# Project Evaluation Summary
## Cross River Rail

**Proponent** Queensland Government
**Evaluation date** 19 July 2017

### Contents




### 1. Summary

Infrastructure Australia has retained Cross River Rail as a **High Priority Initiative** on the Infrastructure Priority List. This rating recognises that the emerging problem of rail capacity into and through Brisbane's CBD is a nationally significant infrastructure problem which will need to be addressed.

Infrastructure Australia has **not** included the current proposal for Cross River Rail as a Project on the Infrastructure Priority List at this time. Infrastructure Australia considers that the benefits of the proposed project, as set out in the business case, are significantly overstated, and that the costs of the project as currently presented are likely to exceed its benefits.

Infrastructure Australia would welcome the opportunity to consider a revised business case which addresses our concerns with benefit estimation, and clarifies the estimated timeframe for the emerging capacity problem. A revised business case should also quantify potential benefits from land use change and urban renewal expected to result from the proposed project, and potential benefits from better integration of Brisbane's rail and bus networks.

The Cross River Rail proposal is a response to strong growth in rail patronage in the decade up to 2011. Continued population increase over coming decades, together with jobs growth centred on the inner city, is expected to drive increased demand for trips to and from Brisbane's CBD. This increased demand is expected to exceed the capacity of the current rail connection into and through Brisbane's CBD at some point in the late 2020s-early 2030s.

The proposed project would address this emerging problem by constructing a new 10.2 km rail line, including 5.9 km twin rail tunnels, through Brisbane's CBD from Dutton Park in the south to Bowen Hills in the north. This would provide a third track pair through the CBD, providing substantial additional capacity into and through the city. The proposed project includes new underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street, and upgraded stations at Exhibition and Dutton Park.

The proponent's stated benefit-cost ratio for the project is 1.4, with a net present value of $1,877 million (2016 business case, $2015, 7% real discount rate, P50 cost estimate, excluding wider economic benefits). Infrastructure Australia has material concerns with key aspects of the business case. These include concerns about:

- patronage projections, with and without the project. These are far in excess of rates of growth previously achieved in Australia over an extended period, including during times of high population and economic growth
- quantification of the project's projected benefits, which appear to substantially overstate the benefits expected to accrue to road users
- benefit growth projections for the project, particularly beyond the modelled years. These are far higher than those for relevant benchmark projects
- the timing of the project, given evidence that the flow of benefits from the project in its initial years of operation would be very low.

The 2016 business case does not include analysis, currently underway, of the potential land use change and urban renewal benefits likely to be generated by the project. It also does not include analysis of potential benefits likely to emerge from better integration of Brisbane's rail and bus networks, reflecting work undertaken in the first part of 2017.

## 2. Strategic context

The population of South East Queensland (SEQ) is expected to continue growing at around 2% per year through to 2036. Much of this growth is expected to be located outside of Brisbane, primarily in the Gold Coast, Ipswich, Sunshine Coast, Moreton Bay and Logan areas. However, employment growth in SEQ is expected to remain centred on Brisbane, leading to an increase in the number of people travelling from outside of Brisbane into the CBD and inner city for work.

The capacity of the SEQ public transport network to meet projected future increases in demand has been considered in a number of studies over the past decade. These studies have identified capacity constraints which will need to be addressed if Brisbane's inner city is to fully support the region's population, employment and economic growth.

The Cross River Rail proposal has been designed to address these constraints. An earlier proposal developed in 2011 was assessed by Infrastructure Australia as being "ready to proceed" in 2012, and a subsequent proposal for a combined 'Bus and Train tunnel' was assessed at the then 'threshold' level (a stage before 'ready to proceed') in 2014. The 2016 business case supersedes the earlier proposals, and has been assessed on its merits.

In addition to Cross River Rail, the Queensland Government has committed to the following programs to improve network capacity and efficiency:

- European Train Control System (ETCS) Inner City project, which will deliver a complete overhaul of the inner city rail signalling and communications systems. This consists of in-cab signalling controls and train safety systems that protect trains from collision and 'over-speed' derailment. The Queensland Government has stated that ETCS will boost inner-city train capacity by 20%. The system will be operational from 2021.
- New Generation Rollingstock project, which will see the delivery of 75 new six-car equivalent train sets. These trains will replace ageing train sets, and increase the fleet size by 30%.
- South East Queensland Rail Stabling Program, which is delivering additional train stabling across the rail network to support the New Generation Rollingstock project, and minimise 'dead-running' of trains.

The Brisbane City Council is also progressing plans for Brisbane Metro, a high frequency rapid bus service based on existing busway infrastructure. A strategic business case for the Brisbane Metro was completed in May 2017. The Queensland Government and Brisbane City Council jointly released a *Connecting Brisbane* strategy in June 2017.

