International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

EFFECT OF RANDOMLY MIXING OF WASTE PLASTIC CEMENT BAG STRIPS

Priyanka Konar[1], Satanuka Das[2], Subham Paul[3], Joyanta Maity[4]

[1,2,3] *B.Tech. student, Dept. of Civil Engineering, MSIT, Kolkata-150*
[4]*Assistant Professor, Dept. of Civil Engineering, MSIT, Kolkata-150.*

Abstract - *For the Large-scale construction of flexible road, requirement of good material in sub-grade is enormous. But due to unavailability of good soils, some strengthening elements are needed to increase the strength of weak clayey soil. In such conditions, clayey soil mixed with randomly distributed waste plastic cement bag strips can be used to increase strength and decrease deformability in road construction in a cost- effective manner. This paper presents the stabilization of clayey soil using randomly distributed waste plastic cement bags strips of length of1cm, 2 cm and 3cm with varying percentages of 0.1%, 0.3%, 0.4%, 0.5% and 0.6% by weight of clayey soil. Compaction tests and CBR tests have been conducted to investigate the behaviour of clayey soil mixed with randomly distributed waste plastic cement bag strips. From the test results, it has been observed that with the increase in percentage of waste plastic cement bag strips in clayey soil, maximum dry density decreases whereas optimum moisture content increases. Further, the CBR (California Bearing Ratio) values have been increased with increase in percentage of waste plastic cement bag strips up to certain limit and then decreases with further addition of it.*

Key Words: *Cost-effective, waste plastic cement bag, maximum dry density, optimum moisture content, CBR values.*

1. INTRODUCTION

In the present day, due to scarcity of good soil, the weak soils cannot be eliminated and must be used to make it capable enough to bear the incomings loads and external pressure. Thus stabilization of soil is an important task to be done before a construction is started. Use of plastic and its effect in the environment has made the use of this material in an ambiguity. It has become one of the major problems for the environment. The use of plastic has to be limited by now otherwise there would be harsh circumstances that human and environment has to face in near future. It is the fact that we can reuse the plastic and make it usable for number of times so that its wastage will be reduced remarkably. These steps are still in progress but this only hasn't been able to paced up as per expectation because the use of this materials has increased in such a way that it is very difficult to limit them instead the alternative for those must be identified and process must be taken accordingly. Stabilization was coined as to make anything in a stable condition which itself is a challenging task and improvement of anything in particular stabilization of soil by increasing the bearing ratio of the soil with the aid of the plastic material which is being used up for the soil. There are different researches going on for incorporating the waste to the soil and stabilized the soil and various good outputs are being reflected back which can have tremendous positive outcomes. The waste cement plastics bag in all construction sites, can be used as an soil stabilizing agent which would be economical and effective implementation in engineering field. Recently, many expensive methods for the stabilization process are carried on such as geo synthetic materials and other techniques. So, this technique can be replaced by the reinforcement with waste plastic cement bag strips which will make the construction process economical. The feasibility of reinforcing soil with strips needs a detailed study pertaining to its use in real life problems is still quite high. In this paper, compaction and strength character tics of clayey soil mixed with waste plastic cement bag strips have been discussed.

2. REVIEW OF PAST WORKS

The mixing of randomly distributed fibers to improve the engineering properties of soil is now well accepted practice in different civil engineering construction, probably started from the beginning of construction of mud shelter houses in early days of civilization at many places of the world. Inclusion of randomly distributed synthetic fibers in compacted fine grained soils is reported to cause generation of greater strength and toughness (Freitag, 1986). Even in sand, fiber stabilization technique has been introduced for air field and road construction. Laboratory and field studies to quantify the effects of numerous variables on the performance of fiber stabilized sand layers where sand was mixed with fibers randomly, had shown improvement in load carrying capacity, and improvement is shown to depend on material of fiber, aspect ratio of the fiber included etc. (Santoni et al 2001). Kumar and Singh (2008) reported on the basis of large number of tests, that there is manifold increase in CBR value when randomly distributed polypropylene fibers are used in compacted fly ash or compacted soil mixed with fly ash. Sreedhar et al (2009) reported experimental study on effect of including geotextile fibers in dry sand as random distributed. They observed phenomenal improvement on CBR value of sand when mixed randomly with such fiber of all length of different aspect ratios.

