

# Overall Conclusions and Recommendations for a Practical Training Programme

## Conclusions

The conclusions drawn from this study are summarised below.

1. A diversity of landslide types prevails in Pakistan, and this is attributed to local geological, climatological, and geomorphological conditions. In the northern parts of Pakistan, the landslide phenomenon occurs more frequently than in other parts of the country.
2. Plane and wedge failures on the Batgram-Thakot section of the Karakoram Highway are more abundant than other types of slope failures, while rockfalls and topples are not uncommon on this important route due to steep cutting and blasting. In the Hunza Valley, on the other hand, different types of failure occur, including mudflows.
3. Circular failures and 'flows' are more frequent in the alternate sandstone and clay layers of the Murree Formation along the Murree-Muzaffarabad Road.
4. Heavy rainfalls and rainstorms, 'reduction in strength of materials on saturation, and earthquakes, although of small magnitude, are the major factors contributing to landslides.
5. Very few government and non-government institutions are involved in research on this problem. Difficulties in bringing about coordination and finding funds for such activities prevent detailed and appropriate studies.

## Recommendations

The following recommendations have been made in the light of the above conclusions.

1. To overcome the problem of landslides and the consequent disasters and losses, a centre for environmental studies (particularly for landslides) should be set up in institutions concerned with geology.
2. The proposed centre must be very well coordinated with the departments or organisations looking into the landslide problem. Any sliding phenomenon, throughout the country, should be immediately documented and initial studies carried out.
3. Landslide inventory maps of the entire northern parts of Pakistan should be prepared and continually updated.
4. The proposed centre should endeavour to mobilise agencies other than the government to come forward and participate in the efforts to mitigate this catastrophic and hazardous phenomenon.
5. Government and non-government agencies should arrange training courses and workshops frequently and use the media for effective propagation and dissemination of knowledge. Two types of courses for practical training are recommended.
  - a) An awareness course for people living in mountain areas (including school children) given by educational institutions and local union councils. The purpose of this training (lasting for 2-4 weeks) should be to identify the problems in the villages and emphasise the need for vigilance and for applying precautionary measures.
  - b) A technical course covering geological, geotechnical, and environmental reports should be arranged for a period of four to six weeks by the universities or the concerned authorities, e.g., the National Highway Authority and Communication Works' Department. The trainees should be from research organisations, universities, colleges, and departments concerned with the development of mountainous areas, highways, and others.
6. Since only five per cent of the land area is covered by forests, intensive afforestation programmes should be carried out.