## 3. Problem description

Brisbane's rail network is capacity constrained. Five lines from the south and west, and six lines from the north, merge into two lines through the CBD. This limits train paths through the CBD. Flat junctions, particularly at Roma Street West, further complicate operations, requiring trains from the west to merge at Milton to allow trains from the Merivale Bridge to operate on the second track into the city.

The network's capacity to service growth in the CBD is also limited by space constraints on platforms and concourses. The existing CBD stations are not expected to have the capacity to meet future forecast levels of demand while maintaining reliability and operational efficiency. These factors are expected to result in increased crowding on trains and at stations, affecting passenger comfort and service reliability.

Brisbane's bus network is also constrained in the inner city. The South East Busway between Woolloongabba junction and Allen Street is currently operating at around 125% of estimated hourly bus capacity (including stations and stops) during the morning peak, as is the Victoria Bridge.

While these constraints mean that the rail network is likely to eventually reach capacity, it is not clear when this will happen. Modelling undertaken by the proponent shows that, in 2026, rail lines to the north and south of the CBD will likely still have capacity, with maximum loadings of 125% of seats (ie for an 80 seat carriage, 20 passengers would be standing) for most sections of these lines and only small sections with maximum loadings of 150% of seats (ie for an 80 seat carriage, 40 passengers would be standing). Given actual train capacity, including standing passengers, is higher than the proponent's modelled future seated load factors, the level of crowding predicted by the proponent's modelling does not indicate that on-train crowding will have a significant impact on reliability and on-time running by 2026.

Modelling for 2036 shows that extensive sections of the network south of the CBD will have maximum loadings over 150% of seats during the morning peak. This indicates that capacity constraints would likely become apparent sometime between 2026 and 2036. However, if patronage growth is lower than currently forecast, capacity issues will take longer to materialise. As set out in Section 6 below, Infrastructure Australia considers that current patronage projections are well in excess of rates of growth previously achieved in Australia over an extended period.

Other investments in network capacity would also delay the need for investment in new infrastructure to increase capacity. For example, the implementation of ETCS in 2021 is expected to allow an additional eight trains per hour through the CBD.

## 4. Proposal

The proposed Cross River Rail project entails construction of a 10.2 kilometre rail line from Dutton Park to Bowen Hills, of which some 5.9 kilometres would be underground in twin tunnels. The line would connect with the existing Queensland Rail network near Dutton Park station in the south and Breakfast Creek Bridge in the north.

The proposed project would also include:

- four new underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street
- upgrades to the Exhibition and Dutton Park stations
- northern surface works consisting of a new track between the tunnel portal and Mayne Yard, via Exhibition station
- provision for additional stabling at Mayne Yard (North) and Clapham Yard
- provision of European Train Control System Level 2 for the project.

The proposed project would provide an alternative route for trains travelling north-south through Brisbane, addressing capacity constraints through the CBD and increasing capacity of the broader rail network.

## 5. Options identification and assessment

The options analysis for the 2016 business case draws on past work, including work underpinning the 2011 Cross River Rail business case, the 2013 business case addendum, and the 2014 'Bus and Train tunnel' proposal. The analysis is supported by a number of studies on the capacity of the SEQ public transport network.

The approach to determining the preferred investment has been staged, with consideration of strategic options, infrastructure investment options, and rail infrastructure options.

- **Strategic options** – this stage considered reform options, operational efficiency measures such as new generation signalling, and infrastructure options. The proponent has indicated it has already investigated and implemented some reform options including better planning processes, better project evaluation and prioritisation practices, travel demand management and fare-pricing initiatives. The proponent considers that these measures alone are not sufficient to meet the transport challenge. The business case does not include quantitative evidence to support this conclusion. Infrastructure Australia notes that the November 2016 update to the 2016 Cross River Rail business case included a fare decrease, which is projected to increase demand.
- **Infrastructure investment options** – this stage sought to determine the most appropriate transport mode for investment, considering road and public transport options, and for public transport, considering bus and rail options. *Connecting SEQ 2031* identifies that improved public transport services will be required to meet additional transport demand to and from the Brisbane CBD. Rail was identified as the preferred public transport mode, noting the bus network would not be able to meet forecast demand and increasing demand for longer trips to the CBD.
- **Rail infrastructure options** – various heavy rail alternative options were examined, including the 2011 Cross River Rail configuration, the 2013 core Cross River Rail configuration, the 'Bus and Train tunnel', duplication of the Merivale Bridge, conversion of the Cleveland and Ferny Grove railway lines to light rail, and heavy rail turn-back options. This analysis concluded that Cross River Rail is the preferred option. Neither the business case nor the Cross River Rail Options Report provide quantitative evidence to support this conclusion.

