

# UTILIZATION OF POND ASH AND POND ASH STABILIZED BY RBI GRADE-81 FOR ROAD CONSTRUCTION

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## ABSTRACT

Thermal power stations are generating large quantities of ash as a by-product. There are about 82 power plants in India, coarse pond ash and bottom ash which are the waste products of thermal power plant. Keeping in view the need for the safe disposal and effective utilization of these waste products, a number of projects taken up by the industry have shown encouraging results. Presently the suitable material for road construction with conservative parameters of % fines less than 15 and PI less than 9 are very difficult to obtain for the road construction. It also explores the improvement in the performance of pond ash by adding RBI Grade-81 as an admixture. In the present project pond ash collected from NTPC, is used. The engineering properties like OMC and maximum dry density from Modified Proctor Compaction test, CBR and permeability have shown that the material is suitable for construction of roads. From this study it is observed that pond ash can be used as a road material with or without the admixture RBI Grade-81 depending upon the type of the road. As the pond ash is a waste material, the use of it in the road construction is cost effective.

*Keywords: Pond Ash, RBI Grade81, CBR.*

## 1. INTRODUCTION

There is a demand for coal based thermal power generation. This in turn results in generation of environmental hazardous byproducts. At present the ash generation is about 170 Million metric tons per annum which may increase 300 Million metric tons per annum by 2032. It is very essential to increase utilization of the coal ashes than spending huge amounts on the maintenance of ash ponds. In this paper, pond ash stabilized with RBI Grade 81 is studied for the pavement construction. The primary objective of this study is to investigate the effectiveness of RBI Grade 81 stabilized pond ash for improving the California Bearing Ratio.

## 2. LITERATURE REVIEW

In general, limited research is reported on stabilization of pond ash than soils. The notable research in this area include the effect of degree of saturation in pond ash by Bera et al. [2007]. Patil and Patil [2013] have used RBI Grade 81 and given the cost comparison. Anitha et al. [2009], Lekha et al. [2013], RAASTA Center for Road Technology, Bangalore, are the other literature papers which give the details on clay soil, pond ash and RBI Grade 81 etc.

## 3. EXPERIMENTAL STUDY

The improvement in the properties of stabilized pond ash by RBI Grade-81 was studied by conducting laboratory tests Specific Gravity, Grain Size Distribution,

Modified Proctor Compaction, CBR, Direct Shear and Permeability tests.

## 4. CHARACTERIZATION OF MATERIALS

### 4.1 Pond Ash

The investigations were carried out on the pond ash collected from NTPC, Ramagundam, Karimnagar District, Telangana. The relevant index and engineering properties of the Pond Ash used are summarized in Table 1.

Table 1 Index and Engineering Properties of Pond Ash

Property	Pond Ash
Specific Gravity	1.97
Grain Size Distribution (%)	
>4.75 mm	3
4.75-0.075 mm	87
0.075-0.002 mm	5
<0.002	5
Atterberg Limits (%)	
Liquid limit	-
Plastic limit	Non Plastic
Modified Proctor Compaction Test	
MDD(kN/m <sup>3</sup> )	10.87
O.M.C (%)	32.8
California Bearing Ratio Value (%)	
Un-soaked condition	27.45
Soaked condition	8.95
Angle of Internal Friction ( $\phi$ )	
OMC condition	36.86°
SMC condition	34.13°
Coefficient of Permeability (k) (cm/sec)	
1*10 <sup>-3</sup>	

### 4.2 RBI Grade - 81

The RBI Grade-81 is an inorganic soil stabilizer and useful as pavement material. Physical and chemical properties of RBI Grade-81 are shown in Tables 2 & 3. Literature study shows that RBI grade 81 is not effective upto 3-4% in soils. Beyond 4% the properties of soils are improving. Therefore, 4 and 8% were chosen for this study. RBI grade 81 was mixed with pond ash by percentage weight of 4 and 8. Mix properties are presented in Table 4.

