International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 01, January 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

SOIL STABLISATION BY USING TYRE BUFFING

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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

Key Word: 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. LITERATURE REVIEW

The review of literature shows that the rubber tire is a versatile material with attractive characteristics and advantages and as a result this material is now being used abundantly all over the world. The number of scrap tires worldwide is increasing every year due to the increase in the population of vehicles both in developed and developing countries. The number of scrap tires may further increase due to rapid economic growth in some developing countries such as India where the demand for vehicles has been increasing significantly. A large number of used tires are disposed of every year. A more productive, environmentally desirable use of these tires would be the construction of embankments and backfills with tire shreds or mixtures of tire shreds and sand (rubber sand).Such fills are lighter than traditional soil fills. Additionally, the present study shows that the strength of these materials is usually adequate for such applications. Reuse of large amounts of scrap tires is beneficial, and several researchers have devoted their attention to the use of scrap tires for civil and environmental engineering application. One of these applications is the use of shredded scrap tires as drainage material in landfill cover systems. Landfill cover design generally consists of three layers: the barrier layer, the drainage layer, and the cover soil layer. The purpose of the drainage layer is to allow any infiltrated water to drain from the overlying cover soil layer so that it is prevented from seeping into the underlying barrier layer and the waste. Tire shreds are very free draining. Even when they are compressed under the weight of overlying fill, they still have permeability greater than 1 cm/sec. With this high permeability, tire chips can be used as drainage layers in landfills and roads. A useful property of tire shreds is that they have a high insulating value. When combined with their good drainage properties, this means that tire shreds can be used to limit frost penetration beneath roads and to remove excess water during the spring thaw. Due to the special properties of tire shreds together with their wide-spread availability, they have been used as lightweight fill for numerous highway embankments and landslide stabilization projects, backfill behind bridge abutments, insulation and drainage layers beneath roads, and drainage layers in landfill liners.

Scrap tires and scrap tire products such as tire bales, tire shreds, tire chips, and granulated rubber have been used in a variety of engineering applications including highway subgrades, embankments, backfills, asphalt mixture designs, leach fields or as erosion control and sorptive
media (Ahmed and Lovell 1993; Upton and Machan 1993; Newcomb and Drescher 1994; Kershaw and Pamukcu 1997; Edil 2005; Zornberg et al. 2005; Ashmanwy et al. 2006). Some of the desirable properties of STR in backfill and embankment applications are due to the light weight of rubber (Edil and Bosscher 1994). The dampening characteristics of STR also have been used to advantage in railroad track beds to minimize disturbance to nearby residents (Feng and Sutter 2000). Although many STR products are currently available for beneficial use.

The literature available on field construction of mixtures of soil with tire shreds or tire chips appears to be limited to embankment fills in highway construction (Siddiki et. al. 2004, Zornberg et. al. 2004, Yoon et. al. 2005). Siddiki et. al. (2004) constructed a 3-m high highway embankment using a 50:50 sand-tire shred mixture. Special consideration was taken to minimize infiltration of water through the sand-tire shred mixture to eliminate the potential for groundwater contamination. Construction using a 50:50 sand to tire shred ratio was chosen to eliminate the potential for exothermic reaction in the tire shreds . Zornberg et. al. (2004) evaluated three embankment sections in Colorado. Their first embankment section was constructed using native soil (silty sand with SM classification and standard Proctor maximum dry unit weight and optimum water content of 18.6

kN/m3 and 12.6%, respectively), the second consisted of successive layers of soil and tire shreds, and the third section was constructed using 10% (by weight) of tire shreds mixed with the native soil. Construction of the embankment sections evaluated six methods for mixing soil and rubber, and a 6.7-ton (6078-kg) sheepsfoot roller was used to compact the embankment lifts. The 15-cm lifts used were shown to have minimal increases in dry unit weight after two passes of the sheepsfoot roller for all three embankment lift types.

Bressette (1984), Ahmed (1993), Benda (1995), Masad etal. (1996), Wu at al. (1997) and Lee et al. (1999) conducted independent triaxial tests on tire chips. The sizes of the materials they tested were from 2mm to 38mm. All the tests were conducted at a compression loading mode except Wu et al. (1997), which conducted compression unloading tests. A linear stress-strain response was observed from all compression loading tests. Due to the variation of confining pressure and the difference of testing mode (compression loading or unloading), the results from these studies varied significantly. The friction angle ranges from 6° to 57°, and the cohesion intercept varies from 0 to 82 kPa.

Ahmed (1993) conducted triaxial tests on tire shred-soil mixtures (tire shred size = 25 mm) with various mixing ratios. A tire shred-soil mixture ratio of approximately 40:60 by dry weight (65:35 by volume) was reported to produce maximum shear strength values at low to medium confining stresses. Although the mixing ratio that produces the maximum shear strength varies depending on the size of the tire shreds, the mixture ratio mentioned above can be used as a reference in the selection of the tire shred-soil mixture ratio to be used in the construction of embankments

various studies that were conducted on field test embankments with tire shred as fill material have shown that tire shreds have only a negligible impact on the environment and on the groundwater quality (Minnesota Pollution Control Agency 1990; Bosscher et al. 1992; Humphrey et al. 2000). However, in severe conditions, leaching of metals can occur due to exposure of the metal reinforcements present in the tire shreds (O'Shaughnessy and Garga 2000). Under such conditions, zinc is often used as an indicator to ascertain if leaching has occurred (Collins et al. 1995; Vashisth et al. 1998).

III. 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,

IV. 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.

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