

Strength Evaluation of Red Soil Admixed with Fly Ash & Coir Fibre

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Abstract— Soil is very important in civil engineering constructions. The poor engineering properties of the local soils may present many difficulties for construction and therefore need to improve their engineering properties. The problem of disposal of fly ash will also be sorted upto some extent. The Soil is mixed with fly ash in varying in varying percentage extent of 20-80% and properties of soil are studied. The optimum value of fly ash content in soil is 30% and the coir fibre content in the rage of 0.5-1.5% with different lengths.

Key words: Fly Aah (FA), Coir Fibre (CF), Red Soil, Unconfined Compressive Strength (U.C.S), California Bearing Ratio (C.B.R)

I. INTRODUCTION

A complete network of road system in developing countries like India is not easy due to limited finances available to build roads. The reduction of available land resources and the increased cost associated with use of high quality materials have led to the need for local soils to be used in the geotechnical constructions.

Soils are complex mixture of mineral, water, air, etc... Soil is defined as an unconsolidated material composed of soil particles produced by the disintegration of rocks and chemical decomposition.

Soil stabilization is used for foundation, embankment and highway construction, airport and village roads to highway or expressway. It improves the bearing capacity, compressibility, strength and other properties of soil.

II. OBJECTIVES

- 1) To evaluate the index properties of red soil by determining yhe physical properties such as specific gravity, OMC, MDD and by performing grain size analysis.
- 2) To improve strength characteristics of the red soil by adding fly ash and coir fibre in various proportions.
- 3) The strength characteristics of the soil are observed to be increasing on a addition/mixing of coir fibre and fly ash respectively.
- 4) The test observation of soil sample and reinforced soil are plotted on graphs.
- 5) The graphs are compared and the percentage at which the maximum strength obtained is to be determined.
- 6) The optimum coir fibre and fly ash contents are determined and strength characteristics of mixture of red soil, fly ash and coir fibre are to be investigated.

III. MATERIALS AND METHODOLOGY

A. Materials

- 1) Soil Sample

- 2) Coconut Fibre

- 3) Fly Ash

B. Methodology

1) Soil Sampling:

The soil type to be collected for tests is red soil. Soil sample is to be brought to geotechnical laboratory and various basic tests such as sieve analysis, atterberg limits an specific gravity should be conducted. Using the obtained OMC and MDD, CBR moulds are prepared.

Sl.No.	1	2	3	4
Properties	OMC	MDD	CBR	UCS
Test Results				
FA0	12.5	1.912	4.1173	1.512
FA5	17.39	1.842	3.368	0.97551
FA10	17.14	1.806	4.4916	1.03258
FA15	15.09	1.774	5.2403	1.49506
FA20	13.43	1.753	6.7375	1.59
FA25	16.21	1.681	5.6145	1.38
FA30	20	1.606	4.1173	0.916

2) Test Procedure for Soil Stabilized with Fly Ash:

The following laboratory tests were carried out for both normal and stabilized soil.

- 1) California Bearing Test
- 2) Unconfined Compressive Strength Test

After removing the impurities, the soil is mixed with Fly Ash in varying proportion by weight in 5%, 10%, 15%, 20%, 25%, 30%.

3) Test Procedure for Soil Mixed with Coir Fibre:

CBR tests were conducted for evaluating the stability of soil subgrade. Coir is a fibre extracted from coconut shell and is added with soil in the proportion of 0.25%, 0.5%, 0.75%, 1%, 1.25%, 1.5%.

The following tests are to be conducted:

- 1) California Bearing Ratio Test
- 2) Unconfined Compressive Strength Test

IV. RESULTS AND DISCUSSIONS

Sl.no	Properties	Results
1.	Particle Size Distribution	
	Coefficient of Curvature(Cc)	1.10
	Uniformity Index(Cu)	11.5
2.	Specific Gravity	2.5
3.	Liquid Limit(%)	33.8
4.	Plastic Limit(%)	20
5.	Plasticity Index	13.8
6.	Compaction Characteristics	
	Optimum Moisture Content(%)	20
	Maximum Dry Density(g/cc)	1.83
7.	Unconfined Compressive Strength	1.45
8.	CBR Value(Unsoaked)	6.737

Table 1: Basic Properties Of Soil

Sl.No.	1	2	3	4
Properties	OMC	MDD	CBR	UCS
Test Results				
FA0	12.5	1.912	4.1173	1.512
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Table 2: Results of Variation of Properties of Fly Ash

