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Experimental Study On Cbr Ratio Of Flyash Using Crusher Dust And Cement

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Abstract - The present work has been undertaken to get a viable solution to save use and earth from its bulk use in construction industry and to facilitate the en mass use of fly ash, which is a surplus material and needs to be used in bulk. Different crusher dust to flyash ratios was evaluated with their perspective optimum moisture content. It was observed that the stabilization of mix increased as the number of interfaces among the different materials was increased. It was found that the maximum improvement in the geotechnical properties of fly ash occurred at a crusher dust and cement to flyash ratio of 100:25:5 when the number of interfaces was three and this combination can be safely adopted as the optimum usage combination based upon the results of the study undertaken.

Key Index - Flyash, Crusher Dust, CBR Ratio, Atterberg's Limits.

I.INTRODUCTION

India is the World's largest producer of fly ash. Its production may soon reach the figure of 150 MT per year. Fly ash is hazardous to health, and pollutes air and water and occupies several thousand hectares of land for its disposal. The level of utilization of fly ash in India is very low. If the utilization is not increased substantially, the menace of fly ash will grow and may become alarming in many parts of the country. Bulk utilization of fly ash produced in India has become imperative in view of its huge production. Therefore, utilization of fly ash in geotechnical and highway applications, such as embankment of roads, bridge approaches, filling of low lying areas to develop sites for residential or industrial buildings etc., should be exploited properly. In order to open up these possibilities, understanding the behaviour of flyash alone and with additives is prerequisite. Accordingly, the present investigation is to study the behaviour of fly ash and the pertinent literature on this topic is reviewed.
Hazardous wastes, the potential hazards to human health and environment when improperly treated and disposed. Metal finishing and electroplating industries generate large quantities of toxic waste sludge containing Cr, Pb, Ni, Cd and Zn that are mainly disposed on landfill, causing real threat to the environment. Solidification/stabilization (S/S) is a widely accepted treatment process for the immobilization of hazardous wastes, including heavy metals. In S/S process fly ash and cement, added with water that reacts to form hydrated silicates and aluminates resulted in a solidified mass. Therefore, the present study aimed at to use fly ash, Portland cement for solidification of electroplating waste sludge containing high concentration of heavy metals. Accordingly, literature pertaining to these areas is also presented. Whereas, the aspect of geotechnical applications *viz.*, compaction properties, shear strength and California bearing ratio, bearing capacity etc., of the mix containing fly ash-waste sludge-cement is not available in literature, therefore, the literature pertaining to fly ash and lime has been presented.

II.LITERATURE REVIEW

S.Bhuvaneshwari and S.R. Gandhi: A study was carried out by S.Bhuvaneshwari and S.R. Gandhi on the effect of engineering properties of expansive soil through an experimental programme. Infrastructure projects such as highways, railways, water reservoirs, reclamation etc. requires earth material in very large quantity. In urban areas, borrow earth is not easily available which has to be hauled from a long distance. Quite often, large areas are covered with highly plastic and expansive soil, which is not suitable for such purpose. Extensive laboratory / field trials have been carried out by various researchers and have shown promising results for application of such expansive soil after stabilization with additives such as sand, silt, lime, Fly Ash, etc. As Fly Ash is freely available, for projects in the vicinity of a Thermal Power Plants, it can be used for stabilization of expansive soils for various uses. The present paper describes a study carried out to check the improvements in the properties of expansive soil with Fly Ash in varying percentages. Both laboratory trials and field tests have been carried out and results are reported in this paper. One of the major difficulties in field application is thorough mixing of the two materials (expansive soil and Fly Ash) in required proportion to form a homogeneous mass. The paper describes a method adopted for placing these materials in layers of required thickness and operating a "Disc Harrow". A trial embankment of 30m length by 6m width by 0.6m high was successfully constructed and the in-situ tests carried out proved its suitability for construction of embankment, ash dykes, filling low-laying areas, etc.
Pandian et.al. (2002). Studied the effect of two types of Fly Ashes Raichur Fly Ash (Class F) and Neyveli Fly Ash (Class C) on the CBR characteristics of the black cotton soil. The Fly Ash content was increased from 0 to 100%. Generally the CBR/strength is contributed by its cohesion and friction. The CBR of BC soil, which consists of predominantly of finer particles, is contributed by cohesion. The CBR of Fly Ash, which consists predominantly of coarser particles, is contributed by its frictional component. The low CBR of BC soil is attributed to the inherent low strength, which is due to the dominance of clay fraction. The addition of Fly Ash to BC soil increases the CBR of the mix up to the first optimum level due to the frictional resistance from Fly Ash in addition to the cohesion from BC soil. Further addition of Fly Ash beyond the optimum level causes a decrease up to 60% and

then up to the second optimum level there is an increase. Thus the variation of CBR of Fly Ash-BC soil mixes can be attributed to the relative contribution of frictional or cohesive resistance from Fly Ash or BC soil, respectively. In Neyveli Fly Ash also there is an increase of strength with the increase in the Fly Ash content, here there will be additional puzzolonic reaction forming cementitious compounds resulting in good binding between BC soil and Fly Ash particles

