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Geotechnical shear zone properties of rockslides in crystalline rock

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Crystalline rocks such as gneisses, schists and phyllites are widespread in orogens. Slopes built up of these metamorphic rocks are prone for large-scale deep-seated mass movements. Many of these mass movements are rockslides characterised by slope displacement along one or several distinct sliding zone(s). These sliding zone(s) are typically composed of disintegrated loose rock material produced by shearing and fragmentation processes. For rockslides the stability is strongly controlled by the strength of these soil-like shear products, also referred to as kakirites and fault gouges. Therefore, information about the mechanical behaviour and the strength properties is crucial when slope stability analyses and reliable landslide forecasts have to be performed. Being aware of this demand, numerous investigations dealt with this issue in the past and produced plenty of data by the geotechnical laboratory testing of these materials. Nevertheless, the data is widely dispersed among various literature sources, making it nearly impossible for the reader to gain a clear overview.

The primary objective of this work was firstly to compile and re-analyse published laboratory data about frictional strength properties of shear zone materials sampled from brittle tectonical fault zones and sliding zones of rockslides and secondly to integrate them into a uniform database. Given that most of the geotechnical stability analyses are based on the Mohr-Coloumb law, the evaluation focuses on the parameters friction coefficient (friction angle) and cohesion. As a result, indicatory values for the shear strength parameters of kakirites and fault gouges for the most abundant crystalline rocks were obtained. The variable testing methods (i.e. triaxial tests and direct shear tests), different stress conditions during the tests and the inherent heterogeneity of the materials lead to a wide scatter of values. Therefore, a regression analysis was performed for each lithology and a statistical mean value as well as the associated normal fluctuation margins determined.

The presented data compilation does not replace site-specific geotechnical tests for case studies, but can provide assistance for preliminary stability analyses if appropriate geotechnical investigations have not yet been carried out or are not feasible.