ISSN: 2348 - 2117

International Journal of Engineering Technology and Computer Research (IJETCR)
Available Online at www.ijetcr.org
Index Copernicus Value 2016: 69.88
Volume 6; Issue 3; May-June 2018; Page No. 01-03

Conduct of Soil with Fly Ash and Tyre Rubber

Mr.Chandra Prakash Sancheti[1], Mr.Shashivendra Dulawat[2]

[1] Master of Technology, Dept. of Civil Engineering, Mewar University

[2] Assistant Professor, Dept. of Civil Engineering, Mewar University

Abstract

India has a total installed capacity of 100,000 MW of electricity generation. To meet the capacity addition target of 78000 MW during 2007-2012, massive resources would be required. Because of this 90% of the Indian thermal power stations are coal based. In 2005, the production of fly ash in India was about 100 million tons per annum and this is likely to touch 155 million tons per annum by 2020 (Singh, 2005). Fly ash is a by-product of the combustion of pulverized coal in thermal power plants. Tyre rubber is a by-product of waste auto tyres. They can be mixed with local soils. The objective of this study is to investigate experimentally the influence of randomly oriented tyre rubber inclusions on the strength behaviour of clayey soil–fly ash mixture.

Keywords: Soil sampling, Fly ash, Tyre buffing, Strength

I. Introduction

The volume of used rubber auto tyres in the world is increasing every year and therefore, their disposal becomes a major environmental problem worldwide. Every year, millions of scrap tyres are either discarded in huge piles across the landscape or dumped in landfills in large volume. Scrap tyres represent one of several special wastes that are difficult for municipalities to handle. Whole tyres are difficult to landfill because they tend to float to the surface. Stockpiles of scrap tyres are located in many communities, resulting in public health, environmental, and aesthetic problems. The need to manage scrap tyres has given rise to numerous scrap tyre management programs and brought about laws or regulations. Scrap tyres have been beneficially utilized in many industrial applications. Scrap tyre is beneficially used as raw material for civil engineering construction.

Fly ash is a fine grained material with most of the particles being of silt size. Fly ash is classified into two classes, F and C, based on the chemical composition of fly ash according to ASTM C 618. Class F fly ash is produced from burning anthracite and bituminous coals contains low amount of free lime (CaO). This fly ash has siliceous and aluminous material which gives pozzolanic property. This material itself possesses little or no cementitious value, but in the presence of moisture, chemically reacts with the lime at ordinary temperature to form cementitious compounds. Class C fly ash is produced from lignite and sub-bituminous coals and normally it contains more than 20% lime (CaO), (Kaniraj and Gayathri, 2004).

The major four countries namely, China, India, Poland, and United states produce more than 270 million tons of fly ash every year. The fly ash is disposed of either in the dry form or mixed with water and discharged as slurry into location called ash ponds (wet method). The most common method adopted in India for disposal of fly ashes is the wet method.

Applications that use large quantities of fly ash and do not threaten the environment are needed to reduce the major impacts of fly ash disposal. It is necessary to utilize fly ash in some beneficial purposes in an environmentally safe manner. Fly ash also can be utilized for various civil engineering applications such as road embankments, landfills, sub-base material, back fill materials and stabilization of soils etc., which hold great promise for consuming large quantities of fly ash in environmentally acceptable manner, at significant economic benefits. Lightweight fill have also been considered as cost effective alternatives in certain applications in the field of transportation engineering.

In this study, fly ash and waste tyre rubber fibers were used to modify the clayey soil at four different percentages of fly ash content (0%, 20%, 35%, 50%) and at three different percentages of fiber content (0%, 5%, 10%). The main objective of this study is to evaluate the effects of waste tyre rubber fibers on the strength parameters of a cohesive soil.

II. METHODOLOGY

Laboratory Methods

The standard method (oven-drying method) was used to determine the water contents of samples. Small representative specimens obtained from large bulk samples were weighed and then oven-dried at 105±5°C for 24 hours. The samples were then reweighed to obtain the weight of water. The difference in weight was divided by the weight of the dry soil, giving the water content on a dry weight basis.

Combined analyses of sieve analysis and hydrometer method tests were conducted on the soil and fly ash whereas sieve analysis was conducted on tyre rubber.

Soil and fly ash were classified using the particle size distribution and the Atterberg limits.

