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EFFECT OF BIOPOLYMER ON THE SHEAR STRENGTH OF GRANULAR SOIL USED IN HIGHWAYS

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ABSTRACT

Weak soil is not safe for heavy structure so it is required to stabilize the soil in various geotechnical projects. Tyre waste from automobiles is found very useful in the form of shredded tyres in geotechnical engineering for improving the soil properties. Every year, over one billion tyres are manufactured worldwide, and equal number of tyres are permanently removed from vehicles, becoming waste. Globally only 7% of waste tyres were recycled on site, 11% were burned for fuel, 5% were exported for processing elsewhere. The remaining 77% were sent to landfills, stockpiled, or illegally dumped; the equivalent of some 765 million tyres a year wasted. Tire wastes can be used as light weight material either in the form of powder, chips, shredded and as a whole. Applications of tire rubber proven to be effective in protecting the environment and conserving natural resources. This study presents the stabilization of soils using rubber at varying percentages The soil properties, compaction and unconfined compression strength were used to gauge the behavior and performance of the stabilized soils.

***Keywords*: tyre waste ,soil stablisation, tyre buffing, weak soil.**

I.INTRODUCTION

The industrial revolution made mind-blogging changes in the trade and transport sector. Developing countries like India mainly depend on the transportation sector for their economical growth. There is a continuous development and growth in the usage of motor vehicles. 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. Rubber does not decompose and as a result, an economically feasible and environmentally sound disposal method has to be found out. One of the common and feasible ways to utilize these waste products is to go for construction of roads, highways and embankments. If these materials can be suitably utilized in construction of roads, highways and embankments then the pollution problem caused by the industrial wastes can be greatly reduced. 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

II.OBJECTIVES OF THE STUDY

The aim of this study is to investigate the use of waste tire materials in geotechnical applications and to evaluate the effects of tire rubber on the strength parameters and the California Bearing Ratio (CBR). Geotechnical properties of tire-chip and its mixture at different percentage with local soil will be investigated through a series of soil mechanical tests such as grain size, compaction, relative density, UCS and CBR.

To study the engineering properties of soil,

To study the optimum moisture content and maximum dry density with different percentage and size of shredded tyre,

To determine the California Bearing Ratio (CBR) value with different percentage of shredded tires,

To conductUnconfined compressive strength test,

Analysis and interpretation of results,

2.1. MATERIALS

Collection of the soil:

Soil of the sample shall be that of locally available soil type .

Scrap tires:

Scrap tires are to be procured from the local market (workshop) will be used for the purposed work.

The present investigation was carried out on soil collected from kurukshetra (dayalpur village) at a depth of 1.0 m below the ground surface. This is poorly-graded silty clay in which 75% of the particles are in the range of 0.2 and 0.1 mm, i.e. fine size particles.

The shredded tyre material used is of size 10 x 20 mm considering aspect ratio (AR = Length of shred/Width) of 2. The shreds had a thickness ranging from 2 to 3 mm and don’t contain any steel wire or nylon fibres. Specific gravity of tyre shreds obtained with a Pycnometer test ranges from 0.90 to 1.12. The view of shredded tyre chips used in the study.

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III.RESULTS

COMPACTION CHARCTAERSITICS

Standard Proctor test is conducted on soil and soil-tyre chips 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 1%, 2%, 3%, 5%, 6%, and 9% by weight of soil and standard proctor test were conducted on soil-tyre chipsmixtures. The compaction curve obtained from the tests for different percentage of tyre chips-soil mixtures is shown inFig 3. The OMC and MDD values obtained from the compaction curves are summarized in Table 1.

