Water infiltration characteristics of unsaturated soil slope and its effect on suction and stability

ABSTRACT

Rainfall has been considered the cause of the majority of slope failures and landslides that happened in regions experiencing high seasonal rainfalls. The mechanism of the failures was mainly due to the lost of matric suction of soils by rainwater. This paper presents the results of a laboratory model study on the effect of slope angle and surface cover on water infiltration into soil and soil matric suction. A field infiltration test is carried out for comparison. A parametric study is also done to examine the effect of permeability ratio, development of perched water table and rainfall intensity on the factor of safety against instability of a soil slope. Results of the model study show that different surface covers on slopes have an effect on the water infiltration. Generally the covered surface (grass or geosynthetic net) has a lower infiltration rate compared with the bare (no cover) surface. On the effect of slope angle, it was observed that water infiltration decrease with increase in the slope steepness. With regards to the movement of the wetting front, it appears that water infiltration is more at the toe compared with the top of the model slope. Based on the parametric study, it is found factor of safety of the slope against instability drops for slope with higher ratio of permeability for the permeable and impermeable stratum. As the perched water table is formed, the factor of safety decreased. The rainfall intensity also has a marked effect on the slope factor of safety. The higher the intensity of the rainfall, the higher is the infiltration rate into the soil, hence the lower is the factor of safety against slope instability.

Keyword: Landslide; Rainfall; Slope stability; Suction; Unsaturated soil; Water infiltration