Phanikumar and Sharma (2004): A similar study was carried out by Phanikumar and Sharma and the effect of Fly Ash on engineering properties of expansive soil through an experimental programme. The effect on parameters like free swell index (FSI), swell potential, swelling pressure, plasticity, compaction, strength and hydraulic conductivity of expansive soil was studied. The ash blended expansive soil with FLY ASH contents of 0, 5, 10,15 and 20% on a dry weight basis and they inferred that increase in FLY ASH content reduces plasticity characteristics and the FSI was reduced by about 50% by the addition of 20% Fly Ash. The hydraulic conductivity of expansive soils mixed with Fly Ash decreases with an increase in Fly Ash content, due to the increase in maximum dry unit weight with an increase in Fly Ash content. When the Fly Ash content increases there is a decrease in the optimum moisture content and the maximum dry unit weight increases. The effect of Fly Ash is akin to the increased compactive effort. Hence the expansive soil is rendered more stable.

III.METHODOLOGY

Flyash:-Fly Ash is one of the residues or by product generated in combustion, and comprises the fine particles that rise with the flue gases. For these experimental work flyash collected from **Kota Super Thermal Power Station, Kota Rajasthan.**

TABLE NO I- INDEX PROPERIES OF FLYASH

Property	Value
Particle Size distribution Sand (%) Silt+Clay (%)	 20.6 79.4
Specific Gravity	2.21
Liquid Limit (%)	27.4
Plastic Limit (%)	Non-Plastic
OMC (%)	21.86
MDD (g/cm3)	1.35
CBR Soaked (%)	1.57

Crusher Dust:- In the present investigation an attempt is made to study the performance of crusher dust as geotechnical material in construction activities which is collected from locally available crusher plant.

TABLE II: INDEX PROPERTIES OF CRUSHER DUST

Property	Value
Natural Moisture Content (%)	6.24
Particle Size distribution Sand (%) Silt+ Clay (%)	 96.8 3.2
Specific Gravity	2.96
Liquid Limit (%) Plastic Limit (%)	19.9 Non-Plastic
OMC (%)	13.92
MDD (g/cm3)	1.94
CBR Soaked (%)	14.56

Cement in this study Ordinary Portland Cement grade 450 used which purchase from the local market.

California Bearing Ratio:- Soaked and unsoaked CBR tests were conducted in accordance with IS: 2720 (Part 16)-1987. Tests were conducted on flyash, crusher dust and flyash-crusher dust mixes. For conducting soaked CBR tests, the samples were prepared at their OMC. CBR testing sample curing done upto 72 hours.

TABLE III: CBR RATIO OF FLYASH WITH VARIOUS % OF CRUSHER DUST AND 5% CEMENT

Correction Loads		(3 DAYS) Soaked CBR Ratio (FA+CD+CEMENT)										
Test No			Flyash(FA)		FA+10+5		FA+20+5		FA+30+5		FA+40+5	
Penetration			2.5	5.0	2.5	5	2.5	5	2.5	5	2.5	5.0
Std.Load			1370	2055	1370	2055	1370	2055	1370	2055	1370	2055
Corr. Load			43.11	62.44	65.45	97.73	77.58	115.53	100.83	147.4	92.43	132.58
	CBR	%	3.15	3.04	4.78	4.76	5.66	5.62	7.36	7.17	6.75	6.45
	Max	%	3.15		4.76		5.66		7.36		6.75	

