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SOIL STABILIZATION USING WASTE PLASTIC MATERIAL

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ABSTRACT- *The Ultimate deciding factor for design of a highway pavement is Sub grade Strength. The sub grade strength is a function of Gradation and Soil Characteristic, which is measured in terms of CBR. It is uneconomical and difficult to design Pavements for high CBR in locations where the Soil has low CBR. Thus to optimize the Pavement and Design and Cost the existing CBR of the Soil needs to be improved by Stabilizing the existing Soil. The present Study aims to evaluate the effect caused by the different Stabilizing Agents on the geotechnical characteristics of expansive/Low CBR sub grade soils. The soil will be treated with varying percentages of Stabilizing Agents 0, 5, 10, 15, and 20 and the improvement/Change in Consistency limits, compaction, California Bearing Ratio, swell potential will be studied for treated and untreated soils. The aim of the study is to identify the Optimum Stabilizing Content for Desired Strength and Cost.*

Keywords: *Expensive Soil, Atterberg's limit, Compaction, OMC, MDD.*

I. INTRODUCTION

Expansive soils have the tendency to shrink and swell with variation in moisture content so it damage to the overlying structures .Generally, the concept of stabilization can be dated to 5000 years ago. McDowell (1959)reported that stabilized earth roads were used in ancient Mesopotamia and Egypt, and that the Greek and the Romans used soil-lime mixtures .Fly ash-soil stabilization for road construction is applied in USA, Japan, Scandinavian countries, and some other countries like India

Different methods can be used to improve and treat the geotechnical properties of the problematic soils like Chemical Stabilization. Chemical (Additive) soil stabilization is achieved by the addition of proper percentages of Fly Ash, Waste Plastic & Sand or combinations of these materials to the soil. The selection of the type and the determination of the percentage of the additive to be used are dependent upon the soil classification and the degree of improvement in soil quality desired.

II. OBJECTIVE OF THE STUDY

To increase the 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 Stabilization using Plastic Waste.

To Determine the Optimum Plastic Content to be used.

III. LITERATURE REVIEW

1. Priti Mishra, Jha Ajachi R.B., Mohnish Satrawala, Harsh Amin, In 2013 conclused by using Waste Plastic Strips (WPS) and Waste Recucled Product (WRP) by improve the CBR value. UCS(Unconfined Compressive Strength) and STS(Split Tensile Strength) increases with increase in Fiber Content, which shows that polythene fibers are more efficient when WRP was subjected to tension rather than to compression. The vertical displacement was significantly higher in the fiber reinforced specimes.

