

March 2016

Review of Bridgewater Bridge design and cost estimate



Contents

Review of Bridgewater Bridge design and cost estimate	3
1. Overview	3
2. Recommendation.....	4
3. Design requirements.....	4
4. Design exclusions	4
5. Options.....	5
6. Differences from initial design	6
7. The preferred option.....	6
8. Issues.....	7
8.1 Public consultation.....	7
8.2 Land acquisition	7
8.3 Existing bridge	7
8.4 Navigation height	7
8.5 Geotechnical studies	8
8.6 Environmental issues	8
9. Project funding.....	8
10. Timing.....	9

Review of Bridgewater Bridge design and cost estimate

I. Overview

Infrastructure Tasmania was charged with the responsibility of conducting a design and cost estimate review for the construction of a replacement structure for the existing Bridgewater Bridge.

The existing Bridgewater Bridge does not meet contemporary loading and design standards as part of the National Land Transport Network. It provides one lane in each direction and has a posted speed limit of 60 km/h. The existing bridge and causeway are reaching the end of their serviceable lives and future refurbishments will be increasingly costly. The bridge has high maintenance costs due to its age and current operation as a vertical lift bridge.

Replacement of the existing structure has been a high priority for many years in light of the reduced functionality and high maintenance costs of the existing structure. A number of studies have previously been undertaken with the most recent concept design in 2012 proposing an \$823 million build for construction commencing in 2019. This costing is based on a P50 evaluation which indicates that the project has a 50 per cent chance of being more expensive and a 50 per cent chance of being less expensive. This is a standard methodology and provides a reasonable level of certainty to allow for consideration of detailed design of the structure. All project figures in this report have been expressed in similar terms.

At this cost the project was deemed too expensive by Federal funding agencies and unlikely on that basis to ever be built. Advice from the key funding agency, the Department of Infrastructure and Regional Development (DIRD) indicated that a structure at that cost was unlikely to be successful in attracting the necessary funding and a cost estimate closer to \$500 million was likely to be more acceptable. The key objective of the review conducted by Infrastructure Tasmania was to achieve an outcome that would be within a funding envelope that could receive funding approval and meet the functional requirements of a key component of the state's primary freight corridor between Hobart and Burnie.

While the 2012 design had been thoroughly considered, and had involved considerable stakeholder consultation, it was determined that it would be beneficial to engage expertise that had not previously had involvement with the project to enable a totally new perspective on the fundamental requirements of the bridge, the constructability of the structure and any opportunities to reduce costs through design or construction efficiency. Bringing this new perspective also allowed for a broader engagement with industry specialists in bridge construction providing a rigorous and robust review of construction options, methods and risks. The review did not ignore previous considerations but analysed them in depth to ascertain where savings could be possible and cost effective elements included in an end construction solution.

Consulting firm, Johnstone McGee and Gandy (JMG) was engaged to undertake an expert review and to provide advice on a more cost feasible bridge crossing solution. JMG was provided with all previous reference material and drawings but was not bound by any particular aspects of the previous assessments. It was requested to provide a limited number of options that could be further analysed and considered with a view to attaining a preferred option. The review resulted in the development of four plausible options from which a preferred option has been proposed for detailed design and costing.

2. Recommendation

It is recommended that Option 1B be progressed to detailed design and costing. A precast concrete beam bridge with spans of approximately 35 metres and a maximum navigable height of 16.2 metres to match the Bowen Bridge, this option has an estimated cost of \$533 million in 2019 dollars.

The proposed structure maintains the same basic footprint as the initial 2012 proposal with no additional land acquisitions expected. It minimises sediment disturbance and provides a solution likely to be in a feasible cost range acceptable for Federal funding support.

3. Design requirements

In seeking to achieve the preferred option there were a number of design requirements that were stipulated. This included the following:

- Four lanes between the East Derwent Highway, Bridgewater and the Brooker Highway
- A minimum design speed of 100 km/h, however a preferred design speed of 110 km/h for the new alignment
- Provision for pedestrian and cycling traffic
- Connecting roads shall have traffic lanes and design speed consistent with the existing network
- Local load connectivity for both short to medium and long term requirements
- Maximum clearance for vessels of 16.2 metres (consistent with the Bowen Bridge) with an alternative clearance of 8.0 metres.

4. Design exclusions

In addition to these specific requirements there were two design exclusions:

- No allowance for rail
- No allowance cost estimates or consideration for removal of the existing bridge.

5. Options

In developing the options, JMG was asked to consider differing navigation heights to ascertain any cost advantage that might be obtained but to also identify impediments in relation to particular heights. The current navigation height of the River Derwent is governed by the air draft of the existing Bowen Bridge at 16.2 metres.

A 16.2 metre air draft has no new impacts on the water traffic requirements of the river and provides a height that matches in well to the embankment on the northern approach. This is a more costly solution as there is more volume in the piers, however, the cost increase is modest at \$20 million.

