

Project business case evaluation summary

Rockhampton Ring Road

Location

Rockhampton, Queensland

Geography

Smaller cities and regional centres

Category

National Connectivity

Capital cost

\$1.094 billion (P90, outturn)

Indicative timeframe

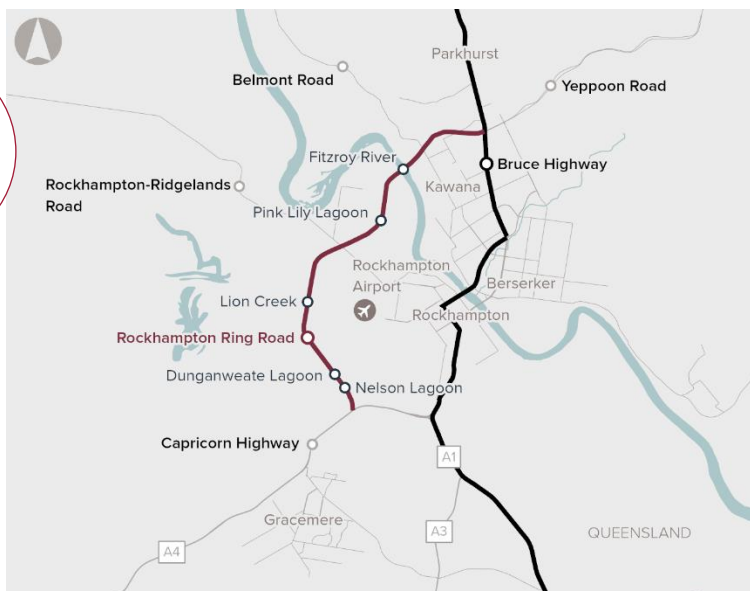
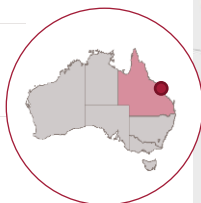
Construction Start: 2022
Project completion by: 2025

Proponent

Queensland Government

Evaluation date

15 April 2021



1. Evaluation Summary

We have evaluated the business case in accordance with the revised Statement of Expectations of 20 December 2020, which requires Infrastructure Australia to evaluate project proposals that are nationally significant or where Australian Government funding of \$250 million or more is sought. The Rockhampton Ring Road business case proposes a solution to a nationally significant problem that is subject to an Australian Government funding commitment of \$800 million.

The Bruce Highway is the major road connection between Brisbane and Cairns and is part of the National Land Transport Network (NLTN). The highway supports both freight and local traffic and runs through the centre of Rockhampton, which results in congestion, inefficient freight movements, and safety concerns from the mix of freight vehicles, local traffic and pedestrians. This section of highway is also prone to closure during severe flood events. These problems are forecast to increase due to traffic growth for passenger and freight vehicles and more frequent and severe flooding due to climate variability and change.

The Rockhampton Ring Road proposal, aims to address the identified problems with the construction of a ring road around Rockhampton, separating local traffic and through traffic, which includes heavy freight vehicles. The proposal forms part of the Bruce Highway Upgrade Program and the program recommended in the 2011 Fitzroy River Floodplain and Road Planning Study.

The proponent's business case states that the costs of the project will significantly outweigh the social, economic and environmental benefits, with a benefit cost ratio (BCR) of 0.57 and a net present value (NPV) of -\$303.2 million using a 7% real discount rate and P50 capital cost estimate when evaluated over a 30-year period. This result is driven by the costs of constructing a road through a floodplain, which are high relative to the expected benefits of the project.

Infrastructure Australia considers that the reported benefits are likely to be slightly understated but that the costs of the project would still significantly outweigh its benefits. However, we agree with the proponent's analysis that the project will enable strategic, program-wide benefits to be realised in the Rockhampton region and along the Bruce Highway. The project's location on a floodplain and its waterway crossings are identified as potential sources of cost risk.

2. Context

Rockhampton is a key urban centre for the Central Queensland Region. An efficient and reliable access route to and through Rockhampton is important for the region's future economic growth and productivity and for central, western and coastal Queensland between Brisbane and Cairns.

