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Investigating Land Use Planning to Assess Earthquake Resilience in Abdanan City

Teimour Jafarie[1], **Mohammadreza Gholami**[2], **Zinat Pirani**[3]

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Original Article

Abstract

INTRODUCTION: Natural disasters, especially earthquakes, are phenomena that will cause great damage if not properly dealt with. Therefore, appropriate urban planning and resilience by understanding the nature of disasters and the capacity of cities are factors that play an effective role in reducing damage and ensuring the peace and safety of citizens, leading to a significant reduction in the level of vulnerability. In this study, land use planning was investigated to assess earthquake resilience in the city of Abdanan.

METHODS: This research is descriptive-analytical with a quantitative approach. In order to collect data related to literature and theoretical foundations, library and document resources, reliable articles and websites, and existing studies were used along with field work. To collect information related to the case study (Abdanan region), related organs and organizations, especially the municipality, were consulted, and the data obtained was extracted using the capabilities of GIS software in the field of processing and combining layers, and final maps were extracted.

FINDINGS: According to the research findings, out of a total of 6,653 households living in the city of Abdanan, more than half live in a very high and high earthquake hazard zone. On the other hand, the central and old areas of the city do not have suitable conditions in terms of resilience in terms of criteria involved in improving the urban structure, such as the type of structures and the quality of building materials, the age of buildings, buildings density, urban road network, access to open spaces, population density, and city expansion side, and in the event of a possible earthquake, high damages will occur.

CONCLUSION: The results show that urban land use planning in the city of Abdanan, which has been implemented in the form of comprehensive urban plans, has not led to improving the resilience of this city in dealing with a possible earthquake.

Keywords: Land use; Resilience, Earthquake, Abdanan, Urban resilience.

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Introduction

Earthquakes are one of the most catastrophic natural phenomena, and Iran, located on the Alpine-Himalayan orogenic belt, is considered one of the most earthquake-prone regions in the world, with 17.6% of every 153 destructive earthquakes occurring in Iran. (1)

Following the occurrence of each earthquake, a wide range of damages arise, and regardless of the financial and economic damages inflicted on the city and, to a lesser extent, on the citizens, human casualties and psychological problems resulting from the death of loved ones, homelessness, and insecurity are each considered a crisis in their own right. Given the country's seismicity, it is possible for each of us to be one of the victims of a future earthquake. Therefore, in the first step, the goal is to prevent such damages from occurring, and since earthquakes cannot be prevented, we must seek solutions to deal with them. (2)

Actions taken before natural disasters occur actually determine what happens after they occur. However, it is not possible to control or predict natural disasters precisely, but what is possible is to take steps towards building a resilient city in the face of disasters. These actions include properly designing buildings and infrastructure systems so

1. Faculty Member, Department of Geography and Urban Planning, Kosar University of Bojnord, Bojnord, Iran
2. Retired Faculty Member, Department of Geography and Urban Planning, Kosar University of Bojnord, Bojnord, Iran
3. Master's Student in Geography and Urban Planning, Kosar University of Bojnord, Bojnord, Iran
Correspondence to: Teymour Jafarie, Email: Tei.Jafarie.53@gmail.com

that they can withstand the types of possible earthquakes. (3)

One of the tasks of urban planners is to guide urban development in a safe direction, along with modifying existing urban development to increase city safety. Urban planning is one of the most appropriate tools of local government in order to realize the concept of resilience at the level of urban communities, and incorporating the concept of risk reduction and prevention into urban development plans, especially land use plans and programs, plays a fundamental role in increasing the likelihood of realizing the concept of resilience.

With appropriate planning, cities are able to make themselves resilient to natural disasters, including earthquakes, and witness minimal damage in the event of natural disasters. This planning includes measures such as resilient construction, crisis management, public education and awareness, and the development of flexible infrastructure. (4)

The city of Abdanan in the southernmost part of Ilam province, due to its specific natural characteristics and structural and geographical differences, which are caused by the surrounding mountain fence, its location along the young and active faults of the Zagros, the unprincipled and rapid expansion of the city that is far from structures that comply with urban planning standards, as well as the lack of planning in urban space planning, failure to observe engineering and safety principles in construction, the weak economy of the majority of residents and disregard for construction principles in seismic areas, etc., has a high probability of risk and high vulnerability to earthquakes. Villa structures with few floors and new areas far from faults and with hard soil physics are more resistant, while new neighborhoods that are unsafe and vulnerable in terms of the number of apartment floors (National Housing Movement) and are located near mountains with active faults do not have favorable conditions for resilience against earthquakes. (5)

