Average Strength Parameters of Reactivated Mudstone Landslide for Countermeasure Works

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Among many approaches to landslide stability analysis, in several landslide-related studies, shear strength parameters obtained from laboratory shear tests have been used with the limit equilibrium method. In most of them, it concluded that the average strength parameters, i.e. average cohesion (c'avg) and average angle of shearing resistance (φ'avg), calculated from back analysis were in agreement with the residual shear strength parameters measured by torsional ring-shear tests on undisturbed and remolded samples. However, disagreement with this contention can be found elsewhere that the residual shear strength measured using a torsional ring-shear apparatus were found to be lower than the average strength calculated by back analysis. One of the reasons why the singular application of residual shear strength in stability analysis causes an underestimation of the safety factor is the fact that the condition of the slip surface of a landslide can be heterogeneous. It may consist of portions that have already reached residual conditions along with other portions that have not on the slip surface. With a view of accommodating such possible differences of slip surface conditions of a landslide, it is worthy to first grasp an appropriate perception of the heterogeneous nature of the actual slip-surface to ensure a more suitable selection of measured shear strength values for stability calculation of landslides. For the present study, the determination procedure of the average strength parameters acting along the slip surface has been presented through the stability calculations of reactivated landslides in the area of Shimajiri-mudstone, Okinawa, Japan.

The average strength parameters along slip surfaces of landslides have been estimated using the results of laboratory shear tests of the slip surface/zone soils accompanying a rational way of accessing the actual, heterogeneous slip surface conditions. The results tend to show that the shear strength acting along the slip surface of imperfectly-reactivated landslides cannot always be considered equal to its laboratory-measured residual strength. The engineers should rediscover the fact that it is reasonable to apply different strength parameters to the stability analysis depending on the actual conditions of the slip surface that are visible on the boring core samples. In that context, we suggest to show that it is more appropriate to consider average strength parameters for imperfectly-reactivated landslides, for which purpose the use of 'residual shear strength' in combination with other categories of shear strength is recommended. This way, the outcome of the stability analysis will be much more inclusive and representative of the non-slickensided portions of a slip surface as well.