ABSTRACT

A probabilistic seismic hazard model of West Bengal and Kolkata have been developed at bedrock level considering 33 polygonal seismogenic sources at two hypocentral depth ranges: 0-25 km and 25-70 km based on seismicity patterns, fault networks and similarity in the style of focal mechanisms. 158 active tectonic sources (faults/lineaments) which have the potential of generating earthquakes of M_w 3.5 and above have been extracted from seismotectonic map of India and additional from LandsatTM/MSS & SRTM data through edge enhancement filtering & principal component analysis for inclusion in the present study. Seismicity analysis is performed using a homogeneous earthquake catalogue in M_w scale. 14 Ground Motion Prediction Equations including 6 Next Generation Attenuation models for three seismotectonic provinces viz. Bengal Basin, East Central Himalaya and Northeast India have been selected through suitability tests and fixing appropriate weights in a logic tree framework. The contribution of background seismicity in the hazard perspective is estimated using smoothened gridded seismicity models at a regular grid interval of 0.1° for the threshold magnitudes of M_w 3.5, 4.5 and 5.5 respectively at both the hypocentral depth ranges 0-25 km and 25-70 km. For the State of West Bengal the Peak Ground Acceleration for 10% probability of exceedance in 50 years is seen to vary between 0.1 to 0.445g while that in Kolkata at the bedrock level varies from 0.11 to 0.151g. Site response analysis is carried out in Kolkata through both the geophysical and geotechnical investigations wherein Microtremor survey has been conducted at 600 locations, Multichannel Analysis of Surface Wave at 45 locations and Geotechnical Investigations in terms of Standard Penetration test at 332 locations. The predominant frequency in Kolkata is seen to vary between 0.67 to 4.22 Hz while the site amplification factor in a negative correlation with predominant frequency varies between 6.1 to 2.8. A first level integrated hazard scenario of Kolkata developed using multidimensional framework of seismological, geological, geotechnical and geophysical information judiciously incorporated through Analytical Hierarchical Protocol based decision support system exhibits High, Moderate, Low and Very Low hazard regions in the city.

Keywords: Ground Motion Prediction Equation, Probabilistic Seismic Hazard, Predominant Frequency, Site Amplification, Analytical Hierarchical Process, Integrated Hazard, West Bengal, Kolkata.