Simulation of Unsaturated Soil Behavior by the Finite Element Method

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The mechanical behavior of partially saturated soils can be very different from that of fully saturated soils. It has long been established that for such soils, changes in suction do not have the same effect as changes in the applied stresses, and consequently the effective stress principle is not applicable. In this paper, a trial embankment on unsaturated soil was analyzed by the finite element method. A procedure was proposed to define the H-Modulus function by applying fitting methods. It depends on identifying the basic properties of the soil such as Attereberg limits and particle size distribution in order to predict the soil water characteristic curve by applying fitting methods with the aid of the program (SoilVision). Then this relation is converted to relation correlating the void ratio and matric suction. The slope of the latter relation can be used to define the H-modulus function. The finite element programs SIGMA/W and SEEP/W were used in analysis. Parametric study was carried out and different parameters were changed to find their effects on the behavior of unsaturated soil. The study reveals that the degree of saturation has a major effect on the consolidation process. The effect of degree of saturation on the behavior of unsaturated soil is apparent at early stages of consolidation and diminishes when the time proceeds. The effect of unsaturated soil on consolidation characteristics appears at early stages of loading. It was concluded that the effect of unsaturation becomes greater at the middle of the clay layer and near the center line of the embankment where more load concentrates than at its toe