

Title: COMPARATIVE STUDY ABOUT THE CHANGE OF PROPERTIES DUE TO THE ADDITION OF SURFACTANTS TO COMPACTED SOILS. MEASURE OF THE SUCTION AND THE UNIAXIAL COMPRESSIVE STRENGTH.

Author: Miquel Oliveras Colomer

Tutors: Josep Suriol Castellví and Antoni Lloret Morancho

ABSTRACT

The main aim of this essay is to study the influence that interstitial water surface tension can produce on the sand mechanical behaviour. We could possibly measure a change in the suction from the soil for the same water content. Therefore, we could see the changes in its mechanical behaviour.

In the first place, a measure of the capillary rise of the water was made. With that test, it was proved the influence of the addition of surfactant (Dehydol) on the water, because it reduced its surface tension and, therefore, its capillary rise.

Once the influence of the addition of surfactants on the water was verified in the capillary phenomenon, we tried to find out if this difference was also produced when talking about the capillary rise through Castelldefels sand. However, the capillary height measure was yielded the same results in both cases, so that we can conclude that the decrease in water surface tension has no effects on capillarity or at least we can claim that the possible effect is less influential than the inevitable mistakes of such a test.

Secondly, we proceeded to the obtainment of the sand-water characteristic curve in order to prove the hysteresis produced on drying and wetting curves. These curves link the soil water content with its matric suction. The results show that, under the same water content, the matric suction in the soil with Dehydol is lower.

From this point, we carried out some mechanical tests. We executed a uniaxial compressive strength test. The results were nearly the same, both in soil and pure water tests tubes, and in surfactant tubes.

Immediately afterwards, we made a tilt test. Unfortunately, the results obtained in this case proved the indefinite slope hypothesis to be inapplicable to the model done to scale. On the other hand, the apparent cohesion created from the suction made the vertical slope surfaces remain stable in all the cases.

The next test was the dynamic proving. In this case, we measured the penetration that a conical point could produce dropped from a certain height on a sand sample. The variable in this test was the water content, the same as in the uniaxial compressive strength test. Once again, the results were very similar, although the conical penetration in the samples with Dehydol were slightly higher.

The last mechanical test was the direct shear with a controlled deformation. We used two variables: the water content and the suction, both obtained from the sand-water characteristic curve. The results, both with and without surfactant, were very similar so that we can claim that the reduction of the interstitial water surface tension has not produced any relevant effect, either. However, the little difference produced is lower than the inherent mistakes of the test itself in any case.

To conclude with, we can claim that, as we tried to prove from the results obtained in all the tests, the reduction of the interstitial water surface tends to reduce the value of the suction under a certain level of water content on the soil and, therefore, to reduce its mechanical resistance. Nevertheless, we can point out that this is an influence comparable to the uncertainty of the test itself.