

Clay Soil Stabilization Using Rubber Tyre Waste As Admixture

Deepanshu Solanki¹, Mayank Dave¹ Dr. D.G.M Purohit²

M.E Scholar, Dept. of Civil Engineering, M.B.M Engineering College, J.N.V University, Jodhpur, Rajasthan, India¹

Professor, Dept of Civil Engineering, M.B.M Engineering College, J.N.V University, Jodhpur, Rajasthan, India²

ABSTRACT: The research is concerned with the stabilization of clay soil using rubber tyre chips. Clay soil was collected from an area of Rajasthan and rubber tyre chips were made available from the locally available tyre tube. Tyre tube was cut into small chips and was mixed into the clay soil. Present work has been carried out by taking 1 – 5mm rubber tyre chips as an admixture. The varying percentage 0%, 0.05%, 0.06%, 0.7%, 0.8%, 0.9% and 1.0% of tyre chips were mixed in clay, with these mix compositions CBR test was carried out at different dry densities obtained from the standard penetration test. The result and conclusion were summed which shows the use of tyre chips mixed in the clay. The results show the use of waste rubber tyre chips.

KEYWORDS: CBR, Clay, Rubber, Expansive, Stabilization

I. INTRODUCTION

Soil is the topmost layer. It supports the structure and the sub structure, to hold the structure soil must have good shear strength. The advancement of soil is very necessary because of construction of cost is rising.

Soil Stabilization is a very good technique, It alters the properties of soil by changing its gradation and making it useful for engineering properties, thus improving the bearing capacity of the soil. A very big amount of rubber tyre waste is available and it is causing the environmental menace, It can be used as admixture in the soil and can be utilized for the further use. The problem of removal and disposing off the waste rubber tyre can be solved by using as admixture.

Rubber tyre chips aids in improving the strength of the clay soil and also helps in improving the clay soil properties in terms of strength. Researchers like Purohit D.G.M. et al. (2009), Awad ALKarni et al. (2012), Jain O.P. et al. (1979), V. Mallikarjuna et al. (2016), Kevin M. (1978) and Wayal A.S. et al. (2012) have worked on stabilization of soils

II. RELATED WORK

Related work is going including the stabilization of dune sand, clay soil, bentonite using the admixtures such as LDPE sheets, plastic waste, glass bottles waste etc.

III. MATERIAL USED FOR STUDY

2.1 CLAY SOIL

The clay soil sample was collected from the town Bhadravaj which is situated in Jalore district in Rajasthan State. It is about 45 km from the district. The soil was collected from there and was used for the further studies.

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2.2 RUBBER TYRE CHIPS

Polythene was collected and cutted into small strips, Polyethylene absorbs almost no water. The gas and water vapor permeability (only polar gases) is lower than for most plastics; carbons,oxygens.PE can become brittle when exposed to sunlight, carbon black is usually used as a UV stabilizer.Polyethylene is a good electrical insulator. It offers good tracking resistance; however, it becomes easily electrostatically charged (which can be reduced by additions of graphite, carbon black or antistatic agents) Polyethylene is of low strength,hardness and rigidity, but has a high ductility and impact strength as well as low friction. It shows strong creep under persistent force, which can be reduced by addition of short fibers. It feels waxy when touched.

The scrap tires in Algeria are estimated at approximately 25,918 tones/year.Waste tires need a larger storage space than other waste due to their large volume and fixed shape. They are unlikely to be decomposed, as burying the waste tires would shorten the service life of the burial ground and have low economic benefit; In addition, buried waste tires often emerge from the burial ground surface or destroy the anti-leakage cover of the burial ground and the exposed waste tires accumulate water that may breed bacteria, molds, insects or mice. In case of fire, waste tires generate toxic gases, such as dioxin, that could result in severe pollution problems

Properties	Rubber
Density	0.82
Size	80 μ m – 1.5 mm
Elongation	(%) 420
Rate of steel fiber	0%

Shredded rubber tyre was cut into different sizes ranges from 1mm to 25mm (Width) and 3mm to 50mm (Length). Added amount of rubber tyre had been varied in proportions of 4%, 5%, 8% and 10%.



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. Water was added afterwards.

IV. EXPERIMENTAL PROGRAMME

The following test programme was conducted –

- 1- Standard Proctor Test to determine the different dry densities of clay soil
- 2- CBR to determine CBR values for clay soil with different mix composition with polythene waste in unsoaked and soaked conditions.

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Figure 2 – CBR Test Mould

V. TEST RESULTS

STANDARD PROCTOR TEST RESULTS

The OMC and Maximum Dry Density of the plain soil without plastic are obtained from the figure as O.M.C is 16 and M.D.D is 1.83 gm/cc and also the other dry densities at water content 10 and 22 are 1.78 gm/cc and 1.69 gm/cc respectively.