Table 2 Physical properties of RBI Grade 81

Physical properties	RBI Grade - 81
Odour	Odourless
Ph	12.5
Freezing point	None
Flammability	Non-flammable
Shelf life	12 months
Storage	Dry storage
Bulk density	700 kg/m <sup>3</sup>

Table 3 Chemical properties of RBI Grade 81

Properties	% by Mass
Ca	CaO 52-56%
Si	SiO <sub>2</sub> 15-19%
S	SiO <sub>3</sub> 9-11%
Al	Al <sub>2</sub> O <sub>3</sub> 5-7%
Fe	Fe <sub>2</sub> O <sub>3</sub> 0-2%
Mg	MgO 0-1%
Mn, K, Cu, Zn	0.1-0.3%
H <sub>2</sub> O	1-3%
Fibers	0-1%
Additives	0-4%

## 5. RESULTS AND OBSERVATIONS

The results of the Grain Size Distribution, Modified Proctor Compaction, CBR, Direct

Shear and Permeability tests performed in the present study on pond ash and pond ash stabilized with RBI Grade 81 are presented. Grain size distribution curve is shown in Fig. 1. The result shows that the percentage fines increases with increase in RBI grade 81 from zero to 8 %. The plasticity characteristics were unaltered.

Table 4 Properties of Pond Ash mixed with RBI Grade – 81

Property	Pond Ash + 4% RBI Grade 81	Pond Ash + 8% RBI Grade 81
Grain size distribution (%)		
>4.75 mm	2	1
4.75-0.075 mm	82	78
0.075-0.002 mm	8	11
<0.002	7	10
Atterberg Limits (%)		
Liquid limit	-	-
Plastic limit	Non Plastic	Non Plastic
Modified Proctor Compaction Test		
MDD(kN/m <sup>3</sup> )	11.82	12.6
O.M.C (%)	27.8	22.6
California Bearing Ratio Value (%)		
Un-soaked condition	29.2	36.61
Soaked condition	16.51	19.93
Angle of Internal Friction ( $\phi$ )		
OMC condition	38.69°	39.28°
SMC condition	34.65°	34.99°
Coefficient of Permeability (k) (cm/sec)		
	$0.86 \times 10^{-3}$	$0.79 \times 10^{-3}$

Fig. 2 shows the compaction curves with increase in RBI grade 81. OMC values are decreasing from 32.8 to 27.8 and 22.6 % for 0 to 4 and 8 % of RBI grade 81 respectively. There was an increase in Maximum Dry Unit Weight value from 10.87 to 12.6 kN/m<sup>3</sup>, for 0 to 8 % of RBI grade 81.

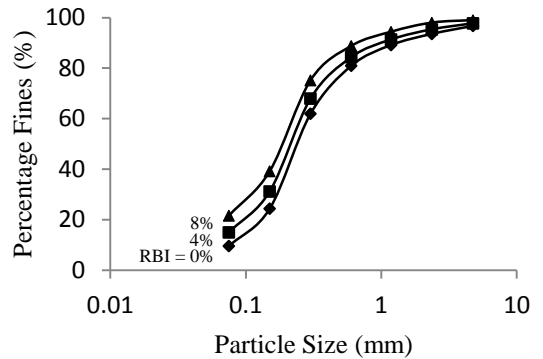


Fig.1 Grain size distribution plot of pond ash and pond ash mixed with RBI Grade-81

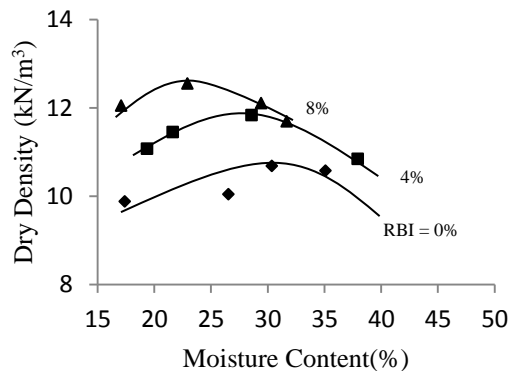


Fig. 2 Modified Proctor Compaction plot of Pond Ash and Pond Ash mixed with RBI Grade 81

Fig. 3 & 4 show the Direct Shear Test (DST) even at saturated condition it gives good frictional properties. Fig. 5 presents the load penetration curves for finding California Bearing Ratio (CBR) value for stabilized and un-stabilized pond ash which indicates the improvement in CBR values with increase in RBI 81. Fig. 6 shows load penetration curves for soaked California Bearing Ratio (CBR) value after a curing period of 7 days for stabilized and un-stabilized pond ash. CBR value of stabilized pond ash increases by 2 times that of un-stabilized pond ash. The permeability value for pond ash is not varying more when compared to stabilized pond ash.

