IMPROVEMENT OF SOME SOFT CLAY SOIL PROPERTIES BY GEOPLYMER MATERIALS

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ABSTRUCT

In general, soil improvement by admixtures or simply (soil stabilization) is a common cost effective way to treat soft clay soils and overcome its undesirable behavior. In this way, this field have seen increasingly many attempts for finding the suitable soil admixtures.

The Geopolymers are innovative materials that illustrate good properties which were argued to overcome the other usual soil admixtures shortcomings. In order to develop the knowledge about the Geopolymer – soft clay strength and the consequent geotechnical performance, an experimental program was introduced, moreover, a considerable concern was conducted throughout this program to the temperature effects which can vary the properties of the resulting Geopolymers to a great extent.

The experimental program consists of main two parts to make a preliminary assessment of soft soil with this new admixture. The first part included the temperature effects on the mechanical strength of Geopolymer – soft clay mix that characterized by the unconfined compressive strength as well as the ductility and the stiffness that represented by failure strain and Young's modulus, respectively. While in the second part, some heated conditions was devoted to investigate some geotechnical properties like specific gravity, liquid and plastic limit, compaction characteristics and California bearing ratio. The microstructure of the treated soil was observed by the scanning electron microscope and the mineralogical changes

were detected by the X-ray powder diffraction using specific heating conditions. The percentage of source material used are 8, 10, 12, and 14 % by dry weight and the total liquid is 38 % which corresponds 4.75, 3.8, 3.167 and 2.714 liquid over fly ash used.

The experimental results showed that the optimum liquid over fly ash ratio with respect to peak unconfined compressive strength is 3.8 when the reported degree of improvement factor about 20.1. Ductility and stiffness were also enhanced considerably with degree of improvement of 3.5 and 8.7 respectively. It can be concluded also that the optimum temperature can vary according to the source material percent and nature.

The specific gravity and the maximum dry density decreased as the fly ash content increased whereas the optimum moisture content increased. The scanning electron microscope test illustrated the formation of the Geopolymer gel and the X-ray powder diffraction analyses confirms the chemical composition of this gel represented by the potassium alominosilicat hydrate and sodium alominosilicat hydrate.