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Improvement of Sub Grade of Pavement by using Waste Shredded Rubber Tyre

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Abstract - *Nowadays lots of non-biodegradable materials are been produced and are not exhausted in the proper manner due to which the environment is been harmed. As an initiative to preserve the environment and to do some contribution to the society from my side in geotechnical engineering I have chosen the following topic as my project. In the project I have used the waste rubber tyres slices of the vehicle in improving the road pavement in the order of 2% to10% by weight of soil. The rubber tyres were sliced to the size of 25mm x 50mm and 20mmx 15mm and were placed by mixing it thoroughly with soil in the preparation of CBR moulds.*

***Key Words*: Lateritic red soil, waste rubber tyres slices, OMC, MDD, Unsoaked CBR.**

1. INTRODUCTION

It is been observable that the industrialization is been developing day after day, as the industrialization growing the traffic volume getting increased, as the traffic volume increased the scraped tyres are being produced more. It is well known fact that scraped tyres are no more useful for anything, so it is needed to disposed off in the open dumping area. Rubber tyres are non biodegradable because it's been made up of materials like synthetic rubber, polymers, natural rubber, elastomers, and other additives. Discarded tyre may cause adverse effect on environment since it does not decay in short time. So in this study some attempts has been made to minimize the disposing off of scraped tyres in the open land by adding in soil which acts like reinforced soil, so that the strength properties of the soil can be made higher.

1.1 SCOPE OF WORK

- OMC and MDD would be find out using modified proctor method with addition tire slices in a deferent % and without addition of tyre slices in the lateritic soil. Lastly the outcomes of both would be compared.
- California bearing ratio going to carry to know modified properties of strength on pure soil as well as soil blended with tyre slices. Outcomes got from this are compared.
- From this study we get to know that tire slices can be used as an additive in the soil to edify the properties.
- Main theme of this study is to prove that utilizing tyre slices as additive will cause no harm on the soil.
- Employing tire slices as additive may minimize the problems of disposal in open area.

2. MATERIALS AND METHODOLOG

There are many more solid wastes or discarded materials are available using which we can edify the geotechnical properties of soil. However, in this study we are using slices of tyres of deferent size. We can edify the soil properties by blending soil with solid waste materials but amount of up gradation in the soil properties depends on the material where it is bringing from. Materials used in this study are brought from nearby areas of Bidar.

2.1 Followings are the materials used in this study

1. Lateritic red soil
2. Slices of tyre of size 15mm×20mm
3. Slices of tyre of size 25mm×50mm

Fig 2.1: Slices of Tyre

Fig 2.2: Slices of Tyre Mixed With Lateritic Soil

Table 2.1: index properties of lateritic soil

Sl. No.	Parameters	Lateritic soil
1	Specific gravity	2.74
2	Constituency limits	
	Liquid limit %	57.62
	Plastic limit %	28.50
	Plasticity index %	29.51
3	Sieve analysis	
	Coarse grained soil %	4
	Medium grained soil %	18.60
	Fine grained soil %	10.20
	Silt and clay %	67.20
4	OMC in %	18.14
	MDD KN/m^3	16.90
5	CBR	6.53

2.2 METHODOLOGY:

Many properties like index properties as well as engineering properties can be checked adding the slices of tyres in lateritic soil but in this study only few index properties and few engineering properties are tested. They are as.

2.2.1 Engineering Properties

1. Compaction Properties.
2. California Bearing Ratio.

Compaction Properties Test: Modified proctor test has been performed to get know the properties of compaction like OMC and MDD. This test has been conducted as per recommended code book IS: 2720(part-7)-1980. This test performed for the pure soil first then this test has been performed adding different percentage of slices of tyre blended with soil.OMC and MDD have been found out separately for each percentage of addition of slices of tyre blended with the soil and each sizes of slices of tyre blended with soil, finally the outcomes will be compared.

