

Effect of coir And Jute Fibre Reinforcement on Strength Parameter and CBR Value On Clayey Soil

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Abstract- The Soil reinforcement is an effective and reliable technique for improving strength and stability of soils. Several studies have been conducted to investigate the influence of randomly oriented independent inclusions on the highly compressible clayey soils. Coir is a natural biodegradable material abundantly available in some parts of south and coastal regions of India. Most of these studies were conducted on small size samples in C.B.R. and direct shear tests. The present work focused on effect of coir on settlement and bearing capacity of footing with parameters such as thickness of reinforced layer with 01.0%, 0.75%, 0.5% & 0.25% laboratory of coir using square footing test the laboratory model tests supported on clayey soil which is compressive and randomly distributed coir fibre and highly reinforced. Increase bearing ratio capacity up to 1.56-2.55 with the adding of coir fibre. There is significant increase in bearing capacity of clayey soil with the inclusion coir fibers. At 25 mm depth of fiber reinforced soil (B/4) and 0.50% fiber content the SBC is maximum. It not necessary to place the reinforced fibre soil at the depth as the sis affected soil to a depth of 2.0 to 2.56 times the width of footing. Sufficient for increasing the SBC there only one fourth width of footing. In general, with the use of coire fibre gives the result to improve strength of soil decrease the settlement. This technique is eco friendly and economical.

Keywords- Coir Fibre, Jute Fibre, Bearing Capacity, Index Properties, OMC, Unconfined Compressive Strength

I. INTRODUCTION

The less amount of land is available for construction because of increasing the urbanization and modernizations. The utilization of land everywhere for the various structure from ordinary house to sky scrapers, from bridges to airports and from village road to highways or expressway. Owing to this, construction of structures these days is being carried on land having weak or soft soil. Now, property of soil decide the any structures stability. soft soil land needs improvement technique, such as soil stabilization and soil reinforcement. Maximum of the soil available are such that it have good compressive strength but weak in tension/ poor tensile strength adequate shear strength To overcome the same, many researchers have contribute their studies on the new

development such type of materials, through the developments of fibre mix. Fibreous material inserting in the soil this idea in geotechnical engineering in a soil to improve the mechanical characteristics. These reinforcements resists tensile stress developed within the soil mass thereby restricting shear failure. Reinforcement react with the soil through adhesion and tension. The practicing engineers are employing this technique for stabilization of thin soil layers, repairing failed slopes, soil strengthen around the footings and earth retaining structures. The inclusion of randomly distributed discrete fibre increases strength parameters of the soil.

II. RESEARCH OBJECTIVES

The main objectives of these project is to adding the jute and coir fibre in the clayey soil. To study the improvement in index properties of soil mix. Also determine the variation of liquid limit, plastic limit, and plasticity index on addition of coir and jute fibre individually. The effect of addition of jute and coir fibre individually on the compaction characteristics of the clayey soil are studied. Determine the improvement in CBR value of clayey soil with addition of coir and jute fibre are individually investigated. To study the strength characteristics of individual soil with the soil mix.

III. EXPERIMENTAL STUDY

A) Material

Coir fibre

Coir is a natural fibre extracted from the husk of coconuts and uses in domestic purpose. It is found between the hard, internal shell and the outer coat of a coconut. The fibres are normally 50-350 mm long and consist mainly of lignin, tannin, cellulose, pectin and other water soluble substances (Rowell, Han, & Rowell, 2000)



B) jute fibre

The jute fibre used was procured from the local market. The diameter of the jute fibre used was 2mm. These fibres were cut in the lengths of 30mm, 60mm and 90mm for conducting our research. Jute fibres are generally available in the threaded form. These are mechanically woven fibres with very fine threads.



C) Soil

The soil used in the investigation was the natural soil collected from Ahmednagar area of Maharashtra. The soil sample was collected from a depth of 60 cm after except the top surface soil from natural ground surface.

Literature review

Hejazi et al. (2012) Soil reinforcement is done with the help of various natural fibres Coconut (coir) fibre, Sisal, Palm fibres, Jute, Flax, Bamboo, Cane and artificial fibres like Polypropylene (PP), fibres Polyester (PET), fibre Polyethylene (PE), Glass fibres, Nylon fibre, Steel fibres Polyvinyl alcohol (PVA) Soil is mixed with these fibres in two ways either manually or mechanically. After that various properties of soil are tested like cohesion, angle of internal friction, shear strength. It is found that the shear strength of soil increased after introduction of fibres.

