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User space analysis and crisis management in urban environment

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Cities exposed the vulnerability of the environmental hazards, including natural and human made ones. Examining the urban dwellings vulnerability to this natural disaster is one of the main objects of the urban planning. To evaluate the vulnerability status of the district 13 housing to natural disasters such as earthquake, was the aim of the present study. The methodology of this study was descriptive-analytical and in the term of goal, it was practical. The data were analyzed by Expert Choice, ArcGIS applications and AHP model. The results indicated that, after analyzing, the most vulnerability was attributed to the region 1 to the natural disaster such as an earthquake, and then regions 2, 3, and 4 were placed in the subsequent ranking; this showed that the four aforementioned districts were not identical in the term of the vulnerability indexes, but different from each other.

Keywords: Spatial Analyses, Crisis, Vulnerability, District 13, Tehran

INTRODUCTION

Vulnerability means a function of exposing (who and what is in danger) and being sensitive to a system (a degree that places and people will be harmed) (cutter et al, 2008: 52). A community sensitivity rate to the events and disasters, in one hand, and the vastness of the hazard and damages at the time of occurrence, in the other hand, is called vulnerability (Bezan & Motahedin, 2013:2); in other words, vulnerability means conditions in which an individual, a system or people in a community are affected by adverse effects of a hazard and harmed. These conditions can be physical, social, economic, environmental or related to the management processes (Purmosavi et al. 2013:34). Vulnerability, in related literature to the earthquake, is defined as tolerance, stability and/or rescue from the effects of a natural disaster over a long term and in the short term equally (Mileti, 1999: 106). Moreover, vulnerability can be understood as a concept which describes the factors or socio-economic, physical or geographical constrains which reduce the ability of a community in facing with hazards (Bemaniyan et al.2014:9).

Studies have been carried out, so far, by domestic or foreigner scholars are pointed out as follows.

Martinelli et al. (2008), evaluated and studied the buildings' vulnerability and various harm scenario in Celano, Italy and divided the buildings into two parts; Concrete and exponential, and their vulnerability was assessed by using Risk-UE model at different earthquake intensities, and estimated the damages in various intensities and modeled damages caused by probable earthquakes.

Giovinazzi et. al (2008), described how to use information technologies in reconstructing process of the 1994 earthquake, US, Northbridge, in an essay, along the cooperation of international and local organizations in reconstructing 2004

earthquake, Sumatra and the Tsunami, and concluded that the information and updating them have a key role in the conditions before an earthquake.Hamani et al. (2013) suggested a model in a paper in the field of the management of the transportation crisis and natural disasters. The suggested model included: emerging two systems, geographical information systems and database management systems. The model helps to manage the sources, good management of the risks and its consequences.

Ashtiyani (1994) addressed the issue of Tehran vulnerability, according to the geological structure and the earthquake record, also, in this area, along a special look to this city Geotechnical condition, buildings statues and vital and major arteries to the extent of engineering judgment by emphasizing on the existing studies. This study attempted to categorize the existing structures and estimating their behaviors at the time of an earthquake.

Zangiabadi & Tabrizi (2007) first, examined and analyzed the structural conditions of various districts in Tehran, in an essay (based on official statistics) and calculated the vulnerability development indexes and their resistance, then categorized the districts based on the amount of resistance and vulnerability to the probable hazard. Finally, some strategies were suggested for prevention, proper planning, and the way of management crisis in the event of a hazard.

Ghaneifard (2015) assessed the vulnerability of the houses in the old texture of Minab to the earthquake by using AHP model. The results showed that Sheikhabad Abbaspoor, Pakveh, Malek-garden and Bariko stream districts are demonstrated as areas of the old texture (old districts) with high vulnerability.While Pakveh and Malek-garden are considered as the areas by high population density in the old texture areas. The results, also, showed that a large part of the damaged caused by the earthquake, is due to being old, less durability of buildings, buildings fine and narrow pavements, which needs adopting particular decision in order to reduce the damage and crisis management. Nazari (2015) evaluated the physical vulnerability of Abhar housing, in a study, to earthquake by using an Analytical hierarchy process (AHP) in GIS environment. The results showed that 4% of buildings have very high vulnerability, 27% have high vulnerability, 40% have medium vulnerability, 24% have less vulnerability and 5% have a very low vulnerability.

