USE OF PLASTIC AS SOIL STABILIZER

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Abstract - *Using plastic bottles as soil stabilizer is an economical method because there is no good soil for embankments. This project includes detailed research on the use of waste plastic bottles in soil stabilization. The analysis is done by performing various tests on soil samples consisting of sand and clay using plastic strips. Comparison of experimental results shows that the proportion of soil structure increases with the increase of plastic material. The ideal percentage of plastic strips in the soil was found by the California Bearing Ratio Test and a direct evaluation was made based on the percentage. The size and content of waste plastic bottle strips have a significant impact on the development of soil energy.*

Key Words: Soil Stabilization, CBR, Plastic fibers.

1.INTRODUCTION

Manage compaction, proportion and/or add necessary materials or stabilizers so the soil can be built up. The principles of soil stability are: evaluating the properties of the given soil, determining the nature of the soil's potential, and choosing a good method and maintaining soil stabilization. Stabilized soil mixture is designed to provide the desired stability and durability values. Stabilization can increase the shear strength of the soil and/or control the shrinkage-swelling properties of the soil, thereby increasing the load-bearing capacity of the subgrade to support the pavement and foundation. Environmental problems. They now block landfills and waterways, clog drains, disrupt ecological cycles and create an unsightly environment. This situation causes great harm to animals, plants and human life. Polyethylene terephthalate (PET) bottles are plastic medicine bottles with high usage costs. They are used in packaging water, soft drinks, soup and many other beverages. As demand increases, their maintenance becomes increasingly difficult. It takes a long time (more than a century) for waste PET bottles to decompose in nature. Recycling and using these plastic bottles to stabilize expanded clay is a move in the right direction and makes the construction industry a suitable candidate as it can be consumed in large quantities. It would be a good choice to eliminate and protect the environment by disposing of plastic bottles.

2. OBJECTIVES

- The main purpose of this study is to identify ground equipment that uses plastic bottle waste products and the environment while supporting the soil understand.
- The agent can increase the shear and tensile strength CBR value of the soil.
- To improve load carrying capacity of soil Using plastic strips and lime as a stabilizer which increases shear, tensile strength CBR value of the soil.

3. MATERIALS

1. Plastic in shredded form.

2. Sandy soil taken from Pondy Marina

3. Clayey soil taken from Thiruchitrambalam koot Road

4. METHODOLOGY

4.1 **Sieve Analysis**:

Soil sieve analysis, also known as particle size analysis testing, determines the percentage of each particle size in a soil sample. The results of this testing can be used to create particle size distribution curves that help classify soils and predict their behavior. This test is performed using a series of metal mesh sieves with graduated mesh sizes. Pour the heavy soil into the upper sieve with the largest mesh opening, with a smaller opening than the upper sieve on each side. The column is then placed in a mechanical shaker and shaken for a while to expose all the material to the sieve hole. Measure the contents of each sieve after shaking. The results of sieve analysis can be used to determine suitability for design, production control and specific applications. Parameters of sieve analysis play an important role in soil such as permeability and consistency. It is usually expressed as the ratio of soil density to water density at standard temperature and pressure.

4.2 **Specific Gravity:**

Measure the weight of the empty mold with the base plate under test with a standard measuring tool. Specific gravity can be used to determine the concentration of different minerals in soil samples and to classify soils for engineering purposes.

The specific gravity of soils can vary widely depending on the composition and structure of the soil.

4.3 **California Bearing Ratio:**

The California Bearing Rate (CBR) test is a test used to measure the strength of sub-grade soil and foundation materials. It is used to determine the thickness of the material required for construction projects such as highways, airport runways, parking lots and other roads. This test compares the resistance of the test sample to the resistance of a standard fine gravel material sample. The CBR test pressure should be input into the soil sample with a plunger and then divide the test pressure by the required pressure to ensure the stability of the concrete material. This rate is usually determined based on 2.5 and 5 mm penetration.