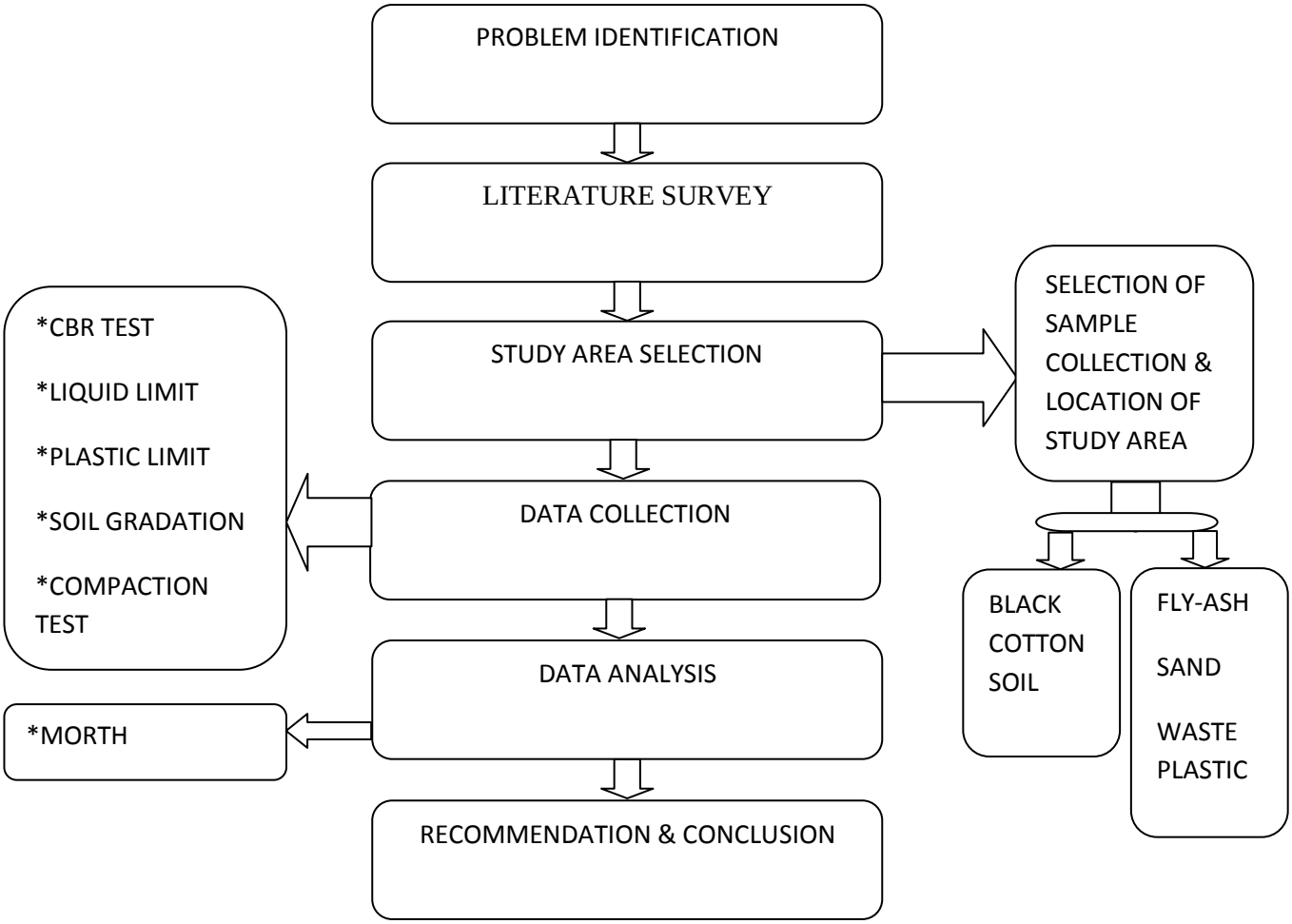
2. F.C.Chebet and D. Kalumba in 2014 concluded by using the result obtained from the testing programme suggested that additional of plastic elements in sandy soils provides an increase in the soil shear strength and load bearing capacity. The investigation yielded results that are a positive indication to the possibility of using the versatile plastic bag material for soil reinforcement and the viability needs to be further explored. Successful application could help to reduce on the amount of plastic waste disposed of to landfills and contribute to sustainable development by providing low cost materials to the resources intensive geotechnical industry.

3. Mariamma Joseph , Meera Varghese in 2011. Kochi (Paper No. H-304) concluded by use of plastic products such as polythene bags , bottles , containers and packing strips etc. is increasing day by day. The disposal of plastic waste without causing any ecological hazards has become a real challenges to the present society. Thus using plastic bottles as a soil stabilizer 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.

4. S.W. Thakare , S. K. Sonule , In 2013 concluded by using the improvements in bearing capacity of Sandy soil reinforced with model plastic water bottle were investigated through model plate load tests in laboratory. The study shows that the ultimate bearing capacity of the footing increases with the introduction of layers of plastic bottles as reinforcement. The increase in bearing capacity may be due to the additional comfinement to the soil in the vicinity of footing similar to that in case of Gevcell. The bearing capacity increases with the increase in width of reinforcement and number of layers. Optimum benefit can be obtained by providing three reinforcing layers with LIB ratio of 2 and spacing between them equal to B/8. Use of waste plastic bottles as reinforcement is recommended to reduce the quantities of plastic waste which creates the disposal problem.