California Bearing Ratio: This test has been conducted to know the CBR value of soil. OMC which we got to know from compaction property test was added in the soil to conduct this test for the study. CBR for each and every increase in percentage of slices of tyre blended with soil and for each size of slices of tyre blended with soil will be found out. This test have been performed using the recommended laboratory test book IS: 2720(part 16)-1979. Loads are calculated from the following table.

3. RESULTS AND DISCUSSIONS

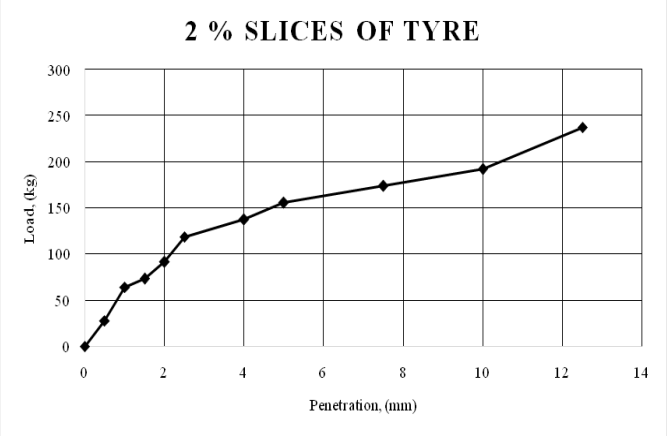
3.1 Soil Properties of Compaction Which Was Blended With Slices of Tyre with Size 25mm×50mm:

Table 3.1: Outcomes of each trial are tabulated below:

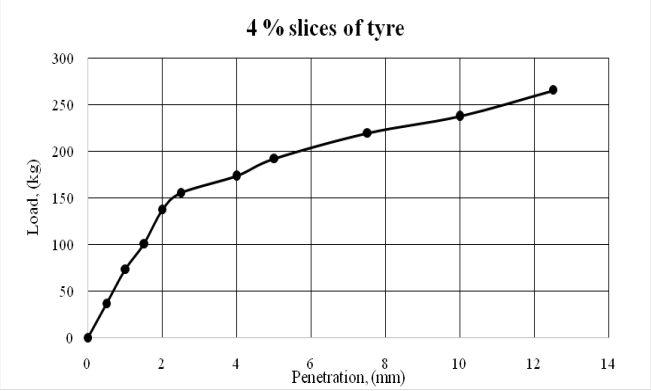
% of shredded rubber tyre	25x50 mm	
	OMC (%)	MDD (g/cc)
2	19.27	1.69
4	18.67	1.68
6	17.54	1.66
8	16.94	1.61
10	15.5	1.57

It has been observed from each trial that maximum dry density getting low with increase in percentage inclusion of slices of tyre. This is due to low weight of tyre compared to soil. On the other hand the optimum water content also gets low as percentage inclusion of slices of tyre increases. This is because of low water absorption capacity of tyre.

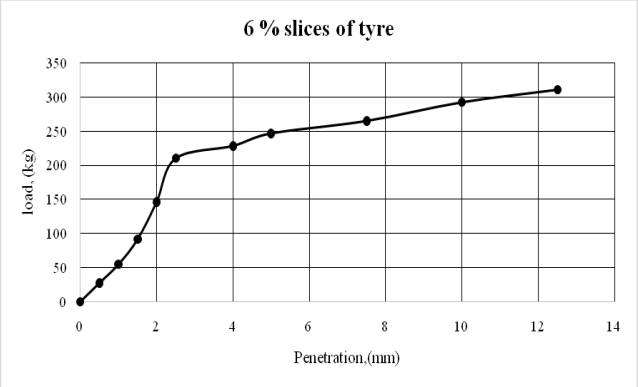
3.2 Variation of CBR with Percentage Inclusion of Slices of Tyre of size 25mm×50mm are shown in the following Graphs:



