

Behavior of some clays on drying and wetting paths

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Abstract This paper presents an experimental study carried out on some clayey soils of Tlemcen region situated in the North West of Algeria. The characterization of the volumetric behavior under the effect of suction is studied on drying–wetting paths which highlight the correspondence between void ratio, degree of saturation, and water content versus suction. The initial conditions of studied material are in slurry form and compacted at different initial water contents. For the slurry form, correlations are derived to predict parameters characterizing the drying path.

Keywords Clays · Drying–wetting path · Suction · Slurry · Compacted · Correlations

Introduction

Compacted soils are commonly used in the construction of soil structures as roads, embankments, and earth dams. Several researchers highlighted the influence of compaction stress and compaction water content on the behavior of unsaturated clayey soils (Taïbi et al. 2011; Fleureau et al. 1999, 2002; Abou-Bekr et al. 2006).

Volume and water content changes in soils are the consequences of environmental factors, such as drying–wetting cycles. Also, changes in the groundwater level generate the shrinkage and the swelling of the soil surface.

The parameter associated with those changes in volume and water content in soils is the negative pore water pressure (u_c) called also capillary pressure or suction. The suction is defined as the difference between the air pressure (u_a) and water pressure (u_w) in the soil:

$$u_c = u_a - u_w \quad (1)$$

In unsaturated soils, the soil–water characteristic curve represents a constitutive relationship. In other words, the soil water characteristic curve describes the relationship between soil suction and soil water content, it also describes the changes in degree of saturation (S_w) or void ratio versus suction (u_c).

It can be used as a tool for the determination of the degree of saturation or water content changes in the soil on drying or wetting paths and to determine also the associated void ratio versus (u_c). This paper presents some experimental results obtained on drying–wetting paths on four clayey soils specimens all collected from Tlemcen region. The selected soils have different liquid limits and diverse areas of use:

- The bentonite of bental factory of Maghnia, used as drilling mud
- The bentonite deposit of Maghnia, the natural material used in the manufacturing of drilling bentonite
- The marl of Bouhennak
- The clay of Sikkak, used in the core of “Sikkak” earth dam

Materials and testing methods

Materials

Table 1 summarizes the results of the physical, chemical, and mechanical identification of the four studied soil specimens.

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