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Deterministic Seismic Hazard Analysis of the Region

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***Abstract* - India is considered one of the most seismically active countries. According to severity of earthquake, Indian zones are divided in to five earthquake zones. To carry out seismic hazard analysis for a particular region one should consider the fault earthquake data first. Earthquake catalogue has been generated by considering region covering some area around that particular region. By considering the faults, shear zones, and lineaments in the area having the past earthquake events (more than 150 events), a seismotectonic map can be prepared. Seismic earthquake catalogue has been used to find out the peak ground acceleration (PGA) that will be used to define the maximum credible earthquake. By using simple mathematical equation shortest distance between sites to source has been calculated causing tectonic activity. Peak ground acceleration (PGA) model has been presented for the basic design parameters of that region.**

Keywords—Peak Ground Acceleration (PGA), Maximum Credible Earthquake (MCE), fault length, seismic hazard,

I. INTRODUCTION

Earthquake is sudden hazardous ground shaking and it is generally occurred any time. Earthquake caused by the movement of tectonic plates and volcanic activity.
It is made up from two words: - earth + quake (hazardous shaking)

Seismic hazard analysis is done by the two ways:

- Deterministic Seismic hazard analysis (DSHA)
- Probabilistic Seismic hazard analysis (PSHA)

Deterministic seismic hazard involve a quantitative estimation of various ground shaking hazard for a particular area. DSHA is a simple process that is
Useful especially where tectonic features are practically dynamic and sound defined. The spotlight is generally on determining the maximum credible earthquake (MCE) motion at the site. DSHA is founded on tectonic features, it tends to be conventional since the highest earthquake the fault is "competent" of generating is tacit to happen at the place on the fault adjoining to the site. DSHA is often used in California due to the familiarity of faults and the region's elevated seismicity. DSHA basically four step process which is shown in the figure.1. Main steps are written below (Kramer, 1996).

- Identification and characterization of all sources
- Selection of source-site distance parameter
- Selection of “controlling earthquake”
- Definition of hazard using controlling earthquake

Seismic hazards can be analysed deterministically as when a meticulous earthquake situation is assumed and probabilistically, when uncertainties in earthquake location, size, and time of occurrence are explicitly considered (Kramer, 1996) [1].

Deterministic seismic hazard analysis gives a cap value for the Probabilistic Seismic hazard analysis.

The aim of probabilistic seismic hazard analysis (PSHA) is to measure the probability of over and above range of ground action levels at a site given all probable earthquakes. The investigative loom to PSHA was initialially dignified by Cornell (1968).
Probabilistic seismic hazard analysis provides not one, two, or three choices, but infinite choices for the user and decision-makers (Wang, 2005)[2].

Krinitzsky (2005)3 explanation on the troubles in the use of probabilistic methods and gives an account on a deterministic alternative which tells that ‘‘A Deterministic Seismic Hazard Analysis (DSHA) uses geology and seismic history to identify earthquake sources and to understand the heaviest earthquake each resource is capable of producing regardless of time, because that earthquake may happen in future. Those are the Maximum Credible Earthquakes (MCEs), the largest earthquakes that can reasonably be expected.

Main point of deterministic Seismic hazard analysis is the determination of the peak ground acceleration (PGA) and spectral acceleration for the particular region.

To develop the design response of different type of foundation material like weak soil, rock, hard soil these parameters are the accepted value which is very effective and also generating potential of that seismic hazard in future should be evaluated.

In seismic hazard analysis basically the seismicity of that region is the main issue and also detailed knowledge of active fault is necessary.

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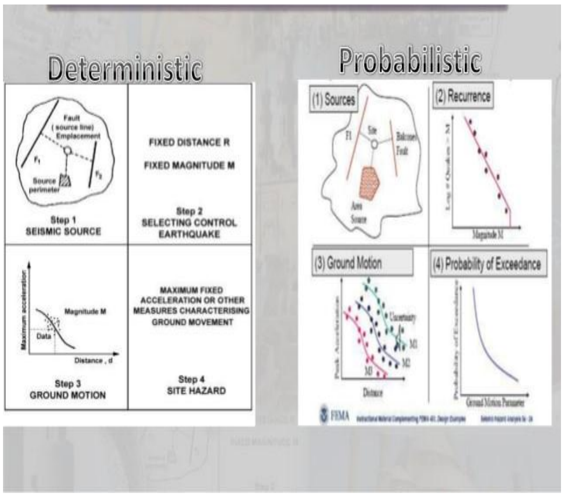

Fig.1. DSHA & PSHA

Mr. Mithlesh kumar tell us about the seismic hazard analysis of the DHARADUN CITY. This city lies in earthquake zone IV. This city situated in the foothills of the Himalayan which is highly seismic region. in this region twenty four seismotechtonic sources were founded. For finding maximum credible earthquake they considered the one third of total fault length as rupture length. For defining the peak ground acceleration they use two attenuation model. by using attenuation model by Sharma (2000) peak horizontal acceleration was calculated to be 0.334g and by using attenuation model Abrahamson and Lithehiser (1989) 0.475g PGA obtained[4]

