

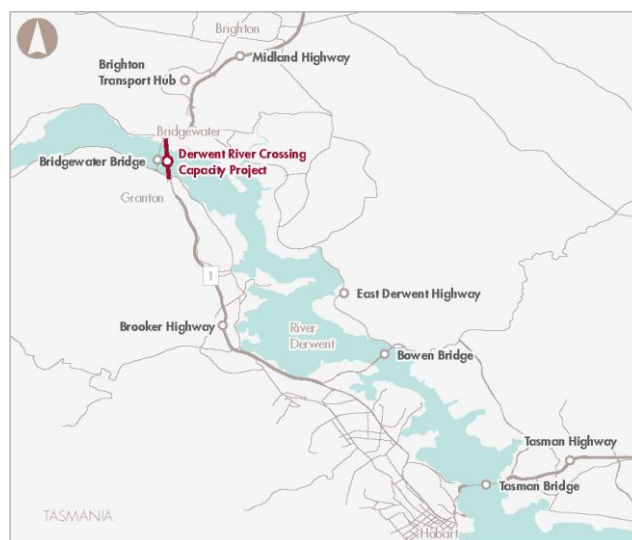
Project Evaluation Summary

Derwent River Crossing Capacity

Proponent Tasmanian Government
Evaluation date 13 June 2019

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1. Summary

Infrastructure Australia has evaluated the business case for the **Derwent River Crossing Capacity project** and determined that its current status as a Priority Initiative on the Infrastructure Priority List should remain unchanged. The Proponent’s business case did not demonstrate that the benefits of the project are likely to outweigh its costs. The business case also identifies a number of unresolved engineering issues that could add further costs to the project, including the future maintenance requirements of the existing bridge.

Infrastructure Australia recognises the strategic importance of crossing capacity over the River Derwent, and would welcome a revised proposal for a less expensive solution that matches the project’s expected benefits.

Bridgewater Bridge to the north-west of Hobart links the Brooker Highway and the Midland Highway across the River Derwent. The Brooker and Midland Highways form parts of the National Highway Network connecting Hobart and Launceston. The bridge is the northernmost of three crossings over the Derwent in Greater Hobart.

The existing bridge opened in the late 1940s and consists of a causeway with a vertical lift steel bridge. Built to the loading and design standards of its time, it is unable to support the load requirements for the largest modern high productivity vehicles. With a single lane in each direction, the bridge and access roads could become congested in the future, increasing journey times. Infrastructure Australia considers these challenges to be nationally significant and a Priority Initiative for Derwent River Crossing Capacity is currently listed on the Infrastructure Priority List.

To address these challenges, the Tasmanian Government proposes to construct a new 1.6 kilometre bridge, with two lanes per direction, a 110 km/h speed limit, and a 16.2 metre air draft. The project aims to improve reliability, connectivity and accessibility between Tasmania’s north and south, and reduce the impact of a seismic event. The Tasmanian Government’s business case states the net present value (NPV) of the project as -\$103.2 million, using a 7% real discount rate and P50 cost estimate. This means the new bridge is expected to cost \$103.2 million more than the value of the potential benefits it is intended to provide. With a benefit-cost ratio (BCR) of 0.53, the proponent expects each dollar spent on the project to return benefits to society of only 53 cents.

We recognise the strategic importance of crossing capacity over the River Derwent, but note that the Proponent's business case shows that the cost of the proposed solution exceeds the expected benefits. Our analysis of the submitted business case identified a number of risks that could result in higher project costs, which would further widen the gap between the costs and the benefits. Independent engineering advice we commissioned also identified a need to further investigate the geotechnical risks of the new bridge alignment. We would welcome a revised proposal that addresses these risks and achieves lower costs that appropriately matches the expected benefits of the project.

2. Strategic context

There are three major road crossings over the River Derwent in the Greater Hobart area – Tasman Bridge, Bowen Bridge and Bridgewater Bridge. Bowen and Tasman Bridges mainly service traffic movements within Greater Hobart, while Bridgewater Bridge is part of the National Highway Network and is the main northern access route into Hobart via the Midland Highway and the Brooker Highway.