S. No.	% WATER ADDED (BY WEIGHT)	DRY DENSITY (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

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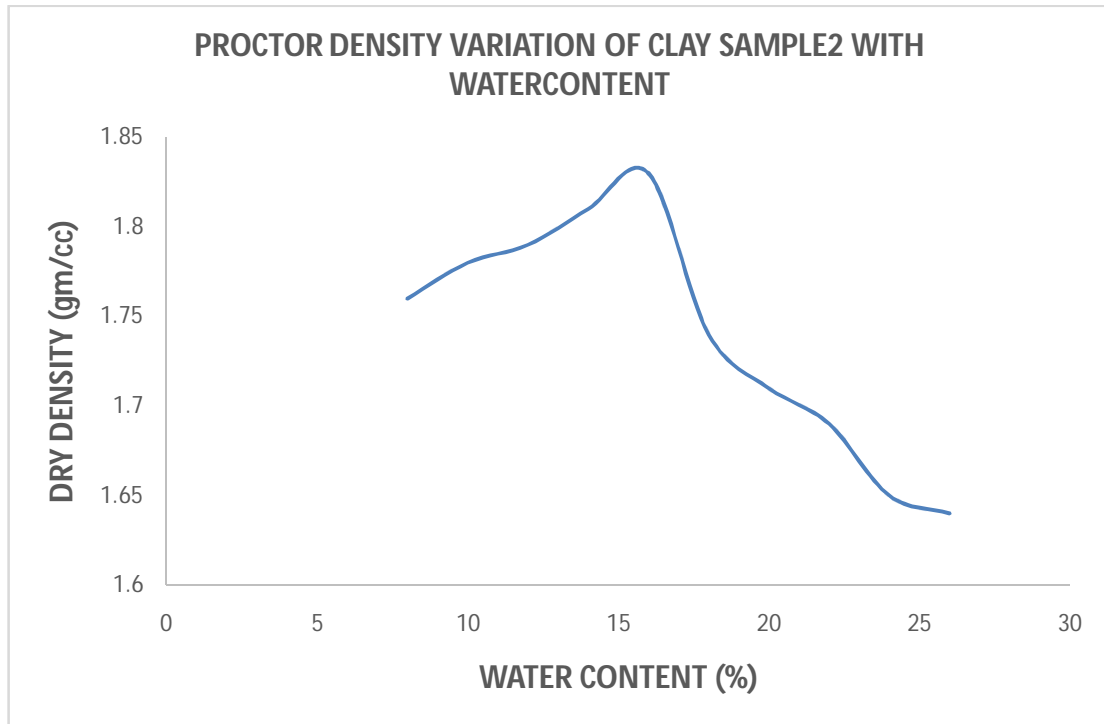


Figure 3: Proctor Density Variation of Clay Sample with Water Content

CBR TEST RESULTS

The test results from unsoaked CBR tests are presented in table with each table has the respective graph chart to present the data.

The unsoaked CBR test has three main dry densities for which the data are obtained experimentally. These dry densities are the maximum dry density 1.83 gm/cc, and the other two are 1.78 gm/cc and 1.69 gm/cc.

Table gives the tabular form of the results of variation of % CBR with mixture of sand and percentage of rubber content in unsoaked condition for each dry density. Figure provides the curve between the different percentages of strip content and % CBR values for all the three different dry densities

TABLE 1
Mix Compositions and Symbols for Unsoaked CBR Test at MDD 1.83 gm/cc

MIX NO.	MIX COMPOSITION	SYMBOL
1	0.05% Rubber + Clay	CB1
2	0.075% Rubber + Clay	CB2
3	0.25% Rubber + Clay	CB3
4	0.50% Rubber + Clay	CB4
5	0.75% Rubber + Clay	CB5
6	1.0% Rubber + Clay	CB6

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TABLE 2

Mix Compositions and Symbols for Unsoaked CBR Test at Dry Density 1.78 gm/cc

MIX NO.	MIX COMPOSITION	SYMBOL
1	0.05% Rubber + Clay	CB7
2	0.075% Rubber + Clay	CB8
3	0.25% Rubber + Clay	CB9
4	0.50% Rubber + Clay	CB10
5	0.75% Rubber + Clay	CB11
6	1.0% Rubber + Clay	CB12

TABLE 3

Mix Compositions and Symbols for Unsoaked CBR Test at Dry Density 1.1.69 gm/cc

MIX NO.	MIX COMPOSITION	SYMBOL
1	0.05% Rubber + Clay	CB13
2	0.075% Rubber + Clay	CB14
3	0.25% Rubber + Clay	CB15
4	0.50% Rubber + Clay	CB16
5	0.75% Rubber + Clay	CB17
6	1.0% Rubber + Clay	CB18

The CBR values according to test results for unsoaked condition at MDD 1.83 gm/cc with rubber content 0.05%, 0.075%, 0.25%, 0.50%, 0.75% and 1.0% of the clay are 6.437, 6.676, 7.253, 6.199, 5.961 and 5.245 respectively. For mix composition at 1.78 gm/cc dry density with rubber content mix 0.05%, 0.075%, 0.25%, 0.50%, 0.75% and 1.0% of clay weight the CBR values in percentage are 5.245, 5.722, 6.199, 5.484, 5.231 and 5.007 respectively. For mix composition at 1.69 gm/cc dry density with rubber content 0.05%, 0.075%, 0.25%, 0.50%, 0.75% and 1.0% of the clay, CBR values in percentage are 6.199, 6.676, 7.153, 6.437, 5.961 and 5.484 respectively

