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Stabilization of Pond ash using sand

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Abstract - *Pond ash is an unwanted product from thermal power stations. Way of reduce the pollution of pond ash disposal determinations is recycled and reuse in different engineering applications. The quality of pond ash can affect the quality and strength engineering applications. In this research paper to achieve strength pond ash is replaced by sand at different proportion as 7.5%, 15%, 22.5%, 30%, 40% and 50%. For these proportion some laboratory tests as compaction test, CBR tests, and direct shear tests are conducted. As per results found that addition of sand by replacing pond ash have better outcomes.*

Key Words: Pond ash, Sand, Angle Of internal friction, Shear Strength, CBR

1. INTRODUCTION

Pond is a waste material obtained from burning of coal. The main aim of this research is to utilization of pond ash and the minimize the effect on the environment on an account of dumping of huge amount. The disposal of pond ash can pollute the water resources including ground water. There may be air pollution from small dust particle of pond ash when pond ash deposits in dry condition without water. By this process of utilization the construction of embankments, roadways, and many more can become economical. For achieve the strength of pond ash which is replaced by sand. To satisfy this objective, an experimental work was done to investigate the impact replacing sand at several proportion 7.5%, 15%, 22.5 %, 30%, and 40% and 50% insertion on the geotechnical behaviour of pond ash. In this study section 2 describes literature views of past studies, section 3 having properties of materials used in this research. Section 4 presents experimental investigation used for this study and section 5 presents experimental outcomes. Finally section 6 offerings conclusion.

2. LITRATURE REVIEWS

Prabhakar and Sridhar (2002)[1] In this research randomly oriented sisal fiber as reinforcement c- Φ soil at four different percentage 0.25, 0.5, 0.75 and 1% by weight of raw soil and four different length of fiber 10,15,20 and 25 mm is used and found momentous improvement in shear strength parameters of the soil.

Rakesh Kumar, Vijay Kumar Kanuajia (1999)[2] this study conducted on the silty sand and pond ash specimens reinforced with different polyester fibers. According research data the inclusion of fibers in sand increases CBR value, friction angle.

Shilpi Gupta, Prateek Negi, Ashok Gupta (2003)[3]- This research paper based on the study of the effect of the lime and pond ash on geotechnical parameters of sand. Fine sand is used in this study, in presence of moisture, pond ash with lime is making a cementation components which helps to improve the strength of weak soil. A series of experiments including x – ray diffraction is performed for this study for direct proportion of sand with pond ash and lime. This research indicates the MDD of sand is increased with the percentage of lime and MDD increases with up to 8% pond ash after that it decrease. CBR value also increases with the percentage of pond ash and lime and angle of friction also increases up to 9% pond ash and after that it decreases.

Ratna Prasad, Darga Kumar , N. (2015)[4]- In this Research on the stability of fly ash at 25% fly ash shows that the effect is better in terms of CBR and strength. As the percentage of fly ash increases from 0% to 25%, the CBR value under both unsoaked and soaked conditions will decrease. For fly ash content exceeding 15%, the CBR value will decrease by about 50% to 65% under both non-wetting and wetting conditions. The percentage of fly ash increases from 0% to 25%, and the internal friction angle of gravel soil decreases. This reduction in the angle of internal friction hardly exceeds 10% of fly ash. From 15% to 25% of fly ash, the observed internal friction angle is almost constant, with a value between 360 and 380. The fly ash in the sidewalk and the base material can effectively use up to 25% of the fly ash construction

3. MATERIAL USED

3.1 Pond Ash

The pond ash produced from Kota super thermal power station, the material was by product from coal combustion collected from power plant dumping area. Index properties of pond ash are following in Table 1.

Table 1: Index properties of Pond Ash

S.No.	Properties	Value
1	Specific Gravity	1.74
2	Liquid Limit	24.14
3	Plastic Limit	Non -
4	Grain Size Distribution	
	Gravel	0%
	Sand	59.47%
	Silt + Clay	40.53%
5	Coefficient of Uniformity (Cu)	6.8
6	Coefficient of Curvature (Cc)	1
7	OMC (%)	18.75
8	MDD (gm/cc)	1.3010
9	CBR unsoaked (%)	4.40%
10	C	0.19
11	Φ (in degree)	11.734

3.2 SAND

Sand is used in this research work was obtained from the Banas River, Rajasthan. Sand was sieved on sieve 4.75mm, to have an appropriate particle size, for better workability circumstances. Index properties of sand are following in table 2.

