DISASTER DUE TO LANDSLIDES IN ROADS

Disasters are extreme events which result in widespread social disruption, trauma, property damage and loss of life. Humans have to face the impact of disasters from time immemorial. Natural hazards, such as, earthquakes, landslides, avalanches, floods, cyclones, tsunami and droughts have repeatedly been the cause of calamities. Despite rapid advances in science and technology, losses due to such disasters continue to result in human suffering, property losses, environmental degradation and also lead to population shift and relocation of establishments.The economic and social costs of disasters will continue to rise with the increase in population and complexities in societies. The aftereffect of the disaster can be even worse than the disaster event itself. Thus, there is an urgent need to acknowledge the need for preparedness towards disaster reduction.

Landslide is a serious concern for both construction and maintenance of roads. A landslide is a geophysical event which affects considerably the communication and infrastructure like roads, railways, telephone lines, cultivable lands, crops, tree plantations, etc. Although the landslides are primarily associated with mountainous terrains, these can also occur in areas where an activity, such as, surface excavations for highways, buildings and open pit mines takes place. India has a sensational record of catastrophes due to landslides, unique and unparalleled. Landslides & avalanches are among the major hydro-geological hazards that affect large parts of India, especially the Himalayas, the Northeastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats and the Vindhyas Ghats range. Not only construction but also maintenance of roads in hilly and ghats region across the country is major challenge to the Engineers. These roadways get blocked due to landslides or avalanches in almost every monsoon period.

A landslide is a generic term that embraces a wide variety of slope failures associated with soil and rock mass downward and outward movements. Although landslides usually occur on steep slopes, they also can occur in areas of milder slope. The materials may move by falling, toppling, sliding, spreading or flowing. Some landslides are rapid, occurring in seconds, whereas, others may take hours, weeks or even longer to develop. Many factors contribute to landslides, including topography, geology, gravity, weather, groundwater drainage characteristics, landuse, land management and human actions.

The identification of locations of active and potential landslides with a view to avoiding landslide prone stretches, whenever possible is an important step in the planning stage of an alignment of a road. Necessary preventive and corrective measures are also to be taken to eliminate the risk of landslide. If this is relegated to secondary importance could lead to serious and perpetual problem. It is easy to recognize active landslides but to delineate between stable and questionable slope is a very difficult task. However, for this purpose, a field investigation of proposed route by an experienced geotechnical engineer along with a geologist is essential. Geological study of landforms alongwith records of rainfall and the effects of construction on soil profile, the underlying rock and ground water conditions are of great significance in determining the vulnerability of an area to landslide. Landslide prevention techniques basically adopt measures to decrease activating forces and or increase resisting forces.With the advances in space technology and remote sensing, it is now possible to map landslides with a good degree of accuracy. Ground studies, however, remain indispensable for scientific interpretation, analyses and treatment of landslides. The methods adopted by using this technology for recognition and identification of landslides hazards are aerial photography, computer-based tool, namely, Geographical Information System (GIS). Also, visual observations are inexpensive and play a very vital role in landslide studies. The remote sensing employing sophisticated methods of information abstraction and interpretation as well as modern geodimeters for monitoring displacement are also being increasingly employed in this direction.

EDITORIAL

Landslide mitigation is both a science and an art of instant decision-making under uncertain premises in crisis times. Between landslide management and disastrous management lies the shadow of our degree of preparedness. The length of this shadow diminishes in direct proportion to the quality of our preparedness to face disasters. Both sound economic and scientific basis are needed for making decisions about reducing landslide-related losses. Quantitative risk assessment is a widely used tool for making such decisions as it provides estimates of the probable costs of losses and provides various options for reducing the losses. Such assessments can be either site specific or regional. Landslide risk treatment is the ultimate objective of the risk management process which aims to mitigate the effects of the hazard. This encompasses a five-pronged strategy comprising:

- Treating vulnerable slopes and existing hazardous landslides
- Restricting development in landslide-prone areas
- Preparing standards of practice for excavation, construction and grading
- Protecting existing developments
- Monitoring and warning systems

Common methods adopted for landslide prevention can be divided into two types viz. Direct Method and Indirect Method. Direct Method consists of construction of reinforced earth, polymer or metal gabions, retaining walls constructed in stone, RCC, CC, wire crates, wooden ballis, bamboos etc., according to the strength required and depending upon situations. Apart from this timber, metal or concrete cribwalls and sausage walls are also used as restraining structures. Butteresses are often used as retaining device to prevent landslide on the hill side. Anchor walls, restraint piles, prestressed rock anchors, tied back walls, reinforced earth, geo-grids and soil nailing are also adopted for resisting slides. Other techniques consist of design of proper slopes in soil, use of proper material to increase shear strength, excavation or removal of unsuitable materials, benching of slopes, change of grades, growing vegetation on slopes like Vetiver Grass and giving slope treatment using jute or coir netting, metal netting, geo-fabrics, geo-composites, geo-grid, woven or non-woven geotextiles, band drains, etc. The Indirect Method of landslide prevention consists of methods for effecting proper surface and sub-surface drainage. This is achieved by construction of properly designed catch water drains, road slide drains, cross drains, horizontal drains in sub-surface, deep drainage drains etc. Maintenance of these drains are often neglected which causes as one of the trigger for landslides.

Landslide clearance becomes a main maintenance activity in the case of roads in many hill ranges of India. Control of landslides is an on-going process and requires in-depth study of number of aspects. Till recently, methods of landslide correction in India relied to a great extent on individual experience without taking proper recourse to appropriate geological investigations in the field. Detailed geological and field investigations together with proper design of preventive and control measures are essential to have a stable slope. Because of highly heterogeneous and variable nature of rock formation as well as geological environment in which they are found, it is difficult to achieve an uniform standardization in regard to landslide control measures. However, a fairly correct measure can be determined from the broad spectrum of available measures with the help of experience and expertise and from the investigations and test results.

The problem of landslide has assumed very great importance in our country because tremendous expansion in road and building construction activity in Hilly and Ghats regions. Therefore, it is important that we look afresh at the issues of saving lives and property and build a new culture of landslide disaster management; one of preparedness, quick response, strategic thinking and prevention of eventualities in the context of developing immense possibilities in man and technology.

R.P. Indoria

(R.P. Indoria)
Secretary General