AN EXPERIMENTAL STUDY ON THE BEHAVIOUR OF KAREWA SOIL BY USING RECRON FIBRE AND FLY ASH

Addil Bashir Sheikh[1], Er Tripti Goyal[2]
[1]M.tech Student, Modern Institute of Engineering & Technology, Mohri (Haryana)
[2]Head of Department, Civil Engineering, Modern Institute of Engineering &Technology, Mohri (Haryana)

Abstract

Soil stabilization is very necessary by the addition of additives in suitable dosages for road pavement foundation because it improves the engineering properties of soil to sustain load carrying capacity in terms of quality and quantity of performance. To overcome the same, many researchers have concentrated their studies on soil stabilization techniques by developing new such materials, through the elaboration of composites. Soil stabilization is the process in which engineering properties of the different type soil is improved. It can be done by the use of controlled compaction, proportioning and addition of suitable different type of admixtures and stabilizers. The stabilization of soil for use in subgrade for pavement is an economical substitute of costly paving materials. Soil stabilization is very necessary for various construction works like road pavement and foundation because it improves the engineering properties of different soil. The main objective of this study is to study the effect of fibers in geotechnical applications. In this study a brief review is prepared on the research work of various authors. This project represents a study of the Recron-3s Fibre as the admixtures or stabilizers in improving some engineering properties soil. This experiment evaluates the effect of the Recron-3s on the some basic engineering properties of these soils such as California Bearing Ratio (CBR) value and Unconfined Compressive Strength (UCS). The different values adopted in the present study for the percentage of fiber reinforcement are 0.3%, 0.6 %, 0.9 %, 1.2 % and 1.5 % and for fly ash is 12 %.

Keywords: Soil stabilization, Unconfined Compressive strength, Recron Fibre, Fly ash

1.1 INTRODUCTION

Stabilization of soil is the way toward shifting the properties of soil to improve its designing properties, with the goal that it very well may be utilized in different works of structural building. The dirt over which the development is to be completed ought to have enough solidarity to convey the structure load, neither should disappointment happen. This issue for the most part happens when development is to be done on Karewa soil. This dirt is viewed as least fortunate material from structural designing perspective. Being volume-less in nature, substitution of soil is not designed answer for handle with the poor soil. Different methods are utilized for improving the built properties of Karewa soil, known as soil adjustment. Improved sub-level soil with higher CBR esteem diminishes the asphalt hull necessities. For instance for configuration traffic of 10 MSA asphalt outside necessity diminishes from 850 mm for sub-grade CBR of 2% to 540 mm for sub-grade CBR of 10%. Stabilization of clayey soils, being weakest with minimum CBR value, can bring economy in highway projects to a great extent.

The stabilisation of soils has been performed for millennia. It was recognized before the Christian era began that certain geographic regions were plagued with surface materials and ambient conditions that made the movement of armies and goods difficult, if not impossible, over the paths between villages and towns. The Mesopotamians and Romans separately discovered that it was possible to improve the ability of pathways to carry traffic by mixing the weak soils with a stabilizing agent like pulverised limestone or calcium. This was the first chemical stabilisation of weak soils to improve their load carrying. Jump forward a few years to the war in Vietnam, the US military were looking for methods for rapid stabilization of weak soils for support of its missions worldwide. Over the past 60 years they had used cement and lime these being the most effective stabilizers for road and airfield applications, but although with careful analysis of ground conditions and the make-up of the existing soils these traditional stabilizers did have a remedial effective. They urgently needed a stabiliser that could be used quickly without having to carry out extensive site tests that would increase the strength of the prevalent soft clay type local soils rapidly to support the landing and take-off of heavy C-17 and C-130 aircraft traffic on their temporary airfields.

1.2 RECRON FIBRE

Recron 3S is changed polyester. It is by and large utilized as execution. Polyester (Recron) fiber utilized for the test having diverse sizes 6mm and 12mm. These filaments were produced using polymerization of unadulterated teraphthalic corrosive and Mono Ethylene Glycol utilizing an impetus. These strands were observed to be generally utilized as a part of solid innovation which has an uncommon triangular cross area and proportional width of fiber was around 32 μm– 55 μm.