5. V.Malikarjuna, T. Bindu Mani in 2016 concluded by in the present study , the improved CBR value of the soil is due to the addition of plastic strips. 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. This work serves as a means to meet the challenges of Amaravathi, the capital of newly formed Andhara Pradesh state and also to the whole society by reducing the amount of plastic Waste and producing useful product from non-useful waste materials leading to the foundation of sustainable society.

IV. METHODOLOGY



"Figure 1. Methodology of Soil Stabilization"

V. LABORATORY INVESTIGATIONS

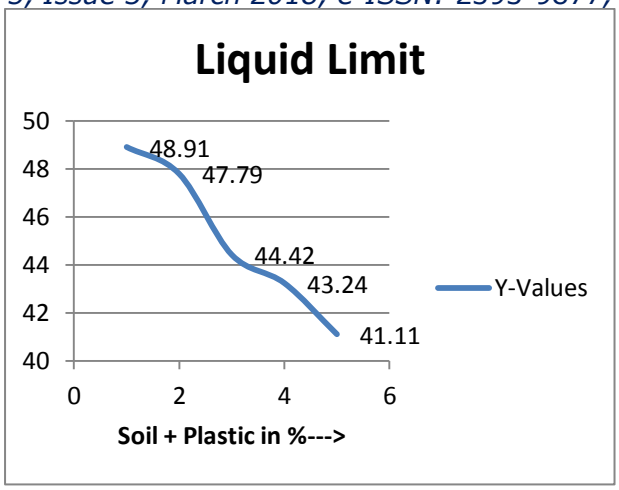
CBR can be said as the indirect measure of the strength as Soil deformed was Shear in Nature. From the Results, it is evident that Waste Plastic increases the CBR value. There is a major increase in CBR value when the soil is incorporated with Waste Plastic Material and compared to that of soil with plastic.

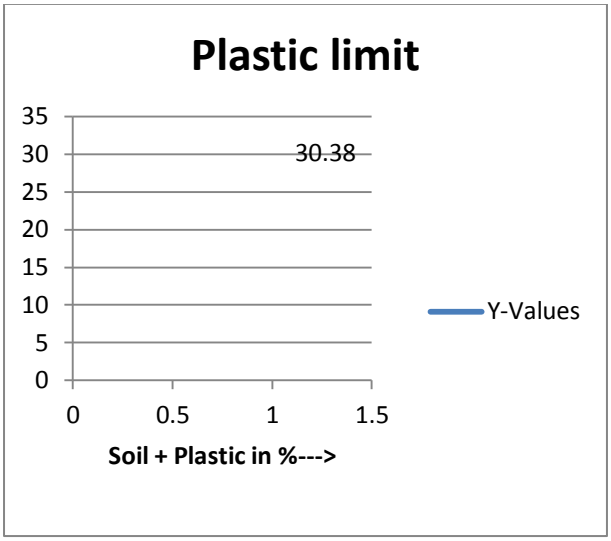
CBR Test is performed on the samples with varying percentages of Waste Plastic Material i.e. 0.5%, 1.0%, 1.5%, 2.0%. In this regard, the CBR value has been increasing up to 1.0% Plastic Content and thereon it started to decrease. From this, it can be inferred that 1.0% Plastic Content is the Optimum Content of utilization of Waste Plastic in the soil.

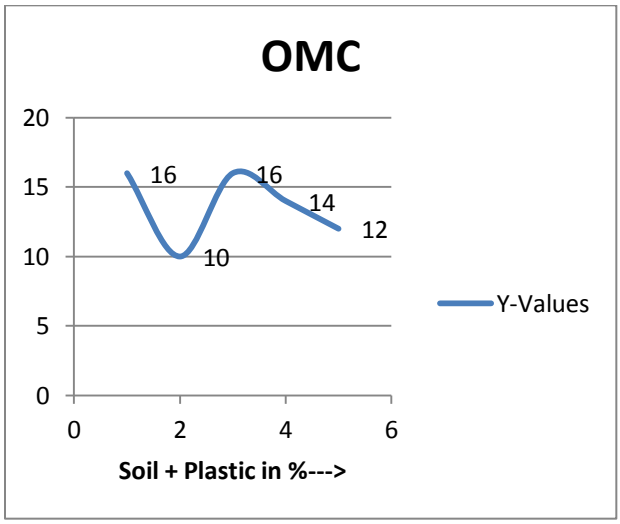
"Table 1. Test Result of soil sample Incorporated with Waste Plastic Material"

