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Simple and Inexpensive Approaches in Identifying and Early Warning of Landslides - Some Case Studies

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ABSTRACT

Instrumentation for monitoring of landslides is normally regarded as a very expensive exercise and hence is always discouraged due to funding limitations. However, there have been several preliminary monitoring studies carried-out in Sri Lanka with locally available knowledge and techniques to suit conditions at a specific locality. Some of the basic parameters of interest useful in landslide monitoring are rainfall, subsidence, heave at landslide toe, tilt and development of cracks, water level measurements, magnitude of displacement, structure slope interaction etc. The following case studies are discussed in detail in this paper.

Trees tilt backward or forward to respond to ground displacements. During a long period of quiescence following a very long spell of movement, one should be able to estimate the period of quiescence by comparing the growth rings (ages) of a vertical tree with that of a tilted tree at the same location. Structures on active slopes may develop cracks and tilt. One of the most significant and at the same time very clear indicator is the presence of a discrete boundary between the stationary and the sliding masses. An outstanding Sri Lankan example is the Watawala earth slide where the discrete earth slide boundary shears are evident.

The simplest and the easiest approach to monitor the slope behaviors is to take recourse to (i) surveying measurements on a pre-established surface grid, (ii) measurement of displacements of surface boundaries, rock outcrops, trees, pillars posts, pegs, monuments or such other observation points on that grid. For remote measurement of slope movement, the observation points can be coupled to an appropriate measuring system. The debris cum rock-fall in Viharagala on the Beragala–Haputale road had destroyed and blocked the road. Many dangerously positioned boulders still remain on the slope. A heavy rainfall could easily slide them down again. These dangerously positioned widely-spaced boulders cannot be dealt individually. Therefore, rock-fall fences with electrical wire detection have been installed on the slope.

In Matale area, several cracks were found in walls and floors of houses. Crack monitoring inside houses is essential in giving warnings against catastrophic failures. The monitoring data confirms their non-uniform behavior and even an extremely low rate of displacement in landslides may endanger human life and property. The crack-gauge developed by NBRO as the monitoring device in this study at Matale has confirmed its reliability for measuring in-plane displacements in severe conditions with simple manipulation, minimum maintenance requirements and at a reasonable price. Though these approaches described above are simple and inexpensive, those provide very valuable information in mitigating landslides.