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Soil Stabilization Using Shredded Rubber Tyre

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Abstract - Shredded rubber tyre having sizes ranges from 15mm to 25mm (Width) and 30mm to 50mm (Length) and the steel belting was removed are used extensively. Added amount of rubber tyre had been varied in proportions of 4%, 6%, 8% and 10%. Use of shredded rubber tyres in geotechnical engineering for enhancing the soil properties has received great attention in the recent times. This paper presents the investigation of behavior of pavement subgrade soil stabilized with shredded rubber tyre. It is found that the 8% (25 mm×50 mm) of tyre content is the specific value where the CBR has got the improvement of 66.28% than in comparison of the plain soil.

Key Words: *Soil Stabilization, Clayey Soil, Shredded Rubber Tyre, CBR etc….*

1. 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 tyre 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 tyres for its use in pavement engineering, i.e. to stabilize the subgrade of the pavements. It discusses about CBR value of soil-tyre mixture and the results are presented.

2. MATERIALS USED

The soil used in this study collected from CCET, Sec. 26 (Chandigarh), India. Classification of soil as per BIS is CI which is clay with intermediate compressibility. Shredded rubber tyre was cut into different sizes ranges from 15mm to 25mm (Width) and 30mm to 50mm (Length). Added amount of rubber tyre had been varied in proportions of 4%, 6%, 8% and 10%. The view of shredded rubber tyre used in the study is shown in Fig.1 and Fig.2.

Fig. 1: Shredded Rubber Tyre

Fig. 2: Soil-Shredded Rubber Tyre Mixture

3. COMPACTION CHARACTERISTICS

Modified Proctor test is conducted on soil and soil-shredded rubber tyre mixtures to determine its

compaction characteristics, namely, the Optimum Moisture Content (OMC) and Maximum Dry Density (MDD). The soil is mixed with tyre shreds of 4%, 6%, 8% and 10% by weight of soil. The OMC and MDD values obtained are shown below in the tables.

Table 3.1: OMC and MDD table for size 15× 30 mm

% of shredded rubber tyre	15× 30 mm	
	OMC (%)	MDD (g/cc)
4	10.81	1.99
6	10.53	1.89
8	9.68	1.85
10	9.32	1.79

Table 3.2: OMC and MDD table for size 20× 40 mm

% of shredded rubber tyre	20× 40 mm	
	OMC (%)	MDD (g/cc)
4	11.38	1.98
6	10.57	1.92
8	10.13	1.85
10	9.54	1.78

Table 3.3: OMC and MDD table for size 25× 50 mm

% of shredded rubber tyre	25× 50 mm	
	OMC (%)	MDD (g/cc)
4	10.52	1.96
6	10.00	1.89
8	9.36	1.84
10	9.18	1.76

It can be seen from the above tables that the MDD of soil-tyre mixtures reduces significantly with an increase in the percentage of shredded rubber tyre. This is due to the light weight nature of shredded rubber tyre. On the other hand, the value of OMC also decreasing with an enhancement of percentage of shredded rubber tyre. This is due to the fact that the shredded rubber tyre has more water absorption capacity.

4. CBR VALUE OF SOIL-TYRE CHIPS

CBR tests were conducted on soil and soil-shredded rubber tyre mixtures to determine the CBR value from which the suitability of soil stabilized with shredded tyres can be assessed. In addition to that the thickness of the pavement can also be determined from the CBR value. The tests were conducted a corresponding OMC and MDD of the soil, soil-tyre mixtures. The soil is mixed with tyre shreds of 4%, 6%, 8% and 10% by weight of soil and modified proctor test were conducted on soil-shredded rubber tyre mixtures. The CBR values of the soil and soil-tyre mixtures are summarized in the respective tables. The variation of CBR value with percentage of tyre is shown in **Fig**. 3, **Fig**.4 and **Fig**.5.

CBR value of Plain soil = 26.01%

Table 4.1: CBR value of Soil-Tyre mixture (15× 30 mm)

% of shredded rubber tyre	Unsoaked CBR (15× 30 mm)		
	2.5 mm	5.0 mm	Percentage variation
4	**36.00**	35.73	**38.36**
6	**36.52**	33.81	**40.36**
8	**37.83**	36.26	**45.39**
10	**33.74**	33.45	**29.72**

Table 4.1: CBR value of Soil-Tyre mixture (20× 40 mm)

% of shredded rubber tyre	Unsoaked CBR (20× 40 mm)		
	2.5 mm	5.0 mm	Percentage variation
4	**37.05**	35.38	**42.39**
6	**37.58**	34.33	**44.43**
8	**39.67**	37.49	**52.45**
10	**34.93**	33.09	**34.29**

