Practical design of force-limiting connections for buildings with reduced higher-mode seismic responses

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Abstract

Force-limiting deformable connections reduce the seismic induced horizontal forces transferred from the floor-diaphragms to the seismic force-resisting systems in buildings with base flexural yielding mechanisms (e.g., reinforced concrete shear wall buildings) or base rocking mechanisms (e.g. precast rocking shear walls, self-centering concentrically braced frames) [1-5]. The force-limiting connections act as a seismic response modification mechanism and their use mitigates the contribution of the second and higher mode responses in the dynamic response of these buildings [3]. This presentation disseminates a practical force-based simplified design method of force-limiting connections [6]. The proposed design method determines the limiting forces at each floor of the building based on a modified version of the ASCE/SEI 7-16 alternative seismic design force method for diaphragms. The design equations are presented. Results from numerical earthquake simulations of reinforced concrete structural wall buildings [6-8] and a self-centering special concentrically braced frame building [5] show that the proposed method enables the preliminary design of force-limiting deformable connections in buildings with reduced magnitude and variability in their seismic response compared to conventional buildings. The advantages and limitations of the design method are highlighted.

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