Computational Design in the Analysis of the Wēiti River bridge

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Abstract

Computational Design (CoDe) techniques have been utilised extensively throughout the design and currently ongoing construction phases of the 535-metre-long Wēiti River bridge, New Zealand's first extradosed road bridge. The current paper describes how employing fully parametric analysis and partially parametric BIM models from the design's inception facilitated the design process, allowing the team to adeptly address complex geometry challenges, automate repetitive design tasks and manage inevitable design changes.

The productivity gained from CoDe was particularly evident in handling several geometry modifications of the cross-section and alignment, allowing the team to concentrate on the implications of these changes rather than their implementation. The parametric approach also proved invaluable in the design of post-tensioning (PT) as it ensured seamless updates of the PT layout and eliminated discrepancies between the analysis model, BIM model, and drawings. Moreover, a multitude of sub-models were developed throughout the design to investigate the interaction between permanent and temporary works, conduct transverse analyses and assess critical construction stages, to only name a few. CoDe enabled the efficient creation and maintenance of these sub-models while minimising the risk of discrepancies. Furthermore, relying on a single 3D parametric model of the superstructure for both analysis and BIM purposes saved significant modelling time and reduced the potential for errors, enhancing overall project accuracy and productivity.

The Wēiti River bridge underscores the benefits of CoDe in bridge engineering. The use of parametric analysis and BIM models from inception through to construction has streamlined the design process with effectively managing complex geometries, repetitive tasks, and design changes. Ultimately, the successful application of CoDe in the Wēiti River bridge design presents a compelling case for its broader adoption in bridge engineering.