Chaple et al. (2011) This journal describes the coir fibres reinforced clayey soil properties .In this clay soil is mixed

with coir fibre in increase proportion of %age and tests are conducted to determine the effect of fibre on bearing capacity and settlement of square footing in clayey soil. It is observed that bearing capacity increases and settlement decreases due to coir reinforced clayey soil. eIt will be also observed that maximum bearing capacity of soil will be when it is mixed with coir in the proportion of 0.50%.

Maury et al. (2007) In this paper coir fibres is used for soil stabilization. Coir fibres are mixed in soil by manual mixing .The %age of coir fibre in each soil sample will be gradually increase like 0.25%,0.50%,0.75%, 1 % and various test are performed like UCS and CBR. Soaked CBR value found to increase from 4.75% to 9.22%, unsoaked CBR values found to increase from 8.72% to 13.55%. UCS value found to increase from 2.75kg/cm² to 6.33kg/cm² It will be concluded that the usage of coir fibre reinforced soil improved the properties of soil and its strength.

Anzar Hamid Many studies have been carried out in regard to reinforcing the soil, so as to enhance its properties. Some of the notable works are mentioned here. The effect of jute fibre on the soil was studied and later jute textiles were used in rural roads the effect of jute fibre in subgrade characteristics improvement was also studied. It was concluded that jute fibre reinforced soil has reduced maximum dry density and increased optimum

Experimental studies and its results

PARTICAL SIZE ANALYASISSIEVE ANALYSIS (clayey SOIL)

To determine the distribution of soil partical

OBSERVATION TABLE

RESULT OF TEST

Sr. No	IS Sieve	Partic le Size(D) (mm)	Mass retained (gm)	% Retai ned	Cumul ative % Retaine d	Cumul ative % Finer(N)
1.	4.75m m	4.750 mm	41.70	10.43	10.43	89.58
2.	2.36m m	2.360 mm	55.61	13.90	24.33	75.67
3.	1.78m m	1.780 mm	53.30	13.33	37.65	62.35

	m	mm				
4.	1.18m	1.180	51.60	12.90	50.55	49.45
	m	mm				
5.	600micron	0.600	68.60	17.15	67.70	32.30
6.	300micron	0.300	61.60	15.40	83.10	16.90
7.	150micron	0.150	41.80	10.45	93.55	6.45
8.	90micron	0.090	3.00	0.75	94.30	5.70
9.	75micron	0.075	4.40	1.10	95.40	4.60
10.	pan		18.39	4.60	100.00	0.00

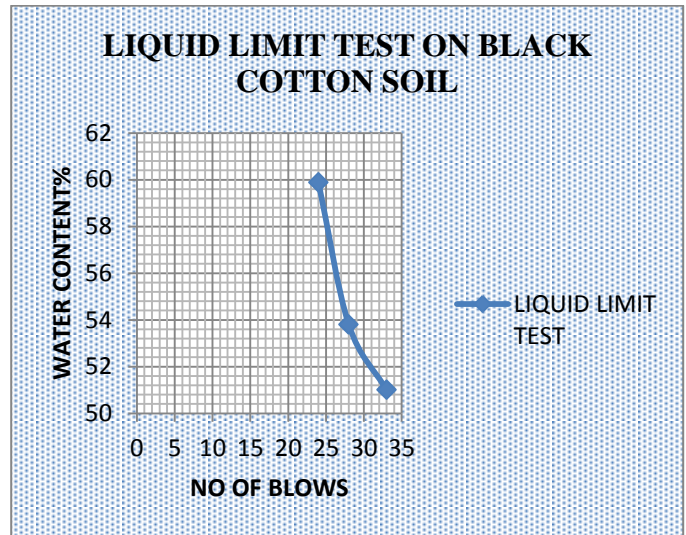
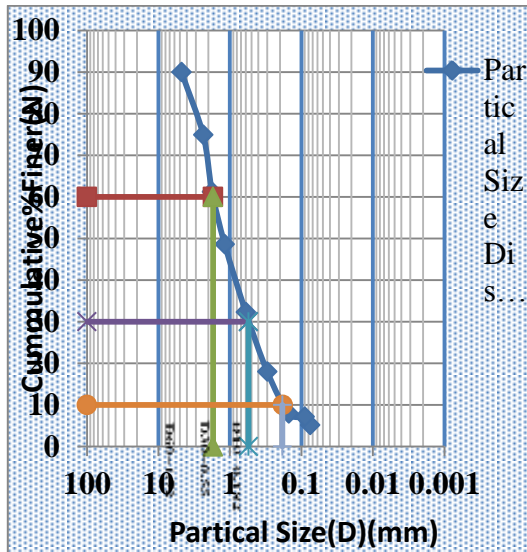
PYCNOMETER+SOIL (W2) =986gm
 PYCNOMETER+SOIL+WATER (W3) =1745gm
 PYCNOMETER+WATER (W4) =1525gm
 $G = \frac{[986-632]}{[(986-632)-(1745-1525)]}$
 $G = 2.646$

