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Study Of Strenth Charataristic Of Black Cotton Stablizing With Fly Ash And Rice Husk Ash

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ABSTRACT:

Expansive soils also known as swelling soils or shrink-swell soils are the terms applied to those soils, which have a tendency to swell and shrink with the variation in moisture content. As a result of which significant distress in the soil occurs, causing severe damage to the overlying structure. During monsoons, these soils imbibe water, swell, become soft and their capacity to bear water is reduced, while in drier seasons, these soils shrinks and become harder due to evaporation of water. These types of soils are generally found in arid and semi-arid regions of the world and are considered as a potential natural hazard, which if not treated well can cause extensive damages to not only to the structures built upon them but also can cause loss of human life. Soils containing the clay minerals montomorillonite generally exhibit these properties. The annual cost of damage to the civil engineering structures caused by these soils are estimated to be £ 150 million in the U.K., $ 1,000 million in the U.S. and many billions of dollars worldwide. In this paper soil is treatd with different proportion of FA(5%,10%,15%,20%,25%) and RHA (,10%,15%,20%,25%,30%) and Optimum moisture content, Maximum dry dencity and california bearing capacity is evaluated. Test was conducted on BC soil and soil, Fly Ash, Rice husk ash mixtures prepared at optimum water content. Addition of Fly ash and Rice husk ash resulted in appreciable increases in CBR of soil. CBR value is used to reduce the thickness of pavement and increasing the bearing capacity of soil.

KEYWORDS: *- CBR, OMC, MDD, Expansive soil, Fly ash, Rice husk ash, Stabilization*

I. INTRODUCTION:

Stabilization is one of the methods of treating the expansive soils to make them fit for construction. Variety of stabilizers may be divided into three groups (Petry 2002): (a) traditional stabilizers (lime, cement etc.), (b) by-product stabilizers (fly ash, quarry dust, phosphor-gypsum, slag etc.) and (c) non-traditional stabilizers (sulfonated oils, potassium compounds, polymer, enzymes, ammonium chlorides etc.). Disposal of large quantities of industrial by products as fills on disposal sites adjacent to industries not only requires large space but also create a lot of geo-environment problems. Attempts are being made by various organizations and researchers to use them in bulk at suitable places. Stabilization of expansive soil is one way of utilization of these by products. Some of the research work conducted by earlier researchers on the above has been described. In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. With the availability of better research, materials and equipment, it is emerging as a popular and cost-effective method for soil improvement. Soil improvement plays a vital role in geotechnical engineering because it is the only way to stabilize and enhance the properties of soils over the times, cement and lime are the two main materials used for stabilizing soils. These materials have rapidly increased in price due to the sharp increase in the cost of energy since 1970s (Neville, 2000). The over dependence on the utilization of industrially manufactured soil improving additives (cement, lime etc), have kept the cost of construction of stabilized road financially high.

Ravine M. Tailor[1], Dr. M. D. Desai[2] has already discussed in IGC 2009 utilization of rice husk ash and fly ash of sub grade having majority of black cotton soils the study shows average soaked CBR of west Gujarat is 2% the aim behind modified design was to reduce the annual maintenance expenditure for flexible pavement & standardized design for city roads. Typical pavement designs for different category of roads were developed by authors with Lime – Fly ash stabilization technique to improve the sub grade CBR. The design achieved the reduced annual maintenance expenditure with more durable road sub grade[1] Dr. Robert M. Brooks[1] has also discussed in December 2009 IJRRAS use of rice husk ash and fly ash is to upgrade expansive soil as construction material remolded expansive clay was blended with RHA and fly ash and strength tests were conducted.

The potential of RHA-fly ash blend as a swell reduction layer between the footing of a foundation and sub grade was studied. In order to examine the importance of the study, a cost comparison was made for the reparation of the sub-base of a highway project with and without the admixture stabilizations. Stress strain behavior of unconfined compressive strength showed that failure stress and strains increased by 106% and 50% respectively when the fly ash content was increased from 0 to 25%. When the RHA content was increased from 0 to 12%, Unconfined compressive stress increased by 97% while CBR improved by 47%.

