Rainfall and Slope Failures in the Granitic Bedrock Areas of Peninsular Malaysia

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Most slope failures in the granitic bedrock areas of Peninsular Malaysia occur during, or following, short periods (< 3 hr) of intense rainfall, or longer periods (> 1 day) with somewhat continuous rainfall. These failures usually occur when the total cumulative rainfall exceeds 70 mm and include debris flows that occur at steep (> 40°) natural ground slopes and embankments in mountainuous terrain. Slump-flows occur at embankments in undulating to hilly terrain. Earth falls and shallow slips occur at steeply sloping (> 60°), low cuts, and upper benches of high cuts (> 10 m high), that expose completely weathered bedrock materials (Morphological Zone 1). These failures occur long after the end of excavation and are usually preceded by the development of tension, and desiccation, cracks. Where the low cuts intersect groundwater tables in undulating terrain, slumps can sometimes occur. Small to large, slumps and slump-flows, occur at high cuts (> 10 m high) excavated at moderate overall angles (usually > 45°, though mostly > 55°), that expose completely weathered, and highly to moderately weathered, bedrock materials (Morphological Zones I and II). These failures occur towards, as well as some months to several years after, the end of excavation; the slumps only occurring at cuts where unweathered bedrock is found close to the ground surface. The slump-flows occur as a result of several converging factors, including the presence of a triggering factor that can be provided by passing heavy vehicles. Wedge failures, block slides and rock falls can occur at the steep (> 60°) lower benches of some high cuts that expose unweathered bedrock (Morphological Zone III)

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 26, No. 5, September-October 2000