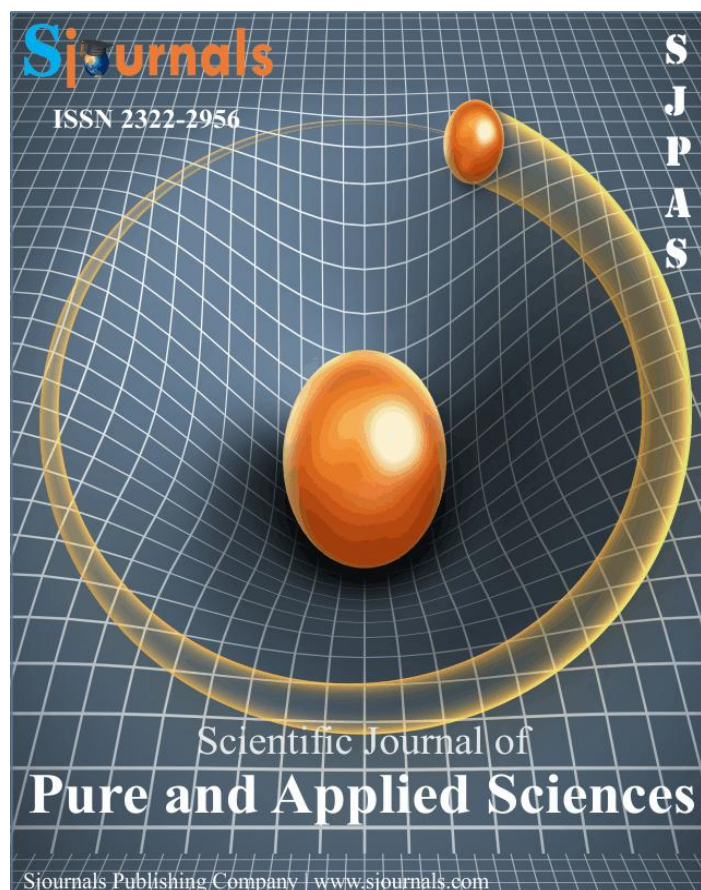


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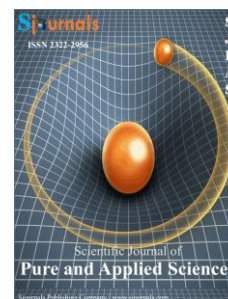
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### Case study

## The assessment of the vulnerability of urban textures in earthquake, Case study: two zone in Tabriz city

Omid Mobaraki<sup>a,\*</sup>, Abdollah Jodat<sup>b</sup>

<sup>a</sup>Assistant professor Geography and urban planning university of Maragheh, Iran.

<sup>b</sup>M.A. Student of Islamic Azad University of Marand, Iran.

\*Corresponding author; Assistant professor Geography and urban planning university of Maragheh, Iran.

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### ABSTRACT

Urban environments are physically characterized by a small scale alignment of buildings, infrastructure and open spaces with their specific types and dimensions. Urban vulnerability to environmental hazards in the countries with the natural and risky environment has been an important challenge in urban sciences, engineering sciences, management and urban planning. The aim of this paper is Assessment of the vulnerability of urban textures in natural disasters and research type is applied and utilizes both descriptive and analytical methods and have been used geography information system software GIS. The research results show many area of two zone Tabriz city have been located in the sector very high vulnerability. So that /35 in the sector high vulnerability, /25 in the sector very high vulnerability, /28 in the sector moderate vulnerability and /12 in the sector low vulnerability have been located. If this subject is important that zone north have high vulnerability and zone south have low vulnerability.

