

STATE SURFACES FOR UNSATURATED
(PARTIALLY SATURATED) SOILS

Suraj de Silva
National Building Research Organisation, Colombo 05.

Vast areas of the earth's surface is covered with unsaturated soils. However, our knowledge of the behaviour of unsaturated soil is very limited because of its very complex nature. Saturated soil is less complex as it consists of only two phases; soil, and water. Therefore, research in soil mechanics in the past has been concentrated on saturated soils. With the development of tropical, semi-arid and arid regions of the world where such soils are abundant, a better understanding of unsaturated soils has become essential. Hence, at present, there is much emphasis in research into unsaturated soils.

The principle of effective stress is a fundamental law in soil mechanics or more specifically, in soil mechanics of saturated soils. With the effective stress principle, it is possible to relate the behaviour of the two phases, soil and water, to one parameter which is called effective stress, thus simplifying the treatment of saturated soil. Many early researchers also attempted to describe the behaviour of unsaturated soils in terms of an effective stress. Bishop's equation of effective stress, an early attempt to define an effective stress for unsaturated soils, was initially widely accepted. However, attention has now been drawn to many fundamental shortcomings of this equation and it is not possible to describe the behaviour of unsaturated soils in terms of effective stresses as in the case of unsaturated soils.

An alternative approach to describe the behaviour of unsaturated soils is discussed. It is shown that $(\sigma - u_a)$ and $(u_a - u_w)$, where σ , u_a and u_w are applied stress, pore air pressure, and pore water pressure in an unsaturated soil medium, are stress state parameters. It is also shown that void ratio (e) and the degree of saturation (S_r) are state parameters for unsaturated soils. Hence, they (e and S_r) define state surface, in the spaces, $[\sigma - u_a)$, $(u_a - u_w)$, $e]$ and $[\sigma - u_a)$, $(u_a - u_w)$, $S_r]$, provided certain conditions are observed.