Soil Stabilization Using Waste Rubber

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Abstract*:* The research is concerned with the stabilization of soil using rubber tire chips. Soil was collected from an area in Kharghar and rubber tire chips were made available from the locally available tire tube. Soil properties play a very important role in construction. Sometimes the properties of soil are not so favorable for construction and we use some methods to improve properties of soil. The method used is called soil stabilization.

Soil amendment techniques are described utilizing solid rubber particles to be mixed with soil to improve porosity and reduce compaction. The rubber particles are preferably derived from shredded rubber tubes. The size of rubber particles may also vary, and the amount of rubber mixed with the rubber may also vary. The inclusion of rubber particles in soil improves use efficiency of water. In this paper we used shredded rubber tube to improve properties of soil. Shredded rubber tubes with size 10mm in width and 20mm in length is used for experimental work. The percentage used is 5%, 10%, and 15% for the experimental work. Use of shredded rubber tubes in Geotechnical Engineering for enhancing the soil properties, has received greater attention in the recent times. This paper presents the effect on the behavior of pavement subgrade when pavement subgrade soil is stabilized with shredded rubber tube.

Key words: Stabilization, Shred, Tubes, Soil.

I. INTRODUCTION

The soil often is weak and has no enough stability in heavy loading. The aim of the study was to use the waste material for stabilization of soil in order to reduce the environmental impact. Several reinforcement methods are available for stabilizing soils. Scrap tire generations is always on the increasing trend everywhere in the world.

Majority of them end up in the already congested landfill or becoming mosquito breeding places. Worst when they are burned. This paper aims at studying the appropriateness of shredded rubber tires for its use in pavement engineering, i.e. to stabilize the subgrade of the pavements. It discusses about CBR value of soil-tire mixture and the results are presented.

Soil properties is very important for every construction work, because we can change the material if it hasn't good quality, but it is very difficult to replace the soil If the property of soil is not too good, because the transportation of soil and change of all existing soil is very difficult work. For such condition we use some admixture and material which improve some important property of soil. Method of using waste material and admixture to improve the property of soil is called soil stabilization. This paper aims at studying the appropriateness of shredded rubber tires for its use in pavement engineering, i.e. to stabilize the subgrade of the pavements. It discusses about CBR value of soil-tire mixture and the results are presented.

Nowadays, considerable attention has been paid to the utilization of alternative materials, which bear higher engineering quality than traditional materials and are financially affordable. Soil is one of the most important materials used in a variety of construction projects including earth canals and earth dams. Clay soils have good plastic properties so that increased moisture results in their decreased shear strength, compressive strength and volume changes. Considering millions of tons of waste produced annually across the country, which not only poses the problem of disposal but also adds to environmental contamination and health risks, utilization of such refuse and industrial wastes and their subsidiary products as alternatives to construction materials may effectively contribute to environmental preservation and minimization of their adverse effects on the environment. In the present study, used rubber and cement is combined with soil and the properties of clay soil were investigated in different mixture proportions. Then the properties of soils including liquid and plasticity limits as well as plasticity index, dry density, optimum moisture content and shear strength are found for the different trails. Since the introduction of used rubber improves the engineering behavior of soils, this review work exposes those qualities and applications that make used rubber a good replacement or admixture during soil improvement and for a more economic approach. In this project, the results from the CBR (California bearing ratio) test are found. One of the most common methods of fine soil improvement is to stabilize it using additives that improve soil properties through physical and chemical changes.

II. OBJECTIVES

1) To determine change in geotechnical properties of soil, Upon addition of different percentages of waste rubber.

2) To bring out effect of waste rubber on compaction characteristics and strength of treated soil

3) To study the change in CBR value of soil on addition of 5%, 10%, 15% rubber to it.

4) To evaluate suitable blend that can be used in stabilization of soil.

5) To determine reduction of pavement thickness upon addition of optimum amount of rubber.

III. LITERATURE RIVIEW

A brief review of previous studies on tests, analysis, modification and various other processes are presented in this section. This literature review focuses on recent contributions related to soil stabilization and its compaction. It is very useful in understanding effectiveness of project work.

Ghatge Sandeep & Dr. P.G. Rakaraddi reported that CBR value of reinforced soil increases with increase in rubber content & this increase in CBR value leads to decrease in pavement thickness.

L. Kokila, G. Bhavitra, C. Iniya & P. Madhu reported that maximum dry density & optimum moisture content increases in addition of rubber.

Arichandran, M. Harikrishna & K. Mahendran reported that use of shredded rubber increases strength of soil having less strength, but more use may decrease compressive strength.

IV. MATERIAL & METHODS

Construction of engineering structures on weak or soft soil is considered as unsafe. Improvement in load bearing capacity of the soil may be undertaken by a variety of ground improvement techniques. In the present investigation, shredded rubber from waste has been chosen as the reinforcement material which was randomly included into the soil at three different percentages of , i.e. 5% 10% and 15% by weight of soil. The investigation has been focused on the strength behaviour of soil reinforced with randomly included shredded rubber fibre.

Materials used:

1. Soil:

Soil was collected from a site located in Kharghar and locally available rubber tires were used in the study. The rubber tire were shredded.

2. Tyre shreds:

Tyre collected were cut into small size of 10mm x 20mm for experimental purpose. This shredded rubber was added to soil in 5%, 10% and 15% by weight of soil and the sample was tested.