MATERIALS AND METHODS

It is a descriptive-analytical and mapping method. Data collection was carried out based on the library sources and field studies. To find the theoretic literature, the topic and the analyses of the collected data from library sources were used, and the AHP hierarchy method and GIS application were used to analyze the data and assess them. Also, quantitative methods, in this study, were used as a marginal method complemented the criteria methods, to assess the vulnerability rate of urban housings by using quantitative and analytical methods.

RESULTS

In the present study, in the term of indexes such as the access to the rescue center, health center and outdoors, firstly considered the spatial density of district 13, Tehran. Then, some criteria were used in order to ranking district 13, Tehran in the term of vulnerability to disasters such as earthquakes, including: technical specifications and type of residential materials, access to the residential usage, the age of the building, the roof state, building infrastructure, map situation, density, rescue facilities , training and awareness. According to the different roles and importance, for each index AHP hierarchical method was used to compare paired.

Vulnerability in the term of access to the rescue centers

Although this radius is usually considered by the average speed, 30 km/h between 1.5-2.5 km (consulting engineers arena, 1997:1), this distance is variable based on the factors such as the city texture, network structure, and traffic situation, etc. it can be increased or decreased. Using Buffering instruction (Buffer) in ArcGIS application, in this study, to examine the access rate situation to health centers in district 13, Tehran.

According to this principle, whatever the access of the urban areas to the health centers is more suitable, the vulnerability is less, to assess the vulnerability rate, and also the functional radius of each hospital is 2 km based on common standards, the performance radius of each hospital and health center have been identified separately. The density of health care services was almost proper, as shown in the following Figure.

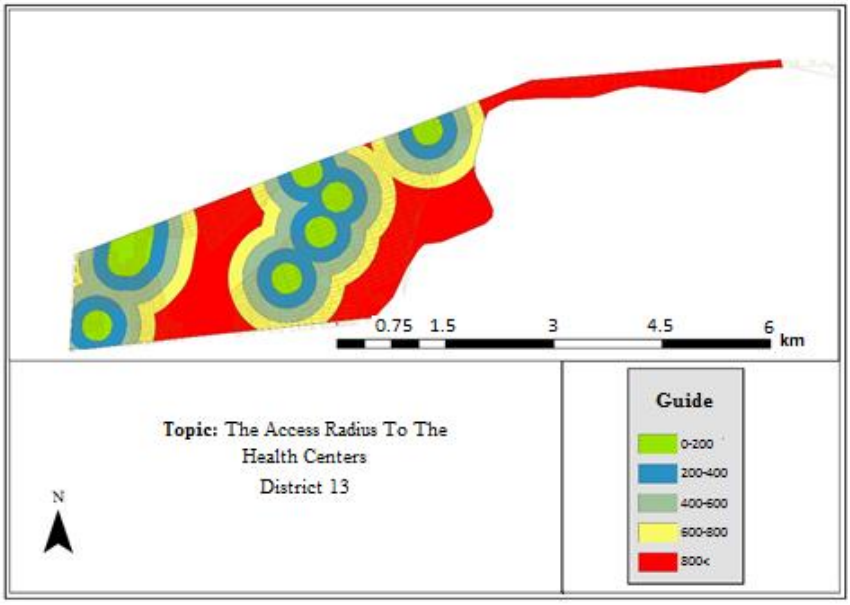

Figure.1: The access radius map to the health center, Tehran, District 13
Source: The Author's Analysis

