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Study of Soil Reinforced with Natural Fiber and Synthetic Fiber

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Abstract –
Soil support has been brought into the field of geotechnical building for a long time so as to improve the properties of ground soil in explicit designing ventures. It is one of the most mainstream procedures utilized for the improvement of poor soils. Further, soil support causes noteworthy improvement in elasticity, shear quality, bearing limit, just as economy. The utilization of coconut fiber, which is presently regularly considered as waste, as an asset to deliver ranch building material to substitute wood item, offers numerous points of interest. They are moth-verification, protection from organisms and decay, give incredible protection against temperature and sound, not effectively burnable, fire resistant, unaffected by dampness and sogginess, extreme and solid, strong, springs back to shape significantly after steady use, absolutely static free and simple to clean. Customary geosynthetics, for example, geotextile, geogrid and so forth have been end up being effective and they are by and large progressively utilized in geotechnical building yet the utilization of glass strands in soil have just begun as of late. Considering these, a progression of tests were performed with red topsoil soil utilizing coconut coir, glass fiber and cement pack as fortification at different rate substance to discover its impacts on the soil and to discover whether the specific soil-support blend is valuable. The principle goal of this task is to discover the difference and the end by looking at the underlying properties and the last properties after utilization of waste coconut coir fiber, glass fiber and cement sack.

Keywords: Soil Reinforcement, Red Soil, Glass Strands, Coconut Fiber, Cement sack, Geosynthetics, Unconfined Compressive Strength

Introduction

Soil soundness is one of the most significant themes in geotechnical designing practices. With visit disappointments of soil mass, regardless of whether it is on an incline or level ground, have end up being exorbitant as far as both life and property. Different soil adjustment systems including fiber fortification have been being used for some time and the outcomes in some of them has been very good. Soil fortification is characterized as a strategy to improve the designing attributes of soil. The procedure of soil fortification assists with accomplishing the necessary properties in a soil required for the development work. Fortifying soils utilizing pressure opposing components is an appealing method for improving the exhibition of soil in a practical way. Soil support by fiber material is viewed as a successful ground improvement technique in light of its cost viability, simple versatility and reproducibility. The utilization of arbitrary discrete adaptable filaments emulates the conduct of plant roots and invigorates the chance of improving the steadiness of close to surface soil layers. This procedure is utilized for the adjustment of slim layers of soil, fixing bombed slants, soil fortifying around footings and earth holding structures. Likewise, the utilization of biodegradable common filaments as soil support materials is picking up fame. There are many general points of interest of coconut strands. They are moth evidence, impervious to parasites and decay, give magnificent protection against temperature and sound, not effectively burnable, unaffected by dampness and clamminess, extreme and sturdy, absolutely sans static and simple to clean. Coconut fiber discovers application in slant adjustment in railroad cuttings and dike, insurance of water courses, giving a sub-base layer in street asphalts, land recovery interstate cut and fill inclines.

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MATERIALS

Red soil can form from iron-rich sediments or the compounds may develop in the soil as it weathers. The soil used in this study was collected from a Jaipur.

Natural fiber (coconut coir)- Coir is a characteristic fiber extricated from the husk of coconut and utilized in items, for example, floor mats, mats, brushes, sleeping cushions. Coir is the sinewy material found between the hard, inside shell and the external layer of a coconut.

Synthetic fiber (Glass fiber) - Glass fiber additionally called fiber glass is produced using amazingly fine strands of glass. Fiber glass is a light weight, incredibly solid and strong material. Glass filaments are among the most flexible modern material known today. They are promptly created from crude materials got from organization containing silica.

They show valuable mass properties, for example, hardness, straightforwardness, protection from substance assault, soundness and idleness, just as attractive fiber properties, for example, quality, adaptability, firmness and solidness.

Waste material (Cement bag) - It is produced using high quality polypropylene woven textures. The utilization of plastic items, for example, cement sack, plastic packs, plastic jugs, holders is expanding can be utilized viably to build the different properties of the soil. One such sort of waste is the cement pack that is added to the soil to expand the shear quality, elasticity and California bearing proportion of the soil.

OBJECTIVE

- It improves the quality of the soil, in this way, expanding the soil bearing limit.
- It is increasingly efficient both as far as cost and vitality to build the bearing limit of the soil instead of diving for deep establishment or pontoon establishment.
- It is likewise used to give greater solidness to the soil in slants or other such places.
- Now and again soil adjustment is additionally used to forestall soil disintegration or arrangement of residue, which is exceptionally helpful particularly in dry and dry climate.
- Adjustment is additionally accomplished for soil water-sealing; this keeps water from going into the soil and thus helps the soil from losing its quality.
- It helps in lessening the soil volume change because of progress in temperature or dampness content.
- Adjustment improves the functionality and the sturdiness of the soil.