3. MATERIALS AND METHODOLOGY

3.1 MATERIALS USED

A. SOIL: Locally available clayey soil collected from Uchhepota, near Kolkata, West Bengal, was used in this experimental study. As per I.S. Classification (IS 1498, 1970), the soil is classified as "ML" (Inorganic low compressible

silt). The physical properties of soil as determined in the laboratory are given in Table 1

TABLE 1: Physical Properties of Soil

PROPERTIES	VALUES
IS Classification	ML
Specific Gravity	2.34
Liquid Limit (%)	34.00
Plastic limit (%)	24.25
Plasticity Index	9.75
Maximum Dry Density (gm/cc)	1.68
Optimum moisture content (%)	15.6
Unsoaked CBR (%) at OMC	2.94

B. WASTE PLASTIC CEMENT BAG STRIPS

Waste cement bag were collected from a nearby construction site for using in experimental program and processed by cutting into small pieces of 1 cm, 2 cm and 3 cm length. Waste plastic cement bag strips were randomly mixed with the soil with various percentages of 0.1%, 0.3%, 0.4%, 0.5% and 0.6% by weight of dry soil. The mixture of soil and plastic was done thoroughly with requisite moisture content.

3.2 METHODOLOGY

In this study, the effect of inclusion of randomly distributed waste plastic cement bag strips on compaction and strength characteristics of cohesive soil have been investigated. The cement plastic bags are cut in length of 1cm and mixed randomly with clayey soil in different proportion of 0.1, 0.3, 0.4, 0.5 and 0.6% by weight of clayey soil. Standard Proctor and unsoaked CBR tests have been conducted as per relevant I.S. code provision.

4. RESULTS AND DISCUSSIONS

Standard Proctor and unsoaked CBR tests have been conducted in this study for cohesive soil mixed with varying percentages of waste plastics cement bag strips. The strips have been cut in 1cm length and mixed with clayey soil in different proportion of 0.1, 0.3, 0.4, 0.5 and 0.6%. The test result of Standard Proctor and unsoaked CBR test are given in Table 2.

TABLE 2: Experimental Test Results

PLASTIC LENGTH (cm)	PERCENTAGE OF PLASTIC (%)	SOIL		
		MDD (g/cc)	OMC (%)	CBR (%)
NO PLASTIC	0	1.68	15.6	2.94
1	0.1	1.671	15.7	3.91
	0.3	1.670	15.9	4.62
	0.4	1.669	16.3	5.28
	0.5	1.66	17.1	6.07
	0.6	1.656	17.8	5.76
2	0.1	1.67	15.8	4.11
	0.3	1.669	16.1	5.14
	0.4	1.668	17.1	5.98
	0.5	1.663	17.5	6.58
	0.6	1.654	18	6.26
3	0.1	1.667	15.8	4.02
	0.3	1.664	15.9	4.83
	0.4	1.661	16.2	5.72
	0.5	1.656	16.8	6.35
	0.6	1.65	17.1	6.12

4.1 Standard Proctor Test:

The Standard Proctor test has been conducted as per IS 2720 (Part-VII) on cohesive soil- waste cement plastics bag strips mix composites to determine optimum moisture content (OMC) and maximum dry density (MDD). The cohesive soil is mixed with randomly distributed plastic cement bag strips of length of 1 cm in varying percentages of 0.1, 0.3, 0.4, 0.5 and 0.6 %. The OMC and MDD values obtained from the standard Proctor test are given in table 2 and variation of MDD and OMC with percentage of waste cement plastics bag strips are shown in Fig. 1 and 2 respectively.

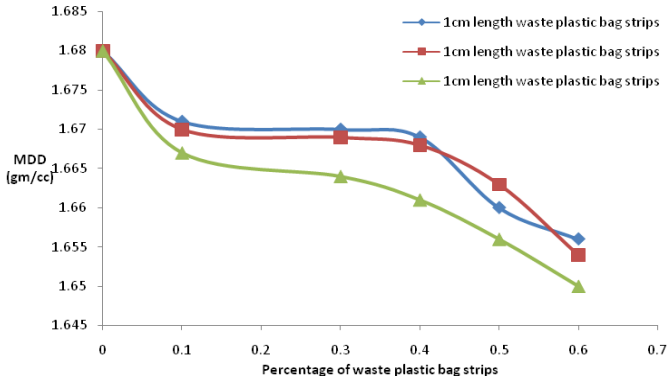

Fig. 1 Variation of MDD with different percentage of waste plastic cement bag strips

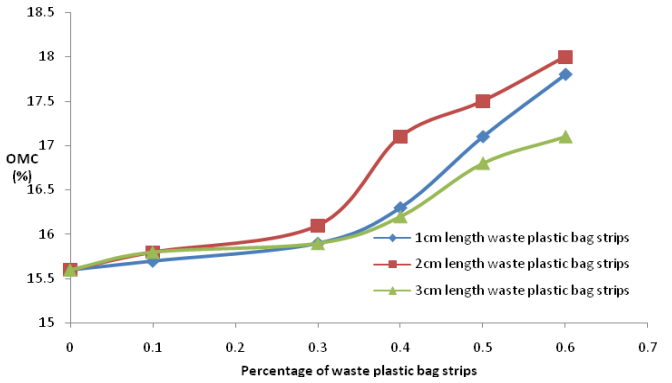

Fig. 2 Variation of OMC with different percentage of waste plastic cement bag strips

From the figures, it has been observed that the maximum dry density of plastic mix soil decreases with increase of percentage of plastic strips, whereas, the Optimum Moisture Content of plastic mix soil decreases with increase in percentage of waste plastic cement bag strips in soil as shown in chart 2.

