Bearing Capacity of a Footing Soil Reinforcement with Rubber Tyre Waste

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***Abstract*- Discarded tyres are becoming globally problematic because recycling them may cause environment related problems. Thus, making use of them needs to be considered, and solutions must be sustainable. In addition, the solution should cover social, environmental, and economic sustainability. Nowadays, the waste tyres are increasingly being considered as construction material. This is because their basic properties are desirable for engineers. In this study, an experimental testing program was undertaken using a large-scale triaxial apparatus with the goal of evaluating the optimum dosage and aspect ratio of tire shreds within granular fills. The effects on shear strength of varying confining pressure and sand matrix relative density were also evaluated. The tire shred content and tire shred aspect ratio were found to influence the stress–strain and volumetric strain behaviour of the mixture.**

***Keywords*- sandy soil, waste rubber, shear test**

I. INTRODUCTION

Solid waste management is one of the major environmental concerns worldwide. For the last 30 years many studies have been conducted in order to assess the feasibility of using industrial by-products and waste materials in civil engineering applications. It is estimated that thousands of millions tyre waste are generated annually and it is either deposited in ground in uncontrolled manner or been burnt in atmosphere which causes air soil pollution. The recycling and re-use of scrap tires has been of growing interest in civil engineering applications during the last two decades. Granulated rubber or tire chips composed of recycled scrap tires exhibit low unit weight of solids, along with low bulk density, high drainage capacity, and high elastic deformability. In this study, an experimental testing program was undertaken using a large-scale triaxial apparatus with the goal of evaluating the optimum dosage and aspect ratio of tire shreds within granular fills. The effects on shear strength of varying confining pressure and sand matrix relative density were also evaluated. The tire shred content and tire shred aspect ratio were found to influence the stress–strain and volumetric strain behaviour of the mixture.

Many researchers have done studies on the application of sand and rubber mixture. (Sompote Youwai and Dennes T. Bergado (2013) [3]; E.A.Subaida, S. Chandrakaran and N. Sankar (2009) [12]; E. Kalkan (2013) [7]; M.S.Chauhan, S.Mittal, and B. Mohanty (2008)) [16].though different studies and test were performed but these paper include soil rubber tyre mixture but not illustrated the use cemented rubber mixture in order to enhance the load bearing capacity of soil. Shear strength properties of tyre buffing / fibre cement sand is required to study not-being found in the literature. In recent years, the application of different fibers to improve strength and other properties of various soils has been investigated. The results of these studies have generally indicated an increase in CBR values [4-8], tensile strength [9-11] and unconfined compressive strength [12-14] of different types of soils when reinforced by various fibers.

Naval et al. [17] studied the impact of using tire fibers in sandy soils. In their study, different percentages of fibers, i.e. 0%, 0.5%, 0.75%, and 1% with various lengths of 25mm, 35mm, and 45mm were examined. The results of their research indicated that adding fibers would increase the strength and the internal friction angle of the soil and it would also decrease its deformation. These changes were more significant at 0.75% fiber content.

Das and Singh [18] investigated the behaviour of cohesive soils mixed with fly ashes and tire fibers. Tire fibers were used in the percentages of 0%, 5%, and 10% of the soil weight and lengths longer than 25mm. The fly ashes were used in the percentages of 0%, 20%, 35% and 50% of the soil weight. The results of their study indicated that adding fibers would increase the adhesion and would decrease the internal friction angle of clayey silt-fly ash-rubber fiber mixes.

Kalkan [17] investigated the application of tire fibers- silica fume mixtures for modification of clayey soils. The fibers were applied in lengths of 5mm to 10mm and in percentages of 1%, 2%, 3%, and 4% of the mixture weight. The results of his research indicated that when only fibers were added to the clayey soil, the maximum dry density and optimum moisture content were reduced. It was also found that at 2% fiber content, the unconfined compressive strength of the examined soil increased from 92.8KPa to 177.1KPa, the adhesion increased from 76kPa to 214kPa and the internal friction angle increased from 16 to 32 degrees.

Panu Promputthangkoon [20] The soil was a laterite having low strength classified as SC according to Unified Soil Classification system. It had a specific gravity of 2.64. The mean particle size of the soil was 1.6 mm; the coefficient of uniformity Cu = 5.4, and the coefficient of curvature Cg = 0.5.

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Panu Promputthangkoon [20] a low strength soil was chosen as a base geometrical to be mixed with recycled tyre chips and stabilised by cement for the purpose of using them as construction material. The soil to tyre chips ratios by weight were 100:0, 98:2, 93:7, 85:15, and 75:25. Each mixture was mixed with the cement ranging from 0, 1, 5, 10, and 15%. The specific gravity values for the soil and tyre chips are 2.64 and 1.11, respectively. The CBR values for both soaked and unsoaked are gradually increased with the increase of cement content.

Panu Promputthangkoon [20] the CBR required for a road base is 80. It was observed that the CBR for pure soil (100S) is just 19; but, it was substantially increased to over 600 when 15 % of cement added. However, for the unsoaked specimen it required only 2.9 % of cement to attain the CBR of 80. Hence, it was interesting to compare this analogy to all of the other mixtures

ekrem kalkan [19] has use the clayey soil silica flume , scrap tire rubber fibre , and complete has experiment . the tyre is shaved off into 150mm length and smaller strips using a sharp ratating disc . they had length ranging from 5 to 10mm , thickness ranging from 0.25 to 0.50mm and width ranging from 0.25 to 1.25mm. the grain size distribution was determined by using fiber width . this mixturebis increase the UCS and its value is obtain by addition of 20 % silica and 2 % fiber mixture

sompote youwai and dennes T. bergado [21] has use shredded rubber tyera , they perfome the triaxial testing and consitutive model test . the result is increasing the proportion of sand in mix , the strength and unit weight increase and deformation due to isotropic compression decreased the deformation was significantly reduced when the sand in the mixture was more than 30 % the proposed hypolasticity model can model the strength and deformation characteristics of shrded rubber tire - sand mixture.

II. DESIGN METHODOLOGY

For the preparation of sub base of foundation cemented rubber soil mixture is prepared. The waste rubber buffings were used in mixture. Sandy soil is used which passes through sieve size of 3.5 mm.

The grade of cement used for mixture was M53 grade. The sub base of foundation was prepared for different composition of rubber and cement and for different width of sub base.

The strength for each width and composition of mixture were found and result were obtained.

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