

# Estimation of Population Wealth Destruction Caused by a Catastrophic Earthquake

Jyoti Singh <sup>1</sup>, Ranjana Kushram <sup>2</sup>, Deepika Pawar <sup>3</sup> and Suryanshu Choudhary <sup>4</sup>

Assistant Professor, Department of Physics, Sant Hirdaram Girls College, Bhopal, India  
 Assistant Professor, Department of Physics, Govt .A.B.P.G, College, Baihar, Balaghat, India  
 Research Scholar, Department of Physics, Rabindranath Tagore University, Bhopal, India  
 Visiting Professor, Department of Physics, SAM Global University, Bhopal, India

## Abstract

According to the United States Geological Survey, many million catastrophic earthquakes occur annually. Approximately 50 earthquakes are detected per day, estimating roughly 20,000 earthquakes occur worldwide annually. Buildings were destroyed as well as people have been killed and wealth being destroyed completely of such an event with a magnitude greater than 4. To evaluation of global susceptibility of earthquakes by using the calculating of percentage of population inhabit in the disaster-prone zones. The percentages of the population staying in seismic risk zones will be calculated by combining population density and seismic hazard maps. The seeming inconsistency is caused by the rise of urban aggregations that will shelter probably bulk of world's increasing population, as well as the location of most areas along tectonic frontiers.

**Keywords :-** Disaster-prone zones, Earthquakes, Seismic hazard maps, Combining population density, Global Susceptibility

## Introduction

An earthquake is an unpredictable natural hazard, which destroy the world's economy and millions of people died due to this hazard. Scientist can't observe the small magnitude earthquakes, but larger scale earthquakes can be analysed. The number of earthquakes is increasing day by day in the world. It's a very astonishment because the people to know about earthquakes from their effects and their causes. Earthquakes occur along plate margins when plates move past towards or away from each other the movement is not smooth. Plates also friction to get stuck and create pressure to build up. Sometimes earthquakes occur to build up pressure beneath the earth. Energy waves move rapidly from this point. The point at the ground level, which directly above the focus is called epicenter. Mainly sources of earthquake located at the boundaries of plates. The earth having radius of approximately 6,380 km and consists of three layers: crust, mantle and core. It is very complicated structure. The crust is the uppermost layer of earth is only up to 100 km thick and it is as thin as 5 km underneath the oceans while much denser than that underneath the continents approximately around 30 km but its maximum thickness underneath the large mountain of the earth. Up to depth of 2,900 km below the crust lies the mantle.

Firstly, the concept of earthquake preparation zone was introduced by Dobrovolsky et al., 1979[1]. Japan is highly seismic prone area in the world and nearly 50 big earthquakes with magnitude > 6 were recorded last 100 years in the region of Japan. In the Japan history the Tohoku earthquake 11 march, 2011 is the largest earthquake and it's ranked as the fourth largest earthquake in the world. Whole Japan was felt in the vibration due to these devastating earthquakes. Before the Tohoku earthquake 2011, the most devastated earthquake in 1995 called Kobe earthquake. Northeastern area of Japan is one of the most important areas in the world. The northeastern area of Japan is located in a typical subduction zone.

## Material and Methodology

Earthquake size is depending on magnitude. Past time the magnitude was traditionally reported using the Richter scale. Charles Richter and Beno Gutenberg were developed by the Richter magnitude scale, it is considered from the greatest seismic wave generated in the crust of the earth recorded through the earthquake. Richter magnitude is depending on a logarithmic scale (base 10). In the Richter scale every whole number is increases, the surface movement increases by 10 times. During an earthquake the moment magnitude scale is another term to express earthquake size and energy. To determine the more accurately size of great earthquake is used to moment magnitude scale by most of the seismologists. Intensity of earthquake is a calculated to how much occur trembling at a located for observations. Measurement of intensity is generally based on the Modified Mercalli Intensity Scale developed by the Italian seismologist Giuseppe Mercalli at the 19<sup>th</sup> century. By Using the Mercalli scale as a Roman numeral ranging from I to XII. Table 1 shows relation between type of earthquake, relative magnitude maximum intensity (Modified Mercalli scale) and effects.

