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Use of Crusher Dust as a Stabilizing Agent to Enhance Flyash Geotechnical Properties

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ABSTRACT: Compaction and CBR ratio are essential for appropriate construction and design of flexible pavement. The principle target of this investigation is to alter the compaction and CBR properties of flyash by including distinctive percentages (10%, 20%, 30% and 40%) of Crusher Dust. These percentages of crusher dust are relating to dry weight of flyash. The main arrangement of compaction and soaked CBR tests were performed on the flyash and similar tests were performed on flyash mix with crusher dust samples. Soaked CBR test were done by keeping test sample in water for 72 hours. CBR ratio increments from 1.57% to 4.87% on addition of 40% crusher dust. Optimum Moisture Content has been decreased from 21.86% to 15.88% and the Maximum Dry Density has been increases from 1.35 g/cm³ to 1.68 g/cm³ by addition of 40% of crusher dust. Lab data report that adding crusher dust to this flyash would be enhancing flyash geotechnical properties

KEYWORDS: Crusher Dust, Flyash, compaction, Liquid Limit, Soaked CBR.

I. INTRODUCTION

Compaction and CBR are important parameters for civil engineering purpose. Compaction of flyash increases their density, shear strength, bearing capacity but reduces their void ratio, porosity, permeability and settlements. The results of this test are useful in the stability of field problems like earthen dams, embankments, roads and airfields. CBR is one of the important parameter used in the evaluation of flyash sub grades or subbase for flexible pavements design and thickness design. It is also an integral part of several pavement thickness design methods. In this study crusher dust by dry weight of flyash was taken as 10%, 20%, 30%, and 40% and mixed with the flyash to examine its effect on compaction characteristics and soaked CBR properties of flyash.

II. LITRATURE REVIEWS

- ❖ **Akshaya kumar sabat, subasis pati EJGE Vol. 19 [2014], Bund. U[7]** From the review of literature on, adjustment of far reaching soil utilizing strong squanders, the accompanying conclusions are drawn: Stabilization swelling soil utilizing solid waste enhances the geotechnical properties of expansive soil. Majority of the analysts have examined the impacts of adjustment on key properties, compaction properties, UCS, CBR and swelling properties of swelling soil. The impacts of adjustment on, solidification properties, shear phenomenon, part elasticity, firmness and water driven conductivity of expansive soil have not been considered by the vast majority of the analysis. Investigations on, impacts of changes on geotechnical properties of balanced out soil, mineralogical studies, toughness and financial of adjustment are restricted in work.
- ❖ **Behera and Mishra[8]** prepared a stabilized mix with different compositions of fly ash, mine overburden and lime. They observed significant improvements in the stress-strain behaviour of developed composites. All the composites with soil resulted in sufficient strength values to be used as subbase or subgrade material. Curing periods and lime content have varying influence in the strength development of the composites. The overburden mine mixed with 30% fly ash and 9% lime was observed to acquire soaked CBR value of 77% and UCS of 2.2

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MPa respectively after 28 days of curing. Continuous increase in CBR and UCS was observed with curing period, however, CBR decreases upon soaking.

- ❖ **Bindhu Lal^{1*}, MD Shafique Alam² and Sushama Kiran¹ [9]** It is seen that there is slight reduction in OMC esteems and increment in MDD esteems as level of stone tidy is expanded. The CBR esteem likewise demonstrates an expansion if level of stone tidy is expanded. The dirt considered for contemplate is having a CBR of 1.97 which comprises the base layer and sub-base layer. If the locally available soil is having a very low CBR value, it can be treated with locally available materials to improve its quality. Stone dust from construction site is not only an environmental hazard but its disposal is also a problem. In this study it has seen that stone dust when with the locally available soil improved the engineering properties of soil, especially MDD and CBR.

III. MATERIAL USED

A. Flyash

The flyash for this study was taken from the Kota Thermal Super Power Station Kota Rajasthan, India. The material was by product from coal thermal electricity production power plant dumping area. Index properties of the soil were determined as per IS codes and are presented in Table 1.

Property	Value
Particle Size distribution	
Sand (%)	20.6
Silt +Clay (%)	79.4
Specific Gravity	2.21
Liquid Limit (%)	27.4
Plastic Limit (%)	Non-Plastic
OMC (%)	21.86
MDD (g/cm ³)	1.35
CBR Soaked (%)	1.57

TABLE I: INDEX PROPERTIES OF FLYASH

B. Crusher Dust

Crusher dust for this study was purchased from Kamal & Company Sabarmati Colony kethunipol, District. Kota,Rajasthan, India. Index properties of the crusher dust were determined. Five different percentages of crusher dust, i.e., 10%, 20%, 30% and 40% were added to the flyash for preparing the samples.

