Enhancing The Engineering Properties of Black Cotton Soil by using Marble Dust And Recron 3s Fiber

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Abstract-Black cotton soils, are fundamentally helpless to hindering volumetric changes, with changes in dampness. Far reaching soils making serious issues the structural Engineering structures. Such soils are having high volume changes after including the water. The Black cotton soil has a poor supporting limit and huge change in volume on varieties of dampness content. Such Black cotton soils may should be improved to make them appropriate for development exercises. The goal of study is to assess the attainability of mechanical waste like marble dust as soil adjustment material. This paper introduces the impacts of marble dust and Recron 3s fiber on compaction qualities, Atterberg'slimit, California bearing proportion, Standard delegate test and unconfined compressive quality parameters of Black cotton soil. The Black cotton soil was blended with marble dust and Recron 3s fiber from 10% to 40% and 0.5% to 2% individually. From the examination of test outcomes it was discovered that, fluid utmost, versatility list, ideal dampness content diminished and most extreme dry thickness, California bearing proportion and edge of inward grating expanded with an expansion in marble dust.

Keywords – Black cotton Soil, Soil Stabilization, Waste Marble Dust, Recron 3s fiber,Atterber limit, Compaction and UCS value.

II INTRODUCTION

Black cotton soils, are fundamentally helpless to hindering volumetric changes, with changes in dampness. Far reaching soils making serious issues the structural Engineering structures. Such soils are having high volume changes after including the water. The black cotton soil has a poor supporting limit and huge change in volume on varieties of dampness content. Such Black cotton soils may should be improved to make them appropriate for development exercises. The goal of study is to assess the attainability of mechanical waste like marble dust as soil adjustment material. This paper introduces the impacts of marble dust and Recron 3s fiber on compaction qualities, Atterberg'slimit, California bearing proportion, Standard delegate test and unconfined compressive quality parameters of Black cotton soil. The Black cotton soil was blended with marble dust and Recron 3s fiber from 10% to 40% and 0.5% to 2% individually. From the examination of test outcomes it was discovered that, fluid utmost, versatility list, ideal dampness content diminished and most extreme dry thickness, California bearing proportion and edge of inward grating expanded with an expansion in marble powder content.Many research works have been done in the direction of utilizing of marble dust waste into the soil stabilization technique in worldwide. The influence of marble dust, fly-ash and Beas sand on sub grade characteristics of blackc cotton soil was studied by Gupta and Sharma (2014).The marble powder was mixed with rice husk ash on black cotton soil by Sabat and Nanda (2011). They reported that UCS and CBR value increases due to addition of these materials and also modify the engineering properties. The utilization of waste marble dust to enhance the soil properties was studied by Vishwakarma and Rajput (2013). reinforcement consists of incorporating certain materials withsome desired properties within other material which lack those properties . Therefore, soil reinforcement is defined as a technique to improve the engineering characteristics of soil in order to develop the parameters such as shear strength, compressibility,density; and hydraulic conductivity. Soil reinforcement canconsist of stone columns, root piles or micro-piles, soil nailingand reinforced earth . Mainly, reinforced earth is a composite material consisting of alternating layers of compacted backfill and man-made reinforcing material.

III MATERIALS USED

1. **Black cotton soil**

   The BC soil was procured from Near Collectorate office in Baran district of Rajasthan. The Properties of black cotton soil are shown in Table-1

Table 1 : Properties of Black Cotton Soil

Property	Value
Water Content	19.3%
Maximum Dry Density	1.72g/Cc
Liquid Limit	63..74%
Plastic Limit	26.74%

Plasticity Index	37%
UCS	1.76kg/Cm^3
Soaked CBR	1.71

2. Marble Dust-

Marble might be a sparkling stone that is perceived for its uniform and smooth surface, shading, moderate hardness and its capacity to be quarried into tremendous squares, gleaming and smooth cleaned surface which supplies a silky vibe. In earth science terms, it's a stone that is framed by the geologic procedure of the lime stone underneath outrageous warm and weight vitality. the most expresses that territory unit agreeing for the marble presence zone unit Rajasthan, Haryana.

Table 2 : Marble dust Properties

Properties	Value
SiO_2	4.99
Al_2O_3	1.09%
Fe_2O_3	1.09%
CaO	32.23%
MgO	18.94
So_3	0.02
K_2O	0.91
Na_2O	0.63

3. Recron 3s fiber-

Recron 3s-fiber utilized in this examination is the most usually utilized manufactured material fiber because of its minimal effort and hydrophobic and synthetically latent nature which does not permit the ingestion or response with soil dampness or leachate and it is a polypropylene fiber which is a stabilizer to improve CBR and UCS values.

