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Detection and modeling of seismic sources in a wide range of operational stations of oil-rich regions adjacent to the residential zones of Ahvaz Metropolitan using erdas imagine sofware

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Key words: Component, Modeling, Seismic sources, Oil-rich areas, Edras imagine, Earthquake**.**

Abstract

One of the main factors always considered by engineers, designers and utilizes is to study the performance of structures against natural disasters, especially earthquake. To fulfill this objective, the first step is to realize maximum probability risk that threatens the structure. In this regard, the most fundamental stage is to identify seismic sources and their exact location concerning the studied site and recognition of their magnitude and size. The more precise and comprehensive is this recognition; the risk analysis and susceptibility of the studied structure will be more complete and precise. On the other hand, traditional and manual methods have deficiencies and disadvantages including the errors due to human mistakes and measuring devices. To this end, concerning the sensitivity of the oil-rich areas and existing structures in this area, in this study, it is tried to model the seismic sources in area of 200 km from operational oil-rich stations surrounding residential areas of Ahvaz metropolitan city using Edras Imagine and explain the results**.**

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Introduction

At the time of design and planning of structures for their implementation, knowledge of risk magnitude and its due damages has always been one of the main objectives of engineers and experts to prevent and obtain required preparations to confront the events and crises and minimize them. One of the most important and destructive factors that can create great crises and events and un-compensable damages is earthquake. To this end, to estimate the damage rate and prevent or minimize them, knowledge of the rate and severity of the force due to earthquake and also determination of risk level and specifying the performance of the structure at the time of their occurrence is unavoidable.

The first step to study and investigate these issues is to obtain complete and sufficient knowledge of the project implementation site and its neighboring areas (A.Sa`ed, 2011). Faults as the source of earthquake and seismic sources are the most important and effective factors that should be studied.

The first and most critical procedure of performing studies on faults of each area is to specify the precise coordination of points located on faults (Ambrasis, N 1991). To fulfill this objective, various methods and procedures are used, some of which have high risk due to the use of printed maps and manual devices such as rulers and on the other hand, due to very high scale of the existing maps of the faults. One of the other modeling errors in traditional methods is failure to consider the circularity of the earth in calculation of fault's length and seismic sources that are clearly observable in the obtained results.

Thus, in the present study, it is tried to possibly reduce the error by digitizing the lines of the faults that have been shown on map. Various software such as Arc GIS and EDRAS IMAGINE have the capability of performing the mentioned activities; in this study, due to high precision and low error rate of EDRAS IMAGINE, this software has been selected. One of the software that can be used to this end is ERDAS IMAGINE that models all points on the faults with high. The aim of this study was detection and modeling of seismic sources in a wide range of operational stations of oil-rich regions adjacent to the residential zones of Ahvaz Metropolitan using erdas imagine software precision and prepares for computations such as seismic hazard analysis.

Concerning the significance of faults' modeling proposed in introduction and the high risk of seismic hazard in oil-rich areas, the study of the behavior of structures at the time of earthquake is required and necessary. The first step is to know seismic sources that in the studied area are faults.

Since no study has been done on the modeling of existing faults in the territory of studied area and there is no precise and classified information, it seems necessary to collect and develop data on these faults. To this end, in this study it is tried to use data collection, field studies and data analysis of faults using Edras Imagine software to study the existing faults in the area with the aim of using them in applications such as seismic hazard analysis, susceptibility analysis, crisis management due to earthquake and other similar cases and perform modeling

Methodology

Introducing software

EDRAS IMAGINE has been designed by ESRI Company and is distributed and marketed by Laica Company in Swiss. The high capabilities of this software allow the users to simultaneously process and analyze various data in different formats (raster and vector). This software is one of the most practical, precise and simplest software that is used in GIS and processing of satellite images. The software has the ability to make an image raster.

The other advantage of ERDAS than other image processing is its multipurpose; i.e. this software has not certain incline toward sciences such as soil protection, geology …. And by full preservation of image processing principles, it provides special processing environment that makes its application in all sciences (urban and rural geography, geomorphology, irrigation, structures, geology, natural sources, agriculture, hydrology etc.) possible and provides the possibility of supporting various formats and image evaluators (SPOT, RADAR, ETM, TM, IRS, ASTER AVARR, MODIS etc.).

After data collection from International Institute of Earthquake, a territory of 200 km has been specified and selected from the operational stations of oil-rich areas adjacent to residential areas using the instruments in Edras Imagine software. After precise determination of faults' path and coordination of the first and last points, the coordination of all adjacent points on the fault's path has been modeled and finally expressed. Then, using the obtained data, the length of each fault, the rupture length, minimum distance from the studied site and other data that are required for applications such as seismic hazard analysis, susceptibility, crisis management due to earthquake and similar cases have been explained.

