

**COMPARISON OF POND ASH CHARACTERISTICS WITH DIFFERENT
SOILS****Ravichandra Honnali¹, Praveen Ashok M², Basavaraj B³, Sagar N S⁴**¹Assistant Professor in civil dept, Ballari Institute of Technology & Management, Ballari,²Assistant Professor in civil dept, Ballari Institute of Technology & Management, Ballari,³Assistant Professor in civil dept, Ballari Institute of Technology & Management, Ballari,⁴Assistant Professor in civil dept, Ballari Institute of Technology & Management, Ballari,

Abstract-Construction and maintenance of pavements in good condition has become quite problematic especially in areas where problematic soils are encountered below the sub-grade. After construction the pavement may fail due to climatic variation, keeping these aspects in view experimental investigations are carried out to study the effect of pond ash, Black cotton soil and red soil on engineering and strength properties of sub-grade. The properties of soil such as compaction characteristics and California bearing ratio were evaluated. Comparing the CBR value of pond ash with Black cotton soil and red soil, the pond ash value is higher than the two soils. Hence pond ash is preferred for construction of pavement.

KEY WORDS: Black cotton soil, Pond Ash, Red soil, OMC, MDD and CBR.

I. INTRODUCTION

Pavement fails mainly due to insufficient load bearing capacity of soil and due to lack of insufficient good quality of granular material. The properties of soil can be altered or can be modified by adopting various techniques like soil stabilization, providing reinforcement etc. Soil stabilization is of great importance in road construction due to an increase in the shear strength of the soil for the given requirements of a project as well as meeting those requirements under specific weather and traffic conditions. In most of the cases the in-situ soil will not be having sufficient strength to bear the traffic load coming from the vehicles. Many of the roads failed due to poor sub grade.

Some of the previous studies on pond ash as a geotechnical material have been mentioned below.

Goutam and Venkatappa Roa (2007) have studied bearing capacity of footing on compacted pond ash with coir geo textiles bearing capacity increases. Bera et al (2007) studied on compaction characteristics of pond ash. Raju Sarkar et al (2009) studied on compaction and strength characteristics of pond ash. Ghosh et al (2010) conducted laboratory test on pond ash to determine the suitability of pond ash for base and sub base construction of road. Jakka et al (2010) studied on strength and other characteristics of pond ash. Arumugam et al (2011) experimented on characteristics and other geotechnical characteristics of pond ash as a fine aggregate in concrete. Sreedhar et al (2011) studied on behavior of pond ash reinforced with non woven geo textiles. Balendra Mouli Marrapu and Ravi Shankar Jakka (2012) studied on analysis of road embankment with pond ash in active seismic region.

In this study pond ash is collected from Raichur thermal plant and the tests are conducted to know the different soil properties such as grain size analysis, liquid limit, plastic limit, compaction characteristics, specific gravity and CBR with respect to OMC and MDD. Similarly red soil and black cotton soil is collected from Bagalkot soil properties are compared with pond ash and checked for suitability for flexible pavement construction.

II. MATERIALS COLLECTED

Three test samples are considered in this study. Pond ash is collected from Raichur thermal plant, Karnataka. Red and black cotton soils are collected from Bagalkot district, Karnataka

III. EXPERIMENTAL PROGRAM

Collected soil sample is tested for different engineering properties like wet sieve analysis, liquid limit (LL), plastic limit (PL), plasticity index (PI), optimum moisture content (OMC), maximum dry density (MDD), specific gravity and California bearing ratio (CBR).

3.1 Grain Size Analysis

Test is conducted as per IS: 2720-part 4. Grain size analysis is carried out for determining percentage of different particle such as gravel (%), sand (%) and for determining fines such as clay and silt hydrometer or pipette method is performed.

3.2 Liquid limit plastic limit and plasticity index

Test is conducted as per IS: 2720-part 5. the purpose of these tests is to determine the water content at which change in behavior of soil. Liquid limit is the boundary between liquid and plastic state and plastic limit is boundary between plastic and semi solid state.