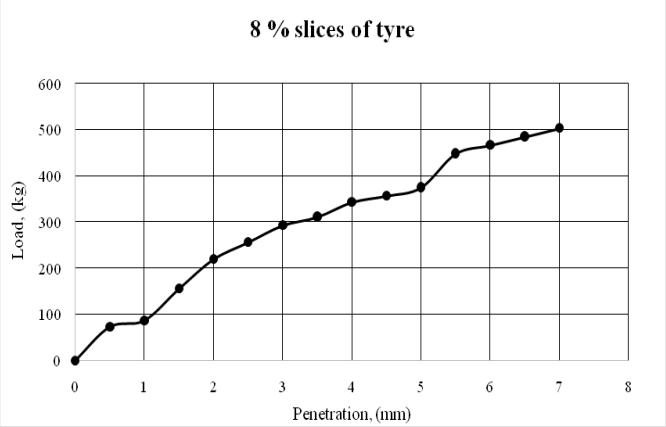
Graph 4.1: graph showing the variation of load verses penetration when 2% of slices of tyre are added in lateritic soil.



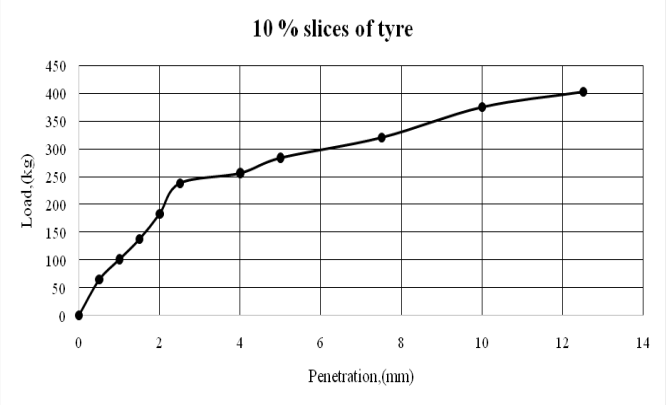
Graph 4.2: graph showing the variation of load verses penetration when 4% of slices of tyre are added in lateritic soil.



Graph 4.3: graph showing the variation of load verses penetration when 6 % of slices of tyre are added in lateritic soil.



Graph 4.4: Graph showing the variation of load verses penetration when 8% of slices of tyre are added in lateritic soil.

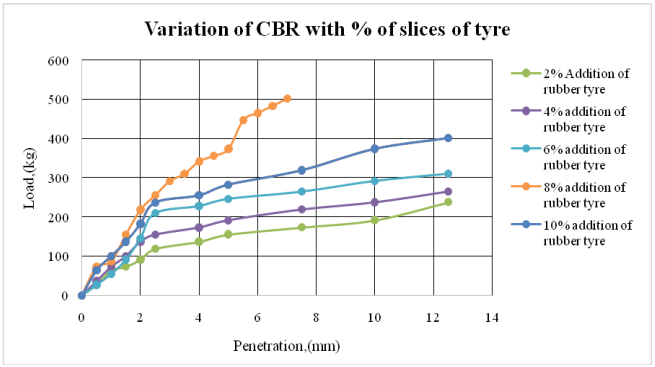


Graph 4.5: graph showing the variation of load verses penetration when 10% of slices of tyre are added in lateritic soil.

Table 3.2: Outcomes of California Bearing Ratio test for each trial are tabulated below

Addition of tyre slices in %	Penetration at 2.5mm	Penetration at 5mm
2%	8.67	7.56
4%	11.34	9.34
6%	15.35	12.01
8%	18.68	18.24
10%	17.35	13.79

In the following table it has been given the CBR values at a penetration of 2.5mm and 5mm at deferent percentage inclusion of slices of tyre



Graph 4.6: above graph showing the values of CBR with increase in percentage inclusion of slices of tyre.