4.4 **Direct Shear Test:**

CBR pressure gauge should be inserted into the soil sample with a plunger and then divide the gauge by the pressure required to ensure the stability of the concrete material. This rate is usually determined based on 2.5 and 5 mm penetration. Remove the soil from the mold and add 3% water by weight of the soil. This test involves placing the soil sample in a shear box consisting of two steel plates, two porous stones, two screws, a tamping disc and a lid. The shear box can be round or square, and the horizontal direction of the structure is limited. A stress limit is then applied vertically to the sample and the top ring is pulled laterally until the sample fails or exceeds a specification. The applied load and induced strain data are recorded sequentially to determine the stress-strain curve for each stress limit.

Therefore, using these plastic wastes for various construction purposes is a real solution to manage them effectively while promoting environmental sustainability.

RESULTSAND DISCUSSION

Table -1: Sieve analysis (sand)

Sl no.	Sieve Size	Wt. retained (g)	%wt. retained (g)	Cum% retained	Cum% passing
1	4.75 mm	23.2	2.32%	2.32%	97.68%
2	2.36 mm	36.6	3.66%	5.98%	94.02%
3	1.18 mm	51.9	5.19%	11.17%	88.83%
4	600µ	113.3	11.33%	22.5%	77.5%
5	300µ	588.9	58.89%	81.39%	18.61%
6	150µ	128.6	12.89%	93.95%	6.05%
7	PAN	60.5	6.05%	100%	0%

Table -2: Sieve analysis (clay)

Sl no.	Sieve Size	Wt. Retd. (g)	%wt. Retd.(g)	Cum% retd.	Cum% passing
1	12 mm	96	9.6	9.6	90.4
2	10 mm	85	8.5	18.1	81.9
3	6 mm	150	15	33.1	66.9
4	4.75 mm	94	9.4	42.5	57.5
5	2 mm	150	15	57.5	42.5
6	600 µ	100	10	67.5	32.5
7	425µ	80	8	75.5	24.5
8	300µ	60	6	81.5	18.5
9	150µ	90	9	90.5	9.5
10	75µ	70	7	97.5	2.5
11	PAN	25	2.5	100	0

Table -3: Specific Gravity (sand)

Wt. of empty bottle (W1)	670g
Wt. of bottle +soil (W2)	1170g
Wt. of bottle +soil +water (W3)	1900g
Wt. of bottle +water (W4)	1575g
Specific Gravity	2.86

Table -4: Specific Gravity (clay)

Wt. of empty bottle (W1)	620g
Wt. of bottle +soil (W2)	820g
Wt. of bottle +soil +water (W3)	1450g
Wt. of bottle +water (W4)	1340g
Specific Gravity	2.20

Table -5: CBR (sand)

Penetration	0% plastic	1% plastic	2% plastic	3% plastic
0.5	3.83	5.76	6.38	7.54
1	6.38	7.54	8.94	10.68
1.5	8.94	10.6	11.5	15.45
2	11.5	12.87	14.05	19.63
2.5	12.78	14.05	19.16	23.03
5	24.28	28.15	35.78	42.39

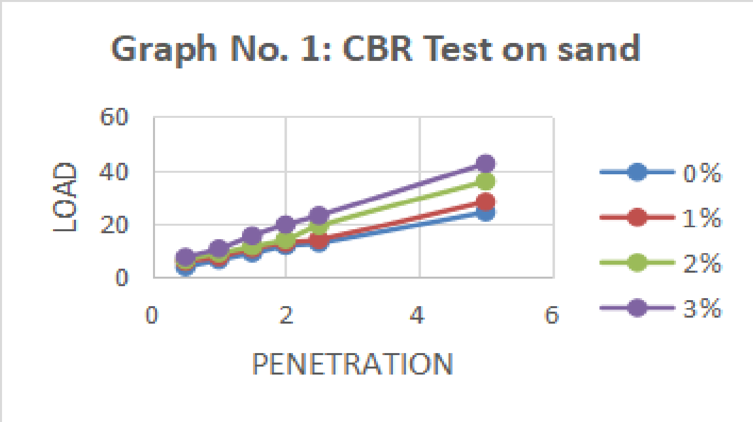


Table -6: Variation of CBR value with plastic (sand)

S no.	Plastic conc. %	CBR (2.5 mm pen.) %	% inc. (2.5mm)	CBR (5 mm Pen.) %	% inc. (5mm)
1	0	0.93	0	1.18	0
2	1	1.02	9.67	1.37	16.1
3	2	1.39	49.46	1.74	47.46
4	3	1.68	70.64	2.06	74.57