Property	Value
Natural Moisture Content (%)	6.24
Particle Size distribution	
Sand (%)	96.8
Silt+ Clay (%)	3.2
Specific Gravity	2.96
Liquid Limit (%)	19.9
Plastic Limit (%)	Non-plastic
OMC (%)	13.92
MDD (g/cm ³)	1.94
CBR Soaked (%)	14.56

TABLE II: INDEX PROPERTIES OF CRUSHER DUST

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IV. 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 and flyash-crusher dust 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.

California Bearing Ratio Test

Soaked CBR tests were conducted in accordance with IS: 2720 (Part 16)-1987. Tests were conducted on soil, crusher dust and flyash-crusher dust mixes. For conducting soaked CBR tests, the samples were prepared at their OMC. In the mould the displacer disc of 148 mm diameter was placed and the material is compacted in 5 layers, each layer given 55 blows by a hammer of 2.489 kg. The displacer disc was removed after the compaction. Surcharge weight of 2.5 kg is kept on flyash sample mould. The mould with sample was immersed in water for 72 hours soaking to allow free receive of water to top and bottom. Moulds with sample were tested in a CBR testing machine. A mechanical loading machine, equipped with a movable base that moves at a uniform rate of 1.25 mm/min and a calibrated proving ring having constant multiply factor, was used to record the load. The proving ring is attached with a plunger, which penetrates into the compacted specimen. Diameter of the piston is 50 mm. The load was recorded carefully as function of penetration up to a penetration of 7.5 mm with a dial gauge of least count 0.01mm and proving ring least count 0.002.

V. RESULTS AND DISCUSSION

A. Effect of Crusher Dust on Compaction

The maximum dry density of soil was found to increase from 1.35 g/cm³ to 1.94 g/cm³ with the increase in percentage of crusher Dust. On the other hand optimum moisture content of soil decreases to 21.86% from 13.92% with the increase in percentage of Crusher Dust.

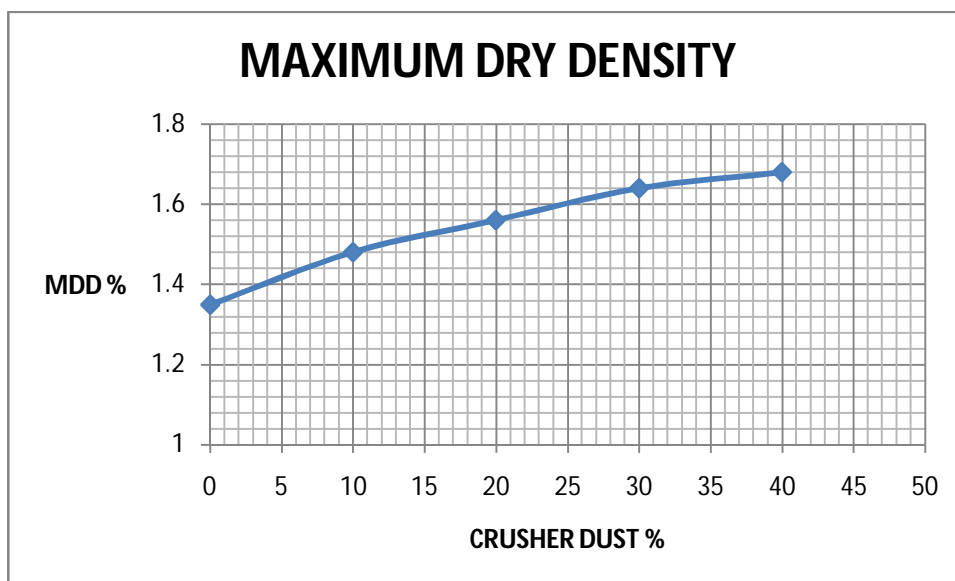


FIG NO: 1; THE VARIATION IN MDD VALUE WITH DIFFERENT PERCENTAGES OF CRUSHER DUST.