LIQUID LIMIT TEST

6.4.1. BLACK COTTON SOIL

NO OF BLOWS	WATER CONTENT %
28	53.80
33	51
24	59.88

FLOW CURVE



RESULT: -

From the curve calculate

Uniformity coefficient (Cu)

$Cu = D_{60}/D_{10} = 1.72/0.182 = 9.45$ (5-15)

Coefficient of curvature (Cc)

$Cc = (D_{30})^2/D_{10} * D_{60} = (0.55)^2/0.182 * 1.72 = 1.25$

As $cu > 6$ and $1 < cc < 3$ the soil is well graded soil.

2.SPECIFIC GRAVITY TEST BY PYCNOMETER

clayey SOIL

The major measuring equipment in this test is Pycnometer.

This is a glass jar of 1 litre capacity that is fitted at its top by a conical cap made of brass. It has a screw type cover.

EMPTY WEIGHT OF PYCNOMETER (W1) =632gm

. PLASTIC LIMIT TEST

clayey SOIL

OBSERVATION TABLE

Container No.	1.	2.	3.
Wt. of container, W1 (gm)	8.8	8.5	8.2
Wt. of container, W2 (gm)	15.3	14.4	15.5
Wt. of container+dry soil sample, W3 (gm)	13.5	12.7	13.1
Water Content (%) = $\{(W2 - W3)/(W3 - W1)\} * 100$	28.2	23.61	32

PLASTIC LIMIT (MEAN VALUE, %) =28%

4.3.2 Plasticity index (Ip): $IP = WL - WP = 58 - 28 = 30$

So soil is high plasticity clay.

It is also determine from the IS plasticity chart.

As per the plasticity chart we obtained that the soil is above A-line and CH or OH group.

So soil is highly clay or high plasticity Liquid limit is = 58%

PLASTIC LIMIT = 28% Plasticity index= 30

Liquidity index (IL):- $LI = (W-PL) / (LL-PL) = (35-28) / (58-28) = 24\%$

Activity of soil (A):- $A = Ip/F = 28/6 = 4.66 > 4$

So it means soil is highly active clay soil.

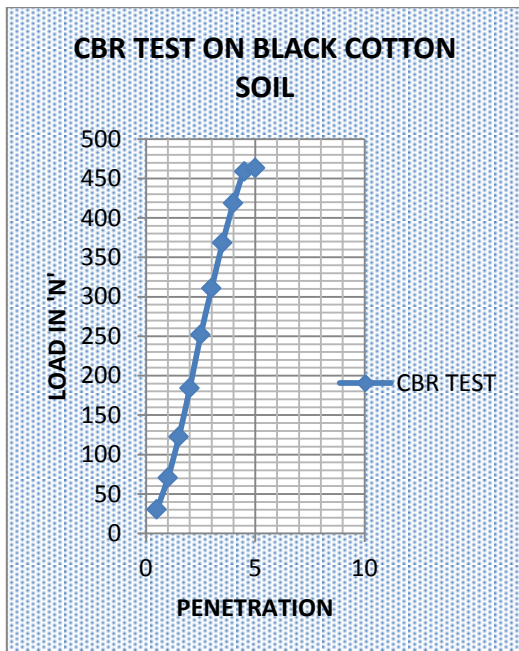
RESULT:- from the graph we obtained the liquid limit corresponding to 25 blows. Liquid limit is = 58%

CALIFORNIA BEARING RATIO TEST

6.6.1. BLACK COTTON SOIL

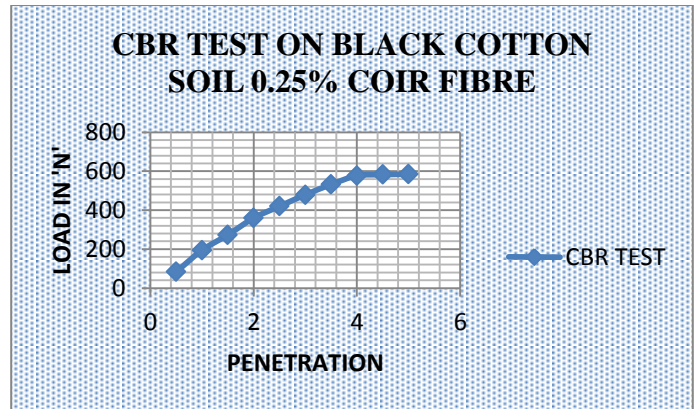
To determine the California bearing ratio by conducting a load penetration test in the laboratory.

