SOIL STABILIZATION BY USING PLASTIC WASTE

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***Abstract*—**Reinforced earth is relatively new construction material which has only been used for 40 years or so for ground improvement. Now a days usage of plastic products is increasing day by day and creating the disposal problem for the society. Attempts are therefore being made to utilize waste plastic as geotechnical material to solve both geotechnical and environmental problem. The project results show that there is considerable increase in bearing capacity value with the inclusion of plastic waste. It was observed that from the laboratory test results of unconfined compression strength test there is a considerable increase in strength of the soil with inclusion of waste plastic

Keywords – waste plastic, ground improvement, unconfined compression strength, reinforcing material for soil.

I. INTRODUCTION

Plastics are considered as one of the most important invention which has remarkably assisted in different aspect of life whether it might be in scientific field or others. As plastics are non-biodegradable materials which have given and more problem to the users and also destroyed the component of the environment to the great extent. There are difficult ways where the use of the plastic is being done it is not only limited to shopping bags, storages and marketing but also man bottles and other various things are made from plastic, which when thrown away creates many hazardous. Toward this end; randomly reinforcing the soil by using high density polyethylene strips obtained from waste plastic containers may provide an easy and sometimes an economical means to improve the engineering performance of sub grade soils.

II. LITERATURE REVIEW

Studied on the 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 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 waste materials that lead to the foundation of sustainable society.

III. MATERIALS

1.Soil

Locally available clay soil was used in this study. We are used in three samples from different locations.

2) *Plastic waste:*

We are used in the three types of plastic. coloured plastic & PET bottles plastic and tea cups plastic waste it is low tensile strength.

1.Table

Type of plastic	Size
Coloured plastic waste	72mm
PET Bottle waste	36mm
Tea cup plastic waste	1mm

Typical property of PET Plastic values

Physical Properties	PET
Density	0.0499
water absorption ,24 hours	0.10
Mechanical properties	PET
Specific gravity	1.38
Tensile modulus(Gpa)	2-4
Poisson ratio	0.37-0.44(oriented)
Coefficient of friction	0.2-0.4

IV.PRELIMINARY TEST

1.Specific Gravity of Soil

The specific gravity (G) has been determined using Pycnometer as per IS 2720 (Part III/sec I) 1980. The Three soil samples are taken and three trials are conducted to Specific Gravity Test

Specific Gravity Test Result

Sample -1 =2.65

Sample -2 =2.72

Sample -3 =2.67

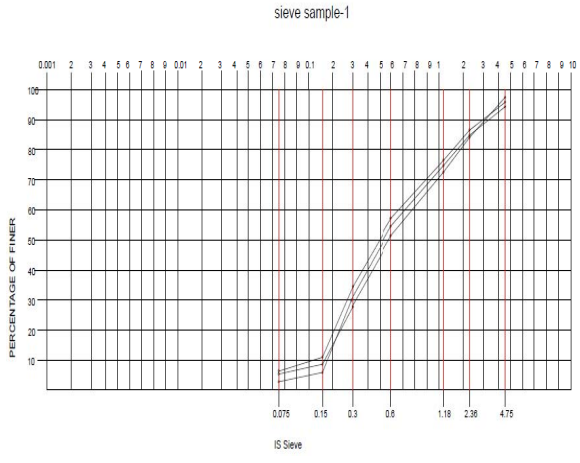
2.Sieve Analysis

Sieve Analysis test has been conducted on the soil sample as per IS 2720 (Part IV) 1985. The Three soil samples are taken and three trials are conducted to Sieve Analysis Test. Weight of soil sample is taken to 1kg.

SIEVE SIZES

4.75mm,2.36mm,1.18mm,600micron,300micron, 150micron,75micron,pan

SIEVE ANALYSIS SAMPLE-1



Sieve Analysis Test Result

Classification of Soil

By recommendation s of IS Soil classification (IS: 1498-1970)

Sample 1	Medium sand soil
Sample 2	Medium sand soil
Sample 3	Medium sand soil

By recommendations of IS Soil classification (IS: 1498-1970)

SAMPLE-1	SW-Well graded sands, gravelly sands, little or no fines
SAMPLE-2	SC – Clayey sands, poorly graded sand-clay mixtures.
SAMPLE-3	SC – Clayey sands, poorly graded sand-clay mixtures.

