Review On Soil Stabilization Techniques

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***Abstract*: The main objective of this study is to investigate the use of waste fiber materials in soil applications and to evaluate the effects of waste polypropylene fibers on strength of unsaturated soil by carrying out different tests, such as direct shear test, unconfined compressive test on soil sample with fibers and without fibers. The results obtained are compared for the two conditions and inferences are drawn towards the usability and effectiveness of fiber reinforcement as a replacement and as a cost effective approach for increasing soil strength. This paper gives a comprehensive report on stabilization techniques for soils.**

***Keywords:* Soil Stabilization, Shrinkage limit, liquid Limits, plastic limit.**

INTRODUCTION

Soil is a material with low strength and markedly affected by water but it can be relatively strong in dry condition. If water is added to clay, it will behave as plastic or flow like liquid. Because of its low permeability, dissipation of excess pore pressure is slow. These soils cause distress and damage to structures founded on them as they show volumetric changes in response to changes in their moisture content. These phenomenons create a lot of problem at construction sites, so the improvement of soil is needed. Both, Lime and fly ash provide an economic and powerful means of chemical improvement, as demonstrated by the dramatic transformation that is evident in their mixing with clay. The addition of lime to soils to improve their use for construction purposes has a very long history. For instance, McDowell (1959) mentioned that stabilized earth roads were used in ancient Mesopotamia and Egypt, and that the Greeks and Romans used soil-lime mixtures. The clay minerals have a high adsorptive capacity for water which leads to the problem of swelling. Mechanism of swelling is complex and is influenced by a number of factors such as the type and amount of clay minerals present in the soil, the specific surface area of the clay, structure of the soil and the valency of the exchangeable caution. When waste fibre material is added into a soil, this result is changes.

LITERATURE REVIEW

Akbar Pashazadeh1 et al (2012)

In this research, the shear resistance parameters of mixture of reinforced sand-kaolinite were determined with random distribution of polyethylene fibers (PEF). All samples were compressed to a certain density and then the direct shear test was done. The dimensions of direct shear set were 10×10×2 cm. Different materials such as sand, Kaolinite and polyethylene were used in the experiments. In these experiments, moisture content, amount of polyethylene (PEF), fiber size and speed of shear stress were variable. Test results show that by increasing fiber ratio the shear resistance parameters of sand-kaolinite mixture increase. Also, in reinforced mixture of sand-kaolinite the shear resistance increases by increasing the speed of shear stress.

Behzad Kalantari (2011)

This article describes a laboratory study on the effect of inclusion of polypropylene fibers (PPF) in cement-stabilized windblown sand specimens. Test specimens were prepared with varying admixtures of ordinary Portland cement content (1%, 3%, 5%, 7% and 10 %) and polypropylene fibers (0.1%, 0.2%, and 0.4%) by the weight of dry soil. Along with index property tests, laboratory California Bearing Ratio (CBR) tests were performed to investigate the strength behavior of fiber-reinforced stabilized windblown sand. The test results indicated that adding fiber inclusions in stabilized windblown sand resulted in higher CBR values. These primary conclusions were obtained from this investigation. First, the inclusion of randomly oriented discrete fibers improved the California bearing ratio of wind-blown sand. Second, an optimum fiber content of 0.2% (by the weight of dry soil) was identified for the stabilization of windblown sand. Finally, the inclusion of PPF in cement-stabilized windblown sand with lower content of cement (1% and 3%) improved the CBR values better than higher cement content (5% and 7%).

Shah Kinjala et al (2012)

Expansive soil reinforced with polyester fibers is a modified method developed in recent years. This paper reports the results of laboratory study performed on expansive soil reinforced with polyester fiber and demonstrates that randomly distributed fibers are useful in restraining the shrinkage tendency of expansive soils. Polyester fibers of 12 mm size having triangular cross section were used. Atterbergs limits of expansive

soil reinforced with varying fiber content (f = 0%, 0.2%, 0.5% and 1%) were studied. The effect of fibers is studied for liquid limit, plastic limit and shrinkage limit.

Rabindra Kumar Kar et al (2012)

Clay soils and their related abnormal behavior such as excessive shrinkage, swelling, consolidation settlement and cracking on drying has been the subject of many investigations. In recent years, an increasing need is being felt for various types of constructions in marginal, low or reclaimed lands and coastal areas which are not suitable normally for construction purposes. Clays, well known for its high compressibility and poor shear strength, pose numerous problems to builders. Previous studies mainly evaluated the effects of additives such as lime, cement and sand on these characteristics of clays. Initial results indicated that the soil characteristics were improved. However, reportedly in many cases, these additives resulted in a decrease in plasticity and increase in hydraulic conductivity. As a result, there has been a growing interest in soil/fiber reinforcement. The present investigation has focused on the impact of short random fiber inclusion on consolidation settlement in compacted clays. To examine the possible improvements in the consolidation characteristics, local clayey soil was reinforced with random distribution of polypropylene (synthetic) and coir (natural) fibers as percentage (0-1% at an increment of 0.2%) of dry weight of soil with 10, 15 and 20 mm lengths. Results indicated that the compression index and coefficient of volume change decrease with inclusion of polypropylene/coir fibers in the soil up to certain fiber content and increase thereafter. The coefficient of consolidation increases with increase in fiber content and fiber length in the range of fibers considered in the investigation. Thus, the time required to achieve primary consolidation decreases for fiber-reinforced soil for a given degree of consolidation and a given drainage path.

