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Spectral Amplification Factors of Indian Earthquake Ground Motion

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***Abstract:** The successful working of this network the strong ground motion data base considered in the present work consists of various earthquakes recorded in the northern part of India.*

As laid the foundation of Earthquake Early Warning System (EEW) in India. Strong motion data from various regions of India have been used to study attenuation characteristics of horizontal peak acceleration and velocity. It is observed that the bedrock motions with low amplitude produce high amplification factors while high amplitude bedrock motions produce low amplification factor.

***Keywords:** Attenuation, Amplification Factor, Ground Motion, Intensity.*

INTRODUCTION

Earthquake motion is instruments designed to record the time history of strong ground motions where the traditional high gain seismographs used to routinely locate earthquakes go off the scale. It is very dangerous for the environment. These records are essential for evaluating earthquake resistant design procedures, estimation of attenuation characteristics, assessment of seismic hazard and earthquake risk. Earthquake has claimed, and continue to claim, thousands of human lives. The larger and more frequent ones are associated with interplate environments. Mostly we seeing the large and destructive earthquakes in India occur along and close to margins of the Indian plate. Regions of high seismicity can be identified as the Himalayan arc, with a dense concentration of epicenters in the eastern and western syntaxes. It is the result of a sudden release of energy in the earth's crust that creates seismic waves. The seismicity, seismic, or seismic activity of an area refers to the frequency, type and size of earthquakes experiod of time.

STUDY AREAS

According to the present analysis, four months after the earthquake the Gujarat government announced the Gujarat Earthquake Reconstruction and Rehabilitation Policy. The main objectives of the policy included repairing, building, and strengthening houses and public buildings. Earthquake in Bengal, Bihar, and Assam are more dangerous areas because the located more than 500 kilometers from the Indian border, an earthquake measuring 6.8 on the Richter scale has hit Myanmar, Bihar, Patna, and Kolkata. While it has been reported that the tremors lasted for 10 sec in Kolkata, Patna experienced the strong earthquake for about three seconds. People within these constructions experienced their worst nightmare within a few seconds time.

The earthquake shook building situated in Myanmar's biggest city of Yangon and a range of other cities and towns.11:00 AM IST, 14 April 2016 – The earthquake jolts were also Uttar Pradesh, Chhattisgarh, Odisha and Madhya Pradesh. As the National Central for Seismology, the earthquake occurred around 7:25 P.M and was 74 km South East of Mawlaik. The earthquake was the sec. one in the day as the northeast had already a medium intensity earthquake measuring 4.6 hitting areas .it is the scientific study of earthquake and the propagation of elastic waves through the earth or through other planet-like bodies. A related atmospheric and artificial field that uses geology of inter information regarding part earthquakes is paleoseismology.

SUB SOIL PROPERTY

The work of civil engineering especially in a seismic region is to provide maximum safety in the structures designed and constructed by him against earthquake shocks at the acceptable economic costs.

Briefly expressed task of engineers is:
- (a) To know the seismic history of the area.
- (b) To introduce suitable factors of safety in the new construction.

The high incidence of liquefaction during earthquakes, with its potential to damage, has made the liquefaction a prime subject of concern in geotechnical earthquake engineering.

The term '' Amplification factor'' is hence used here to refer to the ratio of the peak horizontal acceleration at the bedrock. This factor is evaluated for all the boreholes using the PHA at bedrock obtained from the synthetic acceleration time history for each Borehole and the peck ground surface acceleration obtained as a result of ground response analysis using SHAKE 2000.

LOCAL SITE EFFECTS

29 June 2015 – A 5.6 – magnitude earthquake struck Assam at around 6.40 am Sunday morning. According to district officials, three people sustained injuries when an old wall collapsed near the Kokrajhar railway station.

The appearance of an earthquake of appreciable magnitude is generally accompanied by a train of effects some of which may be highly destructive in nature. The character of the various with the severity of the earthquake as well as the distance of the place under consideration from the epicenter of that particular earthquake.

Richter classified the effects of the earthquake into two categories:
- (a) Primary Effects.
- (b) Secondary Effects.

ANALYSIS AND RESULTS

There are several methods and related computer procedures available for studying the dynamic response of embankment to seismic loading. Since response analysis began their way into geotechnical engineering practice in the early 1970s with the development of SHAKE.

These program divided into different ways, but it is useful to distinguish them on the basis of general soil model.

