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RESEARCH ARTICLE

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EXPERIMENTAL STUDY OF WASTE TYRE RUBBER IN SOIL STABILIZATION

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ABSTRACT
In order to manage activities which affects our environment to the great extent, so that they boost our development and do not hinder our environment, utilization of Waste Tyre Rubber (WTR) can be done. The aim of this study is oriented to use of WTR for stabilizing soil. In this report, the use of WTR for stabilizing soil is reviewed. The waste tyre rubber which is used for this study is shredded waste rubber. As the main object of soil stabilizing is to improve the geotechnical properties of a soil and increase the strength of soil. In this study, various experiments have been done on untreated soil and soil was treated with various percentage of Waste Tyre Rubber. The tests, which have been done on these samples, have shown that use of waste tyre rubber in soil stabilization is effective.

Keywords: Waste tyre rubber (WTR), Soil stabilization, CBR, Direct shear test

1. INTRODUCTION

As we all know conditions do not always match perfectly when we start any type of construction. Sometimes soil is good, sometimes it is bad and sometimes it is even worse. So if we want to do any type of construction on soil with unfavourable geotechnical properties, the alternative which is left to a geotechnical engineer is to treat the soil for improving its properties. And that alternative is termed as Soil Stabilization. Soil stabilization is the alteration of soils to enhance their physical properties. Stabilization of soil can increase the shear strength of a soil. It controls the shrink-swell properties of a soil and thus improves the load bearing capacity of a sub-grade to support the foundations and pavements.

R.P. Kulkarni et al (1973) [5] stated that soil stabilization was followed by Indians from the pre-historic and vedic period (upto 600 B.C.) to the period of SilpaSastra (1500 A.D.). In this article he has described soil stabilization of Vedic time. It has been found by Bernal *et al.* (1996) [6] that the use of tire shreds and rubber-sand (with a tire shred to mix ratio of about 40%) in highway construction offers technical, economic, and environmental benefits. The salient benefits of using tire shreds and rubber - sand include reduced weight of fill, adequate stability, low settlements, good drainage (avoiding the development of pore water pressure dung loading), separation of underlying weak or problematic soils from subbase or base materials, conservation of energy and natural resources, and usage of large quantities of local waste tires, which would have a positive impact on the environment. Brooks (2009) [7] investigated the soil stabilization with flyash and rice husk ash. This study reports; stress strain behaviour of unconfined compressive strength showed that failure stress and strains

increased by 106% and 50% respectively, when the flyash content was increased from 0 to 25%.

2. MATERIALS AND METHODS

For this study, waste tyre rubber (WTR) which is obtained by grinding scrap pneumatic motor vehicle and truck tyres, was taken from Meerut Transport Nagar. In waste tyre rubber, the average size of strips is 0.5 to 1.3 cm. The experimental study was carried out to evaluate the mechanical properties of the untreated soil and soil stabilized with waste tyre rubber. In this study, the waste tyre rubber was added in the proportion of 5%, 10% and 15% of weight of soil. The soil was stabilized with waste tyre rubber contents by weight of soil. The test performed includes Atterberg's limit test, Proctor Compaction test, Direct Shear test and California Bearing Ratio Test.

3. Results and Conclusions -

This study made examination of the effectiveness of waste tyre rubber on geotechnical properties of soils taken from Lajapat Nagar Metro Station Phase 3 Site, New Delhi. The results of the study provides details on the compaction and strength characteristics of in situ soils as well as those mixed with different percentages of waste tyre rubber. A series of soil mechanics laboratory tests including Atterberg limits, Standard proctor test, Direct Shear strength test, and California bearing ratio test (CBR), on in situ soils as well as waste tyre rubber treated soils were performed. The investigation demonstrates that waste tyre rubber can be made use of in soil to some extent, solving the environmental problem of waste tyre disposal.

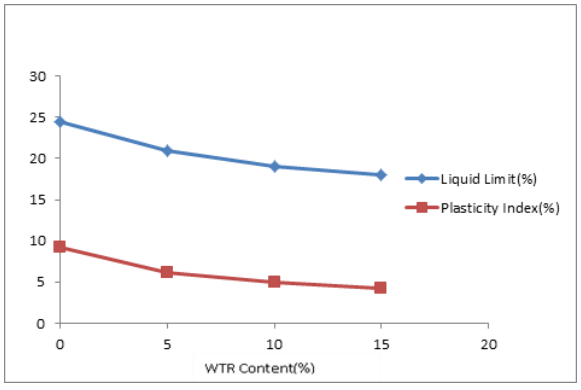

Figure 1 Effect of WTR on LL and PI of soil

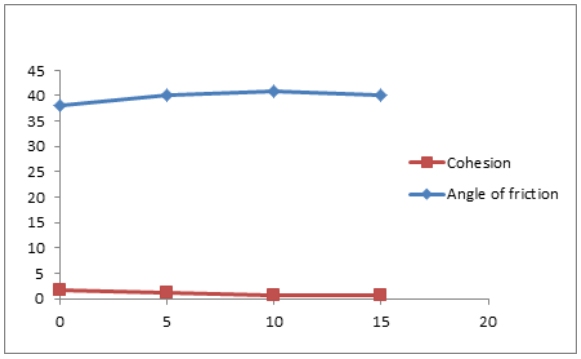

Figure 2 Effect of various weight percentage of waste tyre rubber on value of cohesion c and angle of internal friction Φ

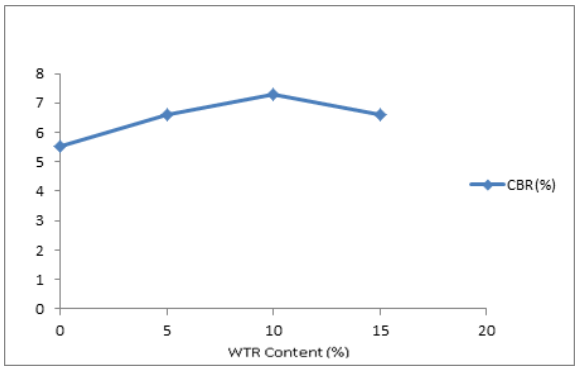

Figure 3 Effect of WTR on CBR of soil

The following conclusion can be made from the results of the investigation:

3.1 Test results indicate that, with the increase in waste tyre rubber content liquid limit, plastic limit and plasticity index decreases as compared to untreated sample. It can be concluded from above that waste tyre rubber can effectively stabilize soil. As the soil used in this study was having low plasticity it also concludes from the study that WTR can effectively stabilize soil of high plasticity and if WTR content will be between 5% to 10% it will be effective for soil stabilization.

3.2. Maximum dry density and optimum moisture content both decreases with increasing waste rubber content, as compared to untreated soil sample.

3.3. Data obtained from direct shear test indicates that there was a slight change in angle of friction and value of cohesion for soil mixed with waste tyre rubber. It indicates that WTR can effectively stabilize soil of different value of c and Φ.

3.4. California bearing ratio (CBR) of stabilized samples increases with increasing rubber content. But at 10% and 15% of WTR content there was a

minor increase in the CBR value. From the data obtained from this test it can be concluded that if waste tyre rubber is added in between 5% -10% in soil it will effectively stabilize soil.

In this experimental study it was observed that if the percentage of waste tyre rubber was increasing in soil treated with it, the liquid limit and plasticity index both were decreasing. The reason for this is non-cohesive property of waste tyre rubber. Basically, the liquid limit is indicative of the compressibility of the soil.

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