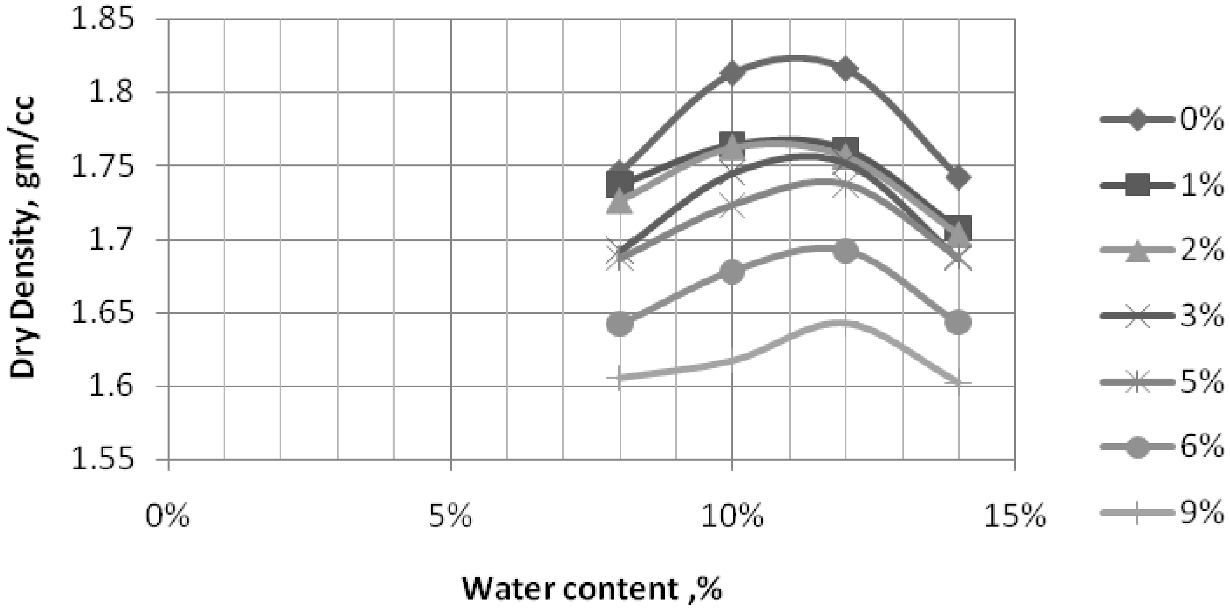
Table 1 OMC and MDD of soil and -tyre chips mixtures

% Tyre mix	OMC (%)	MDD (g/cc)
0%	11.1	1.821
1%	11.0	1.767
2%	11.0	1.763
3%	11.4	1.745
5%	11.8	1.736
6%	12.0	1.691
9%	12.1	1.652

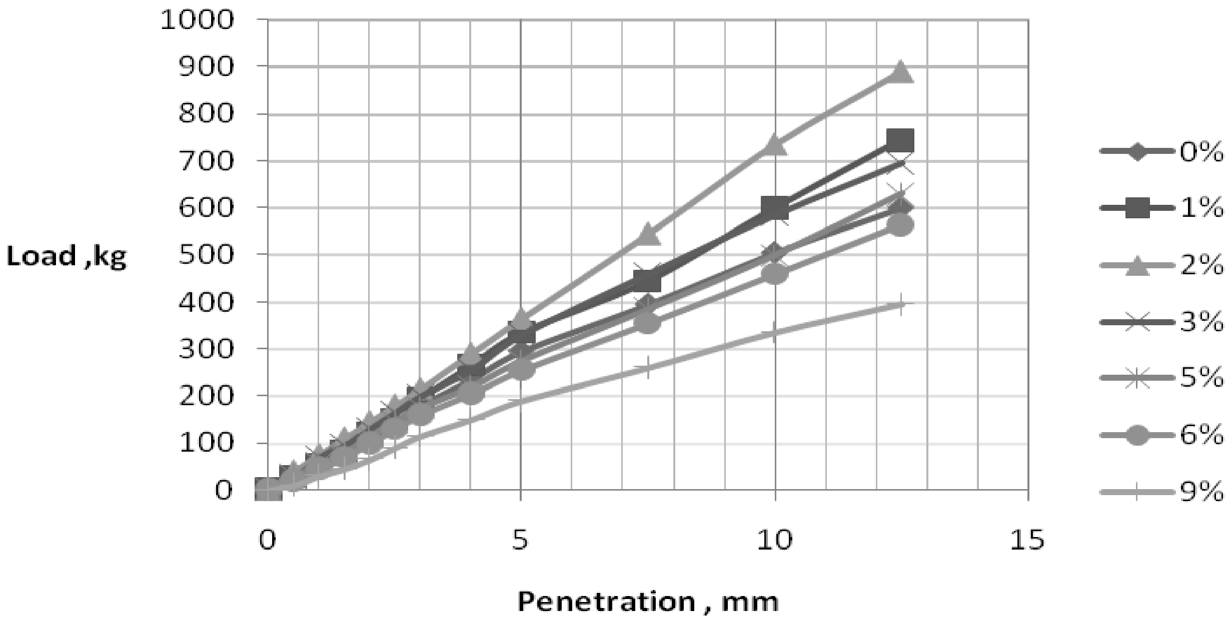
It is seen from Table 1 that the MDD of soil-tyre mixtures decreases significantly with an increase of percentage of tyre chips. This is due to the light weight nature of tyre chips (low specific gravity). On the other hand, the value of
OMC remains same up to 2% of tyre chips and thereafter it increases within increase of % of tyre chips. This is due to the fact that the tyre chips have more water absorption capacity, i.e. about 2%.

