



Use of historic landslide inventories for hazard assessment along communication routes

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Communication routes such as railways or roads in hilly terrain are often prone to slope failure and in due course of time they often retrograde into landslides of larger dimension. Quantitative landslide risk assessment along such corridors requires detailed information on the temporal and spatial probability of slope failures. Such information is normally very difficult to collect, unless historic data on road blockage can be collected from the road maintenance department.

A study was carried out along a 19 km long section of road and railway routes, constructed through the steep slopes of the Nilgiri hills of Southern India, to quantify landslide risk. Geologically, the routes sectors are constructed in charnockite rocks overlain by lateritic soil, with a thickness up to 10 meters. A landslide inventory, was prepared from technical documents of the road and railway maintenance organizations for the period from 1987 to 2007. Out of a total of 783 landslides, the majorities (96%) are shallow debris slides associated with cut slopes. Their volume ranges from two to 3600 m³. Within this period, 94 individual landslide events were recognized of which 40 events resulted into 1 slide, 37 with 2 to 10 slides, 8 with 11 to 20 slides, 10 with 21 to 45 slides and 2 events with more than 50 slides. Out of the 94 events, 75% of them occurred during October to December and 25% during January to September. The incidences of landslides are clustered in particular zones and in particular periods. For example, after the rainfall event of 14th November 2006 the percentage of the road affected by landslides ranged from 5% to 35% in different sectors. The minimum rainfall threshold required for initiating shallow debris slides along the cutslopes were calculated, at different sectors of the routes, from the relationship between daily and

antecedent rainfall. Out of the 3, 5, 15 and 30 days antecedent rainfall, the 5-days one was found to be most appropriate. Even in such a geographically small route stretch, the minimum threshold lines show considerable variation. The slope of the lines varies from 0.74 to 1.5 with intercept varying from 35mm to 250 mm of daily rainfall. These thresholds were validated with the 2006 and 2007 events (which were not included in model preparation) and the success rate showed that 52% of landslide events during October and December were occurring when the threshold was exceeded. The same threshold showed bad results for small landslides occurring in January and February. Based on the average rate of occurrences of such landslide triggering rainfall event, in the time period considered, the probability of occurrence of one or more such event annually as well as in 3, 5, 15 and 30 years time were made. The average annual probability was found to be as high as 90% in some of the route sectors.