



Discrete Boundary Shear Strength of a Landslide at High Rainfall Precipitation Zone in Sri Lanka

A.A. Virajh Dias, S.B.S. Abayakoon, and R.K. Bhandari

Abstract

Boundary shear strength of a landslide is an important parameter for stability evaluation, prediction and remedial designs. A comprehensive study for the determination of shear strength parameters within and at close proximity of the shear zone at Watawala Earthslide, which is located at a high rainfall precipitation zone in Sri Lanka, was carried out. Triaxial tests were conducted to observe the peak and ultimate relations between the shear stress, s' and the effective mean normal stress, $\bar{\sigma}'$. Even though there is a considerable scatter of data, the coefficient of regression is above 0.91 and the linear regression gave effective angle of internal friction 33.50° – 29.82° (peak) and 30.28° – 31.12° (ultimate state). The effective cohesion is 5.99–7.72 kPa (peak) and 0.91–13.77 kPa (ultimate). Loss of strength due to extensive movements is indicated by in-situ Direct Shear Tests results which have an average effective cohesion, C' , of 2.84–4.74 kPa and effective angle of internal friction, ϕ' , of 11.42° – 18.14° . In addition, the laboratory Ring Shear test results give residual angle of internal friction, ϕ_r' , of 9.48° and effective cohesion, c_r' , of 0.0 kPa. On the other hand, the laboratory values direct shear tests give residual internal friction angle, ϕ_r' , between 13.06° and 16.43° and effective cohesion, c_r' , of 0.334 kPa to 3.75 kPa. Thus, strength parameters are highly variable even at the shear zone, probably reflecting a different history of clay mineral weathering and alteration.

Keywords

Watawala Earthslide • Direct shear test • Effective angle of internal friction • Effective cohesion

A.A.V. Dias (✉)
Central Engineering Consultancy Bureau, Centre for Research & Development, Colombo 7, Sri Lanka
e-mail: aavirajhd@yahoo.com

S.B.S. Abayakoon
University of Peradeniya, Peradeniya, Sri Lanka
e-mail: sarathabayakoon@gmail.com

R.K. Bhandari
Landslide Hazard Mapping Project (UNDP/UNCHS) 1990–1996,
National Building Research Organisation, Colombo 5, Sri Lanka
e-mail: rajmce@yahoo.com

Introduction

Most of the Sri Lankan landslides investigated to date are mainly associated with high intensity rainfall, colluvium deposits, residual soils and saturated soil-rock composites. Since, reactivation of repetitive slides is highly dependent on shear strength at discrete boundaries, study on evaluation of parameters of such a landslide would amount to understand the sensitivity of high rainfall. According to the recent case studies, the Watawala Landslide is one of the premier examples to demonstrate the importance of evaluation of discrete boundary shear strength characteristics of soils in high rainfall precipitation zones in Sri Lanka. It is presently stabilized by dewatering and was considered as the most sensitive landslide in the 1990s (Fig. 1).