Evaluation and Analytical Verification of Shaking Table Data from Infilled Frames

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Abstract:

In a comprehensive multi-year experimental study carried out at the U.S. Army Construction Engineering Research Laboratories (USACERL), several half-scale specimens consisting of reinforced concrete frames (bare and with masonry infilling), were subjected to simulated earthquake motions using a shaking table. In- and out-of-plane motions were applied to virgin specimens, previously damaged specimens, and repaired specimens. In the theoretical study reported here (carried out at the University of Texas at Austin), the experimental data obtained by USACERL were used to evaluate the in- and out-of-plane behavior of infilled frames. Load-displacement characteristics were obtained; and maximum loads, deflections, and internal strains were measured and assessed. Dynamic response was predicted using various mathematical idealizations. Simplified analytical idealizations were developed to predict the strength and stiffness of infilled frames. Results from shaking table tests with low levels of base accelerations were not useful for evaluating the strength and stiffness of the specimens. However, results from tests with higher base shears were generally useful. The nonlinear response of infilled frames, excited in-plane, was reasonably well predicted using an equivalent SDOF idealization whose nonlinear hysteretic behavior had first been obtained using a finite element model. The out-of-plane strength of infilled frames, previously cracked under in-plane excitation, was well predicted using two-way, yield-line idealizations, including the effects of arching action.

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