4.2 California Bearing Ratio (CBR) Test:

Laboratory unsoaked CBR test has been carried out on cohesive soil- waste plastic cement bag strips mix composites as per IS 2720(Part-16), 1979. The cohesive soil is mixed with randomly distributed plastic cement bag strips of length of 1 cm in varying percentages of 0.1, 0.3, 0.4, 0.5 and 0.6 %. The CBR values obtained from the laboratory test is given in table 2 and the variation of CBR with percentage of waste plastic cement bag strips are shown in fig. 3.

From the figure, it has been observed that the value California Bearing Ratio (CBR) increases with increase of percentage of plastic strips content up to a certain limit, after that it is decreases and it is maximum at 0.8% of the dry weight of soil. The optimum length of plastic strips inclusion is 2 cm.

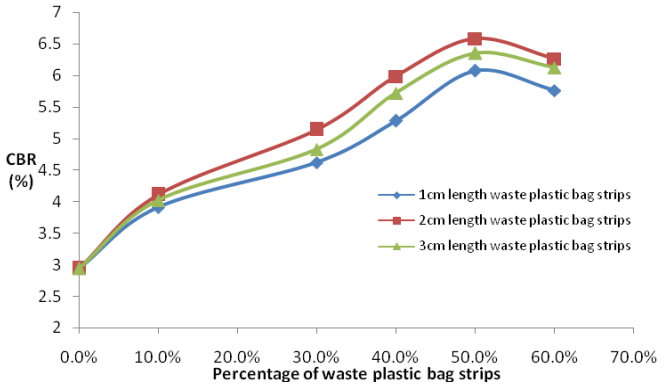

Fig. 3 Variation of CBR with different percentage of waste plastic cement bag strips

5. CONCLUSION

On the basis of the experimental test results, following conclusion may be drawn-

1) With the increase of randomly mixing plastic cement bag strip, the value of MDD decreases whereas the value of OMC increases.

2) There is a considerable increase in the CBR value for clayey soil when mixing with randomly distributed plastic cement bag strips.

3) The maximum CBR value obtained when plastic cement bag strip of 2cm long, are added with 0.5% of the dry weight of soil. Hence, optimum percentage inclusion may be considered as 0.5% of the dry weight of soil and optimum length of plastic strip inclusion is 2 cm.

REFERENCES

[1] Freitag, D. R. 1986. "Soil randomly reinforced with fibers". J. Geotech. Engrg., ASCE, vol. 112, no 8, pp. 823-826.

[2] IS: 2720 (Part VII) – 1980, Methods of tests for soil :Determination of water content- dry density relation using light compaction, Bureau of Indian Standards, New Delhi.

[3] IS: 2720 (Part XVI) – 1987, Methods of tests for soil: Laboratory Determination of CBR value, Bureau of Indian Standards, New Delhi.

[4] Kumar, P and Singh, S.P.(2008) "Fiber-reinforced Flyash subbase in rural roads." Journal of Transportation Engineering (ASCE), 134(4), 171-180.

[5] Ranjan, G., Vasan, R. M. and Charan, H. D. 1996. "Probabilistic analysis of randomly distributed fiber reinforced soil". Journal of Geo-technical and Geo-environmental Engineering (ASCE), vol. 122, no. 6, pp. 419 -426.

[6] Santoni, R.L. and Webster, S.L. (2001) "Engineering Properties of sand-fiber mixture for Road Construction" Journal of Geo-technical and Geo-environmental Engineering (ASCE), 127(3), 258-268.

[7] Sreedhar. et al. (2009) "Investigations on effect of reinforcement in planar and fiber forms on CBR value of sand" Proc. Indian Geotechnical conference, Guntur, (1), 194 – 197.

BIOGRAPHIES

Priyanka Konar, B.Tech. Student, of C.E. Dept., Meghnad Saha Institute of Technology, Kolkata.

Satanuka Das, B.Tech. Student, of C.E. Dept., Meghnad Saha Institute of Technology, Kolkata.

Subham Paul, B.Tech. Student, of C.E. Dept., Meghnad Saha Institute of Technology, Kolkata.

Joyanta Maity, PhD (JU) is Assistant Professor of C.E. Dept., MSIT, Kolkata. His research interests include ground improvement techniques, use of alternative materials and use of natural geo-fibers in Civil Engineering.