Enhancement of Properties of Clayey Soil by Blending Quarry Dust and Coconut Fibre

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***Abstract*— The aim of this research is to stabilize the clay soil with quarry dust and waste coconut fibre and improved other poorest soil properties to used as subgrade. A soil sample was collected from locally available and preliminary tests were conducted to identify the type of soil and it was obtained from the results that the collected soil sample was a poorly graded. Afterword different tests were conducted such as Modified proctor Compaction test, UCS, and CBR to examine the different geotechnical properties of the identified soil. Above these Tests were also conducted on the mixed soil with quarry dust and coconut fibre in varying percentage. From the test results analysis it was found that quarry dust and coconut fibre enhanced the CBR value of clay soil.**

***Index Terms*— Clayey Soil, Coconut Fibre, Quarry Dust & CBR.**

I. INTRODUCTION

Road stabilization is the method of providing strength to the natural weak soil against the heavy traffic load of modern day traffic and, it to reduce the damage of road pavement in a different climate conditions. The various methods to used for stabilization include the use of admixtures, waste materials, compaction and densification of soil. Admixture may be cement, chemical binders, fly ash and industrial wastes. Soil stabilization is a technique used to modify the different properties of soil, and it increases the performance of soil for engineering purpose[1]. The construction of foundation and other civil engineering structure on the soil. the structures are design after the investigation of soil, if the properties of soil are good at shallow depth of earth surface, shallow foundation to be designed like mats and footings, are generally most economical. But, if the firm strata of soil is not available at shallow depth and it is found at greater depth then we have require deep foundation such as Pile foundation, these foundations are cost effective as compare to shallow foundation[2]. Constructing and replacement of existing pavement of road consumes a huge amount of budgets of transportation departments in every country of the world. Methods for reducing the cost of construction and lengthen pavement life can help in better maintain the road network on limited budgets. Modern roads are expected to provide a high level of safety and comfort to the users. Soil can be enhanced either by adjustment or stabilization, or both. The alteration of soil is done by the addition of different types of admixtures to a soil in order to change soil's index properties, though the stabilization of soil is its treatment to improve its strength and durability such that to make it suitable for building proposed structure [3].

II. LITERATURE REVIEW

Niraj Kumar Mishra et al. In this studied has been made to stabilized the soil enhance the engineering properties of clay soil using fly ash as admixtures with lime. It is observed that addition of 30 % fly ash along with 3% lime by weight of plain soil sample. in this investigations found that The mixture of this percentage increased CBR value of soil.

A. Sridharan et al. Quarry dust, which has proved to be a very promising substitute for sand. There are considerable increases in maximum dry density on replacement of quarry dust and attendant decrease in OMC. Finally about 39% decrease in OMC and 21% increase in MDD.

U.Arun Kumar et al. Studied had the replacement of the quarry dust to the simple soil with different percentage of quarry dust. the admixture soil sample reduces the clay content and thus increases in % of coarser particles, to increases the quarry dust content,

it reduce the liquid limit and plasticity index by 26.86% and 28.48% of plain soil respectively. Increase in % of quarry dust OMC of soil is decreased by 36.71%. MDD increased by 5.88% and maximum improvement in CBR value at 40% of quarry dust.

Ayhan Gurbuz et al. this studied had improved the strength of the soil as the marble power at different % then, strength in terms of the results of unconfined compression test of soil samples rises to a peak point; plasticity of mixture soil decreases. Obtained test results show that marble powder could be used as a stabilization material for CI soil.

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A.U. Ravi Shankar et al. The studied had investigation of basic geotechnical properties as such Grain size distribution, consistency limits, specific gravity and engineering properties like OMC, MDD, UCS and CBR, tests were conducted on the plain and mixed soil. The optimized value of lime obtained was 4%. Maximum improvement in unconfined compressive strength and california bearing ratio values are observed when 1% of coir are mixed.

III. MATERIALS AND METHODS

The materials used in this investigation were clayey soil and quarry dust and sisal fibre as an admixture.