Table 3 : Recron fiber Properties

Property	Values
Colour	White
Cut length	6mm,12mm
Denier (d)	1.5
Tensile Strength (MPa)	600
Specific Gravity	1.334
Equivalent diameter (μm)	32-55
Water absorption (%)	85.22
Acid resistance	Excellent
Alkali resistance	Good

IV TESTS PERFORMED AND RESULTS

1. SIEVE ANALYSIS

The wet sieve analysis of soil particles is done by using 75 microns sieve.from the result obtained the soil can be considered as fine grained soil as more than 50% of particles passed through sieve. Based on these results classification is done as per IS 1498(1970). The following table shows the result of wet sieve analysis.

Table 4 Sieve Analysis of BCS

IS SIEVE	PARTICAL SIZE (mm)	Weight Retained	%Weight Retained	Cumulative % Retained	Cumulative % finer
4.75	4.75	0	0	0	100
2	2	6.9	0.69	0.69	99.31
1	1	8.9	0.89	1.58	98.42
0.6	0.6	13.3	1.33	2.91	97.09
0.425	0.425	12.3	1.23	4.14	95.86
0.3	0.3	14.8	1.48	5.62	94.38
0.212	0.212	18.1	1.81	7.43	92.57
0.15	0.15	16.2	1.62	9.05	90.95
0.075	0.075	21.6	2.16	11.21	88.79
Pan		887.9	88.79	100.00	0.00
Total		1000	100		

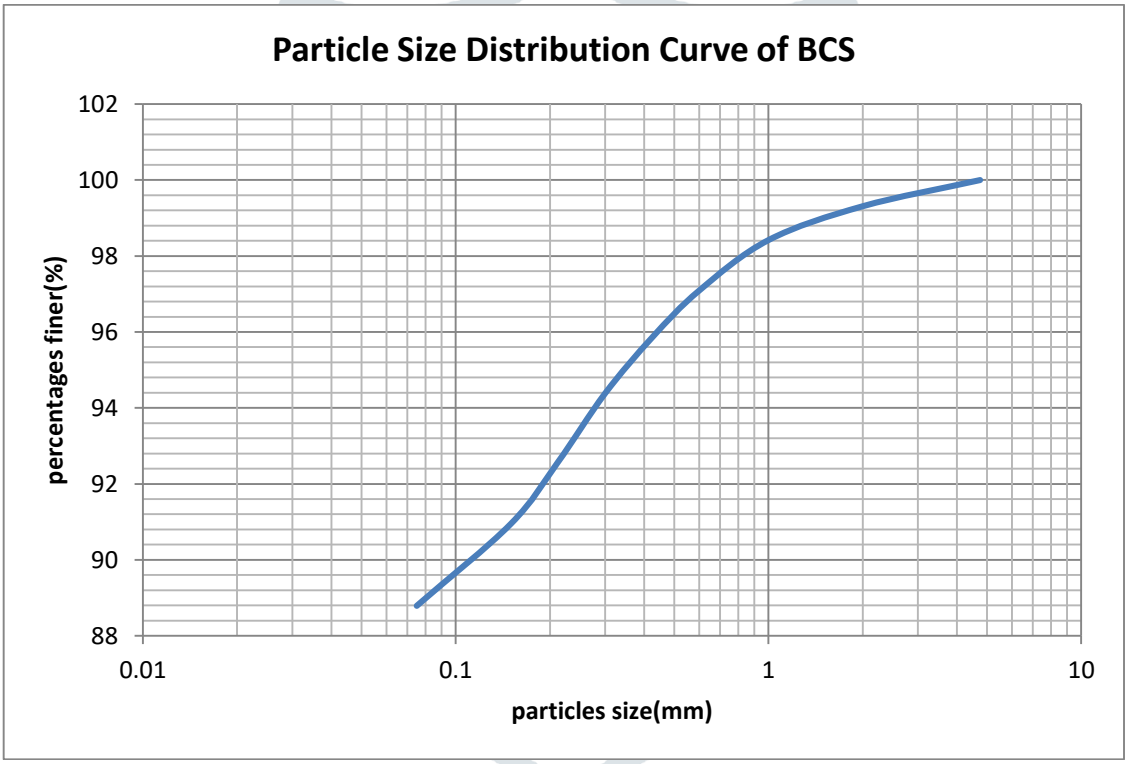

Fig.particle size distribution curve of Black Cotton Soil

2. STANDARD PROCTOR TEST

In standard proctor test soil test is taken in a shape having 1000ml limit and having inside measurement of 10cm. The dirt is compacted in three layers with 25 passes up a rammer of 2.6Kg tumbling from a stature of 310mm. This procedure is rehashed for various water content and a diagram is plotted between dry density and water content to decide most extreme dry density and optimum moisture content.