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## 1. Introduction

Worldwide statistics reveal the increasing number of disasters and disaster impacts in the within the last decades. Indeed, only in the within the last four decades, natural disasters have caused more than 3.3 million deaths and 2.3 trillion dollars in economic damages (WB, 2010). But earthquake is a natural phenomenon; it's one of factors for unpredictable events in societies. Urban vulnerability to natural hazards such as earthquakes is a function of human behavior. It describes the degree to which socioeconomic systems and physical assets in urban areas are either susceptible or resilient to the impact of natural hazards. Over the past two decades, vulnerability has come to represent an essential concept in hazards research and in the development of mitigation strategies at the local, national, and international levels (White and Haas, 1975; Hewitt, 1997; Mileti, 1999; Alexander, 2000). During past century more than one thousand disastrous earthquakes happened in seventy countries around the world and 1.53 million people died and it caused so much loss of property (Alexande, 2002). However, these recent earthquakes caused many casualties in urban centers and 80% of losses and deaths had happened in six countries include China, Iran, Peru former Soviet Union, Guatemala, and Turkey (Kirpes, 1998) Fast growth of urban regions makes these crises more painful and increases their number. Iran's location in region with high possibility of earthquake in the world and having high population density makes Iran a country which is severely vulnerable against earthquake. Iran locates in Alp- Himalaya earthquake belt and it is experience an earthquake 6-7 in Richter once in 5 years. Iran with mortality rate of 120,000 is included in this list of six countries with high mortality rates. Furthermore, during 1982-1991, Iran has experienced the highest number of earthquakes. In most of the world's countries especially the under developing countries, the increasingly process of urbanization in cities is rapidly proceeding and it is itself as a potential factor for occurrence of many damages while happening of natural disasters, more dramatically. Irregular population increase, urban built and it's development to outskirts of the towns without suitable planning and including necessary arrangements and regulations caused to multiply gravity of condition. Way of responding to natural disasters and solving the crisis which caused by events have a direct relation with level of development and achievements of each country. It means that more investment on developing and improving infrastructures of country in order to reduce casualties will have faced negative effects of events and crisis with significant reduction (Lewis, 1981) However, around 50% of Iran's population lives in cities and around 60% of Iranians live in old urban texture and due to this fact the possibility of crisis in Iran makes an irretrievable disaster. In order to reduce risk of earthquake in cities, it is necessary to do more studies and comprehensive researches about knowing effects of earthquake in urban levels and distinguish the most dangerous regions. The rapid growth of cities in the world makes this crisis more and painful (Ahad nezhad, 1389). Over the past five decades, several earthquakes have occurred in our country; almost all of them have led to terrible disasters happenings. Buin-Zahra earthquake (1960), Tabas (1980), roudbar and Manjil (1990), Baam (2003) and zarand in year (2003), Ahar and Varzeqan, Birjand and saravan, Bushehr, Haji Abad and Kakiin year (2012) are the indicate of this sad reality. We have not set an example of past accidents and tragedies occur regularly, while other countries which are at risks of permanent earthquake have achieved great success in this case. Baam earthquake was one of the most catastrophic earthquake in Iran's history or even the world in Percentage of casualties (dorudi, 1389). The high number of casualties in this incident is related to the time and place of an earthquake, but the main cause of mortality in some cases can be summarized as follows:

- Lack of awareness of city vulnerable points
- Inefficient and none resistant construction
- Dysfunctional of crisis management and aid after an earthquake and loss principled organization in this case (Zangiabadi, 1385).

East-Azabaijan Province is located is a high-risk seismic zone to the northwest of Iran and has frequently experienced major earthquakes for centuries, with the City of Tabriz having a long history of destruction and reconstruction, as a result of these natural disasters. The 1721 Tabriz earthquake occurred on April 26, with an epicenter near the city of Tabriz, Iran. Many prominent mosques and schools in the city were destroyed, resulting in the deaths of tens of thousands of people. The total number of casualties caused by the earthquake is between 8,000 and 250,000.

In the 2012 catastrophe, twelve villages in Varzaqan were completely destroyed and approximately 60 others were extremely damaged by the earthquake. The natural disaster also afflicted the area with an estimated four billion dollars in damage. Overall, almost 29,000 units in three devastated areas in Ahar, Varzigan and Harees,

suffered various degrees of damage (fallahi, 2013). Two zones in Tabriz city is one of important and densest zones Tabriz city. The Valiasr dense neighborhoods', Parvaz, Elgoli, Zafarani and exist of important users for example Shohada hospital, Elgoli park, office users and residential and services towers is essential study this zone the vulnerability.

