

THE EVALUATION OF THE VULNERABILITY OF THE URBAN FABRIC OF ALISHAHR TO EARTHQUAKE USING GIS SOFTWARE

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Resumen. La revista QUID, es una publicación científica orientada a presentar aportes teóricos científicos y/o de desarrollo tecnológico aplicados en las áreas de ingeniería, artes, administración y ciencias sociales y humanas; está dirigida a la comunidad académica, investigativa y en general a toda la sociedad que se interese en estos temas de conocimiento. QUID es arbitrada y tiene una periodicidad declarada por semestre. Para lo cual publica constantemente convocatorias invitando a los autores interesados a remitir sus contribuciones representadas en artículos de investigación, reflexión y revisión.

Palabras clave: Se debe proporcionar hasta un máximo de cinco (5) palabras -en orden alfabético-, que ayuden a identificar los temas o aspectos principales del artículo. Para asegurar la adecuación de éstas se sugiere consultar el tesoro de la UNESCO <http://databases.unesco.org/thess/> o el índice de palabras claves de IEEE http://www.ieee.org/documents/2009Taxonomy_v101.pdf

Abstract. One of the dangers that has frequently threaten many cities and their construction projects throughout the world, including our country, is earthquake. Meanwhile, Iran is located in a seismic area in the world, which would indicate there is a threat to the country's cities and residential buildings.

With respect to the significance of the subject, the evaluation and quest of a method, which leads us to minimize seismic hazards, takes priority in the effort initiated by the article. In the article, an attempt was made to make a good estimate of the vulnerability of the city of Ali Shahr in Bushehr Province by using analytical graphical possibilities of geographical information system (GIS). Moreover, using GIS and descriptive data about the component and elements of buildings as well as various qualities of comprising elements, and mining field data from the scope of the study, we can make good prediction about the seismic behavior of the buildings against earthquake with available records. The results made it clear that there is a specific relationship between vulnerability indicators, the quality of foundation, roof, age of building, and type of building materials. As for all the available data, it has been evident that as foundation had 82% of poor quality, so did ceiling, building skeletons with 58% and 57% respectively.

Keywords: Global Position System, strain gauge, geographical information system (GIS), crustal deformation, the model of city vulnerability

1. INTRODUCCIÓN

In order to achieve a comprehensive system for storing, managing, and processing spatial and descriptive data associated with development projects, the use of the most advanced science and technology are taken into consideration. Therefore, the study attempts to set up a comprehensive and integrated GIS system for relevant projects by a sense of necessity for exploiting the extensive capacities of GIS, as well as coordinating the attempts made in the field of urbanity and architecture for implementing GIS. The article practically and in a field manner set out to mine the construction information about the new city Alishahr in Bushehr Province, which is considered as a means of acquiring construction data bank through GIS of development projects, which include as follows:

- 1- Recognizing the need for a GIS view in detail
- 2- Developing a conceptual standard model of spatial database
- 3- Collecting and preparing spatial and descriptive data on sample projects
- 4- Setting up a system of spatial database management

With respect to the evaluation of city vulnerability to earthquake in Iran as well as other parts of the world, many articles dealt with the subject matter, for which an attempt was made to refer to these cases, though few (Beiranvand,2008)

Ahad-Nejad et al (2007), “the evaluation of the vulnerability of outskirt info settlement using geographical information. Azizi, Mohammad, and Akbari (2008) “urbanity considerations in the assessment of city vulnerability to earthquake with application of Analytical Hierarchy Process and GIS”. BeteroFernandex (2009), in his doctoral dissertation entitled “geographical information about the measurement of the extent to which cities are vulnerable to earthquake”, evaluated the role of geographical information and data in order to evaluate city vulnerability to earthquake. Moreover, given the spatial data infrastructure, he dealt with the zoning of social and physical vulnerability in the city of Medellin, Colombia.

2. THE SPATIAL LOCATION OF THE CITY IN QUESTION

The new city Alishahr is the comprehensive plan approved in 1985 by the Supreme Council of

Urbanity Architecture of Iran for the maximum population of one hundred thousand people.

The estimated projects of the city involved about 3 or 4 projects. As for the preliminary projects, phases 1 to 3, an area of approximately 350 hectare was included. The plan came to the revision in 2003. By adding phase 4 extending about 50 hectare, the project was expanded. Moreover, in recent years phases 5 and 6 were added to the city, by which the area of the city extended over 1000 hectare.

At this point, the phases 1 to 4 have been implemented, as the phases 5 and 6 are to be completed in terms of studies. At the present time, around 11000 hectare of housing units are under construction.

School spaces have been anticipated by conforming to the country’s standards, where they were separated into elementary, secondary, and high school as higher education spaces.

Business, trading, and industrial spaces were also anticipated.