Table 2: Index properties of sand

S.No.	Properties	Results
1	Specific Gravity	2.74
2	Grain Size Distribution	
	Gravel	2.96%
	Sand	96.7%
	Silt + Clay	0.14%
3	Coefficient of Uniformity (Cu)	3.33
4	Coefficient of Curvature (Cc)	0.94
5	OMC (%)	11.461
6	MDD (gm/cc)	1.7324
7	CBR unsoaked (%)	15.41
8	C	Non - cohesive
9	ϕ (in degree)	30.633

4. EXPERIMENTAL PROGRAMME

4.1 Standard Proctor Test (Compaction Parameters)

A soil sample is compacted in a mould having a capacity of 1/30 of a cubic foot and having an inner dia of 4 inches. The soil in the mould is compacted in 3 layers with 25 blows per layer from 5.5 pound hammer dropped from 310mm height. The density and moisture content of compacted specimen is plotted on graph and a maximum dry density and moisture content obtain. Standard proctor test is done as per IS 2720 (Part 7) (1980).

4.2 California Bearing Ratio Test (CBR) (Soaked and Unsoaked both Condition)

This is a load deformation test performed in the laboratory or the field whose results are then used with an experiential design chart to determine the thickness of flexible pavement, base and other layers for a given vehicle loading. In this study evaluation of the effect on CBR value of pond ash and sand, is performed according to IS 2720 (Part- 16) (1987) and IRC 37 (1970).

4.3 Direct Shear Test

For determination of Shear Strength Parameters (C and **Φ**) of pond ash and sand , Direct Shear Test (UU Test) is performed for each proportion of pond ash and sand according to IS 2720 (Part – 13) (1886).

5. RESULTS AND DISCUSSION

5.1 EFFECT ON COMPACTION TEST

According to this study it is observed that the maximum dry density is increased with increases in proportion of pond ash- sand mixtures and the optimum moisture content is decreases with increases in proportion of pond ash – sand mixture. The MDD was increased from 1.301 gm/cc to 1.698 gm/cc pond ash- sand mixtures and OMC was decreased from 18.75 % to 12.89% with increases in proportion of pond ash- sand mixtures.

Table 3: Comparison of OMC & OMC of Pond Ash

Percentage of Sand with Pond ash	OMC%	MDD (gm/cc)
Pond ash 100%	18.75	1.301
Pond ash + 7.5% Sand	18.59	1.306
Pond ash + 15% Sand	18.28	1.395
Pond ash+ 22.5%Sand	17.91	1.429
Pond ash+ 30% Sand	17.59	1.500
Pond ash + 40% Sand	15.00	1.633
Pond ash + 50%Sand	12.89	1.698

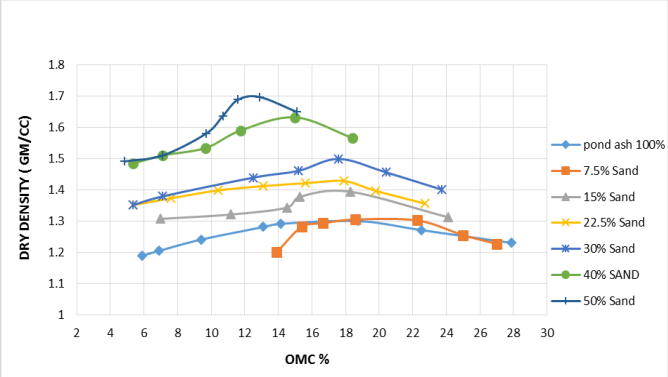

Chart – 1: Standard Proctor Test Results Obtained by Pond ash With Sand

5.2 EFFECT ON CBR TEST

In this research it is observed that the CBR value is proportionally increasing with increasing proportion of pond ash – sand mixture. The CBR value is increases from 4.40 to 12.07 for unsoaked and 3.11 to 10.40 for soaked condition with increase in proportion of pond ash – sand mixture.

