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Optimizing Bridge Deck Construction: A deep Neural Network Approach for Limiting Exterior Grider Rotation

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Abstract : In the United States, bridge construction often employs overhang brackets to support the deck overhang, the weight of fresh concrete, and loads from construction equipment. This approach, however, can lead to significant torsional moments on the exterior girders, potentially causing excessive girder rotation. Such rotations can result in various safety and maintenance issues, including thinning of the deck, reduced concrete cover, and cracking during service. Traditionally, these issues are addressed by installing temporary lateral bracing systems and conducting comprehensive torsional analysis through detailed finite element analysis for the construction of bridge deck overhang. However, this process is often intricate and time-intensive, with the spacing between temporary lateral bracing systems usually relying on the field engineers' expertise. In this study, a deep neural network model is introduced to limit exterior girder rotation during bridge deck construction. The model predicts the optimal spacing between temporary bracing systems. To train this model, over 10,000 finite element models were generated in SAP2000, incorporating varying parameters such as girder dimensions, span length, and types and spacing of lateral bracing systems. The findings demonstrate that the deep neural network provides an effective and efficient alternative for limiting the exterior girder rotation for bridge deck construction. By reducing dependence on extensive finite element analyses, this approach stands out as a significant advancement in improving safety and maintenance effectiveness in the construction of bridge decks.

Keywords : bridge deck construction, exterior girder rotation, deep learning, finite element analysis
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