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Analysis of rainfall infiltration velocity of unsaturated soil and its relationship with safety factor changes of an infinite slope

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This study was conducted to characterize on the relationships of rainfall intensity and infiltration velocity dependent on unit weight in both gneiss weathered soil and granite weathered soil using a column test equipment. In this study, volumetric water content and pore water pressure were measured using TDR sensors and tensiometers at a regular time interval. Unit weight conditions of soils are determined based on the in-situ conditions. For the column test, three steps of unit weights are set as in-situ condition, looser condition and denser condition. Rainfall intensities are selected as 20mm/h and 50mm/h. In the conditions of rainfall intensity 20mm/h and the three unit weights of soil, average rainfall infiltration velocities of gneiss weathered soil and granite weathered soil were 2.854×10-3cm/s∼1.297×10-3cm/s and 2.734×10-3cm/s∼1.707×10-3cm/s respectively. In the conditions of rainfall intensity 50mm/h, rainfall infiltration velocities were 4.509×10-3cm/s∼2.016×10-3cm/s and 4.265×10-3cm/s∼3.764×10-3cm/s respectively. As the results of this test, the higher rainfall intensity and the lower unit weight of soil, the faster average infiltration velocity. Granite weathered soils of rainfall infiltration velocities were faster than gneiss weathered soils of rainfall infiltration velocity except for the looser conditions. These results are related with more homogeneous particle size of granite weathered soil than that of gneiss weathered soil, smaller unit weight condition and larger porosity of granite weathered soil than gneiss weathered soil.
This study also analyzed changes of safety factor of an infinite slope based on the result of rainfall infiltration velocity by the column test. The safety factor was calculated by an equation based on the concept of quasi-dynamic wetness index considering saturation depth ratio dependent on rainfall duration. The equation can calculate the safety factor of a slope on each time due to changes of saturation depth ratio with rainfall in soil. The analyses results show that safety factors were changed rapidly with lower unit weight of soil and higher rainfall intensity. Therefore, it can consider the effect of rainfall on the slope stability.