Clayey soil

The soil was collected from locally by excavating the ground surface from physical observation. It was found that the soil sample was clayey in nature. After experimental investigations by determine consistency limits. Compaction characteristics are determined by conducting IS Code and strength characteristics by conducting UCS and CBR test. The results obtained are in Table 1 and Table 2.

Table 1. Geotechnical Characteristics of Soil

Parameters	Values
LL (%)	40.5
PP (%)	16.0
PI (%)	24.5
Classification	CI

Table 2. Engineering Characteristics of Soil

Parameters	Values
OMC (%)	13.41
MDD (%)	2.3
UCS (kg/cm^2)	3.5
Soaked CBR Test	2.0

Quarry Dust

Quarry dust was collect from the rubble crusher unit which is locally available. Quarry dust is waste product which produced during the crushing process of extract stone. It is rock priceless. it is produce in huge amount, When huge rocks are brake in too small pieces for the construction work. It is like fine aggregate but mostly grey in colour.

Coconut Fibre

Coconut fibre is a waste material that produced remains after extraction of useful natural coconut. The remaining part of the coconut is dumped in landfills but we can make its best use of this for soil stabilization. it have diameter is 0.5 mm. the coconut fibre is cut into pieces of 3 cm, as those percentages of 0.5%, 0.75% and 1%.

IV. METHODOLOGY

The experimental investigations were carried out in two stages. Firstly, laboratory tests were conducted on clay soil with quarry dust in different percentages (10%, 20%, 30 and 40%) and found the optimized value of quarry dust. and further first stage, Soil mixed with the optimized quarry dust and varying percentages of coconut fibre (0.5%, 0.75% and 1.0%.) Modified Proctor compaction test was conducted for determining optimum moisture content (OMC) and maximum dry density (MDD), unconfined compressive strength (UCS) and California bearing ratio (CBR) tests were performed

for strength. The CBR soil samples were immersed in water for 96 hours before testing.

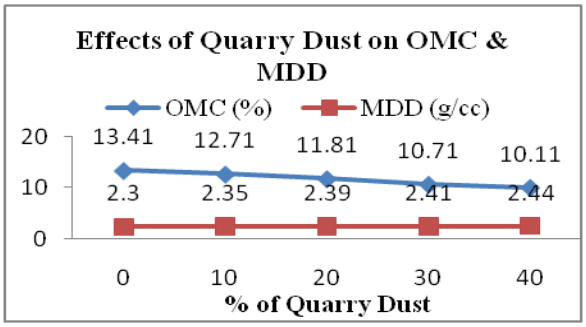
V. Analysis of Results

For the various experiments performed, the methods were used relative to the replacement of different percentages of quarry dust and coconut fibre. Further through the experiment, with the replacement of quarry dust and coconut fibre, its effect on the relationship between OMC & MDD is being studied. The UCS and CBR values are taken into consideration.

Compaction Test

Effects of different % of quarry dust on OMC and MDD

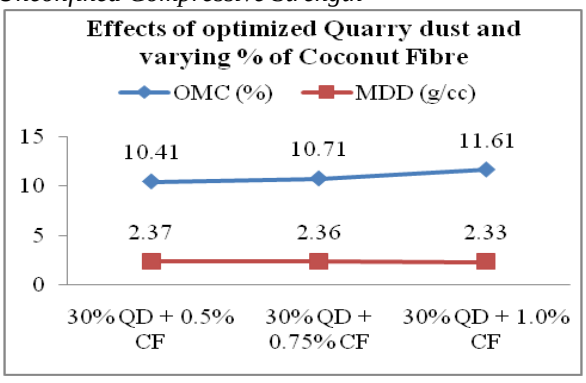
The variation in maximum dry density and optimum moisture content with quarry dust in different percentages is shown in figure. The OMC decreases with increase in quarry dust content. However, the MDD increases with increase the content of quarry dust.