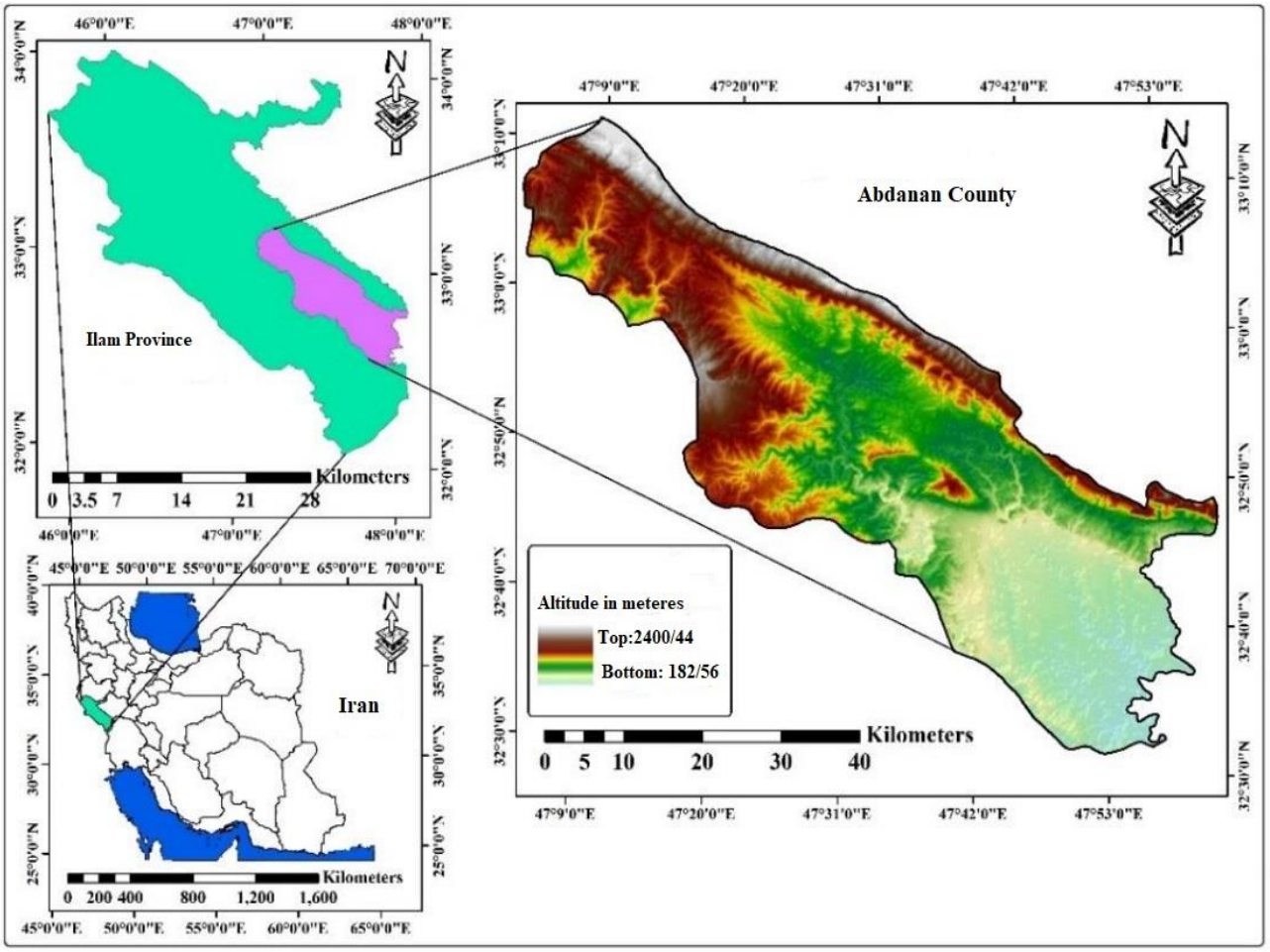

Figure 1. Location of Abdanan County (27)

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Due to the lack of land and the mountainous structure of the city and its unevenness, the lack of fundamental and engineering principles in urban development is clearly evident in different spaces and appearances of the city. The mountainous nature and lack of barren land and uncoordinated expansion, the interference of different uses in the vicinity, narrow and non-standard streets and passages, limited and inappropriate public access, etc., all together make areas of the city unsafe and vulnerable to earthquakes. In the meantime, the main factors determining the expansion pattern of Abdanan city are: severe weakness of the land and housing economy, lack of a strategic plan, instability of macroeconomics and development management, weakness of knowledge and expertise of municipal experts, uncoordinated urban management, instability of municipal revenue sources, and weakness of urban development plans. In general, the interpretation of the results indicates the high contribution of managerial and economic factors in the pattern of urban growth and development. (6)

Taghavi Zavareh et al. (2019) found in their study that the urban fabric and spaces of the central and eastern parts of the Zargandeh neighborhood of Tehran are more vulnerable than other areas due to deterioration, narrow streets, access problems, and high population density. Finally, steps can be taken to improve the resilience of the area by adopting solutions to reduce the weakness of physical systems in urban spaces and educating and building the local community's awareness of natural disasters. (7)

Hadi et al. (2021) in a study titled "Investigating the Compatibility of Urban Uses in Increasing Resilience Against Earthquakes in Tabriz" was conducted in 2022 and examining the extent of damage and injuries caused by earthquakes in the city showed that a high percentage of injuries are directly and indirectly related to the unfavorable state of urban planning and risk reduction, and according to the results of this study, 43.9 % of urban uses are completely compatible with each other. (8)

Kautsary (2022) in a study titled "Multi-disaster-based infrastructure and land use design as the main key to the resilience of the city of Palu" was conducted in. This study emphasized the importance of multi-disaster-based infrastructure design and land use planning in increasing resilience to earthquakes and other natural disasters in the city of Palu in Indonesia, as an earthquake-vulnerable area. This study identified key parameters for disaster-resilient cities, including disaster risk reduction and efficient implementation of programs. (9)

The present study was conducted with the aim of investigating land use planning to improve the resilience of the city of Abdanan against earthquakes, and the basic questions that this study seeks to find a logical and reasoned answer to are: What is the current situation of the city of Abdanan against earthquakes? Have urban uses in the city of Abdanan been created considering the category of urban resilience? What are the components and dimensions that affect increasing resilience and reducing vulnerability in the city of Abdanan against earthquakes? Has the position of urban development and its relationship with increasing resilience to earthquakes in the city of Abdanan been considered? What solutions and measures can be provided to create appropriate urban resilience against natural disasters, especially earthquakes?

In the initial response to the above questions, the following hypotheses were put forward: It seems that the city of Abdanan does not have much resilience to earthquakes, and its old and marginalized fabric is one of the most vulnerable parts of the city, and natural disasters, especially earthquakes, have not been considered in urban planning and urban use establishment in the city of Abdanan. And finally, the dimensions and factors that are effective in reducing vulnerability and increasing the resilience of the city of Abdanan against earthquakes are not effective.

