

# Stabilization of Black Cotton Soil Using Coir Fiber

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**Abstract** — Fiber reinforced soils have become one of the construction materials in civil engineering. Construction of building and other civil engineering structures on availability clayey soil is highly risky, on geotechnical grounds due to poor strength properties of the clayey soil. There may be the need for soil treatment to improve the engineering properties of soil. The purpose of this investigation is to identify and quantify the influence of coir fiber on performance of fiber reinforced soil specimens. In this study, coir fiber mixed with clayey soil in various proportions (0%, 0.5%, 1.0% and 1.5% by weight of dry clayey soil) to investigate the relative strength gained in terms of compaction CBR & Unconfined Compressive strength. The results clearly indicate that 1.5% coir fiber when unsoaked have noticeable influence on CBR value of expansive soil it improved from 1.03 to 2.04. As well as the CBR values after curing for 28 days also showed an increase by 15% after soaking. The unconfined compressive strength was improved by 60% at 1% coir fiber. The UCS also showed an increase about 23% after curing for 28 days. This is because of composite effect of waste materials, which changes the brittle behavior of soil to ductile behavior. So from this study we can state that coir fiber is a good material to enhance the soil properties.

**Keywords:** Black Cotton Soil, Coir Fiber

## I. INTRODUCTION

Soil is considered as the earth's uppermost layer especially where plant grows. It occurs naturally in the universe mainly by rock's disintegration. It is one of the cheapest and easily available material for construction purposes but on the other hand its behavior is quite complex. As it is a naturally occurring material, we cannot predict its behavior properly in the different conditions. Same type of soil behaves different into two different conditions. Here the work of Civil Engineer becomes utmost important, who has to verify the existing soil can withstand the load coming from superstructure or not.

## II. OBJECTIVE

The objective of the project is to minimize the cost of construction material and also save our environment for our future generation. So we are using the waste material from natural by-products, here we added coir fiber for improve the soil.

The different ratio of coir fiber mix with soil where the properties of soil was compared. CBR and UCS tests improved the soil properties in the mixed soil condition.

## III. NEED AND ADVANTAGES

It improves the strength of the soil thus, increasing the soil bearing capacity.

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

It is also used to provide more stability to the soil in slopes or other such places.

Stabilization improves the workability and the durability of the soil.

It helps in reducing the soil volume change due to change in temperature or moisture content.

Increase soil resistance against liquefaction under dynamic loading conditions

## IV. MATERIALS USED

The waste materials are using for Soil Stabilization. These type of materials are using given below.

### A. Black Cotton Soil

The soil used in the study was taken from Geotechnical Laboratory in Swaminarayna Siddhanta Institute of Technology. As per Indian Standard, the soil is classified as CH. Soil used for the study is shown in Fig. 1.1 The main objective of this study is to investigate the change in the behavior of soil when coir fiber at varying percentages was moved in Black Cotton Soil so through the various geotechnical tests conducted in the laboratory.



BLACK COTTON SOIL 1.1

### B. Coir Fiber

Sample used in the project work for the experimental purpose was collected from local temple waste.



COIR FIBER

## V. BACKGROUND OF THE PROJECT

Coir or coconut fiber belongs to the group of hard structural fibers. It is an important commercial product obtained from the husk of coconut. The coir fiber is elastic enough to twist without breaking and it holds a curl as though permanently waved. Shorter mattress fibers are separated from the long bristle fibers which are in turn a waste in the coir fiber industry.

### A. Sieve Analysis

The sieve analysis of soil was determined as per "IS 460: Part 1:1985 specification for test sieves".

### B. Consistency Test

The liquid and plastic limit of the soil was determined as per "IS 2720: part 5:1985 Methods of the test for the soils- part 5: Determination of liquid and plastic limit".



Plastic Limit Apparatus

### C. Standard Proctor Compaction Test

The modified proctor compaction test of soil was determined as per "IS 2720: Part 7-1980 Methods of test for soils- Part VII: Determination of water content – Dry density relation Using Light Compaction".

### D. California Bearing Ratio Test

In the CBR tests on the soil is done as per "IS 2720: Part 16:1987.

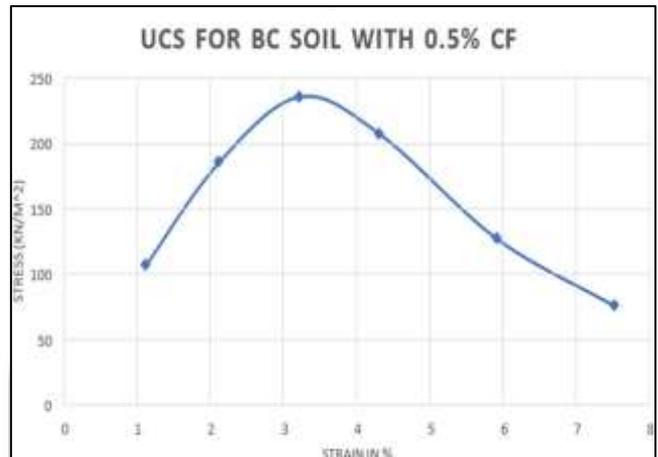
Methods of test for soil-part 16: Laboratory Determination of CBR". Test were carried out for OMC condition  
Soaked condition



Casagrande's Apparatus



Sieve Shaker



Graph UCS of Black Cotton Soil sample +0.5% C.F  
The UCS of Black Cotton Soil sample +0.5% C.F was found to be 235.95 kN/m<sup>2</sup>

### E. Unconfined Compressive Strength Test

In this, unconfined compression test of the soil was determined as per "IS 2720: part 10-1991 Methods of test for soils: part 10 determination of unconfined compression strength".

## VI. CONCLUSION

The Study was conducted to investigate the effect of Coir Fiber Reinforcement on Unconfined Compressive Strength & CBR of black cotton soil. These conclusions are derived after the detailed analysis & experiment of the various samples of soil, the following conclusion can be drawn:

The Unconfined Compressive Strength of Black Cotton Soil Sample was 156.70 KN/m<sup>2</sup>. When the Soil Was Reinforced With 1% Coir Fiber the Value of UCS was 253.96 KN/m<sup>2</sup>

This shows that the soil sample with 1% Coir fiber shows an increase about 60%. This Shows that Soil sample is good after reinforcement.

The CBR Value of Black cotton soil was improved from 1.03 (Without Reinforcement) to 2.04 at Soil+1.5% Coir Fiber.

## VII. SPECIFIC GRAVITY

The specific gravity of the soil (unstabilized) was determined as per “IS 2720: part -3/sec 1-1980, IS 2720: part 3/sec 2:1980. Methods of test for soil: part determination of specific gravity section 1 fine grained so

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