

Zoning of Cities Level of Vulnerability to Earthquake Hazard (Case Study: Tabriz)

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Received 26 November 2012

Accepted 6 July 2013

Introduction

One of the important problems that most of the metropolitans encounter with is natural disasters. Earthquake is a main natural disaster. Annually 27 sever earthquakes are happened by nineteen thousands killed and twenty six homeless. In recent report of United Nations planning office in 2003, Iran has had the first position in number of earthquakes with severity higher than 5.5 Richter annually and resulted damages and number of killed people. According to the researches of the ministry of dwelling and urban building in national physical plan, fifty percent of the urban residents live in areas with high risks of earthquake. Tabriz is one of the metropolitans of Iran located on region with high probability of earthquake. Adjacency of Tabriz fault and population involving 1378935 individuals and significant industrial cultural and historical capitals introduce Tabriz as a risky zone. So Tabriz fault is the hazardous fault in Iran. Such conditions predict occurrence of human disaster in Tabriz in future. Tabriz earthquake zoning plan conducted by Tehran Padir Company has predicted four hundred twenty six thousands killed in maximum level. According to such earthquake potential, the main goal of this research is identification and zoning of vulnerability in Tabriz in earthquake.

Study Area

The study area involved Tabriz district. Tabriz is located in North West of Iran and it is Center of east Azerbaijan. This city is the biggest metropolitan of North West by area of 25231 hectare in geographical situation of 46,11,46,23 east longitude and 38, 1,38,9 north latitude by average length of 1340 meter in Tabriz plain. The geographical situation, settlement of city in alleys intersects and mild slopes and economic and human factors and especially political and cultural boundaries, domestic and transit communication roads and neighbourhood of Russia, Turkey and Iraq have been led to outstanding and strategic situation of Tabriz. The mentioned factors have created cross road position in this city. The population of the city was estimated 1378935 in 2006 according to census and dwelling statistics.

Material and Methods

This research is applied and development and it is descriptive and analytical research. The method is based on analysis and envelopment of information layers in ArcGIS and combination of scale weighting models like AHP and envelopment indicator. At first, by using opinions of experts concerning to earthquake issues like geomorphology, geology, earthquake engineering,

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urban planning and designing and also previous researches the effective criteria in city vulnerability against earthquake were obtained. According to the comprehensive and systemic approach of this research relative to earthquake, the natural and human made criteria were studied. Finally 15 criteria were selected and each criterion was divided into related criterion based on the analyses. In next step by using data and map provided by road and urban building organisation and municipality and also field study, information layers were prepared in software ARC GIS 9.3 based on the selected criteria. After data analysis they were converted into appropriate RASTER format. Finally by using combination of the layers based on the mentioned models, the final map indicating Tabriz vulnerable zones against earthquake was prepared.

Results and Discussion

In this research the city was divided into five zones of highest vulnerability, high vulnerability, middle vulnerability, low vulnerability and very low vulnerability. The results of AHP show that most of the north areas except limited areas in west and east with very low population density are in high risk zone. The north marginal quarters and new constructed towns adjacent to fault like Baghmisheh, Roshdiyeh and etc are in risky zone. By distance from north fault the vulnerability level is reduced. Middle parts and some parts of south west and north east are in high risk zone. At the end of south west and west and east part of city the vulnerability is average and by moving toward south east the level of vulnerability is reduced and these parts are in low and very low vulnerability zone.

The results of Overlay Index indicator model are similar to AHP by this difference that frequency of very high vulnerability is less than AHP and most part of the city is located in middle vulnerability zone and most of the city areas are in middle zone. In this model marginal quarters are located in high vulnerable zone and central, economical and historical centers are in high vulnerability zones.

Conclusion

In a general conclusion and comparison of two models of AHP and Overlay Index, it can be said that Tabriz is not in optimal conditions according to vulnerability against earthquake. Based on statistics of 2006, more than half of Tabriz population lives in very high and high vulnerable zones. In addition most of important land uses and establishments like airport, administrative, political centers, hospitals and historical and cultural monuments are in these zones. It can be referred to development of towns constructed on fault and surrounding areas.

Key Words: Earthquake, Zoning, Vulnerability, Tabriz, AHP, OI.

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