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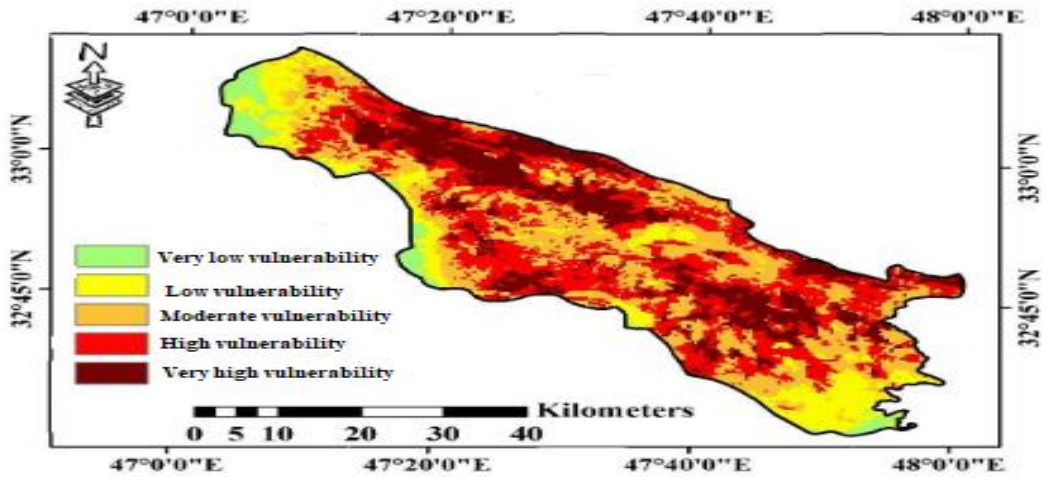
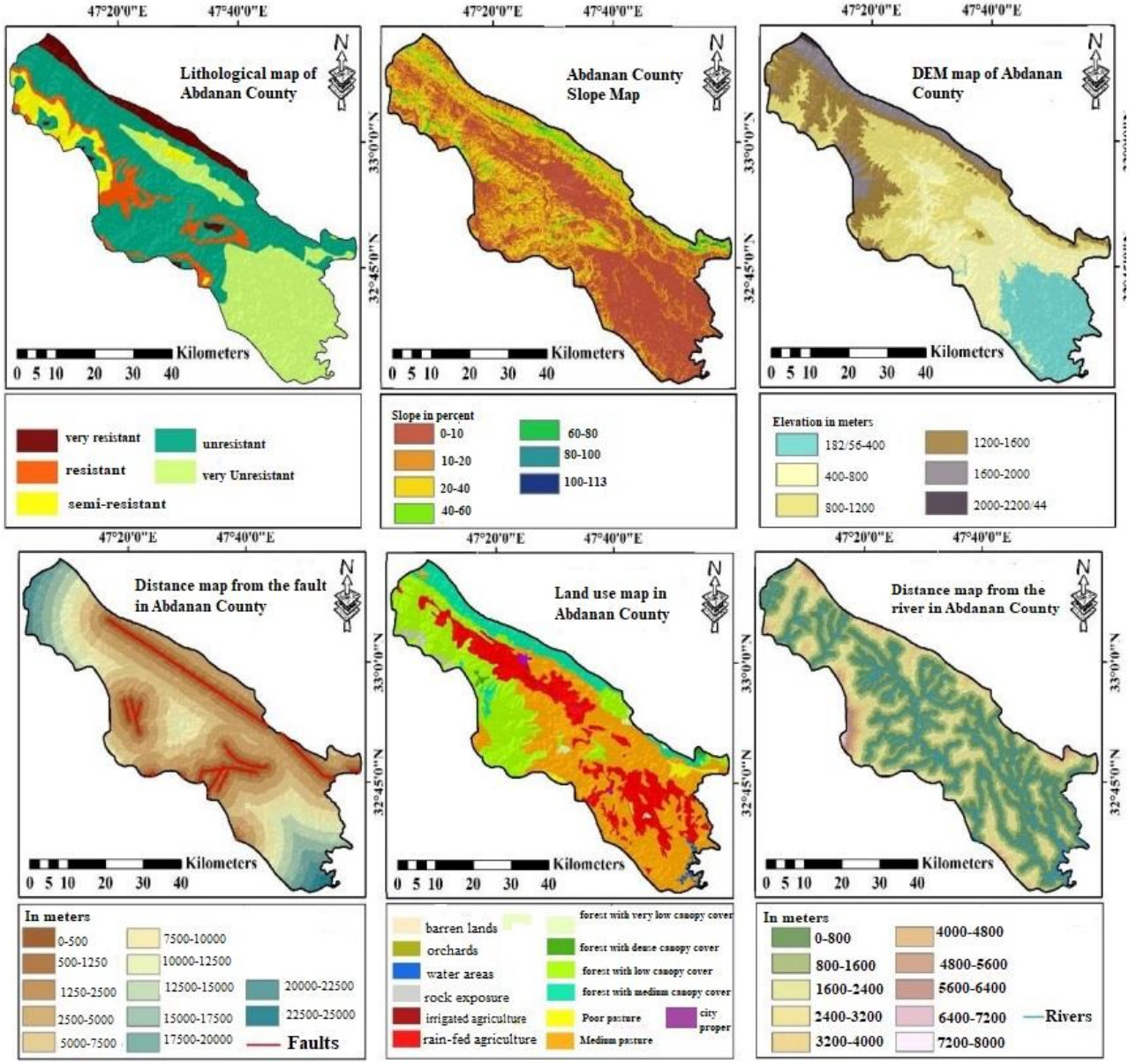


Figure 2. Zoning map of Abdanan County's vulnerability to earthquakes (27)