G.S. Ghataora et al (2010)

Much research has been undertaken on the use of fibres to reinforce soils for varying range of applications such as adobe bricks and walls and pavements, but little is available on the response of these materials to repeated loading the subgrade soils in road pavement may be subjected to. Thus, with a view on the application of pavement design, an investigation was undertaken to assess the effect of fibre on kaolinite and laterite stabilised with both cement and lime subjected to repeated loading. Crimped monofilament of 12 mm long polypropylene fibre with a diameter of 18 microns was used to reinforce both the soils at concentration of 0.3% stabilized with 4% and 6% of lime and cement. Results show that kaolinite soils reinforced with 0.3% of fibers together stabilized with 6% cement under repeated axial load test deform less than 1% after 3,600 load cycles and could be used in pavement construction. For laterite soils under the worst case scenario conditions of soaking, the samples of plain soil and those stabilized with cement did not have enough strength and collapse before loading. However, reinforced and stabilised, particularly were strong enough after soaking to be used in the upper parts of a pavement.

Krishna R. Reddy (2002)

Soil is one of the most important engineering materials. Determination of soil conditions is the most important first phase of work for every type of civil engineering facility. Soil properties are determined by both field and laboratory test methods. In this course, you will learn several laboratory tests that are very commonly performed to determine different properties of soils. These properties are essential for the design of foundation and earth structures. In this course, different laboratory tests will be conducted to determine the following important index and mechanical properties of soils:

- Water Content
- Organic Matter (Content)
- Unit Weight (Density)
- Specific Gravity
- Relative Density
- Atterberg Limits
- Grain Size Distribution (Sieve Analysis and Hydrometer Analysis)
- Visual Classification
- Moisture-Density Relationship (Compaction)

CONCLUSIONS

This paper presents the research carried out by various authors on stabilization techniques of clayey soil. From the experimental investigations it was inferred that stabilization with fiber materials. It has been verified, by using the shrinkage limit , plastic limit , liquid limit , sp gravity of the ,material , Direct Shear Test, Unconfined Compression Test

REFERENCES

1. ASTM D 854 “Standard test methods for specific gravity of soil solids by water pycnometer”.
2. “Method of Test for Specific Gravity of Soils” published by “Department of Transportation Engineering Service Center, California”.
3. “Test Method for the Determination of the Specific Gravity of Soils” published by “Geotechnical Engineering Bureau”, (April 2007).
4. Akbar Pashazadeh1, Mahmood Ghazavi2 , and Morteza Chekaniazar3 presented in there paper entitled “Experimental study of the effect of polyethylene fibers with random distribution on the

engineering behavior of the mixture of flimsy sand with clay soils" (2011)
5. Behzad Kalantari presented in there paper entitled "Laboratory Investigation on the Effect of Polypropylene Fibers on the CBR of Stabilized Wind-Blow Sand" (2011)
6. Shah Kinjala, A.K.Desaib and C.H.Solankic presented in there paper entitled "Experimental Study On The Atterberg Limit's Of Expansive Soil Reinforced With Polyester Triangular Fibers" published in "International Journal of Engineering Research and Applications" (IJERA) Vol. 2, Issue 4, June-July 2012, pp.636-639.
7. Rabindra Kumar Kar, Pradip Kumar Pradhan, Ashutosh Naik presented in there paper entitled "Consolidation Characteristics of Fiber Reinforced Cohesive Soil" (2012).
8. G.S. Ghataora and U.K. Ling presented in there paper entitled "Behaviour of Fibre-Reinforced And Stabilized Clayey Soils Subjected To Cyclic Loading" published in "Studia Geotechnica et Mechanica", Vol. XXXII, No. 3, 2010.
9. Krishna R. Reddy address on "Engineering Properties of Soils Based on Laboratory Testing". (August 2002)
10. Gopal Ranjan, A.S.R.Rao, 1991 "Basic and Applied Soil Mechanics"
11. Strength and mechanical behavior of short polypropylene fiber reinforced and cement stabilized clayey soil published by Chaosheng Tang Bin Shi Wei Gao Fengjun Chen Yi Cai.
12. Dr. K.R. ARORA, "Soil Mechanics and Foundation Engineering", 2008.
13. B.C. PUNMIA, 2007, "Soil Mechanics and Foundation", Laxmi Publications.
14. Ground Improvement by P. Purushottam Raj
15. B.M. Dass, "Principal of Geotechnical Engineering".
16. Ground Improvement Techniques, December 18-2008,
17. www.engineeringcivil.com
18. www.google.com
19. www.wikeipedia.com

