



The stability of natural and man-made unsaturated slopes influenced by different rainfall patterns

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Abstract

Many slope failures have been recorded in Malaysia in recent times, particularly during the rainy season. An irregular rainfall is a change in rainfall patterns that is found to affect the slope stability with the infiltration of rainfall. The objective of this research is to investigate variations in the pattern of rainfall and their effect on the stability of natural and man-made unsaturated slopes in two separate site locations. Case A is located near a student's hall in Universiti Kebangsaan Malaysia (UKM), and another is located at the main entrance of UKM. Both cases are simulated with current and projected rainfall. The behaviour of the slopes with applied rainfall is analyzed with generated pore-water pressure, displacement and factor of safety. The first case was conducted by including the rainfall records from January 2011 to January 2021 and future-oriented data in January 2050. The software package used for this case is Plaxis2D. The results indicate that the highest factor of safety captured for 2021 was 1.156, while the lowest factor of safety was 1.11. It is observed that the obtained safety factor decreased with increasing rainfall intensity. Moreover, the displacement obtained was 0.1761 m. In Case B, the capillary barrier system was used consisting of two layers of soil with different hydraulic properties as slope cover. A parametric study was performed to investigate the effect of several variables, including the hydraulic conductivity of soil and the rate of infiltration. By using SEEP/W from the GeoStudio, the results obtained show that the pore-water pressure in the initial slope is higher than the slope with the capillary barrier system. In addition, the factor of safety was calculated in SLOPE/W, indicating that the slope with a capillary barrier system has a high factor of safety than the original slope. The capillary barrier system was seen to improve slope stability by reducing the rainwater infiltration. These two cases were investigated in regard to the behaviour of unsaturated slopes within the changing rainfall and the unsaturated soil conditions.

Keywords Irregular rainfall · Pore-water pressure · Slope displacement · Factor of safety · Unsaturated slopes

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