STABILIZATION OF BLACK COTTON SOIL USING FLYASH AND POND ASH

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ABSTRACT

Day by day increasing demand of power leads to the generation of by products from the combustion of coal. These by products from the thermal power plant are usually discarded as waste products which lead to damaging the environment. In order to combat the effect that these materials have on the environment, in recent days are being used in making of cement and soil stabilization. The project deals with the use of Pond Ash and Flyash for the improvement of C.B.R. values of clayey soil, which is considered as weak soil for the sub grade layer in construction of highways. Our project is a study based on the effects of the above byproducts on the stabilization of Black Cotton Soil. We are adding the additives in the ratio (1:3) i.e. 1 percent of pond ash for 3 percent fly ash. Various Tests are conducted on soil in order to determine the degree of stabilization achieved and to determine the optimum proportion of fly ash and pond ash. Experiments have shown that with the addition of Pond Ash along with Flyash, the geotechnical properties of the soil are improved significantly and CBR value increases.

Key words: **Pond ash, Fly ash, Optimum proportion, CBR**

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INTRODUCTION

In India about 51.8 million hectares of the land area are covered with Expansive soils (black cotton soil). The Black cotton soils are very hard when dry, but lose its strength completely when in wet condition. Expansive soils are a worldwide problem that poses several challenges for civil Engineers. Various methods are adapted to improve the engineering characteristics of expansive soils. The problematic soils are either removed and replaced by good and better quality material or treated using additive. The stabilization of the problematic soils is very important for many of the geotechnical engineering applications such as pavement structures, roadways, building foundations, channel and reservoir linings, irrigation systems, water lines, and sewer lines to avoid damage due to settle of soft soil or to the swelling action of expansive soil.

Soil Stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of the soil. Stabilization also controls the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations**.** .Soil stabilization refers to the process of changing soil properties to improve strength and durability. There are many techniques for soil stabilization, including compaction, dewatering and by adding material to the soil. This summary will focus on mechanical and chemical stabilization based adding IRC materials.

MATERIALS

The black cotton soil was bought from Raichur. The pondash and flyash were brought from Raichur thermal power plant.

Pulverized fuel ash:

- The flyash used is of the type **Class-C** (cementitious)
- Specific gravity=2.08
- Fineness=349m²/kg
- Chemical properties

Constituent	**Flyash%**
Silica (SiO_2)	59.00
Alumina (Al_2O_3)	21.00
Iron Oxide (Fe_2O_3)	3.70
Calcium Oxide (CaO)	6.9
Magnesium Oxide (MgO)	1.40
Sulphur (SO_3)	1.00
Loss of Ignition	4.62

Pond ash:

Specific gravity= 1.99
Fineness=164m²/k
Chemical properties:

Constituent	**PondAsh%**
Silica (SiO_2)	67.40
Alumina (Al_2O_3)	19.44
Iron Oxide (Fe_2O_3)	8.5
Calcium Oxide (CaO)	2.7
Magnesium Oxide (MgO)	0.45
Sulphur (SO_3)	0.30
Loss of Ignition	3.46

METHODOLOGY

Tests conducted

1. Specific gravity (IS2720 1980 PART-3)
2. Sieve analysis (IS2720 1985 PART-4)
3. Atterberg limits (IS2720 1985 PART-5)
4. Standard compaction ((IS2720 1980 PART-7)
5. Unconfined compression test (IS2720 1991 PART-10)
6. California bearing ratio(CBR).(IS2720 1973 PART-10)

The above tests are to be conducted for the soil and the results as follows and the proportions:

Soil property	Values
Specific gravity	2.5
Liquid limit	61.9%
Plastic limit	32.19%
Plasticity index	29.71%
Optimum moisture content	19.6%
Maximum dry density	1.69 g/cm³

- Soil+ 1% pond ash+ 3% fly ash
- Soil+ 2% pond ash+ 6% fly ash
- Soil+ 3%pond ash+ 9% fly ash.