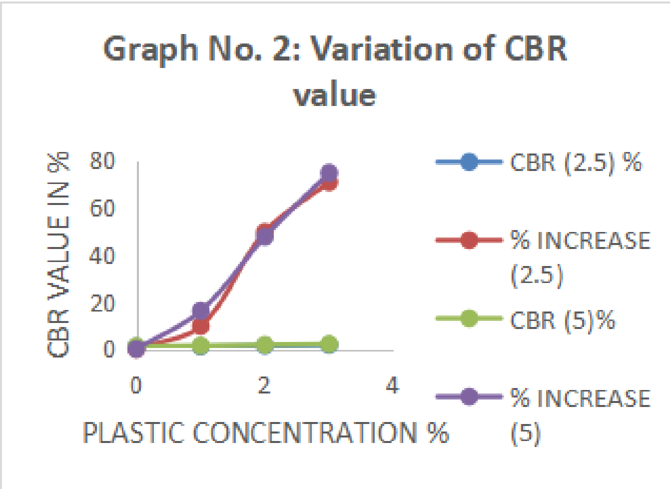


Table -7: CBR (clay)

Penetration	0% plastic	1% plastic	2% plastic	3% plastic
0.5	5.7	7.3	5.7	5.6
1	7.3	12	7.3	10.6
1.5	10.6	15	12	12
2	12	19	15	15
2.5	15	22	22	22
5	29	34	34	42

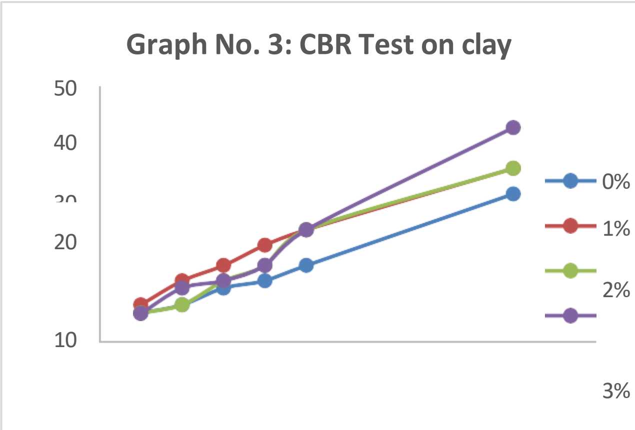


Table -8: Variation of CBR value with plastic (clay)

S no.	Plastic conc. %	CBR value 2.5 mm pen.	% inc. (2.5mm)	CBR value (5mm) pen.	% inc. (5mm)
1	0	1.16	0	1.41	0
2	1	1.54	32.76	1.93	36.87
3	2	1.67	43.96	2.13	51.06
4	3	1.87	61.2	2.35	66.67

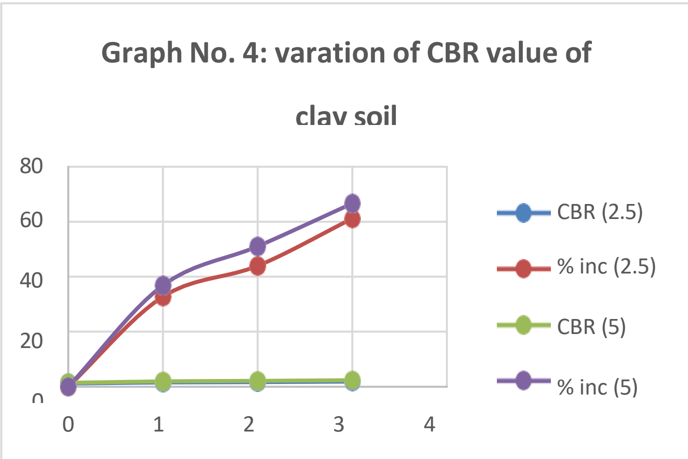


Table -9: Direct Shear Test (sand)

S NO.	Normal stress	Max. shear 0% plastic	Max. shear 1% plastic	Max. shear 2% plastic	Max. shear 3% plastic
1	5	8.34	15.52	33.42	36.48
2	10	9.10	18.88	38.14	40.98
3	15	9.57	19.92	40.30	42.11

