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# The initiation and positive regulation of the catastrophic Siaolin landslide

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The extremely high intensity rainfall of the 2009 Typhoon Morakot triggered numerous landslides in South Taiwan. The Siaolin landslide is the most notorious one where the down slope Siaolin village suffered heavy casualties. The geological characteristics of the Siaolin landslide and the sequence of this catastrophic event have been studied extensively. Even though the kinematics of the Siaolin landslide was depicted quantitatively via numerical simulation, the initiation and mechanisms associated with rapid moving of this landslide is poorly understood. A simplified rigid wedge model is accordingly used to study the initiation of the Siaolin landslide. The north plane of the wedge is assumed the bedding plane overlaid the matrix-supported colluviums whereas the south sliding surface is identified as a high angle fault. Besides, the crown of the Siaolin landslide is set as a tension crack on the eastern side of the wedge. The colluvium and fault gouge were collected from the Siaolin landslide site and a series of low- to high-velocity rotary shear tests was performed. The peak friction angle of the colluvium and the fault gouge are 22.8? and 18.3? under a velocity of 3.3 micron/sec. The factor of safety of the wedge can be calculated using a commercial wedge analysis tool. The result shows the wedge failure happened (FS$<$1) when the average water table attained 96% of the slope height. This result corresponds with the heavy rainfall triggered Siaolin case. Remarkably, the fault gouge, which composed of mainly angular and planar particles, tends to contract during shearing. It implies no normal stress increment provided during sliding and excess pore pressure could be generated. The shear behavior of the fault gouge contributes the positive regulation mechanism and the Siaolin wedge is apt to accelerate after the sliding initiated. Furthermore, the shear tests of the fault gouge and colluvium show the strength dropped substantially after peak under a high shear velocity (1.3 m/sec) condition. The steady state friction angles of the colluvium and fault gouge are 5.7? and 10.5?. With an increasing velocity after the initiation of landsliding triggered by the critical uplift water force, the rapid moving of the Siaolin catastrophic landslide is inevitable.

Keywords: Catastrophic landslide, Low- to high-velocity rotary shear, Friction coefficient, Wedge failure, Excess pore pressure