The Midland Highway is the primary transport link between the north and south of Tasmania. It connects Hobart to the northern ports in Burnie and Devonport, which handle the majority of container movements in Tasmania. Annual land freight volumes in Tasmania are forecast to grow from 1.8 million tonnes in 2015 to 3 million tonnes by 2035 (or by 2.6% each year). Bridgewater Bridge will carry a significant amount of this freight, as well as freight going in and out of the Brighton Transport Hub (north of the river) to Hobart and southern Tasmania.

Under the Midland Highway 10-Year Action Plan, the highway's bridges are being upgraded to 85 tonne gross mass limits. This will allow larger higher productivity vehicles (Performance Based Standard 2B class trucks) to use Tasmania's highway network, connecting major ports and industries across Tasmania. Heavy vehicle combinations of this size do not currently operate in Tasmania.

The Tasmanian Government's population target is 650,000 by 2050 – a 23% increase on the 2018 population or 0.6% growth each year. The bulk of the population increase is expected to be in the outer Hobart suburbs, in areas such as Brighton which experienced a population growth rate of 1.2% each year, or over 1,000 people, between 2006 and 2016. Bridgewater Bridge is one of the key commuter routes serving these communities. In 2016, 17% of all passenger car crossings of the River Derwent used Bridgewater Bridge. This is forecast to rise to 19% by 2037.

As part of Tasmania's main north-south link, the Midland Highway is also an important link for travellers between Hobart and Launceston. Tourism is a major economic driver in Tasmania and is experiencing strong growth, with visitor numbers rising by 8.4% each year over the past five years. Bridgewater Bridge is also heritage-listed due to its links to early colonial development and convict labour. A number of heritage sites and artefacts of significance to the Aboriginal community are located along the River Derwent. Impacts on these sites were considered as part of the options development and screening process. This resulted in options at other locations being ruled out.

3. Problem description

Engineering/structural integrity

The current Bridgewater Bridge consists of a causeway and a steel vertical lift bridge. The bridge was constructed in 1946, while the causeway was initially constructed in 1829. Maintenance and refurbishment costs are forecast to increase for the ageing bridge causeway.

An independent engineering assessment completed in 2018 found that the lifespan of the existing bridge could be extended for another 50 years with repairs and maintenance. This would require a 3-month closure of the bridge (or up to 6 months if pier replacement is required). The proponent has assumed this scenario as the Base Case in the economic evaluation. There are also existing causeway risks with settlement¹ and liquefaction² in a seismic event. Asphalt is also occasionally laid over the causeway to smooth the road surface as it transitions between the causeway and the bridge. However, this can also cause further settlement issues for the causeway.

¹ Settlement means that the causeway is sinking (it has sunk 55 millimetres since 1991).

² Liquefaction refers to soil being partially or fully saturated with water, and acts like a liquid during a seismic event (such as an earthquake).

Independent analysis in 2009 found that a 1-in-200 year seismic event could leave the causeway unserviceable. While the probability of this occurring is low for any given year, the impact of a bridge closure would be high.

Passenger vehicle capacity and freight transport capacity

The existing Bridgewater Bridge has one lane in each direction and a speed limit of 60 km/h. In 2017, the bridge carried around 1,700 vehicles in the morning peak period and 1,900 in the afternoon peak period. Demand is increasing towards capacity along the Brooker Highway near Bridgewater Bridge and on the bridge itself, with volume/capacity³ ratios of 0.89 and 0.74 respectively in 2016. By 2037, these volume/capacity ratios are forecast to reach 0.96 and 0.83. Demand is also forecast to rise significantly on the East Derwent Highway (north of Bowen Bridge), as traffic over the other river crossings grow.

