ABSTRACT

Landslides in the residual hill slopes in tropical countries such as Sri Lanka are initiated mainly by rainfall and are often categorized as shallow planar failures. Residual soil in tropics exhibit distinct soil layering due to varying degrees of weathering, more or less parallel to the ground surface. These layered formations may exhibit contrast in hydraulic and shear strength properties with depth, and this determines the stability of such slopes. The main objective of this study was to model a two layered soil formation subjected to a one dimensional water infiltration during a rainfall event, and to investigate the effect of changing permeability characteristics, and the layer thickness of the two layers, on failure depth, elapsed time and the mechanism causing a shallow landslide.

Two soil types, relatively coarse-grained and fine grained were assumed in the layered soil model. The permeability and the shear strength parameters typical for local residual soil types were assumed. The analysis considered two soil layers overlying one another, with varying infiltration conditions. In partially saturated soils, infiltration has been modelled as a 1-D phenomenon. In this regard, researchers have developed finite difference method based numerical schemes to represent the mixed form of Richard's equation. A MATLAB code representing the mixed form of Richard's equation (1931) was modified and used to address the objectives of this study. As the outcome of this analysis, the variation of pressure head profile across the depth of the two layers were modelled with elapsed time.

The stability analysis has been conducted for varying rainfall intensities and permeability characteristics using a pre-defined stability envelope according to the method proposed by Collins and Znidarcic (2004). This stability envelope was developed using the assumed shear strength parameters of the two soil types and it indicates the critical depth of failure as a function of pressure

correlation was observed with failure depth. It is also observed that the change in thickness of the layers does not change the failure mechanism, as determined for a given layer arrangement.

This study shows that the critical combination of factors: relative permeability, rainfall intensity and arrangement of the fine-grained and coarse-grained soil in the two layered system decided the hazard risk.