

STUDY ON STRENGTH BEHAVIOUR OF BLACK COTTON SOIL USING TREATED COIR FIBRE AND QUARRY DUST USING CBR

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Abstract : *In general black cotton soil is widely distributed all over the india. Construction of land based structures become very difficult on black cotton soil because of black cotton soil characteristics like high swelling index and shrinkage. So we are interested to counter act its characteristics by using waste materials like quarry dust and coir fiber those are of less cost and also minimizing the wastes. It was also a best method of disposal of wastes. Coir fibers are decomposable material to preserve that it was treated with sodium hydroxide (NAOH).*

Keywords: *black cotton soil, quarry dust, coir fiber, NAOH, Index properties, CBR*

1. INTRODUCTION

The bearing capacity of the footing/foundation entirely depends on the bearing capacity of the soil for that soil should have sufficient strength to withstand the loads from structures. To attain the required strength we are stabilizing the soil with using coir fiber and quarry dust.

Soil stabilization means improving the existing properties of the soil by adding any material or admixture. Those all soil properties related to strength. Generally the problems with soil occurs during and after the construction of structure due to change in ground water table. we know that black cotton soil is highly active with change in water content. Due to presence of clayey mineral montmorillonite exhibits high swelling and shrinkage.

In recent works it has been investigated that addition of fibers will improve the ductility behavior of soil. Hence reduce the cracks during shrinkage. Use of artificial posses some environmental problems . Use of natural fibers' like coir, jute and wood pulp can be used as reinforcing material for soil. coir fiber will counter act the shrinkage property of soil.

Quarry dust is a waste material from quarries which have high bonding property. When this quarry dust mixed with soil it will act against swelling property of soil. Thus making the soil stable/strengthen later using the strengthen soil it will have less problems of failures compared to unstabilized soil.

2. Advantages of soil stabilization

- Problems with soil are less because of stabilization
- Easy way of stabilization using quarry dust and coir fiber
- Economical
- Increase in shear strength due to coir fiber
- Increase in tensile strength due to quarry dust
- Depth of footing is less
- Reduces permeability and seepage of soil

3. Methodology

The black cotton used in this study was blended with quarry dust and coir fiber with varying percentages coir fiber with 2%,4%,6%,10%,12%,15%,and quarry dust of 10%,20%,30% were performed on a black cotton soil sample. The following experiments were conducted as per IS code with different percentages.

Sieve analysis

Index properties of soil

Standard compaction

Unconfined compressive strength (UCC)

CBR (California bearing ratio)