METHODOLOGY

Sample preparation: The soil sample was cleaned and then the various index properties of the soil were found out as per Indian Standards codes. The various percentages of fibers that were used were taken by dry weight of the soil sample and mixed with water. The unconfined compression tests were done by compacting the soil at optimum moisture content and maximum dry density.
The following Engineering Tests were performed during the course of the study-
Soil classification by sieve analysis as per Indian Standard of soil classification system (ISSCS) Determination of liquid limit Determination of plastic limit unconfined compression test Standard proctor test Direct shear test

EXPERIMENTAL RESULTS AND DISCUSSIONS

The results obtained from the various engineering tests are shown here.
Fig 1 shows the curve for Moisture content density relationship obtained from the standard proctor test. Hence from the graph,

MDD =1.60 g/cc and OMC = 19.5%.

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Fig shows the comparison of the Stress-Strain curves for different percentages of glass fibers, coconut coir fiber and cement bag waste respectively. It is clear from the figure that as the fiber content increased from 0.25% to 1%, the unconfined compressive strength also increased for all the types of fibers. The unconfined compressive strength of the soil with no reinforcement is 115kPa. For all the fibers, the maximum value of unconfined compressive strength was obtained on addition of 1% of the fiber content. For glass fibers maximum value of unconfined compressive strength was found to be 290.5 kPa, for coconut coir, 280 kPa and for waste cement bag, the maximum value of unconfined compressive strength was found to be 300 kPa. In Fig 5, a comparison of the axial stress versus strain for all the fiber types for the maximum fiber content is shown. It is clear from the figure that the maximum strength increase was found on addition of 1% of cement bag waste as reinforcing material. The increase in strength of the soil due to addition of fibers can be attributed to the high tensile strength of the fibers and hence can be used as reinforcing material.

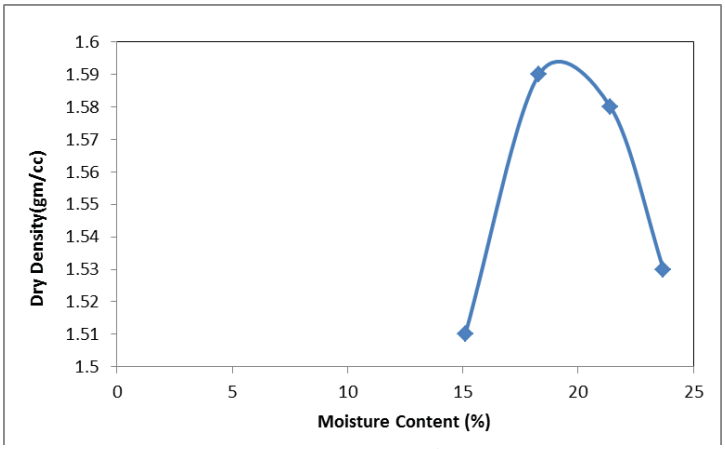

Fig 1: Compaction curve of pure soil

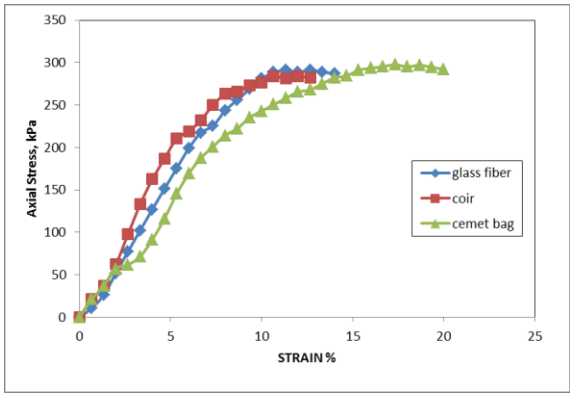

Fig 2 Comparison of stress-strain curve for highest fiber content and waste content

Table 2 Comparison of unconfined compressive strength and direct shear test strength for different fiber contents

Fiber content	Glass Fibers		Coconut Coir		Cement bag waster	
	UCS (kPa)	DST(kg/cm2)	UCS (kPa)	DST (kg/cm2)	UCS (kPa)	DST(kg/cm2)
0%	115		115		115	
0.25%	220		220		179.5	
0.50%	230		230		220	
0.75%	250		260		280	

1%	290.5		280		300	

In table 2, a brief comparison of the unconfined compressive strength and direct shear test of the soil sample reinforced with different fibers and at different fiber contents have been shown.

Conclusion

1. It is seen that all the three types of reinforcement have effectively led to the increase in the strength of the soil with increase in the fiber content.
2. From the literature review we have seen that glass fiber and coconut coir have been used as reinforcing elements in many engineering projects.
3. Among all the three-reinforcing element, the maximum strength was obtained when 1% of waste cement bag was used.
4. This study has shown the effectiveness of waste cement bags as reinforcing material.
5. Use of waste cement bags as reinforcing elements is done for the first time in this project work.
6. In this way we can utilize waste materials in enhancing the strength of weak soils and also reduce landfill costs by utilizing waste bags in a cost- effective manner.

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