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Comparative survey of open spaces between district one and district two in Zanjan city, temporary accommodation of wounded people after earthquake

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Abstract

One of the greatest problems is happening natural disaster such as earthquake which has threatened human societies during the centuries and damaged the cities a lot every year. One of the most affected areas is building and urban utilities. After earthquake, human beings living places come across different degrees of damages. Sometimes, people encounter with problems in providing their basic needs including shelter, etc. After earthquake, one of the basic needs of crisis management in every city is to have open spaces for emergency accommodation of wounded people. So, one aspect of urban planning is designing and providing infrastructure facilities at the time of crisis. Infrastructure facilities include relief centers, predictions of open spaces for emergency accommodation, emergency roads, etc. Non-suitable performance of each member, the existing shortages in this regard, and non-suitable distribution of these facilities based on the population density at the time of after-earthquake encounter crisis management with problem. This research attempts to find the existing shortcomings by studying and identifying. The existing open spaces in the district one and district two of Zanjan city (Iran) for emergency accommodation of people after earthquake and adopting it to the population density of these areas. Arc-GIS and Auto-cad software's are used to design a map in this research.

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1. Introduction

Nowadays so many cities throughout the world are in exposure of damages which are as a result of natural disasters because of location type, inappropriate physical development, local of standard in buildings, etc.. every year some earthquake with different magnitude happen in the world and our country which lead to high damages and casualties. In different region of different cities, confronting with earthquake has been done in different stages: 1-preventive measures 2-during the event measures 3- after the event measures. In all three stages, land use plays an important and incredible role. If necessary measures are planned in all three stages we would have reduction in the potential damage. In general, we can say that those measure that are done before earthquake, will have the most role in reducing the damage with the lowest cost. Thinking about principal of land use planning at risk cities can be an effective measure before the crisis (Aminzadeh,2012).By checking the statistics of earthquake that happened during this century, we can see that have to follow the before the event programme much seriously. The devastative earthquake in recent years is as follow: the Silakhor earthquake hit in 1909, it was mw 7.4 which killed 8000 and destroyed 64 villages. The Salmas earthquake hit in 1930 which killed 2514 people and destroyed 60 villages .In Lar earthquake hit in 1960. It was Mw 6.7 which killed 4000 people and destroyed about 7.5 percent of the whole city. The Boeinzahra earthquake hit in 1962. It was an mw=7.2 which killed 1000 people. In Bayaz plain earthquake hit in 1968. It had magnitude of 7.4 which killed 10500 people and destroyed 61 villages. In qeyr earthquake hit in 1972. It had magnitude of 6.9 of which killed 4000 people. Khorgo earthquake hit in 1977. It has magnitude of 7 which killed 128 people. In Tabas earthquake hit in 1978. It had magnitude of 7.7 which killed 19600 and destroyed 16 villages. The earthquake hit Qaen city in 1979. It had magnitude of 7.1 which killed 130 people. The earthquake hit Sirjan city. It had magnitude of 7.4 which killed 1300 people and destroyed 85 percent of city. The earthquake hit Roodbar and Manjil hit in 1990. It had magnitude of 7.4 which killed 35000 people. The earthquake hit Birjand in 2002. It had magnitude of 6.6. the earthquake hit Bam in 2003. It had magnitude of 6.5 which killed 41000 people and destroyed the whole city. The earthquake hit Zarand in 2004. It had magnitude of 6.4 which killed 612 people and destroyed 10 villages. The earthquake hit Ahar, Haris and Varzaghan cities. It had magnitude of 6.2.

(<http://www.khabaronline.ir/detail/235750/society/urban>)

Table 1. Urban planning role at the time of crisis management

Stage	Description	Planning role and urban designing
Stage one	Earthquake moments (It has physical damaged and urban dysfunction and casualties are as a result of this)	Urban planning can make vulnerable areas in a better way by recognizing them and right planning
Stage two	Escape and shelter (Earthquake consequential damages such as infrastructure utilities damages)	In this stage the prediction has been about done sufficient and suitable open spaces white much distances from earthquake. It has also been considered.
Stage three	Rescue operation	Separation of the city in to different parts, balance distribution of urban and rescue centers in every region, complete coverage of roads network. Various and ongoing access for sending help to different parts of the city
Stage four	Housing of homeless people and temporary accommodation of land use that were destroyed	Temporary establishment of main and important land uses in city (land uses such as hygiene, health, education and city services)
Stage five	Cleaning, repairing, reconstruction, and important	Primary repairing of city infrastructure including roads plumping, electricity, gas, etc.

Adopted from Hamidi 1995

2. Research objectives and subject definitions:

2.1. Crisis management

Planning process and public and governmental administrative organizations have tried to prevent the crisis by observation and analyzing the crisis or they try to reduce the effects, to confront, to do emergency welfare and to reconstruct at the time of event. (Aysan, Davis, 2003)

Urban planning process role is much in reducing the potential danger in critical time. In the following table of this planning at critical time is mentioned.