The Bruce Highway is part of the NLTN and is Queensland's major coastal road corridor connecting population centres between Brisbane and Cairns. The Highway is being progressively upgraded by the Australian Government and the Queensland Government, in accordance with the Bruce Highway Upgrade Program. Developed by the Queensland Government, this program sets out priorities to improve the capacity, safety and flood resilience of the Highway.

The Bruce Highway Upgrade is a Priority Initiative on the Infrastructure Priority List, recognising the need to improve transport efficiency, flood resilience, and safety. These problems exist on the section of the Highway through the Rockhampton Central Business District (CBD).

Programs such as the Bruce Highway Upgrade Program are intended to provide network and local benefits by delivering related or staged projects to address common problems. These common problems along the Bruce Highway include safety concerns, poor flooding immunity, poor connectivity to regional centres and capacity constraints around key economic clusters. The benefits of each project within the program often combine to deliver network benefits that are greater than the sum of the individual projects. For example, the flood resilience benefits of upgrading one section of the Bruce Highway will be diminished if other sections are not upgraded to the same flood resilience standard.

The Rockhampton section of the Bruce Highway is currently the most signalised of all the regional cities. With the completion of the Mackay Ring Road project in 2020 and the Cooroy to Curra Section D project scheduled to be completed in 2024, Rockhampton will be the last remaining heavily signalised section of the Bruce Highway. Delivering one of the final major ring roads on the Bruce Highway is likely to provide significant network benefits.

3. Problem description

The root causes of the congestion, safety and flood problems on the Rockhampton section of the Bruce Highway include its dual role as a freight route and local road, traffic growth, and declining flood immunity with climate variability and change. Based on the proponent's 2018 Traffic Census data, an estimated 3,100 heavy vehicles passed through the centre of Rockhampton daily, which equates to around 1 vehicle passing through every 28 seconds. The traffic modelling estimates that approximately 13,000-16,000 vehicles, including 2,100-2,600 heavy vehicles, would use the ring road each day when it opens in 2024.

According to the proponent's business case, the wide range of vehicle types and trip purposes, traffic signals, intersections, and property access points along the route negatively impact traffic conditions. As a result, movement of freight through Rockhampton is inefficient and congestion occurs within the city at peak times. Several intersections on this section of the Highway are operating at a Level of Service D, which means that drivers can expect to experience occasional major delays, with variable travel times due to conflicting traffic and volumes approaching capacity. Traffic on the current Bruce Highway in the Rockhampton CBD and Fitzroy River Bridge experience average speeds of less than 40 km/hour in the morning peak period. Traffic congestion imposes costs on society through longer journey times and higher vehicle operating costs for individuals and businesses.

The Rockhampton section experiences high crash rates relative to the rest of the Bruce Highway, with 132 crashes between 2014 and 2018. In the five years to 30 June 2019, the Rockhampton section of the Bruce Highway had 27.4 crashes per 1 million vehicle kilometres travelled. In comparison, the average crash rate on the Bruce Highway over the same period was 9 crashes per 1 million vehicle kilometres travelled. Some of these crashes are due to heavy vehicles and freight traffic interacting with local traffic and pedestrians within the Rockhampton CBD. The presence of traffic signals, intersections, and property access points results in stop-start traffic patterns rather than a free-flowing highway standard. Road accidents cause significant economic costs. The high traffic volumes through Rockhampton also has a negative impact on amenity.

Rockhampton is located at the mouth of the Fitzroy River and drains a large basin that experiences significant rainfall events. Floods are common in the region, and Rockhampton has experienced

five severe flood events of at least 5% annual exceedance probability (AEP) since 1918. Rockhampton is often isolated during these severe flood events due to flooding of low-lying areas of the road network.

In 2017, the Capricorn Highway, the Bruce Highway (Lower Dawson Road), and other roads were closed for over four days. The proponent estimates an average annual time of closure of 23.7 hours and 2.8 hours on the Capricorn Highway and the Bruce Highway (Lower Dawson Road) respectively. Road closures impose costs on travellers who are forced to cancel, delay or divert their trips. Australian Government modelling anticipates increased intensity of extreme rainfall in the catchments that drain through the Fitzroy River, via Rockhampton.

These problems are nationally significant and, if not addressed, are expected to impose ongoing costs on the Australian community.