Figure 1.1: Recron Fibre

1.3 FLY ASH

Fly ash is the finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chamber by exhaust gases. Fly ash is produced by coal-fired electric and steam generating plants. Typically, coal is pulverized and blown with air into the boiler's combustion chamber where it immediately ignites, generating heat and producing a molten mineral residue. Boiler tubes extract heat from the boiler, cooling the flue gas and causing the molten mineral residue to harden and form ash. Coarse ash particles, referred to as bottom ash or slag, fall to the bottom of the combustion chamber, while the lighter fine ash particles, termed fly ash, remain suspended in the flue gas. Prior to exhausting the flue gas, fly ash is removed by particulate emission control devices, such as electrostatic precipitators or filter fabric bag houses. Fly ash is most commonly used as a pozzolana in Portland cement concrete applications. Pozzolanas are siliceous or siliceous and aluminous materials, which in a finely divided form and in the presence of water, react with calcium hydroxide at ordinary temperatures to produce cementitious compounds.

Figure 1.2: Fly Ash

1.2 LITERATURE REVIEW

Sunilakumar Biradar et al studied the Stabilization of Black Cotton soil By Using Lime And Recron Fibers. Most of the soil available are such that they have good compressive strength adequate shear strength but weak in tension / poor tensile strength. To overcome the same, many researchers have concentrated their studies on soil improvement techniques by developing new such materials, through the elaboration of composites. The main objective of this study is to investigate the effect of fibers in geotechnical applications and to evaluate the strength of unsaturated soil by carrying out compaction tests and CBR tests on two different soil samples. The fibers are cut in lengths of 6mm and mixed randomly with lime-soil mixture in varying percentages (0.50%, 1.00%, 1.5%, 2.0% 2.5% and 3.0%) by dry weight of soil and compacted to maximum dry density at optimum moisture content. The test results indicate a reduction in the maximum dry density and the optimum moisture content of soil due to the addition of Recron fiber. It also indicates an improvement in the CBR value.

Vishala V. Pandor et al studied the Stabilization of Black Cotton Soil Using Chemical Additive. The Black cotton soil is very hard when dry, but loses its strength completely when in wet condition. In this work, BC Soil was tested using two different stabilizing agents - Terrasil & Lime. Investigation includes evaluation of grain size distribution, Atterberg's Limit, Maximum Dry Density, Optimum moisture content, CBR value and UCS value of Black cotton soil Specimens with and without stabilizers for a curing period. In the present study, terrasil has been used for stabilization of black cotton soil. Lime also been used as stabilizer to improve the CBR value of clayey soil. The test is carried out to determine the Atterberg's Limits, compaction test, CBR value of soil with and without stabilizers for a curing period.

YSV Ganesh et al studied the Geotechnical Properties of Lime Stabilized Expansive Soil with Recron-3S Fibre. The properties of the black cotton soils can be altered in many ways viz. mechanical, thermal and chemical means. Therefore, soil stabilization techniques are necessary to ensure the good stability of soil so that it can successfully sustain the load of the superstructure especially in case of soil which is highly active; also it saves a lot of time. In the present work, an attempt has been made to study the compaction, unsoaked and unsoaked CBR and unconfined compressive strength characteristics tests of black cotton soil mixing with different percentages of lime and Recron-3s Fibre with a view to determine the optimum percentage. Test results shows that stabilizing black cotton soils with lime and imparting Recron 3s fibers enhance the strength.

Gaurav Gupta et al studied the Effect of Fibre Length on Polyester Fibre Reinforced Clay. A series of California Bearing Ratio tests were conducted to study the effect of fibre length on polyester fibre reinforced soil with an idea of upgrading the engineering behavior of clayey soil as a subgrade layer of road. A total 66 California bearing Ratio tests and 21 modified proctor tests were performed. Polyester fibres of 6 mm and 12 mm length were used. Test specimens were prepared with varying percentages of 6 mm and 12 mm polyester fibre (non-reinforced, 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%, 0.9% and 1.0%) by the weight of dry soil. For each fibre content and fibre length, 3 samples were prepared for California Bearing Ratio test and an average value was calculated. Modified proctor test was carried out to know the maximum dry density and optimum moisture content for each fibre content. For 6 mm fibre in clay, highest average value of soaked CBR, 4.62% and unsoaked CBR, 17.50 % was obtained at 0.1% fibre content. For 12 mm fibre in sand, highest average value of soaked CBR, 4.84 % and unsoaked CBR, 17.50 % was obtained at 0.4% fibre.