Some elements are effective at vulnerability to earthquake including city structure, city form, city density, city network, utilities and city infrastructure. Based land using view, some elements are important at vulnerability to earthquake such as city structure, city elements, spatial distribution, city main actions, from, size, how the smallest constituents of the city are combined different model of land segmentation, open or compact from of city, location and city infrastructure. Reflexibility in the city from, proximity and suitability whit each other, city proportional, having the efficient network and hierarchy, building safe, resistant and repairable infrastructure are the main factors which can decrease the effect and consequence of the earthquake to the great extent.(Bahreini1996)

We can divide the physical element of crisis management in different level as local, zonal, regional and city. In the following chart the elements and their operation are mentioned.

Table 2. Physical elements of crisis management

Local	1-Evacuation center 2-Rescuecenter 3-local main way
Zonal	1-Emergency medical centers 2-recume base 3- Police center 4- Secondary ways
Regional	1-Medical center 2- Temporary accommodation bases 3-Food stocks 4-Fire fighting bases 5- Secondary ways
Urban	1-Graveyard 2- Hospital 3-Crisis management center 4-Food stock 5- Red crescent main base 5- Primary ways

(Aminzadeh,, 2012)

2.2. Standard space for emergency accommodation

The require standards are different in different countries for emergency accommodation of injured people at crisis time but most countries accept the United Nation commissioner for view in this regard. Based on human train chart and the minimum standards of relief of UNCR at the time of crisis, every person needs at least 3m for emergency accommodation and one tent for every 5 people. The distance between tents should be at least 8 meters. The streets width of camp should be at least 10 meters and one toilet for every 20 people. (<http://www.helafars.com>)

2.3. Zanjan city area

Zanjan city is in 36°36' -36°45' longitude and it is located in north east of Iran and is capital city of Znanj province (Zanjan comparative plan, vol.1, p.5). Zanjan is almost a big city and it has had a development in population and size in the recent years. Looking at the population growth of the city, it is seen that is1921 census it has 15000 population and based on the censorship, it has population of 47159 people. In 2006, Zanjan city had around 340000. It had 4.61 percent growth of population every year. During in recent 50 years, the Zanjan city has increased 5 times. The Zanjan city has grown from 165 hectares in 1921 to 466 in 1956 and to during time 85 years. (<http://www.amar.org.ir>)

