



PLASTIC AS A SOIL STABILIZER

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Abstract

Soil is a vital part of the natural environment and key element of this nature. Black cotton soils with high potential for swelling and shrinking as a result of change in moisture content are one of the major soil deposits of India. Soil stabilization is the process due to which physical properties of soil improves such as shear strength, bearing capacity which can be done by use of controlled compaction or by adding suitable admixtures like cement, lime, sand etc. The new technique of soil stabilization can effectively use to meet the challenges of society, to reduce the quantities of waste, producing useful material from non-useful waste materials. Since the use of plastic in diversified forms such as chairs, bottles, polythene bags, etc. has been increasing speedily and its disposal has become a problem all the time regarding the environmental concern, using plastic as soil stabilizer will reduce the problem of disposing the plastic as well as increases the density and California bearing ratio (CBR) of soil in an economical way. For improvement of subgrade soil of pavement, soil stabilization using raw plastic bottles is an alternative method. It can significantly enhance the properties of the soil used in the construction of road infrastructure. Results include a better and longer lasting road with increased loading capacity and reduced soil permeability.

Index Terms: California Bearing Ratio, Plastic, Soil Stabilization

1. INTRODUCTION

Soil deposits in nature exist in an extremely unstable manner thereby producing numerous variety of possible combination which would affect the strength of the soil. Major soil deposits are black cotton soil which are very fertile and suitable for farming but not suitable for construction of civil engineering structures because it has low bearing capacity and rigorous shrink-swell process which results in development of cracks. With the formation of new capital, rapid industrialization, increasing population and decrease of available land, more and more number of buildings and other civil engineering constructions has carried out on available black cotton soil which is having low shear strength. Hence, a great diversity of ground improvement techniques such as soil stabilization and reinforcement are needed to be employed to improve behaviour of soil, thereby enhancing the reliability of construction. In the present situation, stabilization of soils is most important, which makes them suitable for various construction

activities. Various materials and methods may be used for stabilizing soils and are presented below.

1.1 Need

Plastic material increases the shear strength of soil, tensile strength of soil, California bearing ratio of the soil. The properties of soil can be significantly enhanced by it which is used in the construction of road infrastructure and available in abundance.

1.2 Objectives

1. To increase the density and California Bearing Ratio (CBR) of soil using plastic as an admixture.
2. To provide an alternative solution for the disposal of plastic waste.
3. To provide an economical solution for soil stabilization using plastic waste.
4. To determine the optimum plastic content to be used.

1.3 Scope

Increase in use of plastics in day to day life has resulted in the municipal solid waste, an ever growing fraction of

plastic materials which were used for a short time and then discarded. Therefore, it is necessary to find alternative uses of reclaimed plastic bag waste to lengthen the usage time of the plastic material and thereby save the degrading environment. The concept of adding soil masses with strips of plastic cover may be relatively, a new growth in development. In contrast, the use of random-materials as reinforcement for soil is probably not older than written history, but only sparsely represented.

2.MATERIALS AND METHEDOLOGY

The materials used in this test are Black cotton soil and plastic material .The tests conducted in this experimental study are

1. Direct Shear Test
2. California Bearing Ratio (CBR) test

2.1 Direct shear test

This is the simple and commonly used test on soil. This test is used to determine the shear parameters of soil by using shear box apparatus. Direct shear test performed on soil samples in the experimental study and their results are as follows.

Table-1: Observations of Direct shear test

| | | Without Plastic | With 1% Plastic |
|---------|---------------|-----------------|-----------------|
| SR. NO. | Normal Stress | Shear Stress | Shear Stress |
| 1. | 0.2 | 0.32 | 0.39 |
| 2. | 0.5 | 0.45 | 0.50 |
| 3. | 0.7 | 0.62 | 0.74 |

Now, from this table a graph is plotted between normal stress versus shear stress.

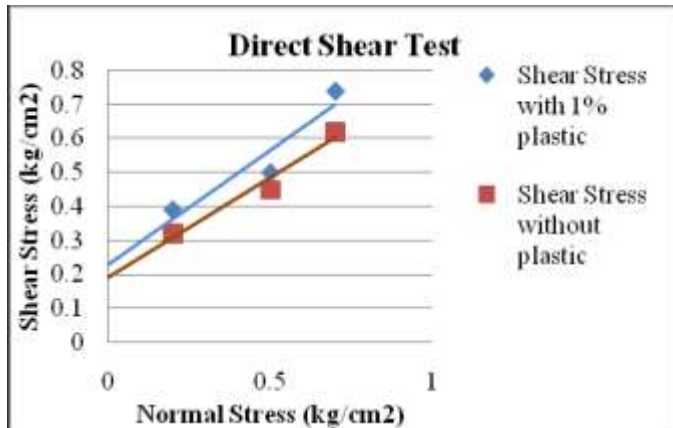


Fig.1 Comparison of Results on Direct Shear Test

The line passing through these points intercepts Y-axis which shows the value of cohesion of soil. So from these graph we can say that the cohesion of soil increases by addition of plastic.

Table-2: Comparison of test results

| Test | Without Plastic | With 1% Plastic | % Change |
|-------------------|----------------------------|---------------------------|---------------|
| Direct Shear Test | C= 0.19 kg/cm ² | C=0.25 kg/cm ² | % increase=24 |

2.2 California bearing ratio test

California bearing ratio (CBR) test was performed in the experimental study to obtain the CBR value on the soil samples with plastic strips in various percentages of 2, 4, 6 and 8 and the results obtained are mentioned below.

Table-3: Test Results of Soil Sample Incorporated with Plastic Strips

| Sr. No. | Sample Description | CBR (%) |
|---------|----------------------|---------|
| 1. | Soil | 1.00 |
| 2. | Soil with 2% plastic | 2.02 |
| 3. | Soil with 4% plastic | 11.70 |
| 4. | Soil with 6% plastic | 4.80 |
| 5. | Soil with 8% plastic | 4.40 |

In this table we can see that, the CBR value has been increasing up to 4% plastic content and afterwards it started to decrease. From this, it can be said that, 4% plastic content is the optimum content of utilization of waste plastic in the soil.

3.CONCLUSION

In the present study, we can conclude that increase in cohesive property of soil, bearing capacity of soil also increases and settlement as well as compressibility decreases. Similarly, the improved CBR value of the soil is due to the addition of plastic strips. Hence, plastic can be utilized as one of the material that can be used as a soil stabilizing agent but the proper proportion of plastic must be there, which helps in increasing the CBR of the soil.

Utilization of plastic products in various forms is rapidly increasing day by day which has an adverse effect in nature and it is not possible to stop its uses. In this regard, the disposal of the plastic wastes without causing any environmental hazards has become a real challenge to the present society. Thus, using plastic waste as a soil stabilizer is an economical and profitable usage because there is lack of good quality soil for various constructions. This work serves as a means to meet the challenges of the whole society by reducing the large amount of plastic waste and producing useful product from non-useful waste materials leading to the foundation of sustainable society. Results include a desirable and extensive lasting road construction with increased loading capacity.

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