3.3 Compaction Characteristics

Compaction is the process of densification of soil mass by reducing air voids. The purpose of laboratory compaction test is so determine the proper amount of water at which the weight of the soil grains in a unit volume of the compacted is maximum, the amount of water is thus called the Optimum Moisture Content (OMC). In the laboratory different values of moisture contents and the resulting dry densities, obtained after compaction are plotted both to arithmetic scale, the former as abscissa and the latter as ordinate. The points thus obtained are joined together as a curve. The maximum dry density and the corresponding OMC are read from the curve.

Specific Gravity (IS: 2720 – Part 3)

This test is to evaluate the specific surface area of the soil particle as the fines increases specific gravity also increase.

3.4 The California Bearing Ratio Test (IS: 2720 - Part 16)

The California bearing ratio test is penetration test meant for the evaluation of sub-grade strength of roads and pavements. California bearing ratio is the ratio of force per unit area required to penetrate in to a soil mass with a circular plunger of 50mm diameter at the rate of 1.25mm / min. The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement.

IV. RESULT AND DISCUSSION

All the experiments are conducted as per IS code. The results are shown below for three different soils.

4.1 Red Soil

Red soil is collected from Bagalkot district, Karnataka. The sample collected is dried and geotechnical properties are determined as shown in Table 1 and Fig 1 & 2.

Table 1: Properties of Soil

<i>Sl No</i>	<i>Description</i>	<i>Red Soil</i>
1	Gravel (%)	27.73
2	Coarse Sand (%)	36.55
3	Medium Sand (%)	7.25
4	Fine Sand (%)	8.51
5	Fines (%)	19.96
6	LL (%)	29.00
7	PL (%)	18.00
8	PI (%)	11.00
9	OMC (%)	12.60
10	MDD (g/cc)	2.20
11	Specific gravity	2.59
12	CBR (%)	9.2

