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Case Study on Stabilized Black Cotton Soil Using Bauxite Residue and Fly Ash

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Abstract*: Soil is not same in all places; it may be sandy, silt, gravelly and clayey soil which exhibits unique properties. Soil is not capable of taking same load; it varies with properties so it needs some modification which can be done by using the method stabilization. Properties can be altered using mechanical stabilization and chemical stabilization. In this study, chemical stabilization is chosen on black cotton soil using Fly Ash and Bauxite residue. In this study, the stabilizers proportion were selected as 10%, 20% and 30% of bauxite residue with fly ash and change in properties of black cotton soil was observed.
Keywords*: Bauxite Residue, Fly Ash, Clayey Soil, California Bearing Ratio

I. INTRODUCTION

Soil can be explained in so many ways based on their application, properties and uses. For an Engineer, it is a weathered product of rocks having different size and properties. For any construction, site exploration will be done and properties of soil will be analysed. The analysis helps in fixing the depth of foundation or thickness of pavement in highways. Sometime engineer may encounter weak soils; it may lead to uneconomical construction cost and also utilisation of more natural sources. To reduce cost and natural sources, the soil properties can be modified to required standards by the method of stabilization. In this study the chemical stabilization is done on clayey soil and tests were conducted to compare the change in properties.

II. EXPERIMENT DETAIL

A. Materials

In this study soil used was clayey soil. Wet sieve analysis was conducted on the soil as per IS-2720 (part 4): 1983 with specified dosage of stabilizers and observed increase in fines (%). Initially observed fines in natural soil was 54.6%, after mixing soil with stabilizer by 10% BR, 20% BR and 30% BR by restricting Fly Ash content to 3%, the percentage fines were 55.8%, 59,2% and 62.5% respectively. Class C Fly Ash was used due to its self cementing properties.

B. Mix proportion

In this study chemical stabilization was conducted using Bauxite Residue and Fly Ash (Class C) and clayey soil. Changes in properties were observed in soil by varying the content of Bauxite Residue and limiting Fly Ash content to 3% by weight. The proportion is mentioned in Table 1.

TABLE 1
MIX PROPORTION

Mix	Soil (%)	Bauxite Residue (%)	Fly Ash (%)
M1	87	10	3%
M2	77	20	3%
M3	67	30	3%

The index properties test was conducted on soil and results of percentage fines, Liquid limit, Plastic limit, and Plasticity Index of natural Soil and stabilized mixes are shown in Table 2 below

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TABLE 2
MIX PROPORTION

Test	Natural Soil	M1	M2	M3
% Fines	54.6	55.8	59.2	62.5
LL %	38	37.2	36.65	36.7
PL %	24.21	25.6	24.65	22.71
PI %	13.79	11.7	12.15	13.55
OMC %	12	15.6	18.4	20
Free Swell Index	12	7.41	7.1	5.87

C. Mixing and Casting

The weighed material was taken based on the specified mix proportion. The soil, Bauxite Residue and Fly Ash was mixed in dry condition and then Optimum moisture content (OMC) was added which was found out by compaction test. OMC for M1, M2 and M3 was 15.6%, 18.4% and 20% respectively. The stabilized soil of different mix was poured in to CBR mould and cured for 7days then soaked for 4 days in water. CBR test was conducted on sample of different mix as per IS-2720 (part 16): 1987.

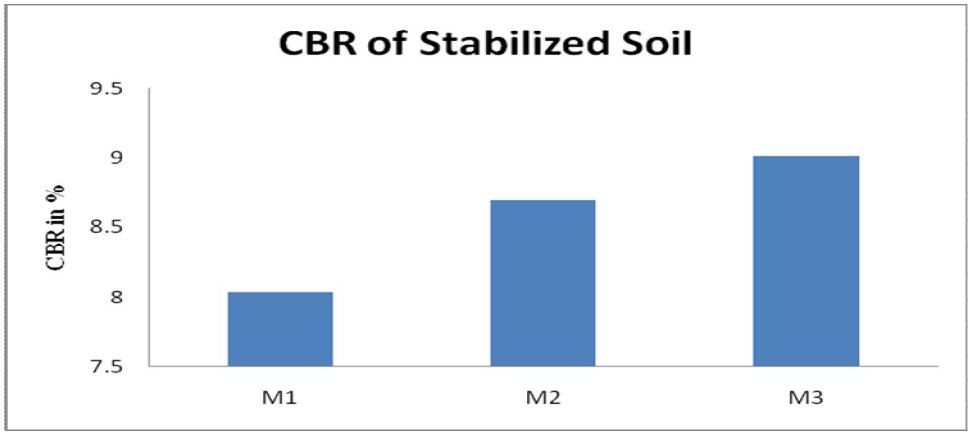
D. Results and Discussion

The CBR test was conducted on each treated sample which was cured using gunny bags and soaked in water for 4 days. The results obtained are shown in Table 3. Graph is plotted in Figure 1 to compare the results. There is a continuous improvement in CBR of stabilized soil as Stabilizer content increases

TABLE 3
CBR RESULTS

Mix	M1	M2	M3
CBR, %	8.04	8.69	9.01

FIGURE1



CBR Results

III. CONCLUSION

A. The observations were made from the results that there is a considerable improvement of 12% in CBR.

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B. Free Swell index properties were decreasing as stabilizer dosage increases

C. Though Increasing trend is observed in CBR, but need to check its Durability and serviceability.

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