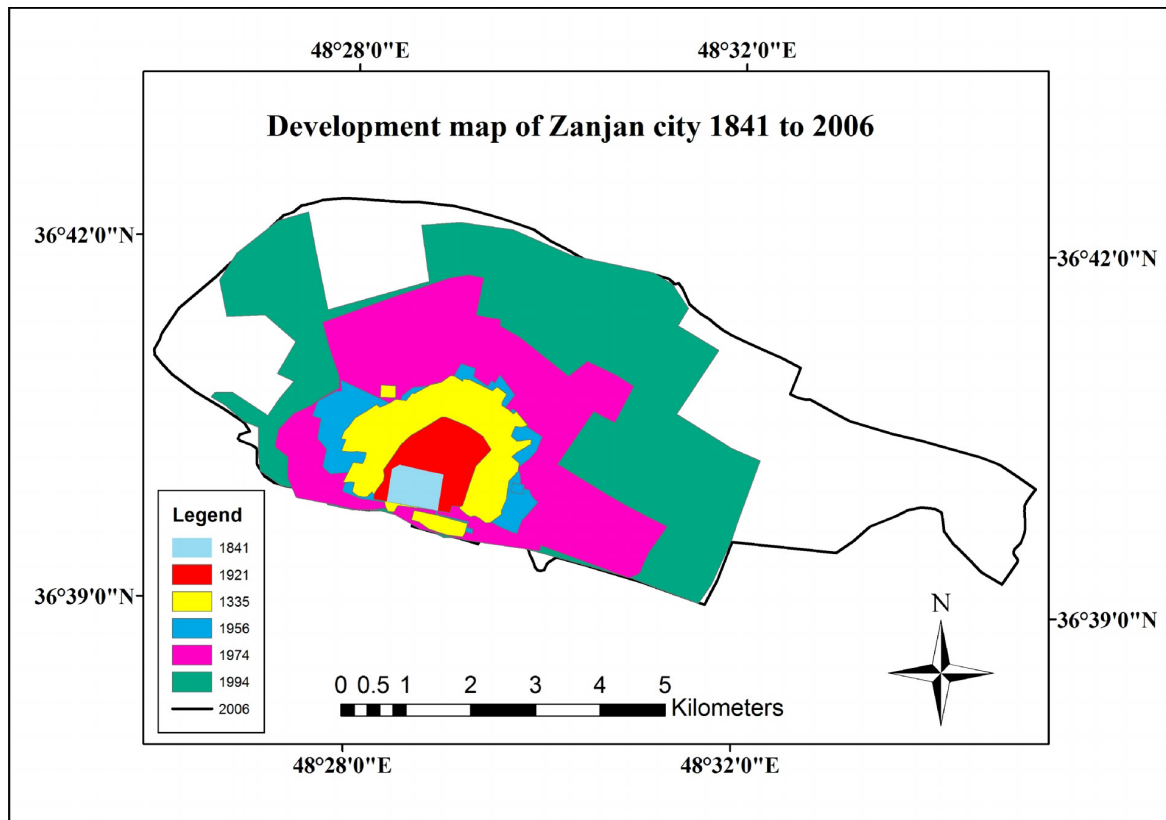


Fig. 1. Development of Zanjan city

In general, crust failure is reefed as fault and earthquake is occurred on it. In Alp belt, faults are started from Europe and enter to our country through Turkey. Its northern branch go through east Azerbaijan province and enter into our province (Zanjan) and it passes Qazvi, Alborz, Tehran, Semnan and Khorasan provinces in Iran and enter into Afghanistan and is extended up to Himalaya mountain ranges. However this failure have general trend in our country, every part has special name because they are septate.

Some of them are located in Zanjan political area and some of them are out of Zanjan political area but their activities create many dangers for Zanjan province. In the following, these faults are explained:

- Tabriz fault:

This fault is strted from Tabriz North Mountains and ended in the Abhar- Zajan plain. It caused many earthquake in west Azarbajan and creat dangers for Zanjan. Only some parts of this fault are located in Zanjan (Eshtokiln1969).

- Soltanniyeh fault:

This fault is extended at the parallel of Soltanniyeh mountains and Abhar- Zajan plain. Its trend is west north to east south of Zanjan province and it is the only fault is completely in our province area. The vibration of this fault has created much damage during the history. This fault it threat all part of Zanjan.(Eshtokiln1969).

- Lahijan fault:

This fault is part of major fault of Albora that is started from Qonbadkavos and extended up to Lahijan and its length is 550 km. Its direction changes toward south and continues over 100 km. This fault enters into Zanjan province through Tarom city which was earthquake focus in 1990 that caused much financial damages and casualties.

- Avaj fault:

This fault is located in Qazvin and Hamadan provinces. At present, it is not in political area of Zanjan province but its vibration create much dangers for Zanjan province (especially the areas which are near to Hamadan and Qazvin province)

- Hasanabad fault:

This fault is located in the parallel of Avaj fault and has great activities from tectonic viewpoints and it was earthquake focus of Boeinzahra. However, this fault is not located in the political area of Zanjan province; its vibration will create much danger to this province.

So many earthquakes has occurred in Zanjan province during the history. There is not enough information about then because they are not registered scientifically. From 1990 to 2005, fifteen earthquakes has occurred in Zanjan province which Tarom has been the strongest in 1990 with magnitude of 7.3.(Ahmadi, 2012)

Roodbar- Manjil earthquake in 1990 hit at 21 GTM (00:30 local). It had 7.3 magnitude and destroyed 700 villages and killed more than 35000 people and wounded 60000 people and made 500000 people homeless.

It caused much damage to the buildings and urban utilities in most cities of Zanjan. Based on earthquake danger delineative, Zanjan, Abhar, Khoramdareh, Hidaj and Saeinqaleh cities are in hazardous area.

(<http://www.ngdir.ir/Earthquake/PEarthquakeDetail.asp?PID=3849>)

3. Results and discussion

3.1. Zanjan district one area

Zanjan district one has the area the area of 491/62 hectares. This district is limited from north to Shohada and beast streets and part of Imam Khomeini street, from south to Zanjanrud, from east to Valiasr street and khorramshahr boulevard, from west to 15Khordad boulevard. Based on the public censorship in 2006, this district has 38098 population.

This region is composed of five areas and 20 locals. Less than 8 percent of the whole area of Zanjan belongs to this region while more then to percent population of Zanjan live in this region. This region has 491/62 hectares which about8/22 hectares is devoted to parks and plant covers. Every person who live in this region has 2.16 square meters green space. However the amount of vacant lands and construction lands are 28/89 hectares, we cannot regard them as lands to use for emergency accommodation at crisis because it is possible these areas have been constructed at crisis. Therefore the regions that we can use for emergency accommodation of wounded people are just parks and green spaces. Considerable part of this space is covered by trees. Without considering this the appropriate green space per person is low in comparing with other regions. On the other land this spaces do not have good distribution and they are mostly located in east and west of this region.

