Ain Shams University
Faculty of Science
Geology Department

Effect of stabilizers in the improvement of engineering properties of soil in some localities of the Nile Delta, Egypt.

By
Zeinab Lotfy El Sayed Belal
(B. Sc., M. Sc., Geology)

A Thesis

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APPROVAL SHEET

Ph.D Thesis

Name of student: Zeinab Lotfy El Sayed Belal

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Ph. D. Thesis:

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ABSTRACT

The present work is concerned with the study of engineering parameters, through the mineralogical composition of four soil groups from the Nile Delta, as well as evaluating the effectiveness of Cement Kiln Dust (CKD) and Granulated Blast Furnace Slag (GBFS) in stabilizing the selected soils. From the laboratory test results, five major soil groups were recognized on the basis of similarity in geo-engineering behaviours. The soils are generally fine grained and they are essentially clays with varying proportions of sand, silt and organic matter. The values of the various parameters indices are mainly influenced by the amounts of clay (and/or sand) and organic matter. Accordingly, the collected soil samples from specific localities of the Nile Delta were classified into four groups; group 1 is represented by extremely high plasticity, low compressive strength, high optimum moisture content and low maximum dry density; group 2 and group 3 are very high plasticity and high plasticity, respectively, whereas group 4 is characterized by medium plasticity. Clay fraction, liquid limit, plastic limit, plasticity index, swelling, shrinkage and the optimum moisture content values decrease through the soil groups from group 1 to group 4, whereas the compressive strength and maximum dry density increase in the same direction.

CKD, GBFS and CKD-GBFS mixture was added to two different soil types, in which the results show that, CKD, GBFS and CKD-GBFS mixture reduced the plasticity index, as compared to the untreated soil. With increasing the curing time, the plasticity index (PI) decreases with increasing the percentage of stabilizer whether CKD or GBFS. According to the engineering characteristics, the first one is mainly clay in composition and the second is mainly silt and fine sand. The effects of the used stabilizers (CKD and GBFS) on the two types of soils are completely different. Soil I, that located at Nasayma Village (Daqahlia Governorate) is mainly affected by CKD and the mixture of CKD and GBFS. On the other hand, the slag is an effective stabilizer on the soil II at El Mahala El Kobra area (Gharbyia Governorate), whereas CKD improved the soil workability. It is noticed that, the behaviour of slag is comparable to lime and CKD like cement in the soil improvement. The slag is used for the clayey soil, whereas the CKD is utilized in the sandy-silt soils in the stabilization purposes of the areas under investigation. The mixture of both additives is highly recommended for the stabilization of the selected soil materials, where the results of compressive strength increase at all curing times.

Key words: Engineering parameters, Construction problems, Plasticity index, Nile Delta.

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