Dr. S.M. prasanna Kumar[1]Indian geotechnical conference – 2010 has already discussed use of fly ash for soil stabilization attributes to the chemical composition and physical characteristics of fly ash, which Favor pozzolana reactions. The major chemical compounds present in fly ash contribute active role in chemical reactions with constituents of soil are calcium Ca +and Silica Si - ions. Black cotton soil (BC Soil) and non-Expansive type – Red Earth (RE) are stabilized using pozzolana fly ash – nyveli lignite fly (NFA) ash and non-Pozzolana fly ash – raichur fly ash (RFA) mixed at different doses along with supplementing additives like lime and cement. The maximum dry density of the BC soil increased from 3.6 to 15.2 KN/m3 for addition of 40% NFA. For Red earthed changed from 14.6 to 17.8 KN/m3 for NFA Addition. Pozzolana fly ash has shown considerable Earth, for addition of 30% of fly ash, NFA.

Saranjeet Rajesh Soni[1], P.P Dahale[2], R.M Doble[3] has discussed IJAEST Vol-No-7, Issue-No-2 economical and effective way to achieve improvement in engineering performance of black cotton soils (B. C. soil). Attempts were made to increase the stability of soil using fly ash (FA) and rice husk powder (RHP). The UCS of natural soil is 198Kpa which is increased after the addition of FA (10%) and RHP (10%) with addition with10% of lime for the period of 28 days curing to 253 kpa. Plasticity Index was reduced to 15.74%, Liquid limit reduces to 35.85%, and Plastic limit reduces to 28.04% after addition of FA (10%) and RHP (10%) with addition with10% of lime for the period of 28 days curing.[4] Alhassan (2008) again carried out experiments to study the effect of stabilizing A-7-6lateritic soil (CH) with 2-12% RHA by weight of dry soil. CBR and UCS tests were conducted for the soil RHA composites. The results obtained indicate a general decrease in the maximum dry density and increase in optimum moisture content. There was also slight improvement in the CBR and UCS values with increase in RHA content. Peak UCS values were recorded at between 6-8% RHA content, indicating a little potential of using 6-08% RHA for strength improvement of A-7-6 lateritic soil.[5]

II. MATERIALS AND METHOLOGY:

Black Cotton Soil : It is collected from Patan Road District Jabalpur Madhya Pradesh from ground having coordinates21.2191° N, 81.3065° E. soil sample is collected from location of Sukkha village, Power grid Office and near bypass of Jabalpur Patan road. Soil Sample is collected 1 meter below the original depth then collected into bag and send into the laboratory for examination

Rice husk ash : IT is collected from virat vidut limited rice husk ash based Bio-Mass Power Plant at Bilaspur (C.G.),

Fly ash : IT is collected from satpura thermal power station MPPGCL Sarni betul Madhya Pradesh. Properties of black cotton soil define as per BIS standards and properties of black cotton soil, Rice husk ash and fly ash are tabulated on table

Methodology : The soil is collected from patan road Jabalpur (MP) and collects into bags and sends in laboratory for examination. First Index property of soil is determined after then fly ash and rice husk ash mix in different proportions in soil and put Into 28 days for curing. Total five combinations are formed and california bearing ratio, Optimum moisture, Maxisimum dry dencity is evaluated.

Sr.No	Description of properties	Value
1.	Particle size distribution Sand (%), Silt + Clay (%)	8% 92%
2.	Liquid limits	40% - 100%.
3.	Plastic Limit	25(%)
4.	CBR	1.5-2(%)
5.	OMC (%)	26%
6.	MDD (Kn/m3)	1.52
7.	Free Swell index	> 50%

Table No.2Oxide composition of RHA.

Sr. No.	Constituent	Composition (%)
1	SiO2	75.2
2	Al2O3	5.2
3	Fe2O3	1.02
4	CaO	1.4

Table No.1 Geotechnical properties of black cotton soil

Chemical composition of Fly Ash classes

`Properties	FLY ASH CLASSES	
	Class F	Class C
Silicon dioxide (SiO2) plus aluminum oxide (Al2O3) plus iron oxide (Fe2O3), min, %	70.0	50.0
Sulfur trioxide (SO3), max, %	5.0	5.0
Moisture Content, max, %	3.0	3.0
Loss on ignition, max, %	6.0	6.0
* The use of class F fly ash containing up to 12% loss of ignition may be approved by the user if acceptable performance results are available		

Rice husk ash : Rice husk is an agricultural waste obtained from milling of rice. About 108 tones of rice husk is generated annually in the world. Meanwhile, the ash has been categorized under pozzolana, with about 67-70% silica and about 4.9% and 0.95%, Alumina and iron oxides, respectively(Oyetola and Abdullah, 2006). The silica is substantially contained in amorphous form, which can react with the CaOH librated during the hardening of cement to further form
cementations compounds.

