

## ABSTRACT

The incidents of earthquake in the Darjeeling-Sikkim Himalaya are broadly associated with the collision tectonics between the Indian plate and the Eurasian plate to the north and the Indo-Myanmar range to the east. Therefore, a new perspective of multi-criteria holistic seismic hazard, vulnerability and risk aspects of Darjeeling-Sikkim Himalaya have been presented. A synoptic Probabilistic Seismic Hazard model of Darjeeling-Sikkim region is generated for 10% probability of exceedance in 50 years at surface level using layered polygonal seismogenic sources, active tectonic sources, smoothen gridded seismicity, seismicity parameters and site specific Next Generation Attenuation models through a logic tree framework. The estimated surface consistent Peak Ground Acceleration (PGA) is seen to vary from 0.260 to 0.861g in the terrain. Seismic microzonation undertaken to assess the likely effects of earthquakes as site specific implications by integrating Geohazard and Seismological hazard themes, namely Geology, Geomorphology, NEHRP Site classes, Landslide Density, Topographic Position Index based Landform Classes, and PGA with 10% probability of exceedance in 50 years at surface level in a fuzzy approach. The vulnerability exposures namely Population Density, Number of Households, Landuse/Landcover, Building Types, Height, Age and Density have been integrated with the Seismic Hazard Microzonation theme to model Seismic Socio-economic and Structural Risk in the Darjeeling-Sikkim Himalaya. The estimated Probabilistic Seismic Hazard Microzonation and Risk are expected to play pivotal roles in the earthquake inflicted disaster mitigation and management of the Darjeeling-Sikkim region with better pre-disaster prevention, preparedness and post-disaster rescue, relief and rehabilitation.

**Keywords:** Probabilistic Seismic Hazard, Seismic Microzonation, Vulnerability, Risk, Darjeeling-Sikkim Himalaya.