International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 6 Issue 9|| September 2017 || PP. 88-91

Stabilization of Clay Soil Mixed With Rubber Tyre Chips For Design in Road Construction

[*]Deepanshu Solanki[1],Mayank Dave[1],Dr. D.G.M Purohit[2]
[1]*M.E Scholar, Dept. of Civil Engineering, M.B.M Engineering College, J.N.V University, Jodhpur, Rajasthan, India*
[2]*Professor, Dept of Civil Engineering, M.B.M Engineering College, J.N.V University, Jodhpur, Rajasthan, India*
Corresponding Author: [*]Deepanshu Solanki

Abstract: *Soil is used as the construction material. It supports the structure and sub-structure. Soil improvement is necessary because of expansive and swelling nature of soil or because of low bearing capacity of soil. Stabilization is process which improves the properties of soil by changing its gradation. Alteration of soil properties to meet specific engineering requirements is known as Soil Stabilization. The clay soil was mixes with rubber tyre chips and properties of soil was takeninto account . Standard proctor test and direct shear test were performed at various copmpostion mix of rubber tyre into clay soil sample at given MDD*
keywords: *Clay, Direct shear, Expansive, Rubber tyre, Stabilization*

Date of Submission: 04-09-2017 Date of acceptance: 17-09-2017

I. INTRODUCTION

The Stabilization is process done for improvement of existing soil by using an admixture. Rubber tyre chips can be treated as admixture. The paper presents experimental results of use of plastic wastage in clay soil for possible use in geotechnical engineering. The study was to use the waste material of rubber tyre in order to reduce the environmental impact. Scrap tyre generation is amongst increasing trend in the world. Tyres are worst when they are burnt as they cause huge environmental pollution. Utilization of rubber tyre chips is very necessary. Soil can be mixed with rubber tyre chips and can be utilized as various constructions and can be further use in road construction. In this paper it discusses about the direct shear test results of soil-tyre mixture, the stabilization of clay soil using crumb rubber at varying percentage.

II. MATERIAL USED FOR STUDY

2.1 Clay Soil

The **clay** soil sample was collected from the town bhadrajun which is situated in jalore district in Rajasthan State. It is about 48 Km north east of jalore district. Clay soil has poor properties for large scale construction because of swelling properties.

2.2 Rubber Tyre Chips

The rubber tyre chips were cutted in different size from 1mm-25mm width and 3mm-50mm length. Tyres main component is rubber other components are stearic acid, zinc oxide, oil, carbon black. It has 420perectage of elongation. Specific gravity of tyre chips obtained with a pycnometer test ranges from 0.9-1.0.

Figure 1 – Rubber Tyre Chips

2.3 Clay Soil-Rubber Tyre Chips Mix

The mixture of clay soil and rubber tyre chips was mixed manually by hand mixing. The tyre chips were mixed in dry clay manually so that it can totally distribute throughout the sample. Water was added afterwards.

III. TEST PROGRAMME

The following test programme was conducted –

1- Standard Proctor Test to determine the different.
2- Direct Shear Test to determine the shear strength of clay soil with different composition mix.

Figure 2 – Direct Shear Test Apparatus

IV. Test Results

Standard Proctor Test Results

The optimum moisture content and maximum dry density of clay soil without using any admixture are obtained from Figure 3 as optimum moisture content is 16 and maximum dry density is 1.83gm/cc

Table 1

S. No.	% Water Added (By Weight)	(Gm/Cc)
1	8	1.76
2	10	1.78
3	12	1.79
4	14	1.81
5	16	1.83
6	18	1.74
7	20	1.71
8	22	1.69
9	24	1.65
10	26	1.64

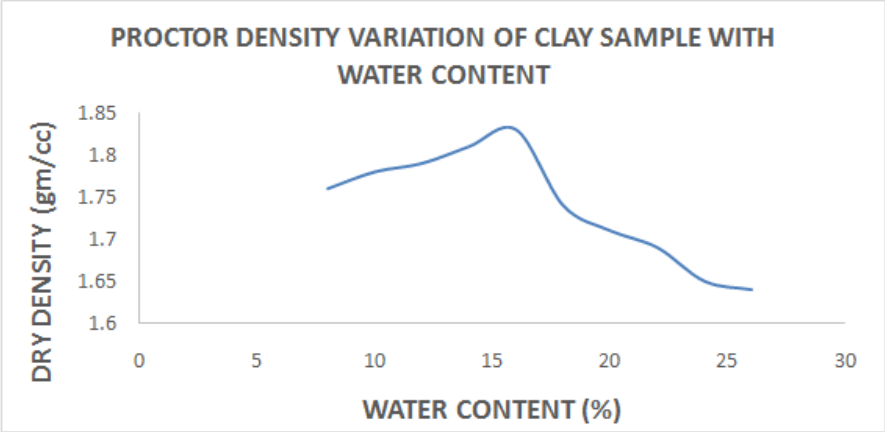

Figure 3: Proctor Density Variation of Clay Sample 2 with Water Content

Direct Shear Test Results

Direct shear test was conducted on the clay soil and rubber tyre mix. The percentage rubber used are 0.5,0.075,0.25,0.50,0.75,1.0. Results of direct shear test at MDD 1.83 gm/cc clay sample are shown in tabular form.

