CENTENARY BRIDGE UPGRADE PROJECT

BUSINESS CASE/COST BENEFIT ANALYSIS SUMMARY

Published October 2019

D19/5549

PURPOSE OF THIS DOCUMENT	This document provides an overview of the Centenary Bridge Upgrade Project Detailed Business Case. 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 Q2 2019. 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	Centenary Bridge Upgrade Project	
LOCATION	South East Queensland	
PROPOSAL OWNER	Department of Transport and Main Roads	
PROPOSED DELIVERY AGENCY	Department of Transport and Main Roads	
P90 COST ESTIMATES	NOMINAL[1]	PRESENT VALUE[2]
CAPITAL COST	$242.3 million	$183.6 million
INCREMENTAL ONGOING COST	$29.34 million[3]	$3.2 million
NET PRESENT VALUE		-$43.2 million
BENEFIT COST RATIO		0.73

2 PROPOSAL OVERVIEW

The Centenary Motorway plays a critical role within the broader South East Queensland transport network providing a key link that carries a mix of inter-regional and local traffic, connecting the rapidly growing western corridor (Ipswich, Springfield and the Ripley Valley) and inner and northern suburbs of Brisbane, as well as the Australia TradeCoast precinct.

Originally constructed as a two-lane arterial, the Centenary Motorway has not kept pace with increasing demand and contemporary design standards. Today, it is one of Brisbane's most congested motorway crossings. In 2017, RACQ named it the city's worst for travel speeds. Trip times are notoriously unreliable, and congestion is heightening crash risks.

3 SERVICE NEED

The Centenary Motorway is operating close to capacity with significant congestion reducing travel time efficiency and reliability and leading to high crash rates.

As Brisbane's only motorway crossing the Brisbane River upstream of the central business district that can service intra and inter-regional traffic, it is a focal point for cross-river trips as noted by recent RACQ surveys. Centenary Bridge is operating close to capacity during peak hours, with around 101,000 trips made across the bridge every weekday. During peak hour, congestion clogs the bridge and it is becoming a major crash site on the motorway. During peak hour, the bridge operates at unacceptable levels of service. Future population and freight growth are expected to degrade the bridge's performance further, resulting in greater commuter frustration and lost economic productivity.

Analysis undertaken found that expanding the capacity of the Centenary Bridge is the priority package of works as the structure beneath its northbound lanes needs maintenance works and heavy freight is not

[1] Nominal capital cost estimates are undiscounted 2019 dollars.
[2] Present value cost estimate in 2019 dollars.
[3] Nominal ongoing operating and maintenance costs, undiscounted 2019 dollars.

permitted to use it. Removing the physical constraint posed by the existing low-capacity bridge would facilitate the broader motorway upgrade and provide some congestion relief for northbound traffic.

4 OPTIONS ASSESSMENT

The project preliminary evaluation examined 13 options to upgrade the Centenary Bridge plus two non-infrastructure options. The two options selected for further investigation in the detailed business case include:

- Option 1A-1: a low-cost option that delivers a new northbound bridge to facilitate critical northbound motorway widening works but does not facilitate southbound motorway widening works
- Option 1A-2: a higher cost option that delivers a new northbound bridge to facilitate critical northbound motorway widening works and a limited refurbishment of the existing bridge (northbound and southbound structures) to facilitate southbound motorway widening works

During a value engineering process for the detailed business case, a further option was recommended for analysis in the detailed business case alongside the two options from the preliminary evaluation:

- Option 1A-3: a higher cost option that delivers a new northbound bridge to facilitate critical northbound motorway widening works and a major upgrade of the existing bridge (northbound and southbound structures) to facilitate southbound motorway widening works plus future eight-laning of the bridge.

To evaluate the three options, a multi-criteria analysis was undertaken to shortlist the project options to two. This process determined that Option 1A-1 was not suitable as it did not meet the project objectives of providing six lanes. As such, Option 1A-2 and Option 1A-3 were assessed in detail during the detailed business case in accordance with Infrastructure Australia's requirement to consider multiple project options as part of the economic assessment.