S.No.	Type of earthquake	Relative magnitude	Maximum Intensity	Effects
1	Great	>8	XI-XII	Tremendous losses

2	Major	7-7.9	IX-X	Devastating damage over large areas
3	Strong	6-6.9	VII-VIII	Felt by all & serious damages
4	Moderate	5-5.9	VI-VII	Felt by all Some weak construction damages
5	Light	4-4.9	IV-V	Felt by many people
6	Minor	3-3.9	III	Sometime felt but no damages
7	Very Minor	<3.0	I-II	Not felt but detect by local instrument

**Table [1] Shows relation between type of earthquake, relative magnitude maximum intensity (Modified Mercalli scale) and effects.**

According to National Earthquake Information Centre (NEIC), 98% earthquakes are less than magnitude 5.0. In the 10 years as period only 63 earthquakes exceeded magnitude > 6.0. The Asia region has one of the highest levels of seismicity on the planet and it is also the setting for many of the largest earthquakes. A recently published catalogue on earthquakes showed more than 1000 deaths since 1900 lists 125 earthquakes worldwide, of which thirty-two occurred in the region represented by participants at this workshop. In addition, in a compilation of historic earthquakes, China had 48 entries, Japan had 42, Russia had 18, and Mongolia had 2. The high seismic risk in the region was recently emphasized by the 12 May 2008 magnitude 7.9 earthquakes in eastern Sichuan Province, China, that caused more than 87,000 deaths and billions of U.S. dollars in damage. In the Asia region the majority of earthquakes are related to plate convergence where one tectonic plate slides beneath another plate in subduction zones. In addition to generating large earthquakes this plate subduction sometimes gives rise to volcanism. Moreover, large earthquakes are not always associated with subduction zones. Faults where horizontal motion takes place (strike-slip faults) also generate destructing earthquakes. The San Andreas Fault situated in United States, the Pacific plate slides northward with respect to the North American plate. Strike-slip faults in China and Mongolia are responsible for various destructive earthquakes, sometimes with magnitudes between 6.0 and 7.5 and particularly greater than 8.0.

### **Result and Discussion**

Large earthquakes in the Asian region have been proved very devastating. In July 1976, Tangshan, China, earthquake fell on a strike-slip fault and resulted in over 240,000 deaths according to the China Earthquake Administration (CEA). Japan 1896, witnessed an earthquake of 8.5 magnitude which resulted in 27,000 casualties and the same thing happened in 1923 in Kanto (Kwanto), Japan, where 7.9 magnitude of earthquake resulted in the loss of 143,000 lives. Mongolia tolerated two earthquakes of magnitudes greater than 8.0 in 1905 and 1957 while Russia, since 1923, had witnessed six earthquakes with magnitudes greater than 6.0, five earthquakes with magnitudes greater than 7.0 and six earthquakes with magnitudes greater than 8.0. On February 27, 2010 earthquake occurred at Chile with magnitude 8.8 which was 60 times greater than other earthquake of magnitude 7.0. The Japan earthquake on March 11, 2011 with magnitude 9.0 was larger than the Chile earthquake. It caused more destruction and fatalities in Japan. Many countries one facing the seismic hazards but the three countries are significantly these problems. Chile had experienced a great earthquake with magnitude 9.5 in 1960, Japan also had experienced a very harmful earthquake in Kobe at 1995. The seismic hazard is effect on local geology due to plate tectonics and having vulnerability as earthquake. Japan having dense populations, huge infrastructure and nuclear power reactors situated on the northeast coastline these places close to the epicentre. In Indonesia on 26 December 2004 occurred the Banda Aceh earthquake-tsunami with magnitude 9.0 created tremendous losses and suffer by millions of people and create social, economic losses in Banda Aceh earthquake in Indonesia.

### **Conclusion**

The number of earthquakes resulting in casualties has been increased approximately in proportion to global populations. The cause of the apparent contradiction lies in the growth of urban agglomerations where most of the world's growing population will live. The recurrence interval for damaging earthquakes varies from 30 years to 3000 years. If population densities remain high in the 21<sup>st</sup> century several megacities will be damaged by significant earthquakes Bilham et al., 1995[2]. Many scientists have done researches to try to predict earthquake occurring for minimize the losses and human lives. When we studied the earthquake disaster then we saw a very interesting result obtained in the research.

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