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A COMPARATIVE STUDY OF SOIL STABILIZATION USING FLY ASH AND RICE HUSK ASH

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ABSTRACT
Approximately 21.4% of the total geographical area of the country covered with Expansive soils. Chemical stabilization of soil using cement, lime etc, is costly. Stabilization of soil using solid wastes like Rice husk Ash and Fly ash which reduces the cost of chemical stabilization a review is made on Rice husk ash and Fly ash.RHA has rich amount of silica and FA believed to be one of the best pozzolans which may be used as chemical stabilizers for soil stabilization. The rice husk ash and fly ash is mixed in various proportions with soil like 5%, 10%, 15% and 20%. Various tests were also conducted on these mixes in order to find optimum proportions.

Keywords: Rice husk ash, Fly ash, Soil stabilization, Chemical stabilizer, Index properties, California bearing ratio, Cation Exchange Capacity(CEC).

INTRODUCTION
Clays exhibit generally undesirable engineering properties. They tend to have low shear strengths and to lose shear strength further upon wetting or other physical disturbances. They can be plastic and compressible and they expand when wetted and shrink when dried. Some types expand and shrink greatly upon wetting and drying – a very undesirable feature. Cohesive soils can creep over time under constant load, especially when the shear stress is approaching its shear strength, making them prone to sliding. They develop large lateral pressures. They tend to have low resilient modulus values. For these reasons, clays are generally poor materials for foundations.
Soil stabilization is the process of increasing or maintaining the stability of a soil mass which results in improving the engineering properties of soil. Soil stabilization is widely used in connection with road, pavement and foundation construction
For foundation construction of buildings and bridges, highway construction, etc there is need of good soil to withstand all types of failures. Soil cannot be replaced with good soil everywhere as it is very costly and increase the project cost. This problem can be overcome with improvement in properties of soil which is to be used for infrastructure project. Many investigations had been carried out to use waste materials to improve the soil properties and to utilize the waste materials in view of better environment.

LITERATURE REVIEW
Bhasin et al. (1988), made a laboratory study on the stabilization of black cotton soil as a pavement material using RHA, fly ash ,along with other industrial wastes like , bagasse ash, lime sludge, black sulphite liquor independently with and without lime. The RHA causes greater improvement than that caused by other wastes due to presence of higher percentage of reactive silica in it. In combination with lime, RHA improved the properties of black cotton soil significantly.
Saranjeet Rajesh Soni (2011), reveals that solid waste (fly ash & rice husk) disposal for Soil stabilization is significant project which serves various benefits to the environment.
Venkatesh Ganja, Venkatesh Jagarlamundi (2012), observed that 20% fly ash and 80% expansive soil mix gives optimum CBR value for the first layer of the embankment.

Pravin Patel, Dr. H. K. Mahiyar (2014) fly Ash and Rice husk ash can be used effectively in the civil engineering construction but it is become more effective with lime.

Aparna Roy (2014) For maximum improvement in strength, soil stabilization using 10% RHA content with 6% cement is recommended as optimum amount for practical purposes.

Dr. ROBERT M. BROOKS (2014) An RHA content of 12% and a fly ash content of 25% are recommended for strengthening the expansive sub grade soil while a fly ash content of 15% is recommended for blending into RHA to form a swell reduction layer.

Ramesh, Jitender Daka (2016) ,Concluded that waste material such as Fly ash and rice husk ash can be used effectively in civil engineering construction.

Er. Jasvir Singh , Er.Harpreet Singh Maan (2017) The soil with 8 % fly ash was further blended with variable percentage of rice husk ash (4%,8%, 12%,16%&20%). The major improvement in CBR occurred at 8% fly ash mixed with 12% rice husk ash and thereafter, further addition of rice husk ash is causing gradual change in CBR values. The peak soaked CBR value is 8.9 %.

Jai Prakash, Kusum Kumari , Vijay Kumar (2017) Silica present in RHA is capable to replace the exchangeable ion present in clay mineral thus can reduce shrinkage and swelling property of clay minerals. The addition of RICE HUSK ASH alone to the test soil resulted in first increase in CBR Value thereafter it decreases towards the end.

