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Risk Analysis to Deterministic and Probabilistic in Babol City

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ABSTRACT

In this paper, deterministic and probabilistic assessment procedure is performed for seismic hazard in Babol city, Iran. Studying area is surrounded between 52.30 E and 36.5 N. 9 potential seismic sources (six surface sources and three linear sources) were detected and modeled as volume sources. Seismic parameters: a and b value and M_{max} were evaluated for each source. Dividing region to 12000 sites, using probabilistic method, Seismic hazard and seismic hazard zoning map of area provided for return period of 475 years. 5 levels of relative danger of earthquake were recognized in the province, Very low danger zone in which: P.G.A<0.1g, low danger zone: 0.1g<P.G.A<0.15g, intermediate danger zone: 0.15g<P.G.A<0.2g, relatively high danger zone:
0.2g<P.G.A<0.3g and high danger zone in which: 0.3g<P.G.A.
KEYWORDS:deterministic method, probabilistic method, potential seismic source

INTRODUCTION

Seismicity is closely related to active Quaternary faults. This attracts many researchers to investigate the quantitative relationships between them. Iranis in the direction orogenic belt of the Alpine - the Himalayas, the high-level of seismic activity in their shows, so has had 130 earthquakes with a magnitude of 7.5 on the Richter scale has experienced [1]. During 1900 to 2000, Iran was part of the six countries that suffered casualties caused by the earthquake [2].In terms of tectonic earthquakes can be wrinkled Zagros, Alborz, KapeDagh and Central Iran and Dasht-e Lut divided [3].

Estimates of seismic hazard estimation of measured ground motion that is expected to occur at a certain point. At this stage, resistance of a structural the risk of earthquake or safety critical structures such as nuclear facilities, bridges, tall buildingsis essential. Two solutions for estimating seismic hazard exists, the solution deterministicfor each source gives the expected maximum earthquake magnitude and assuming the earthquake occurs at the nearest point to consider lowering the ground is estimated using the relationship [4].

Based on previous work on neotectonics regime in Iran, Zagros in south Iran is the most active zone [5]. Then, Alborz in north Iran [6-8] and Central Iran [9-11]have been situated in the next orders.

Probabilistic solutions to collect the probability of a particular level of ground movement in the area around the parameters studied over a period of time is desired [12].In this paper, deterministic and probabilistic assessment procedure is performed for seismic hazard in Babol city was used.

METHODS

Data used in the study area

For study the seismic hazard in the confined area between 52 degrees 30 minutes east longitude and 36 degrees 5 minutes was north latitude, Babol area about 2295 hectares and is located 210 kilometers northeast of Tehran.The city is located in the Mazandaran province of from the north to Babolsar city and the Caspian sea, from the south to Alborz mountains, from the west of Amol city and the from east to Ghaemshahr and sari city related surrey [13]. Intended radius of 150 square kilometers, the number of data used in this project is the magnitude of 4 is 148 number.That from 1924 to 2014 were obtained.Due to the regional tectonic and seismic faults, the model of seismic source (six surface sources and three linear sources) was selected [14-15]. The above data, the linear fit of the parts used and for each area have been normalized with respect to time and area.

Potential seismic sources

By studying the geological structure of the area, soil seismicity patterns and other available information, such as air magnetic map of faults and seismic data geological potential sources were identified in the region.

Seismic sources:

9sources(six surface sources and three linear sources) after dropping off the map and fault data are considered.

Linearsourcenumber one (L1):

The source consists of a portion of theMosha fault due to the high length to width ratio of the linear form is intended that it’s characteristics are summarized in Table 1.

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Linear source number two (L2):

The source consists of a portion of the Eyvanki fault because of the high length to width ratio of the and away of the site is considered to be linear, that it's characteristics are summarized in Table 1:

Linear source number three (L3):

The source consists of a portion of the Gharmsar fault because of the high length to width ratio of the and away of the site is considered to be linear, that it's characteristics are summarized in Table 1:

Area source number one(A1):

The sources consists of a part of Kandovan and North Alborz faults and is part of the Khazar fault. It's characteristics are summarized in Table 1. Geographical location of the sources at latitude 51.011~52.35 and longitude 36.11~36.7.

Area source number two (A2):

The sources consist of between the north Alborz and Caspian faults. It's characteristics are summarized in Table 1. Geographical location of the sources at latitude 52.35~53.25 and longitude 36.01~36.45.

Area source number three (A3):

This is the sources of a part of the Caspian faults. It's characteristics are summarized in Table 1. geographical location of the sources at latitude 52.8~53.25 and longitude 36.45~36.65.

