JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

STABILIZATION OF BLACK COTTON SOIL USING RECYCLED PLASTIC WASTE

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Abstract

Soil stabilization plays a crucial role in improving the engineering properties of weak soils. Black cotton soil, widely found in many regions of India, is known for its high swelling and shrinkage characteristics, which often lead to structural instability and pavement failure. Conventional stabilization methods such as lime and cement treatment are effective but can be costly.

This study investigates the effectiveness of recycled plastic waste as a stabilizing material for black cotton soil. Laboratory tests including sieve analysis, Standard Proctor compaction test, and California Bearing Ratio (CBR) test were conducted to evaluate the improvement in soil properties. The results indicate that the inclusion of plastic waste enhances the strength characteristics of soil, with maximum improvement observed at 0.6% plastic content. The study highlights the dual benefits of waste management and soil improvement, suggesting recycled plastic waste as a sustainable and economical alternative for soil stabilization.

Keywords:
Black Cotton Soil, Soil Stabilization, Recycled Plastic Waste, CBR, Compaction

INTRODUCTION

Soil stabilization refers to the process of improving the engineering properties of soil to enhance its strength, durability, and load-bearing capacity. Black cotton soil is one of the most problematic soils encountered in civil engineering due to its expansive nature. This soil undergoes significant volume changes with variations in moisture content, leading to cracks, settlement issues, and structural damage.

With increasing infrastructure development, particularly in regions where black cotton soil is prevalent, the need for effective stabilization techniques has become essential. Traditional stabilization methods using cement and lime are widely adopted; however, these methods often involve high costs.

Simultaneously, plastic waste has emerged as a major environmental concern. Plastic materials may take hundreds of years to decompose, resulting in serious ecological problems. Recycling and reusing plastic waste in civil engineering applications can provide a practical solution to both environmental and engineering challenges.

This study focuses on the stabilization of black cotton soil using recycled plastic waste, aiming to evaluate its effectiveness in improving soil strength characteristics.

LITERATURE REVIEWS

Previous studies have explored the use of waste materials for soil stabilization. Arya Sunil and Anas Ashraf (2013) demonstrated that waste plastic bottles could enhance soil strength characteristics. Mallikarjuna V. and Bindu Mani T. reported improvements in CBR values with the inclusion of plastic waste.

Several researchers have observed that plastic strips and fibers can improve soil stability by acting as reinforcing elements within the soil matrix. The improvement largely depends on factors such as plastic content, strip size, and soil type. Many studies suggest that the optimum plastic content typically lies within a small percentage range.

These findings indicate that recycled plastic waste has promising potential as a soil stabilizer.

METHODOLOGY

This chapter explains the step-by-step procedure followed to complete the project. This is a quantitative experimental study that aims to generate useful knowledge about using plastic bottles to improve the stability of soil based on its engineering and geological properties. The study is carefully planned and carried out under controlled conditions so that other researchers can repeat the experiment and verify the results. Since environmental problems are increasing, this study focuses on using waste plastic products for soil stabilization as an eco-friendly solution.To check the improvement in the properties of black cotton soil, several laboratory tests were conducted. These include the liquid limit test, plastic limit test, Standard Proctor compaction test, California Bearing Ratio (CBR) test, and Unconfined Compressive Strength (UCS) test. These tests help in measuring the strength and stability of the soil after adding plastic waste.

Selection of site

1.COLLECTION OF Material

2.BASIC TEST ON BLACK COTTON SOIL

3.COLLECTION OF PLASTIC BOTTELS

4.CONDUCT CBR TEST ON PROPOSED LAYERS OF SOILS BY PLACING PLASTIC

5.ANALYSIS

RESULTS

OF PLASTICCONTENT	CBR VALUE BEFOR ADDING PLASTIC	AFTER ADDING PLASTIC
0.0	1.5	1.9
0.2	1.6	1.8
0.4	1.3	1.7
0.6	1.8	2.6
0.8	1.3	1.4
1.0	1.2	1.4