MATERIAL AND METHODOLOGY

Fly ash is residual material remained after combustion of coal in thermal power plant. Fly ash contains fine particles of silicon dioxide (Sio2), aluminum oxide, iron oxide and calcium oxide. Fly ash has been used in many civil engineering projects successfully. Fly ash provides stability to sub grade, reduce earth pressure and also improves stability of slopes. Usually fly ash is mixed with clayey soils to improve properties as these soils cannot be used directly for construction due to their unfavorable properties. Rice husk is a waste material from paddy crop. After burning it gives the rich amount of silica which may be used as chemical stabilizer for soil stabilization. Lots of ways are being thought of for disposing them by making commercial use of this RHA. RHA is a good super pozzolan.

To compare the effects of Rice Husk Ash and Fly Ash on soil as soil stabilizers they mixed in various proportions with soil. These mixers are further tested to find index properties (specific gravity, liquid limit test, plastic limit test) and Engineering properties (California bearing ratio test).

SOIL PREPARATION AND EXPERIMENTS: Fly ash is mixed in varying percentage of 10,15,20,25 with Natural soil. RHA is mixed in varying percentage of 5,10,15,20 with Natural soil.

RESULTS AND DISCUSSION

Plasticity index-

Plasticity index of black cotton soil is decreases at varying percentage of RHA, Fly ash and Lime.

Compaction parameters –

There is not major change in Maximum dry density (MDD) and Optimum moisture content (OMC) of Black cotton soil with stabilizers.

California bearing ratio (CBR) –

The California bearing ratio (CBR) values of BC soil increases with increase of RHA, fly ash and Lime content.

ATTERBERG'S LIMITS

- **The liquid limit of the soil with varying percentage of Fly Ash and Rice Husk Ash are given in Table 1 & 2 and fig 1**

Table 1

% of Fly ash	Liquid limit (%)
0 (BC Soil)	55
5	48
10	49
15	50
20	50

Table 2

% of Rice husk ash	Liquid limit%
0 (BC Soil)	55
5	49
10	50
15	52
20	-

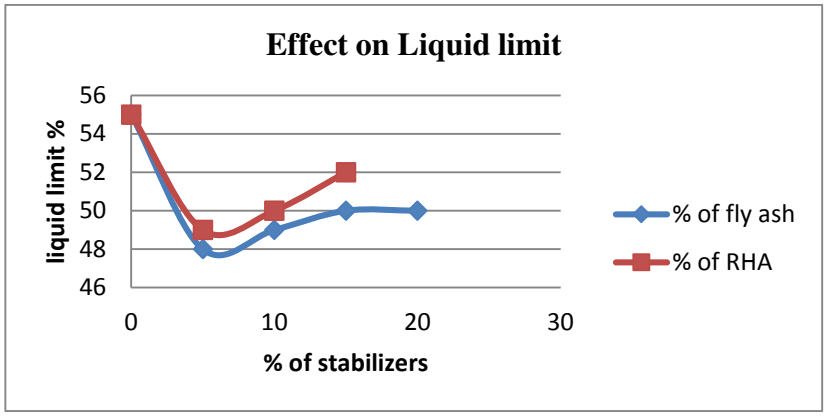

Fig 1

- **Plastic limit of the soil with varying percentage of fly ash and rice husk ash are in Table 3 & 4 and fig 2**

