Seismic performance evaluation of low-rise steel buildings

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ABSTRACT

The objective of this study is to assess the seismic performance comparisons of steel structures with different structural systems and ductility. The structural systems used in the study are divided into three categories: 1 moment resisting frames, 2 concentric braced frames, and 3 eccentric braced frames. In each structural system, the frames consist of 3 ductility, namely, 1. ordinary, 2 intermediate, and 3 special ductility. The levels of seismic density are considered at moderate density at Mueang Chiang Mai. The 8-story steel buildings locate in Mueang Chiang Mai, Thailand are considered. The design and assessment the seismic performances of the building were carried out by nonlinear static pushover analysis. The masonry infilled walls are modelled by a single-strut model. The result also shows that, the failure behaviour of structural steel building from elastic to inelastic behaviour in the capacity curve with concern of masonry wall effects. Capacity curves that show the relationship between base shear and roof displacement are show and compared with structural steel buildings with vary lateral resisting systems and ductility. The results from pushover curve found that the base shear over-strength of the intermediate moment resisting frame steel building is 2.36, compared with the design base shear. The hinge mechanism patterns in various steel frames are also presented. The ability to absorb and dissipate energy depends on the ductility of the structure, which makes the structure more able to absorb and dissipate seismic energy. Regarding the structural capacity, it is discovered that the high-to low-capacity ranging is as follows: concentric braced frame, eccentric braced frames, and moment resisting frames, respectively. However, the eccentric braced frames have more the ductility than the concentric braced frame. Furthermore, the influence of the masonry infilled wall improves the building's earthquake resistance to be around 210 percent. The study is useful for guideline to appropriately select lateral resisting system and ductility for designing the earthquake resistant structural steel buildings in Mueang Chiang Mai, Thailand.

Keywords: Seismic Performance, Steel Structures, Moment Resisting Frames, Braced Frames

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