

## Infrastructure Australia

### Project Business Case Evaluation

<b>Project name</b>	Bruce Highway Upgrade – Caloundra Road to Sunshine Motorway
<b>Rating</b>	Priority Project
<b>Date of IA Board rating</b>	27 July 2016

<b>Location</b>	Brisbane, Queensland
<b>Proponent</b>	Queensland Government
<b>Project timeframe</b>	Anticipated contract award date: August 2016 Anticipated construction completion date: mid-2020

#### Evaluation Summary

The Bruce Highway is part of the Queensland Government's Priority Freight Network and forms part of the National Land Transport Network. The highway plays an important role in connecting regional centres as well as facilitating significant freight movement.

The Australian Infrastructure Audit 2015 (the Audit) estimated that, in the absence of adequate road infrastructure investment, the cost of delay on the North Brisbane to Sunshine Coast corridor, of which the Caloundra to Sunshine Coast Motorway forms the northernmost part, would increase from \$17 million in 2011 to \$194 million by 2031. Progressive upgrades of the Bruce Highway to address capacity constraints, flood resilience, and safety concerns at specific sections along the corridor have been identified collectively in the Queensland Government's Bruce Highway Action Plan 2012, and on the Infrastructure Priority List (IPL) (February 2016) as a priority initiative. The Bruce Highway upgrades would reduce travel times and improve safety and traffic management efficiency for both passenger and freight transport.

The section of the Bruce Highway between Caloundra Road and the Sunshine Motorway has two lanes in each direction and currently carries about 60,000 vehicles per day. During peak hours, each of the at-grade intersections cause traffic to back up onto the Bruce Highway from the on- and off-ramps, leading to significant delays and safety implications for through-traffic. With the region's population projected to grow by around 2% per year to 2031, capacity issues on the region's road transport network are expected to worsen.

The project seeks to address these issues by upgrading each of the Caloundra Road and the Sunshine Motorway intersections, adding new lanes along the 7 kilometre corridor of the Bruce Highway between them, and constructing a new service road on the western side of the highway.

The P90 total project cost estimate is \$929.3 million (nominal). The project is expected to generate substantial economic benefits such as travel time savings, reduced vehicle operating costs, and avoided accident costs.

The proponent's stated benefit-cost ratio (BCR) of the project is 5.6 using a 7% real discount rate and P90 total project cost estimate. The project's net present value (NPV) is estimated to be \$3.3 billion over the evaluation period. We have identified a number of risks to achieving this BCR, particularly relating to the traffic modelling approach used to develop the business case, and calculation of travel time savings. However, after allowing for adjustment to the BCR to account for these risks, and based on the sensitivity analysis provided by the proponent, we are confident that the BCR is greater than 1.

# Context and Problem Description

## 1. Strategic Context

The Bruce Highway is a national highway that serves as the major north-south connector road from Brisbane to Cairns. It is part of the Queensland Government's Priority Freight Network and forms part of the National Land Transport Network. The importance of this highway in connecting regional centres as well as facilitating significant freight movement within, and between, regions is recognised by both the Queensland Government and Australian Government.

The Audit estimated that, in the absence of road infrastructure investment, the cost of delay on the North Brisbane to Sunshine Coast corridor, of which the Caloundra Road to Sunshine Coast Motorway forms the northernmost part, would increase from \$17 million in 2011 to \$194 million by 2031. With the Sunshine Coast population projected to grow by around 2% per annum to the year 2031, traffic demand pressures on the region's road transport network are expected to worsen.

Progressive upgrades to key segments of the Bruce Highway are recognised in the Queensland Government's Bruce Highway Action Plan 2012, and as a priority initiative in the February 2016 IPL.

The project is aimed at reducing travel times and, improving safety and traffic management efficiency for both passenger and freight transport.

## 2. Problem Description

The segment of the highway between Caloundra Road and Sunshine Motorway currently experiences substantial congestion as a result of increased traffic volumes. During peak hours, traffic at each intersections backs up onto the Bruce Highway from the on- and off-ramps, leading to significant delays and safety implications for through-traffic. The increased traffic volumes result from population and economic growth.

Traffic modelling analysis provided by the proponent indicates that delays will worsen at both the Caloundra Road and Sunshine Motorway interchanges unless the infrastructure is upgraded. The intersection at the Caloundra Road interchange is currently operating at, or near, capacity in the AM peak hour.

Delays and queuing are currently evident at the southbound off ramp from the Bruce Highway to Steve Irwin Way. This is due to a large volume of vehicles travelling from Caloundra (heading west), hindering opportunity for vehicles to enter the traffic stream from the off-ramp. Traffic growth within the region is expected to see this situation worsen without intervention.

Furthermore, the proponent reports that this section of the Bruce Highway also has a high accident rate. Between 2009 and 2013, a total of 121 incidents were recorded along the project corridor. Previous studies have shown this segment to be accident prone due to the volume of traffic, road design and the high amount of traffic entering into and exiting from the highway.

It is expected the project will alleviate these problems as well as de-congesting the area to allow vehicles to travel at optimal speeds. Noting that the Bruce Highway is a prime freight corridor connecting north and south Queensland, substantial productivity benefits could be derived from heavy vehicles enjoying safer and less-congested journeys.

## Project Description

### 3. Project Overview

The Bruce Highway upgrade project (Caloundra Road to Sunshine Motorway) comprises upgrades to approximately 7 kilometres of highway, two interchanges, and provision of a service road situated on the western side of the highway. This is the option assessed in the cost-benefit analysis.