Table 3

% of Fly ash	Liquid limit (%)
0 (BC Soil)	32
5	29
10	27
15	28
20	32

Table 4

% of Rice husk ash	Liquid limit (%)
0 (BC Soil)	32
5	29
10	29
15	31
20	-

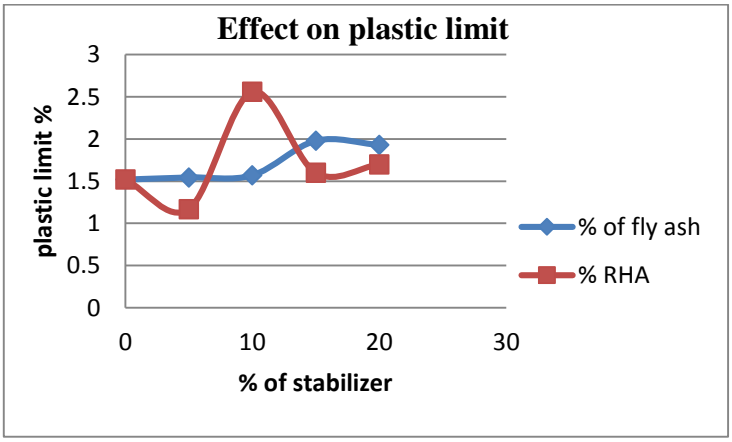

Fig 2

COMPACTION

- **Maximum Dry Density of the soil with varying percentage of fly ash and rice husk ash are in Table 5 & 6 and fig 3**

Table 5

% of Fly ash	MMD(gm/cm²)
0 (BC Soil)	1.71
5	1.58
10	1.64
15	1.7
20	1.65

Table 6

% of Rice husk ash	MMD(gm/cm²)
0 (BC Soil)	1.71
5	1.66
10	1.62
15	1.64
20	1.65

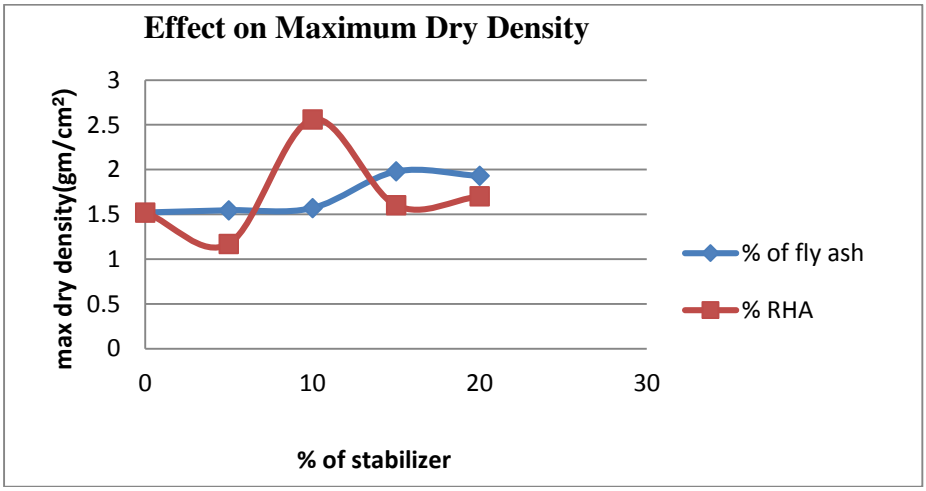

Fig 3

OPTIMUM MOSITURE CONTENT

- **Optimum moisture content of the soil with varying percentage of fly ash and rice husk ash are in Table 7 & 8 and fig 4**

Table 7

% of Fly ash	OMC (%)
0 (BC Soil)	18
5	16
10	15
15	15
20	18

Table 8

% of Rice husk ash	OMC (%)
0 (BC Soil)	18
5	15
10	15
15	18
20	18

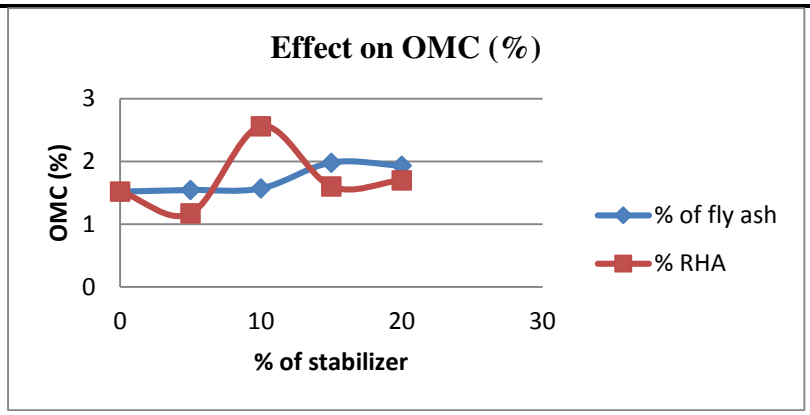

Fig 4

CBR VALUES

- **CBR Values of the soil with varying percentage of fly ash and rice husk ash are in Table 9 & 10 and fig 5**

