BRUCE HIGHWAY CABOOLTURE–BRIBIE ISLAND ROAD INTERCHANGE TO STEVE IRWIN WAY INTERCHANGE DETAILED BUSINESS CASE 2018

BUSINESS CASE/COST BENEFIT ANALYSIS SUMMARY

Purpose of this document	This document provides an overview of the Bruce Highway Caboolture—Bribie Island Road Interchange to Steve Irwin Way Interchange project. The primary objective of this document is to outline the economic analysis undertaken and the key outcomes.
Status	This summary was prepared based on the contents of the detailed business case presented to the Building Queensland Board in April 2018. The information presented may be subject to change as the proposal progresses through future stages of development, delivery and operations.

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1 Summary information

Project name	Bruce Highway Caboolture–Bribie Island Road Interchange to Steve Irwin Way Interchange Project	
Location	South East Queensland	
Proposal owner	Queensland Department of Transport and Main Roads	
Proposed delivery agency	Queensland Department of Transport and Main Roads	
P90 cost estimates	Nominal[1]	Present value [2]
Capital cost	$615 million	$465 million
Incremental ongoing cost	$60 million	$10 million
Net present value		$422 million
Benefit cost ratio		1.9

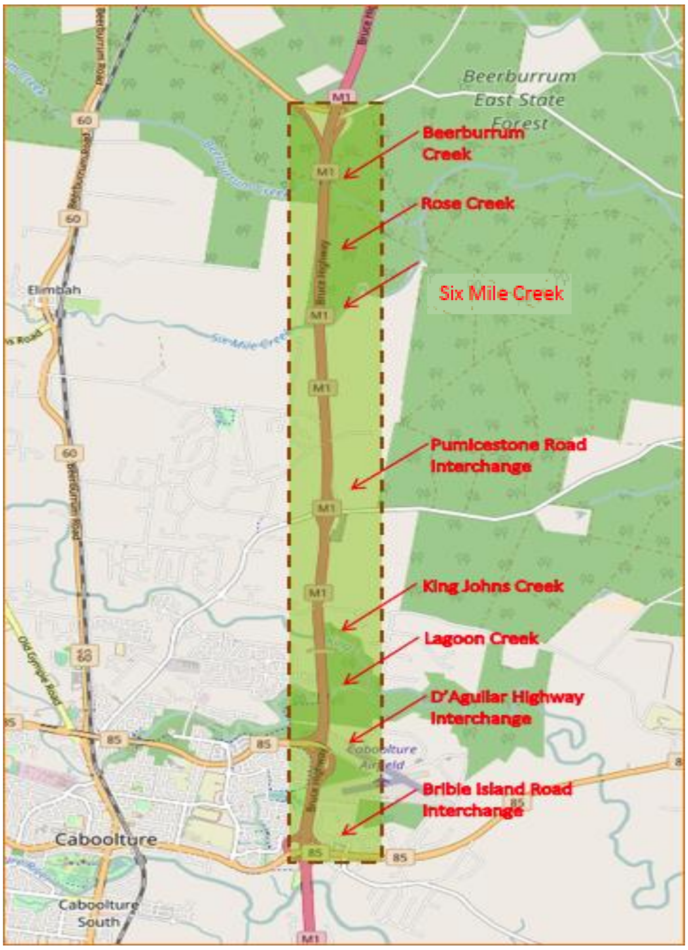
[1] Financial.
[2] Discounted at 7 per cent.

2 Proposal overview

The Australian and Queensland governments are committed to improving the resilience, reliability, connectivity, efficiency and accessibility of the transport system on the Brisbane—Cairns corridor. Part of the National Land Transport Network and a primary freight route for the nation, the Bruce Highway traverses the full length of this corridor. It is the state's biggest traffic carrier and Queensland's principal transport infrastructure asset.

The Pine River on the outskirts of greater Brisbane to Caloundra on the southern edge of the Sunshine Coast is a particularly critical part of the Bruce Highway. This 60-kilometre, minimum four-lane, motorway-standard section directly connects metropolitan Brisbane to the growing regional areas of Moreton Bay and the Sunshine Coast and is the through-route to Gympie and northern communities beyond. It serves as the major north-south freight route in the region and is part of the priority one freight route for greater Brisbane.

Figure 1 Project study area



As the Moreton Bay Region and Sunshine Coast have developed, safety has become a primary concern—particularly along the 11-kilometre stretch from the Caboolture–Bribie Island Road interchange to the Steve Irwin Way interchange, which has the highest crash rates within the 60-kilometre section. This stretch is also the most flood-affected part of the highway from Brisbane to Gympie. When flooding or incidents close the highway, or traffic slows from congestion, impacts are high as there is no reasonable bypass or detour.