1.3 EXPERIMENTAL MIXES

The test will be conducted on the following mix samples:

1. **Mix 1-** Karewa Soil (100 %)
2. **Mix 2** - Karewa Soil (87.7%) +Fly ash (12%) +recron-3s (0.3%)
3. **Mix 3** - Karewa Soil (87.4%) +Fly ash (12%) +recron-3s (0.6%)
4. **Mix 4** - Karewa Soil (87.1%) + Fly ash (12%) + recron-3s (0.9%)
5. **Mix 5** - Karewa Soil (86.8 %) +Fly ash (12%) +recron-3s (1.2 %)
6. **Mix 6** - Karewa Soil (86.5%) +Fly ash (12%) + recron-3s (1.5%)

1.4 STANDARD PROCTOR TEST

The optimum moisture content and the maximum dry density of the soil samples for various percentages of Recron Fibre (0, 0.3, 0.6, 0.9, 1.2, and 1.5 %) and 12 % Fly ash were determined by performing the Standard Proctor's test. The dry density was determined and plotted against the corresponding water content to find the optimum moisture content and the corresponding maximum dry density.

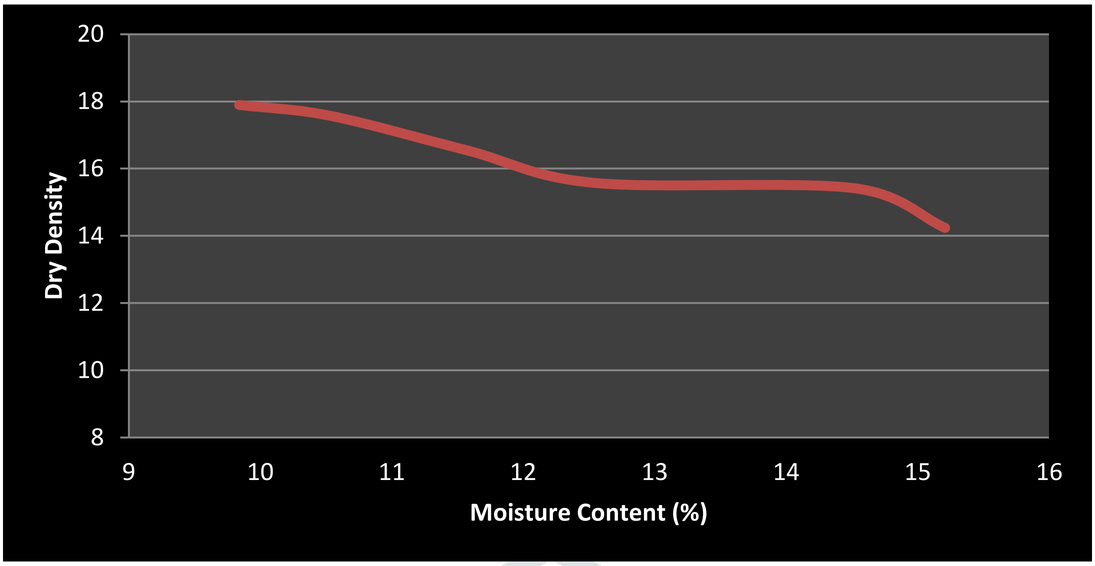

Fig 1.3: Relationship between Moisture content and Dry Density

1.5 DIRECT SHEAR TEST

The test was conducted on the soil sample with various percentages of Recron Fibre (0, 0.75, 1.5, 2.25 and 3 %). The values of cohesion and angles of internal friction for various percentage of Recron Fibre are tabulated in Table 4.6. The figure 4.2, 4.3 and 4.4 show the variation of Cohesion, angle of internal friction and Maximum shear stress for various percentage of Recron Fibre.

