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Research Article

THE VULNERABILITY ASSESSMENT OF OLD URBAN TEXTURE AGAINST THE EARTHQUAKE (CASE STUDY: SAMEN REGION OF MASHAD MUNICIPALITY)

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ABSTRACT
Old texture of the Razvi holy shrine (Samen region of Mashhad municipal) is located near several active faults and most of the buildings of this area are very old, therefore in the case of earth quake occurrence, this region would be prone to high risks. Also, the presence of millions of imam Reza holy shrine pilgrims which is estimated to be more than 23 million people per year, has made it different from the other old textures of the country, and the investigation of the exposure of this region toward the earth quake sounds more important. For these reasons, Samen region of Mashhad municipal was selected as the case study. after the data were collected; by application of Library Studies and AHP prepared questionnaires, they were weighted and analyzed in the form of physical parameters such as: the age of the structure, area of the pieces, the width of the passages, the sort of structures materials, the number of floors, the area of open spaces, and also the population density. In the present study, the mentioned parameters in 4 zones of Samen region were analyzed by use of SPSS and GIS software, and the vulnerability of each of these zones in the case of earth quake occurrence with respect to the expressed parameters, was determined. Accordingly, the 2nd zone has the maximum vulnerability in earthquake against and after that orderly 3rd and 4th zones and finally 1st are being.

Keywords: *Earth quake, Vulnerability, Old Texture, Samen Region*

INTRODUCTION
Today, vulnerability of cities and especially the old and worn out textures again the earthquake has been proposed for the professional in different fields as a global issue. This situation has been proposed in countries with hazardous natural structure like Iran in the last decades. According to the United Nations' report in 2003, Iran has dedicated the first place in earthquakes with high intensity of 5/5 Richter and the highest rank in vulnerability area of earthquake and the number of killed people in this occurrence. According to this report, in Iran, earthquake is the most common natural disaster (UNPD, 2004).
Mashad region has formed among the folded mountains, Kope Dagh from North-North East, Binalood from South-West. Vast plain of Mashad-Ghochan has formed in the collision place of these two areas. Seismic survey of the area indicates the intense activity in the past centuries, especially in 18th century and its next relative calmness (Barbarian and Ghorayshi, 1989). The capable and active faults on both sides of plain and the small distance from the city indicate the potential seismic hazard in the area (Azadi *et al.*, 2009).
Central texture of Mahsad City (the studied area: Masha Samen Region), due to its unique properties such as strong buildings, the lack of open spaces, non-observance of needed standards in some structures, especially the old structures, large population and kind of applying (due to Razavi Holy Shrine and residential and service applications around it), soil vulnerable texture, narrow passages and etc, is among the areas at high risk of earthquake. More than 80 percent of residential buildings and 55/6 percent of residential units in the range of restructure plan has been built in the years before 1973 (Samen Housing Production Company, 1995). The planning and predicting the vulnerability in this region which includes 4 sectors (area), due to excessive concentration of population and millions pilgrims, especially in special occasions have a significant importance.
According to what was said, the main questions of this paper are as follows:

- How much is the effects of various structural and population factors on vulnerability of earthquake in four districts of Samen region in Mashad?

The main purpose of this paper is identifying the main vulnerability factors of spaces and old texture of Mashad City against the possible earthquake in order to help the reduction of damages caused by earthquake and to achieve this purpose; the secondary objectives have been followed:

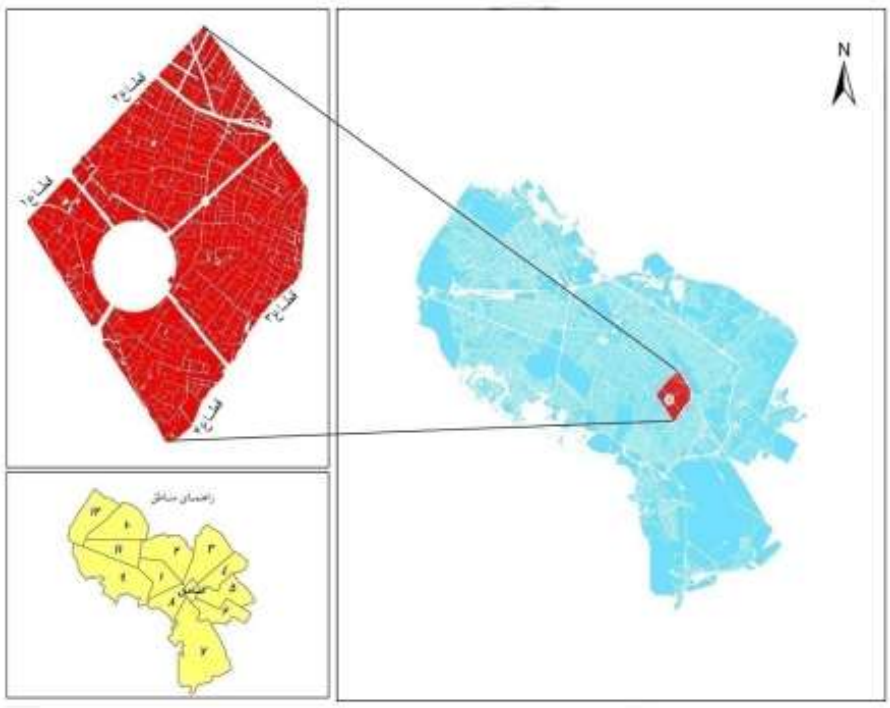
1- To determine the main and effective structural indexes on earthquake vulnerability of Samen Region in Mashad.
2- To survey the contribution of each structural indexes in earthquake vulnerability in the studied area.
3- To identify the vulnerable places of studied area according to chosen criteria.

Research Hypotheses

1- It seems that textual and structural factors have an important role in vulnerability caused by earthquake in the studied area.
2- It seems that the most vulnerability caused by earthquake in Samen Region of Mashad is related to the second sector.

The Studied Area

Iran is located in the Middle East and our studied area is in the east of Mashad located in the Razavi Khorasan Province. The texture arounf the holy shine is surrounded by Vahdat Boulevard and martyr Kamyab from the north, near street of Reza Mall and Martyr Andarzgoo St. from the south, Vahdat Boulevard and 17 Shahrivar Square from the east, and Ayatollah Bahjat St. from the west. The total area of Samen Region as our studied area is 337 hectares that after deducting 69 hectares of holy shrine, the rest area is 268 hectares. It includes modernization plan. In these lands, there are more than 12000 estates with different applying (Samen Region Municipality, introduction of improvement and modernization plan around the holy shrine, 2006).



Map: Samen Region Situation and its sectors in Mashd City (resource: Samen Region Municipality)

According to the classification of municipality, the considered area is divided to four sectors:

Sector 1: Sector 1 includes the streets Imam Reza, Myrtle Andarzgoo, Azadi, and Ayatollah Shirazi to holy shrine. This area is called “the big mall” and is 32 hectares.

Sector 2: It includes Ayatollah Shirazi, Ayatollah Bahjat Streets, railroad Boulvared, and Tabarasi to holy shrine. This area is called " Noghan neighbor" and is 101 hectares.
Sector 3: It includes Tabarasi St., Vahdat Boulvared, Navab Sfavi to holy shrine. This area is called "Tabarasi Neighbor" and is about 92 hectares.
Sector 4: it's includes Navab Safavi, 17 Shahrivar, Reza Mall Streets to holy shrine. This area is called "Eidgah or Chahnou", and is 43 hectares (Samen Region Municipality).
Given to spending nearly 20 years from beginning of modernization and improvement of this area according to annual report of the this region mayor at the beginning of 2012 about 49% of plan was done (around the main streets).

