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Title: Effect of the Structural Wall Modeling in the Seismic Response of Buildings with Force-Limiting Connections Between Diaphragm-to-Wall Joints

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This presentation focuses on the effect of the numerical modeling approach used to simulate the nonlinear flexural behavior of reinforced concrete structural walls on the seismic response of building models with force-limiting connections (Tsampras et al. 2016) between the diaphragm-to-wall joints. A twelve-story building with flexure controlled special structural reinforced concrete wall seismic force-resisting system was considered in this study. Two wall modeling approaches were used to simulate the nonlinear flexural seismic response of the wall. The first approach considers a nonlinear spring hinge that assumes lumped inelasticity at the base of the wall. The second approach considers force-based fiber beam-column elements that assume distributed inelasticity along the length of the wall. Experimentally validated material model parameters were used to simulate the stress-strain response of concrete and steel reinforcement fibers of the force-based beam-column elements (Thomsen and Wallace 2004; Birrell et al. 2021). Both approaches assumed linear-elastic shear response. Numerical earthquake simulations of the twelve-story building models were conducted using eighteen design basis earthquake level ground motions. The numerical earthquake simulation results show that the floor total accelerations and the force responses in the building models with force-limiting connections are less sensitive to the wall modeling approach compared to the floor total accelerations and the force responses in the building model with rigid-elastic connections. The distributed inelasticity modeling approach results in larger story drift demands compared to the story drift demands calculated considering the lumped inelasticity modeling approach in the building models with force-limiting connections and in the building model with rigid-elastic connections.

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Thomsen, John H., and John W. Wallace. 2004. “Displacement-Based Design of Slender Reinforced Concrete Structural Walls—Experimental Verification.” Journal of Structural Engineering 130 (4): 618–30. https://doi.org/10.1061/(ASCE)0733-9445(2004)130:4(618).

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