DISTRIBUTION OF DRIFT DEMAND PARAMETER FOR ESTIMATING NONSTRUCTURAL COMPONENTS VULNERABILITY

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Abstract

In this research the linear and elastic nonstructural displacements are studied under nonlinear behaviors of their supportive structures. In this regard the nonstructural components are investigated in two phases. In the first one the dynamic interactions between structures and non-structures are ignored. In the second phase the effects of dynamic interactions are considered and the nanostructures of different masses with the same periods of supportive structure's main mode are located on the structures' roofs. Then, the maximum relative displacements are compared in two phases. For this purpose, four different models of 4,8,12 and 16 stories are constructed designed in the forms of elastic and rigid bending frames. Then, an ensemble of thirty-two different ground motions, representing hazard levels of 2, 10, and 50% probability of exceedance are used as input to the building models and nonlinear dynamic analysis conducted. In this research the structures and non-structures parameters that affect on the height wise distribution of inter-story drift are investigated.

Keywords: Nonstructural Components, Inter story drift , Vulnerability ,Nonlinear effects.

1.Introduction

It is now widely recognized that the effect of failure of non-structural components is significant during any earthquake. As a result, the losses because of nonstructural components have consistently been reported to be far greater than those resulting from structural damage (Ayers, Whitman, Rihal). After the earthquake, 1971 San Fernando, it was recognized that the damage of nonstructural components may not only be resulted in major economical loss but also poses the threat of lives.

As there are numerous types of nonstructural components in any typical building structure, the evaluation of their responses as well as their impacts on the structure will be a difficult task. An ordinary approach is to classify these components and systems into acceleration-sensitive and deformation-sensitive, based on the seismic input, which govern their response.

Peak inter-story drift ratio (IDR_{max}) is now widely used by the engineering community for estimating the vulnerability of deformation-sensitive nonstructural elements. The recent performance-based earthquake engineering approaches have cast this estimation in a probabilistic form. In this regard, seismic fragility curves are used to represent the probability of a specific damage measure (DM) occurrence, given an earthquake of a specified intensity.

Since nonstructural elements are generally placed at various levels of a building structure, IDR_{max} (defined as the ratio of maximum inter-story drift to inter-story height) is taken as the engineering demand parameter (EDP).