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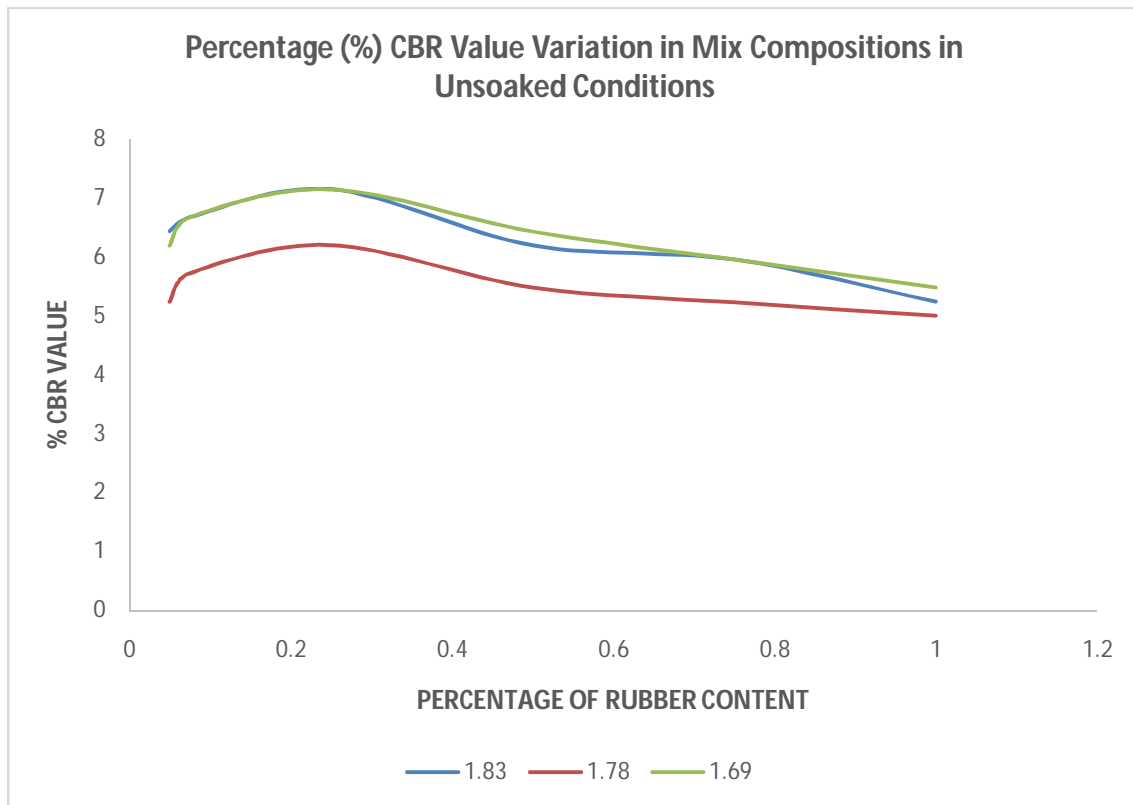


Figure 4: Percentage (%) CBR Value Variation in Mix Compositions in Unsoaked Conditions

VI. CONCLUSION

According to test results it can be seen that on increment of dry density, the CBR value of the mix composition increases. On increasing the percentage of rubber content firstly the CBR value of the mix composition also increases and then starts to decrease for more percentage of rubber content. The maximum results have been obtained at low percentage of rubber content (0.25%) and minimum results at 1.0% plastic content for all the three dry densities. Hence it can be concluded that to use the mix compositions in base and sub base construction, the CBR values can be increased or decreased as needed. Comparative results for all the three dry densities 1.83 gm/cc, 1.78 gm/cc and 1.69 gm/cc have been shown in table for unsoaked conditions. Improvement properties that found are shear strength, ductility, toughness, isotropy in strength. Percentage cbr value etc. up to a limiting value referred to as the critical confining stress, failure occurs by frictional slipping of the reinforcement.

Shear strength increases with increasing amounts of rubber up to 0.50% for clay sample 1, 0.075% for clay sample 2 by weight, beyond which the gain in strength is smaller. The smaller grain size provides greater contact area and better surface frictional resistance between clay and fibers. The results indicate that the soil characteristics such as gradation, particle size, shape and plastic parameters such concentration in the specimen, strip size are affects the strength behavior of the rubber-reinforced soil. The results indicate that the initial void ratio was higher for plain soil and as the rubber waste was added it being lower. As the percentage of rubber waste increased in soil, the density of rubber waste being less, more voids were occupied with rubber waste and resulted in overall reduction of void ratio. The values of

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friction angle increases as the dry density of clay increases. The increase in strength in soil is due to increase in friction between soil and rubber waste and development of tensile stress in the rubber

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