STABILIZATION OF PAVEMENT SUBGRADE BY USING CRUSHER DUST ACTIVATED BY CEMENT

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***ABSTRACT*: The performance of pavement is very responsive to the characteristics of the flyash subgrade. For that reason, weak subgrade is enhanced by adopting the most efficient stabilization technique. Based on the literature review, stabilization with crusher dust activated with cement was found to be an effective option for improvement of flyash properties. In this regard an experimental program was undertaken to study the effect caused by the combined action of crusher dust and cement stabilization on the geotechnical characteristics of weak subgrade flyash. Flyash treated with varying percentages of crusher dust, 0, 5, 10, 15, and 20 percent combined with 5% cement content were studied. Consistency limits, compaction, California Bearing Ratio and permeability tests were conducted on treated and untreated flyash. The experimental results show that addition of cement crusher dust admixture to the flyash has great influence on its properties. It was found that the optimum dosage of crusher dust is 25% mixed with 5% cement revealed in significant improvement in strength and durability and reduction in permeability and liquid limit properties of the flyash. Based on the results, it is recommended that cement-crusher dust admixture be considered a viable option for the stabilization of subgrade.**

***Keywords*: cement, fly ash, crusher dust, stabilization, subgrade, CBR ratio.**

INTRODUCTION

Road network plays a crucial role in promoting social, economical and cultural development of a region. Construction of infrastructure over a weak or a soft flyash is highly risky in terms of geo-technical setbacks like differential settlements, poor shear strength and high compressibility. Poor sub-grade conditions will result in inadequate pavement support and ultimately brings down the pavement life. Coal fly ash is a coal combustion product that has numerous applications in highway construction. Since the first edition of Fly Ash Facts for Highway Engineers in 1986, the use of fly ash in highway construction has increased and new applications have been developed. This document provides basic technical information about the various uses of fly ash in highway construction. The objectives of this project are: Firstly To study and evaluate few waste materials for their adequacy and bulk utilization through stabilizing a silty sub-grade flyash. Secondly, to study the effects of stabilization on index and engineering properties of flyash using types of waste materials as admixtures. Thirdly To compare and suggest choice of admixture based on their relative influence and optimum content on properties of sub-grade flyash.

II. EXPERIMENTAL STUDY

Experimental studies for determination of index and engineering properties on clayey flyash are carried out. The engineering properties are determined on flyash samples in lab. Two types of waste materials are used for study. The details of materials used their properties and details of engineering properties determined in lab presented below.

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 1- 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 perches from the market.

III. EXPERIMENTAL PROGRAMME

Compaction Test

Compaction tests were conducted as per IS: 2720 (Part 7)-1980 a mould of 1000 ml volume used. The compaction characteristics of the flyash, crusher dust, flyash-crusher dust and flyash-crusher dust-cement mixes were studied using Standard Proctor Test. Samples were compacted in 3 layers and with each layer compacted by 25 blows from a rammer of 2.489 kg falling through a height of 310 mm.

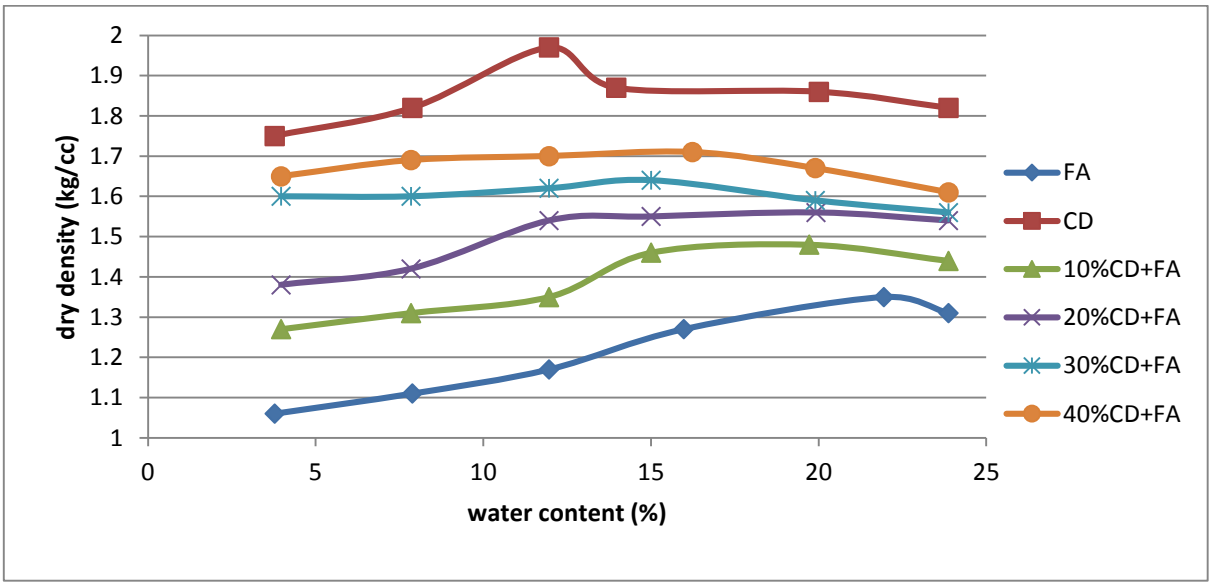

Fig 1 – standard proctor test for flyash with different per potions of crusher dust

