

# Soil Stabilization By Using Plastic Waste

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

**Keywords:** *Plastic bottle strips, Soil Stabilization,*

## 1. INTRODUCTION

Expansive clay soils are types of soils that show a significant change in volume  
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Soil stabilization is the process by which the engineering properties of the soil are improved and it is made more stable. It is used to decrease the soil's unqualified characteristics such as permeability and consolidation potential and increase the shear capacity. The method is mainly adopted for highway and airfield construction projects. Commonly, activities such as compaction and pre-consolidation are used to improve types of soils which are already in good form. But soil stabilization goes way up to encouraging usage of weak soil and reducing the uneconomical process of weak soil replacement. Other than working on the soil mass interaction, chemically altering the soil material itself is also the focus of this process. Sometimes, soil stabilization is used for city and sub-urban streets to make them more noise-absorbing.

Different methods have been developed previously to stabilize weak and unsuitable soils. Some of these methods include mechanical (granular) stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, thermal stabilization, electrical stabilization, as well as grouting stabilization by geotextile and fabrics. Recently, researchers have introduced another way of soil stabilization by using waste materials. Plastics are one of the leading waste materials that are found to be suitable for this purpose. They reduce the cost of stabilization at a large rate. Using plastics for this purpose simultaneously solves the challenges of improper plastic waste recycling that is currently a teething problem in most developing countries.

Expansive clay soils are types of soils that show a significant change in volume once they come in contact with moisture. They expand when exposed to excess water and shrink in hot weather conditions where there is scarce amount of water. They can easily be identified in the field in dry seasons as they show deep cracks of polygonal patterns. This behavior of swelling and shrinking of expansive clay soils in turn affects the stability of structures that is built over these soils causing a serious hazard. It majorly affects the bearing capacity and strength of foundations by uplift as they swell and may cause from cracks to differential movements to structural failures. In order to build on expansive soils, they need to be stabilized to reduce their swelling and improve their mechanical capacities.

## 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**

- It improves the strength of the soil, thus, increasing the soil bearing capacity.
- It prevents soil erosion or formation of dust, which is very useful especially in dry and arid weather.
- It helps in reducing the soil volume change due to change in temperature or moisture content.

- It provides an alternative solution for the disposal of 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 stablization cheap using the plastic waste fibers as soil stablizers is an economical way to overcome this problem.
- 3.Soil stablization 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 plastic strips in optimum amount with suitable dimension is feasible for improving the engineering properties of soil. Thus, using plastic as a soil stabilizer is economical and gainful use in construction as there is lack of good quality soil for various construction. Reducing the amount of plastic waste and producing useful product from non useful waste materials for sustainable foundation and subgrade improvement. This new technique of soil stablization can be effectively used to meet the challenges of society and it can significantly enhance the properties of soil used in

construction of road infrastructure, foundation, stabilization of embankment, pavement sub grade and other different fields as per the needs and flexibility.

## 8. REFERENCES

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