

EPILOGUE

Candidate's presented study constitutes a part of research project entitled "*Studies on TWO Landslides in Kali River basin Kumaun Himalayas: Their Characterization and Hazard Zonation*". The project was funded by the Department of Science & Technology, Government of India under its on-going NRDMS Programme.

In the developed countries, the investigation of landslide hazards has attained the stage of real time monitoring using sophisticated instrumentation however, in India it has just started getting momentum owing to significant growth in infra-structural development, particularly in highways and railway sectors in hilly regions.

The study was envisaged to carry out complete study encompassing small scale detailed field data inputs on geological, geotechnical and remote sensing aspects. The field investigations have been carried out using the most advanced surveying techniques like DGPS, Electronic Total Station and integration of information on GIS environment incorporating large laboratory data inputs on engineering characteristics of rocks and regolithic mass.

The generated field and laboratory results were analyzed using software added data analysis viz. GEOSTUDIO – 2004 (for Stability Analysis); GEOSYSTEM (for Field and Laboratory Data Analysis and Presentation); and ARC GIS & ERDAS IMAGINE (for Landslide Micro – Hazard Zonation).

For obtaining authentic data on rainfall as triggering factor, special rain gauge station was established. Also, attempt was made to correlate landslide incidences with the available earthquake records as well as on rainfall threshold values.

Attempted Landslide Micro – Hazard Zonation for route corridor shows ~ 80% accuracy with the field observations.

SCOPE FOR FUTURE WORKS

Study of landslide particularly the monitoring of its movement and pore-water pressure behaviour is a long time exercise involves huge funds. The study being of limited duration and funding, the candidate had obvious limitations to give full justice to the various aspects of envisaged objectives. However, this study has established a considerable potential for specific studies on the following aspects –

1. Sub-surface investigation through drilling to establish depth and nature of slip surface of the landslide.
2. Study of Micro – deformational structures in the landslide environment for understanding the slope failure mechanism.

3. Effects of rainfall and earthquake as triggering factors from the point of view of establishing correlation between mass movement and such events. This would necessitate developing a good network of rain gauge station as well as broad band seismographs.
4. Carrying out real time monitoring of the landslide by installing sophisticated instrumentation to monitor mass movement and pore-water pressure.
5. Rock-mass behavioural pattern in the proximity of tectonic features like MCT, Chiplakot Thrust, etc. This may be achieved by installing strain gauges/stress monitoring devices.
6. Establishment of landslide data bank and mechanism for its regular updating.
7. To study the efficacy of different remedial measures other than the traditional masonry retaining wall.
8. Effect of un-controlled blasting on rock masses and efficacy of controlled blasting with techno-economic considerations.
9. Dissemination of knowledge on landslide to the local inhabitants and formulating participatory mechanism to acquire sustainability.
10. Finite element studies and mathematical modeling for rock and debris slides.
