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Soil Stabilization Using Shredded Rubber and Design of Flexible Pavement.

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Abstract – *Soil is used as a construction material since a long time. It supports both superstructure and substructure. The improvement of soil characteristics is important to make the soil safe in bearing the load of these structures. Weak in strength and high degree of expansion and contraction due to presence of montmorilonite mineral leads to failure of black cotton soil. Stabilization is a process of improving soil characteristics by using certain additives. Use of shredded rubber for foundation engineering has received a great attention in recent times. This paper aims on studying the effect of shredded rubber when used as an stabilizer to improve the engineering properties of black cotton soil.*

The shredded rubber was added with a varying range of 0%, 2.5%, 5%, 7.5%, 10% for experimental work. Standard proctor tests and CBR tests were performed on both virgin soil and mix soils. The paper presents the behavior of sub grade pavement when soil is stabilized with rubber. The main objective was to improve the CBR value of soil.

Key Words: Soil stabilization, clayey soils, shredded rubber, standard proctor, CBR etc.

1. INTRODUCTION

Soil is a very important construction material. Over 80% of area of Maharashtra has been covered by back cotton soil. For every construction work, we can change material if it hasn't good properties but it is very difficult to replace soil if it does not have the required characteristics that too in large quantity, because of transportation of soil over large distance are not feasible. For such conditions an attempt has been made to use shredded rubber and improve the properties of soil. This method of using waste shredded rubber and improving soil characteristics is called soil stabilization. Stabilization is a process to change the properties of soft and weak soils and thereby improve their stiffness and strength by adding additives in wet or dry conditions. Scrap tyre generations is increasing everyday and most of them end up in congested landfills or are burned. Thus the aim of this paper is to study the appropriateness of shredded tyre and improve the CBR ratio of virgin black cotton soil and study the comparative cost effect on the flexible pavement design of road.

2. MATERIALS AND METHODOLOGY

The soil used in this study was collected from Survey no 4 Ravet, Pune, Maharashtra. The soil was classified as per BIS as CI which stand for clay with intermediate compressibility. Shredded rubber was taken from Apollo Tyres workshop Talwade. The shredded rubber is 5-7 cm in length and 0.5 cm in diameter. The rubber was added in percentages of 2.5%, 5%, 7.5%, 10%. The shredded rubber is as shown below.

Table 1. Engineering Properties Of Virgin Soil.

Sr.no	Properties	Value
2.	Atterberg's limits a) Liquid limit b) Plastic Limit c) shrinkage limit	 53.69% 20.19% 43.33%
3.	Compaction characterstics a) maximum dry Density b) optimum moisture content.	 1.50 gm/cc 14.69%
4.	Specific gravity	2.56
6.	CBR value	

3.0 INVESTIGATIONS AND RESULTS.

The experimental investigation were carried out in two stages. Standard Proctor test and CBR test were carried out as per IS 2720 and IS 2720 Part XVI respectively. The soil was collected from the site, oven dried, grinded and stored in

bags. Soil samples were prepared by adding percentages of rubber as mentioned above.

3.1 COMPACTION CHARACTERSTICS

Table -2: MDD AND OMC FOR SOIL SAMPLES.