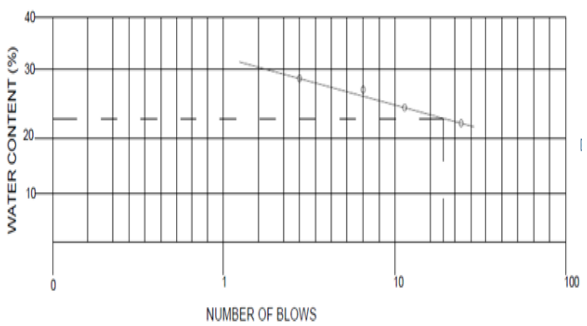
3.Consistency Limits

The liquid limit has been determined using Casagrandes Apparatus. The Plastic Limit has been determined by rolling a thread of 3mm diameter. The shrinkage limit has been determined using shrinkage Dishes.

A) Liquid limit

Liquid Limit test has been conducted on the soil sample as per IS 2720 (Part V) 1985. The Three soil samples are taken and three trials are conducted to Liquid Limit Test.

LIQUID LIMIT SAMPLE-1



Liquid limit results at corresponding to 25 blows

SAMPLE -1	23.16%
SAMPLE-2	43.33%
SAMPLE-3	38%

By recommendation of Is soil classification (IS : 1498-1970)

SAMPLE-1(L.L range less than 35%)	OL-Organic silts of low plasticity
SAMPLE-2 (L.L range less than 35 to 50%)	OI- Organic silts and organic silts clays of medium plasticity
SAMPLE-3 (L.L range less than 35 to 50%)	OI- Organic silts and organic silts clays of medium plasticity

B) Plastic limit

Plastic Limit test has been conducted on the soil sample as per IS 2720 (Part-V) 1985. The Three soil samples are taken and three trials are conducted to Plastic limit Test.

Plastic Limit Result:

SAMPLE -1	24%
SAMPLE-2	29%
SAMPLE-3	26%

B) Shrinkage Limit

Shrinkage Limit test has been conducted on the soil sample. The Three soil samples are taken and three trials are conducted to Shrinkage Limit Test.

Shrinkage test result

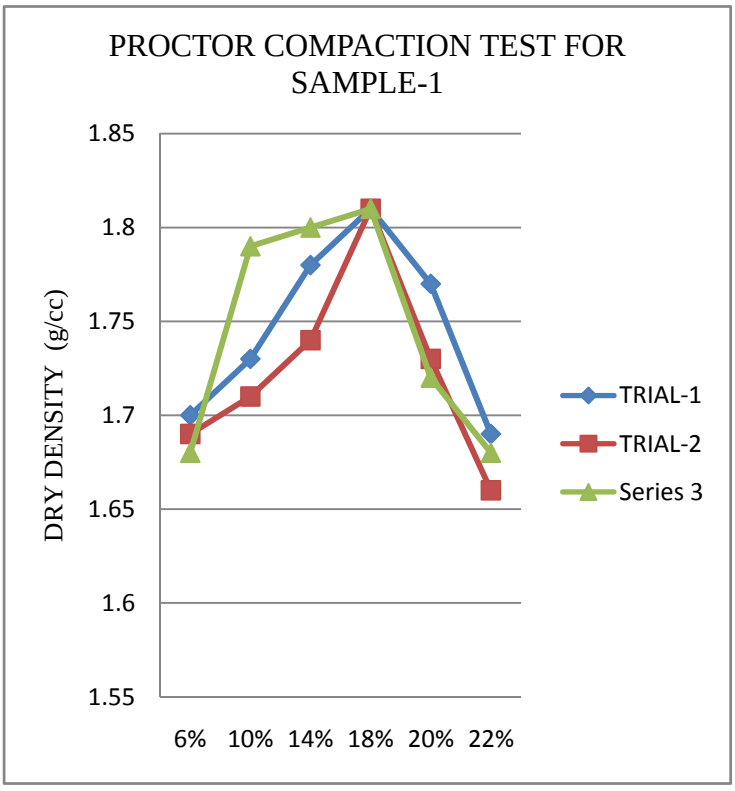
SAMPLE -1	13.35%
SAMPLE-2	18.55%
SAMPLE-3	25.73%

4.Standard Proctor Compaction Test

Standard Proctor Test has been conducted as per IS 2720 Part (XXVIII) 1974. The Dry Density has been determined and has been plotted against the corresponding water Content to find the Optimum moisture Content and the Maximum Dry density. The Three soil samples are taken and three trials are conducted to Standard Compaction Test.