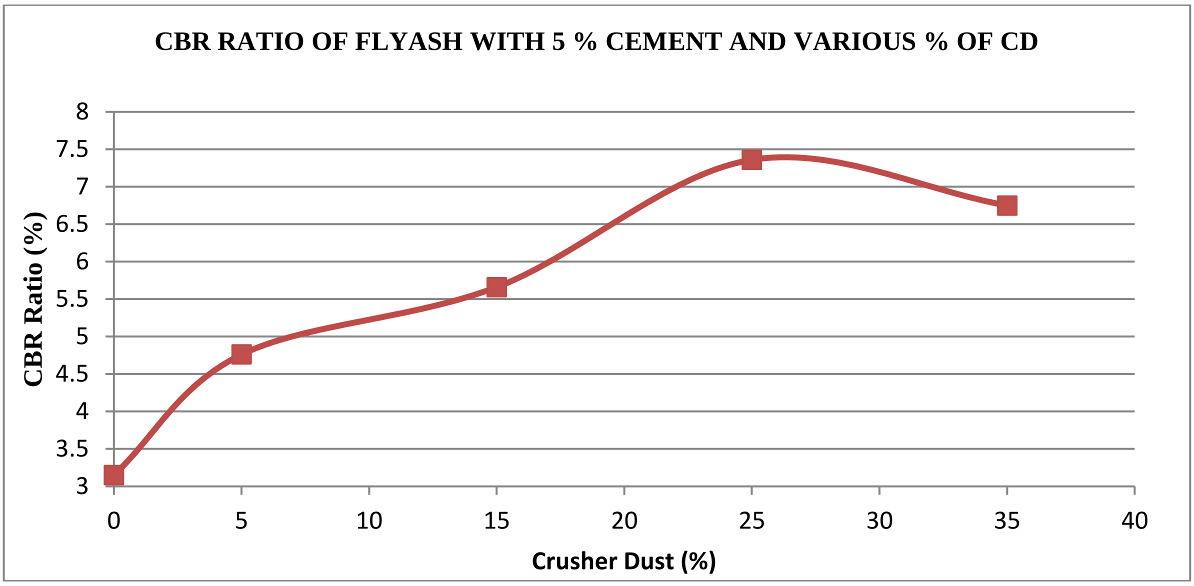

Fig. 1- CBR Ratio of Flyash With Crusher Dust And Cement

TABLE V: CBR RATIO OF FLYASH WITH VARIOUS % OF CRUSHER DUST

Correction Loads			(3 DAYS) Soaked CBR Ratio (FA+CD)									
Test No			flyash		FA+10		FA+20		FA+30		FA+40	
Penetration			2.5	5.0	2.5	5	2.5	5	2.5	5	2.5	5.0
Std.Load			1370	2055	1370	2055	1370	2055	1370	2055	1370	2055
Corr. Load			21.48	31.65	30.37	44.63	40.26	52.59	48.9	71.5	66.93	98.88
	CBR	%	1.57	1.54	2.22	2.17	2.94	2.56	3.57	3.48	4.89	4.81
	Max	%	1.57		2.22		2.94		3.57		4.89	

TABLE V: CBR RATIO OF FLYASH WITH VARIOUS % OF CRUSHER DUST

(3 DAYS) CBR RATIO OF FLYASH WITH DIFF. % OF CRUSHER DUST					
% OF CRUSHER DUST	0	10	20	30	40
CBR RATIO	**1.57**	**2.22**	**2.94**	**3.57**	**4.89**

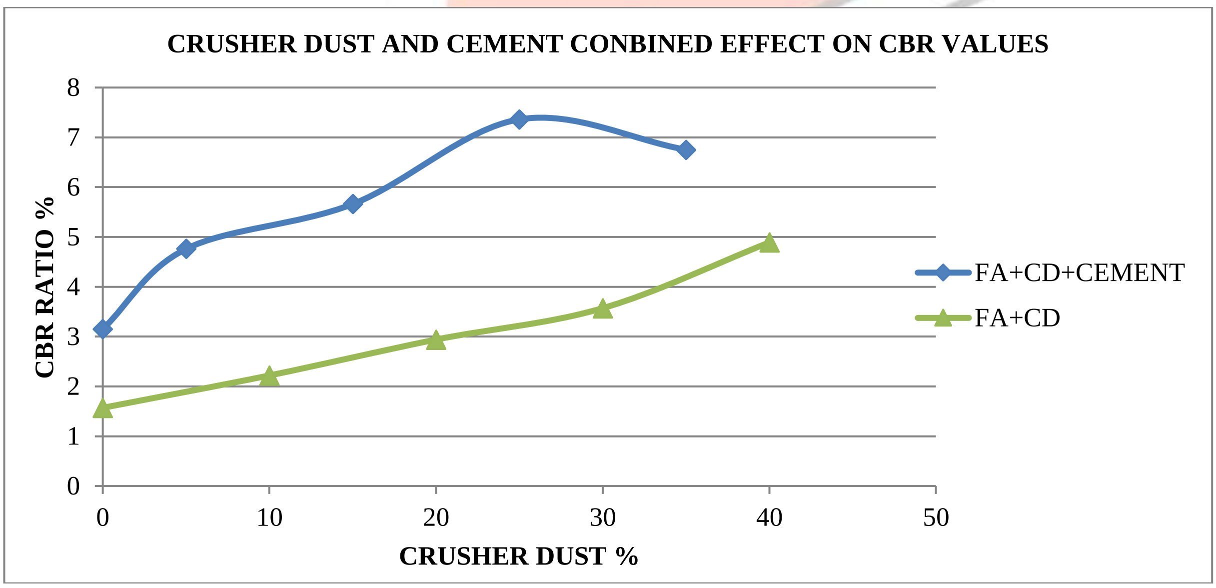

Fig. 2- CBR Ratio Of Flyash+Crusher Dust and Flyash+Crusher Dust+Cement

CONCLUSION

- Laboratory observed data demonstrated that activated admixture pronounce a critical ratio of crusher dust and flyash CBR ratio, further increment of crusher dust with cement into flyash causes the decrement in CBR ratio.
- By mixing 25% crusher dust and 5% cement with flyash CBR is also found to get improve. The CBR Ratio increase from 3.15% to 7.36% approximates 133.65%.
- On adding optimum percentage, 40% of crusher dust only to flyash CBR increases about 67.89% from 1.57 % to 4.89% and mix of flyash with 25 % CD AND 5% cement CBR Ratio higher than flyash mix with crusher dust upto 50.51%.This finding is very useful in decreasing pavement thickness design.

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