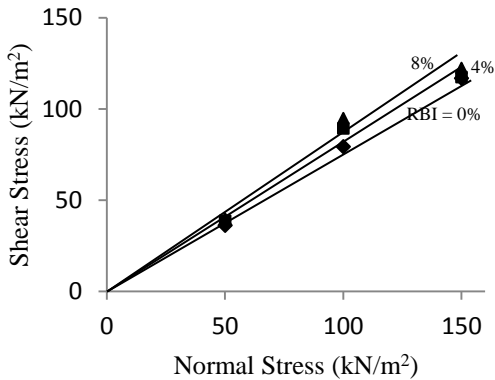


Fig.3 Direct Shear Test (OMC) plot of Pond Ash and Pond Ash + RBI Grade 81

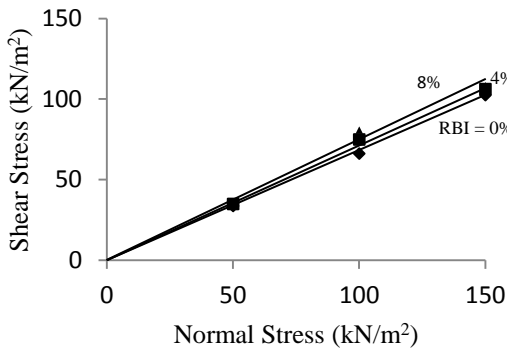


Fig.4 Direct Shear Test (SMC) plot of Pond Ash and Pond Ash + RBI Grade 81

## 6. CONCLUSIONS

Based on improved CBR value, there can be considerable reduction in the thickness of pavement with Pond Ash + RBI Grade 81. So, it can be used as a good subgrade material. It is also cost effective.

Therefore, for the construction of rural roads pond ash can be used and for the construction of urban roads pond ash stabilized with RBI Grade 81 can be used. Pond Ash showed appreciable improvement in strength with the stabilizer under un-soaked condition. Angle of internal friction under saturation condition also unaltered. After addition of RBI Grade 81, the permeability value is almost same and it is a good drainable material which can be used for pavements.

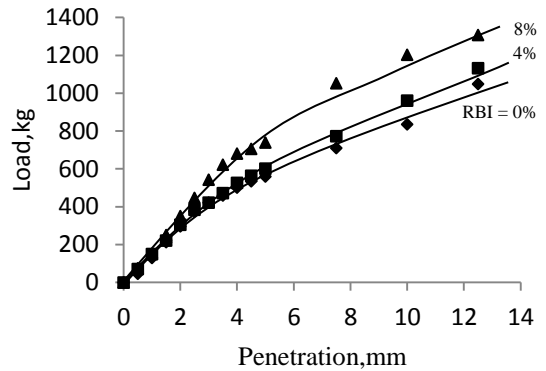


Fig.5 C B R (Un-Soaked) Test plot of Pond Ash and Pond Ash + RBI Grade 81

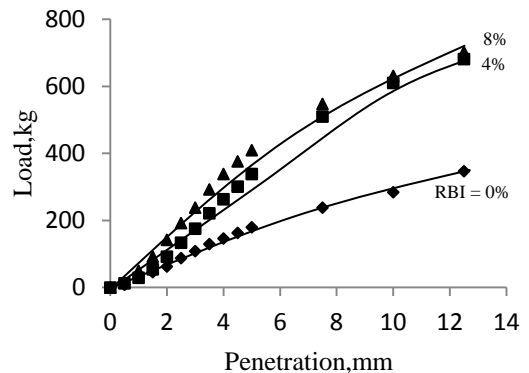


Fig.6 C B R (Soaked) Test plot of Pond Ash and Pond Ash + RBI Grade 81

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