MATERIALS AND METHODS

Research Methods and Procedures

In this study, after determining the required and effective parameters against the seismic vulnerability of studied area, the information and data has been collected by library method (applying the databases and books, internet, map and computer files, journals and scientific papers, tables and form and taking notes), and field method (observation and interview), and also discussion and group consultation. Then the homogeneity of data and obtained information through the SPSS software and are evaluated and modified, finally they are analyzed and it's been determined the role of effective variables. Then it's been acted to compare in paired by AHP method. In the case of the statistical and estate information and available numbers it's been acted to analyze the data and variables by Excel environment and finally it's been analyzed the spatial distribution of vulnerability in the region by ArcGIS software.

Effective Criteria of Vulnerability

In this study, the structural criteria and also the population density are in the considered region and it's been disregarded the other criteria such as fault, general slope of the region and natural complications (due to the limited area of sectors and the distance of four regions from each other and also the available faults). The mentioned criteria include as follows:
The Frame of Structure and the Applied Materials: Inferior quality materials cause reduction of efficiency and increasing the vulnerability for a structure. In the studied area, the buildings are divided to four categories based on the applied materials: **1-** the buildings with steel or concrete framing and irony or concrete roof (with low vulnerability), **2-** the buildings with semi steel or concrete framing and irony or concrete roof (with mediate vulnerability), **3-** the buildings with brick walls and irony or concrete roof (with high vulnerability), **4-** the buildings with adobe or brick wall and wooden or gable roof (with very high vulnerability).
1- ***Number of Floors:*** Increasing the number of floors because the increasing of infrastructure and density it causes the vulnerability of the texture. However, due to being old worn buildings in the area, the number of floors is less totally.
2- ***Building Oldness:*** Building oldness has direct impact on the vulnerability. More the structure is older, more worn out it is and as a result more vulnerability it is against the earthquake. In this study, the buildings are divided to four categories based on oldness: **1-** buildings with oldness less than 15 years (with low vulnerability), **2-** buildings with oldness between 15 to 25 years (with mediate vulnerability), **3-** buildings with oldness 25 to 35 years (with high vulnerability), and **4-** buildings with oldness more than 45 years (with very high vulnerability).
3- ***Land Area (Tininess and Largeness of Texture):*** Separated pieces area is an important factor in detection of the old texture. Less the level pieces is more vulnerability possible it is. In this study, the pieces are divided into four categories: **1-** the pieces with an area more than 300 m (with low vulnerability), **2-** the pieces with an area between 200 to 300 m (with mediate vulnerability), **3-** the pieces with an area between 100 to 200 m (with high vulnerability), and **4-** the pieces with an area less than 100 m (with very high vulnerability).
4- ***Passages Width:*** The passages width has an important role in determine the available quality of pieces. In the most cases that the texture forms automatically, and not any plan is prepared in advance to

access its network, it's been seen lots of narrow and not standard passages. In the conducted studies in these cases, the pieces are divided to five categories in terms of passages width: the passages less than 4 m, 4 to 6 m, 6 to 10 m, 10 to 12 m, and more than 12 m.

Table 1: Scoring of criteria

Rank	Categories	Index name	Row
1	Less than 15 years	Structural age	1
2	Between 15 to 25 years		
3	Between 15 to 35 years		
4	More than 35 years		
1	Steel and concrete structure	Applied materials	2
2	Steel and concrete semi structure		
3	Brick wall with metal and concrete roof		
4	Any type of wall with wooden or gable roof		
1	Floor 1	Number of floors	3
2	Floors 2 and 3		
3	Floors 4 and 5		
4	6 floors and more		
1	More than 300 m	size of pieces	4
2	Between 200 to 300 m		
3	Between 100 to 200 m		
4	Less than 100 m		
1	More than 12 m	Passages width	5
2	Between 6 to 12 m		
3	Between 4 to 6 m		
4	Less than 4 m		
1	Urban facilities and services	Land application	6
2	commercial		
3	residential		
4	Educational, health, religious and administrative		
1	More than 30%	Proportion of open spaces	7
2	Between 20% to 30%		
3	Between 10% to 20%		
4	Less than 10%		
1	Less than 500 people in hectare	Pure density of population	8
2	Between 500 to 700 people in hectare		
3	Between 500 to 700 people in hectare		
4	More than 900 people in hectare		