Table 9

% of Fly ash	CBR Value
0 (BC Soil)	1.52
5	1.545
10	1.57
15	1.98
20	1.93

Table 10

% of Rice husk ash	CBR Value
0 (BC Soil)	1.52
5	1.17
10	2.56
15	1.60
20	1.70

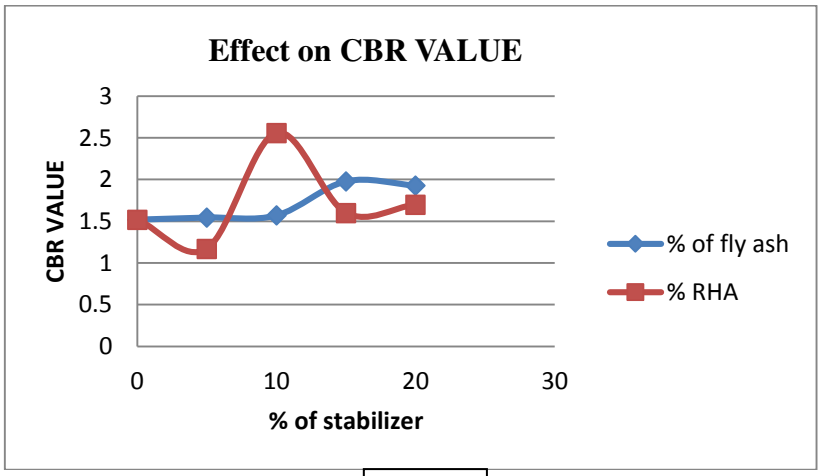

Fig 5

CONCLUSION

SI.NO	Soil+ % of (Fly ash/ RHA)	Liquid Limit (%)	Plastic Limit (%)	Maximum Dry Density(gm/cm²)	Optimum Moisture Content (%)	CBR Value
1	BC SOIL	55	32	1.71	18	1.52
2	5% FLY ASH	48	29	1.58	16	1.545
3	10% FLY ASH	49	27	1.64	15	1.57
4	15% FLY ASH	50	28	1.7	15	1.98
5	20% FLY ASH	50	32	1.65	18	1.93
6	5% RHA	49	29	1.66	15	1.17
7	10% RHA	50	29	1.62	15	2.56
8	15% RHA	52	31	1.64	18	1.60
9	20% RHA	_	_	1.65	18	1.70

The main objective of this research work was to study the effect of adding RICE HUSK ASH and FLY ASH individually on the engineering properties of soil sample. Extensive experimental work was carried out on the engineering properties of the test soil. Major changes were observed in some of the engineering properties of the test soil on the addition of RICE HUSK ASH and FLY ASH.

MAIN CONCLUSION

- Liquid limit and plastic limit of Black Cotton soil increase with increasing % Fly ash and % Rice husk ash.
- CBR value of Black Cotton soil also increase with increasing varying % Rice husk ash. The optimum percentage of Rice husk ash at 20% for gave the best result.
- CBR value of Black Cotton soil also increase with increasing varying % fly ash. The optimum percentage of fly ash at 20% for gave the best result.
- The addition of RICE HUSK ASH alone to the test soil resulted in decrease in the value of MDD.
- The addition of FLY ASH alone to the test soil resulted in increases to 15% then after decreases in the value of MDD.
- The addition of RICE HUSK ASH alone to the test soil resulted in OMC increase.
- The addition of FLY ASH alone to the test soil resulted in OMC increase.
- RHA 20% and FA 20% are the optimum proportions for effective results Silica present in RHA and the binding agent in FA is capable to replace the exchangeable ion present in clay mineral thus can reduce shrinkage and swelling property of clay minerals.
- The waste material such as fly Ash and Rice husk ash can be used effectively in the civil engineering construction.

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