The specific gravity value of the soil (or fly ash) solids was determined by placing a known weight of oven-dried soil in a density bottle and then filled up with water.

The weight of to prepare the soil-fly ash–tyre rubber mix, first the required amounts of soil, fly ash and tyre rubber were measured to start the procedure. The soil–fly ash, soil–tyre rubber and soil-fly ash–tyre rubber mixes were first mixed together in the dry state and the dry mixes were mixed with the required amount of water based on OMC. All mixing was done by mixing manually and proper care was taken to prepare homogeneous mixture at each stage of mixing. A trace additional quantity of fly ash and water were taken to offset the losses during the preparation of specimens.

Table 1 Composition of various mixes for the study

Soil–tyre rubber mixes	Soil–fly ash mixes	Soil–fly ash–tyre buffing mixes
RS+5TR	RS+20FA	RS+20FA+5TR
		RS+20FA+10TR
	RS+35FA	RS+35FA+5TR
RS+10TR		RS+35FA+10TR
	RS+50FA	RS+50FA+5TR
		RS+50FA+10TR

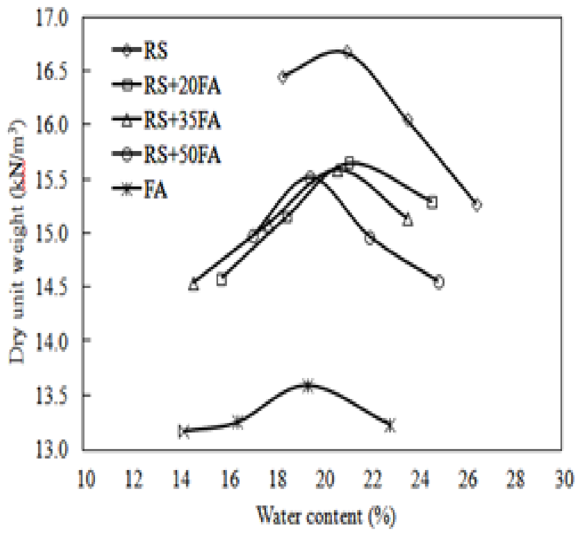

Figure 1: Compaction curves of RS+FA mixes

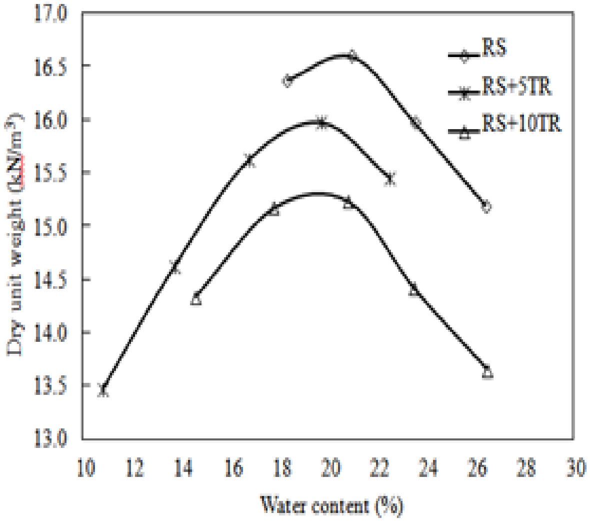

Figure 2: Compaction curves of RS+TR mixes

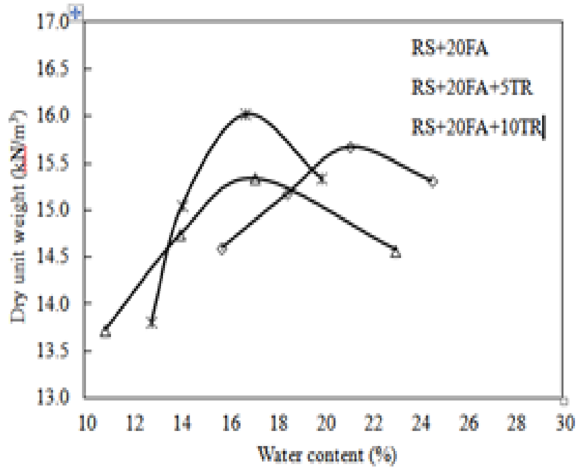

Figure 3: Compaction curves of RS+20FA+TR mixes

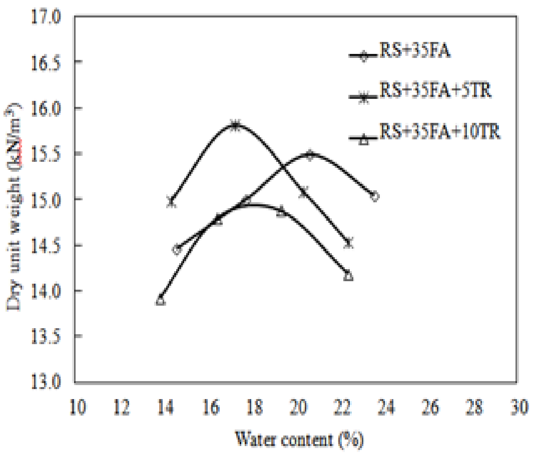

Figure 4: Compaction curves of RS+35FA+TR mixes

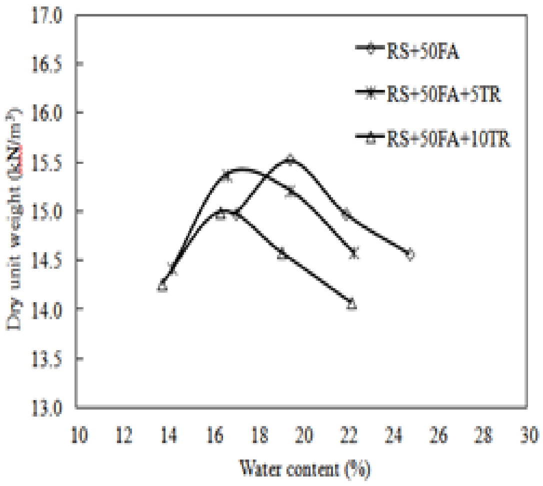

Figure 5: Compaction curves of RS+50FA+TR mixes

III. CONCLUSION

The addition of fly ash to clayey soil changes the gradation of clayey soil and makes it less plastic. Mixing of fly ash to clayey soil enhances the intergranular frictional resistances of clayey soil.

Due to low specific gravity of fly ash and waste tyre the resultant specific gravity of the fly ash and waste tyre added clayey soil mixture shows good promise and a material for construction of lightweight fill.

