Slope Stability Analysis Considering the Apparent Cohesion for Unsaturated Soil

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Abstract

Intense rainfall is one of the major causes of slope failure due to the rise of water table and decrease in matric suction, especially in the cases of unsaturated soil. This analysis aims to investigate the mechanism of multiple slope failure considering apparent cohesion for unsaturated soil. These days, there are a number of studies have been conducted to locate the critical slip surface in slope stability problem: however most of them used non cohesive soil without considering increase in shear strength due to suction and apparent cohesion. In this study four models were coupled as a single unit. They are a two-dimensional (2D) seepage flow model for calculating the degree of saturation, moisture content, pore-water pressure within the slope body, a one dimensional (1D) surface flow (erosion/deposition) model to determining the runoff discharge, flow depth, rate of erosion and deposition, a 2D slope stability analysis model, and a 1D sliding block model. Numerical simulation results in considering the effect of apparent cohesion and experimental measurements are quite close in terms of predicted critical slip surfaces and corresponding failure time of the slope model.

Keywords : Landslide, Seepage Flow, Slip Surface, Sliding Block Model, Unsaturated Soil

1. Introduction

In geotechnical engineering, the limit equilibrium methods frequently have been used in order to study slope stability problems. In the 50s, Janbu (1954) developed his method for generic slip surfaces whereas Bishop (1955) developed their methods for circular surface only. In 60s and 70s, Spencer (1967), made advances in the method. They made the limit equilibrium method a more powerful, refined tool for analysis of slope stability and the results from other comparative studies show that the factor of safety with respect to moment equilibrium is relatively insensitive to the their interslice force assumption. Shear strength of soil registered a very essential engineering property in geotechnical. Several empirical procedures have been developed for predicting the coefficient of permeability and shear strength of unsaturated soils. Vanapalli et al. (1996), Fredlund et al. (1996), have used the soil – water characteristic curve (SWCC) along with the saturated shear strength parameters to estimate the shear strength of unsaturated soils. The application of dynamic programming in slope stability was first published by Backer (1980). In