Studied area

Ahvaz metropolitan city is the capital of Khuzestan province and the second wide city of the country after Tehran, it is located in plain with height of 18 m above sea level. The area of Ahvaz is 20477 ha. The point that strategically distinguishes this metropolitan city from other cities is its being oil-rich and thus, the presence of facilities and stations related to oil industries.

Results and discussions

South oil rich areas

National Company of South Oil-Rich Areas is a big complex including ten subcategories of central committee, Karoon oil and gas, Maroon oil and gas, transportation company, drilling, Masjed Soleiman oil and gas, Aqajari oil and gas, South turbine engineering, oil welfare services and logistics management and goods issues.

Concerning the classification done based on the geographical situation of station, operational stations that are located in Ahvaz and its surrounding areas are subcategory of Karoon oil and gas Utilization Company and among these stations, Ahvaz 2, Ahvaz 3 and Ahvaz 5 stations have inevitably located in neighborhood of residential areas after development of residential areas of Ahvaz. Fig.1 shows the situation of stations and their neighborhood with residential areas in Ahvaz.

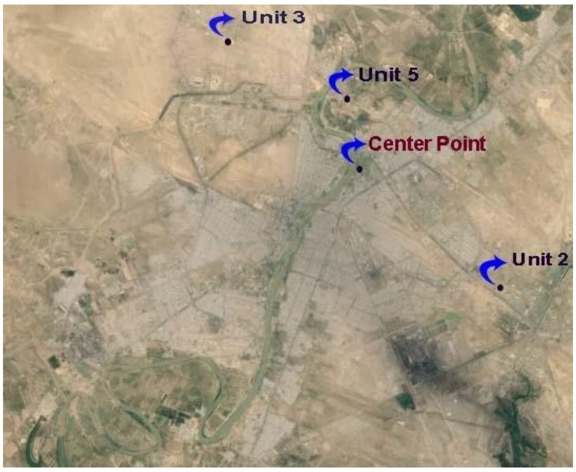

Fig. 1. The situation of studied stations in Ahvaz metropolitan city.

As shown in fig.1, the studied stations have constituted a triangle that in this study due to short distance of stations against each other, the point at the center of triangle has been considered as the base point of the studies.

The Faults' Map of Iran

Fig. 2 shows the map of Iran faults with scale of 1:2500000 that has been prepared from international research center of earthquake:

Detailed introduction of fundamental faults of territory

In this section, the main faults of research territory have been introduced. It should be mentioned that that the mentioned lengths for faults are based on the results of previous studies included in references (http://www.ngdir.com).

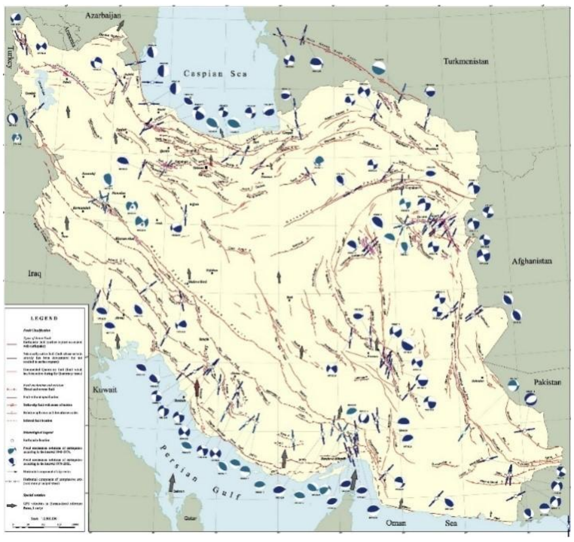

Fig. 2. The map of active faults of Iran.

Aqajari fault

Aqajari fault is some kind of sliding with approximate length of 150 km in north of Aqajari that passes from the side of Aqajari city, Behbahan city and 700 meters from Omidiyeh- Behbahan road.

Maroon Fault

This fault is located in the northwest of Aqajari fault in Zagros folding belt. This fault has NW-SE direction and 50 km length.

Rag sefid fault

Ragsefid fault is a reverse big fault in northern part of Deylam port and can be seen in Deylam-Omidiyeh road. This fault has length of 80 km in W.NW-E.SE direction.

Zardkooh fault

Zardkooh fault with compressive mechanism is located in northwest- southeast direction and has northwest slope parallel to Ardal southern fault. Bazyaftriver is in the path of Zarkdooh fault parallel to its southwest part.

Ahvaz fault

Ahvaz fault with approximate length of 90 km is located in southern Ahvaz and specified the border of zagros folding and Khuzestan plain. It has caused the sliding of Aqajari formation on the quaternary sediments of Ahvaz plain.

Ardal fault

Ardal fault with approximate length of 150 km and northwest slope is located in west- southwest direction parallel to Zagros sliding in Ardal- Taqan territory.