Table 2 - mix compositions and symbols for d.s.t. At mdd 1.83 gm/cc clay

MIX NO.	MIX COMPOSITION	SYMBOL
1	0.05% Rubber + Clay	DB1
2	0.075% Rubber + Clay	DB2
3	0.25% Rubber + Clay	DB3
4	0.50% Rubber + Clay	DB4
5	0.75% Rubber + Clay	DB5
6	1.0% Rubber + Clay	DB6

Table 3 - Variation of φ with Percentage of Plastic at MDD 1.83 gm/cc Clay Sample

S. No.	Mix Composition	Φ (Degree)
1	Db1	14.50°
2	Db2	17.73°
3	Db3	16.02°
4	Db4	14.39°
5	Db5	13.62°
6	Db6	15.48°

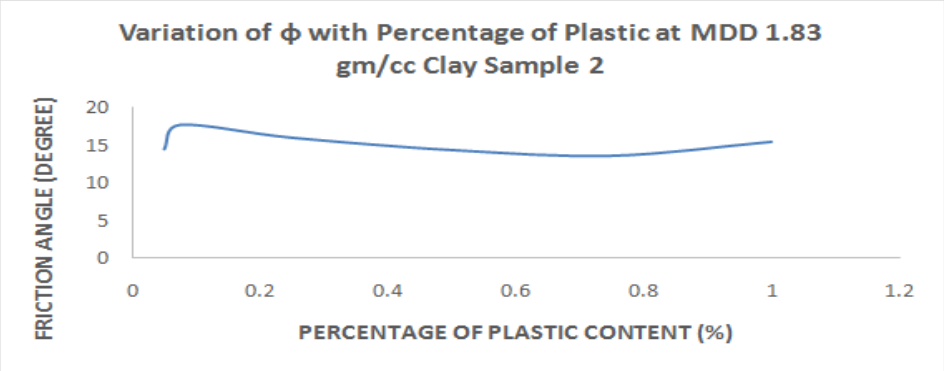

Figure 4: Variation of φ with Percentage of Plastic at MDD 1.83 gm/cc Clay Sample

Table 4 - Variation of Shear Stress with Normal Stress for All Mix Composition at MDD 1.83 gm/cc

Shear Stress (kg/cm^2) for each mix composition at MDD 1.66 gm/cc	Normal Stress (kg/cm^2)		
	0.5	1.0	1.5
Clay + 0.05% Rubber Content (DB1)	0.3391	0.4675	0.5225
Clay + 0.075% Rubber Content (DB2)	0.3575	0.5225	0.6783
Clay + 0.25% Rubber Content (DB3)	0.3758	0.550	0.6691
Clay + 0.50% Rubber Content (DB4)	0.3575	0.4858	0.6141
Clay + 0.75% Rubber Content (DB5)	0.3850	0.4858	0.6233
Clay + 1.0% Rubber Content (DB6)	0.3666	0.5408	0.6508

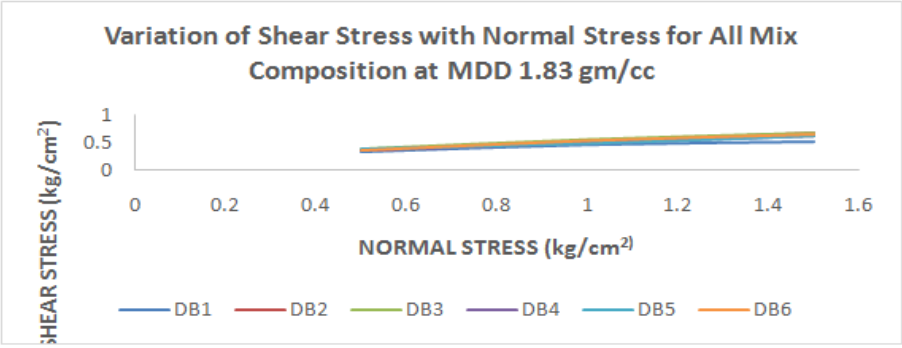

Figure 5: Variation of Shear Stress with Normal Stress for All Mix Composition at MDD 1.83 gm/cc

V. CONCLUSION

After analysis of the test results presented in table and figures of plotted graphs, following conclusion were drawn regarding the experimental study.The shear strength increased with the increasing amount of rubber up to 0.075percentage by weight. The value of angle of internal friction increases with increase in percentage of the rubber tyre strips.Less percentage of rubber tyre chips are giving optimum value, Maximum dry density are 17.73. The rubber tyre chips usage reduce the environmental menace of rubber waste. Soil character sticks like gradation, particle size shape and plastic size affects strength. Strength was increased and hence it can be use for further constructions and in constructions of roads. The smaller grain size provides greater contact area and better surface frictional resistance between clay and chips. Results of tests demonstrated that inclusion of rubber tyre chips waste strips in clay with appropriate amounts improved strength and deformation behavior of sub grade soils.

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International Journal of Engineering Science Invention (IJESI) is UGC approved Journal with Sl. No. 3822, Journal no. 43302.

Deepanshu Solanki. "Stabilization of Clay Soil Mixed With Rubber Tyre Chips For Design in Road Construction." International Journal of Engineering Science Invention (IJESI) , vol. 6, no. 9, 2017, pp. 88–91.