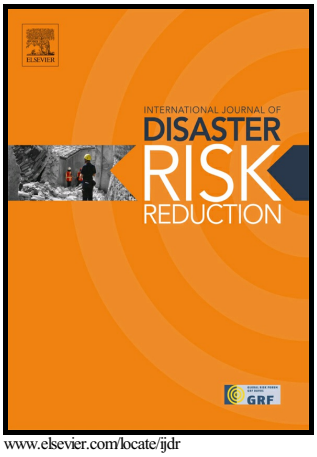
# Developing a Holistic Model for Earthquake Risk Assessment and Disaster Management Interventions in Urban Fabrics

Robabeh Robat Mili, Kambod Amini Hosseini, Yasamin O. Izadkhah




www.elsevier.com/locate/ijdr

PII: S2212-4209(17)30322-9
DOI: https://doi.org/10.1016/j.ijdrr.2017.10.022
Reference: IJDRR702

To appear in: *International Journal of Disaster Risk Reduction*

Received date: 19 July 2017
Revised date: 24 October 2017
Accepted date: 27 October 2017

Cite this article as: Robabeh Robat Mili, Kambod Amini Hosseini and Yasamin O. Izadkhah, Developing a Holistic Model for Earthquake Risk Assessment and Disaster Management Interventions in Urban Fabrics, *International Journal of Disaster Risk Reduction,* https://doi.org/10.1016/j.ijdrr.2017.10.022

# Developing a Holistic Model for Earthquake Risk Assessment and Disaster Management Interventions in Urban Fabrics

**Robabeh Robat Mili[1], Kambod Amini Hosseini[2], Yasamin O. Izadkhah[3]**

1. M.Sc. Graduate, International Institute of Earthquake Engineering and Seismology, No. 21, Arghavan Ave., North Dibajee St., Farmaniyeh, Tehran, Iran
2. Associate Prof., International Institute of Earthquake Engineering and Seismology, No. 21, Arghavan Ave., North Dibajee St., Farmaniyeh, Tehran, Iran, +98 21 22831116 (Corresponding Author), kamini@iiees.ac.ir
3. Associate Prof., International Institute of Earthquake Engineering and Seismology, No. 21, Arghavan Ave., North Dibajee St., Farmaniyeh, Tehran, Iran

**Abstract**

The main scope of this study is to develop a holistic model for assessing earthquake risk and determining priorities for risk reduction and management in urban fabrics. The developed model estimates the earthquake risk at each urban zone based on hazard, vulnerability and response capacity. Additionally, a new indicator called "Integrated Earthquake Safety Index, IESI" is introduced to address the safety level of urban fabrics in relation to earthquakes and assess the impacts of applicable interventions on risk. The proposed model is then applied in two districts of Tehran, having different physical and socio-economic characteristics, to evaluate the safety level for earthquakes. For this purpose, the contributing elements in hazard, vulnerability and response capacity have been assessed based on local conditions and the IESI is determined for each urban zone. In addition, the applicability of the model to address potential improvement measures has also been evaluated. The results show that IESI can be improved by different short to long-term interventions; while amongst short-term measures, promoting community based disaster management activities as well as developing search and rescue bases may increase safety level significantly in the selected districts.

The proposed model is applicable for all seismic prone urban fabrics, while its parameters should be determined based on local conditions. Furthermore, the model can be utilized by disaster management authorities as well as city planners to prioritize short to long-term earthquake risk reduction and management interventions and to allocate available resources more effectively in order to reduce earthquake damage and casualties.

**Keywords:** Holistic Model, Earthquake, Risk Management, Urban Fabrics.

## 1. Introduction

Reducing earthquake risk and improving capacities for responding to potential impacts of earthquakes are amongst the main concerns of disaster management authorities all around the world. Accordingly, local governments in earthquake prone countries need to make appropriate decisions for developing short to long-term disaster risk reduction interventions for urban fabrics, addressing physical and socio-economic characteristics. However, in many cities exposed to earthquakes, proposing applicable interventions for earthquake risk reduction is a challenging task, since the designation of such measures should be based on the available financial and technical resources. In other words, it is important to address the most efficient and feasible methods for risk reduction and management, so that city managers may be able to allocate available (normally limited) recourses to the most critical parts [1]. Thus, before making decision on appropriate measures for earthquake risk management, it is necessary to understand the efficiency of different possible interventions by zone.

Up to now, many studies have addressed the development of earthquake risk assessment methodologies, while few have evaluated appropriate measures for earthquake risk reduction and management in urban fabrics. Davidson and Shah [2] introduced Earthquake Disaster Risk Index (EDRI) to estimate urban risk considering seismic hazards and vulnerability. Cardona et al. [3, 4], Khazai et al. [5] and Frolova et al. [6] also assessed the seismic risk for urban fabrics, addressing physical as well as coping capacity and resiliency parameters. In SYNER-G project [7], one of the most advanced methods for risk assessment of urban fabrics based on vulnerability and loss as well as socio-economic parameters is introduced.

Besides of the aforementioned holistic approaches, there are many other studies focusing on assessment of specific aspects of risk. For instance, Jaramillo et al. estimated the seismic risk in urban areas by evaluation of the social fragility and the lack of resilience [8]. Bathrellos et al. synthesized natural hazard maps to identify suitable areas for the urban development by applying the Analytical Hierarchy Process (AHP) and utilizing a