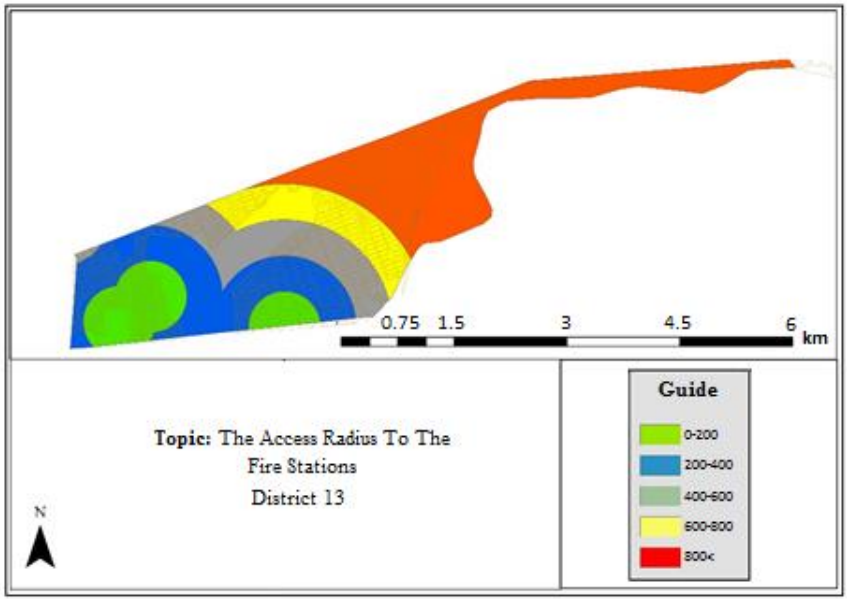

Fig.2: The access radius map to the fire stations, Tehran, District 13
Source: The Author's Analysis

Table 1: Per capita usage of green-space, Tehran, District 13

Type of Usage	Space (m^2)	The Share of Total	Per Capita (m^2)	Standard Per Capita (m^2)	Lack of Existing Situation (m^2)
Park and Green Space	2346229.5	15.8	8.5	8.5	0

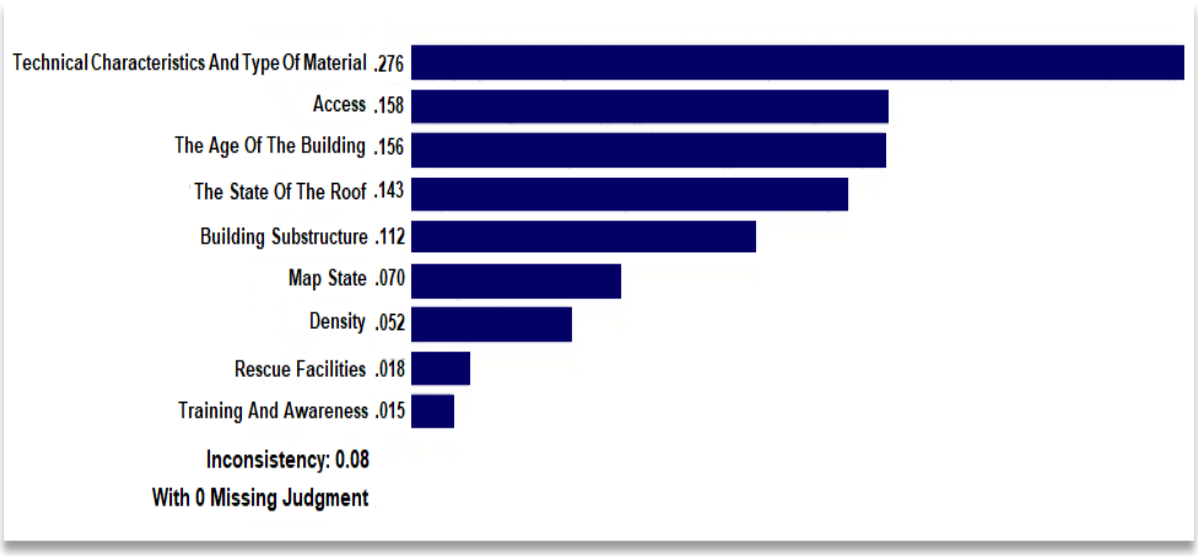

Figure.3: Allocated values to the criteria of vulnerability

Nowadays, increase in population of the cities led to the increase need of daily services, but the optimal distribution of these centers is important. One of the service centers, which plays a major role in cities and guarantees more safety of human life, is fire stations (Pourskandari, 2003:1)Now there are 3 fire stations in the district 13, Tehran. According to a general standard, there should be a fire station per each 50000 inhabitants (department's country; 2005, 186). The access radius is 2-3 km to the fire stations (Shiee, 2011; 177). The access radius is a distance that a fire truck can service in 3-5 min by the speed of 30k in which the radius should be 1.5-2 km. such radius, of course, is changeable due to several factors, including population density, the size and the type of the usage and other issues. According to the common standards in Iran, and based on 270,000 inhabitants in district 13, having 3 fire stations is not proper. Moreover, the distribution of these centers is not fair and there is no fire station in the regions 3 and 4.

