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ANALYSIS AND INSPECTION OF EARTHQUAKES IN IRAN

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ABSTRACT

Earthquake is a natural disaster since the creation of such a puzzle for centuries mind is affected. Iran, due to geographical location and being on a global earthquake zone, has always seen big earthquakes and cargo damages throughout history. Since the early twentieth century, because of establish seismic stations around the world, there are accurate information on the earthquake in Iran, which has been recorded by devices other countries. One glance at the statistics of these earthquakes can be found, how many people due to problems caused by the construction and lack of knowledge have lost their lives. So we must reduce the number of damages and losses with the requisite awareness and standards in this area. This article is going to present available statistics and refer to precautionary points with showing the sensitivity of the issue until the number of losses and damages are minimized.

Keywords: *Earthquake, Earthquake in Iran, Seismic, Earthquake in History, Seismographic Iran*

INTRODUCTION

The earthquake is a result of sudden release energy from the Earth's crust that creates waves of vibration. Earthquake is recorded by a seismograph. The magnitude of an earthquake (Richter) is reported and represents how much energy is released. The earthquake is often impalpable until being lower than intensity three, and greater than 7 are created serious damage. The seismic intensity is measured by the modified method of Mrkaly that determining the effects of earthquakes on earth and the scale is 1 to 14 (Mahdi, 2013). The most significant disaster is earthquake that cause losses and very human and financial costs. Imagined earthquake caused severe anxiety, especially in the area is also prone to earthquakes.

Background of the Earthquake in Iran

The earthquake of Rudbar, Manjil and Bam is the largest and most destructive earthquakes in recent decades in Iran. The National Geosciences Database of Iran report on Thursday morning, 30 minutes and 13 seconds A.M., terrible earthquake struck in Gilan province. Its center is determined at latitude 36 degrees 49 minutes and longitude 49 degrees 24 minutes and 51 seconds. According to initial figures announced, the magnitude was between 7.3 and 7.7 on the Richter scale. The event on 31 Khordad 1369 Hegira, the twentieth of June 1990, in the Rudbar, Manjil and Loshan in western part of the Alborz accrued and killing nearly 35,000 people, injured 60,000 and homelessness, more than 500,000 people. In the event 200 thousand housing units were destroyed that the number of 60 thousand units has been completely destroyed and the initial damage caused by the earthquake was estimated more than 800 million dollars. In this event, the 4 villages in the region of "Eshkavari" Roudsar were buried in the soil because of landslides at the Amarlou Kalishom, Mazandaran mountains, and deep gaps (Nemati, 2014). In the middle of the city Roodbar, East River Sefidrood, there was deep valley that water in the high mountains of the Kolon and Lazbad had been flowed. In an earthquake, the surrounding mountains leading to the valley which was covered with olive trees, forward to the road and the river Sefidrood with a length of one kilometer due drift on. With the displacement, approximately 25 thousand trees were removed and became into a mountain of dirt and trees. The earthquake damaged equivalent to 2.5 percent of GDP. Study of the residual earthquake effects have shown that the depth of the hypocenter of the earthquake was located 19 km below the earth's surface. Faults in the Earth's surface were revealed such as a ladder of discrete pieces, over a distance of approximately 80 km (National report of the Islamic Republic of Iran on disaster reduction, 2005).

Bam earthquake, 1382 Hegira at 5: 26: 26 local time (time GMT; 1: 26: 26 on 26 December 2003) occurred in the city of Bam in southeastern Kerman. The earthquake in the early hours of the morning happened when most of the inhabitants were asleep, that this issue can be considered as one of the rising

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casualties. The official death toll was announced more than 25,000 people and injured 50,000 people. More than 100,000 people were left homeless. Epicenter of the earthquake, according to the main shock and aftershocks information by seismic and gravity graphical is located in Bam area. According to Studies, Bam fault that passes from the Bam has been activated in the earthquake (Khazai and Hausler, 2005; Astaneh-Asl, 2006).

Basic parameters of Iran historical earthquakes and adjacent areas are presented in Figure 2. It should also be noted that historical earthquakes listed in various sources, but Ambraseys and Melville have been seriously questioned with a critical examination of historical documents of the earthquakes. The figures are for the years 139 to 1899 AD (Ambraseys, 1988& 1989).