3. Water:

Ordinary water free from organic content, turbidity and salts was used to provide optimum moisture to the samples used for tests.

Preparation Of Sample:

Specimens of parent soil were mixed with 5%, 10%, 15% weight of rubber tire scrap by weight of soil and various samples were prepared at optimum moisture content. And also a specimen of ordinary soil was made to relatively compare both the specimens

V. PROPERTIES OF SOIL

Basic tests were done on virgin soil to determine the properties of soil. Tests that were done on virgin soil sample were Liquid Limit (Using Cassagrandes's Apparatus), Plastic Limit, Specific Gravity (Using Pycnometer).

Table no. 1 : Properties Of Virgin Soil

Tests	Results
Liquid Limit	25%
Plastic Limit	13.37%
Specific Gravity	2.859

VI. COMPACTION CHARACTERISTICS

Modified Proctor test was performed on virgin soil. It is used to determine the compaction characteristics of soil i.e optimum moisture content and maximum dry density.

MDD and OMC of virgin soil was found by using modified proctor test.

Table No. 2 : Modified Proctor Test Results

Sr No.	% Water(By weight)	Dry Density(gm/cc)
1	16	1.57
2	19	1.61
3	20	1.56
4	22	1.56

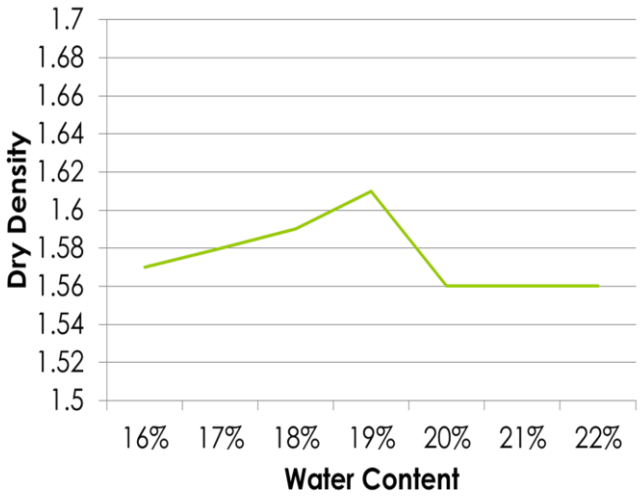

Table No. 3 : MDD & OMC Of Virgin Soil

Soil Type	OMC%	MDD(g/cc)
Virgin Soil	19	1.61

VII. CBR VALUE OF SOIL

The California Bearing Ratio (CBR) Test is a penetration test meant for evaluation of subgrade strength of roads and pavements. The results obtained by these tests are used with empirical curves to determine the thickness of pavement and its composite layers.

CBR tests were conducted on soil and soil-shredded rubber tyre mixtures to determine CBR value from which suitability of soil stabilized with shredded tyres can be assessed. In addition to this thickness of pavement can also be determined from CBR value.

The CBR values of soil and soil-tyre mixtures are summarized in table below, the variation of CBR value with percentage variation of shredded tyre is shown below.

Table No. 4 : Results Of CBR Test

SR. NO.	Percentage Of Rubber	CBR Value
1	0%	6.99%
2	5%	7.51%
3	10%	7.73%
4	15%	4.51%

Graphical Representation Of CBR Results

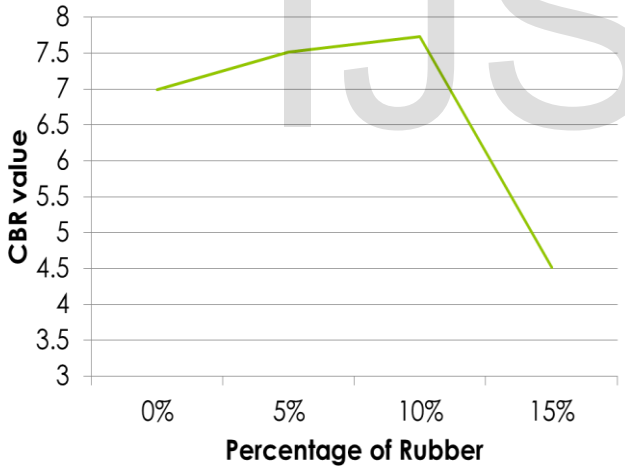

Table No. 5: Pavement Thickness Corresponding to CBR Value

CBR Value	Thickness Of Granular Sub-Base(mm)
7%	230
8%	200

By interpolation thickness of pavement for CBR value of 7.73% is 208mm.

Thickness of pavement thus was found to be reduced by 9.6%.

VIII. CONCLUSIONS

(1) According to the test results, CBR value of composition increases with increase in addition of rubber and then starts to decrease when rubber added in excess.

(2) When soil is mixed with 10% rubber its CBR value increases by 9% compared to virgin soil, which tends to be the maximum CBR value of all to mixtures.

(3) The percentage increase in CBR value, in unsoaked condition results in decrease of pavement thickness and reduces the overall cost of the project.

(4) Pavement thickness was found to be reduced by 9.6%.

(5) It was seen that when soil was mixed with 15% rubber the CBR value was found to be drastically decrease so the optimum dosage of shredded rubber in the soil must be around 10% of the total weight.

(6) Use of innovative technology will not only help to strengthen road construction but also increase the road life as retained stability increases. It is hoped that in near future we will have strong, durable and eco-friendly roads which will relieve earth from all type of rubber waste.

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