## 2. Materials and methods

This study can be regarded as analytical exploratory research, while, due to the nature of the data and the impossibility of controlling the behavior of the influential variables in the problem, the study is non experimental. In the first stage, data collection method is documentary and library, and reviewing literature on earthquake and its damage in urban areas, especially worn textures. In the next stage, two zone information is collected as a field work, statistical data, information of consulting engineers and subject related organizations are used. And maps of 1/2000 were prepared in geographic information systems GIS. The effective factors in resonance of effectiveness of the earthquake are identified. This factors as follows: distance to fault, percent slope, water depth level, population density, buildings quality, buildings material, and distance from risk centers. And then was prepared intelligence layers in geographic information systems GIS software.

### 2.1. Study area

Tabriz is a city in the northwest of Iran and the capital of East Azerbaijan province; it is the fourth largest city in Iran and situated at an altitude of 1350 m at the junction of the Quri River and Aji River; it was the second largest city in Iran until the late 1960s, one of its former capitals, and residence of the crown prince under the Qajar dynasty. Tabriz is located in a valley to the north of the long ridge of the volcanic cone of Sahand Mountain, south of the Eynali mountain range. The valley opens out into a plain that slopes gently down to the northern end of Lake Urmia, 60 km to the west. Like other populated cities in developing world, Tabriz has experienced the phenomenon of rapid urban growth leading to the formation of informal and slum settlements in peripheral zones of the city. During the recent decades, the city has undergone an irregular and rapid growth and has experienced incredible population and spatial change. This city has always been considered to be one of the major political, cultural, and economic poles of Iran, a unique position making the city much more vulnerable to problems arising from unplanned urban growth (Moosavi, 2011).

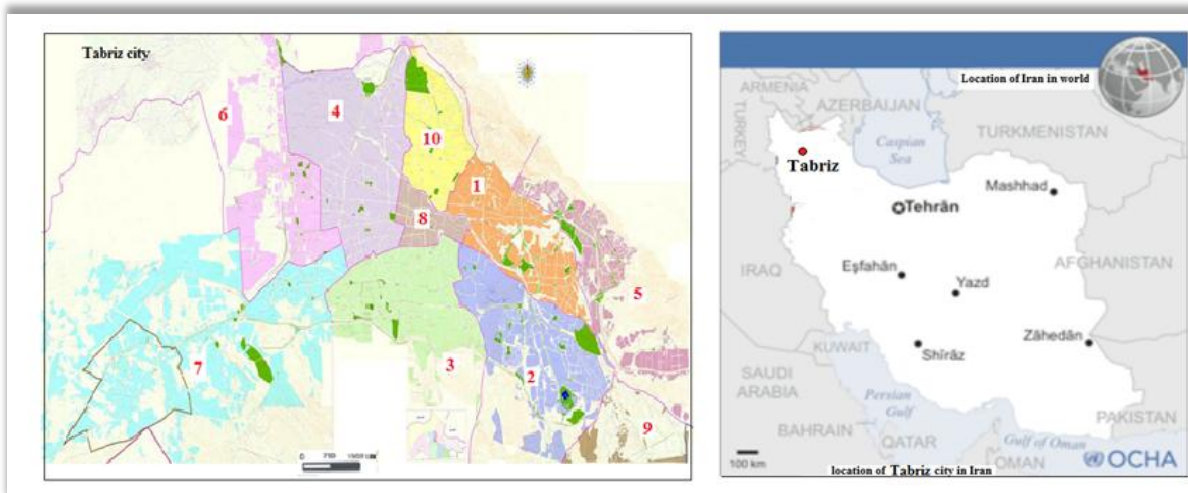


Fig. 1. The map of study zone in Tabriz city.