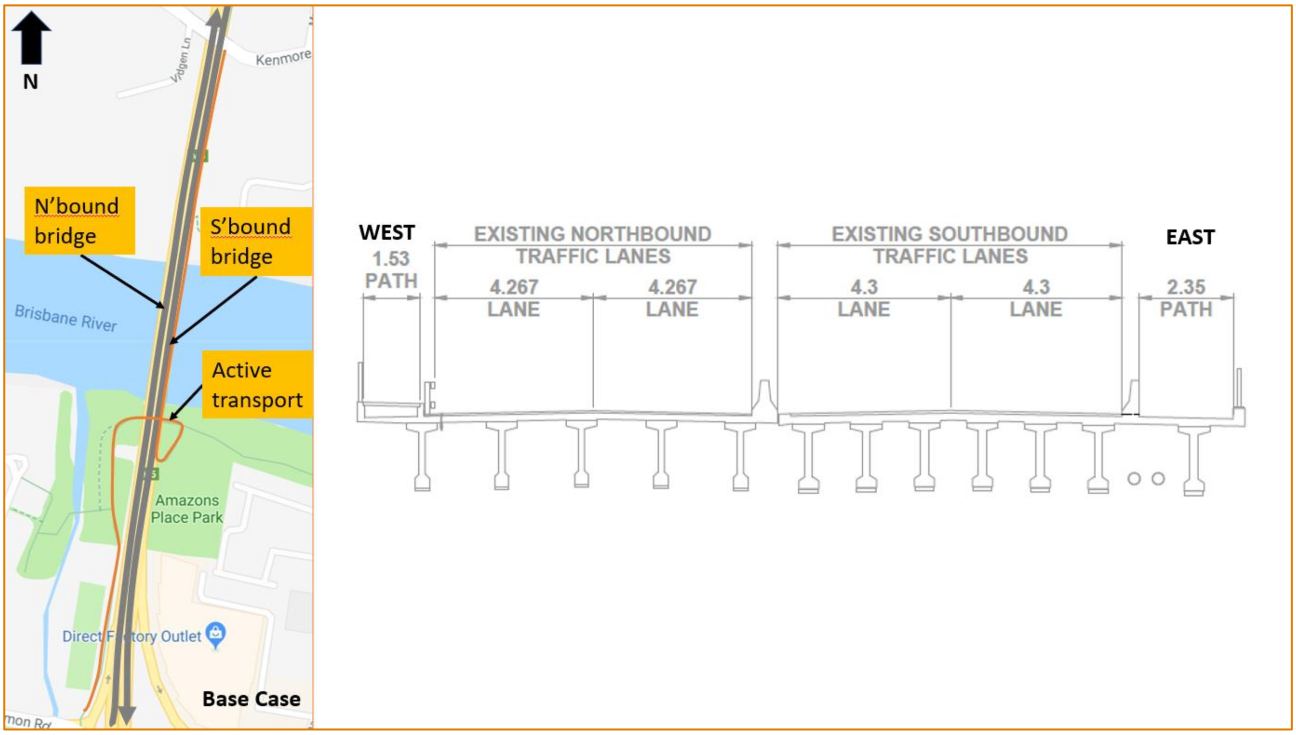
5 BASE CASE

The base case for the detailed business case is the existing bridge infrastructure. There are no committed government projects to address the capacity and safety issues, other than ongoing maintenance and repairs including strengthening works to the existing northbound bridge structure to allow for the safe, long-term use of the northbound structure by vehicles that currently use the bridge.

The Centenary Bridge over the Brisbane River carries four lanes divided by a concrete barrier and a narrow, shared footpath on the eastern side. The original bridge (currently northbound traffic lanes) was built in 1964 as a five-span structure, with oversized foundations to accommodate future widening of the bridge. An additional span was added on each end of the original bridge in 1965 and 1967 and the bridge was duplicated with new southbound lanes in 1986 as shown in Figure 1.

The existing bridge structure includes a 1.53-metre-wide path on the western side of the northbound bridge, which is not used as it does not connect to any footpaths on that side of the motorway. The 2.35-metre-wide path on the eastern side of the southbound bridge connects to the Centenary Cycleway north of the bridge and to the shared path to the south of the bridge at Sinnamon Road.

Figure 1 Existing Centenary Bridge structure



The base case is a do-minimum option, which proposes an option to maintain the existing bridge with the 1964 structure. This option maintains the status quo of the connection and does not improve the situation along the bridge crossing for any transportation modes.

6 REFERENCE PROJECT

Option 1A-3 was selected as the reference project as it delivers the long-term solution of a full six-lane motorway upgrade and enables the future eight-laning of the bridge.

The key technical features of the reference project include:

- new, three-lane northbound bridge that can accommodate four skinny lanes to be constructed to the west (upstream) of the existing Centenary Bridge
- major upgrade of both existing structures, including re-decking of the existing northbound bridge deck with a new steel deck to accommodate three lanes southbound and widened provision for active transport (five metres for a cycleway and a pedestrian path)
- upgraded active transport connection from the Centenary Cycleway on the northern side of the existing bridge to Sinnamon Road intersection on the southern side of the existing bridge
- noise walls or noise mitigation measures for affected properties
- ground treatment works to areas of soft soil on the southern side of the river
- relocation of major services to accommodate project works.