TABLE 4 STANDARD PROCTOR RESULT FOR BLACK COTTON SOIL WITH 30% MARBLE DUST AND RECRON 3S FIBER

Percentages of lime and brick dust with black cotton soil.	Maximum dry density (g/cm^3)	Optimum moisture content
Black cotton soil	1.72	19.7
BCS+30%MD+0.5%FIBER	2.01	13.2
BCS+30%MD+1%FIBER	2.11	12.8
BCS+30%MD+1.5%FIBER	2.05	13.4
BCS+30%MD+2%FIBER	1.99	14.2

It tends to be seen that with expanding rates of Recron 3s fiber at 30% Marble dust in black cotton soil the max dry density of the soil increments and the optimum moisture content gets decreased. Because of essence of marble dust and recron 3s fiber the heaviness of the soil example increments with increment in adjustment content. The maximum dry density increments to 2.11 g/cc from 1.72 g/cc. The MDD value for 30% marble dust with 0.5, 1,1.5 and 2% is 2.01, 2.11, 2.05 and 1.99 g/cc individually. Essentially there is decrease in optimum moisture content with expanding level of recron 3s fiber the OMC of black cotton soil decrease to 12.8 from 19.7 the decrement in OMC for 30% marble dust with 0.5, 1, 1.5 and 2% recron 3s fiber is 13.2, 12.8, 13.4, and 14.2 individually.

3. ATTERBERG'S LIMIT

The liquid limit and plastic limit test results are as follows

TABLE 5 ATTERBERG'S LIMITS FOR BCS MIXED WITH 30% MARBLE DUST AND RECRON 3S FIBER

Percentages of lime and brick dust with black cotton soil.	Liquid limit	Plastic limit	Plasticity index
Black cotton soil	63.74	26.74	37.00
BCS+30%MD+0.5%FIBER	33.50	18.03	15.47
BCS+30%MD+1%FIBER	33.09	17.94	15.15
BCS+30%MD+1.5%FIBER	32.23	16.67	15.56
BCS+30%MD+2%FIBER	31.32	15.78	15.54

From the above figure and table it can be concluded that with increase in percentage of recron 3s fiber in 30% marble dust mixed with black cotton soil the liquid limit and plastic limit of the soil decreases and so does the plasticity index. This decrement in plasticity index, changes soil from CI to CL.

The decrement in liquid limit is up to 31.32 from 63.74%, the decrement in plastic limit is up to 15.78 from 26.74% and change in plasticity index with varying percentage of lime is 15.15 from 37%. The values for liquid limit for 30% marble dust mixed with 0.5, 1 ,1.5 and 2% recron 3s fiber with black cotton soil is 33.50, 33.09,32.23and 31.32 respectively. The change in plastic limit for 30% marble dust mixed with 0.5, 1, 1.5 and 2% recron 3s fiber with black cotton soil is 18.03, 17.94, 16.67 and 15.78 respectively.

4. UNCONFIND COMPRESSIVE STRENGTH TEST

The test results are

TABLE 6 UCS TEST RESULT FOR BCS WITH 30% MARBLE DUST AND RECRON 3S FIBER

Percentages Of Black Cotton Soil With MD And FIBER	UCS Value (g/cc)	% Increase In UCS
Black cotton soil	1.76	-
BCS+30%MD+0.5%FIBER	2.35	33.52
BCS+30%MD+1%FIBER	2.40	36.36
BCS+30%MD+1.5%FIBER	2.21	25.00
BCS+30%MD+2%FIBER	2.15	22.15

From the above table it can be concluded that with increase in percentage of recron 3s fiber the unconfined compressive strength of the black cotton soil mixed with 30% marble dust is increasing. The increase in UCS value at 1% recron 3s fiber reaches to 36.36%. The value of unconfined compressive strength reaches to 2.40g/cc from 1.76g/cc. UCS for the black cotton soil mixed with 30% marble dust and 0.5, 1, 1.5 and 2% recron 3s fiber is 2.35, 2.40, 2.21 and 2.15 respectively.

V CONCLUSIONS

1. It very well may be finished up from the above outcomes that with increment in rates of recron 3s fiber at 30% of marble dust the MDD of soil increments and OMC of Soil decrements.
2. The liquid limit and plastic limit gets reduce with increase in percentages of recron 3s fiber at 30% marble dust and plasticity index also gets reduced with increment in percentage of recron 3s fiber.
3. The unconfined compressive strength gets increased by addition of marble dust and recron 3s fiber, it gets increased to 2.40g/cc at 30% marble dust and 1% recron 3s fiber.
4. From the above observation it can be concluded that recron 3s fiber and marble dust can be used to improve the engineering property of black cotton soil.

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