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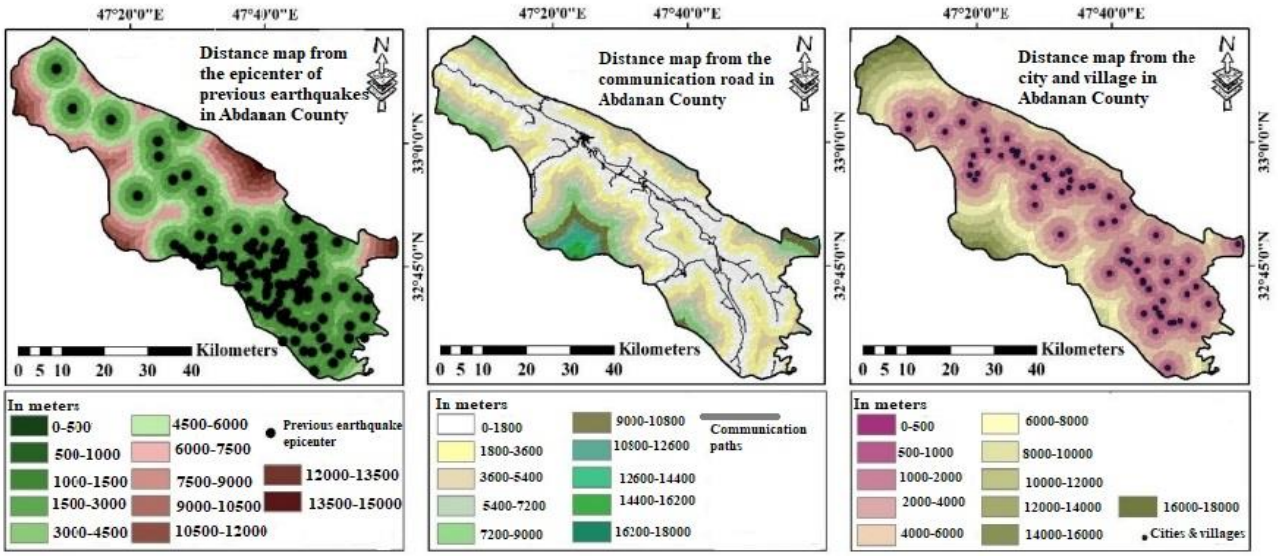

Figure 3. Criteria considered in assessing the vulnerability of Abdanan County to earthquakes (27)

Table 1. Largest quakes in or near Abdanan, Ilam province (28)

Date and Time	Mag	Depth	Location
Nov 24, 2023 09:43 am (Tehran)	4.4	10 km	41 km SE of Abdanan
Nov 10, 2023 07:06 pm (Tehran)	4.8	10 km	32 km east of Dehloran
Jun 28, 2023 10:38 pm (Tehran)	4.6	14 km	Iran-Iraq Border Region
Mar 25, 2023 10:43 pm (Tehran)	4.8	10 km	36 km ESE of Dehloran
Mar 13, 2020 10:32 am (Tehran)	4.6	10 km	Iran-Iraq Border Region
May 5, 2017 09:07 pm (Tehran)	4.4	10 km	Iran-Iraq Border Region
Jun 23, 2016 02:44 am (Tehran)	4.4	10 km	Western Iran
Apr 12, 2016 06:40 pm (Tehran)	4.4	10 km	Western Iran
Nov 21, 2015 10:31 pm (Tehran)	4.7	10 km	Iran-Iraq Border Region
Feb 15, 2015 11:34 am (Tehran)	4.6	10 km	Iran-Iraq Border Region
Oct 15, 2014 05:05 pm (Tehran)	5.7	10 km	Iran-Iraq Border Region
Aug 24, 2014 12:35 am (Tehran)	5.3	10 km	Iran-Iraq Border Region
Aug 20, 2014 02:44 pm (Tehran)	5.5	14 km	Iran-Iraq Border Region
Aug 20, 2014 01:02 am (Tehran)	5.1	10 km	Iran-Iraq Border Region
Aug 18, 2014 09:39 pm (Tehran)	5.1	10 km	50 km ESE of Dehloran
Aug 18, 2014 06:08 pm (Universal Time)	6.0	5 km	Iran-Iraq Border Region
Aug 18, 2014 03:21 pm (Tehran)	5.2	10 km	Iran-Iraq Border Region
Aug 18, 2014 02:53 pm (Tehran)	5.0	10 km	Iran-Iraq Border Region
Aug 18, 2014 08:55 am (Tehran)	5.6	10 km	Iran-Iraq Border Region
Aug 18, 2014 07:02 am (Tehran)	6.2	10 km	Iran-Iraq Border Region
May 3, 2012 01:39 pm (Tehran)	5.2	10 km	39 km SE of Abdanan
Sep 2, 2001 02:08 am (Tehran)	5.0	14 km	Iran-Iraq border region
Oct 5, 1998 05:50 am (Tehran)	5.4	39 km	Western Iran
Oct 4, 1998 04:12 am (Tehran)	5.3	10 km	15 km NW of Darreh Shahr
Apr 3, 1989 12:54 am (Tehran)	5.4	33 km	Iran-Iraq border region
Jan 28, 1988 09:02 am (Tehran)	5.0	75 km	Iran-Iraq border region
Jan 26, 1988 01:15 pm (Tehran)	5.0	78 km	21 km W of Abdanan
Jan 26, 1988 01:04 pm (Tehran)	5.6	34 km	Iran-Iraq border region
Oct 22, 1984 03:10 am (Tehran)	5.0	42 km	27 km E of Dehloran
Jan 4, 1977 07:39 pm (Tehran)	5.1	45 km	Western Iran
Aug 28, 1941 12:18 am (Universal Time)	5.6	15 km	18 km WSW of Darreh Shahr
Jun 10, 1941 08:38 pm (Universal Time)	5.7	15 km	12 km WSW of Darreh Shahr

Methods

The present study, in terms of its nature and research method, is a descriptive-analytical research with a quantitative approach. On the other hand, it is considered a case study due to the overlap of research methods. This research aimed to investigate land use in assessing earthquake resilience in the city of Abdanan, located in Ilam province in 2024. Abdanan county is bordered by Dehloran city, Zarrinabad district, and Malekshahi city from the west and north, Andimeshk city

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(Khuzestan province) from the south, and Darreh Shahr city from the east. (Figure.1)

Geographically, the location of this city and its location in the valley between the two great Zagros mountain ranges, Kabirkoh (in the north) and Dinarkoh (in the south), is located. (10)

A seismic survey of an area of about 1 degree by 1 degree of the Abdanan earthquake epicenter shows that about 1019 seismic events have occurred in the region in the past century, 13 of which have a magnitude of 5 or more. This statistic shows that the Zagros region, which is bordered by Ilam, Lorestan, and Khuzestan provinces, is very seismically active. (11)

To collect data related to literature and theoretical foundations, library and document resources, reliable articles and websites, and existing studies were used along with field work. In the next stage, to collect data in the form of field impressions and use statistics and information from consulting engineers and organizations related to the case sample (Abdanan region), related organizations and agencies, especially the municipality, were referred to and the obtained data was converted into a map. Then, using the software capabilities in the field of processing and combining layers, the final maps were produced, analyzed, and evaluated using a GIS.