3.2. Zanjan district (region) 2 area

This region has the area of 1809 hectares. It is limited from north and west north to Shomali Kamarbandi, from south and western south to the railroad, from east to Shohada and 15 Khordad streets. Based on the public consulship in 2006, it has 145417 populations.

Table 3. Suitable open space per person for emergency accommodation in urban areas inZanjan

Urban region	Region area (square meter)	population	Park and green space (square meter)	Park and green space per person
1	4916273	38098	82288	2/16
2	18096848	145417	358553	2/47
3	12268073	134710	294312	2/18
4	134847762	29925	658070	21/99

Adopted from Zanjan city comparative design (2006)

By looking at the buildings the of the region one, we see that 5/03% have less than five years old, 6/09% are from five to 10 years, 25/57% are from 10 to 20 years , and 10/23% are more than 50 years. If we compare this statistics with the whole of the city, we will understand that region one is much vulnerable to earthquake in the case of risk of building collapse.

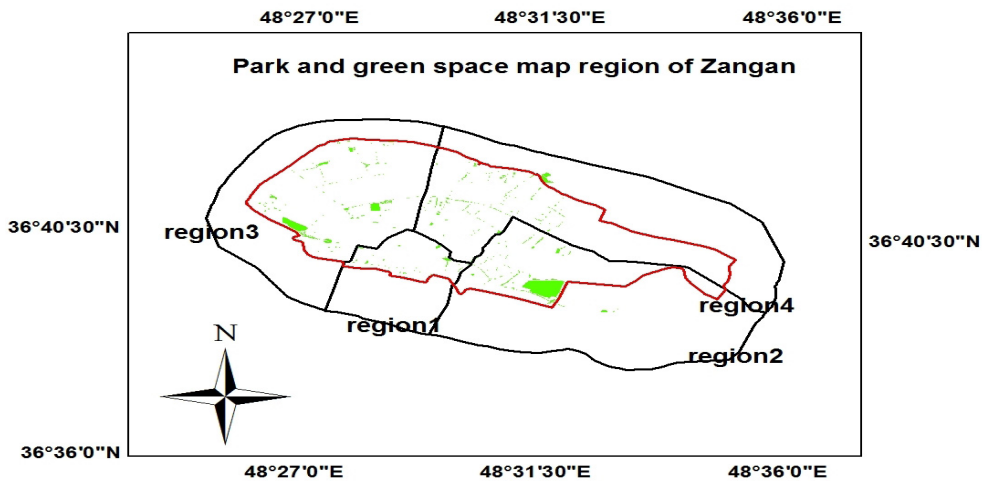


Fig. 2. Parks and green spaces in Zangan city.

By looking out the building condition of region two area of Zangan, we can see that 13.26% of the buildings are less than five years, 7/11% are from 5 to 10 years, 30/15% are from 10 to 20 years, 38/6% are from 20 to 30 years, 8/59% are from 30 to 50 years and 2/29% are more than 50 years. If we compare this statistics to whole of city, we will understand that this region is vulnerable to earthquake in the case of risk of building collapse and it has the third rank after region in this regard.

Table 4. Building ages in Zangan city (percent)

Region	Less then 5 years	From 5 to 10 years	From 10 to 20 years	From 20 to 30 years	From 30 to 50 years	More than 50 years old
1	5/03	6/09	25/57	37/94	15/15	10/23
2	13/26	7/11	30/15	38/6	8/59	2/29
3	22/39	42/15	12/82	21/28	1/32	0/05
4	58/07	12/47	16/69	11/61	1/15	0
Total	23/28	17/36	12/07	28/47	6/26	2/56

4. Conclusion

The require standards are different in different countries for emergency accommodation of injured people at crisis time but most countries accept the United Nation commissioner for view in this regard. Based on human train chart and the minimum standards of relief of UNCR at the time of crisis, every person needs at least 3m for emergency accommodation and one tent for every 5 people. The distance between tents should be at least 8 meter. The streets width of camp should be at least 10 meters and one toilet for every 20 people. Comparing this statistics with the statistics of region one in Zangan city, which has 2/16(square meter) open space per person, show that this space does not meet the needs of wounded people which should be 3(square meter) per person and on the other land, these

spaces are not distributed appropriately and they are mostly in western and cistern part of this region. The central, southern and northern parts of region have the lowest spaces for more than 25% of the buildings are more than 30 years and they are not based on engineering principles. Although region 2 condition is better in comparing with region one and there is 2/47 (square meter) open space per person, it is far from the world standard (International standards). 11% of all buildings in this area or region area more than 30 years and about 50% are more than 20 years. This statistics shows that region one in comparing with region two has low open space and much vulnerable to earthquake. Among the four region in Zanjan, these two regions are ranked as one and three. Generally, in these two regions both building vulnerability is high and population distribution is high from one hand. On the other hand, we will have great problems at crisis for emergency for accommodation because of lack of open space per person.

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