The remaining characteristics of the proposed project were assessed using weighted multi-criteria analysis:

- CBD alignment and station options – the location of the proposed southern CBD station (George Street or Albert Street) was examined, along with the alignment through the CBD
- tunnel length options – the merits of a long tunnel compared to a short tunnel were considered
- northern connection – options to connect the Cross River Rail project to the northern rail network were examined.

Given the proponent's extensive work in developing previous iterations of the Cross River Rail project, the options analysis focuses primarily on rail infrastructure, including project scope, tunnel alignment, station locations and interfaces with the existing network. This approach reflects the fact the Cross River Rail project has a prominent role in long-term state infrastructure planning.

## 6. Economic evaluation

The proponent's economic evaluation (November 2016 update) states the project has a benefit-cost ratio of 1.4, with a net present value of $1,877 million (7% real discount rate, $2015, P50 cost estimate). The June 2016 business case estimated wider economic benefits (WEBs) for the project at $1,209 million (present value, 7% real discount rate). However, this estimate was based on land use forecasts and transport modelling which were superseded in the November 2016 update, and is not consistent with other reported project benefits. Adjustment to align with the November 2016 update may impact on the WEBs estimate.

Infrastructure Australia has material concerns with key aspects of the economic analysis underpinning the business case. These concerns include:

- Rail patronage forecasts
    - The business case projects that rail patronage in the Brisbane region will increase by 6.9% per year from 2015 through to 2026. This strong growth is expected to occur in the absence of the Cross River Rail

project (i.e. in the base case). This is a rate of growth not previously seen in Australia over such a sustained period.

  - This is a similar rate of growth to that projected in the 2011 Cross River Rail business case, which has not been achieved. For example, the 2011 business case projected that patronage in 2016 would be some 374,000 passengers per day (without Cross River Rail). The Queensland Rail Annual Report for 2015-16 reports patronage of around 150,000 per day for the Citytrain network in 2015-16.
  - The majority of public transport user benefits in the business case – 18% of overall project benefits – are attributable to de-crowding. This is a direct function of the high levels of patronage growth projected in the 2016 business case. Infrastructure Australia is concerned that the level of patronage growth projected in the 2016 business case will not be achieved and that the full extent of the projected de-crowding benefits will not materialise.

- Road user benefits. Some 58% of projected benefits are expected to accrue to road users through reduced congestion, and resultant reduced travel time and vehicle operating costs. Infrastructure Australia considers there is a high risk that the benefits projected to accrue to road users are significantly overstated.
  - The benefit of road decongestion per avoided car kilometre under the project is significantly higher than for other similar studies. For Cross River Rail, the proponent's peer review notes the road decongestion benefit per car kilometre avoided at $2.56 in 2026 and $4.14 in 2036 ($2015). As a comparator, Sydney CBD and Melbourne peak heavy traffic decongestion costs have previously been estimated at just over $1 per avoided car kilometre in 2015.
  - The methodology used to estimate growth in the value of time, and the methodology used to estimate vehicle operating costs, are both likely to substantially overstate benefits accruable to road users.
  - The high proportion of benefits expected to accrue to road users is unusual for a public transport project, which would traditionally be expected to deliver a higher proportion of benefits to public transport users.
- The profile of benefits over time
  - The business case projects that benefits from the proposed project would be small initially, before growing rapidly. The undiscounted benefits of the project are estimated at $216 million in 2026, while in 2036 benefits are estimated at $978 million. This represents an increase of 354%, or an annual average increase of 16%. This change in estimated benefits between modelled years is several times larger than Infrastructure Australia has seen for comparable major transport projects.
  - The November 2016 update extends the growth of benefits from 2036 through to 2050. The business case does not provide sufficient evidence to support this ongoing growth of project benefits in the absence of underpinning modelling.

Taking account of these concerns, Infrastructure Australia considers that the project's benefits, as set out in the business case, are significantly overstated. This has a material impact on the project's benefit-cost ratio, which, in Infrastructure Australia's view, is likely to be less than 1.

The business case does not include analysis of the potential land use change and urban renewal benefits likely to be generated by the project. Cross River Rail is expected to influence land use patterns by encouraging infill development, and enabling urban renewal around new stations. Infrastructure Australia understands that the Queensland Government is further developing its land use plans in the inner Brisbane area, and recommends that detailed analysis of these opportunities and the benefits projected to be generated by land use change and urban renewal be included in any future revision of the business case.