Fly ash : In India, about 76% of electrical energy is generated using coal as fuel in thermal power plants. Presently in India,170 millions of tones of fly is being produced by the of thermal power plants, out of which a vast majority is fly ash having low lime content. Fly ash is a solid waste generated by thermal power plants where coal is used as fuel. As the need of power is increasing with a very fast rate for development purpose, the production of fly ash is increasing rapidly while generating electrical energy by thermal power plant. Disposal of this enormous amount of fly ash faces problem of huge land requirement, transportation, and ash pond construction and maintenance, which can be reduced by utilizing fly ash as a construction material for civil engineering structures.

III. RESULTS:

Soil Sample	Optimum moisture content (%)	Maximum dry dencity (gm/cm3)	Soaked CBR
BC SOIL	13	1.70	1.96
S1(5%FA+ 10%RHA)	18	1.645	2.86
S2(5%FA+ 10%RHA)	14	1.70	3.4
S3(5%FA+ 10%RHA)	15	1.65	2.32
S4(5%FA+ 10%RHA)	15	1.69	2.66
S5(5%FA+ 10%RHA)	14	1.52	5.63

Table-3 OMC, MDD, and CBR Values for different soil samples

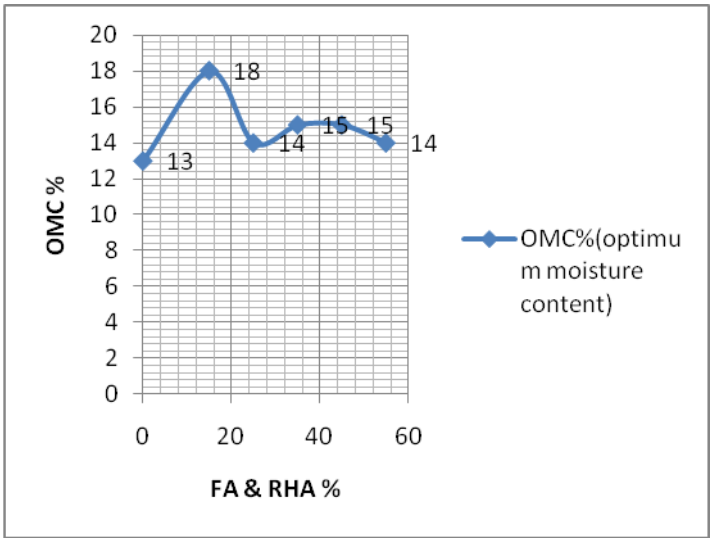

Fig-1 OMC value for BC Soil, Fly ash and Rice husk ash mix soil samples

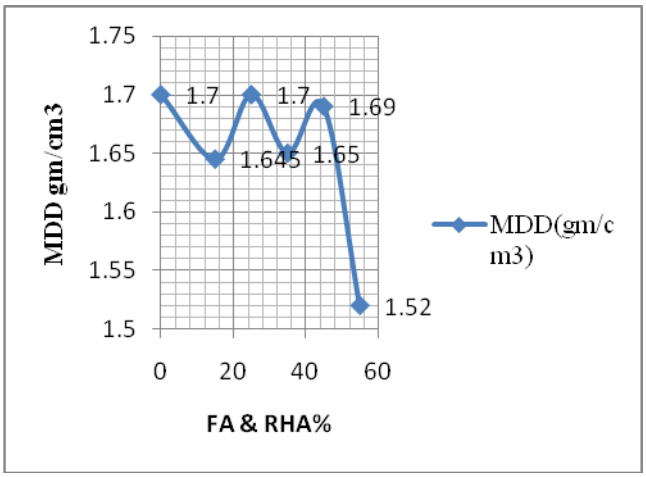