The steel vertical lift bridge also requires vessels taller than eight metres to wait for openings, or delays vehicles when the bridge is raised. There are also maintenance and bridge closure risks relating to the lifting mechanism. However, the business case only reports 68 lifts over a 12-month period, which allowed access for 151 vessels.

4. Project overview

The Tasmanian Government proposes to construct a new bridge: 1.6 kilometres in length, with two lanes in each direction, a speed limit of 110 km/h (30 km/h higher than the current bridge), and a 16.2 metre air draft. It would be constructed near the existing bridge, linking the Midland Highway, and the suburbs of Bridgewater and Brighton, on the northern bank with the Lyell/Brooker Highways in Granton on the southern bank. It includes:

- two lanes in each direction downstream of the existing bridge location, with a 16.2 metre air draft⁴
- pedestrian and cyclist shared paths
- grade-separated interchanges at Granton and at Dunn Street, Bridgewater
- retaining the existing roundabout at the East Derwent Highway – Midland Highway intersection.

The proponent states that the project will deliver a range of benefits, including:

- reducing travel times for users and freight by increasing capacity and speed limits
- creating a permanent air draft for water craft of 16.2 metres, consistent with the downstream Bowen Bridge
- addressing the six investment themes under the State's 10-Year Infrastructure Plan (maintenance, safety, freight productivity, peak commuter demand, visitor economy and active transport)
- avoiding potential risks with the existing causeway, such as flooding and vulnerability to seismic activity
- minimising impacts on the environment and heritage in the region which are important given that the project is located in the Derwent River Conservation Area and the heritage listing of the existing bridge.

The business case does not specify the future treatment of the existing causeway and bridge. It is important to note that there is no provision in the project to replace the rail line on the existing bridge. Closure of the existing bridge would sever the rail connection to Hobart, making Brighton the new southern rail terminus. Media reports indicate that the existing bridge could continue to provide access for pedestrians, cyclists, rail and local traffic.

5. Options identification and assessment

The proponent identified a long list of options, which were initially assessed against qualitative criteria. The resulting five options were then assessed using a multi-criteria analysis, followed by a cost-benefit analysis of the two top-performing options. The proponent eliminated options at other locations primarily due to geographical, geotechnical and environmental/heritage constraints. Five options were retained for further consideration:

- Initial Option A: Retain existing causeway and bridge structure until decommissioning, then use Bowen Bridge, East Derwent Highway capacity, and network improvements to carry diverted traffic from Bridgewater Bridge

³ Volume/capacity ratios are transport modelling outputs which indicate how much of the road capacity is taken up. A volume/capacity ratio greater than one means that there is more demand than the road's capacity.

⁴ Air draft is the distance between the surface of the water and the highest point of a vessel.

- Initial Option B: Maintain existing structure including capital works to extend serviceable life
- Initial Option C: Widen existing causeway and construct a replacement bridge with two lanes in each direction
- Initial Option D: Construct a new bridge at Bridgewater downstream of current location (dual-bridge long-span design with box-girder beams)
- Initial Option E: Construct a new bridge at Bridgewater downstream of current location (single-bridge short-span design with super-T beams).

The proponent assessed these options against the six investment themes of the State's 10-Year Infrastructure Plan. This resulted in the shortlisting of three options (Options B, C and E). Option B was used as the do-minimum Base Case in the economic appraisal, while Options C and E were scoped into Options 1 and 2 respectively:

- Base Case: Repair and maintain the bridge in line with estimates from the 2018 engineering assessment, plus an additional \$118 million to reinforce the causeway in 2020
- Option 1: Widen the existing causeway and construct a replacement bridge with two lanes in each direction. This would reduce the main bridge length to around 400 metres with a clearance of eight metres for vessels and a speed limit of 100 km/h. Option 1 includes an additional \$118 million to reinforce the causeway in 2020
- Option 2: Construct a 1.6 kilometre long bridge downstream of the existing bridge and upgrade the southern approach on the Brooker Highway. The new bridge would have two lanes in each direction, a speed limit of 110 km/h, a shared pedestrian and cyclist path and a clearance of 16.2 metres for vessels.

