



## Seismically Induced Landslide Hazard Analyses for a Road Corridor in the Lower Himalayas

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### Abstract

Seismically induced landslide hazard assessment for important road networks in the hilly regions constitute a significant component of planning and management of road infrastructures. Such multi-hazard assessment, though complicated, carries even more significance for seismically active mountains like the Himalayas. However, traditional Landslide Hazard Zonation (LHZ) practice generally lacks in incorporating seismic factors. An endeavor has been made in the present study to carry out seismically induced LHZ mapping for 85 km stretches of Kalka-Shimla highway (NH 5) in the lower Himalayan belt under a scenario earthquake condition. Eight different landslide preparatory factors viz. lithology, slope angle, aspect, elevation profile, distance from fault, distance from drainage, distance from road, and land-use-land-cover patterns are integrated with the landslide triggering seismic factors in a Geographical Information System (GIS). The seismic factor is included in terms of Peak Ground Acceleration (PGA) parameters generated for a 10% exceedance probability in 50 years using Probabilistic Seismic Hazard Assessment (PSHA). The study develops a heuristic model of landslide hazard assessment coalescing semi-quantitative and bi-variate frameworks to generate the seismically induced LHZ map. The prepared LHZ map demarcates more than 40% of the study area as the zones of high to very high landslide hazard under the scenario earthquake. The prediction accuracy of the proposed method is estimated as 80% for the study. Based on the findings, the study recommends that the seismic element be taken into consideration for a more realistic evaluation of the current landslide threats in seismically active mountain ranges like the Himalayas.

**Keywords:** Seismically induced landslide hazard zonation, Earthquakes, Probabilistic seismic hazard assessment, Analytical hierarchy process (AHP), Frequency ratio (FR) method