Liquid limit

Water content corresponding to 25 blows gives the LIQUID LIMIT of the soil and the results are as follows

Sl num	Percentages	Liquid limit (%)
1	Soil	61.9%
2	Soil + 1% PA + 3%FA	60.5%
3	Soil + 2% PA + 6%FA	57.9%
4	Soil + 3% PA + 9%FA	52.1%

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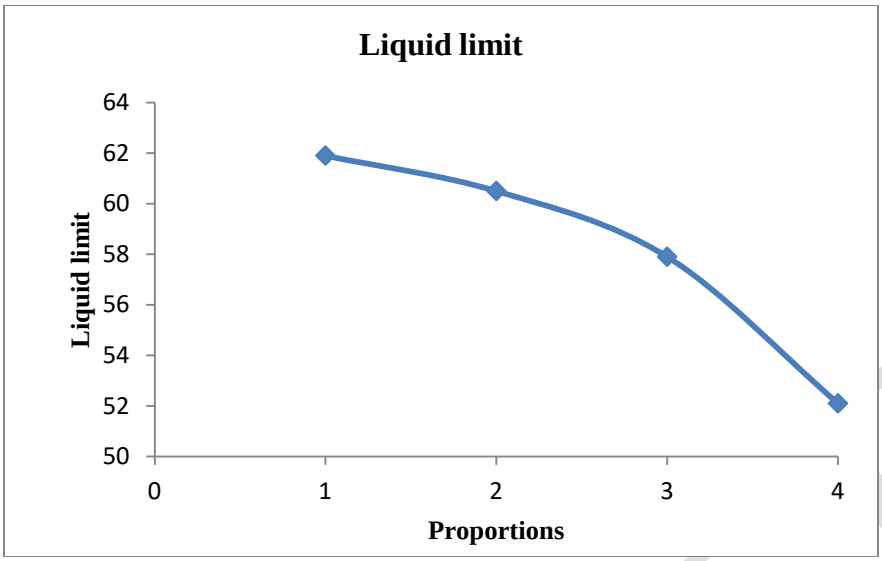
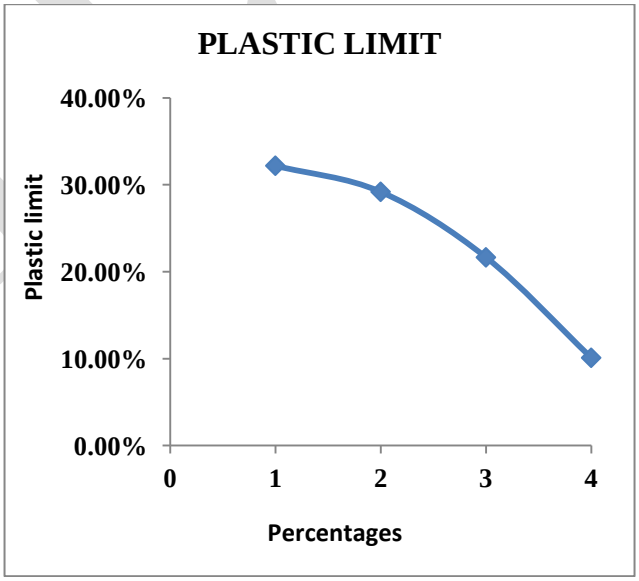


Plastic limit

Sl num	Percentages	Plastic limit (%)
1	Soil	32.19%
2	Soil+ 1% PA + 3%FA	29.19%
3	Soil + 2% PA + 6%FA	21.65%
4	Soil + 3% PA + 9%FA	10.10%



