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Design, Analysis and Hybrid Tests of a Full-Scale 2-story RC Frame with Buckling Restrained Braces

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Abstract

Recent researches indicated that the use of buckling restrained braces (BRBs) can be an attractive option for seismic retrofit of RC buildings. However, researches on applying BRBs for new RC buildings are limited. In this study, four hybrid tests taking into account three different earthquake hazard levels were conducted in April 2015 in NCREE on a full-scale 2-story RC frame constructed with concrete floor slabs and BRBs in zig-zag configuration. The objectives of this study include:

1. Examine the design, fabrication methods of a novel BRB-to-RC member connection detail, and the effectiveness of the proposed performance-based design procedures for the buckling restrained braced RC frame (BRB-RCF).
2. Investigate the seismic performance of the BRB-RCF under various levels of earthquake load effects.
3. Validate the analytical models for accurate simulation of experimental responses.

In this presentation, the design of the BRB to RC member connections, construction of the specimen, selections of ground motions for the hybrid tests, analytical models for response simulations are discussed. The vertical load applying apparatus, lateral support system, load transfer mechanism, monitoring of the controlled displacements, and the hybrid testing techniques to insure accurate representations of the loading and boundary conditions are introduced. Details of story shear distributions, drift ratios, plastic hinge formations and BRBs' force and deformations during each hybrid test are critically evaluated. Tests confirm that the specimen sustained the SLE-DBE-MCE1-MCE2, four earthquake events without any connection failure or significant degradation of stiffness and strength. Tests also confirm that the nonlinear responses of the BRB-RCF can be accurately simulated using the proposed analytical models and procedures.