

## **PENNANT HILLS ROAD BRIDGE SHEAR STRENGTHENING. MANAGING INNOVATION.**

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Pennant Hills Road Bridge Strengthening Project is a story of success and innovation. It provides a valuable lessons learned and a blueprint for similar projects where harnessing novel techniques and solutions to overcome challenging constraints is a necessity.

The existing Pennant Hills Road Bridge over the M2 Motorway in Sydney required shear strengthening, which was confirmed through in-situ observations and several structural assessments. The two-span structure comprises a super-T deck which is 42m long and 80m wide and accommodates a diamond interchange between the M2 ramps and Pennant Hills Road. As such the bridge provides a non-stop connectivity for very significant traffic volumes including dedicated routes for Over-Size Over-Mass and HLP 320 type vehicles. This meant that strengthening solutions requiring frequent and uninterrupted access to the top of the deck were not feasible. Also, allowable impact to the motorway operations was limited to only 8h night-time lane closures. At 90mm thickness, the girders' webs posed another constraint for any heavy-duty connections.

The paper provides the detailed account of the key project decisions and design specifications fundamental to its success. The way risks were managed and adaptivity enabled through competency form an integral part of the story. In technical terms it places an emphasis on the validation process adopted right from the procurement stage and through the design and further execution on site. The strengthening system comprising of epoxy bonded steel plates is explained in detail including important innovations introduced to assist with its application, validation, and enhanced performance. The analytical process of the non-linear system and its verifications is systematically explained. Lessons learned from the installation process are also covered which provide a critical feedback loop to the design.