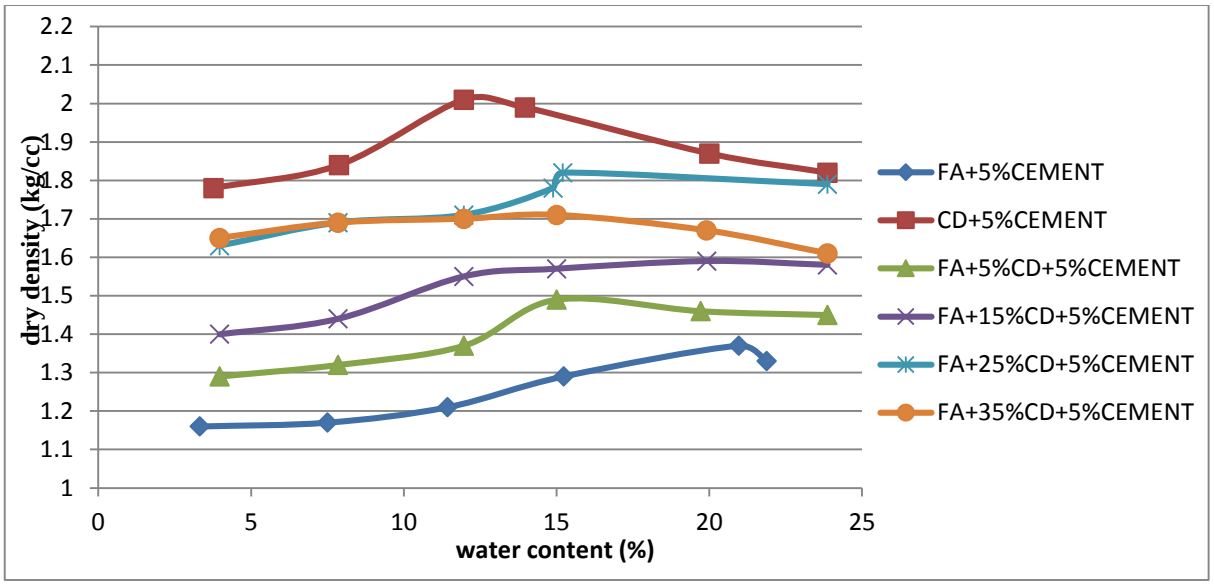

Fig 2 – standard proctor test for flyash with different per potions of crusher dust and cement

California Bearing Ratio Test:-Soaked 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.

