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STABILISATION OF GRAVEL SOIL BY USING PLASTIC BOTTLE WASTE

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Abstract:- Soil is the key element of this nature and all the basic needs of life such as food, house and cloths are fulfilled by the soil. 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 stabilisation is the process which improves the physical properties of soil, such as shear strength, bearing capacity which can be done by use of controlled compaction or addition of suitable admixtures like cement, lime, sand, fly ash or by providing geo textiles, geo synthetics etc. The new technique of soil stabilisation can be effectively used 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 advancing speedily and its disposal has been a problem all the time regarding the environmental concern, using plastic as soil stabiliser would reduce the problem of disposing the plastic as well as increases the density and California Bearing Ratio (CBR) of soil in an economical way. The present study is focused to overcome the problems experienced in Amaravati, the capital of newly formed Telangana State. In the present study, an experimental program was conducted for stabilisation of Black Cotton Soils in the Capital Region i.e., Amaravati of newly formed Telangana State, with the utilisation of Plastic waste as soil stabiliser. Different contents of plastic strips (% by weight varying from 0% to 8%) are added to the Black Cotton Soil and the optimum percentage of plastic strips in soil was found out by conducting California Bearing Ratio Test.

Keywords: Gravel Soil, Waste Plastic Bottles(Polypropylene)PP, Cooking Tin, Wooden Moulds.

1. INTRODUCTION

Soil stabilisation is the process of altering some soil properties by different methods, mechanical or chemical in order to produce an improved soil material which has all the desired engineering properties. Soils are generally stabilised to increase their strength and durability or to prevent soil erosion. The properties of soil vary a great deal at different places or in certain cases even at one place the success of soil stabilisation depends on soil testing. Various methods are there to stabilise soil and the method should be verified in the lab with the soil material before applying it on the field. Major soil deposits in the Telangana state are Black Cotton Soils which are very fertile and suitable for agriculture but not good for construction of Civil Engineering Structures because of its low Bearing Capacity and intensive shrink-swell process which results in development of cracks. With the formation of new capital, rapid Industrialisation, bursting population and decrease of available land, more and more number of buildings and other civil engineering constructions has to be carried out on available Black Cotton soils which are having poor shear strength. Hence, a great diversity of ground improvement techniques such as soil stabilisation and reinforcement are needed to be employed to improve behaviour of soil, thereby enhancing the reliability of construction.

1.1 Overview

In the present situation, Stabilising of soils is of utmost importance in region which makes them suitable for various construction activities. Various materials and methods may be used for stabilising soils and are presented below. There are different materials in utilisation for the stabilisation of black cotton soils. Depending on the internal factor which describes the bonding between the soil and the stabiliser utilised.

1.2 Research on This Project

It is based on the principle of friction i.e., when the admixtures are added to soil and compacted the strength is enhanced due to the friction between the soil and the material added. Examples for the materials which increase the strength by this principle are sand, plastic, geo textiles etc.

Today, due to the fast growth of populations and development activities, it led to discharge of huge wastes. Disposal of these different wastes produced from different industries and urban areas has become a great problem. These materials, most of which are non-biodegradable posed environmental threat by polluting the nearby locality.

2. Literature Review

Which is commonly used for shopping bags, storage and marketing for various purposes due to its most advantage character of less volume and weight. Most of these plastic are specifically made for spot use, having short life span and are being discarded immediately after use. Though, at many places waste plastics are being collected for recycling or reuse, however; the secondary

markets for reclaimed plastics have not developed as recycling program. Therefore, the quantity of plastics that is being currently reused or recycled is only a-fraction of the total volume produced every year. The estimated municipal solid waste production in India up to the year 2000 was of the order of 39 million tons per year. From this plastics constitute around 4 % [2] of the total waste. With the few reasons cited above, it is very important that we find ways to reutilise these plastic wastes. Therefore, the investigation and attempt has been made to demonstrate the potential of reclaimed plastic wastes as soil reinforcement for improving the sub grade soils. The study will describe series of tests carried out to initially understand the types of soil and its properties. Then CBR test was carried out with varying percentage of plastic strips with different length and proportions mixed uniformly with the soil .The results obtained from the tests will be presented and discussed.

MATERIALS AND METHODOLOGY

In order to conduct this study, various materials such as lateritic soil, plastic bottles (both cut and uncut), sea sand and synthetic threads were used.

The Standard Proctor Compaction tests were done to assess the amount of compaction and the water content required in the field. The water content at which the maximum dry density is attained is obtained from the relationships provided by the tests.

The California Bearing Ratio test was conducted to determine the optimum amount of plastic strips in soil. This is done by mixing soil with varying percentages (2%, 4%, 6%,8%) of plastic strips in soil and the 4 day soaked CBR Value is obtained Plate load tests were conducted with plain lateritic soil, soil stabilised with full bottles, soil stabilised with bottles cut to two halves and soil stabilised with optimum percentage of plastic strips. Load settlement graphs for each plate load test were drawn. For each load-settlement graph, the load corresponding to 4mm settlement was noted. The ultimate load and corresponding settlement of the plate is also determined from the load- settlement graph plotted for various test arrangements

The materials which are considered are soil and plastic with chemical composition of poly propylene.

