

LANDSLIDES AND SURFACE EROSION FROM ROADS – EXPERIENCES IN ASIA

SIDLE, R.C.

Disaster Prevention Research Institute
Kyoto University. Email: sidle@slope.dpri.kyoto-u.ac.jp

ABSTRACT

Secondary roads provide vital links between towns and villages in mountainous topography. Nevertheless, mountain roads create instability problems by: (1) altering natural hydrologic pathways; (2) undercutting unstable slopes; (3) overloading and oversteepening fillslopes; and (4) placing unstable fill on slopes subject to seismic activity. In Asia, such roads are constructed under a wide array of jurisdictions, thus, engineering design and standards as well as the structural and non-structural controls on landslide and surface erosion differ greatly from place to place, and investments in such control measures are not always commensurate with the resources being protected. For example, in Japan, large expenditures are made on structural control of landslide erosion along secondary mountain roads, because of the large number of both rainfall and earthquake-triggered slope failures that have occurred in these settings. The high costs of structural stabilization measures, along with their adverse environmental side-effects, beg the need to consider non-structural and avoidance alternatives related to planning, location, and design of secondary road networks. A major typhoon (≈ 1 m of rain) that struck Miyagawa, Japan, in autumn 2004, destroyed much of the mountain road network due to landslides, preventing the forest land owners from managing their property. In spite of the opportunity to redesign a more economically efficient road system in the area, the government elected to reopen the same roads with a high investment in structural controls. At present, there is little objective scientific basis for making such decisions in Japan. Lesser attention is being paid to the more easily correctable problem of surface erosion from mountain roads. Field studies on mountain roads in granitic terrain show that annual soil loss from unpaved road surfaces is in the range from 1.5 – 9 mm. Recent studies in Fudoji, Japan, suggest that the surface erosion from road surfaces is affected by the geomorphology of the upslope area, with concave hillslopes producing the most erosion by means of higher intercepted subsurface flow. In contrast to the high structural controls used along secondary roads in Japan, such roads in much of Southeast Asia are typically poorly located, with little attention to basic road drainage and erosion control. Monsoon storms generate high rates of surface erosion from unpaved roads in Thailand and Malaysia (up to 27 mm/yr); in moderately steep terrain, cutbank slumping and small landslides may contribute as much as 15 t/ha/yr to the sediment budget. Herein, the need to better assess the extent of the sediment fluxes and hazards along mountain roads is emphasized based on how road corridors acts as both sources and conveyers of sediment.

Keywords: roads impacts, landslides, monsoon storms