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Editorial

One of the important measures of post-earthquake functionality in bridges is residual displacement. In their paper “An analytical study of residual displacements in RC bridge columns subjected to near-fault earthquakes”, Saiidi and Ardakani study the analyses of six reinforced concrete bridge columns subjected to near fault ground motion using fiber elements to estimate the residual displacement. Another part of the study aims at determining the residual drift ratio limit beyond which bridge columns would be unsafe. The ability of models to estimate residual displacement was assessed by comparison of the results of the analyses to experimental data. The authors report that fiber element models were generally successful in estimating residual displacements. To determine residual displacement limits, a large number of reinforced concrete bridge columns with different geometries and steel ratios were analyzed subjected to truck loading. The residual moment capacity of the column and the moment due to the trucks and the P-Delta effects were used in the study. The study concludes a residual drift ratio limit of 1.2% or more for typical bridge columns. For a suspension bridge, the balance of design, fabrication, and erection of the hangers presents a major concern. The hangers play an important role for the bridge geometry and are very sensitive to length error. In “Characteristics of hanger for a long span suspension bridge” Inoue focuses on the characteristics of suspension bridge hangers through a study of numerical analyses. Difference between bridges with one hanger rope at a hanger location per each cable plane and with two or more hanger ropes in the longitudinal direction are studied in detail. Erroneous fabrication of angers may cause undesirable results for a real bridge because two or more hangers in the longitudinal direction at one hanger location are occasionally modeled as one hanger element in the design. This simplification may not represent the actual behavior of hangers on suspension bridges. The findings of this study provide important clues to the fabrication requirements of hangers for suspension bridges. Soil-structure and especially soil-pile interaction is one of the main sources of complication in the analysis of jointless bridges. Because of the complexity of the problem, calculation of the critical buckling load of embedded piles has always been a concern to the designers since piles are relatively slender elements. In the current design method, for simplification it is assumed that soil reaction is a linear function of the lateral displacement. In their paper “Buckling of piles in cohesive soil supporting jointless bridges”, Sherafati et al. propose an approach that utilizes the energy method and incorporates p-y curves to estimate the critical axial load of piles embedded in cohesive soil. Pile head displacement is also incorporated into capacity calculation. In this method, the soil reaction is a nonlinear function of lateral displacement and can efficiently model the soil-structure interaction. The method is validated with experimental data for solving the governing differential equation along with calculation of buckling load. Results of parametric study reveal that buckling loads estimated by equivalent cantilever method are highly above the corresponding loads estimated by the energy method at relatively small pile head movement. The authors report for this condition that fully embedded piles will fail before reaching the estimated buckling load because of yielding; consequently, buckling analysis does not govern the design of piles fully embedded in cohesive soil. However for partially embedded piles, the buckling load may govern. Bridge deck durability is often compromised due to corrosion of the steel reinforcement. The use of glass fiber reinforced polymer (GFRP) bars as a substitute for steel is a possible solution to this problematic condition. GFRP is an elastic brittle material with a high tensile strength, and modulus of elasticity that is approximately 20% that of steel reinforcement. Considering these material properties, meaningful data is required to demonstrate compliance with imposed design limits at all relevant limit states. Experimental evaluation of GFRP bars as structural reinforcement for highway bridge decks must recognize and duplicate the load and support conditions specific to this application. Laboratory testing should consider load magnitudes associated with AASHTO service, strength and fatigue limit states, indeterminacy of the deck in the transverse direction, two-way distribution of wheel loads, and load application and deck support conditions as affected by truck tire contact area and girder flange stiffness, respectively. In "Experimental evaluation of GFRP bars as reinforcement for concrete bridge decks: negative bending low cycle fatigue study", Yost and Russo test 2-span continuous concrete beams doubly reinforced with GFRP bars. Testing is conducted under load and support conditions designed to simulate performance of the GFRP reinforcement in a highway bridge deck environment. Monotonic, cyclic, and low cycle fatigue loadings are applied to establish behavior of the experimental deck as related to an actual bridge deck load condition. Test results related to strength, deflection, and crack width are presented.

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