Table 4: CBR Test Results obtained for pond ash- sand mixtures

Test Specimen	Soaked CBR Value (%)	Unsoaked CBR Value (%)
Pond Ash 100%	3.11	4.40
Pond Ash + 7.5% Sand	5.62	6.41
Pond Ash + 15% Sand	6.91	7.74
Pond Ash + 22.5% Sand	7.14	8.12
Pond Ash + 30%Sand	8.27	10.17
Pond Ash + 40% Sand	9.26	11.8
Pond Ash + 50% Sand	10.40	12.07

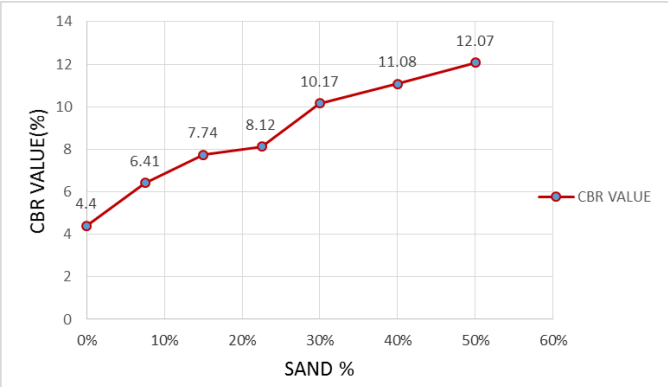

Chart – 2: CBR (Unsoaked) Test Results Obtained by Pond ash With Sand

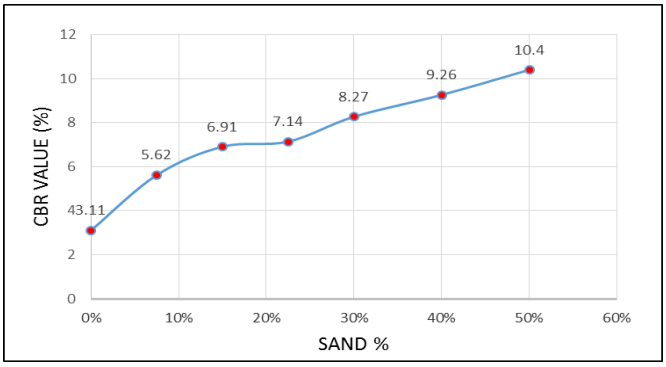

Chart – 3: CBR (soaked) Test Results Obtained by Pond ash With Sand

5.2 EFFECT ON DST TEST

From this study it is observed that the value of **Φ** is upturns with increases in proportion of pond ash – sand mixture. The value of angle of internal friction (**Φ**) is increases from 11.734° to 22.606° with increases in proportion of pond ash – sand mixture.

Table 5: DST Test Results for Pond Ash- sand mixture

S.NO.	Test Specimens	Angle of Internal Friction (Φ) (in
1	Pond ash	11.734
2	Pond ash. + 7.5 % Sand	15.068
3	Pond Ash + 15% Sand	16.699
4	Pond Ash + 22.5% Sand	17.646
5	Pond Ash + 30%Sand	18.849
6	Pond Ash + 40% Sand	19.51
7	Pond Ash + 50% Sand	22.606

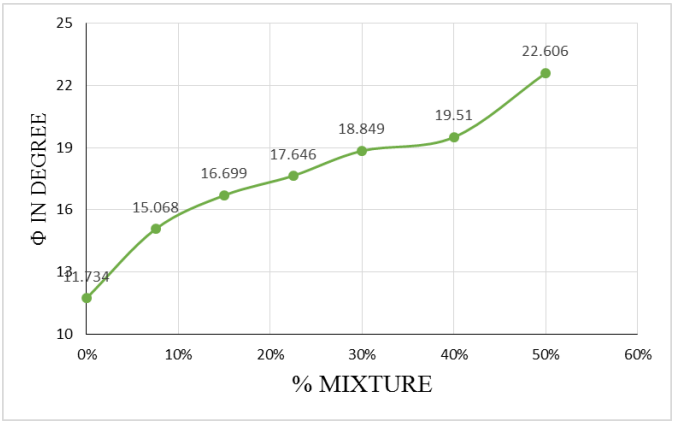

Chart – 3: Variation of **Φ** Value vs different pond ash - sand mixture.

6. CONCLUSIONS

A. Moisture - density relationship of pond ash significantly affected by addition of sand in pond ash. The maximum increase in MDD and the maximum decrease in MDD were found with 50% pond ash and 50% sand mixture which are 1.698 gm/cc and 12.89% respectively.

B. CBR value is improved by adding sand in pond ash significantly in soaked and unsoaked both condition. The maximum CBR value is 10.40 and 12.07 was obtained with 50% pond ash and 50% sand respectively in both soaked and unsoaked condition.

C. In Direct Shear Test, angle of internal friction (**Φ**) of pond ash is significantly improved by addition of sand in pond ash.

The maximum value of angle of internal friction (**Φ**) was 22.606° found on addition of 50% sand in pond ash.

Hence, according to this experimental work we can say that maximum performance can be achieved by addition of 50% sand in 50% pond ash instead of pond ash in sub grads.

7. ACKNOWLEDGEMENT

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