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Effects of using silica fume and lime in the treatment of kaolin soft clay

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Abstract. Soil stabilization can make the soils becoming more stable by using an admixture to the soil. Lime stabilization enhances the engineering properties of soil, which includes reducing soil plasticity, increasing optimum moisture content, decreasing maximum dry density and improving soil compaction. Silica fume is utilized as a pozzolanic material in the application of soil stabilization. Silica fume was once considered non-environmental friendly. In this paper, the materials required are kaolin grade S300, lime and silica fume. The focus of the study is on the determination of the physical properties of the soils tested and the consolidation of kaolin mixed with 6% silica fume and different percentages (3%, 5%, 7% and 9%) of lime. Consolidation test is carried out on the kaolin and the mixtures of soil-lime-silica fume to investigate the effect of lime stabilization with silica fume additives on the consolidation of the mixtures. Based on the results obtained, all soil samples are indicated as soils with medium plasticity. For mixtures with 0% to 9% of lime with 6% SF, the decrease in the maximum dry density is about 15.9% and the increase in the optimum moisture content is about 23.5%. Decreases in the coefficient of permeability of the mixtures occur if compared to the coefficient of permeability of kaolin soft clay itself reduce the compression index (Cc) more than L- SF soil mix due to pozzolanic reaction between lime and silica fume and the optimum percent of lime-silica fume was found to be (5%+6%) mix. The average coefficient of volume compressibility decreases with increasing the stabilizer content due to pozzolanic reaction happening within the soil which results in changes in the soil matrix. Lime content +6% silica fume mix can reduce the coefficient of consolidation from at 3%L+6%SF, thereafter there is an increase from 9%L+6%SF mix. The optimal percentage of lime silica fume combination is attained at 5.0% lime and 6.0% silica fume in order to improve the shear strength of kaolin soft clay. Microstructural development took place in the stabilized soil due to increase in lime content of tertiary clay stabilized with 7% lime and 4% silica fume together.