Effects of optimized % of quarry dust and varying percentages of coconut fibre on OMC and MDD

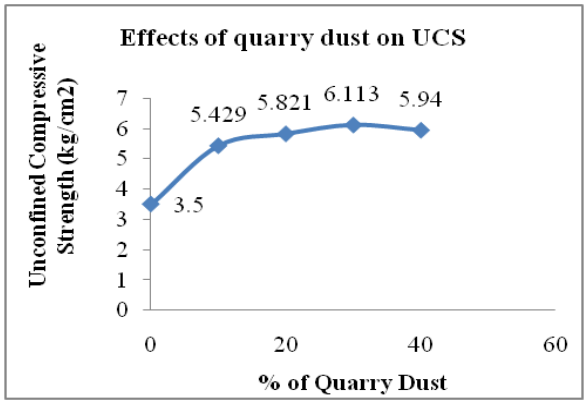
The optimized content of quarry dust was 30%, which found from the different experiment investigations, mixed with varying percentage of coconut fibre for different trails.

Unconfined Compressive Strength

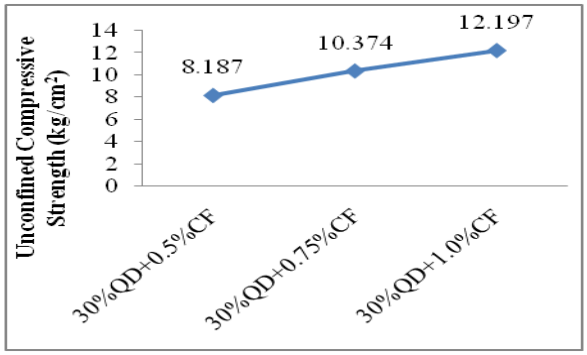


Unconfined compression strength test is most popular and adoptable method of evaluating the strength of cohesive and stabilized soils. This experiment has performed for different conditions, at the results it increases with increase the percentage of waste materials.

Effects of different % of quarry dust on Unconfined Compressive Strength

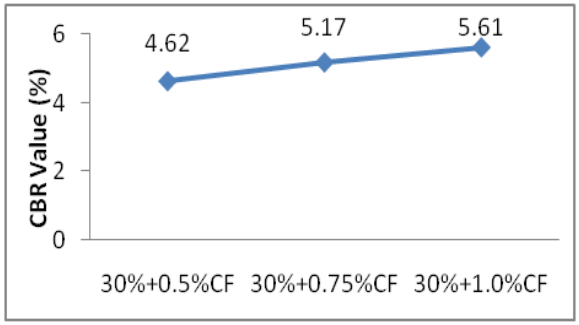


Effects of optimized % of quarry dust and varying percentages of coconut fibre on UCS

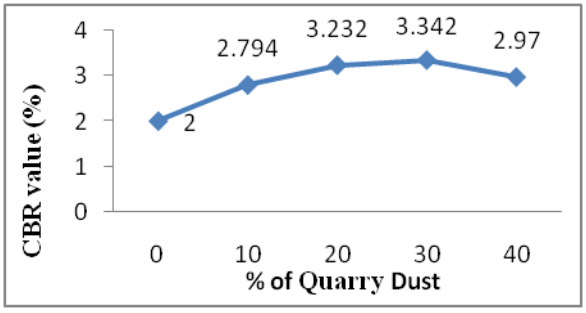


California Bearing Ratio

The CBR method has been found that the bearing capacity of the soil, and evaluating the required thickness of the road pavement to satisfy an applied loading.



Effects of different % of quarry dust on CBR



Effects of optimized % of quarry dust and varying percentage of coconut fibre on CBR

VI. CONCLUSION

1 Maximum dry density, unconfined compressive strength and soaked CBR of the stabilized soils were optimally improved by the mixed with quarry dust and waste coconut fibre.

2 With increase in quarry dust content in plain soil a general increases in MDD was observed, and OMC decreased.

3 Unconfined compressive strength of the soil increases with increase the dosages of the quarry dust upto 30%, at 40% content of quarry dust value of UCS decrease.

4 Optimized value of quarry dust mixed with the varying percentage of coconut fibre in soil UCS value also increase.

5 The CBR value for the plain soil was found to be 2% in soaked condition which increases with the replacement quarry dust and coconut fibre CBR value increases and it found 5.61%.

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