Balarood fault

Balarood fault with approximate length of 40 km is located in north part of the studied territory. The study of historical earthquakes shows that the occurrence of earthquake in this area is low.

Dezful embayment fault (DEF)

Dezful fault as the northern border of Dezfol embayment (Aqajari- Bakhtiari Neogene) is located between the faults of mountain front and Zagros. This fault is located on contour line of 500 m (Tahmasebi Nejhad. H, 2007).

Modeling of existing faults in 200 km of studied area using software

After identification and specifying the 200 km territory of the center of stations' triangle (of Ahvaz metropolitan city) through Erdas Imagine, the faults in the area were numbered and modeled using the software. Fig. 3 shows the numbering and modeling of existing faults in plan territory.

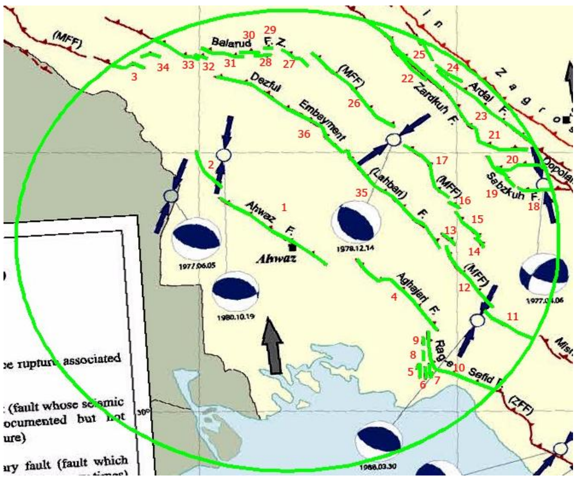

Fig. 3. Numbering of the faults in the territory.

Faults' rupture length

In the present study, the faults' rupture length of faults that are less than 100 km is considered 50% of the fault length and the rupture length of faults with length of above 100 km is considered as 30% of the fault length (Ghodrati Amiri, 2011).

Concerning the numbering of faults shown in fig. 3 and faults modeling with the use of Erdas Imagine software, the results that indicate the length and situation of faults are expressed according to table 1.

Table 1. The results of outputs from faults' modeling.

Row	Description	Fault Length (km)	R_{min} (km)	L (M)
1	F-1	95.5053	1.05	47752.65
2	F-2	36.6642	64.23	18332.11
3	F-3	24.8615	178.65	12430.73
4	F-4	88.6394	51.36	44319.72
5	F-5	17.5733	140.95	8786.67
6	F-6	10.8088	144.77	5404.39
7	F-7	16.6946	145.66	8347.29
8	F-8	9.2698	133.81	4634.92
9	F-9	7.8668	125.73	3933.38
10	F-10	78.1363	124.98	39068.15
11	F-11	41.8302	150.81	20915.09
12	F-12	64.1504	111.24	32075.20
13	F-13	13.4045	108.29	6702.26
14	F-14	10.5607	131.46	5280.35
15	F-15	28.9603	120.48	14480.16
16	F-16	9.8890	117.70	4944.48
17	F-17	58.2688	113.05	29134.39
18	F-18	25.1968	168.18	12598.38
19	F-19	33.6615	158.03	16830.77
20	F-20	39.9202	159.28	19960.11
21	F-21	137.9146	159.34	41374.37
22	F-22	66.8891	169.18	33444.54
23	F-23	92.8814	180.40	46440.72
24	F-24	23.7831	181.74	11891.53
25	F-25	22.9105	185.02	11455.23
26	F-26	86.6259	122.93	43312.96
27	F-27	24.5568	150.36	12278.41
28	F-28	11.9556	159.26	5977.80
29	F-29	6.7657	159.52	3382.87
30	F-30	14.9225	161.98	7461.27
31	F-31	31.7837	159.94	15891.87
32	F-32	10.0852	165.28	5042.58
33	F-33	36.7777	167.16	18388.86
34	F-34	14.5566	181.13	7278.32
35	F-35	77.9258	108.57	32570.92
36	F-36	85.2888	114.81	34444.20

Conclusion

In table1, the results of faults' modeling with the use of Erdas Imagine software have been presented. In table2, the name of faults concerning minimum and maximum value is expressed.

According to the findings of this study and as seen in this table, the closest fault to the sites of the studied area is fault no.1 and the longest fault around the structures in this area is fault no. 21 that are introduced as the most effective seismic sources.

Table 2. The summary of the output results of modeling with erdas imagine.

Fault No.	L_{max}	L_{min}	R_{max}	R_{min}	The maximumfailure	The minimumfailure
F-21	137.915					
F-29		6.766				
F-25			185.024			
F-1				1.052		
F-1					47752.64	
F-29						3382.867

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