Sl.No.	1	2
Properties	CBR	UCS
Test Results		
CM0	4.1173	1.512
CM0.25	6.7375	2.1004
CM0.5	7.486	4.7502
CM0.75	8.2347	5.3197
CM1	10.1062	5.3816
CM1.25	8.983	4.099
CM1.5	8.609	4.03

Table 3: Results of Variation of Properties of Coir Fibre
OMC = 12.5% & MDD = 1.912g/cc

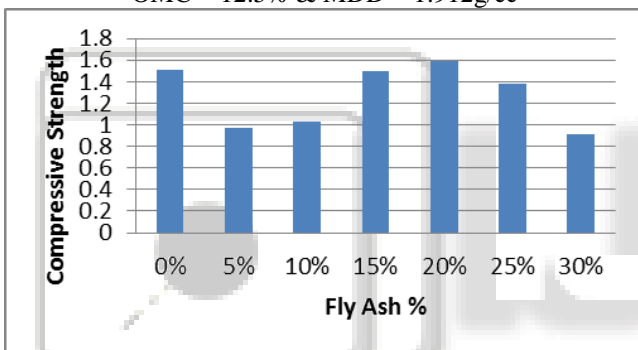


Fig. 1: Unconfined Compressive Strength at varying FA

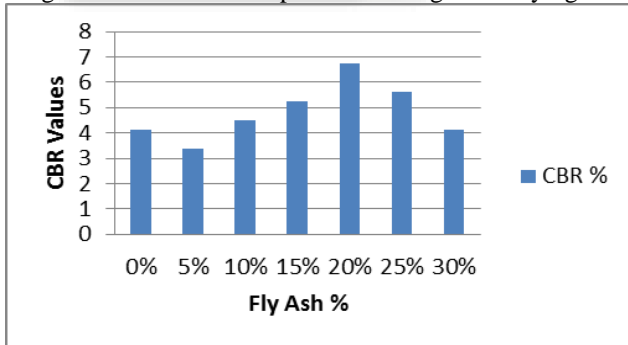


Fig. 2: CBR Values at varying FA

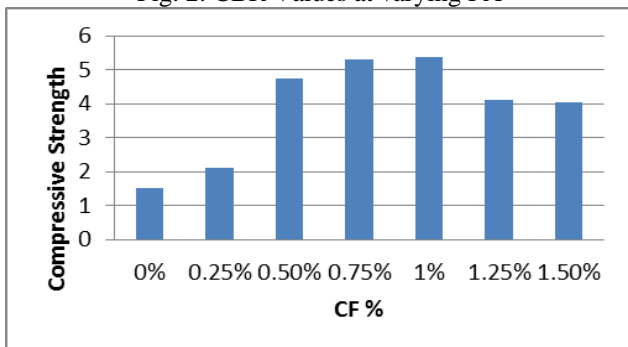


Fig. 3: Unconfined Compressive Strength at varying CF

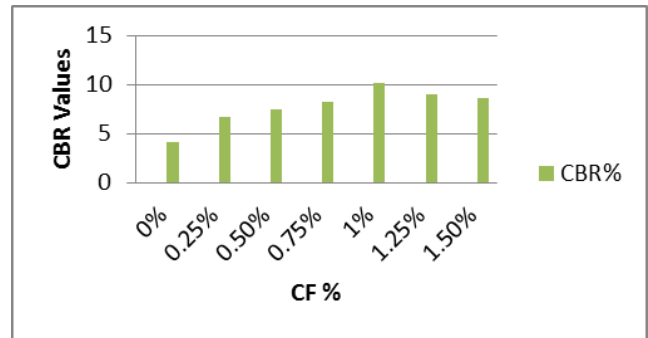


Fig. 4: CBR Values at varying CF

V. CONCLUSION

- 1) OMC increases by increase in percentage of fly ash and percentage of coir fibre and its length. It is due to the volume of soil is replaced by absorptive chemosphere of fly ash and dry coir fibre. As the percentage of fly ash and coir and its length increases the MDD values of soil decreases. It is due the volume of soil replaced by the low density of fly ash and coir fibre.
- 2) The addition of fly ash is improving the CBR values for all mix proportions, but there is an abrupt increase in CBR at 20% fly ash content. There after the increase in strength is gradual.
- 3) The replacement of soil mixed with fly ash and coir fibre increases the strength of soil used in construction activity.

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