Determination of the viscosity value based on the influence of the sliding plane by using a flume channel

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Abstrak

Mudflow is a type of mass movement with high velocity. It is comprised mainly of silt and clay-sized particles. Mudflow movement behavior involves undrained shear strength and viscosity as part of a resistance force that withstands shear stress as a driving force. Many methods have been developed to determine the value of viscosity. This study used Vallejo and Scovazzo's modification method to determine the viscosity value, and assumed that mudflow material behaves as a Bingham plastic material. A flume channel was used in this study to measure the displacement and time required for mud to flow in order to obtain the mudflow transportation velocity. The measurement was conducted for four different slope angles and water contents. To compare the samples, Kaolin soil was used for the pilot project and Parakan Muncang soil was used as the natural landslide material in order to obtain the viscosity value throughout this study. This study aims to evaluate the capability of Vallejo and Scovazzo's method to determine the viscosity value. We found that Vallejo and Scovazzo's method cannot be used in a single slope angle. This approach requires that the sliding plane angle be adjusted for varying shear stress magnitudes, and that, consequently, different strain rates for each shear stress are obtained. The correlation curve between the shear stress and the strain rate, which corresponds to the Bingham plastic material curve, needs to be governed. The viscosity value was obtained by calculating the gradient of the linear tangent line. Furthermore, Vallejo and Scovazzo's method is recommended only for tests at a low strain rate level, as a high strain level would cause difficulties in recording string displacement and mud transportation time. However, testing mud at a low strain rate level will obtain a higher value of mud viscosity that is not representative of mudflow viscosity.