The proponent identified Option 2 as the preferred project as it performs better than Option 1 against the six investment themes used in the 10-Year Infrastructure Plan. Option 2 would also mitigate the existing settlement issues and reduce the risk of Bridgewater Bridge being closed as a result of a seismic event.

Meanwhile, Option 1 relies on widening the existing causeway which may not be feasible given the heritage values associated with the current causeway. The permanent air draft for Option 1 is also half that of Option 2, which would restrict a small number of vessels each year from travelling upstream of the bridge.

6. Economic, social and environmental evaluation

The proponent's stated NPV of the proposed project (Option 2) is -\$103.2 million, using a 7% real discount rate and P50 cost estimate. This means the bridge would cost \$103.2 million more than the potential benefits it is expected to provide. The BCR of 0.53 indicates that each dollar spent on the project is expected to return 53 cents in benefit.

During Infrastructure Australia's evaluation, the proponent updated the economic analysis results in the business case while responding to our questions. The results in this evaluation summary reflect the updated analysis provided in March 2019. Further to these adjustments, Infrastructure Australia has identified the following limitations which may impact on the economic, environmental and social costs and benefits of the project:

- Further geotechnical work is required to ensure the preferred construction method for the proposed project can be supported by the river bed, and that there is a risk of significant cost increases if it cannot
- Cost estimates have been developed prior to release of the updated standard AS5100:2017 for bridge design. There could be further costs for the design to comply with the updated standards
- The cost of decommissioning the current bridge, assumed by the proponent at \$500,000, may be understated. A detailed decommissioning plan was not provided, and publicly available bridge decommissioning information suggests this could be higher. This uncertainty will also impact on the ongoing operating and maintenance costs of the current bridge. There may also be complications with the heritage value of the existing bridge
- The risk of a seismic event impacting on the causeway and existing bridge in the Base Case has not been quantified in the central case of the economic evaluation. Instead, this risk has been considered through a sensitivity test of the bridge failing. Incorporating the ongoing seismic risk and likely impact on traffic into the core analysis would worsen the Base Case conditions and, in doing so, slightly raise Option 2's net benefits
- The proponent has not estimated the maritime benefits of a higher bridge clearance, which would allow vessels to pass underneath without interrupting vehicle traffic. This would benefit road users, but the proponent has advised that this benefit is unlikely to be significant relative to the other quantified benefits

- The proponent has not provided a strategic plan for industrial, commercial, or transport uses of the river, which may capture some minor benefits of economic development
- The new bridge alignment would slightly increase the distance vehicles travel across the River Derwent, resulting in higher vehicle operating costs, environmental externalities, and crash costs
- The proponent's analysis of Option 1 indicated an NPV of -\$47.9 million, with a BCR of 0.67, using a 7% real discount rate and P50 cost estimate. Option 1 is expected to cost \$271 million (nominal, undiscounted), compared with \$471 million for Option 2 (the project). Despite the lower BCR and higher cost, the proponent chose Option 2 as the preferred option for the reasons stated in Section 5, namely, better fit with the six investment themes used in the 10-Year Infrastructure Plan, mitigation of the existing settlement issues, and reduced risk of Bridgewater Bridge being closed as a result of a seismic event.
- Option 1 relies on widening the existing causeway which may not be feasible given the heritage values associated with the current causeway. The clearance for Option 1 is half that of Option 2, which would restrict a small number of vessels each year from passing under the bridge. Overall, we agree with the proponent's business case findings that the costs of the project, as currently specified in Option 2, outweigh its benefits, resulting in net costs to society. We also identified a number of risks which may further increase project costs.

Recognising the strategic importance of access across the River Derwent, we would welcome a revised business case for a solution to this nationally significant problem. A revised proposal should address the outstanding risks and issues identified while achieving a better balance between costs and benefits. Given its lower cost and potentially stronger economic merit, we recommend further exploring Option 1 as part of a revised submission.