## 3. Results and discussion

### 3.1. Urbanization and natural disasters

Today, more than half of the world population lives in urban areas making it essential to focus on urban areas for disaster risk reduction. The concentration of population and assets and the embedded conditions of socio-

economic and spatial vulnerabilities generate disaster risk in urban areas affected by natural hazards. With the likely impacts of climate change, such as heat waves or elevation in sea levels, today, exposure and vulnerability in urban areas deserve a special attention for disaster risk reduction. Urbanization and rapid population growth lead to the concentration of population in hazard- and risk- prone urban areas, both in mega-cities and in small and medium- sized urban centers—although both types of urban growth represent different concerns for disaster risk. While the majority of the urban populations currently live in small- and medium sized cities, this proportion is expected to grow at a slower pace. According to the 2011 Global Report on Human Settlements (UN-Habitat, 2011), in 2000, 54.7 % of the world’s urban population lived in cities of less than 500,000 people. This percentage is estimated to decrease to 50.4 by 2020. In contrast, while in 2000, only 8.2 % of the world’s urban population lived in megacities larger than 10 million people, this percentage will increase to 10.4 by 2020; indicating the growing need to focus on rapidly increasing large and megacities for disaster risk. The size, number, functions, and geographical distribution of medium- to large and mega-cities create a major concern for disaster risk. In 1950, only 85 cities worldwide had populations of one million or more inhabitants. In developing countries, the number of these medium-sized cities increased six-fold since 1950. Today, there are 387 medium-sized cities, a big proportion of which are located in Africa, Asia, and Latin America. Due to the urban concentration of population, the greatest potential for disasters exists in the most populous cities. In 2000, the average size of the world’s largest 100 cities was around 6.3 million inhabitants, increasing from 5.1 million in 1990, and from 2.1 million in 1950 (Wisner et al., 2004; Satterthwaite, 2005). Over three-fourths of the one hundred largest cities are exposed to at least one natural hazard (UNISDR, 2004). Most of them are located in low- and middle income nations and in hazard-prone areas particularly in Asia and in Latin America—a trend which is expected to continue in the next decade. Mega-cities also bear major risks from natural disasters. According to data from UN-Habitat’s (United Nations Human Settlements Program) 2009 Global Report on Human Settlements, based on 2010 population estimates, there are twenty megacities in the world. Ten of these megacities belong to low and lower middle income countries, and the remaining ten belong to upper-middle and high income countries. Moreover, all megacities are exposed to natural hazards ranging from geological (earthquake ground shaking and mass movements) to meteorological (floods and storms) and climatic events (extreme heat and cold) and wild fires, indicating the necessity to think different risk reduction strategies for different conditions in megacities.

During twentieth century, more than 1100 destroying earthquake has occurred all around the world that causes death of more than 1500000 people, 90% of which was caused mainly by the collapse of buildings that were not secure enough (Lantada and et al, 2008). Due to the population growth and increasing urbanization, natural disasters like earthquakes can cause heavy losses and interrupt the development of cities and countries. Necessity of decreasing urban earthquake vulnerability is one of the main objectives of urban planning and physical planning.

### 3.2. Required criteria for zoning the vulnerability amount two zone Tabriz city in earthquake

#### 3.2.1. Distant from fault lines

With as respect two zones Tabriz city is located in proximity of active fault. Therefore for each study in about earthquake must be considered distant from fault lines. Figure 1 shows distant from fault lines in two zone Tabriz city, that is located in distance 2-3 kilometer active fault.

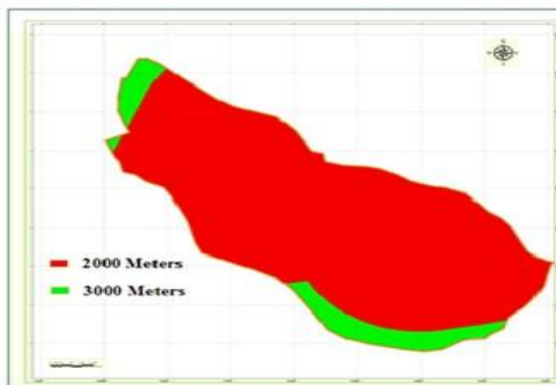


Fig. 3. The map of zoning to fault distance.

