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STUDY ON THE VARIATIONS OF GROUND MOTION PARAMETERS WITH DISTANCE FOR M_w 6.9 SIKKIM 2011 EARTHQUAKE

Shiv Shankar Kumar*, A. Murali Krishna** and Anbazhagan P.***

*Assistant Professor, School of Civil Engineering, Kalinga Institute of Industrial Technology Bhubaneswar Odisha-751024, India, E-mail: shivshankar.mit@gmail.com

**Associate Professor, Department of Civil Engineering, Indian Institute of Technology Guwahati Assam-781039, India, E-mail: amurali@iitg.ac.in

***Associate Professor, Department of Civil Engineering, Indian Institute of Science Bangalore-560012, India, E-mail: anbazhagan@civil.iisc.ernet.in

ABSTRACT

This paper presents the variations of ground motion parameters with distance, for M_w 6.9 Sikkim 2011 earthquake, based on the ground motion records obtained from sixteen locations. Ground motions recorded at different stations located within 35-1000 km from the epicentre were collated and analysed for their ground motion parameters. It has been seen that the peak ground acceleration (PGA) near the source zone is high but as distance increase the value of PGA decreases. Based on the comparison between recorded PGA and estimated PGA from attenuation curves, it was observed that there is a need to revisit the ground motion predication equations and provide other correlations for better prediction of future structural design parameters. Predominant period also needs to be estimated region-specifically considering the prevalent seismicity, since the regional geology, source to site distance and site conditions vary place to place.

KEYWORDS: Sikkim 2011 Earthquake, Ground Motions, Distance, Ground Motion Parameters

INTRODUCTION

Seismic hazard at any place predominantly governed by the ground motion and its associated parameters (Kumar et al., 2018). The ground motion parameters, such as peak ground acceleration (PGA), predominant frequency and effective duration of the ground motion affect the responses of various structures, which vary place to place as a function of distance from the epicentre and local geological soil conditions (Kramer, 1996). The devastation during earthquake of any area or location depends upon the intensity of ground motion parameters and soil stratification present in that area.

For proper design of earthquake resistant structures one need to know about ground motion parameters and dynamic behaviour of soil. In the absence of data, predictive relationships are very useful to estimate the variation of ground motion parameters with distance (Kramer, 1996). The most commonly used ground motion parameters are vertical and horizontal PGA, damped spectral acceleration (s_a), peak ground velocity *(PGV)* because these are directly related to the dynamic behaviour induced in the structures. When seismic waves travel away from the fault, their higher frequency components are scattered and absorbed more rapidly than lower frequency components. Predominant period of an earthquake increases with increasing distance (Kramer, 1996). Thus, the different geology and geotechnical conditions like the distance between source and site can affect the amplitude, frequency content and duration of the ground motion during an earthquake.

A recent major earthquake of moment magnitude (M_w) 6.9 in Indian subcontinent was the Sikkim earthquake that was occurred on September 18, 2011 at 18:10:48 IST. Its epicentre located at 27.72°N, 88.08°E near India-Nepal border region, about 68 km NW of Mangan (Gangtok) at a focal depth of 19.7 km and lasted about 30 to 40 seconds (Rai et al., 2011). The seismic tremors were felt in many cities of North-Eastern (NE) states of India. Ground motions resulted due to this seismic event were recorded at various seismic stations located within 35-1000 km from the epicentre.