Studies conducted by different researchers have shown that before the establishment of the seismic network international standards, the center of macro seismic of earthquakes is much more reliable than locating device; Therefore selecting the most reliable parameters of earthquakes in the time period, it is well considered (Mirzaee, 2002). Macro seismic historical earthquakes of the twentieth century, from the fourth century BC till May 1997, are shown in Figure 2 & 3. Basic parameters of earthquakes are in the first device (1963-1900) and the new system (2000-1964).

Background of Destructive and Fatal Earthquakes in Iran

Iran is one of the earthquake prone regions, and one in a while earthquake causes lots of damages. From the beginning of the twentieth century due to the fact that seismological stations have been made in different parts of the world, accurate information about Iran's earthquakes are in hand, that have been recorded by the systems in other countries (Table 1). Furthermore, according to the historical information there are data about the primitive earthquakes in Iran. Iran is one of the earthquake prone counties in the world, and is located on one of the two earthquake prone belts of earth named Aliped where huge earthquakes take place occasionally (Iran Seismic Center, Geophysics Institute, Tehran University, 2014). Aliped or Alps-Himalaya belt starts from Alps in Europe to Himalaya in north India that is continued to Indonesia. About 20 percent of earthquakes occur in this zone, there is low in depth and causes many جانی and financial losses. Countries located on this belt are: Indonesia, India, Nepal, Afghanistan, Pakistan, Iran, Armenia, Turkey and south Italy (World-Wide Standard Seismographic Network, 2014).

Earthquakes in the Present Era

Geophysics institute of Tehran University started recording and determining the location of earthquakes by establishing the first **seismologic** station in Tehran (from 1958 A.C./1337 Hegira). In the decade of 1960 A.C. the number of seismological stations in the country increased to 5 Analog stations in Tehran, Tabriz, Mashhad, Shiraz and Kermanshah. From these, the three stations in Tabriz, Mashhad and Shiraz are subsets of the World-Wide Standard Seismographic Network (WWSSN). In 1975(1354 hegira) an array of 7 stations called Iran's Long Period Array (ILPA) was installed at south west of Tehran for special purposes and for providing suitable earthquake research information. In the first years of 1981(1360 Hegira) Geophysics institute installed and triggered analog stations at some other points in the country such as Borujen, Minoodasht, Mahabad Dam, Ghamsar Kashan and Ghazi castle Hormizgan. Till 1995(1374 Hegira), these Analog seismological stations recorded and reported of earthquakes occurred in the country. Due to the fact that new seismological equipments were provided, in 1995(1374 Hegira) installation of new seismological systems in Tehran and Tabriz seismographic Networks was started and extended in subsequent years with installation of equipments at seismographic networks in Semnan, Ghuchan, Yazd, Sari, Isfahan, Shiraz, Mashhad, Kermanshah, Birjand and Khoramabad. In 2010(1389 Hegira) seismographic networks of Minab, Kerman, ShahrKord and Hamedan were triggered experimentally. Seismographic stations at these networks are equipped to seismographic moderate band, wide band and very wide band with three components. At the moment **this station** covers most of the earthquake prone regions of the country by means of 100 digit seismographic stations containing 18 local seismographic networks, 4 single station seismographic bases and station.

Earthquake is the result of sudden release of energy from inside of the earth's crust that creates vibrant waves. Earthquakes are recorded by means of seismographic systems. The magnitude of an earthquake (Richter) is reported according to the agreement, earthquakes smaller than 3 Richter are often intangible

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and bigger than 7 will cause serious damages. The force of the earthquake is measured by the edited mescal system. The biggest earthquake taken place in Iran recently that has had irreparable damages occurred at 1990 (31st of Khordad 1369 Hegira) in Gilan and Zanzan provinces with the power of 7.3 Richter. This earthquake had more than 40 thousand killed which is the bloodiest earthquake in Iran. This earthquake destroyed about 1100 kilometers containing 27 cities and 1871 villages in a few seconds. This is while other countries of the region such as Turkey, Syria, Armenia and Afghanistan also confront a vast amount of similar earthquakes due to the fact the they are located on this earthquake zone. Scientists say that the cause of this phenomenon is concealed in the ocean bed that reveals the symptoms of the movements of the Indian subcontinent towards the Asian and European continents. From 30 million years ago the Indian subcontinent was moving towards the Asian and European continents at the rate of 10cm a year and at the moment the speed is decreased to 5cm a year. In order to calculate the amount of danger with the usage of the amount of earthquakes at the first six months of 2014 (1393 Hegira) we can think of the necessary arrangements. Seismographic networks of the center of the Seismographic in the country at the first six months of 2014(1393 Hegira) have recorded and located about 5099 earthquakes with the power of more than 1 Richter that have occurred in Iran and the border regions. The frequency graph of the earthquakes according to the size of the recorded earthquakes is shown in Figure 5 & 6& 7. Among these earthquakes only 19.6 percent were tangible. At this time 154 earthquakes with the power of more than 4 in the country have been recorded by the center of seismographic where the largest was 6.2 that occurred at Mourmuri of Ilam Province.