4. Options identification and assessment

The options identification and assessment process began in 2010 and included three studies:

1. Fitzroy River Floodplain and Road Planning Study – assessed flood solutions for the Bruce Highway.
2. Strategic Assessment of Service Requirements (SASR) – identified options to proceed to the preliminary evaluation stage.
3. Network Optimisation Framework (NOF) – part of the preliminary evaluation and tested non-infrastructure solutions.

The Fitzroy River Floodplain and Road Planning Study assessed the merits of 12 initial options such as longer routes outside of the floodplain as well as existing road upgrades. The strategic base cost estimates for these corridor options varied from \$0.5 billion to \$1.5 billion. The options were assessed using the following process:

- A qualitative multi-criteria assessment which resulted in the 12 options being rationalised into three options: the western, inner-city, and eastern alignment options. The overarching assessment criteria were effectiveness, feasibility, and acceptability. The sub-criteria aligned closely with the objectives of the Bruce Highway Upgrade Program.
- A rapid cost-benefit analysis (CBA) of the short-listed options. This rapid CBA considered travel time and vehicle operating cost savings, as well as the capital costs of the project.

Appraisal of the 12 corridor options resulted in three road options, an inner, western and eastern alignment option. The preferred western alignment option performed best in the multi-criteria analysis and the rapid CBA (in terms of benefit-cost ratio). The inner-city option had the highest net present value (-\$184 million vs. -\$347 million for the western alignment option). The western alignment option scored best across the qualitative multi-criteria analysis due to its separation of through-traffic from urban traffic, improving network efficiency, and broader community support. The proponent therefore selected the western alignment option for detailed assessment due to its better fit to strategic objective.

The preliminary assessment considered the scope of the project, including a 2-lane and 4-lane option. The 2-lane option was \$252 million (P50, risk-adjusted outturn estimate) cheaper and was identified as the preferred approach. The 4-lane option was expected to produce greater travel time savings and reliability improvements.

Infrastructure Australia considers the options identification and assessment process, including the use of a rapid CBA to assess options, to be broadly appropriate. However, as noted by the proponent, the rapid CBA results were used as a criterion in the multi-criteria analysis process which embeds an element of double-counting in the results. This is due to the presence of 'freight connectivity' and 'network efficiency' criteria in the multi-criteria analysis, which were also monetised by the rapid CBA. This is unlikely to have affected the outcomes of the options selection process as the western option was the strongest option across a wide range of criteria.

5. Proposal

The key features of the proposed project include:

- a 14.7-kilometre ring road across the Western Floodplain, including bridges that cross Lion Creek, four lagoons, and a new Fitzroy River Bridge

- two-lane configuration from Capricorn Highway to a West Rockhampton Connector Road and expanding to four lanes from there to the Bruce Highway at Yeppoon Road
- freight connectivity to Rockhampton via Capricorn Highway, West Rockhampton Connector Road, Alexandra Street, and Yaamba Road
- road alignment and design that preserves a corridor for a future rail line.

6. Strategic fit

The project is expected to improve regional productivity, competitiveness of mining and agricultural industries, and opportunities for local employment and residential development.

The Rockhampton Ring Road is expected to deliver safety, flood resilience and transport connectivity and reliability improvements. The expected project outcomes respond to the Bruce Highway Upgrade Priority Initiative on the Infrastructure Priority List, which identified the problems along the Bruce Highway as generally involving safety concerns, poor flood immunity, poor connectivity to regional centres, and capacity constraints around key clusters of economic activity.

Project outcomes respond to the Bruce Highway Upgrade Program, which was established in 2013 and is scheduled to run until 2028. The priority areas of the Program are:

1. Safety improvements: enhance the safety of the highway through the provision of wide centre line treatments, intersection improvements, and safety barriers to reduce the risk of fatal and serious injury crashes so that it is safe for all road users.
2. Flood improvements: enhance the efficiency of the highway by raising bridges and approaches and improving flood immunity on sections of highway subject to frequent flooding.
3. Capacity improvements: enhance economic opportunity through improved level of service on the highway. This will be achieved by the provision of capacity improvement projects such as additional lanes, managed motorways, grade separation (that is, separation of different flows of traffic using physical means) and intersection upgrades.