The compaction test results indicate that the dry density of the clayey soil–fly ash and clayey soil–fly ash–waste tyre mixtures are less than the dry density of typical soils including the reddish fine grained soil used in this study.

Class F fly ash with low calcium (CaO) content lacks in cementitious property and does not contribute to pozzolanic reactions. When soil–fly ash mix is cured, no hardening takes place during curing and does not result in strength gain.

Compared to the soil, soil–fly ash mixes possess higher strength. This is because of the improvement in the gradation/texture and frictional resistance. When fly ash is added to the soil, there is increase in stiffness and peak strength whereas ductility is reduced. Results indicate that a mass of 35% fly ash content is the best possible for blending with the soil.

REFERENCES

1. Cokca, E. (1997). “Frost susceptibility properties of Soma-B fly ash.” *Journal of Energy Engineering,* Vol. 123, No. 1, 1-10.
2. Kaniraj, S. R., and Gayathri, V. (2004). “Permeability and consolidation characteristics of compacted fly ash.” *Journal of Energy Engineering, ASCE,* Vol. 130, No. 1, 18-43.
3. Guleria, S. P., and Dutta, R. K. (2011). “Unconfined compressive strength of fly ash–lime–gypsum composite mixed with treated tire chips.” *Journal of Materials in Civil Engineering*, ASCE, Vol. 23, No. 8, 1255-1263
4. ASTM C 618-08a. “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.” *ASTM International,* West Conshohocken, Pennsylvania, USA.
5. ASTM D 6270-08e1. “Standard Practice for Use of Scrap Tyres in Civil Engineering Applications.” *ASTM International,* West Conshohocken, Pennsylvania, USA.
6. Tan, O., and Iyisan, R. (2001). “Strength and deformation characteristics of fly ash added clay.” *Proc. of the Fifteenth International Conference on Soil Mechanics and Geotechnical Engineering,* Istanbul, Turkey, Vol. 1-3, 1859-1862.
7. Das, S. K., and Yudhbir (2005). “Geotechnical characterization of some Indian fly ashes.” *Journal of Materials in Civil Engineering, ASCE,* Vol. 17, No. 5, 544-552.