Equivalent linear models use an iterative usion approach to approximate the nonlinear, in the clastic behavior of soils. An average shear modulus is used over an entire cycle of loading approximate the hysteresis loop.

The actual nonlinear behavior of the shear modulus and damping ratio dynamic loading conditions can be simulated approximately by an equivalent linear analysis. Combing the observations from the above two steps indicate that the built correction in SHAKE 2000for the estimation of Gmax can be used confidently for the present study.

CONCLUSION

The local site conditions play an important role in the recorded time history of earthquake ground motion. Different site conditions can induce amplification of different period ranges in the response spectra. Therefore the local site conditions become important in ground motion analysis and in earthquake resistant designs.

From this network wealth of strong motion data is getting available which are being used by National and scientists. It is now extremely important that this national asset is nurtured so that it may flourish to serve the nation to its maximum capability. This project aims to use our strong ground motion data for reshaping and upgrading various prevalent relationships for earthquake ground motion parameters, which have been made using strong ground motion data sets from other parts of the world.

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Table 1
Ground Motion properties of the selected input motions

S. N.	Ground Motion Details as per SHAKE 2000	Epicentral Distance (km)	Magnitude	PGA (g)	Duration (s)	Predominant Frequency (Hz)
1	ADAK, ALASKA 1971-M 6.8;R-67KM, N81E	86.77	6.8	0.098	24.58	8.33
2	ANCHORAGE, ALASKA 1875, M-6, R81-GOULE HALL STATION	81.93	6.0	0.036	18.59	10.00
3	ANCHORAGE ALASKA 1975, M 6, R 79, WESTWARD HOTEL STATION (BASEMENT)	78.37	6.0	0.049	38.96	7.14
4	ANZA 02/25/80, BORREGO AIR BRANCH 225	43.1	5.3	0.046	10.25	3.85
5	ANZA 02/25/80 1047, TERWILLIGER VALLEY 135	15.8	5.3	0.080	10.01	16.67
6	BISHOP-ROUND VALLEY 11/23/84 1914, MCGEE CREEK SURFACE 270	42.35	5.8	0.075	6.80	12.50
7	BORREGO MOUNTAIN 04/09/68 0230, EL CENTRO ARRAY 9, 270	60.0	6.4	0.056	39.95	39.95
8	BORREGO MOUNTAIN 04/09/68 0230, PASADENA-ATHENAEUM, 270	216.8	6.4	0.009	60.23	1.22
9	BORREGO MOUNTAIN 04/09/68 0230, TERMINAL ISLAND, 339	205	6.4	0.008	51.80	2.50
10	CAPE MENDOCINO EARTHQUAKE RECORD 04/25/92, MW-7.0, 90 DEG COMPONENT	10.0	7.1	1.03	59.98	50.00
11	CHALFANT 07/20/86 1429, BISHOP PARADISE LODGE,070	19.8	6.4	0.046	39.95	16.67
12	CHILE EARTHQUAKE, VALPARAISO RECORD, 3/3/85	129.2	7.8	0.120	79.39	16.67
13	COALINGA 05/02/83 2342 PARKFIELD, FAULT ZONE 6/ 090	43.9	6.5	0.055	39.95	8.33
14	COALINGA 05/09/83 PALMER AVE ANTICLINE RIDGE, 090	12.5	5.3	0.215	40.00	10.00
15	GEORGIA, USSR 06/15/91 0059, BAZ X	49.0	6.2	0.033	34.07	4.55
16	IMPERIAL VALLEY 10/15/79 2319, BONDS CORNER 230	15.9	5.0	0.100	19.885	5.56
17	KERN COUNTY 7/21/52 11:53, SANTA BARBARA COURTHOUSE 042	80.5	7.5	0.086	75.35	4.17
18	KOBE 01/16/95 2046, ABENO 000	24.9	6.9	0.22	139.98	5.00
19	KOBE 01/16/95 2046, KAKOGAWA 000	22.5	6.9	0.250	40.91	12.50
20	KOBE 01/16/95, KOBE PORT ISLAND 090	0.9	6.9	0.530	42	2.50
21	LIVERMORE 01/27/80 0233, HAYWARD CSUH STADIUM 236	33.9	5.8	0.027	15.98	3.13
22	LIVERMORE 01/27/80 0233 LIVERMORE MORGAN TERR PARK 265	20.6	5.8	0.197	24	5.56
23	LOMA PRIETA TA 10/18/89 00:05, ANDERSON DAN DOWNSTREAM 270	16.9	7.0	0.240	39.59	5.00

