Analysis of Black Cotton Soil by Application of Waste Polyster Yarn and Waste Lime

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***Abstract*- The Aim of this project is to define improvement in Geotechnical properties using polyester yarn waste and yarn in black cotton soil. This type of soil works like hard substance when it is dry but in the wet condition the soil loses its strength. So it is required to improve its quality. The bearing capacity of black cotton soil increased with the help of yarn . So this material can be used in black cotton soil as a recycled component to reform the nature of soil. Stabilization is the concept about reduce the bearing capacity of expansive soil by using these materials. The supporting power of a soil substance referred to as its bearing capacity. Stabilized earth is a composite material, a combination of soil and reinforcement suitably placed in layers to the resist tensile stress. Using this technique, We can improve the stability of the available expansive soil, increase the load bearing capacity, and also helpful in controlling the earthquake vibration. It would be good for reinforcement of soil to improve the properties of weak soil using polyester yarn. In this study the Yarn is used as the reinforcement material in the black cotton soil with the comparison of Soil. By Adding the alternate proportion of yarn we can see the increasing strength of soil.**

INTRODUCTION

Black cotton soil causes too many problems to construct the buildings and roads on it. About 20% of the soil found in India is expensive. In the rainy season black cotton soil absorbs water which results into swelling and softening of soil. In addition to this it's also loses its strength and becomes so easily compressible. In summer season reduction in water content soil shrinks and produces cracks. Black Cotton soil is considered to be unsafe with reference to safety of the structure in serviceability aspects and it needs to be tackled in a well-engineered manner, if it should be used as a foundation soil. Black Soil is a week material consisting of soil grains and as a result it cannot stand up against tensile stresses. Therefore, soils are unsteady below the foundation and defer deformation under loads. In addition reinforced soils are often treated as composite materials in with strengthening resisting their tensile stresses and interacting with soil through the friction.

It is come up with the study causes of the structure failure on black cotton soil. From now on the main problem is to treat the foundation soil itself such that the adverse characteristics are modified by stabilization. Stabilization is the process of improving the properties of soil and making it steadier. Now there is a problem to utilization of industrial wastes are develop from industry. The usage of industrial waste in stabilization of soil grows into easily available and economic also. Polyester is chosen for its high load bearing capacity, easily available, and cheap also. These researches have to study the effect of yarn on maximum dry density (MDD), Optimum Moisture Content (OMC), California Bearing Ratio (CBR) of black cotton soil. The type of black cotton soil and one type of yarn were selected for this project. This method is can be applied in to Road construction, Railway construction, Earth works, and Pipes & Canal construction. The main purpose is to reduce load bearing problems by conserving the soil using polyester yarn. The polyester yarn is the fabric used as an admixture in the black cotton soil because the polyester waste is the material that cannot be decomposed easily that is why it can be used as a reinforcement material in the BC soil to increase the properties.

MATERIAL

CF Polyester Yarn:-The polyester fibers are commonly available in different types as PET (polyethylene terephthalate), PCDT (poly – 1, 4 – cyclohexene – dimethylene terephthalate), EPS (post – consumer expanded polystyrene), and (waste cotton yarn).

Yarn is the most commonly produced by textile industries than any other wastes and it is stronger

material than the other materials and has more elasticity and resilience. Yarn can be used alone or blended with other materials on the BC soil.

Yarn is the material is ethylene derived from petroleum.

It is oxidized to fabricate a glycol monomer dihydric alcohol and that is further combined with another monomer at high temperature in vacuum. The polymerization is the process that produces the accomplished polyester is done with the chemical reaction.

Properties of Yarn:- Specific Weight - 1.22 to 1.38 g/cm³ Tenacity - up to 85 cN/tex Moisture regain - 0.2 – 0.5 % Effects to heat - Melting Point - 249ºc to 288ºc

BLACK COTTON SOIL

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LIME

Lime is a significant and multipurpose material. It has an extensive tradition of use in construction, agriculture, water and waste treatment. More recently, lime has been used in numerous industrialised and processing industries, most especially papermaking, sugar processing, steel fabrication and the manufacture of calcium silicate units. This manuscript is an introduction to lime, how it is produced, and what raw materials are required. It lays specific importance on lime exploitation in the construction industry and the involvement it can make towards low-cost building materials.

There are two main methods of lime, quick-lime and hydrated lime. Quicklime is formed by heating any material holding calcium carbonate to a temperature of around 1000°C for numerous hours. In this process, known as 'calcining' or simply 'burning', the carbon dioxide in the calcium carbonate is driven off parting calcium oxide plus any contaminations.

Quicklime is a chemically unbalanced and hazardous material and is hence normally hydrated, becoming not only more steady but also easier and safer to handle. Hydrated lime is produced by accumulation water to quicklime in a procedure called 'hydration' or 'slaking', where the calcium oxide and water combine chemically to form calcium hydroxide.

In some situations, raw substantial with high calcium carbonate substances will not be accessible. This may not be a restraint for lime used in the manufacture industry since lime enclosing contaminations can be accepted and may even have benefits.

METHODOLOGY

The cotton waste in the form of polyester yarn is segmented into pieces that were 25mm long and the polyester fibres are washed by immersion in distilled water for few hours at the 25ºc, which is normal temperature.

And then the polyester yarn is subsequently oven dried for 24 hr. at 70ºc then the fiber is applied pieces of polyester yarn on soil in layers.

Then the pieces of polyester yarn are applied at the soil in the mould for Heavy Compaction Test.

In the Heavy Compaction Test the waste is applied in the five layers with the raw soil, each layer is compacted with the 4.90 kg rammer in the 2250 volume mould. Each layer is compacted in 55 blows with the rammer.

And after the completion of the compaction the sample is collected from the soil and oven dried for 24hrs. Then the dried soil is compared with the raw soil.

In Atterberg limits the procedure is the same but the pieces of the polyester fibre are mixed in it and record the readings. The tests results are remaining almost same because of the fibre is not completely dissolved in the soil. The results of the liquid limit are decreasing from 60.27% to 60.10% that is not much difference and the plastic limit is increasing from 20.26% to 20.56% that is also not much difference.

In the direct shear test the test procedure is the same but the main difference is that in the soil the pieces of the polyester fibre is mixing with it and then the test procedure is proceed. The results are improving compared to the original soil results.

RESULTS

Properties of black cotton soil					
Property	Raw Soil Value (%)	Soil + 10% Fiber (%)	Soil + 10% Lime (%)	As per IS	Remark
Liquid Limit (%)	60.27	58.57	62.35	40 – 85	High
Plastic Limit (%)	20.26	20.58	20.08	18 – 40	Normal
Specific Gravity	2.51	2.60	2.54	2.63	-
Maximum Dry Density (gm. /cc)	1.70	1.73	1.71	1.21 - 1.82	Standard Proctor
Optimum Moisture Content(%)	22.72	19.01	26.11	11.2 – 27	-
California Bearing Ratio (%)	4.57	5.86	4.95	1.54 – 4	Less than 5 is good

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