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Keynote Paper

Performance-based seismic assessment of slab-column frames

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ABSTRACT

The two-way shear response of slab-column connections has been evaluated by a significant number of experiments. These experiments provide physical tests to examine and calibrate design methods. This paper summarizes an updated database of slab-column connection tests that have been documented in the literature using consistent criteria for selecting key response parameters including the limiting lateral drift capacity and gravity shear ratio. The collected test results include interior reinforced concrete (RC) and post-tensioned (PT) concrete slab-column connections with and without shear reinforcement under combined lateral and gravity shear demands. The updated database confirms that the limiting lateral drift tend to decrease as the gravity shear ratio increases. This database has been used to develop recommended modeling parameters to define the force-deformation backbone relationships for slab-column connection components. The proposed modeling parameters are derived considering a detailed review of the backbone response in the experimental database, and corresponding expressions for limiting drift ratios as a function of gravity shear ratio are developed. Recommendations for updates to the current modeling parameters and acceptance criteria found in ASCE 41-17 are provided.

A nonlinear model monitoring column drift to capture punching shear failure for slab-column connections was developed in the computational platform OpenSees (the Open System for Earthquake Engineering Simulation) to model the lateral load response of slab-column frames. The proposed nonlinear modeling parameters are validated from experiments reported in the literature using the developed punching shear model. Strength and stiffness in modeling and analysis of slab-column frames are discussed.

Based on the verified punching shear model, a four-story post-tensioned flat slab building that had punching shear failures during the 1994 Northridge Earthquake is evaluated. The analysis follows the ASCE 41-17 nonlinear static and dynamic modeling

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procedures with the proposed nonlinear modeling parameters and acceptance criteria. The analysis indicates that the interior SC frames are prone to damage as they do not meet the basic safety earthquake BSE-2E (collapse prevention performance level for the five percent probability of exceedance in 50 year event).

REFERENCES

Zhou, Y. and Hueste, M.D. (2017), “Review of Test Data for Interior Slab-Column Connections with Moment Transfer,” *ACI Special Publication SP-315 and fib Bulletin 81 – ACI-fib International Symposium on Punching Shear of Structural Concrete Slabs: Honoring Neil M. Hawkins*, American Concrete Institute (ACI) and fib (International Federation for Structural Concrete), SP-315-08, 141-166.