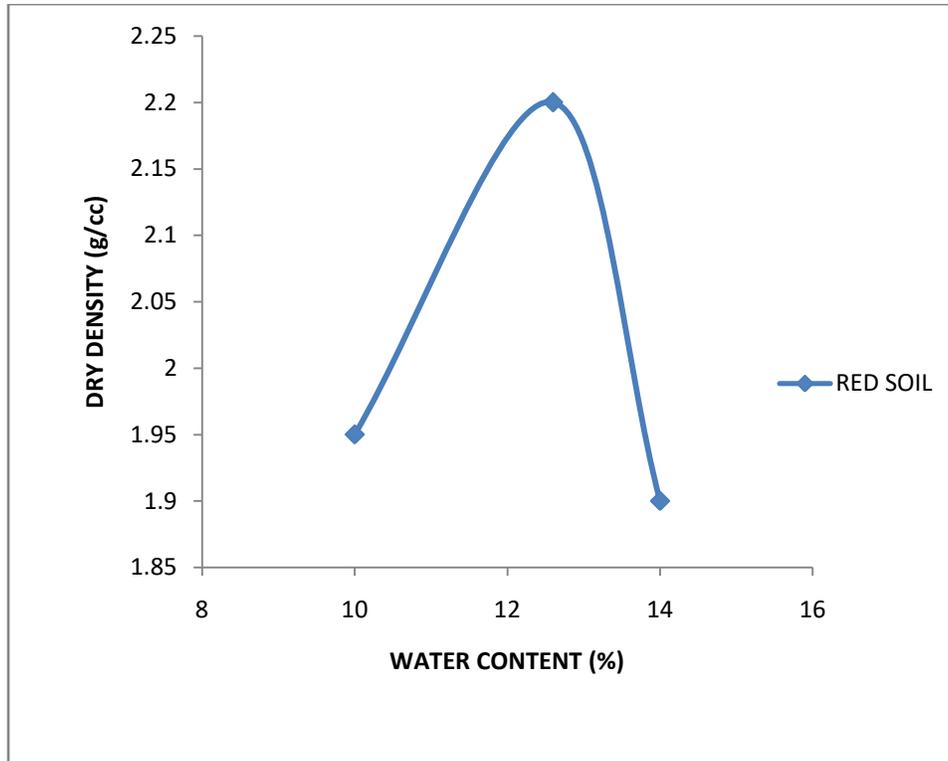


Fig.1: Compaction curve for Red soil

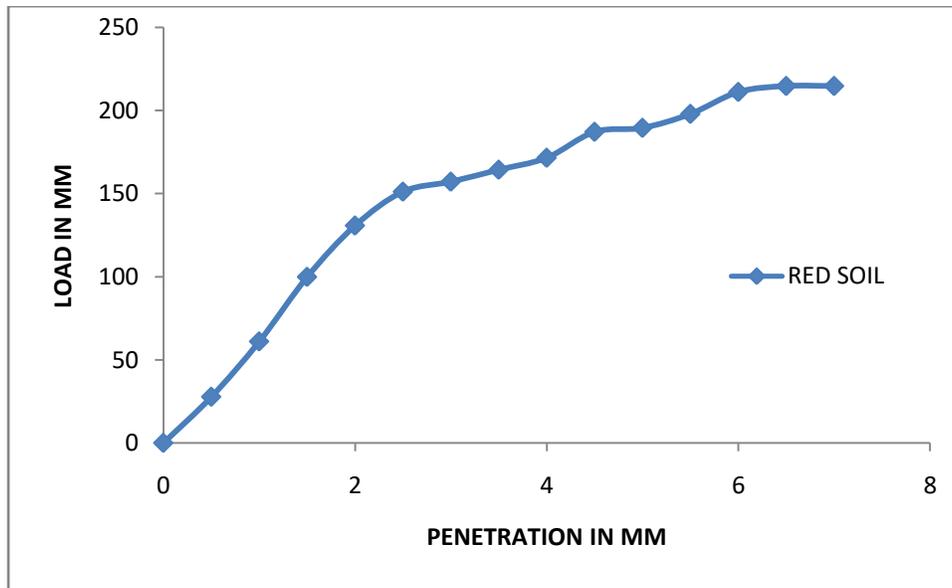


Fig.2: Variation of Load Vs Penetration Curve for Red Soil

4.2 Black Cotton Soil

Black cotton soil is collected from Bagalkot district, Karnataka. The sample collected is dried and geotechnical properties are determined as shown in Table 2 and Fig 2 & 3.

Table 2: Properties of Soil

Sl No	Description	BC soil
1	Gravel (%)	0.00
2	Coarse Sand (%)	5.30
3	Medium Sand (%)	6.62
4	Fine Sand (%)	2.96
5	Fines (%)	85.12
6	LL (%)	78.00
7	PL (%)	43.00
8	PI (%)	35.00
9	OMC (%)	29.80
10	MDD g/cc	1.42
11	Specific gravity	2.82
12	CBR (%)	0.48

