

# SOIL STABILIZATION USING CRUSHED COCONUT SHELLS

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## **ABSTRACT**

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Soil stabilization can be obtained by enhancing the density of the soil or by adding admixtures and then applying mechanical work to compact it, is a more economical solution for improving the performance of problematic soils, by enhancing their cementation, and reducing their sensitivity to moisture

This examination surveys the impacts of crushed coconut shells on balanced out soil. Fundamental tests were completed on the normal soil test for distinguishing proof and arrangement purposes, likewise, designing property tests, for California Bearing Ratio(CBR)

Cocos Nucifera trees, also called coconut palm trees, develop liberally along the drift line. Thus coconut shells are bounteously accessible and it has been effectively used in numerous fields. This exploration is conducted to evaluating it's appropriateness as a balancing out operator in the field of ground modification methods. It mainly presents an experimental study on the effect of crushed coconut shell on the strength of soil. Test conducted on soil with varying percentage of crushed coconut shells (5%, 10%, and 20%).

Therefore crushed coconut shells could be used as one of the best waste materials for soil stabilization.

Keywords:-

Soil stabilization, crushed coconut shells, California Bearing Ratio, compressive strength.

## INTRODUCTION

As the population increases the interest in immense advancement in foundation for land has expanded extensively for as far back as couple of decades. This has lead to restricted accessibility of land assets. Thus a specialist is compelled to do the different development exercises even on hazardous soil. There comes the significance of ground modification methods. Accordingly unique soil stabilizations are increasing more significance in the present situation. Distinctive soil stabilizers are utilized in this field. . The over dependence on industrially manufactured soil improving additives (cement, lime etc) have kept the cost of construction financially high. So as to make lacking soils valuable and meet geotechnical building structure necessities researcher have concentrated more on the utilization of conceivably financially savvy materials that are locally accessible from mechanical and horticultural waste so as to enhance the properties of insufficient soils. Kerala is a land favored with a great deal of coconut trees. Coconut tree give various favorable circumstances in which Crushed coconut shell is utilized as crude material for mechanical generation and different applications

The utilization of coconut shell powder in the field of soil adjustment has not yet been used. Henceforth a trial ponder on impact of CSP on quality of soil is made. It has distinctive properties that make it appropriate as soil stabilizer, for example, strength, and high durability. Coconut shell has long standing use and it is ecological well disposed.

## OBJECTIVES

The main objective of this study includes the determination of improvement in CBR value of soil with crushed coconut shells. The objectives are briefly summarized below.

- To improve the soil property with inclusion of crushed coconut shells
- To increase the CBR value of soil with the inclusion of crushed coconut shells within soil at different depths

## MATERIALS AND ITS PROPERTIES

Coconut shells collected for the study have maximum shell thickness in range of 2-8mm, they were crushed to the required sizes in the range 5-15mm using hammer and mechanical crusher. Crushed shell pieces prepared of different sizes (0.5cm,.1.0cm and 1.5cm) were separated using sieves

**Table 1: Properties of crushed coconut shells**

Physical and Mechanical properties	Crushed coconut shells
Moisture content (%)	4.2
Water absorption (24hrs) (%)	24.0
Specific gravity	1.4
Impact value (%)	8.15
Crushing value (%)	2.58
Abrasion value (%)	1.63
Shell thickness (mm)	2-8mm
Bulk density (kg/cub.m)	55.0

## EXPERIMENTAL INVESTIGATIONS

### Preparation of Soil sample with crushed coconut shells

The following are the steps for preparation of soil sample with CCS

- In this method, a known quantity of air - dried soil passing 4.75mm sieve was taken and mixed with requisite water to get optimum moisture content.
- Then the soil was transferred to the mould and compacted to the required height using hammer.
- Top surface was scratched and the coconut shell pieces were spread over it.
- Soil was filled in five layers approximately equal mass each layer being given 56 blows with 4.90 kg hammer equally distributed and dropped from a height of 450 mm above the soil and compacted.
- The compacted soil mould prepared as per standard procedure for further test conduction using California Bearing Ratio.

In the experimental program soil type was kept as a constant parameter and varying Density or concentration of crushed coconut shell i.e. 5%, 10%, 20%. The below table number-2 gives the CBR test conducted for 5%, 10%, 20% with inclusion of crushed coconut shell in the expansive soil and results

**Table-2: CBR Test Conduction for Various Depths**

Penetration depth	Dial Gauge Reading in mm			Load in Kg		
	5%	10%	20%	5%	10%	20%
2.50	2.6	2.7	3.8	3.05	3.175	4.468
5.00	3.5	4.0	5.0	4.116	4.704	5.88
7.50	5.3	5.8	6.2	6.23	6.820	7.29
10.00	6.3	7.4	7.7	7.408	8.702	9.0552
12.50	7.0	8.8	9.3	8.232	10.348	10.936