Fig-2 MDD value for BC Soil, Fly ash and Rice husk ash mix soil samples

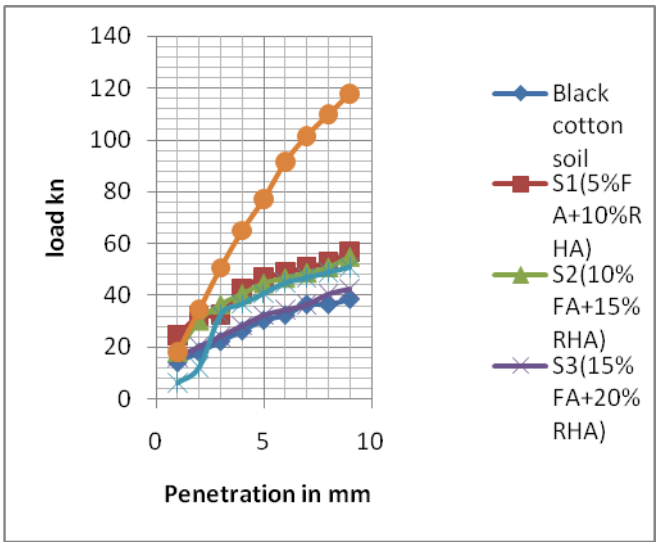

Fig-3 OMC value for BC Soil, Fly ash and Rice husk ash mix soil

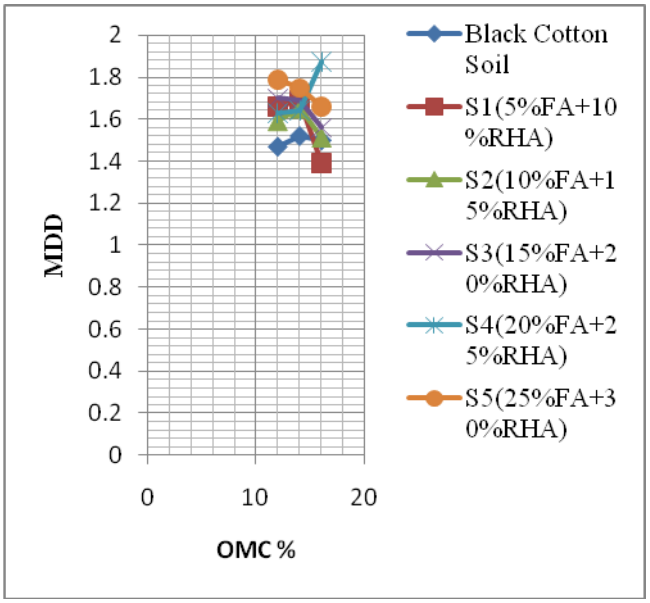

Fig-4 OMC, MDD value for BC Soil, Fly ash and Rice husk ash mix soil

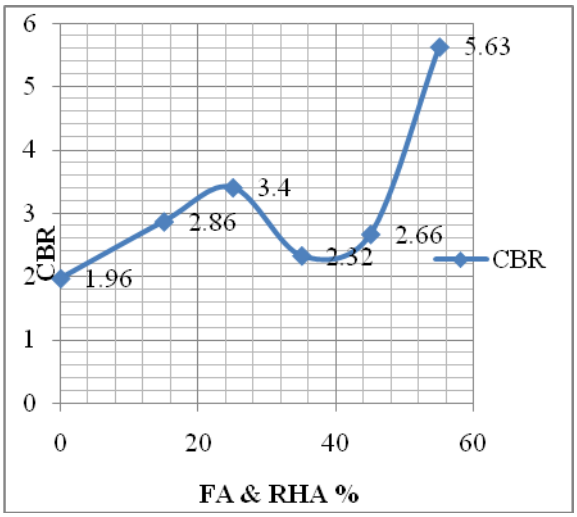

Fig-5 CBR value for BC Soil, Fly ash and Rice husk ash mix soil

IV. CONCLUSION

[1] I t is found that maximum dry density of black cotton soil was 1.70 kn/m^3 for first sample(5%FA+10%RHA) it is reduced to 3.34% for second sample(10%FA+15%RHA) it is increases to 3.2% for third sample(15%FA+20%RHA) it is reduces to 3.03% for fourth sample(20%FA+25%RHA) it is increases to2.42 % for fifth sample(25%FA+30%RHA) it is reduces to 11.18%

[2] Optimum moisture content is reduces.

[3] 3. It is found that CBR of black cotton soil for 5mm penetration 1.96 % when it replaced with first sample (5%FA+10%RHA) it is increases to 45%. In second sample (10%FA+15%RHA) it is increases to 73% for third sample (15%FA+20%RHA) again it is reduces to 18% for fourth sample (20%FA+25%RHA) it is increases to 35% for last sample (25%FA+30%RHA) it is increases to 287%.

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