4. Materials

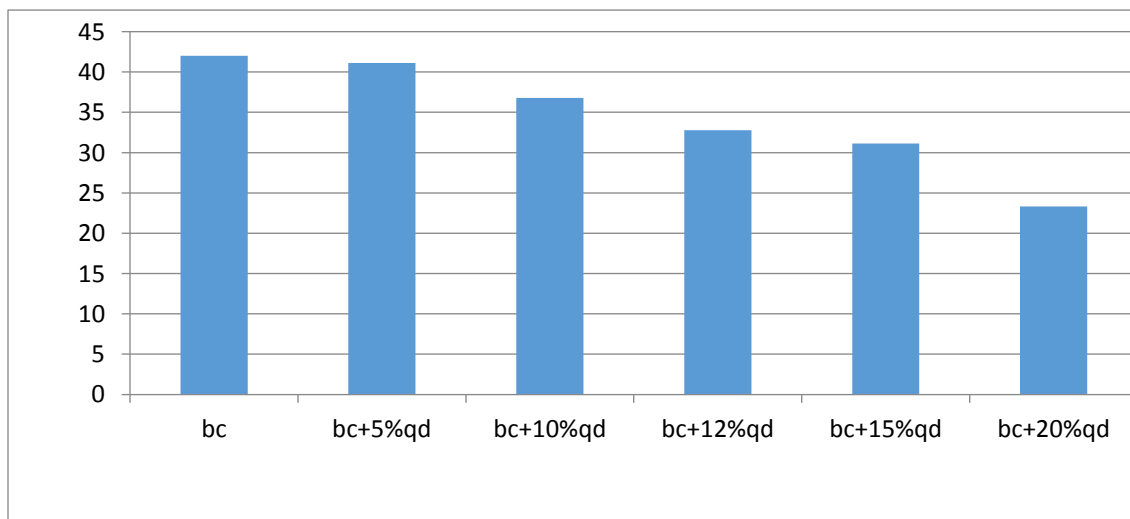
- A. QUARRY DUST: Now a days quarry dust is used as one of the stabilizing material because of its characteristics like high bonding and fineness. Quarry dust is obtained by crushing of stones in rubble. quarry dust is collected from Vijayawada, Krishna (dist), Andhra Pradesh.
- B. Coir fiber : coir fibre was also used as stabilizing material because it has high tensile strength
- C. compared to all other fibres. Collected from eluru, west Godavari (dist), Andhra Pradesh.
- D. Black cotton soil: highly active soil with changing water content. High swelling and shrinkage properties due to presence of clayey mineral montmorillonite and it is highly problematic soil and it is collected from vatluru, west Godavari (dist), Andhra Pradesh.
- E. Sodium hydroxide (NAOH): which is used as a preservative for coir fiber. It will protects the coir fiber from decomposition and increases the durability. It is collected from Vijayawada, Krishna (dist), Andhra Pradesh.

