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Seismic Hazard Microzonation of Barak Valley Region in Northeast India

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Abstract—*In this paper, seismic hazard microzonation study of Barak Valley Region (BVR) in Northeast India (NEI) has been done. Northeast India has already faced several high magnitude earthquakes (M_w> 7.5) in the past. Based on the past data, there is a 25 % probability of occurring earthquake of M_w 8.0 in the region. With this in view, in the present study an attempt has been made to calculate the seismic hazard of Barak Valley Region at grid points of 5 km X 5 Km using the region specific ground motion prediction model for NERI. We have calculated ground motion parameters at the different grid points for different time periods. In calculating seismic hazard at the different grid points, we have considered different seismic source potentials (i.e, maximum no. of faults existing within a radius of 300 km) along with their location and the most probable earthquake it can produce.*

Deterministic Seismic hazard study for the Barak Valley region will be useful for the practicing engineering in design of various seismic resistant structures.

Keywords*: Ground motion parameters, Deterministic Seismic hazard microzonation and Seismic source potentials.*

1. INTRODUCTION

Predicting strong ground motion expected during future earthquakes is one of the most challenging problems in the field of earthquake engineering. Estimating future hazard of a region from all possible sources of earthquake constitutes an important problem for engineers. Generally, there will be several seismic sources near the site and since earthquakes occurrence are random, difficulties exist in selecting the design ground motion parameters. Engineers have recognized that development of sophisticated ground motion simulation model alone will not solve the problem of structural design and safety. In addition to these models one should know the areas where earthquakes occur and how often earthquakes of given magnitude occur in their source region. The problem of estimating design ground motion has to be handled either through Deterministic Seismic Hazard Analysis (DSHA) or through Probabilistic Seismic Hazard Assessment (PSHA) where ground motions from all possible magnitude and location combination is considered in estimating the seismic hazard. Seismic hazard characterized from existing geological and seismotectonic set up in a region has to be considered in structural design. Engineering structures should be designed in such a way that the possible damage is minimized. It is therefore necessary to understand both the nature of the ground motion that these systems may experience during their lifetime and their response to these excitations. It is well known that earthquake ground motions are uncertain and at present it does not appear possible to predict the forthcoming events precisely at a specific location in time and frequency content. So, the question arises as how to obtain the design ground parameters at a site of interest?

2. SEISMOTECTONIC STATUS OF BARAK VALLEY REGION

Southern Assam is popularly known as Barak valley (situated within longitude and latitude of 24.5000 N and latitude of 92.5100 E). It is divided into three districts viz. Cachar, Karimganj and Hailakandi. The Barak valley is surrounded in the north by N.C Hills , Jaintia Hills of Meghalaya , in the south by the state of Mizoram , in the east by Manipur and in the west by Tripura state and Sylhet district of Bangladesh. The valley is reported in seismic zone - V as per IS: 1893:2002 which is considered as high risk earthquake prone zone. Seismic hazard microzonation is thus necessary for a high risk earthquake prone region depending on all the possible combination of distances and seismic source potentials.The seismotectonic map of NERI has been shown (fig 1).It has been observed that several earthquakes of different magnitudes have shocked this region. The major tectonic features which can induce vibration in the valley during a seismic event are Dauki fault , Naga thrust, Dudhnoi fault ,Kulsi fault ,Disang thrust, Mat fault, Atherkhet fault, Dhansiri & Kopili fault, Eastern Boundary Thrust zone, Shillong zone. The Kopili fault has the record of producing the 1869 Cachar earthquake (M>7) and 1943 earthquake (M>7). Based on the past data, there is a 25 % probability of occurrence of earthquake of M_w 8.0 in the region. The different faults existing around Barak valley within a radius of 300 km along with their surface rupture length (SRL) is given in the table below (Table 1).

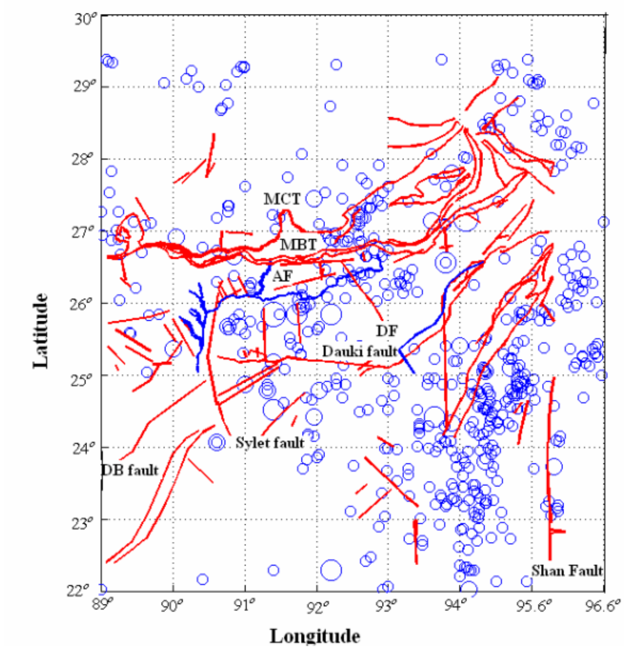

Fig. 1: Seismotectonic map of Northeastern region of India(M>5)

Table 1: Faults along with respective surface rupture length(SRL)

No: of Faults	Faults	SRL(km)
1	1	81.2
2	2	84.84
3	3	25.2
4	4	35.84
5	5	19.6
6	6	138.88
7	7	130.76
8	8	24.64
9	9	16.24
10	10	5.32
11	11	9.24
12	12	121.54
13	13	34.44
14	14	43.68
15	15	61.9
16	16	12.6
17	17	19.6
18	18	432.88
19	19	252.84
20	20	19.6
21	MAT FAULT	137.2
22	SYLHET FAULT	118.16
23	KULSI FAULT	75.8
24	DAUKI FAULT	330.12
25	DHANSIRI KAPILI FAULT	150.92
26	DISANG FAULT	429.8
27	ATHERKHET FAULT	143.46

3. DISCUSSION OF THE SEISMIC HAZARD RESULTS

In this study, Seismic hazard of Barak Valley Region has been calculated based on Deterministic Seismic Hazard Analysis (DSHA) at grid points of 5 km X 5 Km. We have used the specific ground motion prediction model for active region at rock condition (Rahman et al 2016) developed for Northeastern Region of India (NERI).

Spectral Acceleration values calculated at 5 % damping on the rock level condition at 0.04sec, 0.075sec, 0.1sec, 1sec are

1. At dwarbond 0.45g, 0.37g, 0.32g, 0.08g respectively.
2. At Hailakandi 1.58g, 0.95g 0.78g, 0.197g respectively.
3. At Algapur 1.104g, 0.92g 0.78g, 0.197g respectively.
4. At Jalalpur 3.74g, 3.11g, 2.64g, 0.65g respectively.
5. At Karimganj 2.45g, 1.56g, 1.32g, 0.33g respectively
6. At Silchar 1.85g, 1.54g, 1.31g, 0.32g respectively.

4. CONCLUSION

We have presented seismic value for the Barak Valley using DSHA and ground motion model proposed by Rahman et al, 2016. These values are valid for rock level condition. We have to calculate the Surface level seismic hazard value by accounting the Soil factor. Seismic Hazard value will be different on rock and soil. Surface level Seismic Hazard will be useful for the structural Engineers to design various seismic resistant engineering structures.

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