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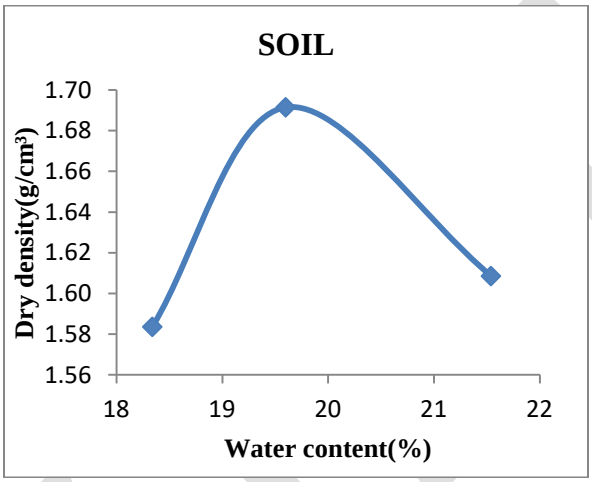
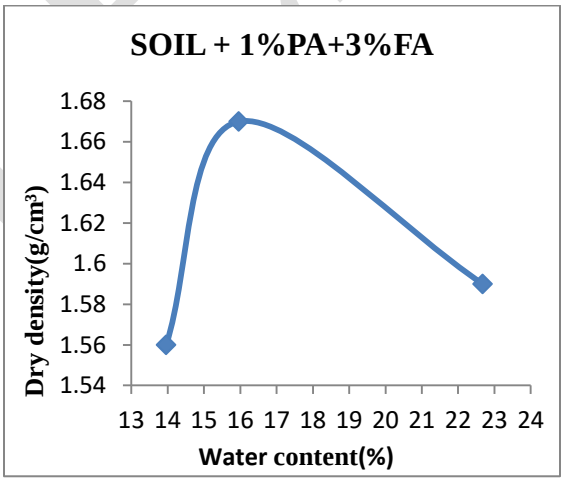
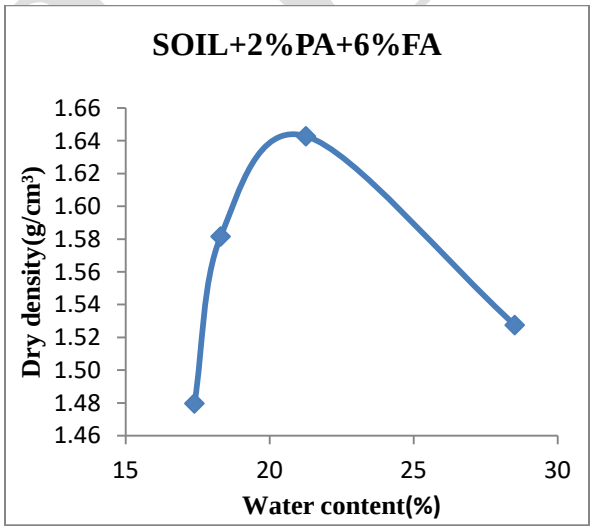
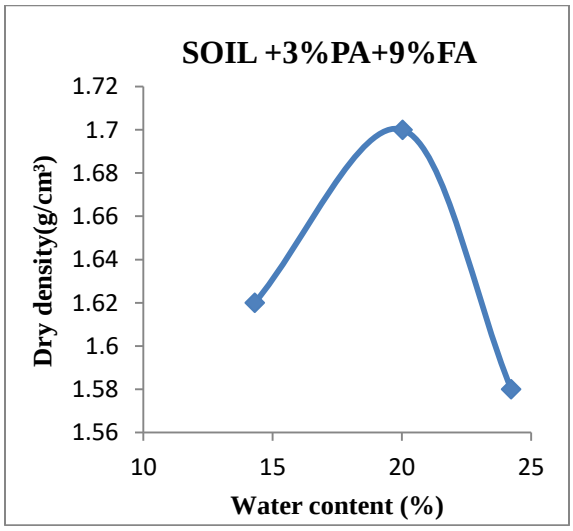
STANDARD COMPACTION TEST