In order to investigate the level of resilience of the city of Abdanan to earthquake risk, from a wide range of criteria for intervention in improving the urban fabric, the criteria of the type of structures and the quality of building materials, buildings age, buildings density, urban road network, access to open spaces, population density, compatibility of uses, and towards the development of the city were selected, and by assigning points to each of the classes, a zoning map of the level of risk to earthquakes was obtained. In this research, after collecting and forming the required database in the GIS environment, by selecting variables and indicators related to the subject, an analysis of the level of resilience was carried out in the study area.

The statistical population in this study was the entire city of Abdanan (including the central Abdanan areas) with a population of 24,500 people based on the statistics of 2016 with an area of 37/23912424 Hectare Square kilometer. (12)

Findings

According to the results obtained from data collection, field observations, and analysis and evaluation of the combination of GIS map layers, the findings obtained according to criteria under consideration based on the area of the city are listed.

A) The type of structures and the quality of building materials

The status and the quality of the building structures in Abdanan city is examined in three parts; the type of structure, the age of the buildings, and the number of floors. The area of the dilapidated structure in the city is 130 hectares, which is more than 20% of the total area, which includes the old neighborhoods and the central fabric of the city. The building materials used in the construction of the building are one of the major factors in determining the quality of residential buildings, therefore, paying attention to and reviewing the type of building materials to determine the quality of the residential fabric and adopting various intervention policies in the fabric is of particular importance. Table 2 shows the building materials used in the residential parts of Abdanan based on the consultant's field survey in 2017.

Table 2. Construction materials used in Abdanan residential units (14)

Materials	Numbers	Amount (%)
Metal frame	376	11
Concrete frame	293	8
Cement block	5	0/09
Brick and iron	3010	82/24
Mudbrick	10	0/20
Brick and wood	7	0/15
Unspecified	54	1/4
Total	3750	100

The majority of Abdanan's residential buildings, 98.11%, are made of durable building materials such as brick and iron, metal frame, reinforced concrete, and cement blocks, and a small share of Abdanan's residential parts are made of less durable materials such as brick and wood or brick and stone. Also, a limited number of residential units in Abdanan are built of non-durable materials such as brick, wood, and mud. (Table 2)

B) Age of buildings

Table 3 shows the age of residential buildings in Abdanan.

Table 3. The age of Abdanan residential area (12)

Age of the building	Numbers	Amount (%)
From 0 to 5 years	470	1253
From 5 to 15 years	223	595
From 15 to 30 years	2003	41/53
More than 30 years	1007	2685
Unspecified	47	125
Total	3750	100

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Accordingly, the time periods used in the index of age of residential buildings are as follows: less than 5 years, 5 to 15 years, 15 to 30 years, and more than 30 years. According to the table, more than half of the residential buildings in Abdanan (41.53%) are between 15 and 30 years old. Also, a significant share of residential buildings in Abdanan are more than 30 years old. Overall, about 80% of the buildings in Abdanan are more than 15 years old, and only 20% of the buildings are less than 15 years old. (Table 3)

C) Buildings density

Table 3 shows that residential density is higher in area 4 than in other areas and lowest in area 11. Overall, the buildings density of the city is about 138 %. (Table 4)

D) Urban road network

The road network of Abdanan covers an area of 82.02 hectares, which is equivalent to 41.0 % of the net land area of Abdanan city. Given the high level of the city's roads, it seems that different parts of the city have good access.

Table 4. Building and floor density (29)

Area	Buildings density	Average substructure	Average number of floors	Average plot area	Area	Number of floors	Per capita residential area (square meters)	Net residential density per hectare	Population
1	153.2	146.9	1.04	244.8	28398	116	39.1	255.75	1200
2	133.1	129.7	1.03	216.2	130354	603	37.81	264.47	3500
3	152.6	149.1	1.02	248.4	105828	426	47.87	209.89	2500
4	164.6	157.6	1.4	262.7	118995	453	32.91	303.86	3500
5	144.8	134.2	1.08	223.7	161969	724	38.59	259.15	4250
6	145.2	140.8	1.03	234.6	103696	442	36.37	274.95	2846
7	0	0	0	0	0	0	0	0	0
8	129.1	120.3	1.07	200.4	60127	300	39.08	255.85	1400
9	124.5	120.3	1.04	200.4	33872	169	41.82	239.11	1000
10	113.3	113.0	1.00	188.4	6594	35	34.71	288.1	600
11	99.5	99.3	1.00	165.5	82925	501	39.3	254.43	2800
Whole city	137.9	132.6	1.04	220.9	832758	3769	38.48	259.84	24.500

The urban road network is one of the most important vital arteries of cities, which has a significant impact, especially after an accident and a crisis, on search, rescue, and relief operations to transport the injured and damaged. Therefore, it is necessary to assess the vulnerability of the urban road network and plan to reduce these damages. (14) The roads of Abdanan city are another element that forms the urban skeleton in Abdanan. The network of roads and main streets of Abdanan city create an irregular grid. In the central part of the city, the old neighborhoods and the width of the streets do not meet the standards, and given the conditions, it is not possible to make changes to it. In terms of accessibility, there have been positive changes in access to the depth of the textures, as a result of which there is a positive trend and trend of improvement and renovation in old neighborhoods. Cities are constantly changing and developing physically, and their road network is also expanding and increasing. Abdanan, as the city center, has an administrative and political function, and all areas of its county are within the city's political and commercial sphere of influence, although factors such as distance, ethnic relations and social issues, the way services are established, and other related factors are involved.