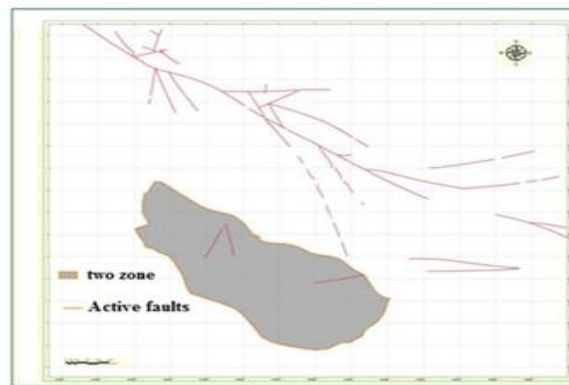


Fig. 2. The map of location of two zone to fault line.

### 3.2.2. Water depth level

With as respect earthquake intensity it's related to water depth level. Two zone Tabriz city zoning is amount and water depth level. Figure 2 shows zoning two zones Tabriz city to water depth level.

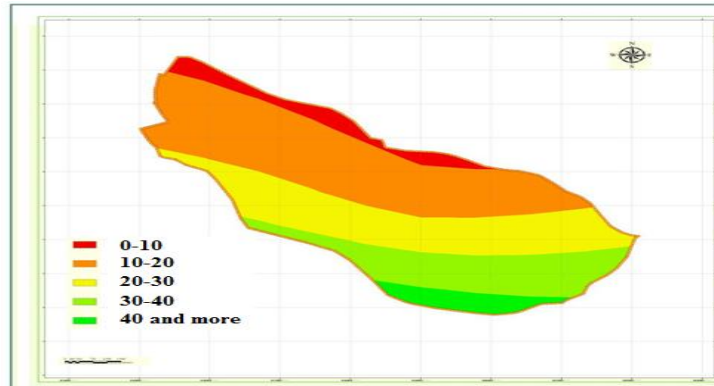


Fig. 4. The map of zoning to water depth level.

### 3.2.3. Slope

With as respect slope increase cause unstable, earthquake intensity has direct relationship with slope. Two zone Tabriz city is located in the area with variable slope. Figure 5 shows slope percent two zone.

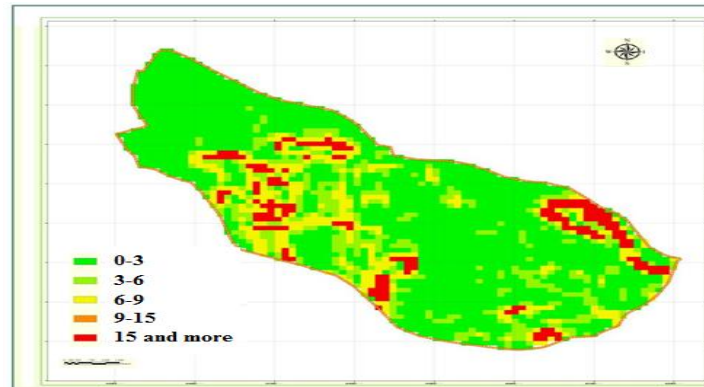


Fig. 5. The map of slope percent.

### 3.2.4. Buildings materials

One of the methods important of opposition with damaging effects of earthquake is stabilization of building and certainly building stability has inverse relationship with earthquake effects. Figure 6 shows building materials in two zones.

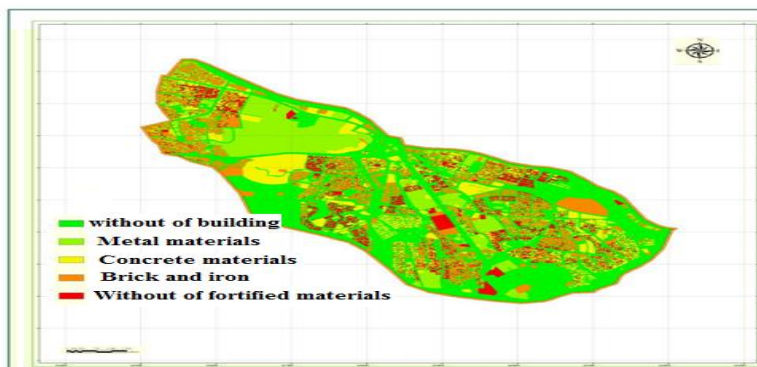


Fig. 6. the map of building materials in two zones.