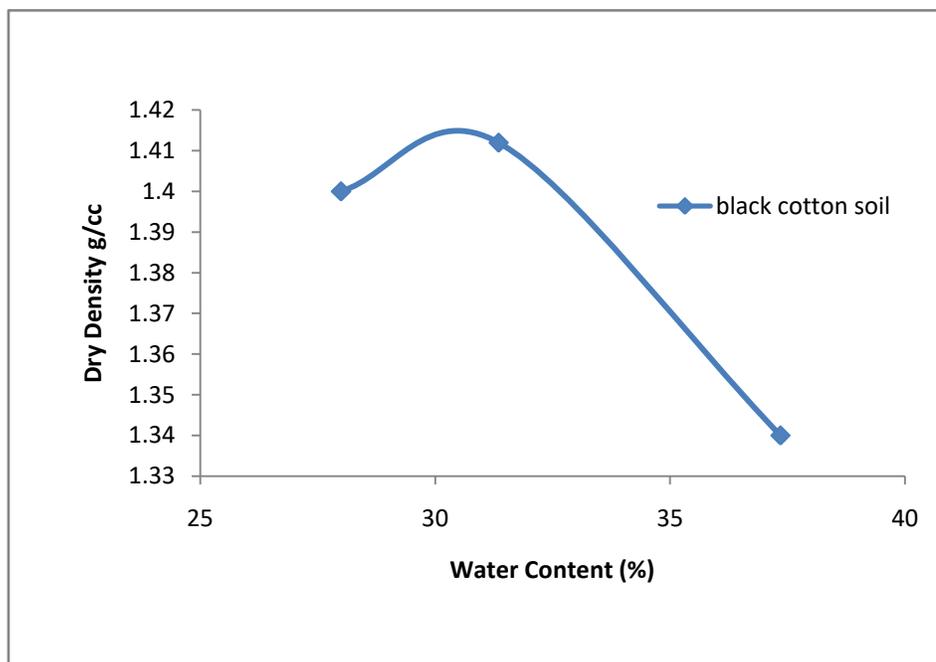


Fig.3: Compaction curve for BC

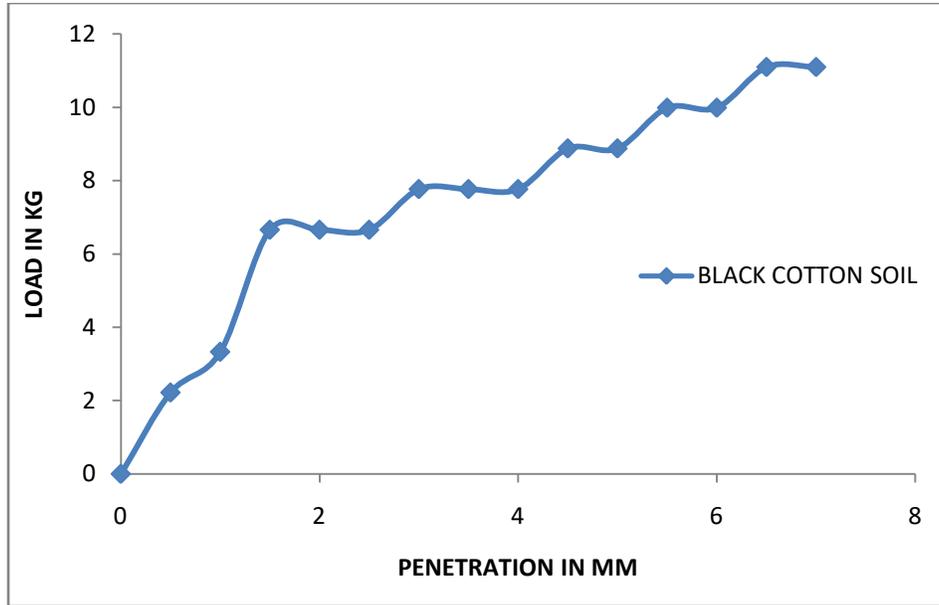


Fig.4: Variation of Load Vs Penetration Curve for Black Soil

4.3 Pond Ash

Pond ash is collected from Raichur thermal power plant, Karnataka. The sample collected is dried and geotechnical properties are determined as shown in Table 3 and Fig 5 & 6.

Table 3: Properties of Soil

<i>Sl No</i>	<i>Description</i>	<i>Pond Ash</i>
1	Gravel (%)	0.38
2	Coarse Sand (%)	3.85
3	Medium Sand (%)	21.45
4	Fine Sand (%)	52.36
5	Fines (%)	21.85
6	LL (%)	55.00
7	PL (%)	NA
8	PI (%)	55.00
9	OMC (%)	31.00
10	MDD g/cc	0.93
11	Specific gravity	2.01
12	CBR (%)	15.53

