

issued by PennDOT worth USD 793 million, plus private equity contributions totaling USD 58 million. The financing is to be repaid through milestone payments linked to the achievement of prescribed levels of work, totaling around USD 224 million, and periodic availability payments that include both a fixed element (90 percent) and a CPI-indexed element (10 percent) of around USD 35 million. The performance-based availability payments were set to begin once construction of the bridges had been substantially completed, to incentivize early completion of construction. A portion of the milestone and availability payments due will be used by PennDOT to pay the PAB purchasers. Accordingly, payment of the PABs is linked to the achievement of required asset performance levels.

### Lessons Learned

By bundling, the project achieved economies of scale for due diligence, project preparation, and the tendering process, and thereby saved time

and money. Specifically, it is estimated that the efficiency inherent in bundling numerous projects together will save taxpayers approximately 30 percent of what it would otherwise have cost to replace the bridges. In addition, this project will address a sizeable portion of the structurally deficient bridges in the state. Logistically, this would have taken an estimated ten to fifteen years for PennDOT to complete on its own. Instead, the private partners assume the construction risk and can better mobilize a large-scale construction effort than the resource constrained PennDOT.

Although the project is considered a success in terms of clearing PennDOT's backlog of bridge repairs, progress has proven somewhat slower than expected, with the completion date moved from 2017 to 2019. Challenges such as higher than anticipated costs, difficulties obtaining right-of-way access, and issues related to utility coordination have been cited as causes of the delay.<sup>34</sup>

<sup>34</sup> GIH. 2017. "Pennsylvania Rapid Bridge Replacement Project." GitHub. Accessed January 25, 2019. [https://github-webtools.s3.amazonaws.com/local-umbraco/media/1455/gih\\_showcaseprojects\\_penn-bridges\\_art\\_web.pdf](https://github-webtools.s3.amazonaws.com/local-umbraco/media/1455/gih_showcaseprojects_penn-bridges_art_web.pdf);

Delmon, Jeffery. *Small-Scale Municipal PPP*. Washington, D.C.: World Bank Group, 2014. Accessed January 25, 2019. [https://www.thegpsc.org/sites/gpsc/files/26\\_feb\\_small\\_scale\\_municipal.pdf](https://www.thegpsc.org/sites/gpsc/files/26_feb_small_scale_municipal.pdf);

Plenary Walsh Keystone Partners. 2015. "What is The Rapid Bridge Replacement Project?." Paraidbridges. Accessed January 25, 2019. <http://paraidbridges.com/projectoverview.html>;

Engineering News-Record. 2018. "Cost constraints slowing PennDOT rapid bridge replacement program." Roads & Bridges. Accessed January 25, 2019. <https://www.roadsbridges.com/cost-constraints-slowing-penn-dot-rapid-bridge-replacement-program>.

<sup>35</sup> Glabb ([https://commons.wikimedia.org/wiki/File:Hangzhou\\_Bay\\_Bridge\\_South.JPG](https://commons.wikimedia.org/wiki/File:Hangzhou_Bay_Bridge_South.JPG)), „Hangzhou Bay Bridge South“, <https://creativecommons.org/licenses/by-sa/3.0/legalcode>

## 16. Challenging Case: Hangzhou Bay Bridge, China



Photo Credit<sup>35</sup>

### Background

To showcase China's rapid development and further stimulate growth, Ningbo and Jiaying municipal governments decided to pursue the construction of a trans-sea bridge connecting the two municipalities in 1993. The trans-sea bridge was expected to help boost economic development in the Yangtze River Delta, known as the Golden Industrial Triangle.

### Project Structure

In 2001, after nearly a decade spent completing feasibility studies and designing the bridge, the Ningbo and Jiaying municipal governments and 17

private enterprises jointly set up a project company called Ningbo Hangzhou Bay Bridge Development Co. Ltd. The project company was tasked to build the bridge under a Build-Operate-Transfer (BOT) scheme with a concession term of 30 years. The project company would be responsible for delivering and managing the bridge over the life of the project, including preparation, financing, construction, operation, maintenance, and transfer; as well as overseeing and coordinating related projects and ancillary facilities. The project company invested RMB 11.8 billion (USD 1.42 billion) in the project, of which RMB 149 million (USD 18 million) was provided by the 17 private enterprises.

The primary revenue source for the project was expected to be toll fees. Additional income would come from hotels, restaurants, gas stations, and a viewing tower located on a platform in the middle of the bridge. Based on the feasibility studies, the project was expected to recover the capital cost in 15 years with a return on investment (ROI) of 12.58 percent (including construction period).<sup>f</sup> 12.58 percent (including construction period).

