1. Introduction

Infrastructural development in the Hindu Kush-Himalayan Region is a formidable task, because considerable problems are caused by washouts and failures resulting from erosion, gullying, and landslides. Planning and designing mountain infrastructures, without giving due consideration to natural processes, such as geological processes, and climatic severity, such as heavy monsoon precipitation, have resulted in risks to the infrastructure itself as well as to the environment. Furthermore, limitations are imposed on intensive farming and economic activities in mountain regions by topographical constraints and ecological diversities, both horizontally and vertically. Developing countries with limited resources and marginal economies cannot sustain economic losses from the frequent failures and high costs of maintaining mountain infrastructures. High initial costs and subsequent cost overruns from poorly designed and estimated infrastructures misdirect investment priorities and cause losses in return on investments by sacrificing otherwise more effective activities.

Effective establishment of infrastructures in mountainous areas requires the integration of essential modern technologies with effective and sustainable resource management. Mountain infrastructural development, therefore, cannot be the domain of a single discipline, i.e., civil engineering alone. National level planning for mountain infrastructures must consider the existing and potential resources; land use potentials; natural and human-induced hazards, such as erosion, landslides, and undercutting; realistic cost trends; implementational capabilities; and intersectoral linkages. Engineering-geological, environmental, socioeconomic, engineering, and planning and decision-making considerations therefore become vital. All these considerations are necessary from the planning to the implementation stages, but the rigour of treatment should vary according to the scale of the project and different cycles of the same project.

At the project level, it is essential to have a thorough understanding of engineering-geology, rock mechanics, the mechanics of transported and residual soils, bio-engineering, meteorology, hydrology, behaviour of young streams, and appropriate technologies.

Project feasibility studies without adequate input from all of these various considerations will not give a realistic picture.

The aim of this paper is to promote awareness about mountain-specific infrastructural planning, management, and engineering by highlighting the various aspects of mountain infrastructures with a focus on mountain roads in Nepal. Mountain-specific infrastructural techniques, documented in the Mountain Risk Engineering (MRE) Handbook prepared by the International Centre for Integrated Mountain Development (ICIMOD), have been discussed briefly to illustrate the knowledge base and the tools available in this area.