Stabilization of Clayey Soil using Shredded Rubber Tyre and Marble Dust

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Abstract— *Stabilization of soil, in a wide sense, consolidates the different strategies utilized for changing the properties of a soil to enhance its designing execution. Stabilization of soil is being utilized for an assortment of building works, the most widely recognized application being in the development of highway and runway asphalt, where the development cost by making best utilization of locally accessible materials. We know a noteworthy issue connected with financial advancement of a nation is waste transfer. More secure disposal of tyre waste has turned into a challenging job. So in the present examination, Shredded rubber from waste has been picked as the reinforcement material and marble dust as binding agent which was reinforced into the soil at different percentages with different combinations from 2% to 10% (Multiple of 2) by weight of soil. This not just permits us to gather modifier crude material requiring little to no effort, additionally gives an answer towards environmental threat postured by expanded utilization of rubber.*

Keywords— OMC, MDD, UCS, TYRE, MARBLE DUST

I. INTRODUCTION

Soil stabilization is a system to enhance the soil parameters, for example, shears quality, compressibility, density, hydraulic conductivity etc. Soil stabilization goes for enhancing soil strength and expanding imperviousness to softening by water through holding the soil particles together, water sealing the particles or mix of the two (Sherwood, 1993). The least difficult adjustment procedures are compaction and seepage (if water drains out of wet soil it gets to be more grounded). Alternate procedure is by enhancing degree of molecule size and further change can be accomplished by adding binders to the feeble soils (Rogers et al, 1996). Soil stabilization can be refined by Geotechnical engineers the world over are looking for new exchange materials which are required both for savvy answers for ground change and for preservation of rare normal assets. Transfer of reusing tyre represents a noteworthy issue around the world. A ton of exploration work is going on worldwide to adapt up to this issue. Waste tyre have qualities that make them difficult to arrange, and possibly burnable. Gigantic stockpiles and uncontrolled dumping of tyre, all through the nations, is a risk to general wellbeing and environment. One of the option methods for discarding waste tyre is to utilize them for geotechnical applications.

II. MATERIALS

A. Soil

Almost 150 Kg of locally accessible clayey soil was gathered from Kaithal (Haryana) and completely hand sorted to dispense with the vegetative matters and stones. At that point the soil was sieved through 4.75 mm sieve to expel the gravel part. Soil was oven dried for 24 hours before execution of geotechnical tests.

S. No.	Parameters	Result
1.	Light Compaction Test MDD (gm/cc) OMC (%)	1.554 24.163
2.	Liquid Limit (%)	45.05
3.	Plastic Limit (%)	21.49
4.	Plasticity Index (%)	23.56
5.	Specific Gravity	2.5
6.	Indian Soil Classification	CI

Table 1: Physical properties of Soil

B. Tyre Rubber

Tyre rubber has been bought from the sector-2 industrial area Kurukshetra. The rubber tyre are cut into bits of roughly 10-20mm length and width 1-2mm and are blended in rate of 2%, 4%, 6%, 8%, 10% by dry weight of soil.

Property	Range/Value
Tyre Rubber Length, mm	10-20
Tyre Rubber Width, mm	1-2
Specific Gravity	1.02-1.27
Poisson ratio, μ	0.5
Elastic modulus (E),psi	6×10^3 to 12×10^3
Elongation (%)	420

Table 2: Properties of Experimental Tyre Rubber

C. Marble Dust

Marble dust has been bought from the market of Kurukshetra. The property of marble is given in table 3.

Properties	**Value**
Specific surface area (cm^2/gm)	11.4×10^3
Bulk density (kg/m^3)	986
Specific gravity	2.78
Grain Size	Medium Grained
Streak	White
Porosity	Less porous
Cleavage	Perfect
Resistance	Heat Resistance

Table 3: Physical properties of Marble Dust

III. EXPERIMENTAL PROCEDURE

A. Compaction Test

This Phase of Study included a point by point examination of the compaction characteristics of the virgin soil and mixed specimen containing different percentage of Tyre Rubber and marble dust substance, so as to get the optimum moisture contents and maximum dry densities. The optimum moisture contents subsequently got is utilized as a part of get ready specimens for Unconfined Compressive Strength Test. This test affirms to IS: 2720 (Part 7)1980.

B. Unconfined Compressive Strength

After the compaction test the compressive strength of the specimen is measured. Cylindrical specimen is compacted by static compaction in 3.8 cm diameter and 7.6 cm high mould. The internal surface of the mould is greased up with versatile oil in order to expel the sample from mould with least aggravation. The sample is put inside the mould in seven layers utilizing spoon, leveled and delicately compacted. Pressure pad will be embedded into the mould and the entire get together will be statically compacted in stacking edge to the sought thickness. The specimen is to be kept under static burden for at the very least 10 minutes so as to record for any resulting increment in stature of test because of swelling. The specimen will then be expelled from the mold with the assistance of test extruder. Introductory measurements are measured.