### Lessons Learned

Construction began in June 2003 and was completed in June 2007. Following a series of trials and evaluations, the bridge opened in 2008 as one of the longest trans-sea bridges in the world, with a length of 36 km. It shortened the travel distance between the two municipalities from 400 km to 180 km, or from a four-hour drive to only two hours. In 2013, however, the project was reportedly struggling, due in part to the following:

- i. Another bridge was built near the Hangzhou Bay Bridge with a toll price that was half that charged at the Hangzhou Bay Bridge;
- ii. An updated study completed in 2011 forecast that total costs would not be recovered over the 30-year concession period;
- iii. Facing these challenges, the private partners, which initially owned 80 percent of shares in the project company, quit the project, contributing to a capital shortage; and

- iv. After the private companies' divestment, the public sector became the majority shareholder (85 percent), such that the risks that had been assumed by the private sector were transferred back to the government.

The platform in the middle of the bridge that offered hotels, restaurants, and viewing deck was ultimately closed down to reduce costs.

This project highlights the following:

- Municipalities should try to consider all of the potential risks throughout the entire life of the life and strive to ensure a fair allocation of risks between the public and private partners. Transferring too much risk to the private partner can result in or contribute to project failure.
- PPPs entail a long-term agreement, over the course of which both parties need to be willing and properly incentivized to work together to ensure the project's success. This may include allowing reasonable accommodations, permitting alterations in the scope or design of the project, and not taking actions that would threaten the project's viability, including by agreeing to limit or prohibit competing projects.<sup>36</sup>

<sup>36</sup> Wang, Queena Likun. *Case Study on P3 Failures in China: Taking Hangzhou Bay Bridge as an example*. Hamilton, Ontario: McMaster University, 2016. Accessed May 25, 2019. [https://www.eng.mcmaster.ca/sites/default/files/uploads/case\\_study\\_on\\_p3\\_failures\\_in\\_china\\_report-likun\\_wang.pdf](https://www.eng.mcmaster.ca/sites/default/files/uploads/case_study_on_p3_failures_in_china_report-likun_wang.pdf);

Urio, Paul. *Public-Private Partnerships: Success and Failure Factors for In-Transition Countries*. Lanham, Maryland: University Press of America, Inc, 2010. Accessed May 25, 2019;

Ke, Yongjian, Shou Qing Wang, and Albert Chang. "Public-Private Partnerships in China's Infrastructure Development: Lessons Learnt." Paper presented at CIB international Conference: Changing roles: New roles, New challenges, Noordwijk, January, 2019. Accessed May 25, 2019. [https://www.researchgate.net/publication/260267511\\_Public-Private\\_Partnerships\\_in\\_China's\\_Infrastructure\\_Development\\_Lessons\\_Learnt](https://www.researchgate.net/publication/260267511_Public-Private_Partnerships_in_China's_Infrastructure_Development_Lessons_Learnt);

Torres, Adrian. "PPP in Australia." ADB Presentation, Tokyo, Japan, June 2, 2015. Accessed May 25, 2019. <https://www.carecprogram.org/uploads/3-PPPs-in-Australia-1.pdf>.

<sup>37</sup> Photo in the public domain published by OSX [https://commons.wikimedia.org/wiki/File:Cross\\_City\\_Tunnel\\_entrance,\\_Harbour\\_Street,\\_Sydney,\\_New\\_South\\_Wales\\_\(2010-10-16\)\\_01.jpg](https://commons.wikimedia.org/wiki/File:Cross_City_Tunnel_entrance,_Harbour_Street,_Sydney,_New_South_Wales_(2010-10-16)_01.jpg)

## 17. Challenging Case: Cross-City Tunnel, Sydney, Australia



Photo Credit<sup>37</sup>

### Background

To ease congestion in the Sydney Central Business District (CBD), the Roads and Traffic Authority of New South Wales (NSW) planned to build a cross-city tunnel (CCT) – a 2.1 km twin two-lane motorway running east and west beneath the Sydney CBD. The estimated total project cost was as high as AUD 1.050 billion (USD 712.7 million). Due to the high cost, the NSW authority decided to pursue a PPP to deliver the project.

### Project Structure

In October 2000 a total of eight consortia expressed interest in bidding for the project. Of the eight, three were shortlisted, leading to the selection of Cross City Motorway Pty. Ltd. (CCM), a consortium comprising Bilfinger Berger AG, Baulderstone Hornibrook Pty. Limited, and Deutsche Bank AG, as the winner in 2002. CCM was selected due to its innovative design, more aggressive traffic forecast, and willingness to provide an upfront payment of around AUD 100 million (USD 68 million) to the NSW state