### 3.2.5. Buildings quality

The buildings quality is of effective factors in earthquake effects reduce, and if new buildings increase will be less earthquake damage. Figure 7 shows building quality in two zones.

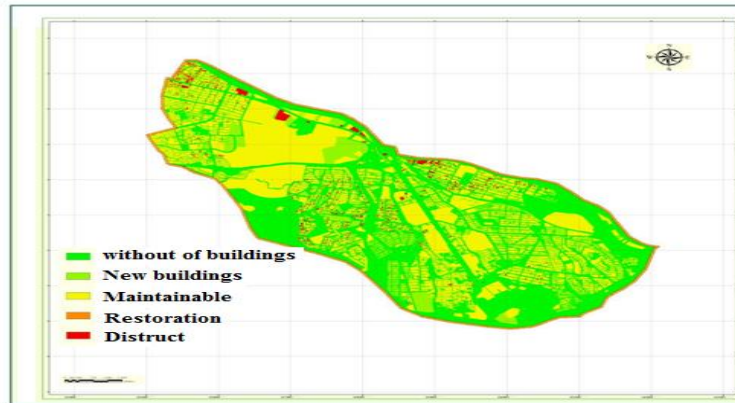


Fig. 7. The map of building quality.

### 3.2.6. Distance from risk users

Installation and users such as petrol station, gas, and also power plant are the use of that in case of explosion cause earthquake effective resonance. With reasons zoning two zone in term of risk centers.

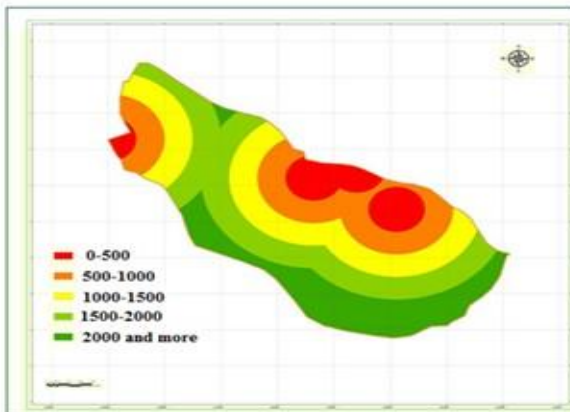


Fig. 9. The map of zoning distance of risk users.

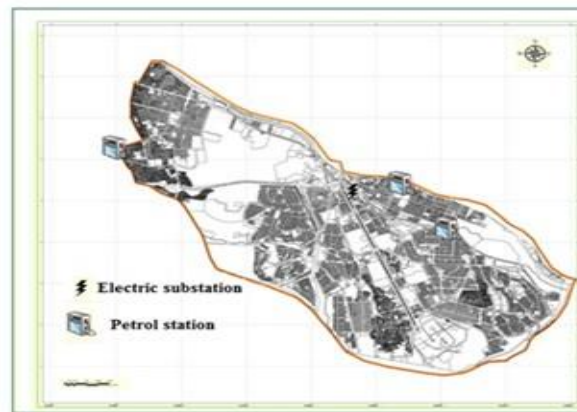


Fig. 8. The map of location risk users.

### 3.2.7. Population density

With as respect human casualties is of dimension important earthquake, with increase of population density increase human and financial casualties.