Area source number four (A4):

The sources consist of between the north Alborz and Caspianfaults andAstaneh and Damghan faults. It's characteristics are summarized in Table 1. Geographical location of the sources at latitude 53.25~54.15 and longitude 36.01~36.82.

Area source number five (A5):

The sources consist of between the Astane and Atari faults. It's characteristics are summarized in Table 1. Geographical location of the sources at latitude 52.95~54 and longitude 35.65~36.01.

Area source number six (A6):

The sources consist of between the north of Tehran faults. It's characteristics are summarized in Table 1. Geographical location of the sources at latitude 51.22~51.8 and longitude 36~36.01.

Table 1. Parameters determined for each sources

Sources	Δ(L)	Length of the sources (Km)	Effective length of sources	Maximum magnitude	Magnitudes calculated	Magnitude choice	Minimum distance from the site	Maximum distance from the site
L1	19.4	77.8	77.8	5	6.7	6.7	97.13	108.07
L2	16.27	65	65	5.3	6.6	6.6	142.98	146.66
L3	7.15	28.6	28.6	5.3	6.2	6.1	144.38	148.18
A1	-	-	-	6.4	-	6.4	29	-
A2	-	-	-	7	-	7	10.58	-
A3	-	-	-	5.67	-	5.67	17.8	-
A4	-	-	-	5.8	-	5.8	52.3	-
A5	-	-	-	5.9	-	5.9	90.76	-
A6	-	-	-	4.6	-	4.6	95.38	-

RESULTS AND DISCUSSION

The calculation method of ground motion parameters for the design and useful life of 50 years is calculated. It is noteworthy the above calculations for horizontal acceleration by lowering connection Boore et al(1993)[16]. Lowering relationship should be chosen to select a relationship that is more compatible with the selected site for the purpose of lowering relationship Joyner and Boore was parameters with respect to the selection set.

Boore et al(1993) has developed for western North America earthquake of magnitude 5.0 to 7.7 at a distance 100km of the projection of the fault to develop the predictive relationship for peak ground acceleration (PGA):

$$\text{Log (PGA)} = b_1+b_2 (M-6) + b_3 (m-6)^2 + b_4 r + b_5 \log (r) + b_6 G_B + b_7 G_c \quad (1)$$

Where

$$r = \sqrt{d^2 + h^2} \quad (2)$$

d= closest distance to the surface projection of the fault in kilometers

$G_B = 0$ for site class A

= 1 for site class B
= 0 for site class C
G_C = 0 for site class A
= 0 for site class B
= 1 for site class C

According to Table 1, the values of the magnitude and the minimum distance is mentioned. Ground motion parameter, peak horizontal ground acceleration, PGA, is selected. PGA calculation method for deterministicthe basis of Boore and Joyner 1993 lowering relationship, PGA estimated. Zoning of earthquake in Babol city and the surrounding areas to determine, with respect to the data in Table 2, the minimum and maximum acceleration of 0.013g and 0.22g is expected in the region. In a study risk of earthquakes based on the method of determining the after review of available geological and seismology data collection, seismic sources and maximum potential seismic sources in the regeneration of Mmax, and then the ground motion is estimated.

Table 2. Calculation of parameters related to peak ground acceleration

	B1=-.038	B2=0.216	B3=0	B4=0	B5=-0.777	B6=.158	
L1	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =6.7	R=97.13	
						PGA=	0.037g
L2	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =6.6	R=142.98	
						PGA=	0.026g
L3	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =6.1	R=144.38	
						PGA=	0.020g
A1	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =6.4	R=29	
						PGA=	0.08g
A2	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =7	R=10.58	
						PGA=	0.22g
A3	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =5.67	R=17.8	
						PGA=	0.08g
A4	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =5.8	R=52.3	
						PGA=	0.038g
A5	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =5.9	R=90.76	
						PGA=	0.026g
A6	B7=0.254	H=5.48	GB=0	GC=0	M_{max} =4.6	R=95.38	
						PGA=	0.013g

Based on the Gutenberg - Richter relationship, seismicity parameters a and b were determined for each sources. The maximum expected magnitude of the sources due to tectonic history and status were estimated. For each sources (linear and arae) all calculations were performed using probabilistic method. Seismicity parameters are shown in Table 3 each sources.

