ANZAC Bridge Stay Cable Upgrade

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Summary

With the recent revisions to the Australian Bridge Code and other codes of practice around the world, the Roads and Maritime Services of New South Wales propose to refurbish and improve the performance of the stay cable system and other infrastructure on the ANZAC Bridge. This will extend the life of this key link in Sydney's transport network. This maintenance project is being delivered via an alliance framework by Bridge Solutions Alliance.

The project involves four main areas namely: Stay Cable Improvements; Access Improvements; Fencing and Temporary Works. In the development of the design solutions, the designers assessed a number of inter-related criteria including safety, cost, maintenance, urban design, community and stakeholder input, traffic and constructability. The latest technology in stay cable design and maintenance from around the world was investigated, a comprehensive load rating to current design standards was undertaken and in-situ testing was completed to determine the scope of works for the project.

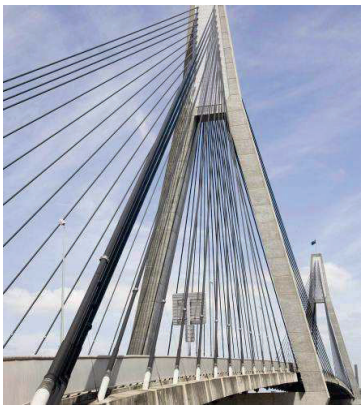

Fig. 1. ANZAC Bridge looking towards the west

Keywords: Stay cable, Maintenance, Retrofitting, Vibration mitigation, Fatigue, Rain&Wind induced vibration, Cable robot, Additional dampers.

The ANZAC Bridge (fig. 1) was designed and constructed in the early 1990's. The bridge has three main cable-stayed spans measuring a total length of 805 m and 32.2 m wide. These spans are supported by 128 stay cables.

Towards the end of the original construction, larger than expected oscillations were observed in the stays under certain combinations of rain and wind. This phenomenon is known as rain-wind induced vibration. The concern was that these large vibrations could, over time cause a premature loss of fatigue life in the strands.

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Two design features are proposed to solve the problem. The first is to fix a helical rib to the exterior surface of the stay cable sheath using a purpose built robotic welder module fitted to a cable climbing robot.

The second is to apply dampers to the cables at the bottom anchorages. Internal Radial Dampers will be installed to minimise vibration effects on the stays. They will be located at 1.5 m above deck level. A two-part steel guide tube will connect to the existing steel formwork tube to provide support to the dampers and transmit the lateral loads back to deck level.

The following refurbishment works will be undertaken in order to improve the drainage of the stay system:

- Repair the damaged over-lap sleeves near the top of the stay cables and adjust the main sheathing to maintain minimum overlap for thermal expansion/contraction using rope access techniques.
- Remove the HPDE duct within the formwork tube to provide better access for maintenance using a special cutting tool
- Drill a new 30 mm diameter hole through the concrete anchorage blister, below the edge beam to allow water egress from the anchorage zone
- Incorporate additional drainage holes through the new guide tubes and IRDs above deck level

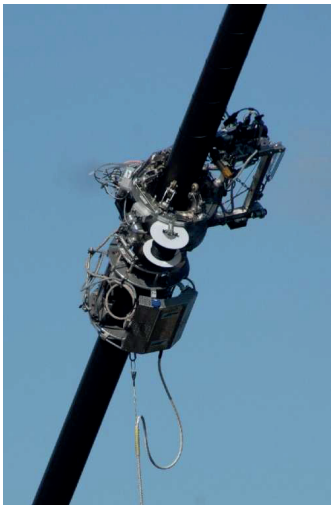

Fig. 2. On site helical fillet welding

The design phase of the project was delivered in less than six months and the construction phase is currently on program. This has been achieved through a collaborative approach adopted by each project participant. The final solutions to the project challenges have involved a number of innovations including the retro-fitting of a helical fillet weld to the stays on an operating bridge - a world first.

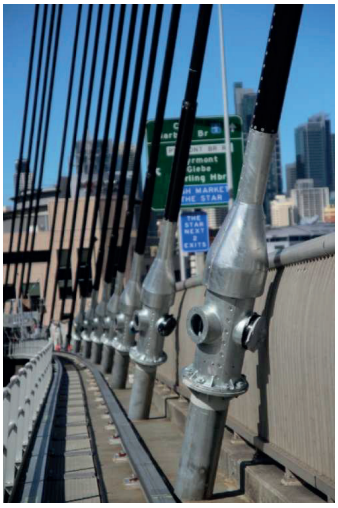

Fig. 3. Additional stay components installed at deck level

Acknowledgements

The Bridge Solution Alliance was formed by the Roads and Maritime Services of New South Wales (Australia) together with Freyssinet, Baulderstone, and Sage Automation. Within the Alliance, Freyssinet was in charge of designing and implementing the cable retrofitting.

The robotic welder module and the special HDPE duct cutting tool have been developed by Alpin Technik und Ingenieurservice GmbH (ATIS), in Germany, jointly with Freyssinet.

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