An Evaluation of Urban Roads Network Vulnerability to Earthquake (Case Study: Tabriz Baghmishe Town)

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1. Introduction

ZAKERI Gary (1750) found that earthquake is jolts of some places or significant portions of land to natural causes with big voices like thunder that is often accompanied by an eruption of water, fire, smog or wind. After the earthquake, building efficiency greatly reduces because of the network's collapse and closing of paths. However, after a catastrophic disaster, communication networks play a vital role in saving lives and accelerate the reconstruction and return of the city to normal activities. In the meantime, communicative networks, which are among the bastions of infrastructure, play an important role in increasing or decreasing the damage caused by natural disasters such as an earthquake. Continuing to live in this situation requires the continuation of infrastructure actions and traffic flows for meeting critical needs, the continuity of public services and facilitate urban management. Therefore, if the communication network does not hurt after the earthquake and maintain its efficiency, the earthquake losses will be reduced greatly, because the possibility of escape from dangerous situations and providing access to secure areas and traffic equipment aid vehicles will take place easily.

Studies show that in 2003, according to the United Nations report, Iran was ranked first among countries in the number of earthquakes with a magnitude of 5.5 and had one of the highest rates of vulnerability in the number of people killed in earthquakes. According to the same report, in Iran, earthquake is dominant among natural disasters. Tabriz as the fifth most populous city (Census, 2006) because of being located on seismic zones and several active faults with a history of major earthquakes that had had severe losses has always been faced with the dilemma of natural earthquake. Baghmisheh town is one of the most vulnerable parts of Tabriz in terms of exposure to the vicinity of active faults and two original faults are exactly in the north and south sides of the town. While the designated space for these faults is 2 kms, whole of the town is located within 500 meters of the fault.

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2. Study area

Baghmisheh town is geographically in 38 degrees and 20 minutes of east longitude, 46 degrees and 4 minutes of north longitude, and in terms of urban area, it is located in District five of Tabriz. The town, in terms of vulnerability, has very high earthquake risk and is in the privacy range of fault. This town is the one of the high-density settlements in Tabriz.

3. Material and Methods

In this study, we have tried to use practical and analytical methods to assess the vulnerability of urban passages network against an earthquake. For this reason, Baghmishe town was selected. After reviewing previous studies in this area and seek the views of experts, eight criteria were selected for the study, which consisted of five sub-standards. To use these criteria in the extraction process and overlap on the final map, data should be converted to spatial data. In this context, using the use of field visit data, 1/2000 urban maps, satellite images and other sources, the model map was prepared in GIS support format. Map of structural quality is composed of four maps that include maps of building quality, grading component, the lifecycle of the building and finally IDW interpolation method was used. Data of Tabriz Master Plan and earthquake hazard Micro-Zoning plan that are provided by Tehran Padir Company in the form of GIS maps can be an important source for the study of structural quality, in particular, soil type maps glazed. The next stage of research criteria is standardized by fuzzy TOPSIS model and the importance of each criteria and sub criteria was found. By using analytic functions and commands of Arc GIS 10 Software, final overlay was done based on Fuzzy Topsis for Baghmisheh town passage network vulnerability map that indicates the objectives of the study.

4. Results and discussion

The results of using these criteria in the Baghmisheh town and combining them by using GIS show that the communication network in this town does not have a good position on the earthquake risk (first hypothesis) and more than half of these networks in the area are among the average of the top risk, 6% of networks are in the very high risk area, 22% in high risk, 34% moderate risk, 28% low risk, and 10% very low risk, which represents that this town has twofold importance in terms of seismic and post crisis management because of relatively high population density with according to area and location of the town near the active fault.

5. Conclusion

Decreasing density and height of building’s walls, using highly resistant structures, devoting semi-public spaces to the buildings, using maximum area in separation crossing wall parts, observing safety course in network design, particularly passage slop, chamfer radius and nodes, observing the proper distance from the center and the right distance from the fault risk are the best practices and recommendations to improve safety and reduce the vulnerability of the city's passage network

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Key Words: Earthquake, Roads Network Vulnerability, Fuzzy-TOPSIS, Baghmishe Town, Tabriz.

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