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Determination of Structural Fragility Curves of buildings with Hazus methodology for Seismic risk Assessment in the city of Semnan, Iran

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Abstract

In this paper, structural fragility curves developed via Hazus methodology for estimation of seismic risk assessment in the city of Semnan, Iran. Model building type chose according to FEMA-178 that provided in Hazus method. For determination of structural fragility curves, required parameters obtained from study ward and some of governmental reports. Due to limitations in the application of the Hazus software, Hazus methodology just used to develop fragility curves. Obtained fragility curves shows model building types are vulnerable to slight damage and least vulnerable to complete damage in each of design level code in study area of Semnan. But there are some of unexpected results exist in pre code design level between slight and moderate damage state that needs more investigation. Logic results shows Hazus methodology can utilize for seismic risk assessment in study ward of Semnan and fragility curves could obtain good results for various situations.

Keywords: Earthquake, Seismic risk assessment, Hazus, Fragility curve.

1. INTRODUCTION

In the twentieth century, 1200 devastating earthquake occurred in the world and over of 10 billion dollars losses estimated during this time [1]. Financial losses resulting from earthquakes are increasing rapidly. Federal emergency management agency (FEMA), estimated annual financial losses of earthquake equal to 4.4 billion dollars in United States in 2001. 65% of this amount is related to California State. In addition to financial losses, there are 10000 people have lost their lives in the earthquake (On average) between 1900-1999 [2]. In 2001, three large earthquake occurred in Bhuj in India (Mw=7.9), El Salvador (Mw=7.6) and Arequipa in Peru (Mw=8.4) and 26,000 people has died [3-4].

Iran is one of the most seismically active countries in the world, being crossed by several major fault lines. The Iranian plateau is subject to most types of tectonic activity, including active folding, faulting and volcanic eruptions. It is well known for its long history of disastrous earthquake activity. Not only have these earthquakes killed thousands, but they have also led to waste of valuable natural resources. Since 1900, at least 126,000 fatalities have resulted from earthquakes in Iran. In 2003, in Bam earthquake (Mw=6.6), 26,000 people were killed in Iran [5]. In past 10 years, there was some of enormous earthquake occurred in iran includes: 2013 Sistan and Baluchestan earthquake with 35 fatalities (Mw=7.8), 2013 Bushehr earthquake with 30 fatalities (Mw=6.3), 2012 Tabriz earthquakes with 306 fatalities (Mw=6.4), 2010 Damghan earthquake with 19 fatalities (Mw=5.9), 2006 Borujerd earthquake with 70 fatalities (Mw=6.1), 2005 Zarand earthquake with 602 fatalities (Mw=6.4) and 2004 Mazandarān earthquake with 35 fatalities (Mw=6.3).

Financial losses and damages caused by the breakdown of buildings and lifelines are considerable. Furthermore, the economic impact of the earthquake getting increases with development of urban areas and the cost of construction. Some of research indicated Collapse of buildings is responsible for 75% of deaths in this century. The Kobe earthquake in Japan in 1995, 73% of people was killed in building collapses [2,6]. In Loma Prieta earthquake in 1989, San Francisco (Mw=7.1), 62 people were killed. 42 people of these lose their lives because of collapse of bridge [7]. Major reason for increase in losses and damage due to