% SHREDDED RUBBER	MDD	OMC
0%	1.50	14.69
2.5%	1.52	11.67
5%	1.40	11.60
7.5%	1.29	13.77
10%	1.25	11.95

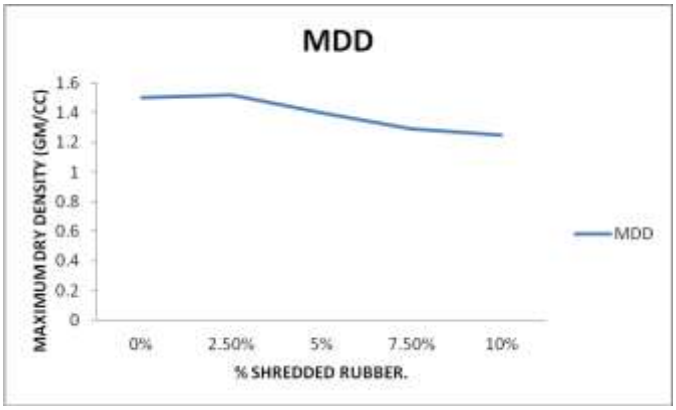

Chart -1: Shredded Rubber Vs MDD

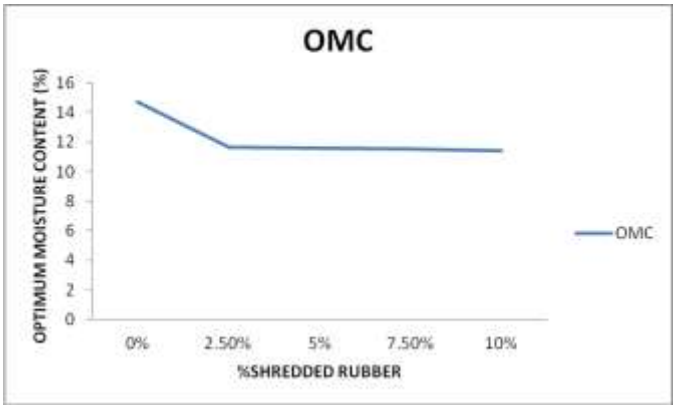

Chart -2: Shredded Rubber Vs OMC

From the results we can conclude that MDD of soil sample increases upto 2.5% and then reduces significantly with increase in rubber content. This may be due to light weight nature of rubber tyre that causes reduction in total weight. Similarily it has been found that OMC reduces significantly as percentage of rubber increases.

3.2 CBR values.

Sr.no	% SHREDDED RUBBER	Soaked CBR value
1	0%	1.38
2	2.5%	1.42
3	5%	1.58
4	7.5%	2.62
5	10%	1.28

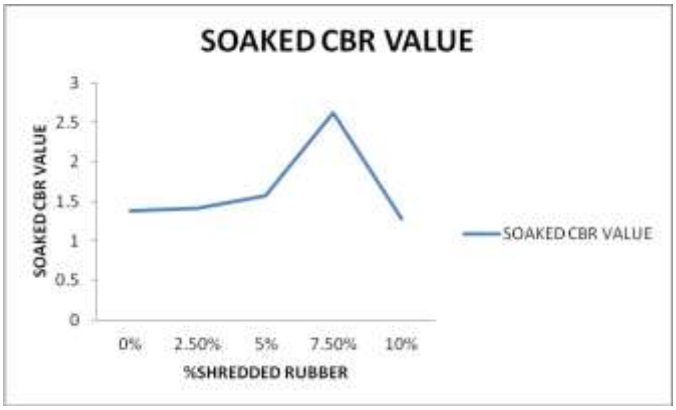

Chart -1: Shredded Rubber Vs Soaked CBR value.

The CBR values shows a slight increase upto 5% and there after increases significantly at 7.5% and then reduces drastically. The maximum improvement of soaked CBR value is found at 7.5%

4.0 Design For Flexible Pavement

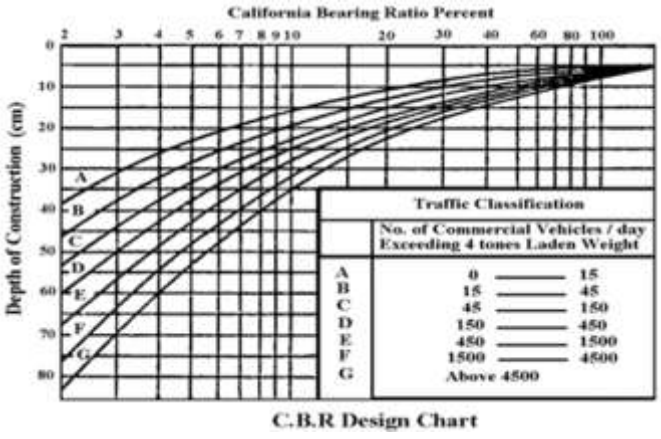

Fig -1: Pavement thickness design chart(Recommended by IRC)

Sr no.	CBR curves applicable	Traffic (commercial vehicles per day)
1	A	0-15
2	B	15-45
3	C	45-150
4	D	150-450
5	E	450-1500

4.1 Design of flexible pavement for black cotton soil
4.1.1 Design of flexible pavement for black cotton soil without stabilization.

Number of vehicles per day- 1500

Applicable CBR curve- E

CBR of sub grade soil- 1.38

Hence pavement thickness from chart- 750 mm.

4.1.2 Design of flexible pavement for black cotton soil with stabilization

Number of vehicles per day- 1500

Applicable CBR curve- E

CBR of sub grade soil- 2.62

Hence pavement thickness from chart- 620 mm.

Total reduction in pavement thickness= 750-620=130mm

Percentage reduction in pavement thickness= 17.33%

3. CONCLUSIONS

From the tests carried out and design following this can be concluded-

- MDD of soil sample increases upto 2.5% and then reduces significantly with increase in rubber content.
- OMC reduces significantly as percentage of rubber increases.
- The CBR values shows a slight increase up to 5% and there after increases significantly at 7.5% and then reduces drastically.
- The maximum improvement of soaked CBR value is found at 7.5% which is 2.62.
- Percentage reduction in pavement thickness= 17.33%.

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