*5- **The Range of Open Space:*** The presence of open spaces in an area is effective in different ways to reduce the vulnerability and increasing relief after accident. More the number and percentage of open spaces increase, more the impact of structures reduce in the case of damages. In this case, the population density that is the cause of increasing damages will reduce. On the other hand, it's possible getting the appropriate shelters when the crisis happens and doing relief and temporary accommodation after crisis happens.

*7- **The Type of Application:*** The type of application can also be effective in vulnerability of earthquake. To damage to some structures cause the double damage in terms of importance, and vice versa, the destruction and damage to some other structures doesn't leave much or deep damages. Accordingly, the area is divided into 4 groups with very high importance, high importance, mediate importance and low importance. In this classification, the pieces with administrative, education, health and care and religious application are in group 1 (with very high importance), the pieces with residential application are in group 2 (with very importance), the pieces with business application are in group 2 (with medium importance) and the pieces with urban services, facilities, parkings and etc are in group 1(with low importance).

*8- **Population Density:*** One of the most important and effective features of earthquake vulnerability is the population and people who are in the scene. Because the importance of human casualties is more than any physical and material damages and it cannot be compensated in any way. So in addition to the physical and structural indexes in this study, the population density index is also taken into consideration. More the population density is greater in a region; the possibility of damages and human injuries is greater.

It should be noted that one of the distinguishing characteristics of the studied area (Samen Region) is the remarkable and influential presence of pilgrims in this area that impact on the residents. In addition to the population in the area, the approximately resident pilgrim population is also considered.

The Applied Model: The applied model in this study is conducted in 5 steps as follows:

*1- **To determine the Goal, Criteria, Infrastructures and Options by the Information of Presenting Situation in the Area:*** The main goal of this study is the rate of pieces vulnerability in Samen region of Mashad based on the presenting criteria. That the presenting criteria are combining in GIS environment in order to identification of the places with restructure priorities to identify the priority in the area.

*2- **Drawing the Indexes Information Tables and Scoring them:*** Given that the indexes are different in the quantitative and qualitative nature, and there's a discontinuity among them, first it must be weighting the indexes and classify them to the same scale. In this step, a table is prepared in order to classification and scoring the indexes to rate the infrastructures or indexes based on time table.

*3- **Paired Comparisons:*** In this step, based on the results obtained from questionnaires which are completed by experts, the comparison is done in pair. To determine the paired comparison matrix of indexes, (A=aij), it's calculated the geometric means of experts' opinions matrix elements.

*4- **Entrance the Data to AHP Extension:*** In the next step, it should be calculated the compatibility in judgments and then in stability coefficient. This step is calculated with entrance the data of paired comparison table through the software AHP.

*5- **Combining the Layers in Arc GIS and AHP:*** In this step, it's combined the relevant layers by overlap method based on the previous calculations and scoring the indexes to get the considered places. After implementation of this model, the results are classified into four groups which are obtained based on higher priority of areas with low relative risk, areas with mediate relative risk, areas with high relative risk and areas with very high relative risk.

RESULTS AND DISCUSSION

Findings

First Step: Criteria Measurement

1- The Frame of Structure and the Applied Materials: The studies show that about 21% of buildings are located in the studies area in group with low vulnerability, about 17% in group with mediate vulnerability, about 48% in group with high vulnerability and about 13% in group with very high vulnerability.

Among them, sector 2 with only 11% stable buildings (with frame) and about 88% of buildings without frame (brick) are the most vulnerable areas in Samen Region.