The stated objectives of the project align with Bruce Highway Upgrade Program and Fitzroy River Floodplain Program objectives. The proponent provided a stylised economic evaluation of the Fitzroy River Floodplain and Road Planning Study (FR&FRPS), which includes the Rockhampton Ring Road. This additional analysis demonstrates the network effects which are realised when several FR&FRPS projects are assessed as a program. In this stylised example, the economic benefits of the program exceed the costs.

The project is also consistent with other Queensland strategies: the Queensland Plan (2014), a 30-year roadmap for growth in the state; the State Infrastructure Plan (2016), the state's strategic direction for delivering infrastructure; and the Central Queensland Regional Plan (2013). The project supports these plans through its regional focus, prioritisation of freight movements, and support for population growth in Rockhampton.

Rockhampton is one of three major access points to central and western Queensland from the Bruce Highway. Central West Queensland supports significant agriculture, livestock and mining industries. Upgrading the road network by delivering a high immunity ring road around Rockhampton will improve access to a key urban centre for essential services and export markets.

The project supports the Rockhampton Regional Council's Advance Rockhampton Economic Action Plan, which identifies inefficient transport routes and national linkages as issues to be addressed.

7. Economic, social and environmental value

The proponent's quantified benefits consist of travel time benefits, travel time reliability, vehicle operating cost savings, safety benefits, externalities, and flood immunity benefits. Infrastructure Australia evaluated the business case and considers the project to have a strong strategic case, however, our evaluation confirms the proponent's analysis, which found that the project benefits do not outweigh the costs.

The proponent's business case states that the net present value of the project is estimated to be -\$303.2 million with a benefit-cost ratio of 0.57, using a 7% real discount rate and P50 capital cost estimates in 2020 prices. We have considered the sensitivity of the appraisal to the discount rate and note that:

- Using a 4% discount rate results in a NPV of -\$69.5 million and a BCR of 0.91.
- Using a 10% discount rate results in a NPV of -\$394.2 million and a BCR of 0.38.

The proponent assessed the project with a strategic traffic model, covering Rockhampton City and Livingstone Shire, and a mesoscopic traffic model for the Rockhampton CBD. The use of strategic and mesoscopic models and data limitations required uncommon approaches to estimating some economic impacts of the project, such as:

- Induced demand: Benefits to new users could not be estimated directly using the origin-destination data in the traffic model. Instead, the proponent estimated induced demand impacts using the overall network modelled data (vehicle travel time, vehicle kilometres travelled), rule-of-half assumptions, and other adjustments. The proponent's method does not fully align with that set out in the ATAP guidelines and was adopted due to data limitations. The impact of this approach on evaluation outcomes is unclear.
- Vehicle operating costs: The proponent's traffic modelling did not estimate vehicle kilometres travelled by road type. Instead, the proponent used the lengths of different road types to measure the vehicle operating costs of the project. The impact of this approach on the economic results of the project is unclear.
- Safety benefits: There was not enough information for the proponent to estimate how the crash cost per vehicle kilometre travelled might change in Rockhampton CBD due to fewer through-traffic freight trips. This approach will reduce the economic benefits of the project.

Freight connectivity benefits were estimated within the economic analysis through travel time, vehicle operating cost, and emissions savings. However, key freight assets (such as Aurizon's Depot Hill intermodal terminal, Pacific National's Port Curtis intermodal terminal and the Port of Rockhampton) were not represented as special trip generators in the strategic traffic model. The traffic modelling provided does not demonstrate how the project would support freight movements to these assets, and so is not accurately captured within the economic model. As a result, freight benefits are likely to be underestimated in the economic analysis.

A key strategic objective of the Bruce Highway Upgrade Program and this project is to improve flood immunity. The business case includes \$23.3 million (present value, as measured in 2020 prices) in flood immunity benefits over the appraisal period. The proponent assessed the flood benefits by estimating the diversion time for traffic affected by flood events. This estimate reflects Rockhampton Regional Council preference to not allow heavy commercial vehicles to use Upper Dawson Road in the event of flooding. Diversion time was linked to a weighted average annual time of closure for the affected roads.