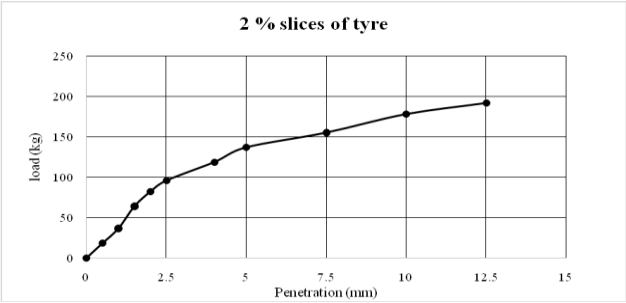
3.3 Soil Properties of Compaction Which Was Blended With Slices of Tyre with Size 25mm×15mm:

Table 3.3: outcomes of each trial are tabulated below

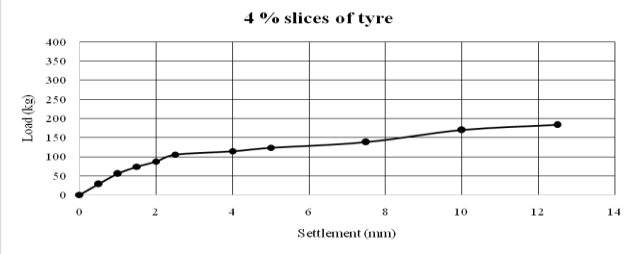
% of Tyre slices	20 x 15 mm	
	OMC (%)	MDD (g/cc)
2	15.84	1.56
4	16.71	1.57
6	17.39	1.63
8	18.14	1.69
10	18.86	1.72

It has been observed from each trial that maximum dry density getting higher with increase in percentage inclusion of slices of tyre. This is due to less size of tyre. On the other hand the optimum water content is higher as percentage inclusion of slices of tyre increases.

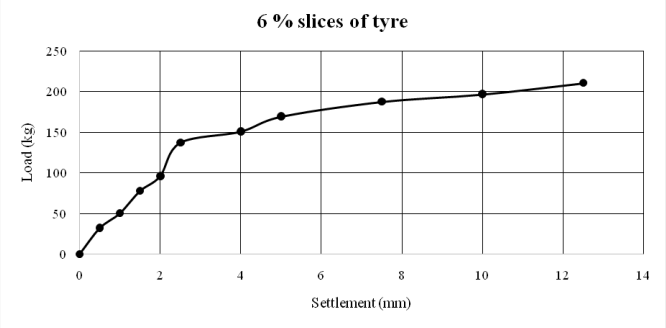
3.4 Outcomes of California Bearing Ratio test performed with specimen of lateritic soil which was blended with slices of tyre of size 20mm×15mm.



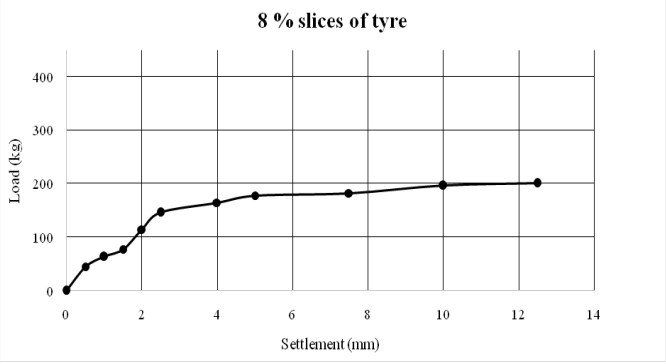
Graph 4.7: Graph showing the variation of load verses penetration when 2% of slices of tyre are added in lateritic soil.