*2- **The number of Floors:*** In Samen Region of Mashad, about 85% of land pieces have one floor building, 7% two second floors, 4% three floors, 2% four floors, 1% five floors and 1% more than five floors buildings.

In surveyed studies, sector one with 82% one floor buildings, 12% with two or three floors buildings, 5% with four or five floors buildings and 2% with six floors buildings and more have the higher building rather than the other sectors and as a result, it's the most vulnerable sector in Samen Region.

3- ***Building Oldness:*** In conducted survey from the studied area, about 15% structures have oldness less than 15 years and about 47% have oldness more than 45 years.

Map: The final priority of vulnerability against the earthquake in the studied region

4- ***Land Area (Tininess and Largeness of Texture):*** By survey of the available information, it's understood that the sector three has the most rate of pieces less than 100 m (35% pieces), and also the least number of pieces are more than 300 m (only 9% of pieces). So the sector three has the most rate of vulnerability in the studied area and after that sector two.

5- ***The Passages Width:*** In this study, it's specified that sector two has the most percentage of passages with less than 4m width in the region (52%), and also this sector has the least passages with more than 12 m (9%). So it's the most venerable sector in the region. After the mentioned sector, sector three with 47% of passages less than 4 m and 9% passages with more than 12% are more vulnerable.

6- ***The Range of Open Spaces:*** By survey the obtained information from the presenting numbersin studied region, it's been observed that sector two with only about 4% open and green spaces, is the most vulnerable sector in the region. After that sector one with about 5% has the next vulnerability rate.

7- ***The Type of Application:*** In terms of application, sector two with about 88% sectors in high and very high important application group has the first place of vulnerability.

*8- **Population Density:*** Sector 4 with 1081 densities and then sector two with 1043 density (people in hectare) has the most vulnerability rate in terms of population density in the region.

Step 2: Applying the Model

As it mentioned before, after determining the goals and criteria and also weighting to indexes, it will be done the paired comparison and then it will be obtained the information and the final map by software and AHP method.

Analysis

As it mentioned, the basic idea of this study is that despite of the overall importance of Mashad central part, and around the Holy Shine (Samen Region), the urban texture of this region impacted on some factors, is an unsafe place against the earthquake. Recognizing the vulnerability needs to understand the features, functions, and structures of vulnerable and effective systems. Then to answer this question that which factors have the most effects in vulnerability of this part textures in Mashad, two hypotheses have been proposed and studied:

- ***The First Hypothesis:*** It seems that environmental and structural factors have an important role in earthquake vulnerability of Samen region in Mashad city.

As it's observed from the study results, the studied region is poor and vulnerable in terms of all these indexes which are main indexes in the old texture.

It's been specified that more than 60% of total region is constructed by unstable materials, mud and brick and only about 21% of buildings have the appropriate and stable materials.

Also in terms of oldness of structures, we came to this conclusion that about 47% of buildings are more than 35 years old and only 25% of structures are less than 25 years old.

In terms of land application, more than 70% of pieces are residential that it causes to increase the earthquake vulnerability rate.

In terms of passages width and also the other old textures, the studied region has the narrow passages so that about 47% of its passages have the width less than 4meter that this issue causes increasing the vulnerability and relief after accident.

Also, in terms of open spaces, Samen Region has the least green and open space so that about only 11% of region has the green and open spaces.

But in terms of number the floors; the studied region has the less vulnerability; because more than 85% of its buildings are the flat floor. Then according to the above issues, the first hypothesis is approved.

- ***The Second Hypothesis:*** It seems that the most vulnerability caused by the earthquake in Samen Region is related to piece 2.

As it mentioned, sector 2 is the vastest sector in the region and has the low indexes and then has the higher vulnerability rate. Here, we pay to these indexes:

In terms of number the floors, the sector 1 has the higher vulnerability rate, in it 82% of structures are the flat floor.