Sr.No	Penetration	Reading on gauge	Load in 'Kg'	Load in 'N'	CBR Value in '%'
1.	2.5	15	175	251.6	18.3
2.	5.0	4.4	322	463.0	15.6



6.6.10. BLACK COTTON SOIL WITH 0.25% COIR FIBRE

Sr.No	Penetration	Reading on gauge	Load in 'Kg'	Load in 'N'	CBR Value in '%'
1.	2.5	18.4	292	419.89	30.64
2.	5.0	1.4	407	584.54	28.44



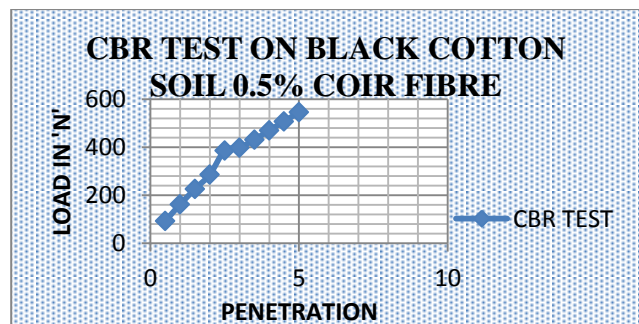
6.6.11. BLACK COTTON SOIL WITH

0.5% COIR FIBRE

0.5% COIR FIBRE

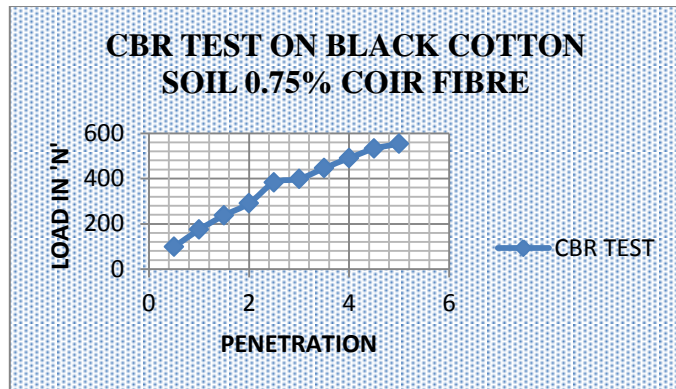
Sr.No	Penetration	Reading on gauge	Load in 'Kg'	Load in 'N'	CBR Value in '%'
1.	2.5	13.6	268	385.2	28.1
2.	5.0	16.0	380	546.4	26.5

0.5% COIR FIBRE



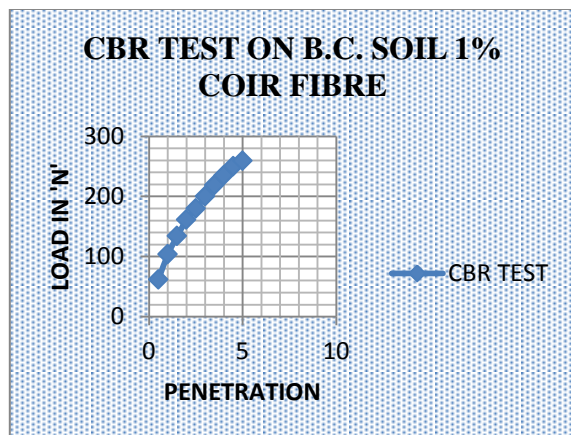
6.12. BLACK COTTON WITH 0.75% COIR FIBRE

Sr.No.	Penetration	Reading on gauge	Load in 'Kg'	Load in 'N'	CBR Value in %'
1.	2.5	13.2	266	382.50	27.92
2.	5.0	17.0	385	553.63	26.94



6.6.13. BLACK COTTON WITH 1.0% COIR FIBRE

Sr.No.	Penetration	Reading on gauge	Load in 'Kg'	Load in 'N'	CBR Value in %'
1.	2.5	5.0	125	179.75	13.12
2.	5.0	16.0	180	258.84	12.59



VI. RESULTS AND DISCUSSION

On many sites soil is weak in nature. Coir can be used as reinforcement in such cases.

In this project coir fibres are used as reinforcement in different proportions & there effect on soil properties is observed.

With addition of Coir 0.25% black cotton soil strength properties are increases.

Coir fibres are used to enhance soil which is weak in nature.

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