Experimental and Analytical Evaluation of Disproportionate Collapse Flat-Plate Buildings

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ABSTRACT

This research focuses on the evaluation of potential of disproportionate collapse in older flat-plate structures subjected to the loss of a supporting column in extreme loading events. In order to make the most accurate determination of the potential for disproportionate collapse of flat plate structures, this research seeks to accurately evaluate the punching shear capacity of slab-column connections using the conditions present in a potential collapse event. The in-plane lateral restraint provided by the floor slab can enhance the punching shear strength of surrounding slab-column connections and may be significant. In addition, the post-punching capacity of the original failed slab-column connection may reduce the amount of load to be redistributed to the surrounding connections. In order to investigate the effects of lateral restraint and post punching capacity, six restrained and unrestrained static tests were conducted at 1% and 0.64% reinforcement ratios. Since isolated slab-column testing cannot fully represent behaviors of an actual building, multi-panel testing was done at a sub-structure system level. The specimens consisted of two 9 column portion of a flat plate building, one tested with an exterior column instantaneous removal and another tested with an interior column instantaneous removal. The tests further investigated the dynamic load redistribution, punching, and post-punching responses in a flat-plate structure.