Table 4.1: CBR value of Soil-Tyre mixture (25× 50 mm)

% of shredded rubber tyre	Unsoaked CBR (25× 50 mm)		
	2.5 mm	5.0 mm	Percentage variation
4	**41.25**	39.06	**58.52**
6	**41.51**	40.12	**59.52**
8	40.46	**43.27**	**66.28**
10	**37.43**	36.73	**43.91**

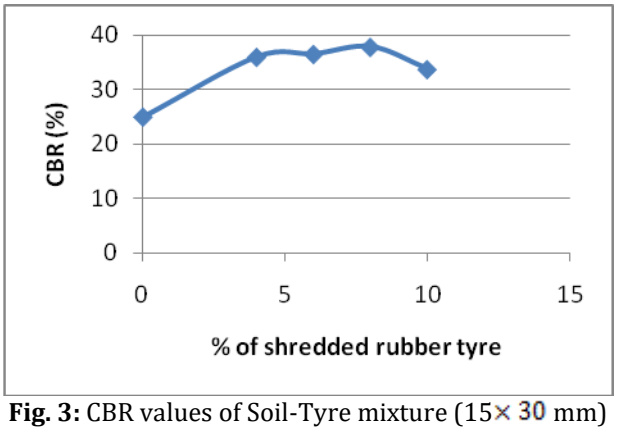

Fig. 3: CBR values of Soil-Tyre mixture (15× 30 mm)

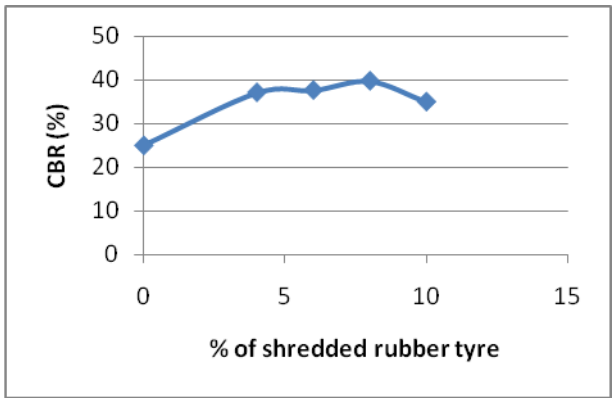

Fig. 4: CBR values of Soil-Tyre mixture (20× 40 mm)

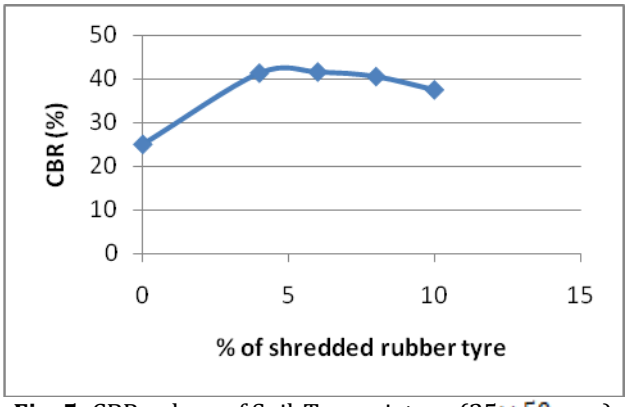

Fig. 5: CBR values of Soil-Tyre mixture (25× 50 mm)

It is inferred from Tables and Fig.1, Fig.2 and Fig.3 that the 8% of size 25 mm×50 mm of tyre content is the specific value where the CBR has got the improvement of 66.28% than in comparison of the plain soil (26.01%). An improvement in CBR value of 66.28% can considerably trim down the overall thickness of the pavement and hence the total cost involved in the project.

5. CONCLUSIONS

Based on the experiments carried out on soil and soil-tyre mixtures, the following observations and conclusions are drawn:

i) The optimum moisture content as well as maximum dry density is found to decrease with the increase of the percentage of rubber tyre content. This might be due to light weight nature of tyre waste.

ii) Shredded rubber tyre mixed with soil showed enhancement in CBR value with adding up to 8 % and there beyond decreased with additional increment in tyre content in unsoaked condition. Hence the optimal value of shredded rubber tyre is 8 % of size 25 mm×50 mm in unsoaked conditions.

iii) The percentage enhancement in CBR value of stabilized soil is 66.28 % in unsoaked condition whereas an increase in CBR value can considerably trim down the total thickness of the pavement and hence the total cost concerned in the project.

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