Upgrading the Bruce Highway from Pine Rivers to Caloundra was identified as a key project to 'fix the Bruce' six years ago when the highway was considered one of Australia's most dangerous roads. It was listed in the Department of Transport and Main Roads' 10-year Bruce Highway Action Plan (2012) and subsequently included as part of the Australian and Queensland government's combined Bruce Highway Upgrade Program.

3 Service need

The main drivers for the Bruce Highway Caboolture–Bribie Island Road interchange to Steve Irwin Way interchange project are congestion and safety. This stretch of the highway between the Caboolture–Bribie Island Road and Steve Irwin Way interchanges has a high crash rate and there is worsening weekend congestion, resulting in increased travel times and reduced trip reliability. It is also affected by flooding, with bridges across five creeks well below the 1 per cent Annual Exceedance Probability flood level. Disruptions and closures have high impacts as motorists have no reasonable bypass or detour. Forecast traffic growth is beyond the reliable capacity of the existing infrastructure, with the populations of Moreton Bay and the Sunshine Coast anticipated to grow by more than 50 per cent on 2011 levels by 2036. Without interventions the highway will become more congested under normal conditions and severely congested when disrupted.

4 Options assessment

A three-phased process was undertaken during the preliminary evaluation to investigate options to determine the preferred solution for the project: Phase 1 Treatments; Phase 2 Options analysis; and Phase 3 Review and refine.

Phase 1 considered a wide range of treatments to address the strategic assessment of service requirements. Non-infrastructure, existing infrastructure and new infrastructure treatments were considered. A combination of the following treatment options was required to successfully meet the objectives:

- upgrade the highway to six lanes to address operational efficiency and safety
- improve flood immunity at all creek crossings to address reliability
- undertake safety works over the full length of the project area.

These three shortlisted treatments form the overall approach for the development of the alignment options. Phase 2 was divided into a two-stage process including bridge construction options and alignment options with preferred bridge construction option. A multi-criteria analysis was used to assess the individual elements in Phase 2, and to determine the preferred option for the project.

The preferred option was refined during the preliminary evaluation phase through various reviews including a value-for-money considerations review; value management workshop; constructability review; construction staging review; and technical peer review.

5 Base case

The base case is the benchmark against which the reference project[3] is assessed. The base case was modelled on a whole-of-life basis and includes all expected impacts, costs and benefits of the situation that would exist without the project.

Between the Caboolture–Bribie Island Road interchange and the Steve Irwin Way interchange the highway is a four-lane divided carriageway with a wide grassed median. Interchanges are located at Caboolture–Bribie Island Road, D'Aguilar Highway, Pumicestone Road and Steve Irwin Way. Bridges located at Lagoon Creek, King Johns Creek, Six Mile Creek, Rose Creek and Beerburrum Creek are subject to flooding during large rainfall events.

[3] In the context of an economic analysis, a reference project represents an indicative investment proposal which addresses the identified service need. While the reference project may be subject to change during the detailed design process, it provides a reference point to assess the potential costs and benefits of the infrastructure proposal.

Demand already exceeds capacity on southbound lanes most Sundays and holiday periods, which experience significant congestion. In recent years, flows have also begun breaking down in northbound lanes on Saturday mornings.

Currently, there is no significant congestion on the highway on weekdays. However, as the population of the Moreton Bay Region and Sunshine Coast continues to expand, peak-hour commuting volumes are projected to grow. Development is well underway on new mega-suburbs at Palmview and Caloundra, anticipated to supply housing for 67,000 people over 20 years, and a future growth area for 60,000 people has been identified in Caboolture West. With almost half of future jobs in the region (to 2036) expected to be in Brisbane City, daily commuting numbers will greatly increase, reducing road access for freight on this priority route.

Modelling indicates the base case would have inadequate capacity to cope with forecast traffic flows, causing severe congestion and major adverse effects on freight and commuter traffic. Without investment, by 2031 crash costs will increase by 50 per cent to $75.4 million annually and average speeds through this stretch on Sundays will drop to 30 kilometres an hour. Within five years, weekday commuter volumes during peak hour will exceed the capacity of the two highway lanes, impacting commuter and freight efficiency and impeding the economic growth of the region.

6 Reference project

The reference project consists of an upgrade to the Bruce Highway's existing four-lane divided motorway between the Caboolture–Bribie Island Road interchange and the Steve Irwin Way interchange to a six-lane divided motorway. This includes associated upgrades to interchange ramps where they are impacted by the mainline widening works.

The reference project includes replacement of existing bridges with wider and higher bridges in both the northbound and southbound lanes at Lagoon Creek, King Johns Creek, Six Mile Creek, Rose Creek and Beerburrum Creek. The bridges and associated works will improve the flood immunity of the highway to withstand a flood event with an Annual Exceedance Probability (AEP) of 1 per cent.