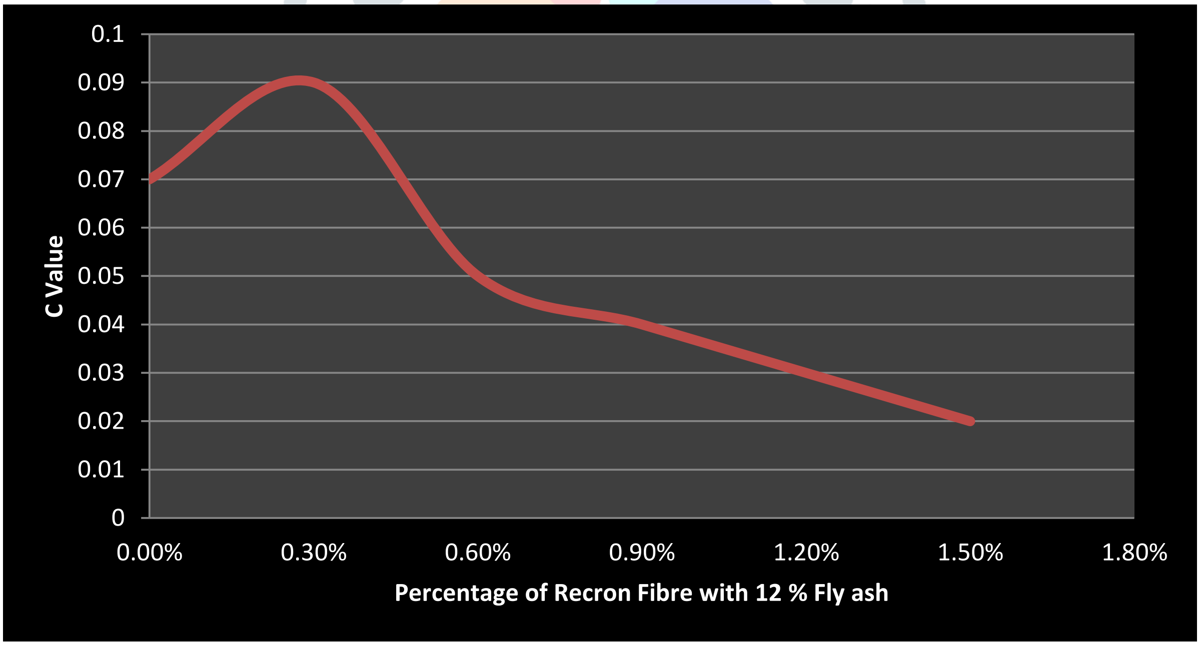

Fig 1.4: Cohesion Vs % of Recron Fibre

1.6 UNCONFINED COMPRESSION TEST

The unconfined compressive strength is the load per unit area at which the cylindrical specimen of a cohesive soil falls in compression and by plotting the axial stress and strain in the graph, following unconfined strengths are computed as per reinforcement

