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ENGINEERING PROPERTIES OF CLAYEY SOIL STABILIZED WITH LIME

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ABSTRACT

Kaolin soil represents the soft clay soil with a depleted bearing capacity and an elevated compressibility level. Thus, in order to hold up civil structures, the bearing capacity of kaolin soil needs to be raised. Several soil improvement procedures are currently available. These include soil replacement, preloading, corduroy and chemical stabilization. However, as these procedures are harmful to the environment, efforts to achieve soil stabilization ought to make use of materials that are environmentally friendly. The utilization of industrial waste that does not have a negative impact on the environment would represent a significant step forward in this area. Among the most frequently employed procedures to achieve soil stabilization is the utilization of a binder such as lime. This study puts forward an array of laboratory investigations to assess the influence of lime on the compressibility and swelling traits of soil. According to the findings, the liquid limit and plasticity index of soil is reduced with the introduction of lime. Pozzolanic reactions transpire due to the siliceous and aluminous nature of the material which has a negligible cementation value and is made up of large particles. This circumstance culminates in a reduction of the liquid limit. With a 9% application of lime, an elevation in the liquid limit was observed (a decrease in other reaction materials). This is attributed to the excessive presence of lime. The optimal water content rose from 20% to 23% with a 5% application of lime. The stabilizer content (lime) reduces the maximum dry density from 1.63 to 1.585 g/cm3. Lime content enhances the compressibility of soft clay by lowering the coefficient of volume compressibility (mv) reduces with increasing stabilizer content and the optimum percent for lime. This is a result of the reaction between lime and soil.

Keywords: kaolin, clay, stabilization, lime, compaction, compressibility.

INTRODUCTION

The usage of local soils in construction schemes is currently in the limelight due to escalations in the prices of premium materials. However, local soils are frequently saddled with inappropriate engineering traits that include a poor workability level and low strength. These setbacks represent major stumbling blocks in efforts to reduce costs in the field of construction through the utilization of local soils. Lime, cement, fly ash, lime–cement–fly ash admixture, emulsified asphalt, goofier and polymer among others, are commonly utilized as additives to enhance the geotechnical traits of soil. A substantial number of stabilization techniques for raising the engineering qualities of soil are also currently available. These include compaction, consolidation, grouting, Admix Turing, reinforcement and thermal techniques. For the most part, soil characteristics are altered to enhance the shear strength, loading capacity, stability, and the capacity for deformation management. The determination of an additive and its impact is dependent on the nature of the soil in question and the field circumstances. Hence, prior awareness on the mechanical behaviour of treated soil significantly influences the determination of an appropriate stabilizer.

Procedures to improve the engineering traits of soil that involve the introduction of chemicals such as cement, fly ash, lime, or a blend of these chemicals, usually change the physical and chemical characteristics of the treated soil. Two principal mechanisms are involved in the enhancement of soil properties through the utilization of chemicals (Asgari, Baghebanzadeh Dezfuli *et al.* 2015);

1. Enlargement of particle size attributed to cementation, rise in shear strength, alteration in plasticity traits, and a decrease in the odds for deformation.
2. Absorption and chemical binding of moisture that will pave the way for compaction.

For many years, researchers in this domain have concentrated their efforts on soil stabilization through the utilization of a range of additives including lime, cement, fly ash, industrial waste products, potassium nitrate, calcium chloride, silica fume and phosphoric acid (Basma and Tuncer 1991, Sherwood 1993, Bell 1996, Miller and Azad 2000, Harichane, Ghrici *et al.* 2011, Yilmaz and Ozaydin 2013, Fattah, A'amal *et al.* 2015, Fattah, Al-Saidi *et al.* 2015)

Soil stabilization is an economical and environmentally friendly process for altering the mechanical and chemical traits of soils through pozzolanic reaction for the purpose of enhancing their engineering qualities (Cuisinier, Auriol *et al.* 2011, Harichane, Ghrici *et al.* 2011). Chemical stabilization also plays a crucial role in the treatment of soil systems in relation to the construction of dams, canals, river levees and more than. However, studies on the effects and effectiveness of lime treatment on the consolidation behaviour of soil are exceedingly restricted. Compressibility is among the most significant properties of soil in the context of engineering construction. This feature is crucial for a wide variety of geotechnical applications that include dam projects,