Table 3. Seismicity parameters of potential seismic sources

sources	a value	b value*	Mmax
L1	-3.191	0.718	6.7
L2	-3.011	0.718	6.6
L3	-2.19	0.718	6.1
A1	-7.81	0.718	6.4
A2	-7.11	0.718	7
A3	-4.94	0.718	5.67
A4	-7.91	0.718	5.8
A5	-7.11	0.718	5.9
A6	-6.74	0.718	4.6

*Because for all sources from a linear fit was similar for all kinds of b.

Horizontal ground acceleration for a specified probability was calculated as follows:

PGA for theprobability of 2% in 50 years:

P (2% in 50 years) = 0.02 / 50 = 0.0004

P (0.0004) =0.27g

PGA for theprobability of 5% in 50 years:

P (5% in 50 years) = 0.05 / 50 = 0.001

P (0.001)=0.2g

PGA for theprobability of 10% in 50 years:

P (10% in 50 years) = 0.1 / 50 = 0.002

P (0.002)=0.18g

Conclusion

Zoning of district for five levels of relative risk is considered. Very low-level of risk, the lower the expected acceleration of 0.1g, an area with a low risk level and acceleration of $0.1<PGA<0.15$, the average level of risk and acceleration of $0.15<PGA<0.2$, and the relatively high-level of risk the acceleration expected at $0.2<PGA<0.3$ and a high-level of risk the expected acceleration is more than 0.3g. In most areas of the city of Babol the relative risk of earthquakes is low, and only a small part of the city, the relative risk of earthquakes is low.

REFERENCES

1. Ghafory-Ashtionay, M., 1999. Rescueoperation and Reconstruction in Iran, DisasterPrevention and Management, 8(1): MCB university, ISSNO965-3562.
2. Yasmin, I and J. Davis, 2003. Architecture and planning reproduced, translated by A. Fallah, publisher Publications Center, Shahid Beheshti University, Tehran, 200 p.
3. Berberian, M., 1976. Contribution to the seismotectonics of Iran (Part II), Geol. Surv. Iran, Rep. 39.
4. Gupta, I. D., 2002. The state of art in seismic hazard analysis, ISET, 428, 39(4): 311-346.
5. Rahimi, N., M. Arian, 2014. Tectonic Geomorphplogy of Hamedan-Sosangerd Region, West Iran, Advances in Environmental Biology. 8, 119-124.
6. Arian, M., Maleki, Z., H. Noroozpour, 2011a. Cenozoic Diastrophism and Deformational Events in the East Central Alborz. Journal of Basic and Applied Scientific Research. 1, 2394-2400.
7. Arian, M., N. Bagha, 2012. Active Tectonics of Tehran Area, Iran. Journal of Basic and Applied Scientific Research. 2, 3805-3819.
8. Moghimi, H., Arian, M., A. Sorbi, 2015. Fault Movement Potential of Marzanabad Area, North Alborz, Iran, Open Journal of Geology. 5, 126-135.
9. Arian, M., Toudeshki, V.H., H. Noroozpour, 2011b. Active Tectonics of QezelOzan River Basin, NW Iran. Journal of Applied Environmental and Biological Sciences. 1, 291-295.
10. Arian, M., Pourkermani, M., Sistanipour, A., H. Noroozpour, 2011c. Seismicity and Fault Segmentation of Bafq-Baghin Fault System (Central Iran). Journal of Applied Environmental and Biological Sciences. 1(10), 382-396.
11. Arian, M., Pourkermani, M., Sistanipour, A., H. Noroozpour, 2011d. Kinematic Significance of Fold- and Fault-Related Fracture Systems in the Rafsanjan's Northeast Highlands (Central Iran), Journal of Basic and Applied Scientific Research. 1, 3398-3406.
12. Cornell, C. A., 1968. Engineering Seismic Risk Analysis, Bull. Seism. Soc. Am., 58(5): 1583-1606.
13. Zysta Consulting Engineers, 2000. A comprehensive plan for the city of Babol, the Department of Housing and Urban Development.
14. Alsinawi, S. A., 2002. Seismicity, Seismotectonics, Crustal Structure And Attenuation Data On Iraq, The Relemr Meeting, Antakya, Turkey, 12-14 December.
15. Alsinawi, S.A and Z. O. Al-Qasrani, 2003. Earthquake Hazards Considerations For Iraq; Fourth International Conference of Earthquake Engineering and Seismology, 12-14 May Tehran, Islamic Republic of Iran, pp: 75-80.
16. Boore, D. M., W. B. Joyner, and T. E. Fumal, 1993. Estimation of response spectra and peak accelerations from western North American earthquakes: an interim report, U.S. GeoL Surv. Open-File Rep. 93-509, 72 pp.