Amenities, green spaces, etc., were anticipated adequately or even greater than the country’s standards.

However, at this moment, it has 11 public and private schools at different levels, and the presence of Islamic Azad University has made Alishahr a higher education hub in higher education sector.

In terms green spaces, the city has 4 parks, fire station, as its fuel station is under construction.

As for religious spaces, in addition to Quran Circle and Ceremonial Moaning Houses (Tekyeh), the city has 4 mosques and 2 Hosseinieh (typical of Moaning House), as well as Anonymous Martyr Memorials, asa Friday Pray Place has been inaugurated in the city.

In terms of health facilities as well as sport spaces, the city is endowed with a center for healthcare and several private clinics as well as two sport complexes.

An urban train line works between Bushehr and Alishahr. At the present time, it is pursued and studied.

The new city Alishahr is situated 24 kilometer southeast of the city of Bushehr on the path of Delawar Road with the following specifications:

Altitude: 50 meters

Longitude: 50°, 51' from the prime meridian
 Latitude: 28 ° 59' and 30'' of the equator
 Earth Resistance: 2.5 kg cm square
 The average slope of the land: 1.5 per cent in the North West

Average annual rainfall: 281/4 mm
 The average annual temperature: 24.8 ° C
 Dominant wind direction: North and Northwest .



Figure 1. Bushehr Province

3. METHODS OF DATA AND INFORMATION EXTRACTION

The study phase included all the residential, commercial-residential buildings in the new phase of Alishahr, where they are categorized and evaluated with respect to the following items:

1. The number of building stories
- 2- The year of construction
- 3- Type of foundation
- 4- Quality of foundation
- 5- Type of skeleton
- 6- Quality of skeleton
- 7- Type of ceiling
- 8- Quality of ceiling

The level of qualities have been extracted from the written reports of the consultant engineers of the buildings in question and the information of the City Development Organization of Alishahr as well as those of Construction Engineering System along with the field studies and visits.

Having analyzed the information obtained, the number of buildings in various years are presented in figure 3, whose most number of construction is shown in 2004.

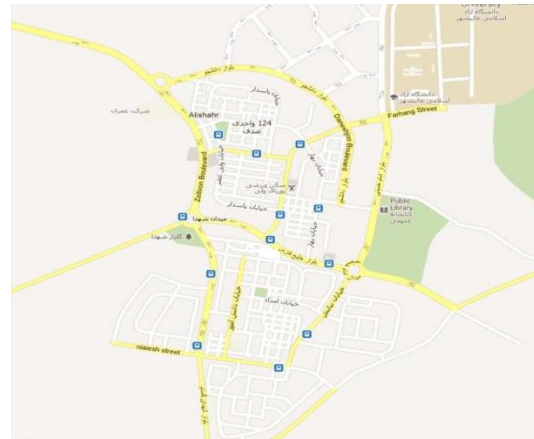


Figure 2. Case study area

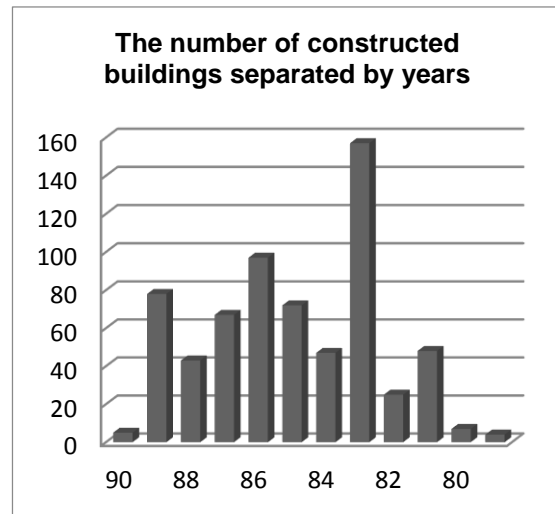


Figure 3. The number of constructed buildings separated by years

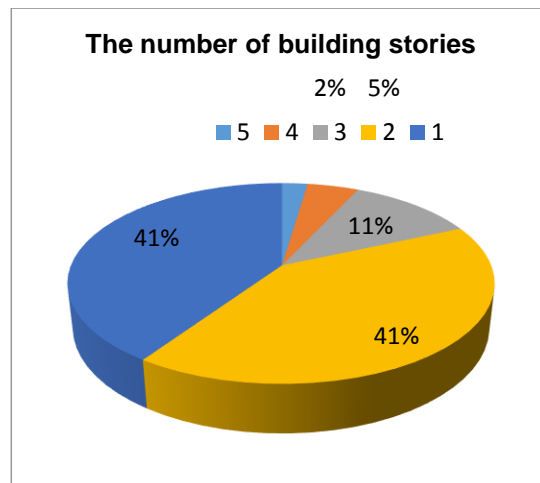


Figure 4. The number of building stories is shown in figure 4, for which the highest percentages of constructed buildings were associated with 1 or 2 story buildings (each 41%)