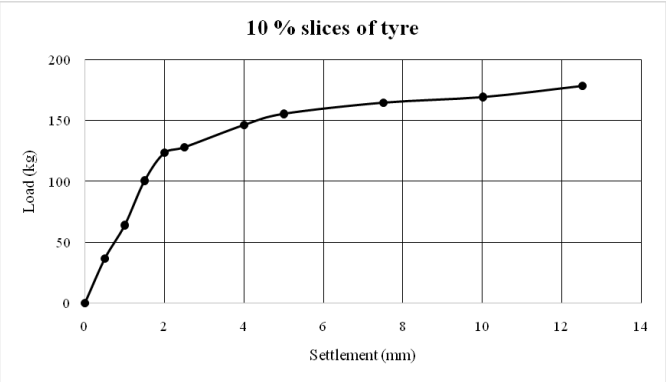
Graph 4.8: Graph showing the variation of load verses penetration when 4% of slices of tyre are added in lateritic soil



Graph 4.9: Graph showing the variation of load verses penetration when 6% of slices of tyre are added in lateritic soil.



Graph 4.10: Graph showing the variation of load verses penetration when 8% of slices of tyre are added in lateritic soil

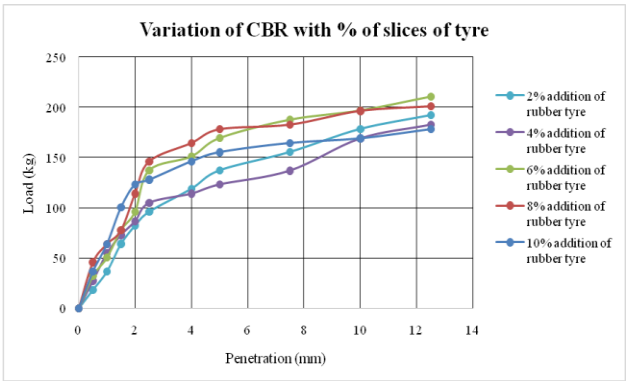


Graph 4.11: Graph showing the variation of load verses penetration when 10% of slices of tyre are added in lateritic soil.

Table 3.4: Outcomes of California Bearing Ratio test for each trial are tabulated below:

In the following table it has been given the CBR values at a penetration of 2.5mm and 5mm at deferent percentage inclusion of slices of tyre.

Addition of tyre slices in %	Penetration at 2.5mm	Penetration at 5mm
2%	7.01	6.67
4%	7.67	6.01
6%	10.01	8.23
8%	10.68	8.67
10%	9.34	7.56



Graph 4.12: Above graph showing the values of CBR with increase in percentage inclusion of slices of tyre.

It can be known from all trials that @ 8% inclusion of slices of tyre of size 20mm×15mm the CBR attains to 10.68%. Which means it got increased up to 163.14% as compared to pure lateritic soil.

4. CONCLUSIONS

The study that has been conducted with lateritic soil using tyre slices as an additive material provides huge verities of outcomes on many problems from which followings are concluded.

- From the outcomes which we had in this study can be conclude that maximum dry density gets to low with increase in percentage of up to 10% of slices of tyre of size 25mm×50mm, it helps to reduce the self weight of soil but gives more resistance to the external loads. However for size of 15mm×20mm MDD goes on increases with increase in % inclusion of tyre slices.
- It could be concluded from the above results that California bearing ratio getting hiked with increase in percentage inclusion of slices of tyre only up to 8% inclusion of slices of tyre beyond 8% the CBR value goes on decreases. So we can name CBR value which we have gotten at 8% inclusion of slices of tyre is a Ultimate California Bearing Ratio of lateritic soil mixed with tyre slices for both the sizes of additives.
- It has been observed from the above study that optimum moisture content getting to decreased with hike in slices of tyre percentage for a size of tyre slices 25mm×50mm, this is because of low water absorption capacity of tyre. However for slices of size 15mm×20mm OMC gets hiked with more % inclusion of tyre slices. This is because of reduction in the size of the slices of tyres.
- It has been proved from this study that slices of tyre can be used efficiently in edifying the engineering properties of lateritic soil as well as other soil too.
- Problems of Open land dumping of discarded vehicle tyres could be minimized by employing discarded slices of tyre in strengthening of soil-proved by this research.
- Since discarded tyres are freely available material, soil strengthening with this kind of material is cheap and economic.

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