E) Access to open spaces

Access to urban open spaces is of great importance both during and after an earthquake. These places provide spaces for shelter, gathering and settlement of affected populations, relief and rescue teams, and provision of urban services. Open spaces have the ability to separate areas with different vulnerabilities from each other (15)

Regarding the fact that proximity to urban open spaces is associated with increased quick access to them and, as a result, reduced vulnerability and damage, due to the presence of open spaces and lack of multi-story buildings, ease of quick access to open spaces in most areas of the city except for area 4, despite the large number of 4-story apartments (National Housing Movement) and the high density of this area, a radius of 120 to 200 meters is desirable, proper access in a low radius is risky and not possible, but other areas were selected to examine this criterion due to the presence of open spaces and the lack of high-rise buildings, allowing for radial distances of less than

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30 meters, or a radius of 50 to 100 meters. Examining the conditions and radius of proper access to safe open spaces (except in Area 4) in ten other areas of the city, an estimate of a safe radius of 30 meters is 55% and a radius of 50 to 100 meters is 45%.

Open spaces such as parks, gardens and wastelands have the capacity to gather and take refuge. With the increase in the level of access to such uses, the level of vulnerability will also be lower. (14)

F) Population density

Population density is an important indicator for determining the population burden during an earthquake. It should be noted that the higher the population density, the slower the speed of sheltering and providing relief services. The greater the presence of humans and the population density, especially without considering the principles of urban design and planning in creating settlements in high-risk areas, the greater the damage and casualties will be. When a hazard occurs, especially an earthquake, the rate and speed of search, rescue, first aid operations, and overall service provision will decrease, and vice versa (16).

In fact, it is the presence of humans in high-risk areas prone to natural hazards that turns them into tragic and unfortunate events. If the location of people and houses is not in the path of damage or on the fault line of an earthquake, the occurrence of these hazards is not difficult and may even be beneficial, because, for example, in the case of an earthquake, it causes the earth's energy to be depleted. In general, the widespread presence of human communities and the density of this large population without considering the principles of proper urban design and planning in residential construction, especially its intensification in high-risk areas, will lead to more damage and casualties.

G) The city expansion side

Due to its suitable and pleasant climate and suitable pastures, it has been a good place to settle for nomadic settlements. Since the 1934 settlement law that was implemented in Iran, tribes from the region's tribes have made Abdanan their permanent residence, to the point that it was chosen as the district center in the early 1970s and became a primary city in 1976. It had a population of 6,800, mostly composed of tribes, who speak Kurdish with the Dari dialect and are of Aryan descent. (17)

The Abdanan City Master Plan, which examined the final model and analysis of the city's physical development process in 2009 and 2017, states the ultimate limit of Abdanan City's physical development (including the city's service area, new peripheral neighborhoods, wasteland areas, important transportation routes such as the tunnel area - under development, and peripheral areas with economic activity) as follows: cities usually act as administrative-political centers and play a mainly service role in their sphere of influence.

Studying the resilience of land use patterns in Abdanan city/zoning earthquake hazards in open spaces

In this study, criteria were selected from various factors that can be controlled by urban planning. The city of Abdanan is divided into two residential and military areas for land management and control. Its boundary is also designated as a separate area with specific rules and regulations, and in the residential area, axes have been designated as centers with the ability to create mixed residential, service, neighborhood, and urban-scale units.

Table 5. Average number of floors by region (12)

Areas	Fourth Floors	Third Floors	Second Floors	First Floors	Total Floors
1	2	2	10	113	147
2	5	8	16	587	663
3	8	6	6	418	480
4	80	15	20	433	838
5	6	6	53	669	808
6	0	7	14	428	477
7	0	0	0	0	0
8	0	2	20	279	325
9	2	6	6	163	201
10	0	3	5	40	59
11	0	5	3	500	521
Total	103	60	153	3630	4.519

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Table 6. Final assessment of earthquake risk in Abdanan county (29)

Risk type	Area	Average age of buildings	Area (hectares)	Population	Population (persons)
Very high risk	4	10	118995	33/99	3500
High risk	3	20	105828	42/33	2500
Moderate risk	5	30	161969	38/11	4250
Low risk	1	30	28398	23/66	1200
Very low risk	9	20	33872	33/87	1000
Total	-	22	449062	171.96	24500

Discussion and Conclusion

The growing trend of urbanization and the physical expansion of cities in a way that does not have sufficient resilience to hazards and disasters, especially natural disasters, can lead to high human casualties. The poor state of the city structure, such as an inefficient road network, lack and improper distribution of open spaces, high urban density, incompatibility of land uses and dilapidated buildings, are very effective in increasing the vulnerability and, consequently, the level of damage caused by earthquakes in these areas. (21)

In recent years, the greatest amount of development in the city of Abdanan has taken place to the south, southwest, and west, and based on the earthquake hazard zoning map, the distance of this part of the city's physical growth to active faults and sensitive, high-frequency formations to earthquake waves has gradually decreased, which can pose significant risks to the city and its residents.

A review of research criteria in the city of Abdanan indicates that the areas of the center, south, southeast, which are most of the old textures of the city of Abdanan, and in the west (the apartment structures of the National Housing Movement) do not have the characteristics of resistant structures and suitable standard conditions and will suffer high damage and loss in the event of an earthquake. In urban development, the vulnerability and resilience of new constructed textures, the exploitation of qualities or improvements are of great importance, and this component can be examined by examining the development of the city of Abdanan in terms of distance or proximity to danger points, quality of materials, safety principles and attention to standards, etc. Land use planning for earthquake resilience is a complex and challenging task and requires careful examination of various factors. The challenges and limitations discussed in this response highlight the need for effective communication and collaboration among stakeholders, accurate and up-to-date data, political support, public awareness, education, evaluation, and monitoring of mitigation measures.