Test Specifications:

Diameter of mould = 10 cm
Height of mould = 12 cm
Empty weight of mould (W_0) = 3959 g
Volume of mould = 942.478 cm^3
Hammer weight = 2.60 kg
Number of blows = 25



Proctor Compaction Test Result

Sample -1	Dry density =2.15 g/cc Moisture content =12%
Sample -2	Dry density =1.81 g/cc Moisture content =18%
Sample -3	Dry density = 1.58 g/cc Moisture content =22%

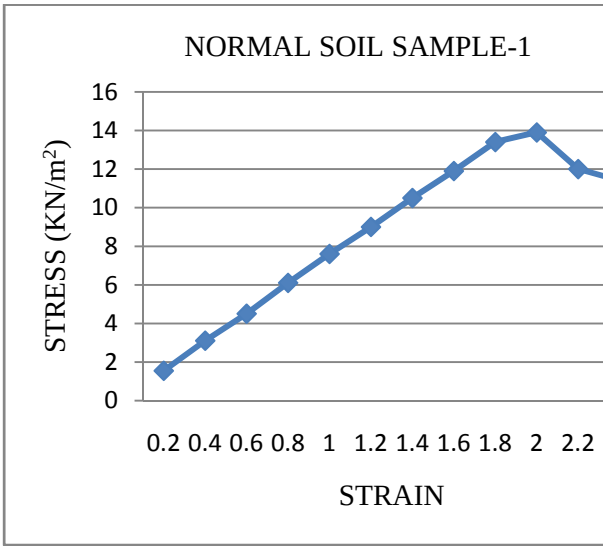
5.Unconfined compression test

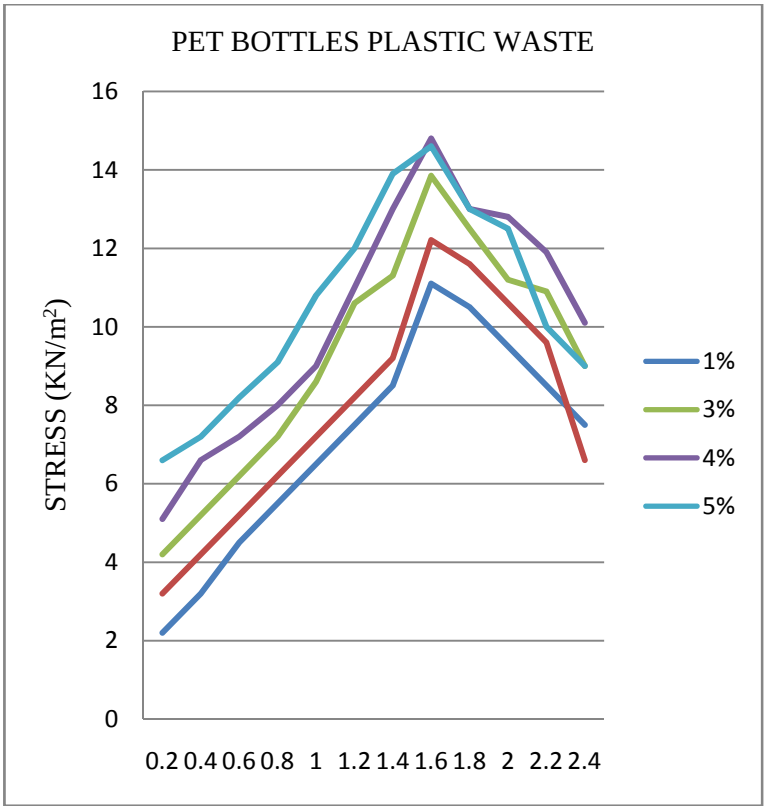
This experiment is used to determine the unconfined compressive strength of the soil sample which in turn is used to calculate the unconsolidated, untrained shear strength of unconfined soil. The Three soil samples are taken and three types of Plastic wastes are used. The UCS tests were conducted on the PET Bottle Plastic Waste, Tea Cups Plastic Waste, Coloured Plastic waste on Clay Soil Sample and the plastics are added on the soil in 1%, 2%,3%,4%,5%.

Test Specification:

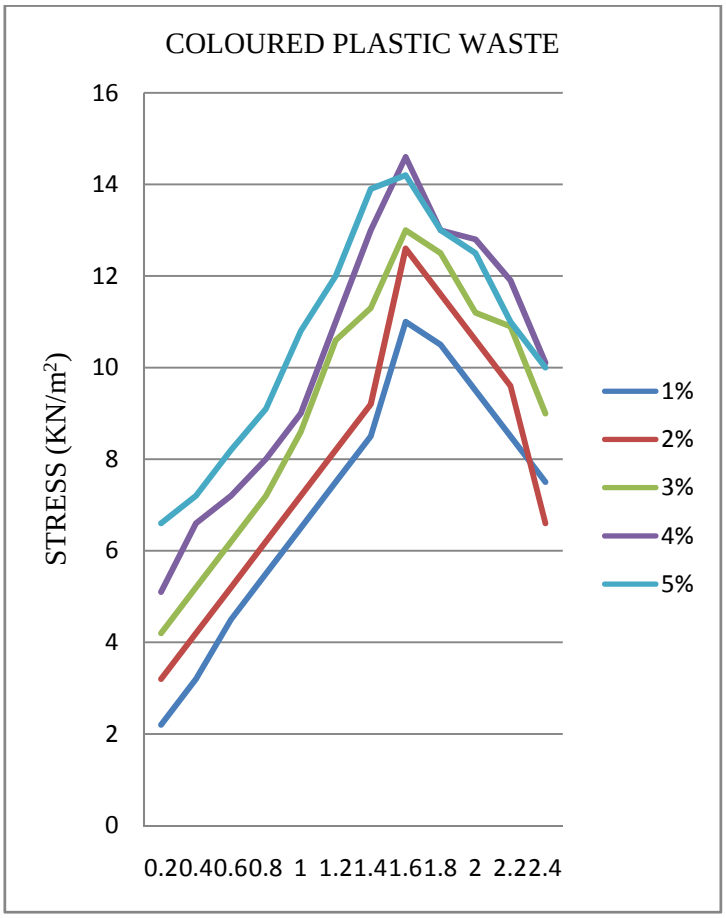
Diameter of specimen = 38 mm
Length of specimen = 76 mm
Area of specimen =(X 38^2)/4

