

VULNERABILITY ASSESSMENT OF A 3-STORY STEEL BRACED FRAME WITH KHORJINI CONNECTIONS AND INFILLS IN TEHRAN

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ABSTRACT

Connection failure of extremely large number of steel buildings with semi-rigid "Khorjini" connections has been reported in past major earthquakes in Iran (i.e. Bam-2003 and Manjil-1990). In the present paper, atypical 3-story steel braced-frame building with "Khorjini" connections with infill wall is selected and the incremental dynamic analysis (IDA) is performed to investigate its seismic performance. The probability of exceeding desired performance limits on future probable earthquakes in Tehran are estimated for Tehran. In order to develop such fragility curves, 44 records as offered by ATC-63 are adjusted for the study area and used to perform nonlinear analyses. IDA-generated fragility curves are presented for Immediate Occupancy (IO), Life Safety (LS) and Collapse Prevention (CP) limit states performance. The results showed 56% probability of exceeding the CP performance level for earthquakes with a return period of 2475 years. For return period of 475 years, this value was 16%.

INTRODUCTION

The 2006 census data for Iran indicated a total of 82% of the housing units as masonry or steel constructions. 47.3% of these housing units are categorized as low seismic resistant constructions. For Tehran, low quality steel or masonry housing units account for about 50% of the total housing units. For city of Sari in northern Iran (2011 census data), the above figure is 43% of the dwellings. Also it is noted that the Khorjini type steel structures were very popular in larger cities two to three decades ago because of the simplicity of the method and the relatively low cost of the construction.

In such frames, continuous parallel beams cross and encase several columns and the joints are formed by welding two angle sections on each side of the column intersection and at the top and on the bottom of the beam flanges. A popular and typical configuration of such connection is shown in Fig. 1. Collapse of large number of buildings in past major earthquakes in Iran such as Manjil (1990) and Bam (2003) events has been reported by different researchers.