5. Experimental results

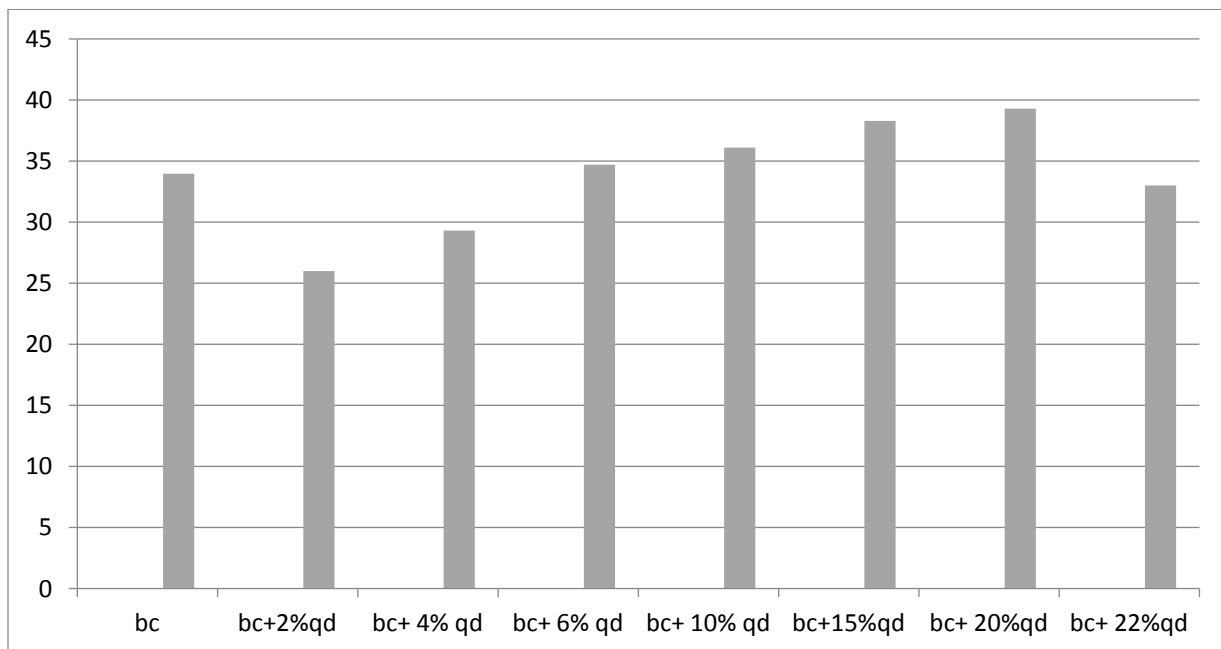
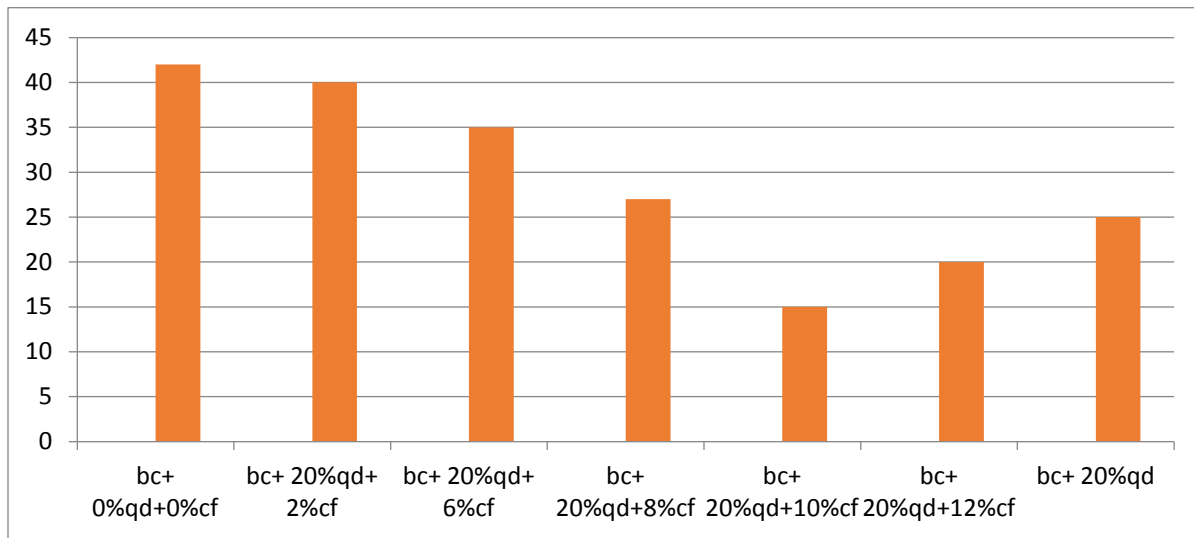
	ATTERBERGS LIMITS	
1	Liquid limit	42%
2	Plastic limit	33.96%
3	Plasticity index	8.04
4	Type of soil	MI
5	Optimum moisture content	15.5%
6	Maximum dry density	1.54 g/cc
7	California bearing ratio(CBR)	2.6%

6. Results of liquid limit

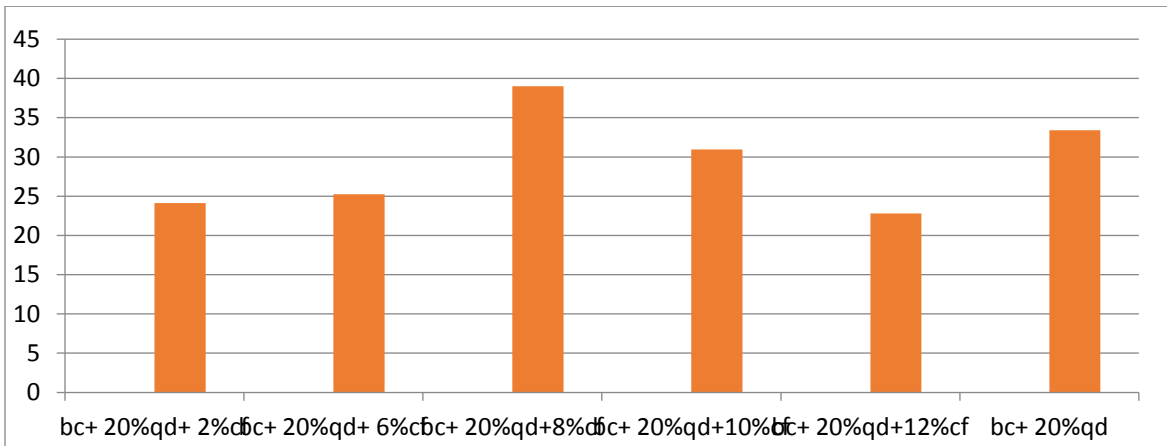
S.NO	% mixtures	Water content(%)
1	Black cotton soil	
2	B.C+5%qd	41.11%
3	B.C+10%qd	36.77%
4	B.C+12%qd	32.79%
5	B.C+15%qd	31.11%
6	B.C+20%qd	23.33%