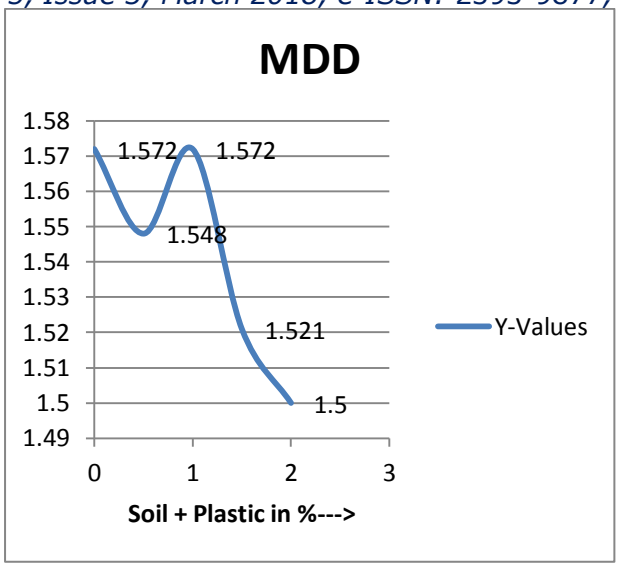
Sample Description	L.L.	P.L.	OMC %	MDD gm/cc	CBR %
Soil	48.91	30.38	16%	1.572	9.72%
Soil + 0.5% Plastic	47.79	NP	10%	1.548	10.02%
Soil + 1.0% Plastic	44.42	NP	16%	1.572	10.98%
Soil + 1.5% Plastic	43.24	NP	14%	1.521	10.53%
Soil + 2.0% Plastic	41.11	NP	12%	1.500	10.33%

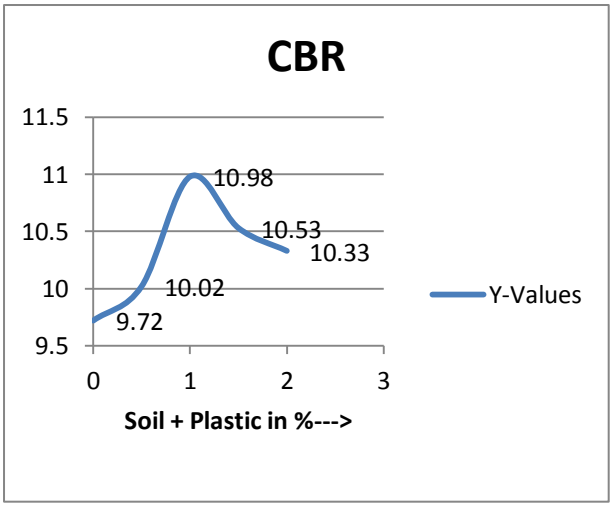
Where,
L.L. = Liquid Limit
P.L. = Plastic Limit
OMC = Optimum Moisture Content
MDD = Maximum Dry Density
CBR = California Bearing Ratio











VI. CONCLUSION

In the present study, the improved CBR value of the soil is due to the addition of waste plastic material. Plastic can be utilized as one of waste plastic 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.

It can be concluded that CBR percentage goes on increasing up to 1.0% plastic content in the soil and thereon it decreases with increase in plastic content. Hence, we can say that 1.0% plastic content is optimum content of plastic waste in the soil.

Utilization of plastic products in various forms is enormously increasing day by day. This has an adverse effect in nature and it is not possible to restrict its uses. In this regards the disposal of the plastic wastes without causing any ecological hazards has become a real challenges to the present society. Thus, using plastic as a soil stabilizervis an economical and gainful usage because there is lack of good quality soil for various constructions.

Thus, reducing the amount of plastic waste and producing useful product from non-useful waste materials leading to the foundation of sustainable society.

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