

Effect Of Foundry Sand On The C.B.R Characteristics Of Soil

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Abstract— Soil stabilization is a technique of improving the properties of soil, such as shear strength, bearing capacity etc. This can be done by using several methods. Production of industrial waste products such as ash, paper waste, Waste Foundry Sand, etc. is increasing day by day leading to various environmental concerns. Therefore the disposal of these wastes without causing any ecological hazards has become a real challenge. Thus using waste foundry sand as a soil stabilizer is an economical utilization since there is scarcity of land for its disposal. This paper involves the detailed discussion on the possible use of Waste Foundry Sand for soil stabilization. The effect of Foundry sand on the C.B.R characteristics were investigated by conducting various tests as per Indian Standard specifications. This paper focuses on the beneficial use of Waste Foundry Sand on the geo technical characteristics of soil and its applications as a soil stabilizer.

Index Terms—Bearing capacity, Foundry waste sand, Stabilization

I. INTRODUCTION

A foundry produces metal castings by emptying liquid metal into a preformed mold to yield the subsequent solidified cast. Foundries effectively reuse the sand commonly in a foundry. At the point when sand can never again be reused in the foundry, it is expelled from the foundry and is termed "foundry sand", (Abichou et al, 2004). Foundry sand creation is about 6 to 10 million tons yearly. In the same way as other waste items, foundry sand has gainful applications to different commercial ventures There are two essential sorts of foundry sand accessible, green sand (frequently alluded to as embellishment sand) that utilizes dirt as the cover material, and artificially reinforced sand that utilizes polymers to tie the sand grains together. Green sand comprises of 85-95% silica, 0-12% earth, 2-10% carbonaceous added substances, for example, ocean coal, and 2-5% water (Brajesh Mishra, 2015). Green sand is the most usually utilized embellishment media by foundries.

In engineering applications in India at present foundry sand around 5 to 7 lakhs tones is used annually. Due to paucity of funds in India especially for low volume village roads there is a requirement of cheaper materials for construction. Foundry sand along with iron turnings and locally available materials can be used in embankments and sub-base of rural roads. In this paper an effort has been made to use this material as a stabilizing material for the soil. The waste materials for soil stabilization have become popular by considering environment and economy. In the present study some quantity of soil is replaced by different proportions of foundry waste and different tests were conducted to find the CBR values etc. The broad objective of the present work is to carry out the experimental studies on the potential use of fines obtained from foundry waste as stabilizing material for improving the strength of sub grade soil.

II. MATERIALS AND METHODOLOGY

Materials used in this study are kaolinite soil and foundry sand

Soil: The study was conducted on processed kaolinite soil which was bought from English India Clay Limited Trivandrum. According to soil classification of soil it was classified as low compressible clayey soil (CL). Properties of soil were given in table 1.



Fig. 1. Kaolinite clay

Table 1. Properties of kaolinite

SOIL PROPERTIES	VALUES OBTAINED
Specific gravity	2.67
Liquid limit (%) (IS 2720 PART 5 1985)	33
Plastic limit (%) (IS 2720 PART 5 1985)	20.66
Plasticity index (%) (IS 2720 PART 5 1985)	12.34
IS classification	CL
OMC (%) (IS 2720 PART 7 1985)	24.5
Dry density (g/cc) (IS 2720 PART 7 1985)	1.60
% clay (IS 2720 PART 4 1985)	68
% silt (IS 2720 PART 4 1985)	24.8
% sand (IS 2720 PART 4 1985)	7.2
UCC strength (kg/cm ²) (IS 2720 PART 10 1985)	0.634

Foundry sand. Foundry sand (FS) sample was obtained from a foundry of Trivandrum city of Kerala, a state of India .The physical properties of foundry sand is as shown in Table 2.

**Fig. 2.** Green sand**Table 2.** Physical properties of Foundry Sand

Properties	Values obtained
Specific gravity	2.54
Coefficient of uniformity ,Cu	1.35
Coefficient if curvature, Cc	1.218
% Sand	99.2
% Gravel	0.8

METHODOLOGY

California Bearing Ratio test

The California bearing ratio (CBR) test is done for calculating the suitability of the sub grade and the materials used in the sub base and base of a flexible pavement. In the present study, California bearing ratio(CBR) tests were conducted to determine the strength of the original soil as well as for the soil mixed with different percentage of fine foundry waste (i.e.10%, and 20 %) by weight of the soil. The test was conducted in accordance with IS:2720 (Part 16) 1987. California

bearing ratio (CBR) is the ratio of force per unit area required to penetrate into a soil mass with circular plunger of 50 mm diameter at the rate of 1.25mm/min. CBR value at 2.5mm penetration is generally higher than that at 5.0mm penetration. CBR value corresponding to 2.5mm penetration is reported as CBR of the material. However if the CBR value corresponding to 5.0mm penetration is higher than that of 2.5 mm, than the test is repeated for check. If the same results are obtained again, the higher value corresponding to 5.0 mm penetration is reported as the CBR value. Material passing 20mm sieve only is used for the test.

III. RESULTS

EFFECT OF FOUNDRY SAND ADDITION ON C.B.R

The California Bearing Ratio (CBR) test was performed on soil mixed with varying percentages of foundry sand by weight of soil to study the load bearing capacity as per IS:2720 (Part 16) 1987.

The after effects of California bearing proportion (CBR) tests on kaolinite soil treated with foundry sand are as shown in figure 3. It was observed that CBR estimation of kaolinite soil increased with addition of foundry sand. The estimation of CBR increases from 18.64% to 63.94% for soil. Thus, it can be well said that with the increase in the percentage of foundry sand, the CBR value increases.

Table 3. Variation of CBR with foundry sand addition in kaolinite soil

Foundry sand (%)	CBR (%)
0	18.65
10	32.50
20	63.94

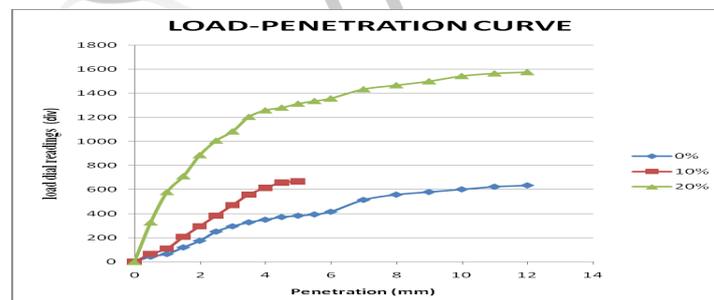


Fig. 3. Variation of CBR with foundry sand addition in kaolinite soil

IV. CONCLUSIONS

Based on study and experimental investigation following conclusions were drawn

- It was observed that with the addition of foundry sand in kaolinite soil, the California Bearing Ratio (CBR) values of the soil foundry sand mixture increases.
- On the basis of study it can also be concluded that foundry sand which is a waste material can be used for stabilization of weak soil sub-grade material to improve the strength of soil.
- Finally it can be concluded that a mixture of 80% soil and 20% foundry sand was found to be the best and appropriate combination resulting in maximum MDD value. Hence this mix can be considered appropriate for construction of sub-grades especially for rural roads where the traffic volume is on lesser side.

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