The key features of the reference project include:

- mainline upgrade to a six- lane motorway-standard highway
- wide cross-section lanes, shoulders, verges, wide centre median, emergency stopping bays and safety barrier allowance
- realigned interchange entry and exit ramps to the new wide motorway
- new bridge structures and creek crossing upgrades to withstand 1 per cent AEP flood height levels
- modified Caboolture–Bribie Island Road interchange southbound exit ramp
- modified Beerburrum Creek southbound bridge to suit future upgrades.

7 Economic methodology

The economic analysis for the project utilised cost benefit analysis to assess the incremental economic benefits and costs of the project to society.

The key benefits of the project expected to accrue from:

- increased capacity of the network to improve average travel speeds and travel times
- reduction in crash costs
- improved flood resilience to avoid costs associated with flooding events within the project location.

Externalities are calculated from the application of parameter values to vehicle kilometres travelled (VKT) applied to demand forecasts over the evaluation period. These externalities may be negative, for example where there is a net incremental reduction in modelled network VKT.

The Australian Transport Assessment and Planning guidance differentiates the value of travel time for business and personal use for cars. Noting the significant traffic volumes on weekends, the share of cars classed as business travel is treated differently on weekdays and weekends, with greater share of car travel on weekends expected to be discretionary in nature, assuming a great degree of leisure travel as compared to weekdays. Assumptions made regarding the share of business travel for cars on weekday and weekend periods are included in Table 2.

Table 2 Share of business travel assumptions—weekday and weekend periods

DAY	% SHARE OF BUSINESS TRAVEL—CARS	SOURCE
Weekday	21.08	ABS Survey of Motor Vehicle use, 30 June 2016, Table 9, Share of business use, passenger vehicles (Queensland)
Weekend	6	Transport and Main Roads, Travel in South East Queensland: An analysis of travel data from 1992 to 2009 p116, Percentage of work-related trips – weekend

Key assumptions and parameters adopted to use in the economic appraisal are presented in Table 3.

Table 3 Cost benefit analysis assumptions

PARAMETER	VALUE	SOURCE
Discount rate	A 7% real discount rate is used for the central case with sensitivity tests conducted at 4% and 10%	Infrastructure Australia Business Case Assessment Template 2016
Price year	2017	Cost Estimate
Evaluation period	30 years from the end of capital investment first year of measured benefits is 2024 (first full year of benefits)	Australian Transport Assessment and Planning Guidelines (Category 4, section 2.4)
Indexation	Unit costs and parameter values indexed to the price year by the consumer price index (CPI) (including sub-categories as appropriate), average weekly earnings and producer price index	Australian Bureau of Statistics

PARAMETER	VALUE	SOURCE
Annualisation	365 days with volume expansion factors applied during holiday periods	Department of Transport and Main Roads traffic modelling report and analysis of permanent traffic count data
Unit costs and parameter values	Cost estimate	Department of Transport and Main Roads Project Cost Estimating Manual
Modelled periods	2026, 2031	Department of Transport and Main Roads Transport Model

8 Demand forecasts

Detailed traffic modelling was undertaken to assess demand over the road network under the base and case and the project case to inform the economic appraisal.

The project followed a three-tiered process:

- **Tier 1**: Regional multimodal strategic travel forecasting model—estimates and forecasts travel demand characteristics based on land use planning or demographic and transport network assumptions.
- **Tier 2:** Regional mesoscopic/detailed assignment model—detailed representation of route choice compared to the Tier 1 models.
- **Tier 3**: Microsimulation model—detailed traffic simulation of complex interactions between vehicles and can evaluate network dynamics, blocking back, merging, weaving, detailed travel times and interactions between vehicles, traffic control process and network geometry.

The traffic assessment required the use of both Moreton Bay and Sunshine Coast Tier 2 models. Although the project is located within the Moreton Bay model area, congestion from the project area flows upstream into the Sunshine Coast model area.

Sub-network models were extracted from both Tier 2 models and combined to form the Tier 2 Caboolture to Steve Irwin Way (C2SIW) project mesoscopic model. This model was locally calibrated to 2013 conditions and, future year 2023, 2026 and 2031 scenarios developed.

The traffic modelling results present significant differences in vehicle kilometres travelled (VKT) between the base and project cases, which were a result of vehicles which could not be assigned to the network under the base case. For the purposes of calculating the economic benefits of the project, VKT and vehicle hours travelled (VHT) under the project case have been adjusted to account for these unassigned vehicles during the modelled periods to enable an accurate assessment of the benefits of the project. The results presented in the adjusted modelled outputs for VKT and VHT indicate that the project will result in significant travel time benefits across all modelled time periods and modelled years.