Mr T. G. SITARAM had done the seismic hazard analysis on the BANGLORE region. it is seismically active city . Firstly microzonation is done on this city and DSHA is a part of this. In this the maximum credible earthquake is obtain by acceleration time history plot. Geological, seismological and Regional investigation for Bangalore section is carried out by considering shear zones, faults and lineaments active around Bangalore to particular distance and earlier period earthquake actions in the area by considering seismotectonic activity, maximum credible earthquake has been obtained in 350 km in radius around city. Peak ground acceleration is calculated for various sources by finding the minimum distance b/w Bangalore to source. In term of moment magnitude the maximum credible earthquake found is 5.1 with peak ground acceleration 0.146g [5].

Here the relation used is Iyengar and Raghukanth (2004)(6)

$$\ln(y) = c1 + c2(M-6)+c3(M-6)^2-\ln(r)-c4(r)+ \ln(\varepsilon)$$

C1, C2, C3 and are the constants

K.S. RAO did seismic hazard analysis on the AHMEDABAD region GUJARAT. Earthquake list of the region casing 350 km radius concerning the Ahmadabad city has been generated one by one after giving out of collected earthquake figures since 1668 to 2010. For the particular region The Peak Ground Acceleration (PGA) standards have been estimated using predictive relationships. analysis shows that PGA from Ahmadabad area has been differ from 0.14 to 0.44 g with maximum credible earthquake (MCE) of magnitude 6.1 generated from East Cambay Fault. It has been established that PGA values will be extremely elevated in a few part of the area compare to standards recommended in IS 1893: 2002, which indicates the critical review near codal terms with addition of extra meticulous studies complement both deterministic and probabilistic approaches. [7].

$$\ln(y) = c1 + c2(M-6)+c3(M-6)^2-\ln(r)-c4(r)+ \ln(\varepsilon), \quad (1)$$

$$\ln(y) = -7.9527 + 1.4043\ Mw - \ln(r2 + 19.822)½ - 0.0682S \quad (2)$$

c1, c2, c3 and c4 are constants and depend on different region

Ganapathy.G.P did a seismic hazard analysis on the cultural heritage sites of Tamil Nadu. Its 73% area belong to Seismic Zone II and 23% belong to Seismic Zone III. It is noticed that many heritage and historical sites like Kamakshi Amman Temple of kanchipura Mahabalipuram Kapaleshwarar temple of Chennai are come under Zone III. Six far from possible earthquake sources inside the area founded as region sources for seismic hazard estimation derived from geophysical , seismological and geological information. Which are used to detect the source to site distance and used to find the peak ground (PGA) acceleration with maximum credible earthquake (MCE). Here they used Iyengar and Raghukanth (2004).

Current revision disclose the truth that the seismic hazard wes tern and north eastern division of Tamil Nadu is indirectly identical with the local seismic zonation geared up by Bureau of Indian Standard, 2002[8]. Southern division shows less seismic than the other part [9].

$$\ln y = c1+c2(M-6)+c3(M-6)^2 - \ln R - c4\ R + \ln€$$

c1, c2, c3 and c4 are constant and differ according to area

A. G. HULL & A. Augello did a hazard assessment of northwest Oregon, U.S.A. and 54 earthquake are evaluated there and then they find maximum credible earthquake MCE around 200km .in this region 12 dam sites are present. Earthquake caused by 14 active fault are evaluated for the hazard analysis and provide the controlling value for dam site. For the dam site PGA value lies in the range of 0.57g to 0.16g [10].

Muhammad Waseem1 and team mates done ground motion assessment of the area situated in the Peshawar. It is carried out deterministically considering faults sources around the area of 100 km radius. Analysis shows that the main boundary thrust situated 29 km distance to the site. Maximum value of magnitude which cause seismic hazard is 8.1.PGA value for this site is estimated 0.232g [11].

NEELIMA SATYAM. D* and K. S. RAO** done seismic hazard analysis on Delhi and they find out the peak ground acceleration for this region. Delhi is seismically very active estimation of ground motion parameters is important. Seismological put in that describes the frequency content duration and amplitude of the expected motions are necessary to measure the seismic concert of the structures. Some experiential relations are accessible in the narrative for the

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evaluation of these ground motions. In this cram, the stochastic finite fault simulation technique which gear the concept of fault discretization wherein the sub events are represented as stochastic point sources is used [12]

II. CONCLUSION

Aim of this paper gives an attempt has been made to review a variety of literatures for the seismic hazard investigation of some area which is introduced by the deterministic seismic analysis of that area by using some relationship and these relationship are used to find out the peak ground acceleration [PGA] by considering the scenario earthquake data. These techniques give the highest value PGA which is the limited value for the DSHA and also give the amount of hazard caused by the earthquake and also maximum credible earthquake MCE.

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