Use Of Coir Geotextile In Rural Roads

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Abstract- *The progress of transportation network is pivotal to the overall growth of a nation. For nations like India, where there is a shortage of resources, the significance of rural or unpaved roads is to be incredibly considered. The sub grade, which is the lower most layer of the pavement, consists of compacted soil and so additionally for the highway and railway embankments. The road configuration is established based on many elements, of which primary is the accessibility of right soil along the proposed alignment.*

Expansive soil cover 20% of land area in India. These soil holds weak properties due to the existence of clayey minerals known as "montmorillonite". Usual behavior of soil results in failure of structure in form of settlements cracks etc. therefore it is important to remove the existing weak soil by stabilization. Expansive soil usually exhibit undesirable properties.

Keywords- Coir Geo textile, stabilization, Unpaved roads.

I. INTRODUCTION

The introduction of geo synthetics in the recent years has brought in new scope to the solutions of diverse tough troubles in the field of geotechnical engineering. The vast majority of geo synthetics, overlaying a wide sort of woven and non – woven geo textiles, geo grids, geo pipes, geo membranes, geo nets, geo foams, geo synthetic clay liners and geo composites are especially polymeric, although organic materials also can be used.

The polymeric materials used in the production of geo synthetic are polypropylene, polyamide, polyester and polyethylene. They are feigned from the byproducts of petroleum, a raw material that would grow to be scarce with the passage of time. These merchandise normally have lengthy life spans and do not go through biological dilapidation, but are prone to create environmental problems inside the long run. However, ecological and environmental engineering considerations have imposed restrictions at the substantial use of geo synthetics. Coir, Jute and Bamboo are some of the organic materials which are used as an alternative to polymeric geo synthetic materials.

II. COIR GEOTEXTILES

Coir is extracted from the exo carp of the fruit of the coconut tree "Cacos nucifera Lynn" mostly grown in the tropical nations primarily for the high oil content of the endosperm (copra).

Coir being an environment friendly and biodegradable material is nearly inimitable by any of the present polymeric substitutes. With the diversification of the products and advancement of latest technologies for the production of fibers, the export of coir products has been increased enormously.

COIR FIBRE

Coir fibers are derived from the husks surrounding the coconut. There are two distinctive varieties of coir fiber on the basis of extraction process viz., white coir and brown coir. The average fiber yield depends on geological area and the type of coconut tree. In southern states of India and in Sri Lanka, where the best class fibers are produced, the average yield is 80 to 90 grams per husk. Husks are made up of 70% of pith and 30% of fiber on a dry weight basis. The maximum total world production of coir fiber is estimated to be between 5 and 6 million tons per year.

PHYSICAL PROPERTIES OF COIR

A fiber material would be apt for geo textile production when it has convincingly good mechanical properties and opposing to microbial attack. Coir fibers are of diverse types and are classified according to varying scale of length, color and thickness. The decomposition of coir fiber is usually known to be much less than that of jute fiber due to its high lignin content. The engineering properties of coir fiber are given in the table.

COIR GEOTEXTILES

Coir geo textiles with its Indianised subtext of "Coir Bhoovastra", a standard member of the geo synthetic family, are made up from the coconut fiber extracted from the husk of the coconut. Like their polymeric substitutes, coir geo textiles can be synthesized for specific usages in geotechnical engineering applications. Coir geo textiles are not a consumer product, but a technology oriented product. A wide variety of mesh matting is available, meeting different requirements.

III. METHODOLOGY & EXPERIMENTS

The experimental work consists of following steps:

1. Specific gravity of soil
2. Determination of soil index properties (Atterberg limits)
    i. Liquid limit by Casagrande's apparatus
    ii. Plastic limit
3. Particle size distribution by sieve analysis
4. Determination of maximum dry density (MDD) and the corresponding optimum moisture
   Content (OMC) of the soil by proctor compaction test.
5. Preparation of reinforced samples.
6. California bearing ratio
    i. Unsoaked CBR

IV. MATERIALS USED

- Soil Sample : Black Cotton Soil procured from Machenalli in Shivamogga District.
- Reinforcement : Grade I H2M6 (Woven), 6 mm Thick Coco Bed (Non Woven), 6 mm Thick Plastic Reinforced Coco Bed (Non Woven)

Fig 4.1 Black Cotton Soil

Fig 4.2 Grade I H2M6 Coir Geo textile

Fig 4.3 6 mm Thick Coco Bed

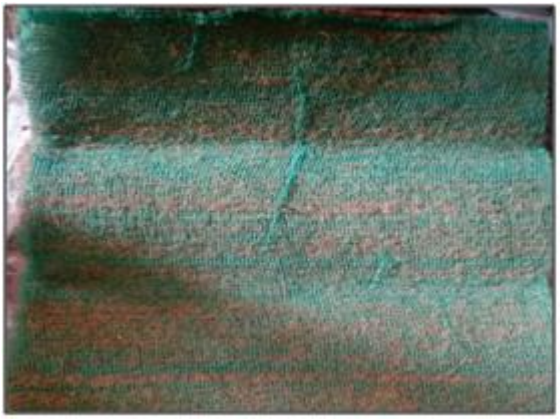


Fig 4.4 6 mm Plastic reinforced Coco Bed

V. RESULTS AN DISCUSSION

One of the important properties of soil that needed to be proved through the addition of coir fiber is their strength. Increase in the soil solid volume occupation either by heavy compaction and/or by other mechanical methods always increases the soil strength. But important exception occurs when compaction gives raise to excess pore pressure. For such soils improvement in the strength is characterized by introducing the fiber into the compacted granular mass, the soil particles of such soil mass are sufficiently strong bound to

resist the external agencies. In this chapter strength of soil mixed with fiber has been studied for compaction behavior of soil, compression test and CBR test.