The reference design of the project comprises three stages. These are:

- Stage 1 – upgrades of the Bruce Highway – Caloundra Road interchange (CRI) and the Bruce Highway – Sunshine Motorway interchange (SMI). In particular:
  - CRI upgrades comprises signalised ramp terminals at exit ramps, construction of a new four-lane bridge, and construction of a northbound flyover entry ramp
  - SMI upgrades comprises realignment of the northbound exit ramp, provision of a free-flow northbound entry loop (resulting in removal of the existing at-grade ramp crossing).

- Stage 2 – construction of a fully connected Western Service Road and completion of the SMI. This includes:
  - six-laning of the Bruce Highway from CRI to south of Pignata Road underpass, and between Sippy Creek Road and the SMI
  - upgrades to the north-facing ramps at the CRI
  - completion of the SMI, including upgraded southbound interchange ramps and removal of the weaves on the Sunshine Motorway between the Bruce Highway and Sippy Downs Drive through the construction of direct ramps between Sippy Downs and the Bruce Highway.
- Stage 3 – completion of the six-laning of the Bruce Highway, reconstruction of the Pignata Road underpass and new bridges on the highway across Sippy Creek, and completion of remaining upgrade works on the Western Service Road.

The project aims to reduce congestion and improve safety along the project corridor.

## **Business Case and Economic Evaluation**

### **4. Options Identification and Assessment**

The development of options for upgrading the Caloundra Road–Sunshine Motorway section of the Bruce Highway has been in process since 2001:

- A 2001 planning option study identified the route alignment options
- The Queensland Department of Transport and Main Roads selected the current route alignment option following its study in 2007
- The Bruce Highway Planning Study in 2011 identified high level interventions to address the service needs of the corridor, including the need for safe and efficient traffic flow
- A 2013 options analysis study confirmed the current route alignment option and tested staging options
- Staging options were finalised in 2015 based on feedback from public consultation.

The economic evaluation detailed in the proponent's submission considers two investment options based on the current alignment. Option 1 includes all three stages of construction. Option 2 only includes Stages 1 and 2. Both options would be constructed as a single package and delivered by 2021. Option 1 was selected.

### **5. Economic Evaluation**

The proponent's stated benefit-cost ratio (BCR) for Option 1 of the project is 5.6 (exclusive of WEBs) using a real discount rate of 7% and P90 total project cost estimate. Approximately 75% of project benefits are derived from travel time savings, and 19% from vehicle operating cost savings. The P90 total project cost estimate used in the economic evaluation is \$929.3 million in nominal terms.

The proponent has used a three-tier hierarchical approach to model traffic demand on the project corridor. A strategic model was used as a basis for trip generation, distribution and mode choice taking account of future development patterns and population forecasts. Mesoscopic models were used for traffic assignment, while microscopic models for the study area were developed to provide detailed assessment of intersection and network operation.

Infrastructure Australia identified a number of risks with achieving the proponent's stated BCR. In particular, expansion factors used to annualise peak hour traffic counts were higher than standard benchmark figures used in similar road project appraisals, and assumptions used to derive inter-peak and off-peak congestion benefits also appeared to be somewhat optimistic. Furthermore, the transport modelling has not allowed for induced demand, which may reduce project benefits if the expanded road network reaches capacity prior to the end of the 30-year evaluation period.

Despite these risks, sensitivity tests conducted by the proponent including use of a lower expansion factor to annualise traffic demand, demonstrated that the BCR remained substantially higher than 1. Whilst the proponent's stated BCR reported in their submission is likely to be overstated, Infrastructure Australia is confident that it is greater than 1.

## Major cost items

The following shows the composition of the nominal capital costs at P90 in 2014-15:

Construction	\$652.6 million
Contingency	\$197.7 million
Escalation	\$79 million
<b>Total</b>	<b>\$929.3 million</b>

Total capital cost (nominal, undiscounted)	\$929.3 million (P90, 2014-15) \$841.2 million (P50, 2014-15) – funding is sought on the basis of the P50 total
Proponent's proposed Australian Government funding contribution (nominal, undiscounted)	\$623.79 million (P50) – 80% of project cost estimate \$49.2 million (P50) – previously allocated from Australian Government)
Other funding (source / amount / cash flow) (nominal, undiscounted)	\$168.2 million from Queensland Government

Total estimated project cost in present value (PV) terms using a 7% real discount rate is \$717.5 million:

- capital costs: \$704.35 million (PV)
- incremental project maintenance costs: \$19.53 million (PV).

## Major sources of benefit

The estimated project benefits in present value terms using 7% discount rate is \$4.03 billion. This is made up of:

- travel time savings: \$3,034.2 million (PV)
- vehicle operating cost savings: \$776.9 million (PV)
- avoided accident cost savings: \$237.2 million (PV).

Residual values were estimated to be \$6.4 million (PV) but were counted as an offset to costs.

A small externality of -\$15.3 million was quantified as a disbenefit.

## Deliverability

The key risks for the project have been identified as follows:

- state forest encroachment
- geotechnical challenges relating to the soil condition currently traversed by the road
- constructability risks associated with the interchanges and structures over live traffic
- management of high volumes of highway traffic during construction
- staging of construction to minimise impact on stakeholders.

The proponent's submission includes mitigation strategies to minimise environmental impacts of the project, developed in accordance with relevant State and Commonwealth environmental and natural habitat conservation policies and legislation.

Should the project proceed, Infrastructure Australia recommends the proponent undertake a post-completion review after the project has commenced operation, to assess whether the project benefits have been realised.

While the proponent has not investigated opportunities for direct user funding of the project, Infrastructure Australia would encourage the proponent to consider network-based road user charging as part of its funding options assessment.

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This evaluation summary was considered by the Infrastructure Australia Board in July 2016.

Following Infrastructure Australia's process of fact checking the evaluation summary prior to publication, the brief was amended to clarify the cost of delay on the North Brisbane to Sunshine Coast corridor between 2011 and 2031.