Proportions	Optimum moisture content (%)	Max dry density (g/cm³)
Soil	19.6	1.69
Soil+ 1% PA + 3%FA	21	1.67
Soil + 2% PA + 6%FA	21.26	1.64
Soil + 3% PA + 9%FA	20.03	1.70









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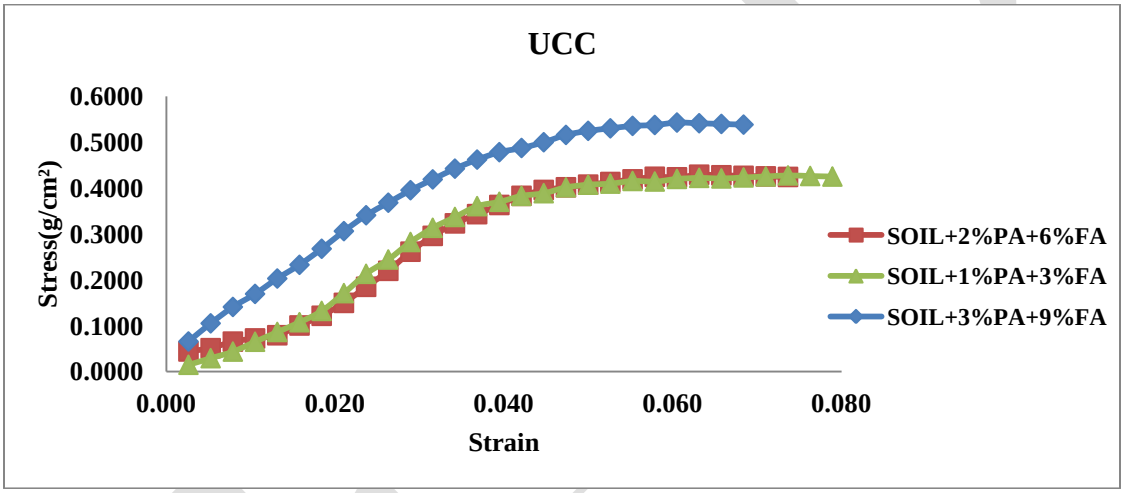
UNCONFINED COMPRESSIVE STRENGTH

Sl No	Proportions	Shear strength(Kg/cm²)
1	Soil	0.417
2	Soil +1%PA+3%FA	0.427
3	Soil +2%PA+6%FA	0.430
4	Soil +3%PA+9%FA	0.543



CALIFORNIA BEARING RATIO

For un-soaked soil sample

Sl No	Proportions	CBR (%)	
		2.5 mm	5 mm
1	Soil	1.3	1.1
2	Soil +1%PA+3%FA	5.02	4.8
3	Soil +2%PA+6%FA	2.5	2.5
4	Soil +3%PA+9%FA	3.6	3.2

