeth Street, using busway and Captain Cook Bridge on the 579 service, which stops at Mt Gravatt and Buranda busway stations
	2.4 Comparative AM peak hour public transport travel time for same distance from other areas of the city	**BUS** • **Garden City to City** (111 service) via South East Busway express 19 minutes • **Aspley to City** (King George Square) via Gympie Road/Lutwyche Road and Inner Northern Busway express 31 minutes • **Carindale to City** (King George Square) via Old Cleveland Road and South East Busway 34 minutes – uses South East Busway inbound of Buranda **RAIL** • **Banoon to Central:** 33 minutes • **Ferny Grove line to Central:** 30 minutes • **Caboolture line to Central:** 28 minutes • **Banyo to Central:** 22 minutes
	2.5 Accessibility	• 13% of passengers using the busway stated they previously did not travel when the busway was not in place. This illustrates the busway has increased accessibility, particularly important for those without access to a car. • the walk-up population catchment of the busway stations is 31,000 people, when looking the walk-up catchment of services that use the busway the catchment grows to 341,000.
3. Economic	3.1 Cost savings for operators	• An additional 342 buses would be needed to service the AM peak. • An additional 167 buses would be needed to service the PM peak
	3.2 Value of peak hour travel time savings – daily and annualised ($ value)	• $517,000 in daily travel time savings for busway passengers • $130 million per year in travel time savings for busway passengers
	3.3 Cost per person of busway maintenance and road maintenance based on peak hour volumes	• South East Busway $0.15 per person trip, • South East Freeway $0.09 per person trip.
4 Transport System	4.1 Road network congestion without busway in place	• In the AM peak (inbound) the South East Freeway between Mt Gravatt to Eight Mile Plains would go from LOS D to F, and from Holland Park to CBD would go from LOS E to F.
	4.2 Safety/accidents	• $3.1 million per annum savings in crashes
	4.3 Number of peak hour vehicle trips removed from the road network	• 47,476 (busiest two hour AM peak period) and 42,794 (busiest two hour PM peak period) – for a total of 90,290 private vehicle trips removed from the road network on an average weekday
5. Environment	5.1 Carbon dioxide emissions per person per peak hour trip on busway compared to private vehicle trips between Mt Gravatt and the City	**Assumed average of 30 passengers per bus, 1.1 passengers per car** • each person trip n the South East Freeway has about 4 times more CO_2 emissions a person trip on the busway • each person kilometre travelled on the South East Freeway produces more than 5 times the CO_2 emission of a person km on the busway **Assumed average 40 passengers per bus, 1.1 passengers per car** • each person trip n the South East Freeway has about 5.5 times more CO_2 emission than a person trip on the busway • each person kilometre travelled on the South East Freeway produces more than 7 times the CO_2 emissions of a person km on the busway

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KEY MESSAGES

Key messages from the evaluation were:

- *Busways deliver higher public transport use:* The South East Busway has outperformed the rest of Brisbane's bus network with 20% patronage growth from 2005-06 compared to 12% on average growth for all Brisbane Transport Services. This clearly highlights the busway can be a catalyst for delivering higher than average increase in use of public transport.

- *Busways are an efficient use of space:* The busway carries up to 12,400 passengers an hour (one-way) during peak times. A general traffic lane can only carry approximately 2,000 people per hour, making busways an efficient way to move high volumes of people. Increased pressure on space in the city as population grows will mean public transport solutions such as busways will have an increasingly important role in meeting the city's transport needs into the future. If all passengers travelling into the CBD on buses via the South East Busway were to travel by car, seven additional inbound lanes would be needed on the Captain Cook bridge to cater for peak travel demand.

- *Busways provide fast, frequent and reliable travel:* Busways can carry commuters at 60-80km/hr, often more than twice the speed of general traffic during peak times. Trips on the busway are also more reliable due to congestion free running and passengers are able to rely on trips taking the same time each day.

- *Busways can service a broad geographic area:* The benefits of a busway can be delivered to a broad catchment as buses can enter and exit the busway to serve residential and commercial areas away from the busway. Around 80% of passenger movements are from suburban areas not adjacent to the busway.

- *Busways deliver benefits for the environment:* Busways help reduce greenhouse gas emissions. A ½ full bus (around 30 passengers), produces around 4 times less CO_2 emissions per person trip than an equivalent car trip. In the peak, with higher passenger loads on buses the environmental benefits would increase.

- *Busways deliver economic benefits:* The 2007 value of travel time savings for busway passengers during peak periods is estimated at $130 million annually. As congestion worsens on the road network, the value of these travel time savings will be even greater. The busway also helps operators save money. This also means it costs the Queensland government less to provide bus services that use the busway than buses running in congested traffic conditions. Without the busway more buses and drivers would be needed to move the same amount of people, due to trips taking longer.

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COMPARISON TO MODELLING FORECASTS AND BCR FINDINGS

It is clear that what we observe on the South East Busway is different from what the Benefit Cost Analyses are suggesting. The most likely sources of this difference in how we value benefits and the tools we use to do so.

Three key reasons why the transport models at our disposal may not be suitable for assessing the benefits the busway has introduced are:

- these models are based on mode choice relationships in the past and a new type of landmark project such as the South East Busway (supplemented by a Translink branding revolution) is likely to change the way the travelling public perceives public transport;
- we have the wrong base case. The levels of congestion forecast under "do nothing" simply are not sustainable and the associated land use patterns hard wired into the model could therefore not eventuate. What a project like the South East Busway facilitates is an increase in accessibility to the CBD, allowing it to be competitive and realise the levels of development assumed to be there; and
- we don't properly consider travel times. Our models generally only consider link-based costs and over time, as congestion grows, it is reductions in intersection delays which are the greatest source of potential benefits. These are simply not accounted for even if we claim to validate our strategic link-based models to represent them in the base year as they reflect a far greater proportion of corridor delays in the future than they do in the present.

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CONCLUSIONS

For many years, Benefit Cost Ratios have been demanded for public transport business cases in Queensland (and throughout Australia) and strategic transport models have been used as the primary tool for generating these benefits. This approach has regularly assessed public transport projects as not being economically viable and returning economic benefits far lower than competing road projects. Best practice world wide has still not been able to address this limitation.

The limitation of our current metropolitan transport models to properly capture the benefits of landmark public transport projects is the key reason for this.

Alternative evaluation methodologies, such as the post-implementation evaluation undertaken for the South East Busway, can provide decision-makers with effective alternative sources of information to base funding decisions on. Developing a series of key messages on a range of benefits likely to be delivered by such a project provides a broader and stronger basis for seeking funding.

This, of course relies on the transport modelling fraternity acknowledging that it simply does not yet have the appropriate tools to properly quantify the benefits of major public transport projects implemented over long timeframes and hence does not have the ability to generate meaningful Benefit-Cost Ratios for these projects. Assessment of road projects offen simplifies evaluation and does not address issues post day of opening, such as induced travel demand.

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