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Stabilization of Black Cotton Soil Using Waste Pet Bottles

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Abstract

Soil is a most essential component of the earth's ecosystem. But now a day's the soil is getting polluted due to disposal of waste plastic materials by human beings. For engineering consideration's, black cotton soil is one of the challenging material for construction purpose, which will not easily get stabilized due to its high potential of shrinking and swelling as an effect of change in moisture content. It will minimize the stability and shear strength of black cotton soil when compared to other types of soil. This paper explains stabilization of black cotton soil through application of PET (Polyethylene Terephthalate) bottles which is efficiently used to come across the challenges of society, to reduce the quantities of plastic wastes, to improve the physical properties of soil, such as shear strength, bearing capacity through controlled compaction. PET (Polyethylene Terephthalate) bottles are used in different proportion (3%, 5%, and 7%) in size is less than 0.5 mm. Then index Properties test, Standard Proctor, Unconfined Compressive, Moisture Content and California Bearing Ratio are conducted to find the properties of soil which will increases the bearing capacity of soil.

Keywords-soil stabilization, black cotton soil, plastic wastes, PET bottles.

INTRODUCTION

In nature, soil will deposit and occur in an erratic manner, thus turn out an infinite variety of possible combination which will affect the strength of the soil. For years' research personnel have tried to improve the mechanical properties of soil to suit the requirements of engineering structures. Since new techniques are either available or constantly emerging. Now a day's sites which have been deemed unsuitable, are being put to use for the construction of new challenging structures. The buildings which are constructed in cohesive soils may tend to easy settlement of the structure. In order to withstand the load of the structure, it is essential to improve the shear strength, bearing capacity and behavior of the soil. Soil stabilization means the improvement of stability or bearing power of the soil by the use of proportioning and the addition of suitable admixture or stabilizer's and controlled compaction. Over the last few years there has been a considerable rise in the use of plastic products which caused a proportionate increase in the plastic waste. But only a lesser quantity of such materials are recycled and reused and rest of them are stored or thrown to the disposal. The disposed or stored plastic waste pollutes the soil mass and causes health problems. These plastic materials are used in lesser quantity for engineering purpose. Several studies have shown that the addition of plastic waste in soil will cause a development in the strength characteristics of soil.

PHYSICAL & ENGINEERING PROPERTIES OF MATERIAL

Clay soil - Clay soil will have poor aeration compared to sandy soil. But it holds water much better than sand, however is susceptible to water logging which results in settlement to structures.

PET bottles - PET bottles are semi rigid to rigid, and it is lightweight. It was a fair moisture and good gas barrier and barrier to alcohol and solvents. It is impact-resistant and strong. PET becomes white when exposed to chloroform and other chemicals such as toluene.

Water - This is the important ingredients of soil. The water, makes the soil strength and it should be clean and free from harmful impurities such as alkali, oil, acid etc. In general, the water, which is fit for drinking, should be used.

Sample collection -The samples are taken from the location as per procedure. In each location three points are fixed at an interval of 5m. Then at finally the samples are mixed well and used for the experiments.

Table 1: shows sample details and location of sample

S.No	Sample	Location
1	Black Cotton Soil	Thondamuthur (Coimbatore)

Laboratory model test

The laboratory test is to improve bearing capacity of soil by using Waste PET bottles. Initially the preliminary tests are carried out only with clay soil in order to determine the Properties of soil. The Experimental laboratory test results includes Atterbergs limit, Oven dry method, sieve analysis, Hydrometer analysis, Standard Proctor tests, Unconfined compressive test and California Bearing Ratio test.

1. Determination of strength properties of soil

Experimental test is carried out by standard proctor compaction test to determine the optimum moisture content of the clay soil, Unconfined Compressive test to determine the strength of the clay soil and California Bearing Ratio test to