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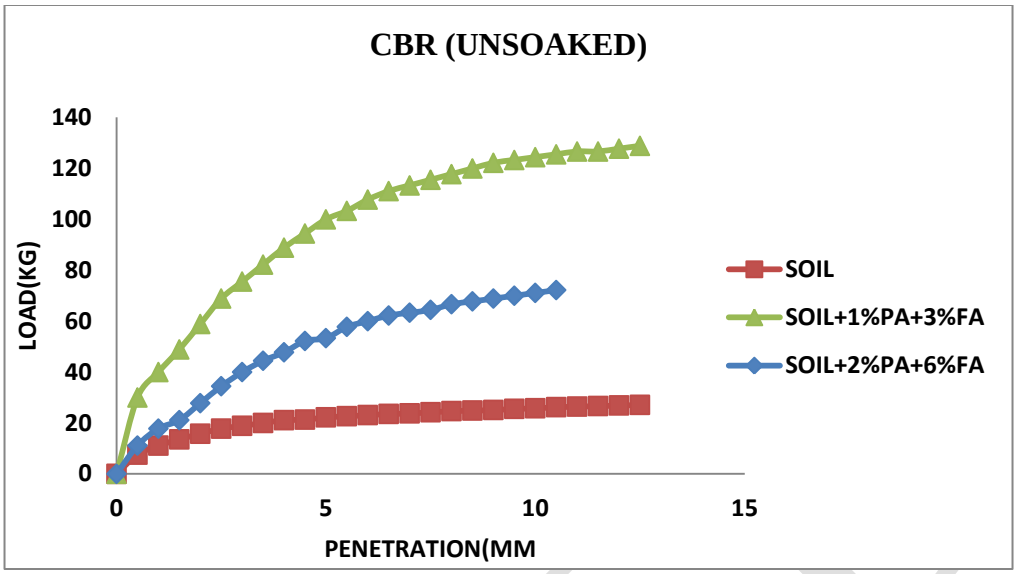
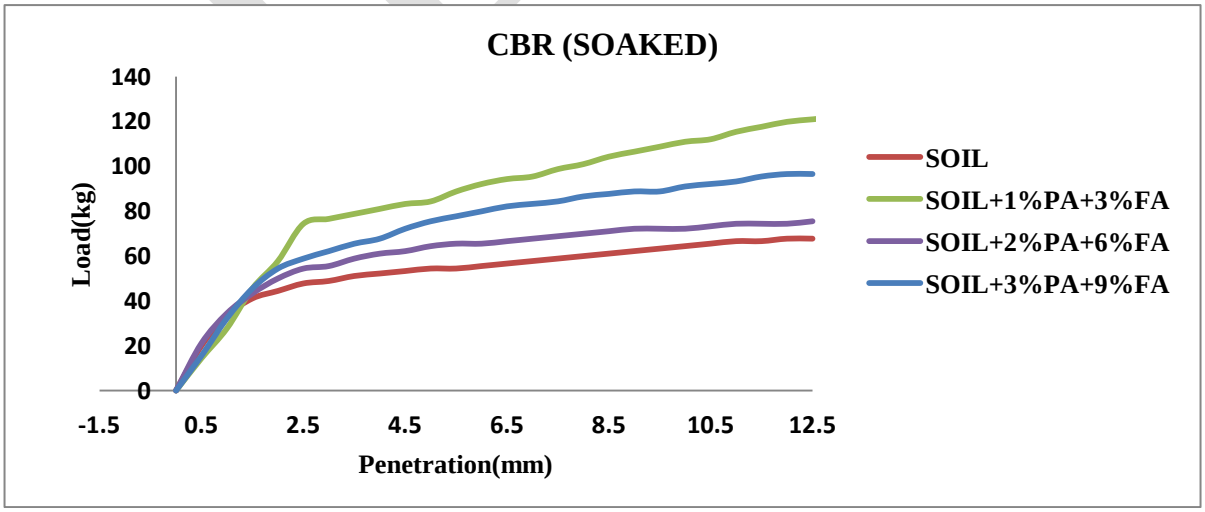


For soaked sample

Sl num	Proportions	CBR (%)	
		2.5 mm	5 mm
1	Soil	3.5	2.6
2	Soil +1%PA+3%FA	5.4	4.1
3	Soil +2%PA+6%FA	3.8	3.13
4	Soil +3%PA+9%FA	4.3	3.7