Figure 1: The earthquake in Roodbar and Manjil

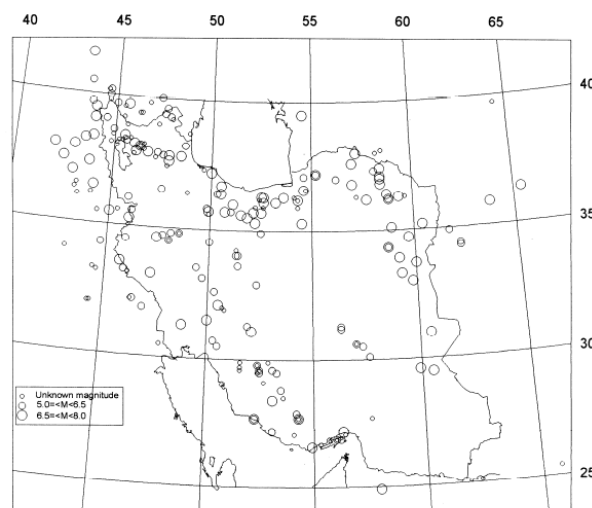


Figure 2: Map of macro seismic historical earthquakes in Iran and adjacent areas

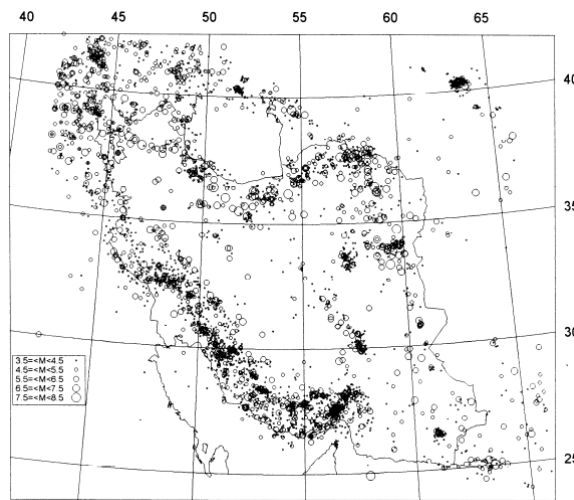


Figure 3: Map of macro seismic historical earthquakes in Iran (The fourth Century B.C. till May 1997)

