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ABSTRACT

Influence of solutions added into non-cohesive soils on their mechanical properties

Subject of this work are laboratory tests and field tests on the effect of surface-active additives, selected chlorides in selected concentrations, on the mechanical properties of a non-cohesive to weakly cohesive sandy soil. This influences the electrical double layer of the soil particles and thus the mutual attraction forces and electrical charging forces.

In order to be able to assess the mechanical properties, tests on compaction, the oedometer modulus, the shear resistance and the water permeability of the present sandy soil are carried out in the laboratory. The field tests are evaluated using the plate load test.

This sandy soil is a fine sand with medium-sandy, silty and clayey portions. According to (DIN EN ISO 14688-1, 2011-06) [94] this sand is classified as $fS, m\bar{s}, u'$.The compactability is determined by Proctor-tests according to (DIN 18127, 2012-09) [79], with the shear strength being determined using the direct shear test according to (DIN 18137-3, 2002-09) [86]. The examinations of the oedometer module are carried out in the laboratory according to (DIN 18135, 2012-04) [84] in the oedometer consolidation device, with the determination of the E-modules E_{v1} and E_{v2} as field tests using a plate load test according to (DIN 18134, 2012-04) [83]. Modified laboratory tests on the influence of the chlorides used on the water permeability of the soil are based on (DIN 18130-1, 1998-05) [82]. These investigations, which are common in soil mechanics, show the influence of the chlorides brought into the soil on its mechanical properties. In addition, according to (ISO13099-2, 2012-06) [103] measurements of the zeta potentials of the particles and thus the measurement of the electrical double layer of the particles should provide a possible explanation for the differences that occur in the emerging mechanical properties of the fine sand.

Salts, chlorides such as sodium chloride (NaCl) but also other thawing agents such as calcium chloride ($CaCl_2$) and magnesium chloride ($MgCl_2$) or other salts are applied to prevent ice formation or to thaw ice and snow on streets and pavements. While chlorides,

principally sodium chloride (NaCl) and calcium chloride ($CaCl_2$), in varying concentrations, have been used in the United States since the beginning of the last century to stabilize the soil of low cost roads and roads in general, they remain in Germany and most of Europe disregarded. The calculation of a slope failure using the parameters obtained in the laboratory for the mechanical properties is intended to show the effects on project planning.