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The relationship between water content and swelling parameters of soils

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The level of swelling dependent damages of low-rising engineering structures constructed on and/or in unsaturated zone of soil deposits is generally controlled by mineralogical compositions and water content of soils. It is well known that seasonal or even daily variations in water content causes volumetric changes within unsaturated zone of a soil composed mainly of swelling type clay minerals. In this regard, in addition to mineralogical composition of soils, water content should be considered as another major factor for understanding swelling behavior of soils. It can be concluded from literature review that swelling parameters of soils were determined by performing experimental studies on dry samples or samples having natural water content without incorporating seasonal continuous variations in water content. Thus, the effect of variation in water content on swelling mechanism of soils is not yet sufficiently studied in previous studies. For achieving accurate understanding of swelling behavior at field conditions, a new approach is required to identify swelling parameter at different initial water content. For this purpose, a comprehensive study was performed to investigate the effect of water content on swelling behavior of soils and to find a new parameter for assessing swelling parameters of samples prepared at different initial water content conditions. Based on main objectives of this study, soil samples having wide range in terms of grain size distributions, mineralogical compositions and Atterberg limits were collected from different locations in Turkey. To minimize the effect of dry unit weight on swelling behavior of soils, samples were prepared at the same dry unit weight (14.6 kN/m3) and different initial water contents. It was determined that there is a linear relationship between initial water content and swelling parameters, and swelling parameters decrease with increasing initial water content conditions. By utilizing this relationship, a new approach called as “Soil Swelling Designation” is recommended to predict the swelling parameters of any soil in any water content.

Key words: Initial water content, soil swelling designation, swelling pressure, swelling percent