S.NO	% mixtures	Water content(%)
1	B.c+0%qd+0%cf	42.00%
2	B.c+20%qd+2%cf	40%
3	B.c+20%qd+6%cf	35%
4	B.c+20%qd+8%cf	27%
5	B.c+20%qd+10%cf	15%
6	B.c+20%qd+12%cf	20%
7	B.c+20%qd+15%cf	25%



Bc+20%qd+2%cf	24.13 %
Bc+20%qd+6%cf	25.24 %
Bc+20%qd+8%cf	39.00 %
Bc+20%qd+10%cf	30.95 %
Bc+20%qd+12%cf	22.80 %
Bc+20%qd+15%cf	33.40 %



8. Results of compaction

S.NO		OMC(%)	MDD(g/cc)
1	Black cotton soil	15.5	1.54
2	B.c+10%qd	15.42	1.64
3	B.c+20%qd	15.31	1.91
4	B.c+30%qd	14.21	1.69
5	B.c+20%qd+2cf	14.70	1.73
6	B.c+20%qd+4cf	14.00	1.77
7	B.c+20%qd+6cf	13.90	1.826
8	B.c+20%qd+8cf	13.27	1.937
9	B.c+20%qd+10cf	14.22	1.677

9. Results of California ratio

S.NO	% mixtures	2.5	5.0	7.0
1	B.c	2.60	1.70	1.20
2	B.c+10%qd	3.90	3.40	2.90
3	B.c+20%qd	4.2	4.35	3.70
4	B.c+30%qd	3.90	3.20	2.50
5	B.c+20%qd+2%cf	4.70	4.20	3.90
6	B.c+20%qd+4%cf	5.20	4.80	4.30
7	B.c+20%qd+6%cf	6.70	6.40	5.12
8	B.c+20%qd+8%cf	9.20	7.40	6.30
9	B.c+20%qd+10%cf	5.90	5.30	4.90

10. CONCLUSION

Based on the results obtained from various test conducted on expensive soil, quarry dust mixes. The variations in various engineering characteristics of the soil are discussed below. The liquid test showed results a decrease in the water content from 10% to 20% and quarry dust coir fiber mixes. Its results showed to decrease in the water content from 6% to 10% .

The compaction test results showed a decrease in OMC from 15.42 % to 15.31% and increase in MDD values from 1.69g/cc to 1.91g/cc with a addition of quarry dust from 10% to 20% .as a results showed to decrease in OMC from 13.90 % to 13.27% and increase in MDD from 1.826g/cc to 1.937g/cc with a addition of coir fiber and quarry dust from 20%qd+6%cf to 20%qd+8%cf.

The California bearing ratio test results showed a increase from 3.90% to 4.2% and decrease from 4.2% to 3.90% with a addition of quarry dust from 10% to 20% and 20% to 30%. As a results showed to increases from 6.70% to 9.20% with a addition of quarry dust coir fiber from 20%qd+6%cf to 20%qd+8%cf.

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