A lower solution of eight metres was also considered. It was found that an eight metre air draft solution would require further stakeholder management with the future users of the waterway.

Furthermore, there may be unfavourable emergency provision impacts by not allowing the higher passage. In the unlikely event of a significant flood in the Upper Derwent or any other event that threatens access to New Norfolk via either the Lyell Highway or Boyer Road, the river could become an important feature for providing access. The Police Boat, Van Dieman would also be unable to pass Bridgewater at an eight metre air draft.

The consultants also considered solutions that utilise extensive embankments (causeways) within the river. This option has the largest environmental footprint and increases project risks associated with the environment through threatened and protected species and potentially problematic soils and construction and maintenance risks associated with settlement and seismicity. The authors of the 2012 concept design gave consideration to an embankment bridge however discounted this early on the basis of geotechnical risk. Therefore, an embankment option has not been investigated in any real detail.

On the basis of these requirements and exclusions and following detailed assessment and consultation with experts in bridge construction methodology, JMG identified a list of four primary options for consideration. The options as summarised below and couched in 2019 figures for comparative purposes:

1. A low cost option: using the existing embankment (causeway) and providing a height restriction on vessels of eight metres (current restriction on the Derwent is 16.2 metres imposed by the Bowen Bridge) at \$441 million (known as Option 2)
2. A practical solution proving a low level concrete bridge with a height restriction for vessels of eight metres at \$509 million (Option 1A)
3. The practical solution of a height restriction matching the Bowen Bridge of 16.2 metres at \$533 million (Option 1B). The preferred option.
4. An aesthetic solution consisting of a composite bridge using a precast concrete structure as per 3 above with a cantilever section over the navigation span at \$577 million (Option 1C).

Following preliminary estimates presented for options 1A, 1B, 1C and 2A it was decided to not proceed with more refined estimates for Option 1A. Additional design and estimating was completed to breakdown quantities to a more detailed level, somewhat consistent with the estimate used in the 2012 concept design. Costs associated with the design phase, property acquisition and delivery phase were further refined. Upper and lower bounds were applied to each line item of the estimate and a P50 and P90 estimate determined.

6. Differences from initial design

The key differences from the initial design are:

- No curving roadway – the new design is a straight bridge crossing of the Derwent thereby reducing the length of the bridge and construction costs. The initial curving design was complex and difficult to build.
- Utilisation of bored piling construction methods. This is expected to minimise the disturbance of sediments during construction.
- The new pile construction methodology allows the construction of more piles at closer spacings, with shorter spans and thinner structural depth of the bridge deck between piers, thereby reducing build costs.
- Utilisation of the existing East Derwent Highway intersection/roundabout further reducing costs
- Utilisation/expansion of the existing cause way would provide geotechnical challenges associated with the settlement of the fill into soft sediments. The filling may also cause movement in the existing causeway. This could be a long term issue as the settlement can take many years to finalise, noting that the existing causeway is still moving many decades after construction. It is also thought that any causeway may be subject to liquefaction in the case of ground movement. Piling provides support to the infrastructure from below the areas that may be subject to the above.
- Changes will be required to the Boyer Rd intersection requiring New Norfolk traffic to travel towards the East Derwent Intersection to gain access and egress from the new bridge as the existing causeway will not be maintained.

7. The preferred option

Option 1B is the preferred option. It proposes a precast concrete beam bridge with spans of approximately 35 metres and a maximum navigable height of 16.2 metres to match the Bowen Bridge. Final design and costings will necessitate further work in respect of potential environmental issues and their management and geotechnical studies.

The estimated cost of the recommended option in 2019 dollars is \$533 million. A project of this cost is likely to receive Federal funding support through DIRD in the order of 80 per cent of the construction cost.

This recommendation makes no provision for rail access and includes the closure and decommissioning of the existing structure. This will avoid the substantial costs of maintaining an operational span and the problematic causeway.

It maintains the same fundamental foot print as the initial proposal with no additional land acquisitions expected. It minimises sediment disturbance and provides a solution likely to be in a feasible cost range acceptable to DIRD and hence likely to be successful in seeking supporting funding.

8. Issues

8.1 Public consultation

No public consultation has occurred in relation to this new proposal. There was extensive consultation in relation to the 2012 proposal and the fundamental footprint and amenity has changed very little. No further acquisitions are anticipated beyond those which were proposed for the previous design. The southern access is unchanged from the previous design and the only difference at the northern access is that an at grade arrangement is proposed for the roundabout at the junction with the East Derwent Highway rather than grade separation. It is understood that there may have been an understanding that local traffic in the Bridgewater area directly north of the river may have sought to enjoy continued access to the existing bridge once a new structure was built. The instability of the existing structure and the likely increasing cost of maintenance and risk would preclude that as being a plausible option going forward. Bridgewater traffic and traffic travelling from Boyer Road will need to access the new bridge via the East Derwent roundabout.

