

Design of Australia's first curved torsion box girder pedestrian bridge

Dr Huy Binh Pham*, Technical Principal, SMEC

Mr Noritomo Maruo, Senior Associate Engineer, SMEC

Mr Adrian Gibson, Senior Modeller, SMEC

SMEC Tower 4, Level 20, 727 Collins St, Melbourne, VIC, 3008, Australia

Abstract: The Eel Bridge, part of the North East Link Project in Melbourne Australia, is designed to carry pedestrians and cyclists across Lower Plenty Road. Designed by SMEC with architectural input from Wood Marsh, it is to be constructed by the Spark Consortium. The bridge features an irregular steel torsion box structure with cantilever crossbeams, supported by tapered rectangular piers and monopiles.

The first challenge in the design of this bridge was to select the bridge's alignment and pier locations that are influenced by numerous site constraints, including existing roads, a creek and residential buildings. Other complex technical challenges include torsional behaviour of an irregular box, complex steel connections, and dynamic performance under foot traffic and wind excitation. The bridge also has an extremely complex geometry with curves both in plan and elevation, which posed significant challenges in setting out. Despite all these challenges, the outcome of this design is an aesthetically pleasing six span structure with the longest span being 47m long. The curved deck, made of thin reinforced concrete with permanent steel forms, supports timber battens and a stainless-steel mesh balustrade. It fits nicely with its surrounding with a minimised footprint on the ground. Its elements are slender with smooth transitions to each other and its approaches.

This is a result of various in-depth structural studies and innovative modelling techniques. They included the use of finite element analyses, long-term effect investigation and construction staging calculations. The bridge geometry was meticulously modelled in 3D using Revit, incorporating extensive metadata and automated scripting to handle the complex alignment and interactions of elements. These studies and techniques will be described in this paper in detail. As this is Australia's first curved torsion box girder pedestrian bridge, this paper can provide a good reference for designers and researchers alike while working on this special bridge form.