7 METHODOLOGY

The economic analysis has been undertaken using a cost benefit analysis framework. The cost benefit analysis framework is based on an annual discounted cash flow model with an appraisal period of 30 years from the finalisation of capital investment. The analysis was undertaken through the following steps:

- defining the base case against which the project case is then compared
- identifying the costs and benefits that are expected moving from the base case to the project case
- determining the analysis parameters, such as the base year for prices to calculate present dollar values
- developing traffic assessments for the base and project cases
- quantifying the costs and road user related benefits over the appraisal period
- estimating the benefit cost ratio and net present value using discounted cash flow techniques
- testing the sensitivity of various inputs.

An appraisal period of 30 years of operations was adopted for this analysis. The sub-sections below detail the headline assumptions underpinning the approach.

Cost benefit analysis compares the costs and benefits of the project case with a “do minimum” base case (i.e. the ‘business as usual’ or ‘keep safe and operational’ situation). For the purpose of this study, the base case is defined as minimal works required to extend the life of the bridge while maintaining safety and operation of the network. To do so, strengthening of the 1960’s northbound bridge is required.

The project case is defined as a ‘do something’ option that reflects a proposed intervention, as described previously. Two project case options have been evaluated as part of the detailed business case.

8 DEMAND FORECASTS

Upgrading the motorway and bridge will address challenges posed by population and employment growth, which are driving increased demand for urban transport infrastructure—highlighted as critical issues in key Commonwealth, state and local government policy and planning documents including the *Australian Infrastructure Plan*, The *Queensland Plan, State Infrastructure Plan* and *ShapingSEQ: South East Queensland Regional Plan 2017*.

Between Frederick Street (Toowong) and Sumners Road (Jamboree Heights) the motorway is operating close to capacity with significant congestion reducing travel time efficiency and reliability and leading to high crash rates. Traffic speeds drop to just 20 and 25 kilometres per hour in the morning and evening peaks (respectively) along the bridge. Forecast traffic demand exceeding historical growth trends will exacerbate these impacts. Average speeds in the morning peak period will drop from 80 to 60 kilometres per hour by 2026, with peak periods lasting much longer.

Over the 20-year period from 2016 to 2036, traffic demand along the Centenary Motorway corridor is forecast to increase by 45 percent (an average growth of three per cent per annum), with weekday daily demand reaching about 157,400 vehicles per day across the Centenary Bridge by 2036. Traffic demand across the bridge will increase by 28 per cent between 2016 and 2026 and a further 13 per cent to 2036. This suggests the existing four-lane bridge would be operating at capacity for about 18 hours of the day.

The economic appraisal brings together elements of the entire project, such as engineering, cost estimates and transport demand assessment and places them within an economic context.

9 COST BENEFIT ANALYSIS RESULTS

The summary results of the detailed cost benefit analysis for the reference project are presented in Table 1 for the P90 level of risk, developed based on assumptions noted in Table 2. Key economic decision criteria are presented along with the disaggregated cost and benefit categories assessed as part of the detailed business case.

The Reference Project has a lower ongoing cost requirement when compared to the base case. This is the result of new infrastructure which reduces the operational and maintenance costs. When it comes to benefits, an increase in operating speed will lead to a reduction in vehicle operating costs, however, this has been counteracted by the increase in volumes which will lead to an increase in crash costs and an increase in negative externalities such as emissions.

Table 1 Cost benefit analysis results

COST TYPES	REFERENCE PROJECT
COSTS	$ MILLION
Capital costs	$163.3
Ongoing costs	-$0.6
Total costs	**$162.7**
BENEFITS	
Travel time savings	$76.7
Vehicle operating cost savings	$38.1
Crash cost savings	<$0.1
Emissions	-$0.5
Residual value	$5.2
Total benefits	**$119.5***
RESULTS	
Benefit cost ratio (BCR)	0.73
Net present value (NPV)	-$43.2

* Difference in total benefit is due to a difference in residual value.

Table 2 Cost benefit analysis assumptions

PARAMETER	ASSUMPTION
Discount rate	The discount rate adopted in the analysis is 7 per cent per annum (real) and is used to calculate present values. Sensitivity tests are undertaken at discount rates of 4 per cent and 10 per cent. These values are in accordance with guidance from Infrastructure Australia. The economic discount rate differs from the discount rate used in the financial analysis. The economic discount rate represents the time value of money while the discount rate in the financial analysis represents the cost of borrowing.
Price year and inflation	All costs and benefits in the economic analysis are presented in 2019-real constant prices (i.e. excludes inflation).
Appraisal period	An analysis period of 30 years (operational) was adopted in line with Australian Transport Assessment Planning (ATAP) Guidelines.