District 13 is equipped, in the term of parks and green-space by accounting Sorke Hesar Park and is in the favorable condition. So that, the total of the existing parks and green-space is about 2346229.5 m^2, which is 8.5m^2 per capita in the proportion of the resident population and comparing the per capita standard is favorable to the 8.5 m^2. Thus, by considering the per capita standard and counting Sorkhe Hesar Park, the lack of green-space area is about zero in district 13 and not face with the shortage of green-space (Table 1).

Having access to the outdoors and green-space is considered as positive index at the time of crisis, because whatever this index is more in the city texture, shows the low density of that texture, and this can improve the relief and the possibility of taking refuge and escape at the time of crisis. Figure 3 showed the outdoors and green-space of Tehran, district 13 which provide the possibility of taking refuge and relief at the time of disasters such as the earthquake. The created privacy indicated that the outdoor of district 13, Tehran, is in a relatively favorable state.

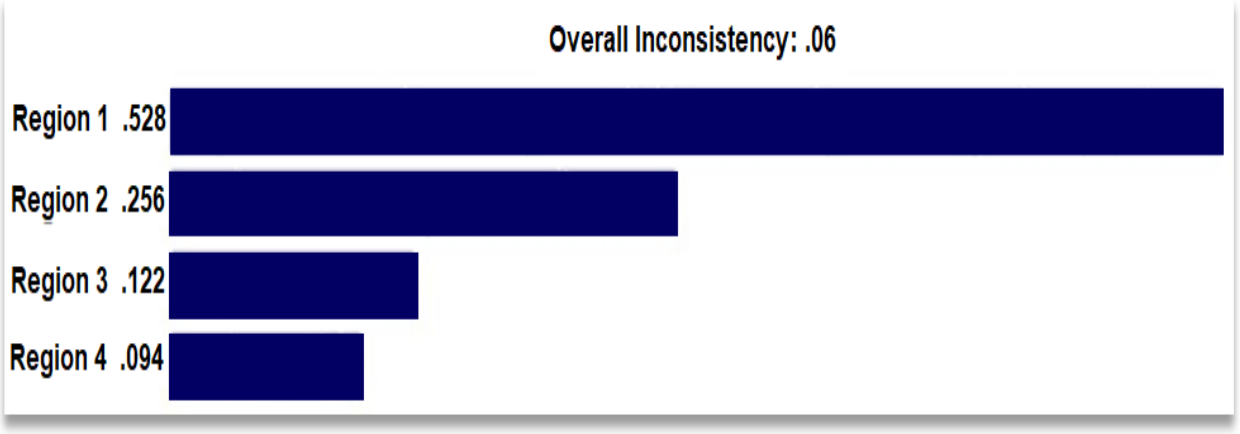

Figure 4: Grading district 13, Regions based on the vulnerability level to the earthquake
Source: The Author's Analysis

Assessing the vulnerability level of the various areas in Tehran, district 13 to the earthquake

In order to classify the residential areas of Tehran, district 13 in the term of having indexes representing urban settlement vulnerability to earthquake, hierarchical cluster analysis (AHP) was used and quadruplet areas in district 13 were classified.

In fact, the received value for each criteria in Choice Expert Application, is based on their importance in a relationship with the vulnerability of the residential usage. All values of the criteria and areas were calculated at the end. According to the results of this analysis, region 1 in district 13 is considered the most vulnerable area to the events such as earthquake. Regions 2, 3 and 4 are placed in the subsequent ranks

CONCLUSION

The present study was carried out the spatial analysis of the housing vulnerability of Tehran, district 13 to natural disasters such as earthquake. The results indicated that the density of the health care center space in district 13 is proper approximately. According to the common standards in Iran and based on the 270,000 inhabitants in district 13, there were 3 fire stations which is not suitable for this district. Whilst, the distribution of these centers was not in balance, there were no fire stations in regions 3 and 4. Moreover, the outdoor state in Tehran, district 13 was relatively in a favorable state.

In order to classify and grade the residential areas of district 13, in the term of having indexes representing the urban residential vulnerability to natural disasters such as earthquake, the hierarchical cluster method (AHP) was used and quadruplet regions of Tehran, district 13 were graded. At the end, all values of the criteria and regions were calculated. According to the results of this analysis, region 1 was considered as the most vulnerable region in district 13 to the events such as earthquake. Regions 2, 3 and 4 were placed in the subsequent ranks.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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This article has been extracted from the master's thesis and the name of the supervisor is also in the article.

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