

Stabilization of Soil and Rubber Crumb by using CBR Test

R. S. Shinde¹, Divya Kamble², Geeta Kamble³, Ruksar Ambi⁴

¹Lecturer, Department of Civil Engineering, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji, India

^{2,3,4}Student, Department of Civil Engineering, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji, India

Abstract: A major problem associated with socio-economic development of a country is waste disposal. In India, the scrap tires are being generated and accumulated in large volumes causing an increasing threat to the environment. It is estimated that 259 million tyres are discarded annually. The growth and usage of motor vehicles have not only caused noise pollution, air pollution etc. but also has created problems in discarding the tyre's. Material recovered from waste tyres, known as "crumb," is generally only a cheap "filler" material and is rarely used in high volumes. Now a day's construction is also being carried out on marginal sites having extremely poor ground conditions like soft clays that were earlier considered unsuitable due to their poor strength and high compressibility. Such soils, when loaded cause excessive settlements and early failure of structures. In this paper we studied the feasibility of soil stabilization by using rubber crumb for different soil samples.

Keywords: Compaction, C.B.R, Rubber crumb, Stabilization, Settlements.

1. Introduction

Soil stabilization is the process of improving the engineering properties of the soil and thus making it more stable. Many countries already banned the disposal of the waste tires in sanitary landfills. The use of waste tires as a fuel is now prohibited by Indian government since 2006 due to its environmental impact. With globalization of Indian economy and emphasis on development of infrastructure, the no of vehicles on road is increasing day by day. This increase in growth apart from causing noise and air pollution has begun to cause pollution in terms of stock piles of discarded tyres. Huge amount of soil is used in the construction of roads and highways but sufficient amount of soil of required quality is not available easily. Utilization of various industrial wastes such as crumb rubber as a soil replacement not only solves environmental problems but also provides a new resource for construction industry. In the present economic and environmental ambience, high pressures are laid on engineers to identify suitable methods wherever possible to re-use any locally available waste materials in order to minimize the costs of a project and its impacts on the environment.

2. Objectives and methods

A. Objectives of soil stabilization

Stabilization is being used for a variety of engineering works, the most common application is being in the construction of road and airfield pavements, where the main objective is to reduce the construction cost by making best use of locally available materials.

- To create solid and strong sub base.
- To increase the strength of soil.
- Utilization of waste tire scrap.

B. Methods of soil stabilization

- Mechanical Stabilization
- Soil-lime Stabilization
- Soil-cement Stabilization
- Soil –Bitumen Stabilization
- Stabilization by Chemical

In ground improvement methods, waste materials are also used to improve geotechnical properties of soil. Waste materials such as scrap tires. Rubber crumb in addition with cement can also tried now a days.

C. Material used

- *Soil:* Locally available clayey soil was collected from the different fields. In this study, subgrade soil is used.
- *Crumb Rubber:* For improving the engineering properties of the clay, crumb rubber was chosen as an additive. Crumb rubber is a term usually applied to recycled rubber from automotive and truck scrap tires.

3. California Bearing Ratio Test

The CBR test is penetration test meant for the evaluation of subgrade strength of roads and pavements. The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. In this study we studied different types of soil samples with rubber crumb with different percentage. Generally, penetration is ranges from 0, 2.5, 5, 10 and so on values. On particular penetration we can calculate load. CBR can be calculated from standard load and formula is given as below. This paper particularly takes the tests by putting CBR in a centre.

$$CBR = (\text{Test Load} / \text{Standard Load}) \times 100$$

4. Results

Table 1
Properties of soils

Test	Sample 1	Sample 2
Sp. gravity	2.222	2.222
Liquid limit test	70	68.25
Plastic limit test	50	36.111
MDD	29.508	26.513
OMC	28.75	28

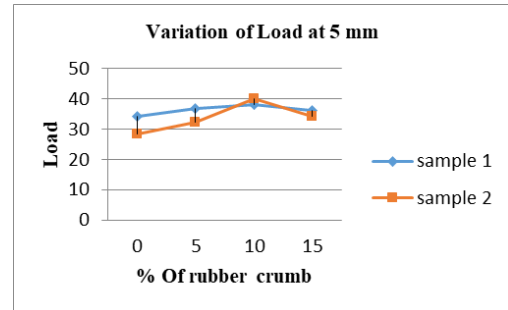


Fig. 1. % of rubber crumb vs. Load

Sample Calculations

Table 2
Sample 1

% of rubber crumb	Penetration	Load
0%	5	34.2
5%	5	36.8
10%	5	38
15%	5	36.1

Table 3
Sample 2

% of rubber crumb	Penetration	Load
0%	5	28.5
5%	5	32.3
10%	5	39.9
15%	5	34.2

Table 4
Soil and CBR value

Soil	CBR Value			
	Crumb Rubber %			
	0	5	10	15
Sample 1	8.32	8.95	9.24	8.68
Sample 2	6.93	7.85	9.71	8.32

Table 5
Soil and CBR value

Soil	CBR Value			
	Crumb Rubber %			
	0	5	10	15
Sample 1	11.92	12.46	13	11.38
Sample 2	9.21	10.83	13	11.37

Table 6

Standard Loads Adopted for Different Penetrations for the Standard Material with a CBR value of 100%

S. no.	Penetration of plunger(mm)	Standard load(kg)
1	2.5	1370
2	5	2055
3	7.5	2630
4	10	3180
5	12.5	3600

5. Discussion

Other geotechnical parameters such as hydraulic conductivity, consolidation parameters etc. can be calculated. Durability aspects of crumb rubber treated soil like drying and wetting, freezing and thawing actions and response to various chemicals like alkalis, chlorides, sulphides may also be investigated. The result may vary with different soil samples. In this paper we purely studied about the feasibility of different soil samples in stabilization, So the results may vary with different soil samples. The document is a template for Microsoft Word versions 6.0 or later.

6. Conclusion

This project will help in reduction of waste tyres in optimum manner by utilizing as a soil stabilizer material. The idea of using rubber tyre crumb as a stabilizer can be implanted in any soil work after testing its suitability. This will be helpful for construction managers to manage and to reduce cost of a construction sites. CBR Value increases with increasing rubber crumb upto 10% after it will decreases. If the percentage of rubber crumb increases more than 10%, the soil strength gradually decreases. Addition of crumb rubber crumb due to rubber mix, CBR value increases and hence thickness of pavement decreases.

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