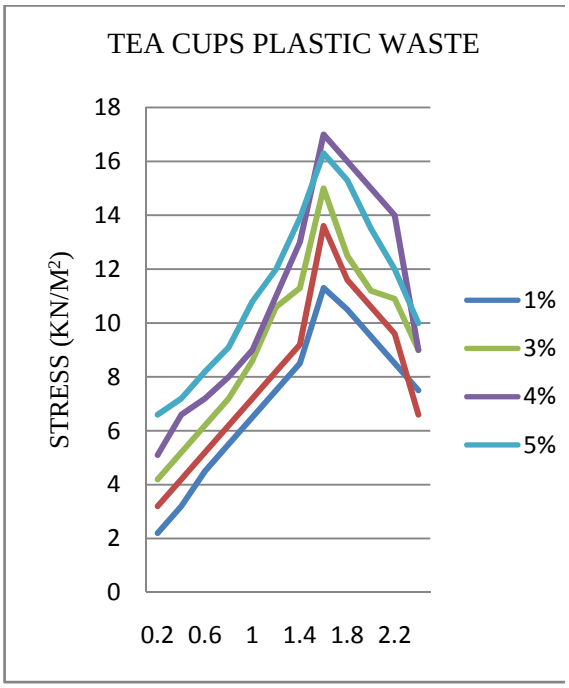
= 11.35 cm^2





X-Direction represented by Strain





UCC TEST RESULTS

UCC STRENTH OF SAMPLE 1 (KN/m^2)	NORMAL	COLOURED PLASTIC					PET PLASTIC					TEA CUPES PLASTIC				
		1%	2%	3%	4%	5%	1%	2%	3%	4%	5%	1%	2%	3%	4%	5%
	14.8	11.9	12	12.6	**14.9**	14.7	11	12.2	13	**14.8**	14.6	11	12.2	13.3	**18.9**	18.3
UCC STRENTH OF SAMPLE 2 (KN/m^2)	11.1	16.5	17	30.5	**32.5**	31.9	25	26	29	**39.9**	39.5	24	25.9	29.3	**32**	31.5
UCC STRENTH OF SAMPLE 3 (KN/m^2)	14.9	23	25	**32.8**	32.6	31.6	32	34.3	34	**34.5**	33	23	19.8	24.3	**26.6**	25.3

CONCLUSION

From the above work the conclusions are given below

From Coloured plastic waste:

By addition of 4% of coloured plastic waste there is a increase in shear strength of 14.9 KN/m^2 of soil and for sample-2 the shear strength increases up to 14.8 KN/m^2 and for sample -3 the shear strength increased up to 18.9 KN/m^2 only.

From PET plastic bottles:

By addition of 4% of PET bottles plastic waste the shear strength increase up to 32.5 KN/m^2 by adding 4% of PET bottles plastic waste and for sample-2 they also have an increase in shear strength up to 39.9KN/m^2 and for sample-3 the shear strength also increased up to 34.5 Kn /m^2 .

From Tea cup plastic waste:

By addition of 3% of tea cup waste the increase in shear strength of 32.8 KN/m^2 has been achieved, and for sample-2 it has been increased up to 34.5 KN/m^2 for 4% of plastics, and for a sample -3 shear strength has increased upto as 26.6 KN/m^2 only for 4% of tea cups plastic waste.

From the above work it has been concluded that addition of 4% PET bottle plastic waste can improve the shear strength of the soil sample up to 39.9KN/m^2 which is the maximum value obtained .So, from this we can suggest that 4%. PET bottle plastic waste can be mixed with the soft soil to get maximum supporting strength of soil in the foundations for the building.

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