COMPUTING SEISMIC FRAGILITY CURVES FOR BASE ISOLATED STRUCTURES

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In this article comparative study on the seismic performance of isolated and fixed base buildings performed. Seismic performance of Steel Moment-Resisting Frames (SMRFs) equipped with base isolation system has been investigated. The model's probability has been based on incorporating with uncertainties of ground motion (Banazadeh et al., 2010).

Seismic isolation approach is the most effective technology for protecting structures from the damaging effects of earthquakes (Naeim and Kelly, 1999). However, it is necessary to recognize base isolated structures under uncertainties of seismic excitation. Lead-Rubber Bearings (LRB) and High Damping Rubber Bearing (HDRB) considered as two types of base isolator in our research. (Bridgestone's HDR Technical Report, 2010).

The seismic demand models for multi-story buildings, which are equipped with base isolation system, have been developed in this study. The developed demand models used to estimate the seismic fragility of two types of buildings (Fixed and Isolated). The methodology's damage-analysis stage uses fragility functions to calculate the damage probability of facility components given the force, deformation, and/or other engineering demand parameters (EDP) to which each is subjected (Porter et al., 2007). The fragility estimates in isolated frame compared with fixed base models, which currently used on demand models for the overall maximum inter-story drift.

Seismic fragility analysis evaluates the performance and vulnerability of structures under earthquakes. It plays an important role in estimating seismic losses and decision-making process, which base on building performance during seismic events (FEMA P-58-1, 2012). Structural capacity limits and demand models need to develop seismic fragility curves. To achieve this purpose, we needed to obtain some requirements. One of these objectives in Performance-Based Earthquake Engineering (PBEE) is to quantify the seismic reliability of a structure at the purposed site (Mahdavi Adeli, 2005).

Probabilistic seismic demand analysis (PSDA) is used as a tool to estimate the mean annual frequency of exceeding a specified value of a structural demand parameter, which is inter-story drift ratio in this essay (Mahdavi Adeli et al., 2011). A Bayesian approach used to estimate the model parameters. Linear models in logarithmic space considered to describe the relationships between drift demand and seismic Intensity Measure (IM) (Mahdavi Adeli et al., 2010).

Fragility curves obtain from the probability of exceeding specified damage Limit State (LS). The Incremental Dynamic Analysis (IDA) procedure is applied and two different levels of structure performance, which are Collapse Prevention (CP) and Immediate Occupancy (IO), assessed.

Nonlinear Dynamic Analyses (NDAs) carried out using the family of two-dimensional single-bay SMRFs for 3-, 6-, 9- and 12-storey structures. Nonlinear response history analyses conducted for each frame with their detailed two-dimensional analytical models under different earthquake ground motions, which have varying seismic intensities. More than 50000 (NDAs) were performed within the IDA procedure and were used as an input to the PBEE methodology (Jalali et al., 2012). After performing IDAs, the next step towards evaluating the probability of failure is to meet the desired performance of structures. So then, fragility curves extract from them. The fragility function is the probability of violating LS for any input ground shaking while intensity is equal to a specific IM value. IO fragilities for buildings illustrate in this essay. In addition, the fragility curves corresponding to CP also compared in the following. At last, fragility curves present in a series of graphs.

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