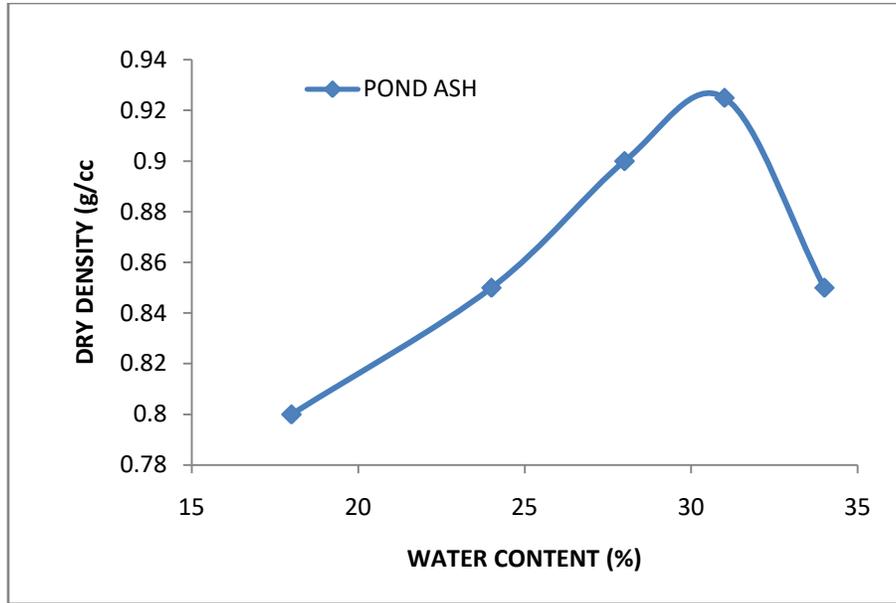


Fig 5: Compaction curve for pond ash

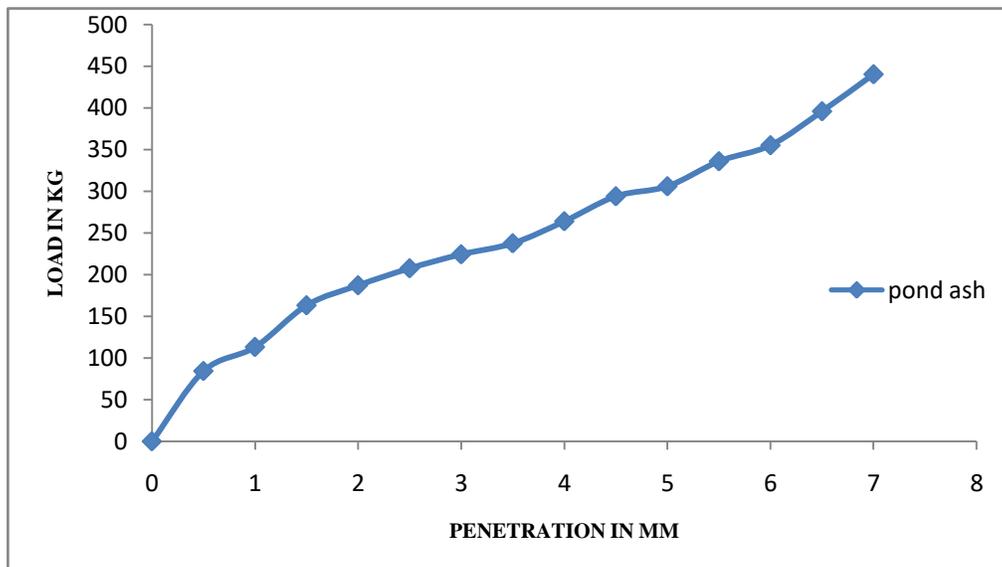


Fig.6: Variation of Load Vs Penetration Curve for Pond Ash

From the test result of red soil it was observed that MDD and OMC of soil is 2.2 gm/cc and 12.6% and CBR obtained from the test is 9.2%.

From the test result of Black cotton soil it was observed that MDD and OMC of soil is 1.42 gm/cc and 29.8% and CBR obtained from the test is 0.48%.

From the test result of Pond ash it was observed that MDD and OMC of soil is 0.93 gm/cc and 31.0% and CBR obtained from the test is 15.53%.

Comparing the results of pond ash with red soil and black cotton soil, MDD is less than the red soil and black cotton soil and OMC is higher than the red soil and black cotton soil. As the CBR value is higher than the two soils i.e 15.53 %. Hence from the test results pond ash gives the higher strength than the red soil and black cotton soil.

V. CONCLUSION

- As the CBR value for pond ash is higher than the other two soils it can be used for construction of sub-grade and as a fill material for low lying area.
- Wherever Black cotton soil encountered it can be replaced by pond ash and can be avoided the stabilization of black cotton soil.
- As the density of pond ash is less, the volume consumed is also less with good stability for flexible pavement

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