In this study, in line with Behzadfar et al. (2019), the authors believe that addressing the challenges and limitations can help improve the effectiveness of land use planning for earthquake resilience. (22)

More than three decades after the initial research on urban resilience, the concept still lacks a comprehensive and operational understanding in various scientific fields, including disaster management. Many of the contradictions over the meaning of urban resilience arise from cognitive biases, methodological approaches, and fundamental conceptual differences, as well as perspectives that focus on research in ecological, social, or a combination of both. The definitions provided include a sustained path of healthy functioning after a natural disaster, a conscious effort to move forward in an enlightened and integrated manner, and a learned experience from adverse conditions, the capacity of a dynamic system to adapt successfully, disruptions that threaten a city's survival and growth, and a process for harnessing resources in the face of disasters to maintain well-being. Therefore, in defining urban resilience, it is important to identify resilience as an attribute, a process, and an outcome, and it is often tempting to take a dual approach to whether resilience exists or not. It is important to note that there are varying degrees of resilience in cities in different areas of life. (23)

Rapid population growth, climate change, and natural and man-made disasters require new approaches to appropriate and planned design and development. The greatest opportunity for disaster resilience, especially in remote areas with minimal facilities, is that the authors of this article have tried to think more critically about the resilience of the urban environment and its related issues, because forward-looking design can greatly affect the health of people and communities. It is not without merit to mention an example here, and that is that in the city of Abdanan, there is an air base that was built before the revolution and is now used as a

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residential area, with respect for the physical framework and compliance with standards in its uses and distances, even in the shape of the area and passages and the layout of streets and green spaces and the facilities and capabilities that have been considered for this space, a significant difference in the fundamental construction of this structure is clearly visible.

Considering the issue of land shortage, removing existing restrictions, and creating a basis for balanced and sustainable development of the city, in the new comprehensive urban plan of Abdanan, based on the city's population growth rate, regional characteristics, and city needs, in relation to the review of the consultant's proposed lands within the development area, adding an area of 25 hectares to the urban area, based on the challenges in city development, the topography of the area, respecting environmental boundaries, and the current branching of the city's structure, low per capita use of some uses, especially green space, has been put on the agenda. In line with the research of Amanpour et al. (2019), Farzad Behtash (2013), Behzadfar et al. (2019), and Parizadi et al. (2019), earthquake resilience is very essential and one of the dimensions and effective factors in reducing the vulnerability of the city. (23-26)

In this study, the explanation of land use to improve earthquake resilience, especially in the city of Abdanan, was discussed and hypotheses were put forward, including that the city of Abdanan does not have much resilience to earthquakes and that its old and marginal areas are among the most vulnerable parts of the city and that natural disasters, especially earthquakes, have not been considered in urban planning and the establishment of urban uses in the city of Abdanan. Finally, the dimensions and factors effective in reducing vulnerability and increasing resilience to earthquakes in the city of Abdanan have not been effective, and improving resilience and reducing its risks should be increasingly on the agenda of planners and politicians.

In fact, it should be said that the city of Abdanan is vulnerable to earthquakes due to proximity to active faults and the presence of dense and worn areas, which makes addressing the issue of vulnerability and improving resilience more important than ever. Therefore, all these hypotheses were confirmed.

It should be acknowledged here that, considering the theories put forward regarding dealing with disasters and reducing their adverse effects, the role of urban planning and urban planning in this matter can be assessed as very important. Urban planning, by affecting the prevention of hazards, providing the possibility of escape and escape, and providing relief, can play an effective role in reducing the human and financial damage to human communities in three periods before, during, and after an earthquake, and ultimately contribute significantly to creating a resilient society. In fact, urban planning is reflected in physical and spatial indicators.

Although social and economic issues are considered in the planning process, ultimately the physical design that is its final product plays a significant role in making societies resilient.

With a review of the understanding of resilience as a complex construct in which individuals, families, and organizations exhibit varying degrees of resilience, depending on spatial and temporal conditions as well as the level of development and culture of cities, further research relies on the development of operational definitions of resilience.

Although it is not possible to predict the occurrence of more natural disasters, especially earthquakes, efforts to increase the resilience of communities will have a great impact on reducing damage caused by disasters.

Finally, according to the research findings, some effective points and features in the city of Abdanan in terms of resilience can be mentioned, including: the presence of abundant open spaces of appropriate quality in most parts of the city; the willingness of people to participate in the improvement and renovation of neighborhoods; a high percentage of residential ownership in different areas; the presence of a sense of belonging to the place of residence among residents and readiness to accept necessary changes; a high level of education among residents of different areas; the concentration of service activities in certain areas of the city; the location of the main market in the city center; greater prosperity of commercial activities in central areas and high real estate values in most places; the location of the Grand Mosque in the city center; the passage of the main arteries of the city through the main area and the old fabric of the city.

Compliance with Ethical Guidelines

There were no ethical considerations in this research.

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Author's Contributions

In this article, Zinat Pirani was responsible for conducting the research, collecting, and analyzing the data; and the first author, Teimour Jafarie, was responsible for the design and supervision, and Mohammadreza Gholami was responsible for the methodology. However, Teimour Jafarie and Zinat Pirani were responsible for corresponding and editing the final manuscript submitted to the journal.

Conflict of Interests

The authors declare no conflict of interest.

