Topic : *Earthquake Hazard in the Northeast India – A Computer intensive Seismic Microzonation Approach with Typical Case Studies from Sikkim Himalaya and Guwahati city*

Scientific efforts and endeavors with contemporary technology towards seismic hazard mitigation are imperative to deliver assailable knowledge products about expected ground motion. Seismic microzonation involves detailed analytical as well as numerical treatment of seismological, geological, geomorphological and geotechnical concepts. The integration of various themes is achieved following an analytical hierarchal process, a multi-criteria evaluation technique.

Seismicity analysis performed in the northeast India establishes four seismic zones EHZ, MBZ, EBZ, and SHZ that encapsulates various seismogenic structures of the region. An estimate through Bayesian interpretation of frequency magnitude distribution with Gamma function implicating a moderate deviation from the standard Gutenberg Richter model has attached EHZ, MBZ, EBZ and SHZ with the maximum earthquakes of MW 8.35 (±0.59), 8.79 (±0.31), 8.20 (±0.50), and 8.73 (±0.70) respectively. Two contrasting cases of geological situations have been examined here – hilly terrains in the Sikkim Himalaya and the alluvial basin in the Guwahati city. The estimated maximum earthquakes implicated the scenario earthquake of MW 8.3 and MW 8.7 in the Sikkim Himalaya and Guwahati City respectively for deterministic seismic hazard estimation. The seismic hazard scenario in term of spatial distribution of Peak Ground Acceleration (PGA) has been computed for the scenario source. Crustal structure, composite fault plane solution and azimuthal variation of site response are the key input parameters for the F-K integration method adopted here while frequency dependent quality factor and site amplification have been considered for stochastic simulation.

The hazard zonation procedure for Sikkim Himalaya involves Geomorphological themes - Surface Geology, Soil Cover, Slope, Rock Outcrop and Landslides to achieve first level geological hazard distribution (Geohazard). Seismological themes classified as Site Response, Predominant Frequency, and Peak Ground Acceleration were then integrated with Geohazard to obtain the seismic microzonation map of the region. The seismic hazard microzonation map classifies the Sikkim Himalayan territory into six broad hazard zones - 'Low', 'Moderate', 'Moderately High', 'High', 'Very High' and 'Severe'. We could correlate the classifications with the BIS nomenclature, 'Low' hazard level to BIS Zone II, 'Moderate' hazard level to Zone III, 'Moderate' and 'Moderately High' hazard levels to BIS Zone IV, 'High' hazard level to BIS Zone V(A) along with new classifications of BIS Zone V(B) and V(C) covering both 'Very High' and 'Severe' earthquake hazard levels. On the other hand, the microzonation study of the Guwahati city accounts for nine themes - Geological and Geomorphological, Basement or bed rock formations, Landuse, Landslide, Factor of Safety, Shear wave velocity, Site Response, Predominant Frequency, and Peak Ground Acceleration (PGA). The seismic hazard microzonation map achieved for the city established five zones 'Low', 'Moderate', 'High', Moderately High' and 'Very High'. Two classifications –zones of 'Low' and 'Moderate' hazard levels being clubbed in BIS Zone IV, and 'High', 'Moderately High' and 'Very High' hazard zones being grouped in BIS Zone V(A). The hazard maps, thus derived, present better representation of the local specific seismic hazard variation ready for adaptation to building (BIS) codes.