In terms of being old, the sector 1 has the most vulnerable structures in the region and then sector 2. Sector 1 has 11% structures less than 15 years old, 61% older than 45 years old and sector 2, 17% less than 15 years old and 47%, older than 45 years old.

In terms of land area and tininess and largeness of texture, sector 2 has the second place in vulnerability so that in sector 3, 77% of pieces are smaller than 200 meter and 9% are larger than 300 meter.

In terms of population density, sector 2 has the very high vulnerability rate like sector 4, so that sector 4 has 1083 people and sector 2 has 1043 in every hectare.

In terms of the other features such as materials, passages width, and type of application, the sector 2 has the first place in vulnerability rate in the region so that with only 11% stable buildings and about 88% buildings without brick frame is the most vulnerable district in Samen region. In terms of passages width, about 52% of passages are smaller than 4 meter and only 9% of them are larger than 12 meter. In terms of application type, 88% pieces have important and very important application.

According to mentioned issues and weighting and apply the coefficient in mentioned indexes, its obvious the vulnerability of sector 2. By the way, the obtained results from GIS software prove this.

So according to above issues, the second hypothesis is approved.

Conclusion

Samen Region of Mashad City as our studied area accepts about 23 million pilgrims and travelers every year and it's been expected that in 2021 this number reaches to 30 million people. This population has impacted on the residents there and it needs to special attention. This population reach to millions people in some especial times. This issue has distinguished the old studied texture from the other ones.

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 Samne Municipal Information Center, interviews with officials and regional experts and questionnaires from the professionals.

In the studied region, this issue has a particular sensitivity and complexity due to the importance of reconstruction and also the different problems such as tininess of texture, high price of lands and estates, various agencies involved in this issue like municipality, charity affairs, housing and urbanism organizations and etc. in order to solve the problems and to conduct the urgent and effective measures to improve and reconstruct the texture around the holy shrine, the development organization (Ministry of Housing and Urban Development) and Astan Quds Razavi were established. This is a very good and successful experience to achieve the desired goals.

The studied region includes four sectors (area) that have surrounded the holy shrine from four sides. The purpose of this study is to assess the earthquake vulnerability indexes in these four sectors. To do this, it should be considered some indexes to compare them, and then a coefficient for each index. So seven important and influential indexes have been evaluated including: 1- materials, 2- oldness of structure, 3- number of floors, 4- land area (tininess and largeness of texture), 5- passages width, 6- open spaces in sectors, 7- type of applying, 8- population density. Completed details of each number from Samen Municipality Information Center are prepared and evaluated.

According to the results obtained from this study, sector 2 is the most vulnerable area in the region, then sectors 3 and 4 and at last sector 1 has the least vulnerability rate in the region.

Recommendations

1- To prioritize and strengthen the implementation of plan in the sectors with higher vulnerability and crisis.

2- Needed planning and expecting in order to reduce the vulnerability indexes rate in texture such as passages and green spaces and parking, and etc.

3- Providing the adequate facilities in order to reconstructions of old buildings by owners and cooperatively.

4- To develop and promote the applying of new technologies in construction industry in the private and cooperative sectors.

5- To observe the terms and conditions of designing and construction of buildings and urbanism and passages.

6- Predicting the appropriate aid facilities compatible with region capacity and access roads.

7- 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.

8- Observing the presenting regulations for the building height limits.

9- Predicting the particular passages in order to relieve and rescue in accordance with existing roads.

10- Proportional population distribution in different areas and preventing of increasing the population density in a particular district.

11- Considering to public participation in plan implementation and engaging the people in that.

12- Transferring the attractive centers for population including the major boniness centers to the out of district.

13- Necessary trainings to residents and pilgrims on how to deal with crisis compatible with local conditions.
14- Applying the high quality materials and new construction technologies.