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References

1. Habibi K, Shie I, Torabi K. [Investigating the vulnerability of cities to earthquakes using the inverse AHP and GIS (case study: District 6 of Tehran Municipality) (Persian)], 4th International Congress of the Islamic World Geographers. [April 13, 2010]
2. [Iran Floods 2019, Post-Natural Disaster Reconstruction and Rehabilitation Needs Assessment Report, Final Report (Persian)], [Internet] [October 2019] Available from: https://B2n.ir/qu1695
3. Moehle J, Barkley Ch, Bonowitz D, Karlinsky S. The resilient city – a way of thinking about preparedness, mitigation and rebuilding, proceeded in earthquake engineering annual conference (NZSEE). [April 3-5, 2009] [Internet] Available from: https://db.nzsee.org.nz/2009/Pres01.pdf
4. Kashkouli M, Seydbegi P. [The role and position of urban planning in reducing the effects of natural disasters (floods and earthquakes) in Asadabad city using SWOT analysis (Persian)]. Interdisciplinary Studies of Arts and Humanities. 2016; 2(8-9):29-45
5. Ghadiri M, Khosnood F. [An analysis of the pattern and factors of spatial expansion of Abdanan city (Persian)], Quarterly Journal of Geographical Space. Islamic Azad University, Ahar Branch. 2018; 18(63): 273-298
6. Mehr News Agency. [A look at the deprivations of Abdanan County/ Narrow roads that only allow one car to pass through (Persian)]. [Internet] [November 27, 2013] Available from: mehrnews.com/xpzbY
7. Taghavi Zavareh M, Saremi H, Rafiian M. [Assessing the vulnerability of urban spaces to natural hazards with a physical resilience approach, a case study: Zargandeh neighborhood of Tehran (Persian)]. Journal of Crisis Management. 2019; 9(2): 127-137.
8. Hadi L, Pourmohammadi M, Hakimi H, Hadi A. [Investigating the adaptation of urban land uses to increase resilience against earthquakes, case study of region 4 of Tabriz municipality (Persian)]. Geography and Planning, 2021; 25(77): 277-289
9. Kautsary J. Infrastructure design and multi disasters-based land use as the main key to Palu resilience city. IOP Conference Series: Earth and Environmental Science, 2022 https://doi.org/10.1088/1755-1315/955/1/012017
10. The great for the great Islamic encyclopedia. [Abdanan at a Glance (Persian)]. [Internet] [March 03, 2015] Available from: https://B2n.ir/sg5746
11. Abdanan City Master Plan. Pouya Consulting Engineers, Role of city and building. housing and urban development organization, Ilam Province, Architecture and Urban Development Management. First Edition. 2010.
12. Abdanan [Internet] [August 13, 2025] Available from: https://B2n.ir/qr2300
13. Iran Ministry of Roads & Urban Development. [Specialized Mother Company for Urban Development and Improvement. Ilam Province Construction and Housing Company (Persian)]. Khod-avand Consulting Engineers Co. First Edition. 2017
14. Ahadnejad Roshti M, Roustaei SH, Kamelifar M. [Assessing the vulnerability of urban road network to earthquakes with a crisis management approach, case study: Tabriz district 1 (Persian)]. Journal of Geographic Information, 2015; 24(95): 37-50
15. Azizi A, Davoudi Dehaqani A, Gholami H. [Evaluation of the performance of law enforcement management in the earthquake crisis in Abdanan County(Persian)]. Resource Management in the Law Enforcement Force, 2021; 9 (3): 355-378.
16. Shiea E, Habibi K, Torabi K. [Investigating the vulnerability of cities to earthquakes using the inverse hierarchical analysis (IHWP) method and GIS, case study: District 6 of Tehran Municipality (Persian)]. Fourth International Congress of The Islamic World Geographers, Iran: Zahedan. [Internet] [April 13, 2010], 2010
17. Mashregh News Agency. [The Shahi throne is pledged to Takht Qapu (Persian)]. [Internet] [June 19, 2015] Available from: mshrgh.ir/426687
18. Heydari SH. [In search of Ilam's urban identity (Persian)]. Publisher: Urban Planning and Architecture Study and Research Center, Tehran. First edition. 2009.
19. Earthquake of 2014 in Murmuri, Ilam [Internet] [August 18, 2014] Available from: https://B2n.ir/xk5120
20. Poorheidari GH, Valadbeigi B. [Crisis resilience: a national mandatory including an introduction to the review and upgrade of the law establishing the

[DOI: 10.61882/jorar.17.3.7]

national crisis management organization (Persian)]. Publisher: Arvij Iranian. Tehran: First edition. 2014
21. Jafari T, Salmani Moghaddam M, Saeedi M. [Investigating the role of urban planning in improving resilience to earthquakes (Case study: Bojnord city) (Persian)], Third National Conference on Crisis Management and HSE in Vital Arteries, Industries and Urban Management, Iran; Tehran. [Internet] [May 26, 2016]
22. Behzadfar M, Shirgir E, Kheirodin R. [Explanation and brief analysis of the concepts of urban resilience and sustainability and the relationship between them (Persian)], Fourth National Conference on Architecture and Sustainable Cities, Iran; Tehran, [Internet] [February 26, 2019]
23. Pietrzak RH, Southwick SM. Psychological resilience in OEF-OIF Veterans: application of a novel classification approach and examination of demographic and psychosocial correlates. J Affect Disord. 2011;133(3):560-8. https://doi.org/10.1016/j.jad.2011.04.028.
24. Amanpour S; Hosseini Amini H, Ebadi H. [Explaining strategic crisis management with urban resilience environment (case study: dilapidated fabric of Ahvaz city) (Persian)]. Journal of Geography and Environmental Hazards. 2019; 8 (30): 183-209.
25. Farzad Behtash M, Keynejad M, Pirbabaei M, Asgari A. [Evaluation and analysis of dimensions and components of resilience of Tabriz metropolis (Persian)]. Journal of Architecture and Urban Planning. 2013;18(3): 42-33
26. Parizadi T, Sheikh-e-Islami A, Karimi-Razkani A. [Analysis of the status of urban resilience against natural hazards (case study: Baghershahr city) (Persian)]. Journal of Urban Research and Planning. 2019; 10(37): 41-54
27. Abedini M, Aghayari, L, Pirouzi, L. [Investigation and zoning of vulnerability of Abdanan County to earthquake risk (Persian)]. Journal of Geography & Environmental Planning, 2025; 36(1): 1-22 https://doi.org/10.22108/gep.2025.143524.1690
28. AllQuakes. [Internet] [2025] Available from: https://allquakes.com/earthquakes/iran/ilam/abdanan.html
29. Pouya Consulting Engineers, Role of City and Building. [Abdanan City Master Plan (Persian)]. Ilam Province Housing and Urban Development Organization, Architecture and Urban Development Management. First Edition. 2010.

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