Table no.01

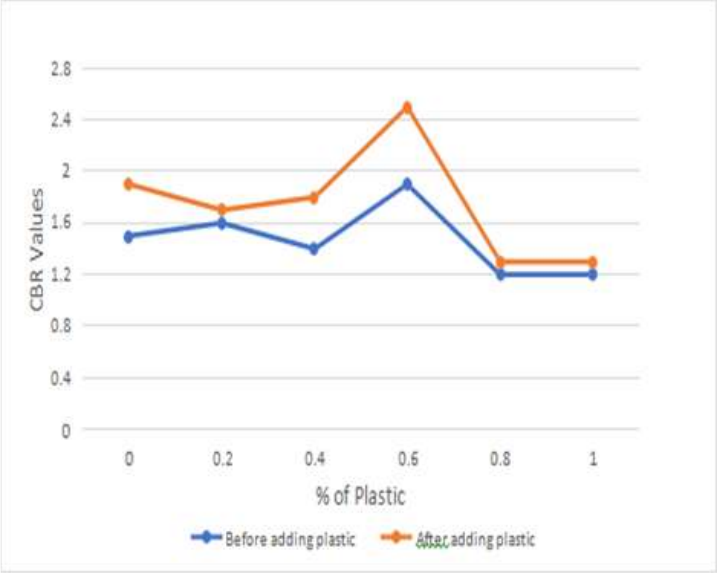


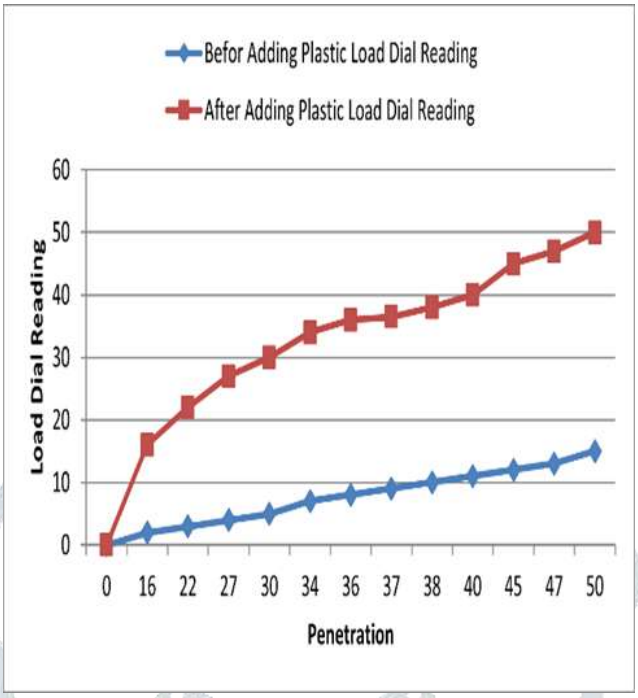
Fig. Graphical Representation Of CBR Test

Explanation of Graph :-

From above table & Graph we have taken readings before adding plastic and after adding plastic. We got results as shown in above graph. After adding plastic the apex of rises at 0.6% of plastic. So addition of plastic increases the stability of foundation soil.

Penitration	Before Adding plastic Load dial reading	After Adding Plastic Load Dial FReading
0	0	0
15	2	15
21	3	21
26	4	26

31	5	31
33	6	33
35	7	35
38	8	38
39	9	38.5



CONCLUSION

Based on the experimental investigation, the following conclusions can be drawn:

The inclusion of recycled plastic waste improves the California Bearing Ratio (CBR) value of black cotton soil.

The optimum plastic content was found to be 0.6%, at which maximum improvement was observed.

The use of plastic waste offers both engineering and environmental benefits.

Recycled plastic waste can be considered a sustainable and economical soil stabilizer.

However, further studies on long-term performance and field applications are recommended

REFERENCES

1. Arya Sunil and Anas Ashraf (2013), Soil Stabilization Using Raw Plastic Bottles, Journal of Engineering and Development, Vol. 17, No. 4, pp. 489–492.

2. Arora K. R. (2004), Soil Mechanics and Foundation Engineering, Standard Publishers Distributors.

3. Mallikarjuna V. and Bindu Mani T., Soil Stabilization Using Plastic Waste, International Journal of Research in Engineering and Technology.

4. Mercy Joseph Poweth et al., Effect of Plastic Granules on the Properties of Soil, International Journal of Engineering Research and Applications.