NUMERICAL ANALAYSIS ON SINKHOLE STABILITY INDUCED BY RAINFALL

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Abstract

Sinkholes are more reported to occur during rainfall seasons rather than dry seasons, especially after long drought seasons. However, the stability of underground cavity is known to increase with ground water table rise because of the decrease in the effective stress. The changes in the ground water table resulting from heavy rainfall does not explain the frequent sinkhole occurrence; other geohydrological factors have to be accounted for the reduction in cavity stability. In this study, the cavity stability was numerically evaluated considering the effect of the dissipation of negative pore water pressure, head difference between the cavity and surrounding soil, and the increase in overburden pressure above the cavity due to rainfall. The finite element analysis software, PLAXIS, was adopted for stability calculation, and the Hardening Soil model was used to define the stress-strain behavior of soils. In order to simulate the behavior of unsaturated soils, the van Genuchten model was adopted for Soil Water Characteristic Curve, and the negative pore water pressure was simulated accordingly. The variation of cavity stability with rainfall duration was calculated for different head difference and the increase in the overburden pressure. Considering the heavy rainfall and the three geohydrological factors, the cavity stability was found to significantly decrease with time, indicating that geotechnical simulation should account for not only the change in pore water pressure resulting from rain fall but also the change in head difference and overburden pressure.