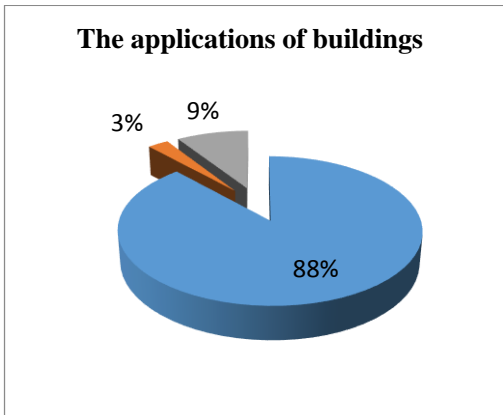


Figure 5. The applications of buildings are introduced in figure 5; 88% of them are residential, 9% of them are commercial-residential and 3% of them is commercial

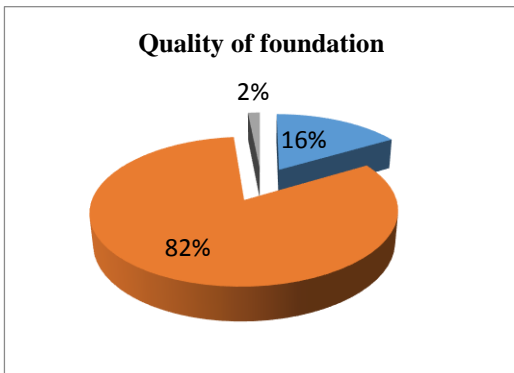


Figure 6. Quality of foundation, 82% medium quality, 2% low quality, 16% high quality

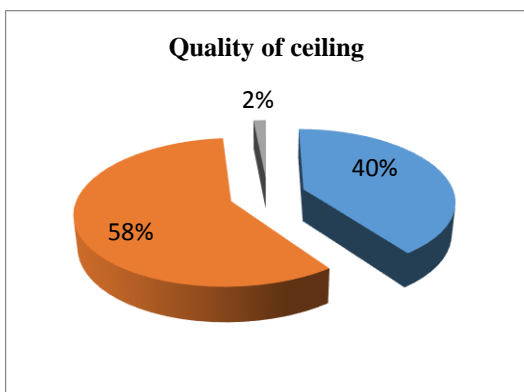


Figure 7. Quality of ceiling, 40% high quality, 58% medium quality, 2% low quality

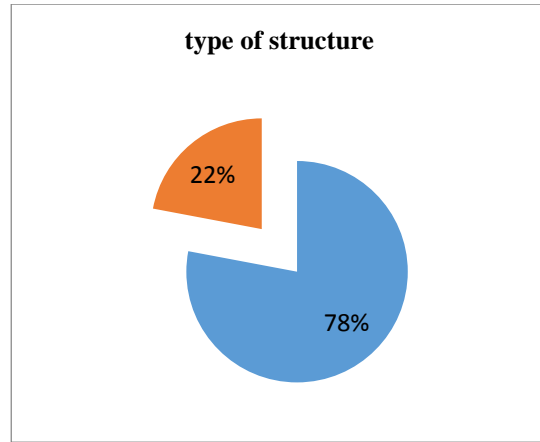


Figure 8. Type of structure, 78% Concrete, 22% Traditional

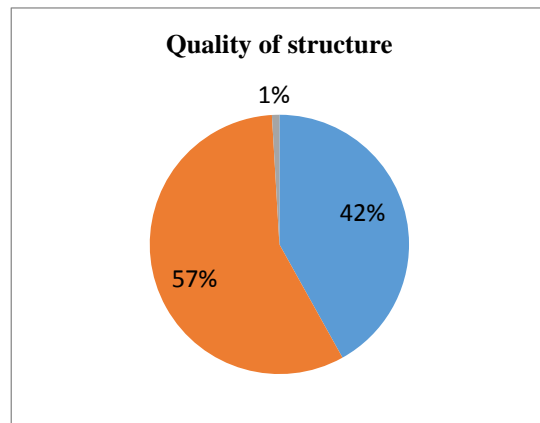


Figure 9. Quality of structure, 42% high quality, 57% medium quality, 1% low quality

CONCLUSION

In the present study, it became evident that the available structures in the city of Alishahr are facing huge troubles with reference to vulnerability to earthquake. It was also made clear that the highest vulnerability was associated with the foundations in question; this matters most in term of the importance of structures. In what follows as grave concerns are ceilings, which requires stricter revision and performance; this also calls for further evaluations.

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