Benefits and Costs breakdown

Proponent's stated benefits and costs		Present value (\$m, \$2018/19) @ 7% real discount rate	% of total
Benefits			
Travel time savings		\$110.98	95.6%
Improved trip reliability		\$14.76	12.7%
Vehicle operating cost (VOC) savings ¹		-\$12.44	- 10.7%
Avoided crash costs		-\$0.01	0.0%
Environmental externalities		-\$1.18	- 1.0%
Residual value		\$3.97	3.4%
Total Benefits²		\$116.09 (A)	100%
Costs			
Capital costs (P90)		\$232.77	106.1%
Operating costs		-\$13.45	- 6.1%
Total Costs²		\$219.32 (B)	100%
Core results	Net benefits - net present value (NPV)^{2,3}	-\$103.22 (C)	n/a
	Benefit–cost ratio (BCR)⁴	0.53 (D)	n/a

Source: Proponent's business case

(1) Vehicle operating costs increase with the project as the new bridge alignment would slightly increase the distance vehicles travel.

(2) Totals may not sum due to rounding.

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

(4) 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)	\$633 million (P90)
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The Tasmanian Government's proposed Australian Government funding contribution	\$506 million (80% of the total capital cost)
Other funding (source / amount / cash flow) (nominal, undiscounted)	\$127 million (Tasmanian Government contribution, 20% of the total capital cost)

7. Deliverability

The proponent assessed the advantages and disadvantages of four different procurement approaches: design and construct, construct only, alliance, and public-private partnership. The proponent's preferred approach is design and construct, as it could provide greater certainty over the project delivery cost and present opportunities for innovation. Risks with this approach include potentially higher tendering costs (leading to less competitive tenders or fewer tenderers), and higher prices. This reflects potential uncertainties in final design and flow-on construction cost impacts. The proponent noted that the preferred procurement approach may be revisited later.

The Tasmanian Government has proposed that, based on previous funding for projects in the state, the investment be split 80:20 with the Australian Government. Value capture mechanisms including rates, betterment levies and user charges including tolls were considered. However, given the minimal expected change in service levels, betterment levies, rate increases or user charges were considered by the proponent not to be appropriate.

The proponent plans to establish a Project Delivery Team, in addition to a Project Steering Committee and a Stakeholder Advisory Group. The last time the Tasmanian Government delivered a similar project was Bowen Bridge in the 1980s and, by the proponent's own admission, delivering a new crossing over the Derwent will be a new challenge. Major highway and road upgrades have been completed by the State Government in recent years.

The project site is within the River Derwent Marine Conservation Area. This encompasses 1,636 hectares along the River Derwent between New Norfolk and Claremont. The reserve contains diverse habitats and large areas of wetlands of high conservation value. Construction activity within conservation areas is required to follow a Tasmanian Parks and Wildlife Service Reserve Activity Assessment process.

Further work is required to fully understand the nature of the construction impact on its surrounds. At this stage, however, no specific environmental issues have been identified that cannot be managed.

As noted in Section 6, there remain limitations relating to the level of design maturity of the current proposal that means the deliverability of elements of the project cannot be assessed with confidence:

- Plans for decommissioning the existing Bridgewater Bridge remain unclear and unconfirmed.
- There are inconsistencies in the plans for a shared cycling and pedestrian path on the proposed new bridge and how this integrates with the broader network.

Further geotechnical assessment is needed to ensure that the proponent's preferred option for a new crossing can be supported by the river bed. This is supported by the findings of additional independent engineering advice commissioned by Infrastructure Australia. Since this option features a new alignment across the River Derwent, there may be risks that are different from those associated with the alignment of the current bridge. The final decommissioning plan for the existing bridge may also have geotechnical implications.

In the event that the project proceeds, we encourage the proponent to undertake and publish a Post Completion Review to assess the extent to which expected project benefits and costs have been realised. This will help to inform the development of future projects. In particular, such a review should assess project costs, and outcomes against the expectations set out in the business case.