

Soil Stabilization by Using Plastic Waste

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Abstract: *Soil stabilization is a process which improves the physical properties of the soil, such as increasing in shear strength, bearing capacity etc. Which can be done by the use of controlled compaction or addition of suitable mixtures like cement, lime, and waste materials like fly ash, coconut shell etc. The cost of introducing these additives has also increased in recent years which opened the door widely for the other kinds of soil additives such as plastic, bamboo etc. This new technique of soil stabilization can be effectively used to meet the challenges of the society to reduce the quantities of waste, producing useful stabilization from plastic waste. Use of plastic products such as polythene bags, bottles etc is increasing day by day leading to various environmental concerns. Therefore, the disposal of plastic wastes without causing any ecological hazards has become a real challenge. Thus, using plastic as soil stabilizer is an ecological utilization since there is scarcity of good soil for construction. This project involves the study on the possible use of waste plastic.*

Keywords: *Black Cotton Soil, Plastic Strip,*

1. INTRODUCTION

The soil is weak and does not have enough stability to bear heavy loads. The aim of the study is to make use of waste material for stabilization of soil. For this project we have selected the use of waste plastic stripes which are generally found available as waste in abundance in every nook and corner of not only in our country but in the whole world as these days every day is found of consuming it as a food. After consumption all the plastic are thrown into the waste baskets or in the open. Soil reinforcement technique can be a significant secondary market for waste HDPE to improve the strength of sub-grade soils. This technique has been found effective and reliable method to improve the strength of sub-grade soils. A treated or stronger subgrade soils shall require relatively thinner section of a flexible pavement as compared to that of an untreated and weaker sub-grade resulting in significant cost advantage. Over the years, the use of geotextiles and other polymeric reinforcements such as geogrids has increased drastically in geotechnical engineering. However; in certain cases; especially for low cost. The

study regarding the stabilization of black cotton soil by using plastic strips carried out by experimental work. These work are reviewed keeping in view the methodology, principal and various aspect for situation. Based on literature review, the gap in research work is identified to carry out further research work. Black Cotton Soils which you have referred basically falls under montmorillonite group having more swelling and shrinking characteristics. Depending on its application in civil engineering, different ways of stabilization are employed to give it more strength.

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2. LITERATURE REVIEW

- Literature Survey No. 1

Tarun Kumar, Suryaketan “Behaviour of Soil By Mixing Of Plastic Strips”, International Research Journal Of Engineering & Technology e-ISSN: 2395- 0056, Vol. 5, Issue 05, May 2018 This study is carried out on the development of the roadways which is very important and required to be strong enough to support different loads. To meet these challenges plastic wastes are used in the forms of strips of various sizes for identifying the required percentage amount of plastic strips and providing the alternative way for disposing the plastic wastes. To study this reinforcing effect of mixed plastic strips in soil, a series of standard proctor and unsoaked CBR tests have been conducted and based on this it is observed that the maximum dry density of plastic mix soil decreases with increase of percentage of plastic strips, and for CBR increases with increase of percentage of plastic strips within a certain limit. Based on this conclusion should be drawn is that by increasing the amount of plastic contents , the value of the MDD decreases whereas the value of OMC increases. There is increase in CBR value for soil with increasing the percentage of plastic strips.

Literature Survey No. 2

Kiran kumar Patil, Shruti Neeralagi “Soil Stabilization Using Plastic Waste”, International Journal of Advanced Technology in Engineering & Science, ISSN 2348-7550, Vol. 5, Issue No. 07, July 2017 In this they are used plastic bottle strips and plastic bag strips for stabilization. From this study conclusion made is there is increase in CBR value of a soil and maximum CBR is achieved when 0.75% amount of plastic bottle strips are added to the soil after further addition of the strips there is decrease in the CBR value. In case of plastic bag strips, it has been observed that 2% of the total weigh of the soil is the optimum proportion of the strips, we can also state from this study that strips cut out of plastic bottles are better option than strips of soil bags, to increase the CBR value of the soil.

- Literature Survey No. 3

Sayli D. Madavi, Divya Patel “Soil Stabilization Using Plastic Waste” International Journal of Research in Science & Engineering, Vol. 3, Issue 2, March-April 2017 .

For the construction of any civil engineering structure the foundation is very important as it supports the structure and to achieve this strength stabilization of soil is required. This study reviews the experimental program conducted for stabilization of black cotton soil in the Amravati, a Capital of newly formed Andhra Pradesh state. They performed series of CBR testings to find out optimum amount of plastic content is required for obtaining maximum CBR value. It can be concluded that CBR percentage goes on increasing up to 4% plastic content in

the soil and thereon it decreases with increasing the plastic content. Hence, we can say that 4% of plastic content is the optimum content of plastic waste in the soil.

- Literature Survey No. 4

Sharan Veer Singh, Mahabir Dixit, “Stabilization of Soil by Using Waste Plastic Material: A Review”, International Journal of Innovative Research in Science, Engineering & Technology, ISSN(Online) 2319-8753, Vol. 6, Issue 2, February 2017.