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	

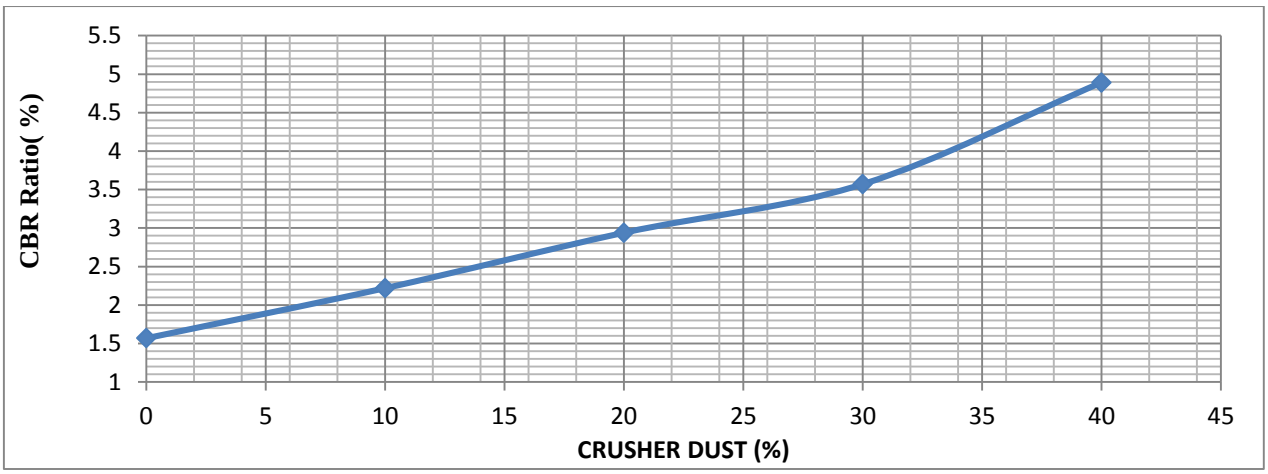

Fig 3- CBR Ratio for flyash with different per potions of crusher dust

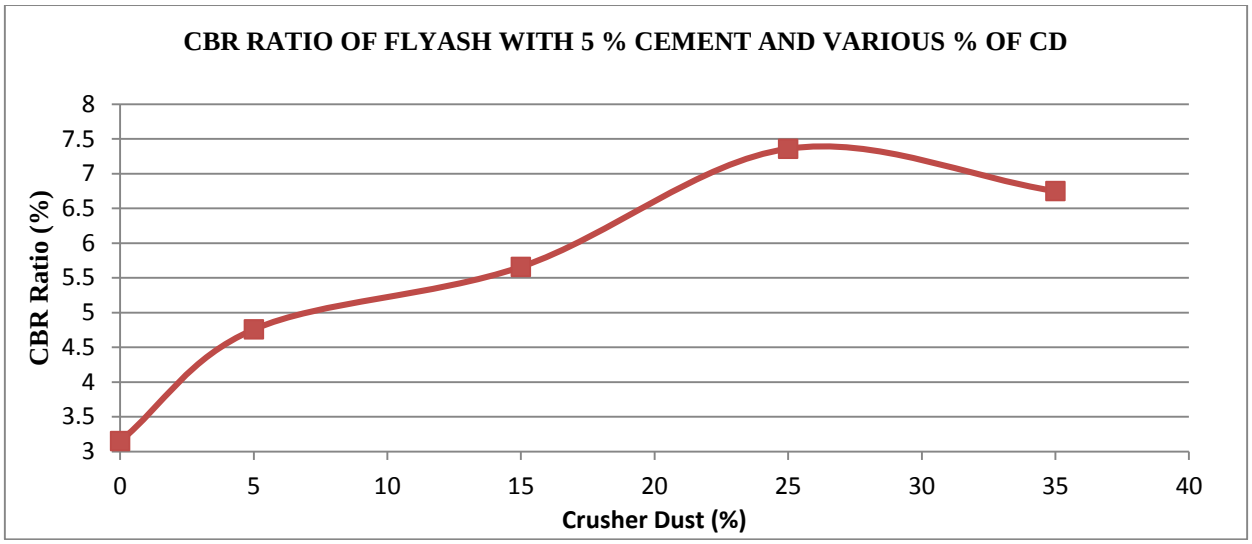

Fig 4- CBR Ratio for flyash with different per potions of crusher dust and cement

IV. RESULTS AND DISCUSSION

A. Effect of Crusher Dust and cement on Compaction

The maximum dry density of flyash was found to increase from 1.35 g/cm3 to 1.71 g/cm3 with the increase in percentage of crusher Dust. When we added the 5% of cement to flyash, crusher dust mdd increases upto 1.82 g/cm^3 .On the other hand optimum moisture content of flyash decreases to 21.86% from 16.23% with the increase in percentage of Crusher Dust. But further added cement to mix spacimen omc decreases 15.20%.as compare to crusher dust when cement added the mdd increases 6.04% and omc reduce 6.34%.

B. Effect of Crusher Dust and cement on CBR Ratio

The CBR Ratio of flyash was found to increase from 1.57% to 4.89 5 with the increase in percentage of crusher Dust. On the other cement mix 5% into flyash crusher dust CBR Ratio increase 7.36%.CBR Ratio increase upto 25% crusher dust and 5% cement then further addition of crusher dust into flyash CBR Ratio reach to 6.75%.

V. CONCLUSIONS

1. There is a demonstrable effect on maximum dry density of flyash on mixing crusher dust. Adding 40% percentage of crusher dust increases its maximum dry density from 1.35gm/cc to 1.68 gm/cc. adding the small amount of cement mdd increase upto 6.04%.
2. The study also reveals the fact that with increase in percentage of crusher dust and cement in flyash, the optimum moisture content decrease which is helps in decreasing water quantity required during compaction upto 25% of crusher dust added.
3. By mixing 25% crusher dust and 5% cement with flyash CBR is also found to get improve. On adding optimum percentage, 40% of crusher dust to flyash CBR increases about 67.89% and mix of 25 % CD AND 5% cement CBR Ratio increase upto 78.66%.This finding is very useful in decreasing pavement thickness design.

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