3.1. CBR VALUE OF SOIL-TYRE CHIPS

CBR tests were conducted on soil and soil-tyre chips 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 1%, 2%, 3%, 5%, 6%, and 9% by weight of soil and standard proctor test were conducted on soil-tyre chips mixtures. The load-penetration curve obtained from the CBR tests for different percentage of tyre chips-soil mixtures is shown in figure for unsoaked and soaked conditions respectively.



Compaction curves for soil-tyre chips mixtures.



Load-penetration curve from unsoaked CBR tets.

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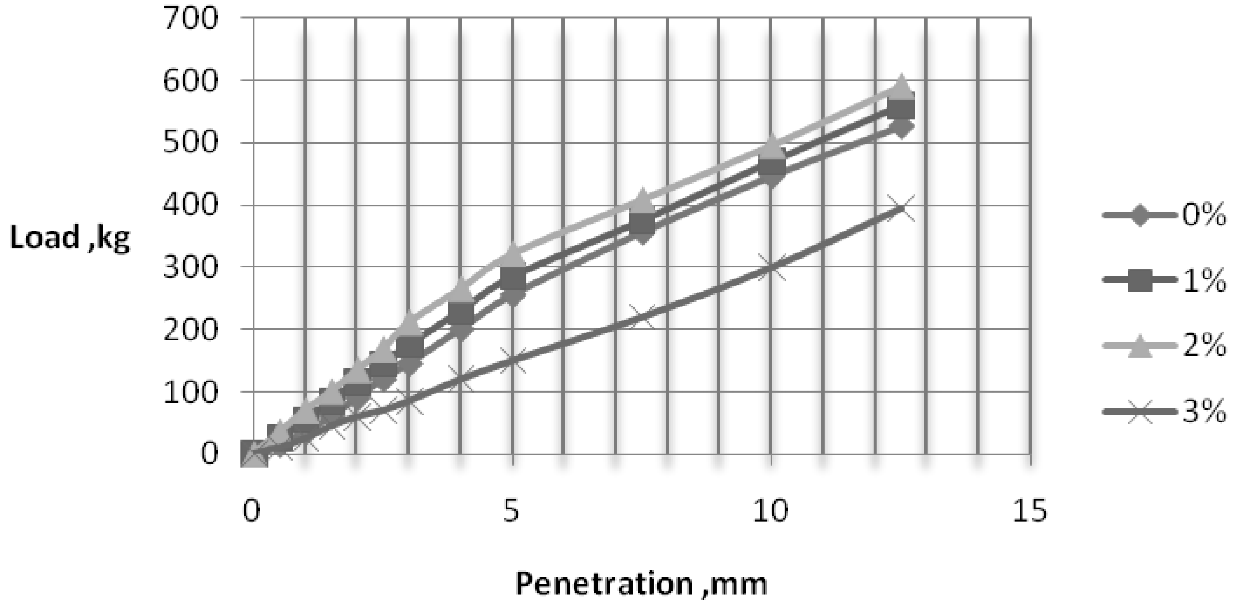

Load-penetration curve from soaked CBR tets.

IV. CONCLUSION

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

Dry density reduces with increase of % tyre waste, however, there is no significant change in OMC. This could be due to light weight nature of tyre waste. Tyre waste material mixed with soil showed improvement in CBR value with its addition up to 2% and there onwards decreased with further increase in tyre content in unsoaked/soaked condition. Hence the optimum value of waste tyre content is 2% in unsoaked and soaked conditions. Max. CBR values are 13.21 % and 12.31 % for unsoaked and soaked condition. As per AASHTO standards the CBR values for sub grade soils lies in the range of 10% to 25 %. The percentage improvement in CBR value of stabilized soil is 21% in unsoaked condition and 22% in soaked condition. An increase in CBR value can significantly reduce the total thickness of the pavement and hence the total cost involved in the project.

However, the long term durability and sustainability of subgrade stabilized with tyre chips in different ground water conditions are to be investigated, before using them in practice.

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