The project may also deliver benefits that were considered qualitatively by the proponent, such as:

- increased local skills and knowledge capacity gained through the construction process
- increased capacity for freight haulage via road transport into the future
- improved ability for government agencies to respond in the event of an emergency
- improved road user experience in Rockhampton CBD
- improved amenity for the local community, local business, and visitors and tourists in the CBD
- potential for improved land use in Rockhampton
- improved industry connectivity throughout the region

Overall our review concurred with the business case and found that, with the scope proposed, the project, in isolation, is unlikely to deliver a productivity benefit to the economy. The Rockhampton Ring Road is part of the program of works recommended in the 2011 Fitzroy River Floodplain and Road Planning Study. The other projects recommended in the study include:

- Yeppen North and Yeppen South (completed and opened in 2013 and 2015, respectively)
- Rockhampton Northern Access Upgrade (currently under construction)
- Capricorn Highway Duplication: Rockhampton – Gracemere (currently under construction).

While a program business case and economic analysis for the full program of works is not available, the proponent provided analysis to us in February 2021 of the potential benefits of delivering the full program of works recommended in the Fitzroy River Floodplain and Road

Planning Study. This analysis suggests that the delivery of the complete program, including the Rockhampton Ring Road, may provide net benefits for society.

The proponent prepared the business case with information collected prior to the COVID-19 pandemic. The impact of the pandemic was not specifically considered by the proponent in the business case.

The following table presents a breakdown of the benefits and costs stated in the business case.

Benefits and costs breakdown

Proponent's stated benefits and costs	Present value (\$m, 2020, P50) @ 7% real discount rate	% of total
Benefits		
Travel time savings	\$277.1	69.9%
Externalities ¹	\$33.6	8.5%
Vehicle operating cost savings	\$27.3	6.9%
Flood immunity benefits	\$23.3	5.9%
Safety (net accident impacts)	\$18.6	4.7%
Travel time reliability	\$16.8	4.2%
Total Benefits²	\$396.7	(A) 100%
Initial capital costs (P50)	\$720.2	102.9%
Repairs and maintenance	\$18.9	2.7%
Lifecycle capital costs ³	-\$19.4	-2.8%
Residual value (non-risk adjusted) ⁴	-\$19.8	-2.8%
Total Costs²	\$699.9	(B) 100%
Net benefits - Net present value (NPV)⁵	-\$303.2	(C)
Benefit-cost ratio (BCR)⁶	0.57	(D)

Source: Proponent's business case

(1) Externalities include air pollution, greenhouse gas emissions, noise, water, nature and landscape, urban separation, and upstream/downstream costs

(2) Totals may not sum due to rounding

(3) Lifecycle capital cost savings is typically reported as a benefit instead of a negative cost

(4) Residual value is typically reported as a benefit instead of a negative cost

(5) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A – B)

(6) The benefit-cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

The proponent's reported capital costs and funding is presented in the following table.

Capital costs and funding	
Total capital cost	\$1,011 million (P50, undiscounted) \$1,094 million (P90, undiscounted)
Australian Government funding (committed)	\$800 million
Other funding (QLD Government)	\$200 million

Source: Proponent's business case

The proponent is seeking an Australian Government funding contribution to the project of 80% under the Bruce Highway Upgrade Program in recognition of the strategic importance of the Highway at a national level. The Australian Government has committed up to \$800 million and the Queensland Government has committed \$200 million towards the project. The P90 nominal capital project cost exceeds the committed funding amount.

The route alignment through a floodplain and a number of waterways including lagoons, creeks, and the Fitzroy River, are a key driver of the significant capital costs. As noted in the proponent's risk and cost assessment, the 22 bridge crossings account for 63% of the total construction cost but only 30% of the length of the ring road, which reflects the high costs associated with building over a floodplain. The proponent advised that they will manage this potential funding gap by refining the scope and de-risking the project. Additional costs would be managed within the Bruce Highway Upgrade Program allocation in consultation with the Australian Government.

The cost estimates have been developed by a cost consultant and were independently peer reviewed. The cost estimates reflect a preliminary design standard, with the project being classified as Type 2 under the Queensland Department of Transport and Main Roads' Project Cost Estimation Manual, 7th edition. The Manual recommends a 30-40% contingency for a project in the business case phase. The cost estimates provided in the business case infer that, at P90 costs, contingencies are 30% of base costs. However, the costs were estimated based on normal economic and industry circumstances. The COVID-19 pandemic has resulted in considerable uncertainty which may lead to cost increases.