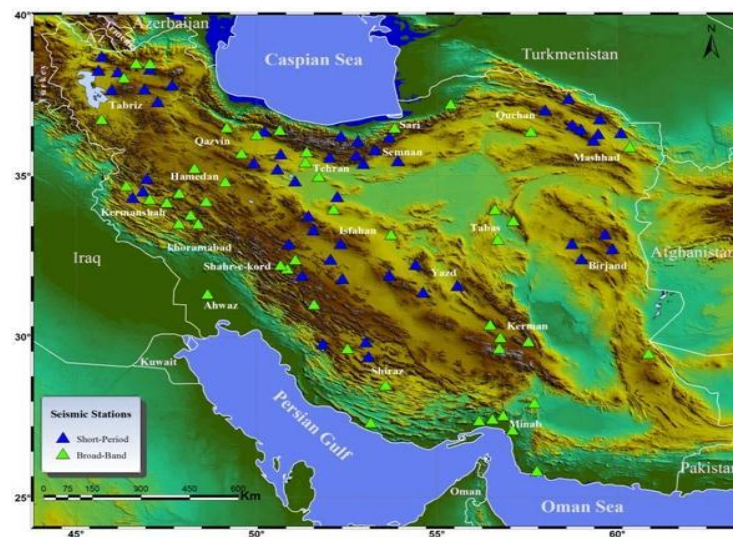


Figure 4: Seismographic network in Iran

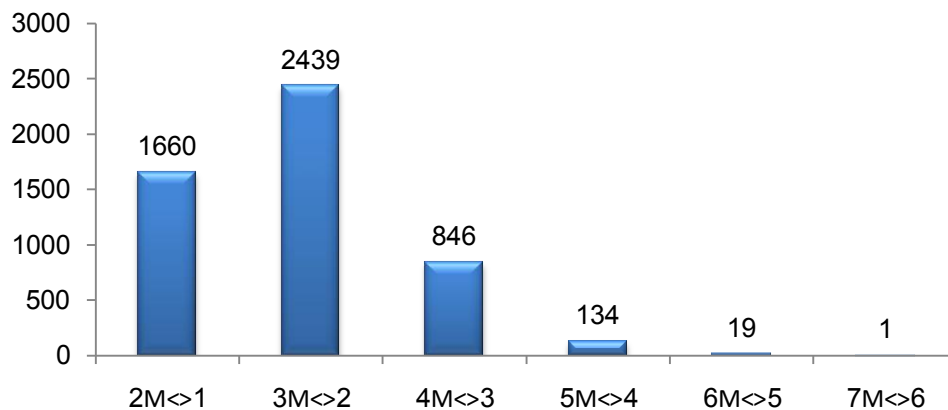


Figure 5: Number of Iran earthquake in first six month 2014(1393 Hegira) (Richter)

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Table 1: Data of earthquake in Iran (Iran Seismic Center, 2014)

No.	Day (AD)	The center of earthquake	Richter	Losses	Official Name
1	856 AD	Damghan	8	200000	Earthquake Damghan
2	893	Ardebil	7.9	150000	Earthquake Ardebil
3	1727	Tabriz	7.6	40000	Earthquake Tabriz
4	1727	Tabriz	-	77000	Earthquake Tabriz
5	1755	Kashan	-	40000	Earthquake Kashan
6	1908	Boroojerd	7.3	8000	Earthquake Boroojerd
7	1923	Kashmar	5.7	2000	Earthquake Khorasan
8	1968	Dasht Biaz	7.3	12000	Earthquake Dasht Biaz
9	1978	Tabas	7.8	15000	Earthquake Tabas
10	1990	Roodbar and Manjil	7.4	40000	Roodbar and Manjil
11	1997	Ghaenat	7.3	1567	Earthquake Ghaen
12	2002	Boin Zahra	6.5	262	Earthquake Boin Zahra
13	2003	Bam	6.6	30000	Earthquake Bam
14	2004	Mazandaran	6.3	35	Earthquake Mazandaran
15	2005	Zarand	6.4	602	Earthquake Zarand
16	2005	Gheshm	6	13	Earthquake Gheshm
17	2006	Boroojerd	6.1	70	Earthquake Boroojerd
18	2008	Gheshm	6.1	7	Earthquake Bandar Abbas
19	2010	Damghan	5.9	19	Earthquake Damghan
20	2009	City Fahraj	6.5	11	Earthquake Fahraj
21	2012	Ahar and Varzaghan	6.4	306	Earthquake Ahar and Varzaghan
22	2013	Dehestan	6.3	60	Earthquake Dashti
23	2013	Khash	7.8	35	Earthquake Saravan
24	2013	Goharan	6.2	-	Earthquake Goharan
25	2014	Mourmouri	6.2	-	Earthquake Mourmouri