This paper focus on the soil stabilization by using plastic waste products. The plastic inclusion can improve the strength thus increasing the soil bearing capacity of the soil. Use of plastic waste as reinforcement which reduces the disposal problem of the waste materials. Research has been done in India to determine the suitability of these waste materials for Indian roads. Based on these the further study is required to find out the optimum amount of the percentage of plastic waste content.

3. MATERIAL USED

Black Cotton Soil

Soil used in this study is taken from farm which is about 1.0 km away from Jagadambha College Engineering and Technology, Yavatmal. The soil is collected at certain depth of 2m from the ground level. The distributed soil sample is then transported to the Geotechnical Laboratory of JCOET Yavatmal.

Waste Plastic Strips

Cold drink bottles are collected and cut into strips of aspect ratio two. The dimensions of waste plastic bottle strips used in this study is 2cm × 1cm. These strips are added in the soil in different proportion by weight. In this study strips used are 0%, 0.2%, 0.4% and 0.6% of dry weight of soil.

Plastic Bottle Cutter

To cut the plastic bottles into strips a plastic bottle cutter is made at home with the help of carpenter. It is made by cutting a wood of length 17.5 cm and width of 3.5cm and base cross section of 3.5cm × 2cm. Two cuts are made in this wood piece, one along length up to depth of 4.5cm and one across length which is 1cm deep. A blade is fitted in this cuts which converts plastic bottles into desired strips.

4. OBJECTIVES

- To improve the shear strength of black cotton soil.
- To control shrink-swell property of soil.
- To improving the soil bearing capacity of sub-grade and foundation soil.
- To improve durability of soil
- To reduce the settlement of soil.
- To improve the soil properties and make that soil useful for future construction activities.
- To alter the soil condition in the site by using low cost plastic waste.

5. METHODOLOGY

1. Free Swelling Index test of Soil

Free swell is the increase in volume of a soil, without any external onstraints, on submergence in water. The possibility of damage to structures due to swelling of expensive clays need be identified, at the outset, by an investigation of those soils likely to possess undesirable expansion characteristics. Inferential testing is resorted to reflect the potential of the system to swell under different simulated conditions.

2. Liquid Limit test of Soil

A liquid limit of soil is the moisture content expressed as a percentage of the weight of over-dried soil, at which soil changes from a plastic to a liquid state.

3. Plastic Limit Test

The plastic limit of a soil is the moisture content, expressed as a percentage of the weight of the oven-dry soil, at the boundary between the plastic and semisolid states of consistency. It is the moisture content at which a soil will just begin to crumble when rolled into a thread of 3mm diameter.

4. Specific Gravity of Soil

Specific gravity is defined as the ratio of the weight of a given volume of soil solids to the weight of a equal volume of distilled water. It deals with the method of test for determination of specific gravity of soils which finds application in finding out the degree of saturation and unit weight of moist soils. The unit weights are needed in pressure, settlement and stability problems in soil engineering.

6. Future scope

1. From many years, researchers developed a lot of new additives like lime, cement kiln, and fly ash to improve the physical properties of soil. But in recent days, thisstablizationis becoming more expensive to use in the soil stablization process.
- 2.This problem demanding an alternative stablizer to make the soil stabilization cheap using the plastic waste fibers as soil stablizers is an economical way to overcome this problem.
- 3.Soil stabilization using plastic waste fiber will improve the strength of soil. This method will result in better and longer lasting structure with increased loading capacity.
- 4.This technique also help to meet the various social challenge like reducing the quantity of waste, producing useful material from non useful waste materials and other.

7. CONCLUSION

Based on the review of the various research paper we can conclude that In our day to day life the plastic material products such as bottles, polythene carry bags usage has become more, because of which today we find that more wastage is of the plastic material. Hence in order to get the best out of this wastage. Thus this project is to meets the challenge of society to reduce the quantities of plastic waste, the plastic stripes were made out of this plastic wastage and are used in making the payment and it is found that there is an increase in the strength of the soil.

8. REFERENCES

- [1] Ref. IS: 2720 (Part 2) -1973, for moisture content.
- [2] Ref. IS: 2720 (Part 7) - 1980, for light compaction.
- [3] Ref. IS: 2720 (Part 16) - 1987 (Re-affirmed 2002), for CBR

- [4] Edwards, J.E. (1992) “Markets first” MSW Mgmt.,
- [5] Cofield, G. (1992) “Recycling plastics: Curving the collect and reject syndrome” MSW Mgmt.,
- [6] Dutta , M. (ed.) (1997) “ Waste disposal in engineered landfills” Narosa publishing house, New Delhi,3-4
- [7] A.K. Choudhary¹ J.N. Jha² and K.S. Gill³, A study on CBR behavior of waste plastic strip reinforced soil.
- [8] Arora, K. R. (2004) ‘Soil Mechanics and Foundation Engineering. Standard Publishers Distributors’.
- [9] Purushothama Raj, P. (2005) ‘Soil Mechanics and Foundation Engineering. Pearson Education’
- [10] Meera Manuel and Shyla Joseph (2014). “Stability Analysis of Kuttanad Clay Reinforced with PET Bottle Strips” International Journal of Engineering Research & Technology (IJERNovember-2014