Infrastructure Tasmania met with the Mayors and General Managers of the three councils impacted by the new structure - Glenorchy, Derwent Valley and Brighton. Although not provided for in previous designs, concern was expressed at the lack of provision for passenger rail on the new structure. It was highlighted that the Infrastructure Tasmania report on light rail had proposed a corridor from Granton to Hobart on the basis of the significant additional cost of any river crossing, estimated to be in the region of in excess of \$100 million. Previous designs for the Bridgewater Bridge in the recent decade have not included provision for rail. Councils were of the strong view that retention of the existing structure in a care and maintenance mode provided a strategic positioning in the event that a future business case could demonstrate a positive benefit for a passenger rail across the Derwent River.

8.2 Land acquisition

The owners of all land required for a new structure have previously been notified with those choosing to settle the matter early, already having their acquisitions completed.

Fifteen parcels of land have been acquired with four ongoing. The prime outstanding land acquisition matter is around the treatment of the access from the northern shore of the Derwent River to link up with the northern at grade roundabout. This component of the overall design does not impact significantly the overall project but is an important ancillary issue that needs to be resolved.

8.3 Existing bridge

The revised proposal does not allow for any costs as to the future options/management of the existing bridge. The proposal does not allow for the use of the existing structure as a local link for pedestrian and cyclist traffic. Any continued use will incur considerable costs in terms of the maintenance of the lifting capability and associated infrastructure maintenance which was one of the key reasons necessitating the project. The future of the existing infrastructure and its associated heritage values is yet to be determined. At this stage it is planned that the navigation span will be lifted and secured in position to allow river traffic pending the assessment of future options.

8.4 Navigation height

The clearance height of the Bowen Bridge of 16.2 metres has been maintained on the proposed bridge such that the structure does not provide any further impedance on river traffic. It has been estimated that this imposes a cost in the order of \$20 million on the cost of a similar structure with a clearance of eight metres.

8.5 Geotechnical studies

Detailed geotechnical studies have not been carried out on any of the proposed alignments. Geotechnical conditions have a large bearing on the bridge substructure and optimisation. A full geotechnical survey along the route alignment will enable a more precise substructure design and a more robust evaluation of the risks and costs associated with the project.

8.6 Environmental issues

The Bridgewater Bridge site is within the River Derwent Marine Conservation Area. This conservation area encompasses 1 636 hectares within the River Derwent between New Norfolk and Claremont. The reserve contains a diversity of different 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 and possible issues and management. At this stage however no specific environmental issues have been identified that cannot be managed.

9. Project funding

The agreed funding model with the Australian Government is that it will meet 80 per cent of the cost of National Highway projects with the remaining 20 per cent being the responsibility of the State Government. Some initial funding has been provided to facilitate land acquisition and another tranche will be required to support further geotechnical and environmental studies. In order to meet anticipated time tabling for the project there will also need to be funds advanced for detailed design work. The 20 per cent contribution from the State Government has not been factored into forward budget estimates at this time, however, it is under active consideration within the forward budget process.

The process for obtaining funding involves a dual track process where a business case needs to be prepared and submitted to both Infrastructure Australia (IA) and DIRD. Bridgewater Bridge has previously been submitted and accepted by IA as a priority initiative for Tasmania. The detailed business case must include a rigorous cost benefit analysis and must be submitted in accordance with the required templates and format stipulated by IA. The business case is likely to require specialist expertise in developing the cost benefit analysis and will need to be factored into the project timetable. Once received by IA it will evaluate the business case and work with the project sponsor to test the viability of the proposal, generally through the agency of an appointed expert consultant. DIRD will also review elements of the business case from its perspective to ascertain relative merit in respect of other projects and its global allocation. It will have regard to the findings and determinations of the IA process.

It is likely that in seeking Federal funding, IA will not want to limit itself to the options canvassed in the JMG evaluation but will seek to satisfy itself that all possible options have been considered including, for instance, why the relatively under-utilised Bowen Bridge could not service the freight and passenger needs of traffic seeking to cross the Derwent River. It will be important to not only address the shortcomings of the existing structure but to methodically respond to other plausible options that may appear to have a more cost effective solution.

10. Timing

In terms of timing for the project it is proposed that, along with the already agreed Midland Highway upgrade works, this project be a priority for funding in the next five year national partnership funding program. A commencement of construction of the bridge in 2019 would be highly desirable. This will require immediate and urgent attention to business case development in order to secure overall funding support for the project but also to trigger a release of funding to allow for detailed design work to commence.

It is anticipated that final design would be undertaken during 2017-18 allowing for construction to commence in 2019.



Infrastructure Tasmania

10 Murray Street, Hobart TAS 7000 Australia

GPO Box 536, Hobart TAS 7001 Australia

Phone: 1300 135 513

Web: http://www.stategrowth.tas.gov.au/home/about_us/infrastructure