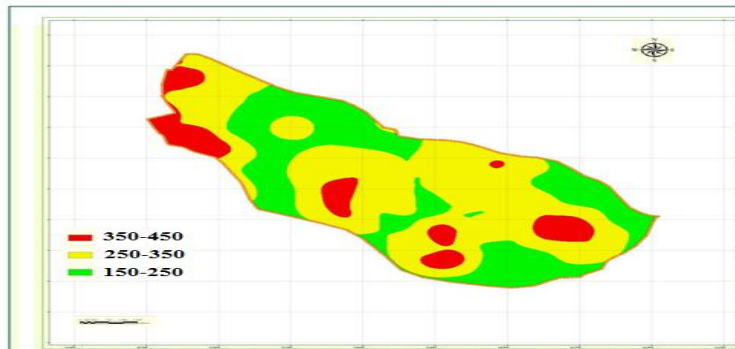


Fig. 10. the map of zoning population density.

The so preparation information layers of criteria for zoning of vulnerability of urban texture two zone this layers convert raster format. And so layers overlap prepared the final map.

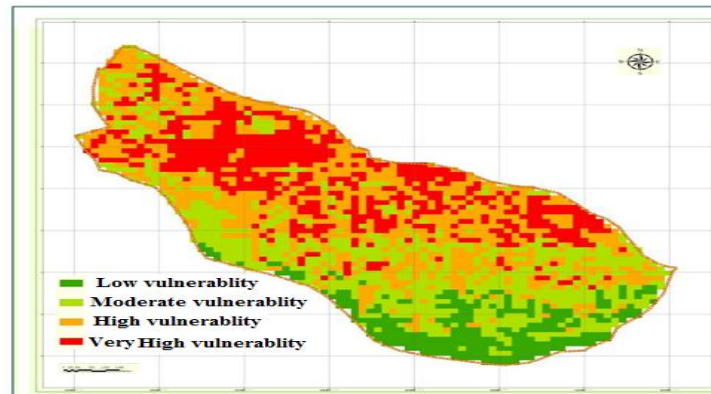


Fig. 11. The final map zoning vulnerability of two zone Tabriz city in earthquake.

#### 4. Conclusion

Disasters and development have an interlinked and multifaceted relationship. They can mutually have a negative effect on each other. On the other hand, sustainable development can also help reduce disaster risks. Today, research on this complex relation is more essential than at any other time in history, as worldwide statistics indicate an increasing number of disasters as recent patterns, and as earthquake vulnerability are expected to increase the intensity and severity of hazards in urban areas. Vulnerability to natural disasters is expected to be increasingly affected by the global force of urbanization. Urbanization, together with other interlinked forces, can either generate or increase intensity of hazards (such as with earthquake), as well as having the potential to increase vulnerability to hazards. The earthquake is one of the most destructive and damaging natural disasters in Iran and the world that every year kills a large number of people around the world. This study has been prepared with the aim of survey the effects of different factors on the earthquake vulnerability. In the line with it, background and history of research were evaluated in and out of the country. By the way it was applied the data and information of two zone Municipal Information Center, interviews with officials and regional experts and questionnaires from the professionals. Tabriz is a city in the northwest of Iran and the capital of East Azerbaijan province; it is the fourth largest city in Iran and situated at an altitude of 1350 m at the junction of the Quri River and Aji River; it was the second largest city in Iran until the late 1960s, one of its former capitals, and residence of the crown prince under the Qajar dynasty. Tabriz is located in a valley to the north of the long ridge of the volcanic cone of Sahand Mountain, south of the Eynali mountain range. Two zones in Tabriz city is one of important and densest zones Tabriz city. The Valiasr dense neighborhoods', Parvaz, Elgoli, Zafarani and exist of important users for example Shohada hospital, Elgoli park, office users and residential and services towers is essential study this zone the vulnerability. The research results show many area of two zone Tabriz city have been located in the sector very high vulnerability. So that /35 in the sector high vulnerability, /25 in the sector very high vulnerability, /28 in the sector moderate vulnerability and /12 in the sector low vulnerability have been located. If this subject is important that zone north have high vulnerability and zone south have low vulnerability. However in the sector high vulnerability have been created important users (university of Tabriz, international hospital, telecommunication center, residential and office towers). Recommendation:

- To prioritize and strengthen the implementation of plan in the sectors with higher vulnerability and crisis.
- Land use planning with respect zoning natural hazard
- To develop and promote the applying of new technologies in construction industry in the private and cooperative sectors.
- To observe the terms and conditions of designing and construction of buildings and urbanism and passages.
- Considering to public participation in plan implementation and engaging the people in that.
- Predicting the particular passages in order to relieve and rescue in accordance with existing roads



- Settlement the rent and residential houses, health centers, education and etc that accept a significant number of pilgrims and necessary confirmation of building resistance against the earthquake.
- Transferring the attractive centers for population including the major business centers to the out of district.

