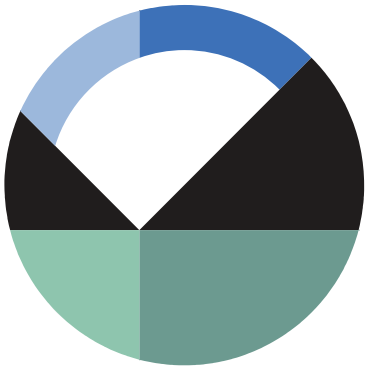
Add-In: Saturated-Unsaturated SHANSEP



GEOSLOPE International Ltd. | www.geoslope.com

1200, 700 - 6th Ave SW, Calgary, AB, Canada T2P 0T8
Main: +1 403 269 2002 | Fax: +1 888 463 2239

Introduction

This simple add-in allows different tau-sigma ratios to be defined for the saturated and unsaturated zones. A practical application of this model would be the analysis of a geotechnical structure under a pseudo-static dynamic load, where a different undrained strength is required only within the saturated zone of the underlying soil.

Background

The add-in calculates the strength at the base of each as:

$$s_u = \sigma_v^{'} S \qquad \text{Equation 1}$$

where s_u is the undrained strength, $\sigma_v^{'}$ is the vertical effective stress, and S is the ratio of undrained strength to vertical effective stress. The add-in allows S to be specified uniquely in the saturated and unsaturated zone for a single material. The vertical effective stress calculation gives consideration to the slice weight, surcharge loads, and the y-seismic force. If the pore-water pressure at the base of the slice is negative (i.e. unsaturated zone), the pore-water pressure is ignored from the vertical effective stress calculation.

Numerical Experiment

The numerical experiment comprises a simple homogenous slope with the pore-water pressure defined using a piezometric line. There are two analyses in the file. The material is defined using the Shear-Normal Function material model, as this is required to access the Shear Vertical Effective Stress add-in. In the first analysis, the S ratio is the same in the saturated and unsaturated zone. Figure 1 presents the shear-normal function used for the second analysis. The shear-normal type is

set to ‘Add-In Function’ and the saturated and unsaturated strength ratios are set to 0.75 and 0.2, respectively.

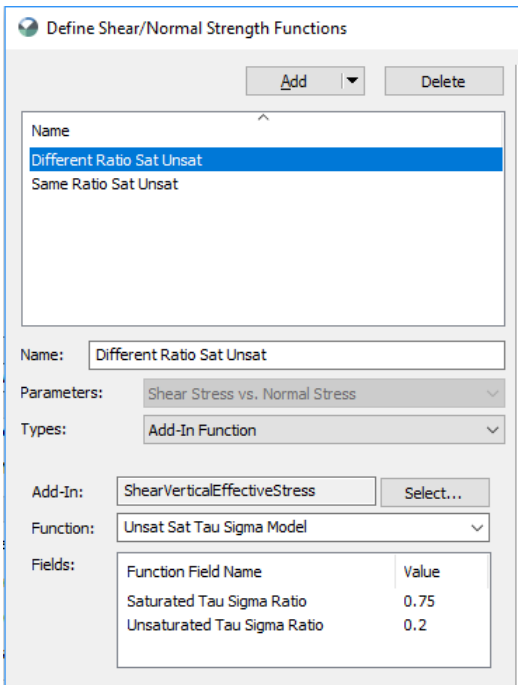


Figure 1. Strength definition in the saturated and unsaturated zone.

Results and Discussion

Figure 2 presents the undrained strength calculated at the base of each slice. The sharp transition between slice 5 and 6 occurs at the phreatic surface. Slices 6 through 31 are using the S ratio for the saturated zone.

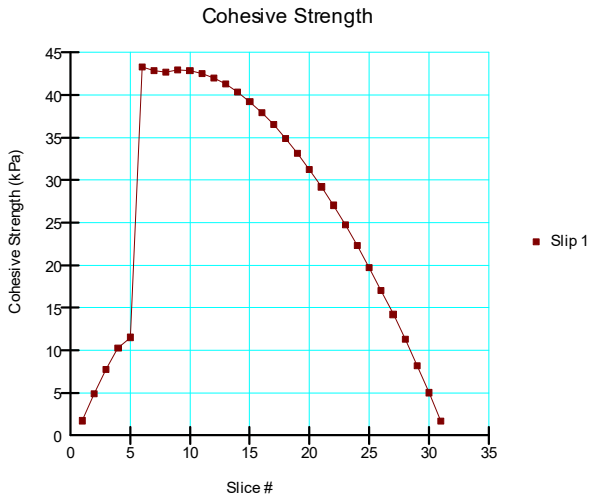


Figure 2. Undrained strength verses slice number.