Performance Based Seismic Design of a Confined Masonry Building

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Abstract:

Based on various studies of some recent earthquakes in seismic-prone areas of the world, some of the well designed and constructed confined masonry buildings met the required life safety (LS) performance level. This encouraging result initiates a need for a reliable aseismic design approach for this type of low-income building construction. In this study, an attempt is made to employ a performance based seismic design approach for a confined masonry building with an irregular configuration. This approach was rooted in the capacity spectrum method for reinforced concrete buildings, proposed by the ATC-40 (1996). To obtain capacity curves of a confined masonry building, various pushover analyses were performed on a FE model of the building along X and Y axes. For developing the FE model, a total strain rotating crack model was used to model reinforced concrete bond-beams and tie-columns. Likewise, the Hoffman (1967) yield criterion with low orthotropic factor was adopted to interpret the nonlinear behavior of masonry walls before strength degradation. The capacity spectrum was determined based on the capacity curve. The demand spectrum was computed by simulating an earthquake hazard level. These two spectra were intersected to produce the performance point of the building. The worst case response of primary elements at performance point was compared with the requirements of the Mexican seismic code for masonry structures (NTC-M, 2002) and with Alcocer et al (2004) performance criteria. Also, cracking patterns within the reinforced concrete bond-beams and tie-columns and unreinforced masonry walls of the building were represented to recognize the vulnerable components. Based on the results, the proposed seismic design approach can be implemented in a typical confined masonry building.

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