Issue 7, Vol. 3 (May 2017)
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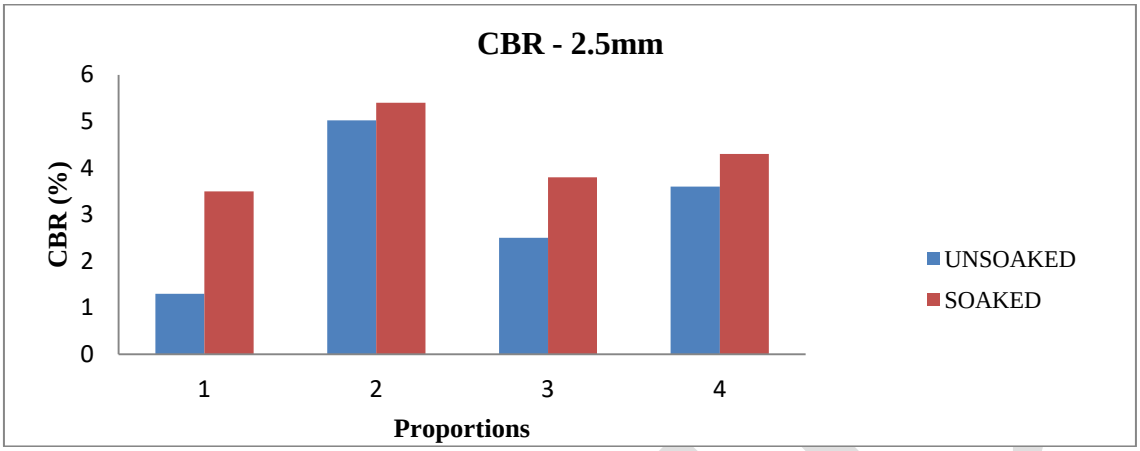
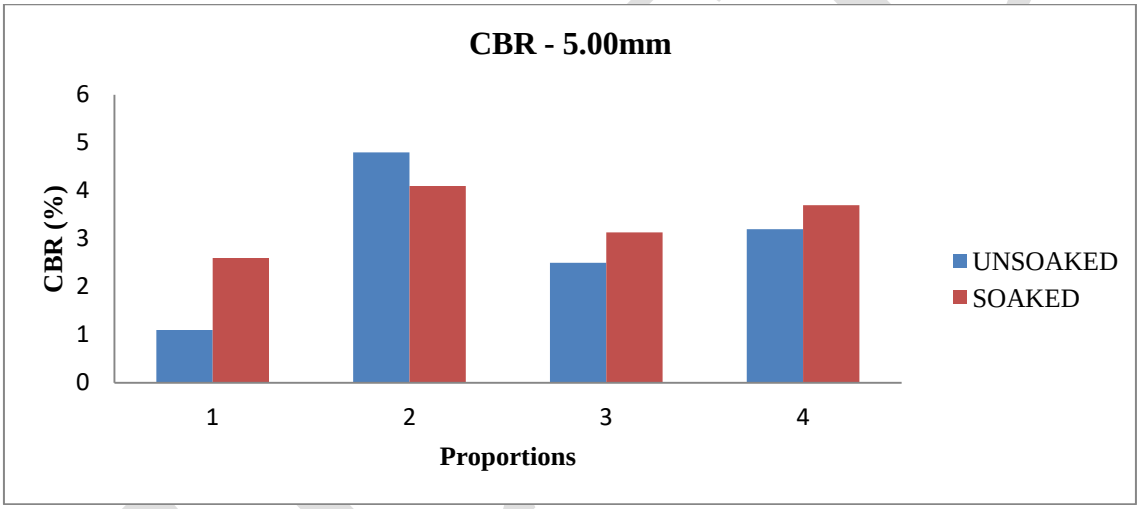
Comparison





CONCLUSION

- The geotechnical properties of clayey soil improve significantly due to the addition of Pond Ash and Fly ash.
- There is an increase in OMC and decrease in MDD with the addition of PA and FA but CBR value get increased with the addition of PA and FA. Therefore the strength will not decrease with the decrease in MDD.
- The CBR value of untreated soaked soil was about 5.00% for 2.5mm penetration and 4.80% for 5mm penetration which has increased considerably and is found to be maximum for 1% of PA and 3% FA. For soaked sample as 5.4% for 2.5mm penetration and 4.1% for 5mm penetration. As the CBR values increases with increase in PA and FA, it can be recommended for improving the performance of clayey soil.
- The use of locally available clayey soil for sub grade saves natural granular material.
- The use of Pond Ash and Fly ash for road construction work reduces environmental pollution up to certain extent.

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