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Long term durability problems of steel girder bridges due to temperature variation

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Composite bridge construction using reinforced concrete decks and steel girders is a widely used structural system in the world due to economic advantages. However, in bridges and viaducts with complex geometry, such as curved girders, the prediction of deterioration due to temperature variations is a challenge. Long-term damage processes associate with thermal movement can be severe and become critical. In the research presented in this article, a 19-span steel twin-box girder bridge, in Denver, Colorado, was inspected and monitored in order to detect long term damage due to temperature variations. The structure construction was completed in 1985 and has four horizontal curves and three vertical curves. The bearings are all expansion pot bearings except those on the middle pier, which are fixed bearings. Due to the extreme daily temperature changes in Colorado, excessive transverse superstructure movement has resulted in fractures of the bearing guide bars. The lack of guiding system allows the superstructure moves in an unintended manner. Additionally, the transverse forces introduced from the superstructure led to tensile cracking of the concrete pier caps. In the successive pier inspections completed in 2001 and 2015 a significant amount of active cracks on the pier caps was reported. Besides, corrosion in the exposed pier reinforcement could result in compromised safety of the bridge substructure. In this study, multiple types of long-term damage processes of the bridge were identified and investigated. Results show that traditional method of determining movement due to temperature does not suffice to predict the actual bridge deterioration processes with enough accuracy. Due to the complex and unusual geometry of the structures, a more accurate and precise approach is necessary to predict cyclic displacements and damage due to temperature variation.

Biography

Yang Zhou is a PhD student and Research Assistant in Civil Engineering Department at the University of Colorado Denver. He obtained a BS in Civil Engineering at North-east Forestry University and an MS in Structural Engineering at the University of Colorado Denver.

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