PROBABILISTIC DEMAND ASSESSMENT OF SEISMIC BASE-ISOLATED STRUCTURES IN OMMEDIATE OCCUPANCY PERFORMANCE LEVEL

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ABSTRACT

Evaluation of isolated structures in the form of Performance-Based design framework would make greater understanding of behavior such these structures and give a quantitative idea about regulation's adequacy in preparing safety margin under extreme loadings especially in performance objects with lower damage states. Seismic demand analysis of Base-Isolated special moment steel Structures has been investigated in this paper. 4-, 6- and 8-storey of three dimensional designed structures has been modeled in OpenSees Platform. The structures were Analyzed and Designed based on ASCE 7-2010 standard, ANSI/AISC 360-10 and ANSI/AISC 341-10 Specifications and some two dimensional frames were adopted from these archetypes for Evaluation of the performance objective. Various Source of Nonlinearity such as Material and Geometric Nonlinearities have been Intended in Finite Element Models. To consider the uncertainty in one hand and create comprehensive fragility curve on the other hand, Incremental Dynamic Analysis (IDA) using Far Field Ground Motions Set has been utilized. The structure performance would be presented in terms of "fragility curves" and "limit state frequencies" for immediate occupancy performance object. Results show that the mean annual frequency of models are much lower than the Fixed-base ones. It can be observed that the ASCE 7-2010 Standard can provide a uniform risk in models with various type of configuration too.

INTRODUCTION

Application of seismic isolation to protect the structure against earthquake's threats has been increasingly prevalent during recent years. Implementation of this technology plays a significant role in mitigating the damage and loss caused by earthquake in structural and non-structural components, and demonstrates the performance compared to fixed-base structures. Therefore international loading standards have attempted to define the relevant frameworks required for design of these systems. While the event life cycle risk at isolated structures is proved to be less than conventional fixed-base ones, the higher initial construction and cost as well as the maintenance fee have made the isolated structures feasible mostly in highly seismic zones and in structures with Important occupancies. These factors, combined with outstanding uncertainties, have made today's loads and modern design regulations and standards apply more strict criteria for design engineers. Although design requirements and monitoring criteria defined in regulations relating to earthquake-resistant systems are emphasized to provide life safety and prevent lateral collapse level, they also take into account other performance levels such as immediate occupancy performance state (IO). This performance level is important because the isolated structures are generally so significantly