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Effect of Steel Reinforcement Corrosion on Cyclic Behavior of Bridge Piers

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Bridges in transportation networks are susceptible to damage from the aggressive environment. Steel reinforcement corrosion is one of the main causes of deficient behavior in the reinforced concrete (RC) bridge. The corrosion of steel rebar negatively affects the serviceability and seismic performance of many RC bridges. Climate change accelerates steel reinforcement corrosion and more severe damage is expected to occur in a short period of time in the future. When these bridges are located in high seismic regions, they may experience severe earthquake events along their service life. Therefore, their seismic performance must be carefully evaluated. In this study, an efficient three-dimensional nonlinear finite element analysis based on the explicit dynamic method for sound and corroded bridge piers was established to study the effect of corrosion levels of 10, 20, and 30% on the cyclic behavior of bridge piers. The used model considers the loss of bond strength and damaged material properties of concrete and steel for compression and tension response under cyclic loading. The model is validated through a comparison with the results of the experimental test. The results revealed that the proposed method provides a good estimate of the load-carrying capacity of bridge piers. Furthermore, the used nonlinear finite element model will help identify the bridges with the highest priority for retrofitting by examining all existing bridges.

Keywords: Corrosion, Bridge Pier, Cyclic Loading, Ductility, Energy Dissipation.

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