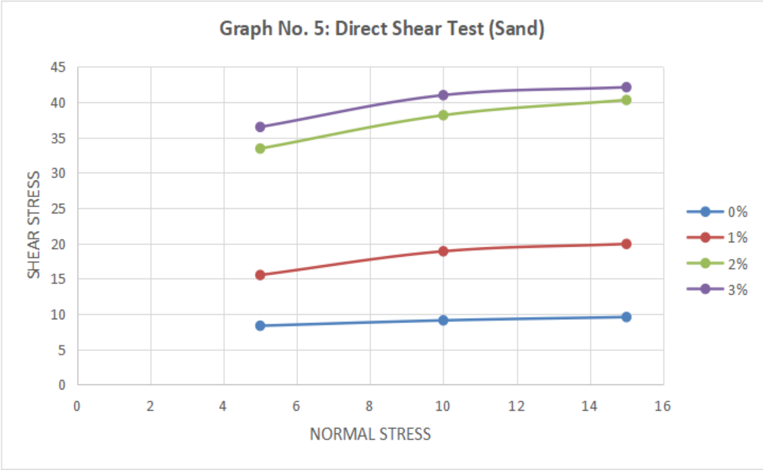
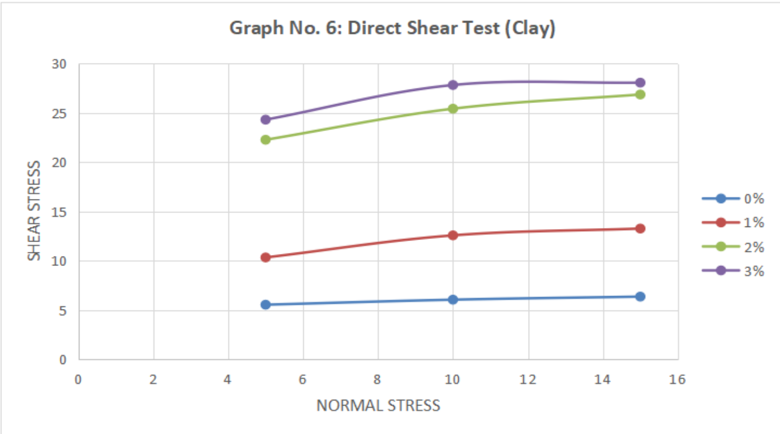


Table -10: Direct Shear Test (clay)

S N O.	Normal stress	Max. shear 0% plastic	Max. shear 1% plastic	Max. shear 2% plastic	Max. shear 3% plastic
1	5	5.56	10.35	22.28	24.32
2	10	6.07	12.59	25.43	27.83
3	15	6.38	13.28	26.87	28.07



3. CONCLUSIONS

Therefore, using these plastic wastes for various construction purposes is a real solution to manage them effectively while promoting environmental sustainability. Soil samples (sand and clay) were collected from Pondi Marina and Thiruchitraambalam Koot roads. Strength and shrinkage tests were performed on sand samples and clay samples with plasticity content1%, 2% and 3%. A test such as sieve analysis, gravity, California Transport Rate and direct shear were performed on the above soil samples. The results of the above test are as follows: -

- The fineness modulus obtained after performing Sieve Analysis on sandy soil is : 3.17.

The fineness modulus obtained after performing Sieve Analysis on clayey soil is : 6.73.

- The result obtained after performing the Specific Gravity test on sandy soil is : 2.86 The result obtained after performing the Specific Gravity test on clayey soil is : 2.20

- The result obtained after performing CBR test on soil sample (sandy soil and clayey soil) upto 3% of plastic content suggests that as the plastic content of the soil increases , the CBR value of the soil also increases.

- The result obtained after performing Direct Shear test on soil sample (sandy soil and clayey soil) upto 3% of plastic content suggests that as the plastic content of the soil increases , the shear value of the soil also increases.

As the shear value of the soil increases, the plastic content of the soil increases and the shear value of the soil also increases. The other way, transforming plastic waste into reliable construction materials can also be seen as a sustainable solution.

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