24	LOMA PRIETA TA 10/18/89 00:05, HOLLISTER DIFF ARRAY 255	13.9	7.0	0.270	40	1.92
25	MICHIOACAN EARTHQUAKE 19/9/85, CALETA DE CAMPOS, N-COMPONENT	38.36	8.1	0.140	81.06	2.27
26	NORTHERN CALIFORNIA 09/22/52 1141, FERNDALE 134	44.3	5.2	0.070	40	5.00
27	NORTHRIDGE EQ 1/17/94 1231, ANACAPA ISLAND	71.4	6.7	0.013	40	25.00
28	NORTHRIDGE EQ 1/17/94 1231, ARLETA 360	9.5	6.7	0.310	39.94	16.67
29	PARKFIELD 06/28/66 04:26, CHROME # 8	11.2	6.1	0.116	26.09	25.00
30	TRINIDAD 11/08/08, 10:27, RIO DEL OVERPASS E	72.0	7.2	0.130	22	3.13

Table 2
Range of amplification factor corresponding to bedrock PGA

Range of bedrock PHA (g)	Ranks of bedrock PHA	Range of Amplification factor (AF)	Ranks of AF
0.03-0.08	1	7.5-2.7	3
0.08-0.22	2	2.8-2.2	2
0.22-0.53	3	2.2-1.0	1

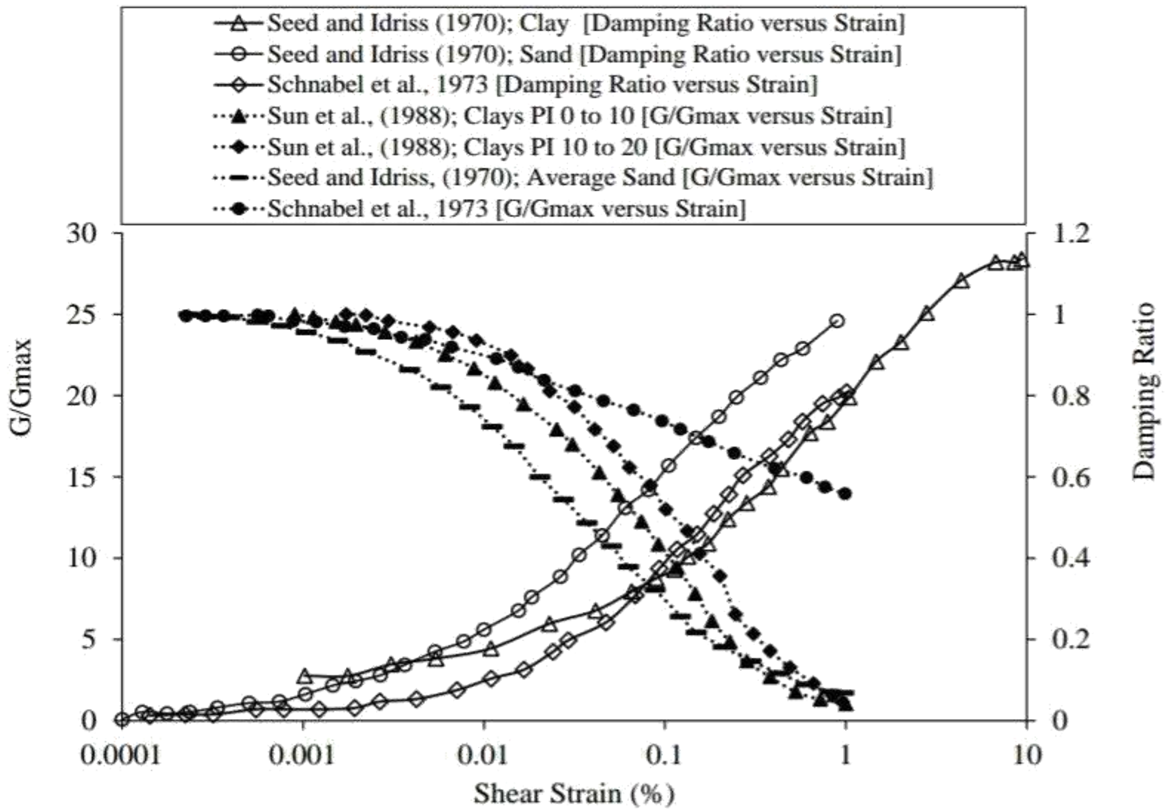

Figure 2: Dynamic properties of selected soils

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