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Mechanism of combined earthquake and rain induced landslide in weathered volcanic slopes in Tandikat Area, West Sumatera, Indonesia

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This paper concerns with the combined mechanism of earthquake and rain-induced landslide which occurred in weathered volcanic slopes in Tandikat Area, West Sumatera, Indonesia on September 29, 2009. Geological and geotechnical site investigations, which include the drilling of two boring to a total depth of 50 meters, were carried out to investigate the geological conditions controlling the stability of slope. Series of ring shear tests were conducted to analyse the behaviour of saturated soils under the triggering of earthquake ground acceleration. Such analysis was also supported by slope stability numerical analysis with the finite element method.

According to the ring shear test, the actual seismic wave form with the Peak Ground Acceleration of 0.3 gal (which was about 42 KPa) for the period of 7 seconds could not induce the soil liquefaction which creates landslides. The slope stability analysis confirmed with this laboratory finding, by showing the Safety Factor more than 1 under the same acceleration and water pressure. In other hand, the monotonic loading of 1 gal (which was about 126 KPa) for the period of 60 seconds, in combined with the water pressure of about 60 KPa on 10 m thick silt-clay soil with the cohesion of 32 KPa and dry density of 14 KN/m^3, resulted in soil liquefaction and created continues rapid sliding in the slope. Therefore, it is apparent that the landslide occurred not only due to the extreme rainfall which can induce pore water pressure up to 60 KPa, but also due to the amplification of the earthquake acceleration in response to the local control on slope stability conditions, i.e. the slope morphology with the steep inclination (of 40 degree) as well as the existence of thick-loose tuffaceous silt-clay material covering the slope surface.