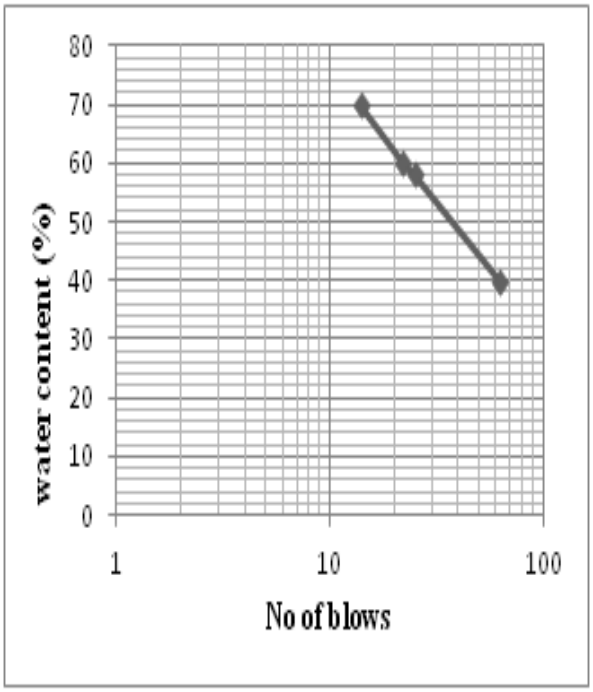
Specific Gravity

Average specific gravity = 2.19

INDEX PROPERTIES

Liquid Limit

The liquid limit value of black cotton soil is obtained using casagrande apparatus. Method of finding liquid limit is simple to understand and easy to conduct as well. Water Content obtained for 25 blows is known as Liquid Limit and for black cotton soil obtained LL is 58%.



Graph 5.1: Liquid Limit Graph for Black Cotton Soil

Plastic limit

The plastic limit of the soil sample is determined by kneading the soil sample for approximately 3mm in diameter and the water content wherein crumbles when this diameter is reached. The plastic limit of the black cotton soil was found to be 29.7%.

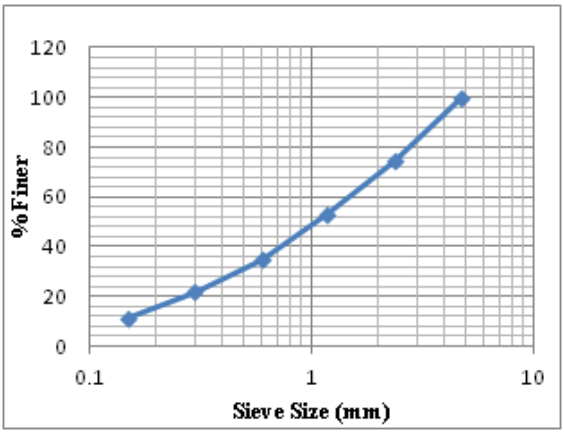
Plasticity Index

$I_p = 58 – 29.7,$ $I_p = 28.3\%$

PARTICLE SIZE DISTRIBUTION

Table 5.2: Particle Size Distribution

Sieve size	% of soil retained	Weight retained	Cumulative % of weight retained	% finer
4.758	0.5	5	0	100
2.36	25.1	251	25.6	74.4
1.18	22.25	222.5	46.85	53.15
0.6	19.3	193	65.15	34.85
0.3	14.1	141.5	78.30	21.7
0.15	10.5	105	88.8	11.2
0.09	7.25	72.5	95.05	4.95
Pan	1.0	10	100	0

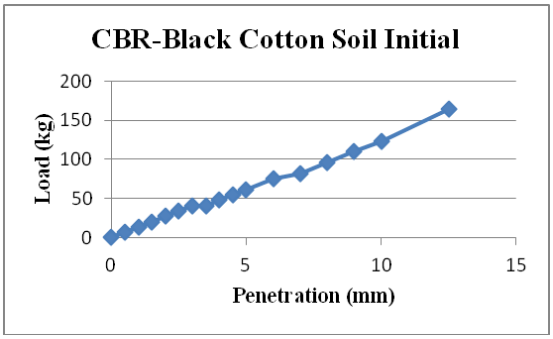


Graph 5.2: Sieve Analysis Graph

STANDARD PROCTOR COMPACTION TEST

Optimum moisture content (OMC) = 19%
Maximum dry density (MDD) = 1.62 g/cc

California Bearing Ratio (CBR)



Graph 5.4: CBR Black Cotton Soil Initial

VI. CONCLUSION

Based on the above laboratory investigations conducted on black cotton soil with coir geo textile of different types, the following conclusions can be drawn.

- The addition of coir geo textiles into the black cotton soil has changed the compaction parameters.
- The CBR values have increased significantly with the addition of both woven and non woven coir geo textiles.
- The CBR values indicate that the values have increased from 3.04 to 19.60.
- The CBR values for plastic reinforced non woven geo textile are greater than that for non woven geo textile without plastic reinforcement.
- The CBR values are the greatest for woven coir geo textile at 19.60.

From the above laboratory investigations it can be concluded that the cheap organic material like coir geo textile has an immense potential to modify the engineering behavior of soil and make it suitable for the application of unpaved roads. Interfacing of both woven geo textile as well as nonwoven coir geo textile in an unpaved road especially with expansive soil, increases the penetration resistance and hence the CBR strength. Therefore, the performance of the unpaved road is better with the inclusion of both the geo textiles.

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