ABSTRACT

The Indian subcontinent containing three earthquake-prone morphotectonic provinces viz. the Himalaya, Indo-Gangetic Foredeep and the peninsular shield region account for ~3% of the world-total earthquake induced fatalities. The tectonic assemblage containing the West-Central Himalaya, Nepal Himalaya, Indo-Gangetic Foredeep, Bengal Basin, Eastern Himalayan Zone and Northeast India, had experienced numerous devastating earthquakes in the past *viz.* the 1897 Shillong earthquake of M_W 8.1, 1905 Kangra earthquake of M_W 7.8, 1918 Srimangal earthquake of M_W 7.6, 1934 Bihar-Nepal earthquake of M_W 8.1, 1950 Assam of M_W 8.7, 1991 Uttarkashi earthquake of M_W 6.8, 2005 Muzaffarabad earthquake of M_W 7.6, and 2015 Gorkha-Nepal earthquake of M_W 7.8, leading to substantial casualties and property damage, highlighting the crucial necessity for a site-specific seismic hazard study in this region. A probabilistic seismic hazard assessment has been conducted at engineering bedrock, utilizing 98 layered polygonal sources, active tectonic sources, in 0-25km, 25-70km, 70-180km, and 180-300km depth ranges, site-specific Next Generation Attenuation models through a logic tree framework which estimates revealing a Peak Ground Acceleration (PGA) to vary from 0.09-0.83g. The effective shear wave velocity of the soil/alluvium column determined through detailed invasive and non-invasive investigations accompanied by nonlinear regression analysis of geology, geomorphology, topographic gradient, and landform and measured shear-wave velocity classified the terrain of into site class A, B, C1, C2, C3, C4, D1, D2, D3, D4, and E in confirmation with NEHRP and other local published protocol. Surface-consistent hazard through a systematic 1D/2D site response analysis aid in generating Design response spectra incorporating 5% damping. liquefaction analysis as secondary hazard has also been estimated as a layer to be included in seismic microzonation analysis. This hazard assessment lays the foundation for a comprehensive seismic hazard microzonation of selected capital cities and urban centres in this seismogenic tectonic assemblage. This assemblage provides a distinctive benchmark in the form of a hybrid seismic hazard-disaster model that spans both regions and locales. It aids in pre-disaster planning through the implementation of revised municipal regulations, post-disaster restoration, and future disaster management.

Keywords: Peak Ground Acceleration, Site Class, Site Response, Liquefaction, Seismic Hazard Microzonation.