Stability in Slopes Related to Expansive Soils

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Abstract : Expansive soils are characterized by their significant volumetric variations, tending to suffer an increase of this volume when added water in their voids and a decrease of volume when this water is removed. The parameters of resistance (especially the angle of friction, cohesion and specific weight) of expansive or non-expansive soils of the same field present differences, as found in laboratory tests. What is expected is that, through this research, demonstrate that this variation directly affects the results of the calculation of factors of safety for slope stability. The expansibility due to specific clay minerals such as montmorillonites and vermiculites is the most common form of expansion of soils or rocks, causing expansion pressures. These pressures can become an aggravating problem in regions across the globe that, when not previously studied, may present high risks to the enterprise, such as cracks, fissures, movements in structures, breaking of retaining walls, drilling of wells, among others. The study provides results based on analyzes carried out in the Slide 2018 software belonging to the Rocsience group, where the software is a two-dimensional equilibrium slope stability program that calculates the factor of safety or probability of failure of certain surfaces composed of soils or rocks (or both, depending on the situation), - through the methods of: Bishop simplified, Fellenius and Janbu corrected. This research compares the factors of safety of a homogeneous earthfill dam geometry, analysed for operation and end-of-construction situations, having a height of approximately 35 meters, with a slope of 1.5: 1 in the slope downstream and 2: 1 on the upstream slope. As the water level is 32.73m high and the water table is drawn automatically by the Slide program using the finite element method for the operating situation, considering two hypotheses for the use of materials - the first with soils with characteristics of expansion and the second with soils without expansibility. For this purpose, soil samples were collected from the region of São Bento do Una - Pernambuco, Brazil and taken to the soil mechanics laboratory to characterize and determine the percentage of expansibility. There were found 2 types of soils in that area: 1 site of expansive soils (8%) and another with non- expansive ones. Based on the results found, the analysis of the values of factors of safety indicated, both upstream and downstream slopes, the highest values were obtained in the case where there is no presence of materials with expansibility resulting, for one of the situations, values of 1.353 (Fellenius), 1,295 (Janbu corrected) and 1,409 (Bishop simplified). There is a considerable drop in safety factors in cases where soils are potentially expansive, resulting in values for the same situation of 0.859 (Fellenius), 0.809 (Janbu corrected) and 0.842 (Bishop simplified), in the case of higher expansibility (8 %). This shows that the expansibility is a determinant factor in the fall of resistance of soil, determined by the factors of cohesion and angle of friction.

Keywords : dam. slope. software. swelling soil