8. Deliverability

The Queensland Department of Transport and Main Roads will deliver the project. The proponent considered a range of delivery models, including several public private partnership (PPP) options and traditional delivery options, during the Preliminary Evaluation process and produced a shortlist of two delivery options. The two options were assessed against the following criteria: minimising whole-of-life costs, aligned with market interest, appropriate risk allocation, timing certainty, encouraging innovation, improve asset utilisation. The Transport Infrastructure Contract – Construct Only delivery option is preferred for the project as:

- the scope for innovation is limited
- the project risks are well understood or can be fully defined prior to procurement
- it maximises value of pre-construction time available in the current program
- the construction techniques are well understood by both the proponent and the market
- it reflects the considerable design work that has already been completed by the proponent.

Infrastructure Australia considers the delivery options assessment approach to be appropriate. The contract will be managed by the Department of Transport and Main Roads, which has extensive experience in delivering similar major highway and road upgrades.

The business case also analyses a one, two, and three package approach for procuring the construction contracts and delivering the project. The proponent advised Infrastructure Australia that the preferred two-package approach, which splits the project into a northern and southern side, will ensure timely delivery and that costs can be managed within the project budget. However, the proponent has indicated that local supplier capability and capacity is a risk with a multiple contract model. Early engagement with the market is recommended to mitigate this risk.

The proponent conducted a detailed project risk assessment in accordance with their Risk Management Framework and Engineering Policy. A risk register was developed, and the likelihood and consequence of each risk assessed. A medium post-mitigation risk rating was applied to 19 of the identified risks, including construction, environmental, community, and cultural/heritage risks. The assessment approach is consistent with the Infrastructure Australia Assessment Framework.

The proposed alignment for the Rockhampton Ring Road through a floodplain and the inclusion of a significant number of water crossings in the scope represents major sources of risk for this project. The proponent has acknowledged these risks by completing a higher level of design than is typically required for the detailed business case stage. The proponent identified geotechnical risks as a major source of project risk and rated the residual risk at a medium level with mitigation measures in place. Infrastructure Australia recommends that the proponent continue to closely monitor the geotechnical and bridge structural risks as the project progresses.

The proponent's business case included a Review of Environmental Factors for the Reference Project. The proponent reported that all environmental impacts were found to be manageable. In response to a clarification question from Infrastructure Australia, the proponent has confirmed that a formal Environmental Impact Statement will not be required for this project. Based on a review

of the information provided in the proponent's submission, the environmental impacts of the project appear to be manageable.

The proponent's business case outlines a Benefits Realisation Plan for the project. This sets out the project's benefits and its contributions to the overall Bruce Highway Upgrade Program. The approach and responsibility for measuring and reporting these benefits are outlined in the Benefits Realisation Plan. The proponent will measure expected criteria such as crash rates, journey times, and average annual time of closure for flood events. The Benefits Realisation Plan is detailed and robust and aligns with the objectives of the overall Bruce Highway Upgrade Program. Infrastructure Australia encourages the proponent to prepare and publish a Post Completion Review to capture the lessons learned from the design and delivery of this project for the benefit of future projects.

Consideration of COVID-19

The COVID-19 pandemic has significantly affected the use of infrastructure. Infrastructure Australia has been working collaboratively with the Australian Government to provide advice on a staged response for managing, and recovering from, the impacts of the COVID-19 pandemic.

One critical element of our advice is to maintain a pipeline of nationally significant infrastructure investments. Nationally significant infrastructure projects are long-term investments, typically considering a 30-year view of the project's social, environmental and economic impacts. In evaluating the business case for this project, Infrastructure Australia continues to take a long-term view and has also considered the sensitivity of key planning assumptions using the best data available to us.

As noted in the 2019 Australian Infrastructure Audit, we must continue to evolve the way we plan for Australia's infrastructure to embrace uncertainty. There are still many uncertainties regarding the long-term impact of the COVID-19 pandemic on infrastructure use.

We will continue to collaborate with industry, the community and governments at all levels to understand the impacts of the COVID-19 pandemic on infrastructure decisions in Australia.