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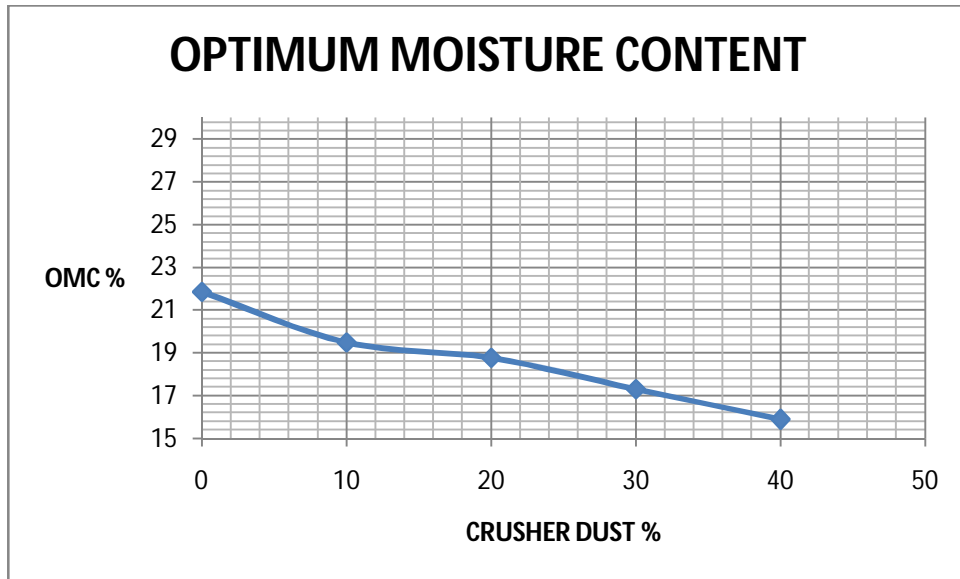


FIG NO: 2; THE VARIATION IN MDD VALUE WITH DIFFERENT PERCENTAGES OF CRUSHER DUST.

B. Effect of Crusher Dust on CBR

It is observed the variation in soaked CBR value with different percentages of crusher dust. The CBR of soil first increases to 4.89 from 1.57 with the increase in percentage of crusher dust from 0% to 40%.

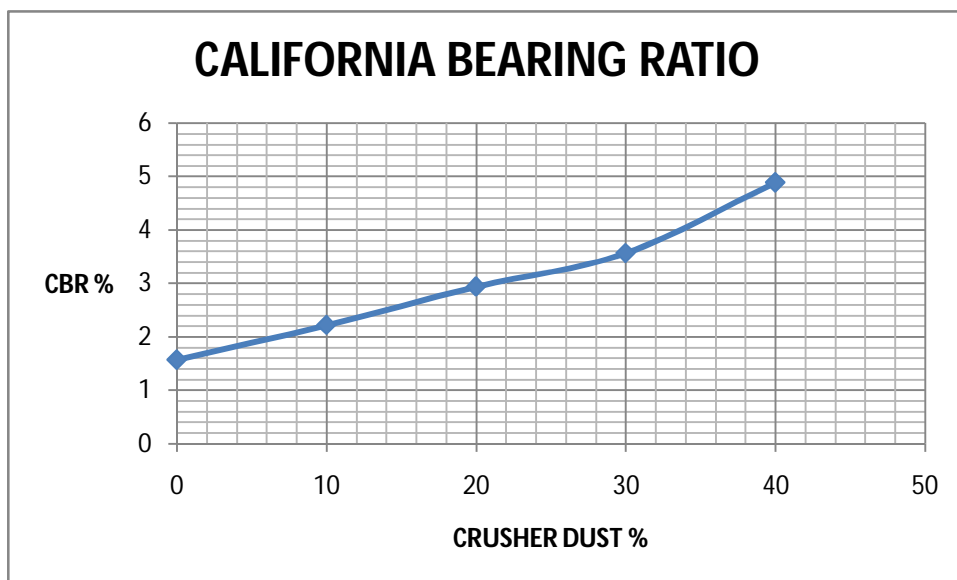


FIG NO:3;THE VARIATION IN SOAKED CBR VALUE WITH DIFFERENT PERCENTAGES OF CRUSHER DUST.

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VI. CONCLUSIONS

1. There is a demonstrable effect on maximum dry density of soils on mixing crusher dust. Adding small percentage of crusher dust increases its maximum dry density from 1.35 to 1.68 gm/cc.
2. The study also reveals the fact that with increase in percentage of crusher dust in flyash, the optimum moisture content decrease which helps in decreasing water quantity required during compaction.
3. By mixing crusher dust with flyash CBR is also found to get improve. On adding optimum percentage, 40% of crusher dust to soil CBR increases about 210%. This finding is very useful in decreasing pavement thickness design.

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- [9] Bindhu Lal¹*, MD Shafique Alam² and Sushama Kiran¹ ISSN 2319 – 6009 www.ijscer.com Vol. 3, No. 4, November 2014 © ijscer." use of stone dust from construction site as a stabilizing agent in flexible pavement construction: a case study"