3rd International Conference on Steel & Structure
11-12 December 2018
Olympic Hotel, Tehran, Iran

The Effect of Nonlinear Soil-Structure Interaction on Fragility Assessment of High-rise Steel Moment Frames

***Nassim Mehrvarz[1], Faramarz Khoshnoudian[2], Seyyed Hossein Hosseini[3]**

Abstract

The objective of the present research is to study the influence of nonlinear soil-structure interaction on fragility curve of high-rise steel moment frames. Traditionally fragility curves of buildings are developed with the assumption of fixed base structures. To considering nonlinear Soil-Structure Interaction (SSI) in this paper, a modified Winkler model is used which can stimulate soil flexibility, radiation, and hysteretic damping of the adjacent soil, soil yielding, transient and permanent deformations of the foundation. A special steel moment frame (SMF) for 15- and 20- story building rested on shallow foundations has been considered. The superstructure is modeled using Lignos and Krawinkler model in the OpenSEES. Forty records are selected as input excitation to consider the uncertainty in earthquake ground motions. Fragility curves are derived for fixed-base condition and nonlinear SSI models, using the data obtained from Incremental Dynamic Analysis (IDA) procedure for four damage states according to HAZUS prescription. The results observed from the fragility curves reveal that nonlinear SSI may have a significant effect on component fragility, especially for more critical damage states. Nonlinear SSI improves the seismic performance of buildings and reduces the force demand of the structure by dissipating energy mechanism. The results show that these effects are more notable in buildings with fewer stories. This observation reveals the important role of nonlinear SSI in the assessment of the structural performance.

Keywords: soil-structure interaction, Fragility curves, High-rise steel moment frame IDA analysis

*[1]. Dept. of Civil and Env. Eng., Amirkabir University of Technology, Tehran, Iran. Email: Nassimmv@gmail.com

[2]. Prof. Dept. of Civil and Env. Eng., Amirkabir University of Technology, Tehran, Iran. Email: khoshnud@aut.ac.ir

[3]. Dept. of Civil and Env. Eng., Amirkabir University of Technology, Tehran, Iran. Email: hoseini_h_s@aut.ac.ir