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SCRUTINY OF SOIL STABILIZATION USING PECULIAR MATERIAL

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ABSTRACT

Clayey soils or expansive soil are usually stiff when they are dry and give up their stiffness as they become saturated. Stabilization is the process of physical and chemical alteration of soils to enhance their engineering properties and thus improving the load bearing capacity and engineering properties of soil. Soft clays soils are associated with low compressive strength and excessive settlement. This reduction in strength due to moisture leads to severe damages to buildings and foundations. The soil behavior can be a challenge to the designer build infrastructure plans to on clay deposits. This paper discusses the stabilization of clayey or expansive soil with the help of various materials like cement, lime, etc. In Civil Engineering aspects black cotton soil or expansive soil is giving hazardous Problems to engineers. To solve this problem we using soil stabilization process to improve soil properties, construction techniques and soil improvement.

Keywords: *Black cotton soil, soil stabilization, admixtures, eco-friendly waste*

1. INTRODUCTION

Due to the presence of a clay mineral montmorillonite in black cotton soil they exhibit alternate swelling and shrinkage when they are subjected to moisture content. This causes so many geotechnical problems. Soil stabilization. It is defined as chemical or physical treatments which increase or maintain the stability of a soil or improve its engineering properties.

One of them is expansive soil and it is highly weak because of the large changes in volume due to fluctuations in the moisture content. In monsoon seasons, water which is absorbed by soil results in swelling, and also in the reduction of bearing capacity. In dry seasons, these soils shrink or reduce in volume due to evaporation of water and they become harder. For effective treatment of soil, one of the methods is by adding the quantity of Sodium chloride to develop increased strength varies with the type of clay mineral present.

Natural soil is both complex and variable material because of its universal availability and its low cost, and high swelling it offers a great opportunity for skilful use as an engineering material as well as for construction. If the soil at any particular locality is unsuited for the construction, a basic decision is made whether to accept the site material as it is, the design is made to meet the restrictions imposed by its existing quality.Remove the site material, and replace with superior material. Altering the properties of the existing soils so as to create a new site material capable of better, meeting the requirements of the task at hand.

Montmorinolite is a predominant mineral of black cotton soils or expansive soil. The swelling and Shrinkage behavior of black cotton soils originate mainly from this mineral.Clay minerals are hydra silicate of aluminium and magnesium. They are made of sheets of silica and aluminium stacked are above the other forming sheet like structure with expanding lattice. The structure of some aluminium is by magnesium ions and the minerals becomes chemically active. They attract water molecules(dipoles)and various types of hydrated cations to the surface causing the soil to increase the volume.

Soil improvement is one the methods to increase the soil strength and most importantly to reduce swelling potential of black cotton soils. This was mainly performed in two ways: chemical and mechanical method. Several mechanical methods were proposed to improve expansive soil properties including pre-wetting, imposing surcharge, compaction control, water content control, stabilization by geosynthetics, soil replacement, thermal methods, and

randomly soil reinforcement by artificial and natural fibers. Chemical methods include adding materials such as lime, cement, fly ash, industrial eco-friendly and waste products to expansive soils.

1.1 Stabilization using cement

One of the common methods of chemical stabilization is to mix soil with cement to form a product named as cement stabilization. Soil–cement stabilization can be defined as a mixture of soil and measured amounts of Ordinary Portland cement and water and compacted to the desired density. Soil cement stabilization has been used as a base material as an adoption of improved measure in many engineering properties of soil , such as slope protection of dams and embankments, pavement of highways, building pads, terminals for rail and truck, composting facilities, cheap base for streets, parking lots, channels and reservoir linings, placement for dikes, foundation stabilization etc. The cement stabilization technique has been practiced almost for 100 years. It serves to amend the mechanical and the engineering properties of the soil. The new performance depends on the ability of the additives to react with the mixing soil. There are four main properties of soil; strength, permeability, volume stability, and durability that can be enhanced with additives.

1.2 Stabilization using lime

Limestone is broken down at normal temperatures to form lime. As a result, three forms of lime are produced: quicklime (calcium oxide–CaO), hydrated lime (calcium hydroxide–Ca[OH]2), and hydrated lime slurry; all of which can be used to treat soils. Quicklime is manufactured by chemically transforming calcium carbonate (limestoneCaCO3) into calcium oxide. Furthermore, hydrated lime is created when quicklime chemically reacts with water. Lime is an excellent choice for short-term modification of soil properties. Lime can modify almost all fine-grained soils, but the most dramatic improvement occurs in clay soils of moderate to high plasticity. his reaction results from the formation of calcium silicate hydrates and calcium aluminates as the calcium from the lime reacts with the aluminates and silicates solubilized from the clay mineral surface. This reaction can begin quickly and is responsible for some of the effects of modification. However, the full-term pozzolanic reaction can continue for a long period of time, often for many years. As a result, some soils can produce very significant strength gains when treated with lime. The key to pozzolanic reactivity and stabilization is a reactive soil and a proper mix-design protocol. The results of soil stabilization can include very substantial increases in resilient modulus values, significant improvements in shear strength, continued strength gains over time, and long-term durability over decades of service.

1.3 Stabilization using fibers

The fibers are arranged in some order and all the fibers are placed in the same orientation. The fibers are laid layer by layers orientation. Continuous fibers in the form of sheets, strips or bars etc. are used systematically in this type of arrangement. The arrangement has discrete fibers distributed randomly in the soil mass. The mixing is done until the soil and the reinforcement form a more or less homogeneous mixture. Materials used in reinforcements are generally derived from paper, nylon, metals or other materials having varied physical properties. Randomly distributed fibers have some advantages over the systematically distributed fibers. Somehow this way of reinforcement is similar to addition of admixtures such as cement, lime, fibres etc .Besides easy to add and mix, this method also offers strength isotropy, decreases chance of potential weak planes which occur in the other case and provides ductility to the soil. Maximum dry density of modified soil is maximum at 0.75% coir, which shows an increment of 0.6% and OMC is maximum at 0.25%, which shows an increment of 10%. The Unconfined Compressive Strength value of modified soil gets increased with increase in coir content with an increase of 66.66%. The CBR value of modified soil increases with increase in coir content with an increase of 94.8% at 1% coir. Maximum dry density increases with increase in percentage of tyre(plastic) and the OMC gets decreased with increase in percentage of tyre. The use of shredded rubber tyres since reduces the amount of water required for the compaction effort while maintaining a reasonably good maximum dry density. The UCS value of modified soil is maximum at 2% tyre, which shows an increment of 44.4%. The CBR value of modified soil is maximum at 8% tyre, which shows an increment of 82.05%. The CBR and UCS values of coir at 1% are higher compared to that of tyre. Hence coir is more reliable than tyre.

2. CONCLUSION

The conclusion of the review paper is stabilization of soil improves load bearing capacity of the soil.

•It improves the strength of the soil, thus, increasing the soil bearing capacity and decreased swell potential and volume change

•It is more economical both in terms of cost and as well as energy to increase the bearing capacity of the soil rather than going for deep foundation or raft foundation.

•It is also used to provide more stability to the black cotton soil in slopes or other such places and effect of permeability.

•soil stabilization is also used to prevent soil erosion or formation of dust which is very useful especially in dry and arid weather.

•Stabilization is also done for soil water-proofing. This prevents water from entering into the soil and hence helps the soil from losing its strength and improve engineering property.

•It helps in reducing the soil volume change by effect of compressibility due to change in temperature

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