IV. RESULT & DISCUSSION

A. Compaction Test

The maximum dry density on the virgin soil is observed to be 1.55 gm/cc at optimum moisture content of 24.16% as appeared in Table 1. In any case, after the addition of rubber and marble dust into soil the both MDD and OMC decreases with the increments in added substance up to a certain percentage and on further addition in the marble dust with rubber the MDD of soil increments while the OMC decreases. The after effect of different specimens blended with various percentages of Rubber and Marble dust are appeared in beneath fig 1 and fig 2.

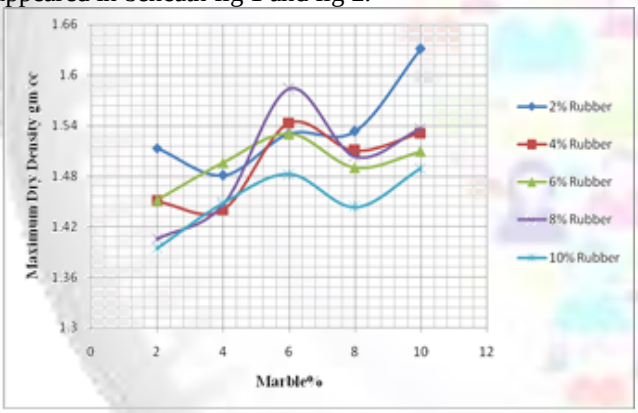

Fig. 1: Variation of MDD with Different percentage of Marble Dust and Rubber

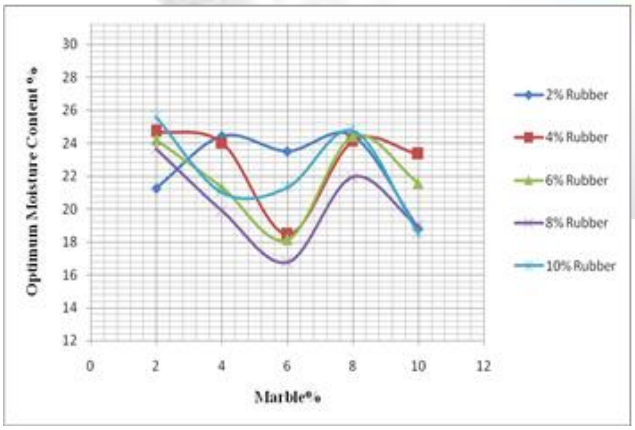

Fig. 2: Variation of OMC with Different percentage of Marble Dust and Rubber

B. Unconfined Compression Test

The unconfined compressive quality is 3.037 Kg/cm2 at optimum moisture content of 24.16% and MDD 1.55 gm/cc from compaction test. The compressive strength of the soil blended with rubber and marble dust demonstrates enormous addition with increment in marble dust into the soil. The after effect of different specimens blended with various percentage of Rubber and Marble dust is appeared in beneath fig 3.

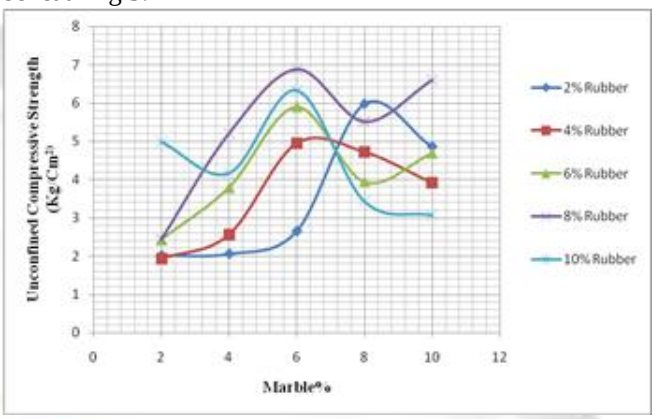

Fig. 3: Variation of UCS with Different percentage of Marble Dust and Rubber

V. CONCLUSION

A. Conclusion

In This proposition, quality attributes of soil-rubber-marble have been contemplated. The accompanying conclusion can be made in light of the test outcome got from rubber-marble settled clayey soil:-

1) With the addition of rubber in the soil the maximum dry density decreases for all the samples and the optimum moisture content doesn't show much of changes. But with addition of marble dust in the soil the maximum dry density starts to increases with a decrease in optimum moisture content. This could be due to specific gravity of marble dust and low plasticity.
2) Waste shredded rubber-Soil mixture showed an improvement in UCS value after the addition of Marble dust into the soil.
3) The plasticity of the soil decreases as we add the Marble dust in to the soil.
4) Deep foundations and raft foundations for structures on soil with low bearing capacity can be replaced by shallow foundation with soil stabilized by shredded rubber waste.
5) Shredded rubber fiber can be considered as a good reinforcement material.

B. Scope of Further Studies

Enhancing properties of soil turn into a matter of foremost significance today. Here an exertion has been made to enhance the soil quality and diminishing the plasticity of the soil utilizing rubber and marble. There are numerous options accessible in doing likewise. Here are a few proposals made for further studies:

1) Similar study can be made at different moisture content.

2) Rubber length and percentage can be made varying, instead of using same length.
3) Different waste material from agricultural land, municipality or industrial can be used to improve the soil characteristics.
4) Other type of soil can be used for further studies.

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