Seismic Risk Assessment of 7 Floors Steel Moment Frame Structure Based on the Standard 2800 of Iran in Tehran

Godrati Amiri Gholamreza[1], Khoshnevis Naeem[2], Shakeri Kazem[3], Afzal Soltani Reza[4]

1-Professor, Department of Civil Engineering, Iran University of Science and Technology
2- Earthquake engineering graduate student, Iran University of Science and Technology
3- Assistant Professor, Department of engineering, University of Mohaghegh Ardabili
4- MSc student, International institute of earthquake engineering and seismology

Naeem.khoshnevis@yahoo.com

Abstract

There are two approaches to the seismic risk assessment of an area. In the first one, known as the "what if" scenario, the current situation can be evaluated. In the second approach the vulnerability of not yet constructed structure in an area may be evaluated. Only after estimating the safety, performance, and economic considerations, may the construction begin. Since the building area covered by steel structures is approximately six times greater than that covered by RC structures in Tehran, In this paper the vulnerability of a 7-floor steel moment frame building, designed according to standard 2800 in different regions of Tehran, will be evaluated. For each type of soil, PGA, spectral acceleration Sa at 0.3 s (Sa0.3), and Sa at 1 s (Sa1.0) will be reached from a probabilistic analysis of the standard 2800. SELENA ver. 5.0 software has been employed for seismic risk assessment, and the results have been displayed through ArcGIS software.

Keywords: Seismic risk assessment, Tehran, Hazard U.S, standard 2800, steel moment frames.

1. INTRODUCTION

Iran is situated over one of the seismic zones of the world, the Himalayan-Alpide seismic belt. The occurrence of devastating earthquakes has imposed notable damages to the buildings and lifelines, and, unfortunately, has caused huge loss of human life. Tehran as the capital of Iran with the population of over 10 million people is known as an economic and political center. Therefore, destruction in this city has severe effects on the whole country. The city of Tehran is situated on the south plateau of central Alborz Mountain, and over alluvium sediments. Its southern parts lie roughly on the North-west corner of Iranian large desert (with mean altitude of 1300 m above sea level). The distance of the nearest mountain to the city is less than 10 km (Tochal Mountain with altitude approaching 3933 m) [1]. To quantify the region's seismic hazard, a peak ground acceleration PGA of 0.35 g for a rock site corresponding to the 10% probability of exceedance in 50 years (the return period of 475-year) is proposed by Iranian Code of Practice for Seismic Resistant Design of Buildings [2]. Tehran is divided into 22 municipality zones as is sketched in Figure 1. To consider the influence of soil conditions and develop more efficient crises management plans, Tehran has been divided into 1246 sub regions. As it is mentioned earlier, the special conditions of Tehran have caused rapid growth in population and construction. More than 95.4% of structures in 1996 were in one of steel, concrete, and masonry categories [3]. Construction of steel structures is more prevalent, and the total building's area of which is 6 times greater than that of other categories [4]. These structures were distributed in all parts of Tehran in 1996. After execution of earthquake retrofitting project (1996-2006), masonry buildings have been mainly substituted with steel structures [4]. Therefore, the total building area assigned to steel structures is more than 70% in regions 3,4,6,7,8,10,11,12,13,14,15,16,19, and 20 in 2006 [4].

Here, we aim to assess the structural damage of 7 Floor Steel Moment Frame Structure in different part of the city of Tehran using the open-source software tool SELENA Ver5.0 [5]. In the current paper we want to know what would happen to a 7 Floor Steel Moment Frame Structure in Tehran city, if we consider all 2800 criteria, comprising of spectral acceleration, soil types, and design of building's standards. Capacity curve of structure has been achieved from Sap-2000 software and converted to Capacity spectrum through ATC-40 approach. HAZUS-MH fragility curves parameters of moderate code Mid-rise steel moment frame are manipulated [6]. ArcGIS10 Software is manipulated to demonstrate the results.