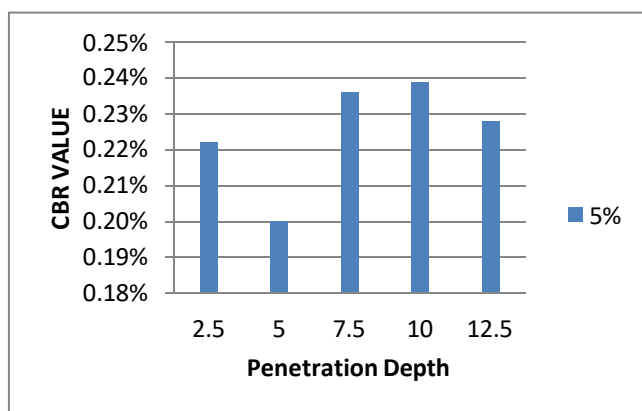
## RESULT AND DISCUSSION

Experimental results shows that different dimensions in CBR values with different percentage of CCS inclusion shown in table number 3

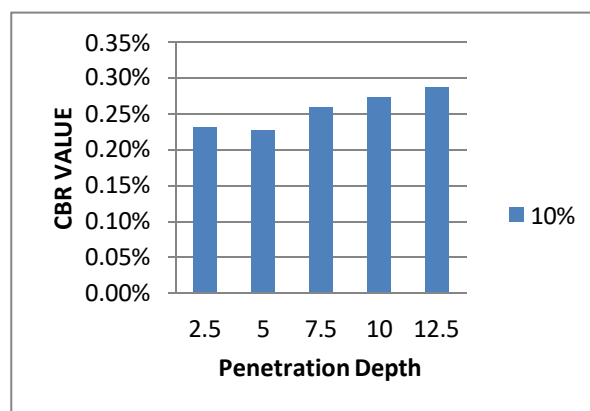
- For 5% of CCS inclusion, the CBR values has fluctuation with gradual increase in depth shown in graph 1
- For 10% of CCS inclusion, the CBR values has increased wit gradual increase in depth shown in graph 2
- For 20% of CCS inclusion, the CBR values has gradual decrease and gradual increase with increase in depths shown in graph 3
- By taking average of CBR values for all depths, it can be say that the CBR values shows the improvement for 20% of CCS inclusion in expansive soil shown in graph 4

Table-3: CBR values

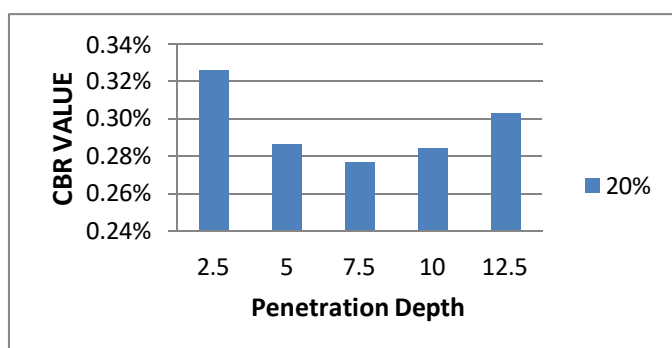
Penetration depth	CBR value		
	5%	10%	20%
2.50	0.222%	0.231%	0.326%
5.00	0.200%	0.228%	0.2865
7.50	0.236%	0.259%	0.277%
10.00	0.239%	0.273%	0.284%
12.50	0.228%	0.287%	0.303%



Graphs-1: CBR Values of Soil with CCS of 5%



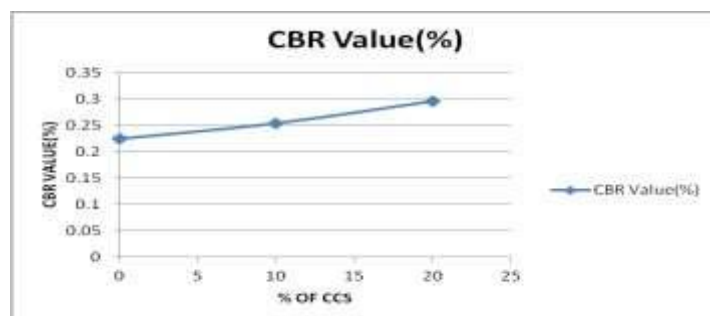
Graphs-2: CBR Values of Soil with CCS of 10%



Graphs-3: CBR Values of Soil with CCS of 20%

Table 4: The average CBR values

% of CCS	CBR value
0	0.225
10	0.254
20	0.295



Graphs-4: The average CBR values

## CONCLUSIONS

Based on this exploration, the obtained conclusions are listed below:

The effect of crushed coconut shells on soil samples were studied by conducting tests with various percentage (5%, 10% and 20%) of crushed coconut shells and the following conclusions drawn.

- 1) The experimental result gives a clear indication that presence of CCS influences the CBR of soil. Improvement is due to the interaction of soil with CCS.
- 2) Good and satisfying improvement is obtained with 20% of CCS inclusion.

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