Performance and Nonlinear Response Comparison of Steel Moment Framework Buildings Designed by Displacement-Based and Force-Based Design Methods in Presence of Torsion

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The study presented in this thesis focuses on evaluation and comparison of seismic performance of special moment frame structures designed using two different approaches. The conventional force-based procedure of the contemporary building codes and the direct displacement-based approach are the focus of study as the design methodologies applied to torsionally-coupled buildings. For this purpose, two series 4, 8, and 12-story steel structures are designed separately using the above different approaches. The same buildings are analyzed afterwards under a suit of 11 consistent strong ground motions. At this stage, several values for torsional eccentricity are considered by displacing the mass center. Responses including the story shears and drifts, rotation of the plastic hinges, and performance levels of the beams and columns are calculated and compared. Overall, this study shows that the buildings designed based on the displacement procedure exhibit less extensive nonlinear responses more or less at all eccentricities. The reduction is more considerable at the stories where the nonlinear response is at its peak within the structure.

Keywords

Seismic behavior, nonlinear, torsional, displacement, force, design.