9 Cost benefit analysis results

The summary results of the detailed cost benefit analysis for the reference case for the project are presented in Table 4 for the P90 level of risk. Key economic decision criteria are presented along with the disaggregated cost and benefit categories assessed as part of the business case. All decision criteria demonstrate an economic return for the community in excess of the net whole-of-life costs for the project.

Table 4 Cost benefit analysis results

COST BENEFIT ANALYSIS RESULTS (P90)	TOTAL, $ MILLION	PRESENT VALUE (7%), $ MILLION
PROJECT COSTS		
Capital expenditure	573	464.92
Maintenance	39.83	10.28
TOTAL	**612.83**	**475.20**
PROJECT BENEFITS		
Travel time	3,115.95	834.07
Passenger vehicle—business	*732.62*	*189.34*
Passenger vehicle—private	*2,064.26*	*560.91*
Heavy vehicle	*319.07*	*83.82*
Vehicle operating costs	126.00	28.13
Passenger vehicle	*1.96*	*0.20*
Heavy vehicle	*124.04*	*27.93*
Externalities	-1.36	-0.38
Crash	88.73	25.90
Flood	20.18	5.81
Residual value	38.32	3.59
TOTAL	**3,387.82**	**897.12**
Net present value	421.92	
Benefit cost ratio	1.91	
Internal rate of return	12.9%	
First year rate of return	7.9%	
Productivity benefits	**300.73**	

The results demonstrate net economic benefits will be realised from the delivery of the project, with the benefit cost ratio of 1.91 and net present value of $421.92 million primarily driven by the travel time benefits for passenger vehicles, which are derived from the forecast performance improvement for road users.

The internal rate of return is the minimum discount rate at which the initiative is viable in economic terms. The observed internal rate of return of 12.9 per cent indicates the project will return a positive net present value for all discount rates below this rate.

Productivity benefits of $300.73 million accrue from travel time and vehicle operating cost savings for private vehicle use for business purposes and heavy vehicle/freight movements.

10 Sensitivity analysis

Sensitivity analysis identifies key economic risks within the conducted analysis. It examines how much the results deviate consequently from changes in proposal driver/s, or combinations of drivers.

The sensitivity analysis for the project is summarised in Table 5.

Table 5 Sensitivity tests

SENSITIVITY TEST	REFERENCE PROJECT	
	BENEFIT COST RATIO	NET PRESENT VALUE, $ MILLION
Reference case	1.91	421.92
Project costs at P50	2.02	447.23
Discount rate 4%	2.94	983.59
Discount rate 10%	1.31	133.17
Traffic modelling sensitivity test 1 (No constraints)	2.74	809.20
Traffic modelling sensitivity test 2 (15% reduction during Saturday peak)	1.87	405.86
Traffic modelling sensitivity test 3 (15% reduction during Sunday peak)	2.09	506.20
Capital cost +20%	1.59	328.94
Capital cost -20%	2.38	514.90
Total benefits +20%	2.29	600.63
Total benefits -20%	1.52	243.22
VOT benefits +20%	2.28	588.73
VOT benefits -20%	1.55	255.11
Inclusive WTP Crash Costs	1.92	428.24
Interrupted flow VOC model	2.62	753.77
Benefits -20%, Costs+20%	1.34	180.61
No weekend benefits	1.27	127.77

The above sensitivity tests show that the investment case for the project remains strong even where weekend trips are excluded from the analysis.

11 Wider economic impacts

An average of 256 full-time equivalent (FTE) jobs will be supported over the three-year construction period of the Project. Productivity benefits of $301 million accrue from travel time and vehicle operating cost savings for passenger vehicle use for business purposes and heavy vehicle/freight movements.

12 Social impacts

A social impact evaluation was undertaken to assess the project's social, economic and environmental impacts, and the measures proposed to avoid, manage, mitigate or offset predicted impacts. Positive and negative social impacts were identified across broad categories including economic impacts, quality of living impacts, health and social wellbeing impacts and environmental impacts. The analysis determined that five material social impacts (four positives, one negative) may arise as a result of the project. Positive impacts broadly include:

- employment opportunities
- safety improvements
- increased heavy vehicle productivity
- enhanced emergency access.

Land and property resumption were regarded as the primary material negative social impact.

13 Project implementation

The delivery model analysis undertaken for the detailed business case assessed three forms of delivery contract:

- Transport infrastructure contract—construct only (TIC–CO)
- Design and construct (D&C)
- Design, construct and maintain (DCM).

A value for money assessment of PPP options was undertaken. It concluded that a traditional delivery model would be appropriate, and that the project would be best delivered using two concurrent TIC–CO contracts. In addition to reducing tender administration and bidding costs, a TIC–CO form of delivery would drive value-for-money outcomes by enabling the Principal to address project risks during the detailed design stage. This view was supported by participants in the market sounding process under taken for the project.