## References

- Ahadnejadreveshti, M., 2009. Modeling of urban vulnerability in earthquake against, A case study Zanjan, Supervisor, M., Gharaklou, PhD thesis in geography and urban planning faculty of geography, Tehran university, Iran.
- Akbari, R., Azizi, M., 2005. The effect of urbanism on earthquake disaster management using GIS and RS (case study: Farahzad, Tehran), M.A. thesis on urbanism, Tehran university.
- Alexander, D., 2000. *Confronting Catastrophe: New Perspectives on Natural Disasters* (New York, NY: Oxford University Press). 202.
- Alexander, D., 2002. *Principles of emergency and managements*. Oxford University Press. 38.
- Asadi, M., 2006. Planning and site selection temporary shelter for earthquak survivors, A case study: Tehran 6 municipality region, The second International Conference on crisis management in natural disaster, Tehran University, Iran.
- Bahrani, H., 2005. land use planning in seismical regions, center for study Iran physical disasters, 24.
- Dorudnejad, M.R., 2010. Reducing the seismic vulnerability of the urban structure, construction and retrofitting and upgrading magazine, 20.
- Fallahi, A., 2010. Technical report sheltering, from relief to reconstruction one year after the 2010 East Azerbaijan province earthquake. *Int. J. Architect. Res., Archnet-IJAR*, November 2013 Special Issue. 7(3), 122.
- Kirpes, M., 1998. Bring Environmental Justice to Natural Hazards. 10.
- Lantada, N., Pujades, L., Barbet, A., 2008. Vulnerability Index and Capacity Spectrum. Based Method for Urban Seismic Risk Evaluation *Journal of Nathazards*, 54.
- Lewis, J., 1981. Mitigation Preparedness Measures. In *Disaster and the Small Dwelling*. ed. –Lan Davis. Pergamum press. Oxford. Michigan University. 33.
- Mileti, D., 1999. *Disasters by Design: a Reassessment of Natural Hazards in the United States* (Washington, DC: Joseph Henry Press).
- Moosavi, M., 2011. An introduction to environmental challenges of life in slum settlements of Tabriz. IACSIT Press, Singapore, 2nd International.
- Satterthwaite, D., 2005. The scale and nature of urban change worldwide: 1950–2000 and its underpinnings. Human settlement discussion paper series. International Institute for Environment and Development (IIED), London.
- UN-Habitat, 2010. *The Challenge of Slums: Global Report on Human Settlements*, 26 (London and Sterling, VA: Earth scan).
- United Nations International Strategy for Disaster Reduction (UN/ISDR), 2004. *Living with risk: a global review of disaster reduction initiatives*, 2 vols. United Nations, Geneva.
- White, G., Haas, J.E., 1975. *Assessment of Research on Natural Hazards* (Cambridge, MA: MIT Press).
- Winsor, B., Blikie, P., Cannon, T., Davis, I., 2004. *At risk: natural hazards, people’s vulnerability, and disasters*. 2nd end. Rutledge, London.
- World Bank (WB), 2010. *The Global Facility for Disaster Reduction and Recovery (GFDRR) Disaster risk management in Latin America and the Caribbean region: GFDRR country notes*.
- WU Lang, YE Siyana, WU Xiong, 2006. Risk assessment of earth fractures by constructing an intrinsic vulnerability map, a specific vulnerability map, and a hazard map. *Enviro. Geol.*, 46, 104 -112.
- Zangyabady, A., 2005. Tehran and evaluation of earthquake risk in urban areas, *Journal of Geographical Research*, No. 56, summer 84. 34.

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