Gravel Soil

Plastic Bottle

Polypropylene

OBJECTIVES

To increase the density and California Bearing Ratio (CBR) of soil using plastic as an admixture.

To provide an alternative solution for the disposal of plastic waste.

To provide an economical solution for soil stabilisation using plastic waste.

To determine the optimum plastic content to-be used.

TESTS

1. Soil

Soil collected from the Injapur pond near by our campus was used in this study with specific gravity2.40 having coefficient of uniformity (Cu) of 5.0 and coefficient of curvature (Cc) of 1.80 and free swell index as 40%

2. Plastic

The waste plastic were collected from nearby disposal sites and made into strips of different aspect ratios. A study on CBR behaviour of waste plastic strip reinforced soil having strip width of 10mm and a thickness of 40 micron.

CBR Test procedure

The California Bearing Ratio test is conducted for the soil by adding plastic strips with varying percentage of 0.2 i.e.0.2%, 0.4%, 0.6% etc. and determines the strength of soil until the strength reaches the highest level and stop at the interval when strength decreasing from the highest. Plot the graph and calculate the bearing value for 2.5mm penetration and 5mm penetration and value of 2.5mm penetration and 5mm penetration is recorded. Then finally plot a graph of Percentage of Plastic content and CBR value and obtained the maximum CBR value corresponds to percentage of plastic content.

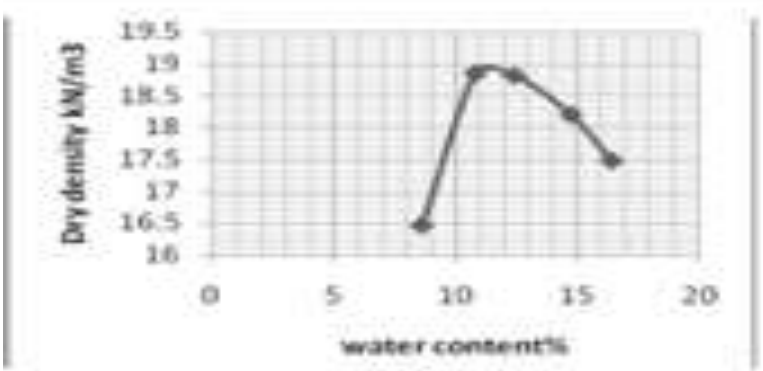
CBR TESTING

COMPACTION TEST In this the compaction test, the maximum dry density and optimum moisture content were obtained as 18.95kN/m3 and 11.22 % respectively. This is used for finding the bulk density of the soil filled in the tank for plate load test

COMPACTION TESTING

RESULT AND DISCUSSION

From the compaction curve, the maximum dry density and optimum moisture content were obtained as 18.95kN/m3 and 11.22 % respectively. This is used for finding the bulk density of the soil filled in the tank for plate load test. The California Bearing Ratio test was also carried out by mixing the soil with optimum moisture content.



Compaction curve

CBR Values for soil with varying percentages of plastic strips Relation between CBR Value and percentage of plastic content. It is observed from the test results that for soil mixed with waste plastic strips, soaked CBR values increased from 1.967 to 2.479 with 0.6% of plastic and there after decreased. Hence the optimum percentage of plastic strip in soil is found to be 0.6%. It was also observed that there was a reduction in the CBR value from 1.967 for plain soil to 1.687 on adding 0.2% plastic this is because the addition of small amount of plastic into soil lead to a dispersed and disturbed structure to soil than that it was in its compact form. Also the optimum moisture content was maintained

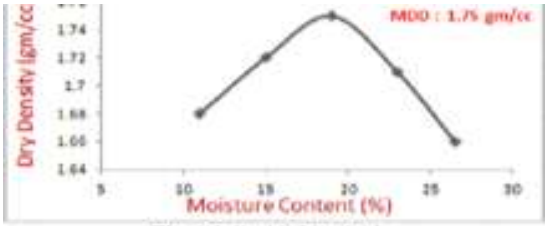
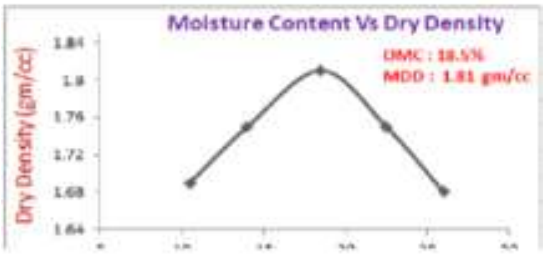


Fig. 1 Soil with 2% plastic



Sample Description	MDD (gm/cc)	OMC (%)	CBR (%)
Soil	1.62	20.5	1.00
Soil with 2% plastic	1.75	19.0	2.02
Soil with 4% plastic	1.81	18.5	11.70
Soil with 6% plastic	1.71	18.0	4.80
Soil with 8% plastic	1.65	17.4	4.40

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CONCLUSIONS

Use of plastic products such as polythene bags, bottles, containers and packing strips etc. is increasing day by day. The disposal of the plastic wastes without causing any ecological hazards has become a real challenge to the present society. Thus using plastic bottles as a soil stabiliser is an economical and gainful utilization since there is scarcity of good quality soil for embankments and fills. Thus this project is to meets the challenges of society to reduce the quantities of plastic waste, producing useful material from non-useful waste materials that lead to the foundation of sustainable society

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