Likewise, the business case does not reflect the significant work recently undertaken to better align, and ensure complementarity of, Brisbane's rail and bus networks, which is set out in the *Connecting Brisbane* strategy launched in June 2017. Infrastructure Australia recommends that detailed analysis of benefits projected to emerge from better integration of the Brisbane rail and bus networks be included in any future revision of the business case.

Infrastructure Australia would welcome the opportunity to consider a revised business case which addresses our concerns with benefit estimation, and clarifies the estimated timeframe for the emerging capacity problem. A revised business case should also quantify potential benefits derived from land use change and urban renewal expected to result from the proposed project, and potential benefits from better integration of Brisbane's rail and bus networks.

### Benefits and Costs breakdown

| Proponent's Stated Benefits and Costs | Present Value ($m, $2015) @ 7% real discount rate | | % of total |
|---|---|---|---|
| **Benefits** | | | |
| Public transport – crowding | $1,174 | | 18% |
| Public transport – generalised cost (excluding crowding) | $648 | | 10% |
| Public transport – reliability | $118 | | 2% |
| Public transport – station amenity | $84 | | 1% |
| Public transport – resilience | $6 | | 0% |
| Road users – car travel time savings | $2,023 | | 31% |
| Road users – car VOC savings | $1,086 | | 17% |
| Road users – truck travel time savings | $349 | | 5% |
| Road users – truck VOC savings | $329 | | 5% |
| Crashes | $137 | | 2% |
| Externalities | $117 | | 2% |
| Farebox | $137 | | 2% |
| Residual value | $269 | | 4% |
| **Total Benefits[1]** | **$6,477** | (A) | **100%** |
| **Total Costs[1]** | **$4,600** | (B) | **100%** |
| **Net Benefits - Net Present Value (NPV)[2]** | **$1,877** | (C) | n/a |
| **Benefit–Cost Ratio (BCR)[3]** | **1.4** | (D) | n/a |

Source: Additional analysis provided by the Proponent in November 2016.
Notes:
(1) Totals may not sum due to rounding.
(2) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A − B).
(3) The benefit–cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

### Capital costs and funding

| | |
|---|---|
| Total capital cost (nominal, undiscounted) | $5.4 billion |
| Proponent's proposed Australian Government funding contribution | The Queensland Government has committed to funding the project independent of any Australian Government funding contribution |
| Other funding (source / amount / cash flow) (nominal, undiscounted) | The Queensland Government has committed to fully funding the project. |

## 7. Deliverability

The proponent has considered a number of packaging and procurement options. These were assessed using an approach consistent with the Queensland Government's *Project Assessment Framework*, and Building Queensland guidelines. The project packaging assessment concluded that the project should be disaggregated into four separate packages: early and enabling works, surface works, tunnelling and station development and rail systems and track.

The preferred delivery model for each package is:

- competitive alliance delivery model for the surface works
- Public Private Partnership for the tunnelling and station development
- some form of hybrid delivery of rail systems and track. Because ETCS is progressing in advance of the Cross River Rail project, a significant amount of design work will already have been completed. This would substantially reduce the design risk for this component of the project. The proponent considers that a solution based on a design and construct approach may be the optimal delivery solution for the package. For other parts of the project, where there are live rail interface risks, an alliance contract could be adopted.

The proponent has identified key project risks including:

- design risks – the need for changes to the design to provide access to emergency services, or to account for geotechnical conditions and contamination
- site-specific risks – including flooding risk, the need to acquire additional land to deliver the project, access to necessary utilities during construction, and risks around access to the site
- industrial relations risks
- construction risks – risk of damage to existing infrastructure, and risks around poor integration or coordination between major contracts
- not meeting community expectations, or encountering community opposition, resulting in changes to project design, or other delays.

Project cost estimates are based on relatively early project designs. An independent review found that cost estimates for tunnels, stations, and contingencies were subject to design maturity risks.

The proponent has outlined a benefits management and realisation plan that is consistent with the Queensland Government's benefit management framework. The benefits management plan will be further developed, with a focus on potential opportunities to enhance project benefits. This is expected to focus on rail patronage, train service frequency, travel times, on-board crowding, accessibility and road network conditions, particularly in the CBD. In the event that the project proceeds, Infrastructure Australia would encourage the proponent to undertake a post-completion review after the project has commenced operation, to assess the extent to which expected project benefits are realised.

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This evaluation summary was considered by the Infrastructure Australia Board in July 2017.

As part of Infrastructure Australia's usual process of finalising evaluation summaries for publication, the Queensland Government was given the opportunity to check the summary for factual inaccuracies and commercial sensitivities.