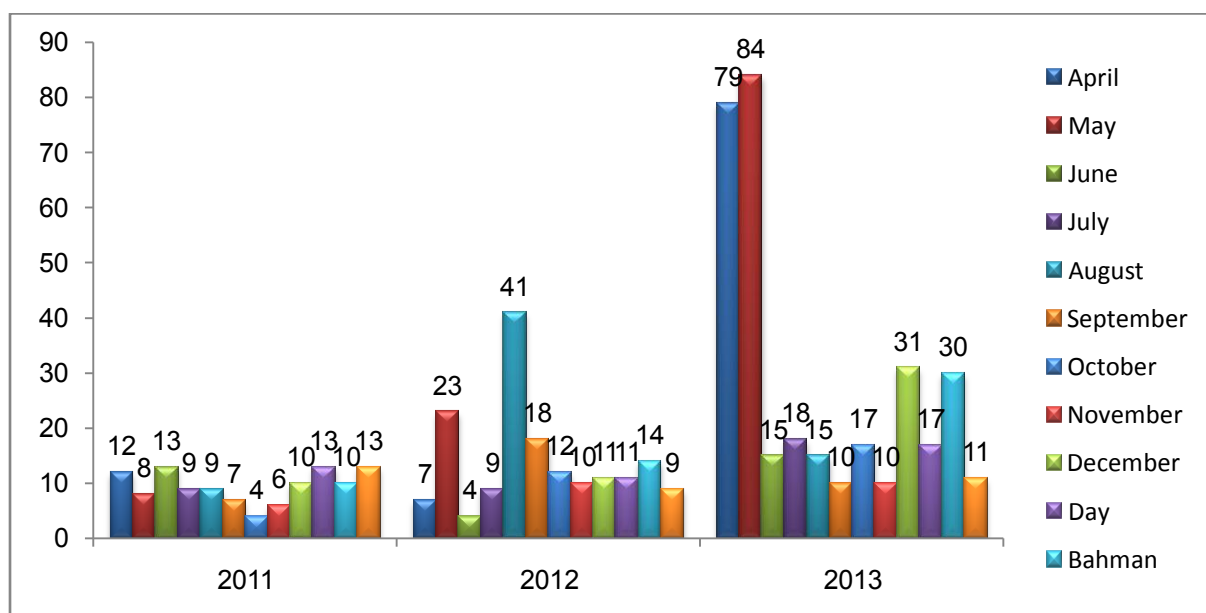


Figure 6: The earthquake upper than 4 Richter in the recent 3 years in Iran

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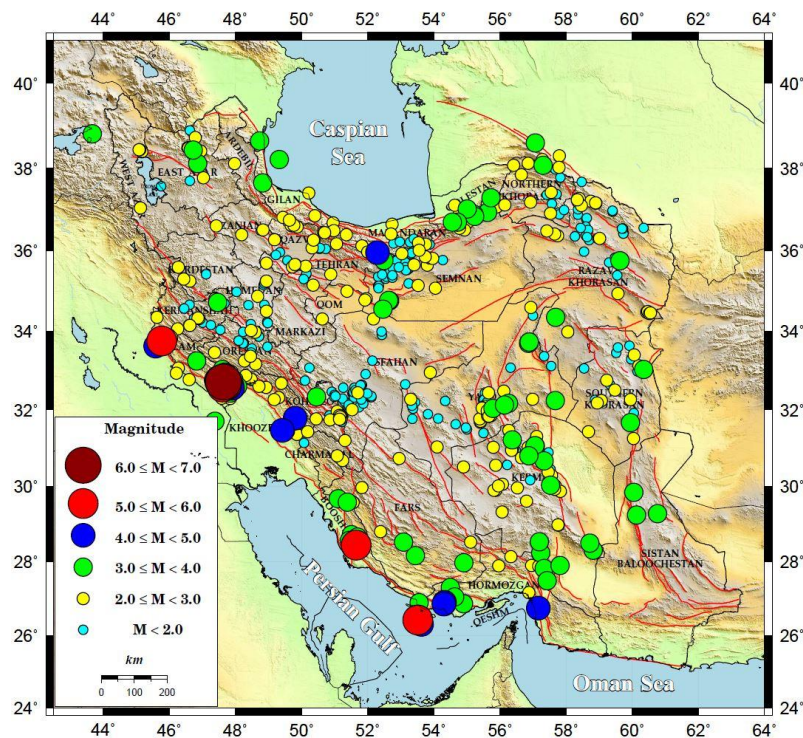


Figure 7: The map of Iran earthquake in 2014

RESULTS AND DISCUSSION

Inspections show that while expanded societies decrease the damages of the earthquake by management and planning. Unfortunately in our country the amount of losses from time to time has increased although we have scientific, technological and social improvements. In fact, what is more effective is not only leakage of provision and law but also no sufficient supervision on construction. Therefore two essence approaches are essential: first graduation of quality in new constructions according to all of the principals related to safety of buildings and also an overview in the executive forms by the construction executers. And second, resistance of inhabitable textures and preparing them for tolerance against damages related to earthquakes. Beside these two, a third index also needs to be considered and that is general education. People should be accustomed to both of the above approaches so that the safety of buildings is clear for them. In such a situation safety of buildings is not an extra cost. We hope that by applying the above approach we have a decrease in the damages related to the earthquakes. By providing suitable education for our children and family members we can be sure about their readiness. While construction, buying a house, preparing it and also arrangement of furniture we should remember that earthquake might happen therefore, essential equipments, first aid, phone notebook and other cases should be in a safe place that every member of the family is aware of. According to the experts of civic affairs resistance of buildings and strengthening construction factors and suitable usage of research in the field of geology is one of the important factors for decreasing the earthquake damages. This fact that Iran is located at the earthquake belt and the usage of experiences in other earthquake prone countries are sensed more than before. Experts believe that if extravagant costs of help and recovery of damages in earthquakes is on the restoration track the results are much better than the past.

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