Timing	
Start year	2019 (price year)
Construction period	2019–2024
Opening year	2024
Finish year	2053
Modelled periods	Cost benefit analysis modelling uses the outputs from the transport model to estimate benefits to the road users. The modelled years from the transport assessment are 2021, 2026 and 2031. A compound annual growth rate formula was used for interpolation between the modelled years. To be conservative, benefits have been held constant after the last modelled year.
Unit costs and parameter values	Adopted from ATAP—Unit parameters include the value of time (i.e. $/hour), vehicle operating costs and emission costs.
Vehicle composition	It has been assumed that vehicle mix remains constant over time within the major heavy vehicle types. That is, the share of light commercial vehicle, medium commercial vehicle and heavy commercial vehicle within the 'Truck' traffic modelling outputs remains the same in the model outputs of 2021, 2026 and 2031.

10 SENSITIVITY ANALYSIS

Different outcomes can result from different behavioural responses by the community and changes in exogenous issues such as fuel prices, environmental concerns and the state of the economy. Consequently, the robustness of the economic analysis results is assessed through a series of sensitivity tests. Since Option 1A-2 resulted in the highest benefit cost ratio and net present value, sensitivity testing was conducted on it using 4 per cent, 6 per cent and 10 per cent discount rates. A summary of the sensitivity testing results is shown in Table 3. When adopting a lower discount rate of 6 per cent, the benefit cost ratio increases to 0.88. Further, if a 4 per cent discount rate is applied the benefit cost ratio exceeds 1.00 at 1.23.

If a lower discount rate of, for example, 6 per cent was adopted this would lead to a positive net present value which would support an investment decision. As such, the headline results should be reviewed in combination with the qualitative assessment to have a full understanding of the potential economic implications.

Table 3 Sensitivity analysis results

	SENSITIVITY TEST	BENEFIT COST RATIO	NET PRESENT VALUE, $ MILLION
	OPTION 1A-2	0.75	-$39.7
1	Discount rate 4%	1.23	$40.2
2	Discount rate 6%	0.88	-$19.7
3	Discount rate 10%	0.49	-$75.9
4	Capital costs +20%	0.69	-$53.0
5	Capital costs -20%	1.09	$10.3
6	P50 capital costs	0.85	-$21.0
7	Operational costs (Base case) +20%	0.75	-$38.9
8	Operational costs (Base case) -20%	0.75	-$40.4
9	Operational costs (Project case) +20%	0.84	-$22.0
10	Operational costs (Project case) -20%	0.85	-$20.7
11	Benefits +20%	1.02	$2.5
12	Benefits -20%	0.68	-$45.3
13	Travel time saving benefit -20%	0.74	-$36.7
14	Travel time saving benefit +20%	0.96	-$6.0
15	Vehicle operating cost saving benefit -20%	0.79	-$29.0
16	Vehicle operating cost saving benefit +20%	0.90	-$13.7
17	Crash cost saving benefit -20%	0.85	-$21.4
18	Crash cost saving benefit +20%	0.85	-$21.4
19	Emission benefit -20%	0.85	-$21.3
20	Emission Benefit +20%	0.85	-$21.5
21	Benefits +20%, costs -20%	1.31	$34.2
22	Benefits -20%, costs +20%	0.55	-$76.9
23	Share of car trips for business purposes: 0%	0.81	-$27.3
24	Share of car trips for business purposes: 10%	0.89	-$15.4

While the central case economic cost benefit analysis results in a benefit cost ratio of less than one, the project forms part of a wider program of proposed works to address the safety and congestion issues currently experienced on the Centenary Motorway corridor. The project, as the critical first stage, should be considered an enabler to the broader upgrade program with each stage providing incremental benefits as they are delivered, and the full economic benefits of the program achieved once all stages are complete. In this regard, planning indicates that the full upgrade of the Centenary Motorway will provide a strong economic outcome for the community.

11 PROJECT IMPLEMENTATION

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

- Transport Infrastructure Contract—Construct Only (TIC–CO)
- Design and Construct (D&C).

The analysis confirms that a traditional delivery model would be appropriate, and that the project would be best delivered using TIC–CO contract. 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 undertaken for the project.

The reference project will contribute to the realisation of the department's key strategic goal of an efficient and effective, integrated and safe transport system by improving travel time reliability, productivity and capacity. Specific roles and responsibilities for delivering, measuring and reporting on project benefits have been identified and assigned to ensure accountability.