REFERENCES

Azadi A *et al.*, (2009). Geological features, geotechnical and geophysical fault tous in north of mashad, *Earth and Space Physic Journal* **35**(4) 65-74.
Azizi M and Akbari R (2008). Urbanism Considerations in Vulnerability Assessment of Cities against the Earthquake, (the Case Study: Farahzad Region of Tehran), *Fine Arts Journals* **34** 25-36.
Bahreyni H *et al.*, (1995). *Land Applying Planning in Earthquake-Prone Areas (Case Study: Loushan, Manjil and Roudbar)*, (Center Fighting with the Natural Disasters of Iran Publication) Tehran.
Barbarian M and Ghoreyshi M (1989). Report of tectonic seismic surveys, seismic danger, faulting and thermal power plant design engineering of nishabour, ministry of energy, engineering services company (Moshanir), Tehran.
Farajzade Asl M, Ahmadnejad M and Amini J (2011). Vulnerability Assessment of Urban Housings against the Earthquake (Case Study: District 9 of Tehran), *Urban and Regional Studies and Research Journal*, 3rd Year **9** 19-36.
Giovinazzi S, Lagomarsino S and Pampanin S (2006). Vulnerability methods and damage scenario for seismic risk analysis as support to retrofit strategies: a European perspective, NZSEE Conference.
Hafiznia M (2010). An Introduction to Research Method in Social Sciences, the Study and Codification of Social Sciences Books Organization (Samt) Tehran.
Khakpour B *et al.*, (2011). Analysis of Physical- structural Vulnerability of 9th District of Mashad, *Geography and Regional Development Journal* **16** 165-73.
Khorasan Housing Production Company (1995). Texture Restructure and Repair Plan around the Holy Shrine of Imam Reza, Report 13.
Lantada N, Pujades L and Barbat A (2009). Vulnerability index and capacity spectrum based methods for urban seismic risk evaluation. A comparison, *Natural Hazards* **51** 501-524.
Monzavi M *et al.*, (2010). Old Texture Damages of Central Part of Tehran against the Earthquake, (Case Study: District 12), *Human Geography Research Journal* **73** 1-18.
Negaresh H (2005). Earthquake, Cities and Faults, *Geographical Researches Journal* **37**(1) 112-19.
Samen Housing Production Company (1995). A Summary of Reconstruction Plan around Imam Reza Holy Shrine Report, Report 13, the Final Edit.
Samen Region Municipality of Mashad (2013).
Shiaa E *et al.*, (2010). Vulnerability Assessment of Urban Communication Networks against the Earthquake by GIS & IHWP methods, the Case Study: District 6 of Tehran, *Bagh-I-Nazar Journal* **13** 35-48.
Statistical and Information Center of Samen Region in Mashad City
Statistical Center of Iran, General Population and Housing Census in 2011
Statistics Bureau (No Date). The Information and GIS of Khorasan Razavi Governor, 2011, Khorasan Razavi Statistical Yearbook.
Tash Counseling Engineers (2006). Chapter 2 Statistical Report of Texture Reconstruction around the Holy Shrine.
UNDP (2004). Reducing Disaster Risk, a Challenge for Development.
www.amar.khorasan.ir
www.amar.org.ir
www.moi.ir
Yavari M (2013). The Study of Urban Earthquake Vulnerability of Old Texture against the Earthquake, (the Case Study: Samen Region of Mashad), Mafi E, MA Thesis, Islamic Azad University of Shirvan.
Zangi Abadi A and Tabrizi N (2006). Tehran Earthquake and Vulnerability Assessment of Urban Areas, *Geographical Research* **56** 115-130.

Zangi Abadi *et al.*, (2009). Vulnerability Statistical Analysis against the Earthquake in 11 and 12 areas of Tehran, *Social Sciences Teacher Journal* **13**(3) 127-34.
Ziyari K and Darab Khani R (2010). Vulnerability Assessment of Urban Texture against the Earthquake (Case Study: District 11), *Geographical Research Journal* **99** 16631-16655.