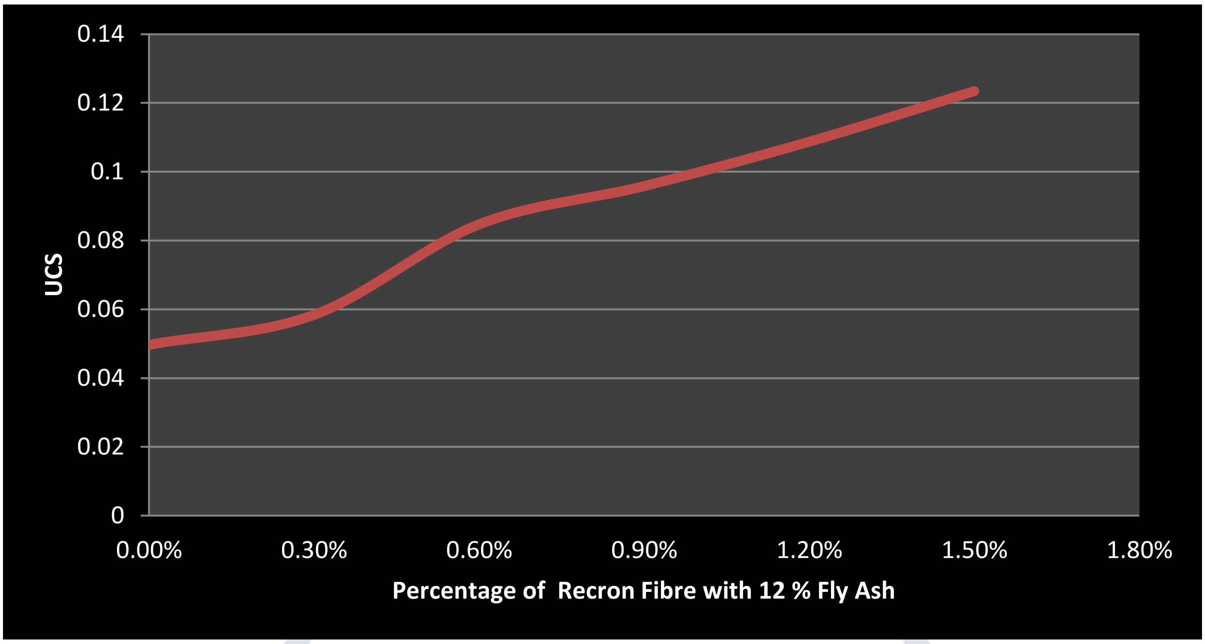

Fig 1.5: Relationship between UCS and Fibre content

CONCLUSION

1. The maximum dry density decreases and Optimum moisture content increases with the increase in the fibre content in the soil mix.
2. The optimum mix is mix 4 containing 12 % fly ash and 0.9 % Recron Fibre.
3. The maximum shear stress is achieved as 0.574 by mix 3 containing 0.6 % Recron fibre with 12 % Fly ash
4. Strength of soil can be increased to the certain extent by using additive materials in soil. Especially Recron 3s, when mixed with soil gives a wonderful result.
5. The angle of internal friction (**Φ**) increases considerably with inclusion of different percentages of Recron Fibre for sandy and clayey soils but the percentage of increase in the angle of internal friction for sandy soil is slightly more than that for clayey soil.
6. Fiber absorbs everything and keeps the road surface intact and many problems can be solved like potholes, cracking & failure of pavement.
7. From the arrangement of standard delegate tests directed, we found that the OMC of the strengthen soil increments with the pickup of the fiber content.

REFERENCES

1. Sunilakumar Biradar, "Stabilization of Black Cotton Soil By Using Lime and Recron Fibers", International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 4, Aug-Sept, 2014, ISSN: 2320 – 8791.
2. Vishala V. Pandor, "Stabilization of Black Cotton Soil Using Chemical Additive", International Journal for Scientific Research & Development| Vol. 5, Issue 02, 201.

3. Tripti Goyal et al, "Experimental study of clayey soil stabilized with fly ash and recron-3s", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 10 , Oct 2018
4. D Vasudev, Performance studies on rigid pavement sections built on stabilized sulfate soils, Msc thesis, University of Texas at Arlington, 2007.
5. H.P Singh and M Bagra, Improvement in CBR value of soil reinforced with jute fiber, International journal of Innovative research in science, engineering and technology, Vol.2 Issue 8, 2013.
6. Amin Chegenizadeh and Hamid Nikraz, CBR test on fibre reinforced silty sand, International Journal of Structural and Civil Engineering, Vol. 1 Issue 3, 2012.
7. Physical and Chemical properties of Recron 3S fibre, www.ril.com, 2011.
8. P.V.KOTESWARA RAO, "Performance of recron-3s fiber with cement kiln dust in expansive soils", International Journal of Engineering Science and Technology (IJEST), ISSN: 0975-5462 Vol. 4 No.04 April 2012.
9. Nandan A. Patel, "Mapping the Improvement of Soil Strength Using Recron-3s Fibers", International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064.
10. Prof. R. K. Sharma, "Subgrade Characteristics of Locally Available Soil Mixed With Fly Ash and Randomly Distribution Fibers", ICEES, March 2012.
11. Azhani Zukri, "Peaken Soft Clay Treated with Hydrated Lime as a Method of Soil Stabilizer" Sciverse Science Direct, Procedia Engineering 53 (2013) 37-41, 2013.
12. Jyoti S. Trivedi, Sandeep Nair, Chakradhar Iyyunni, "Optimum Utilization of Fly Ash for Stabilization of Sub-Grade Soil using Genetic Algorithm" Sciverse Science Direct, Procedia Engineering 51(2013) 250-258, 2013.
13. Manju Suthar and Praveen Aggarwal, "Clayey Subgrade Stabilization with Lime and Recron Fiber+" Journal of The Indian Roads Congress, pg 637, 2015.
14. Mrudul U V, Prof. S. M. Damodariya, Prof. N. B. Parmar, "Laboratory Investigation of Soil Stabilized using Terrasil", ISSN, Vol. 4, No. 6, March – 2016.
15. Siyyagalla Subbarayudu & S.Rozwana (2017) "Study of soil stabilization by using recron-3s,fly ash& lime" International Journal For Technological Research In Engineering Volume 4, Issue 9, May-2017
16. Prem Kumar, A. J. Jeyanthi (2017) "Experimental Investigation of Reinforced Concrete Using Recron-3s" International Journal of Latest Engineering and Management Research (IJLEMR) Volume 02 - Issue 10 || October 2017
17. P.V.Koteswara Rao, K.Satish Kumar and T.Blessingstone, (2012),"Performance of Recron-3s Fiber with Cement Kiln Dust in Expansive Soils", International Journal of Engineering Science and Technology (IJEST), Vol. 4 No.04, pp.1361-1366.

18. Monica Malhotra and Sanjeev Naval (2013), "Stabilization of Expansive Soils Using Low Cost Materials" International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 11, May 2013,pp.181-184.