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Mapping the Improvement of Soil Strength Using Recron-3s Fibers

Nandan A. Patel[1], C. B. Mishra[2]

[1]Student of M. E. (Transportation System Engg.), BVM Engineering College, V. V. Nagar, Anand, India

[2]Asscociate Professor, Civil Engineering Department, BVM Engineering College, V. V. Nagar, Anand, India

Abstract: ***The quality and life of asphalt is enormously influenced by the sort of subgrades. In any case in India the greater part of the adaptable asphalts are have to be built over feeble and dangerous sub-grade. The California bearing proportion (CBR) of these sub-grade have low, it needs to more thickness of pavementt. Lessening in the accessibility of suitable sub base and base materials for asphalt development have prompts a look for financial technique for changing over generally accessible tricky soil to suitable development material.s 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. In this study the Recron-3s Fiber is used as the stabilizers in improving engineering properties soil. This experiment evaluates the effect of the Recron-3s on the some basic engineering properties of soil by using varied proportion of Recron 3s fibers from 0.5% to 2.0%. Four proportion of recron-3s fiber i.e. 0.5%, 1.0%, 1.5% and 2.0% were used to quantify the optimum quantity of Recron-3s on the performance in terms of CBR value and UCS of the soil.***

Keywords: Recron – 3s, Fiber, Soil Stabilization, strength, Stabilization

1. Introduction

Owing to the engines of infrastructure growth of foundation development in India, a great many new road kilometers are expected to extend the system of activity veins in the booming economy to be sturdy and maintaining the quick extension in loaded weight of vehicles on pavement with changing atmospheric environment. It is the fundamental destination of pavement engineers and contractors is to build the quality or security of soil and to decrease the development cost by making best utilization of the provincially accessible materials.

The process of soil stabilization helps to achieve the required properties in a soil needed for the pavement construction work. As needs be a literature audit was completed on the subject that was trailed by research facility tests and field tests. This paper portrays the properties of regular soil and settled it with differing rate of Recron-3s fiber as added substance material correspondingly the test properties are resolved

2. Objectives

To evaluate physical properties of existing soil in laboratory and to find out the improvements in soil by the addition of optimum dose of Recron 3S fibers mixes in terms of CBR value and UCS.

3. Literature Review

Arghya Das , Ch. Jayashree , B.V.S. Viswanadham (2009) explains in their paper on "Effect of randomly distributed geofibers on the piping behaviour of embankments constructed with fly ash as a fill material" that fly ash is being utilized as a structural fill material in expressway and railway banks, for fiery remains lake bunds, levees, filling low-laying ranges and so on. Drainage prompted disappointments as channeling can debilitate and influence the execution of a bank developed with fly cinder as a structural fill material. This paper exhibits enhanced property of soil after the addition of stabilizer. Further in their study various examinations were done for deciding the drainage speed and funneling safety of fly fiery remains, blended arbitrarily with adaptable polyester fibers having different measurements and lengths. At long last the system by which discrete and arbitrarily circulated fibers control piping of fly slag is clarified with the fly fiery remains fiber collaboration

P.V.Koteswara Rao, K.Satish Kumar & T.Blessingstone (2012) in their paper on "Performace of recron-3s fiber with cement kiln dust in expansive soils" made an attempt to study the influence of polymer fibers on the properties of locally available black cotton soil with and without admixture modification. This study uncovered that the fiber support enhances the soil properties regarding enhanced stress strain examples and dynamic disappointment set up of brisk post top disappointment of plain specimens. The unconfined compressive quality of Clay soil is expanded by 7 times with admixture adjustment and 9 times for admixture with fiber change concerning plain specimens. The shear quality parameters of dirt soil are additionally essentially expanded upon admixture adjustment and admixture with fiber treatment. The CBR esteem additionally expanded essentially actually for doused CBR tests. By expansion of CKD the Liquid furthest reaches of the mixture is diminished 23 %, where as plastic point of confinement is expanded by 41%. Versatility Index of the blend is diminished by 57%.

Prof. R.K Sharma (2012) the paper "Subgrade Characteristics of Locally Available Soil Mixed With Fly Ash and Randomly Distributed Fibers" shows the extensive soils cause loads of structural designing structural harm, especially to low-climb structures. Certain inborn properties of these broad soils need alteration for their mass use in the

development of expressways/runway asphalts, banks, and so forth. He state the consequences of examination on the conduct of sweeping soil changed with fly fiery remains, and mix of soil, fly powder and Recron 3S fiber of 12mm length. The properties like grain size dissemination, dampness thickness connection and CBR are mulled over for soil mixed with fly slag in the scope of 20-80%. The mixture of soil with 30% fly fiery debris was chosen for further adjustment with fiber content in the scope of 0.5-1.5%. The properties of dampness thickness connection and CBR are assessed.

4. Materials

The soil sample used for this study is collected from local area at the National Highway-8 Kamrej, surat, India at a depth of 1.5m using the method of disturbed sampling following the ASTM methods.

4.1 Yellow Soil

Simple visual examination of soil indicates the presence of a good concentration of iron oxide which is responsible for giving this soil its yellowish shade. The pivotal engineering properties are determined scientifically in the laboratory.

4.1.1 Properties of Yellow Soil

Properties	*Value*
Liquid Limit (LL)	49.16 %
Plastic Limit (PL)	27.23 %
Plasticity Index (PI=LL-PL)	21.93 %
Free Swell Index	10 %
Specific Gravity	2.525

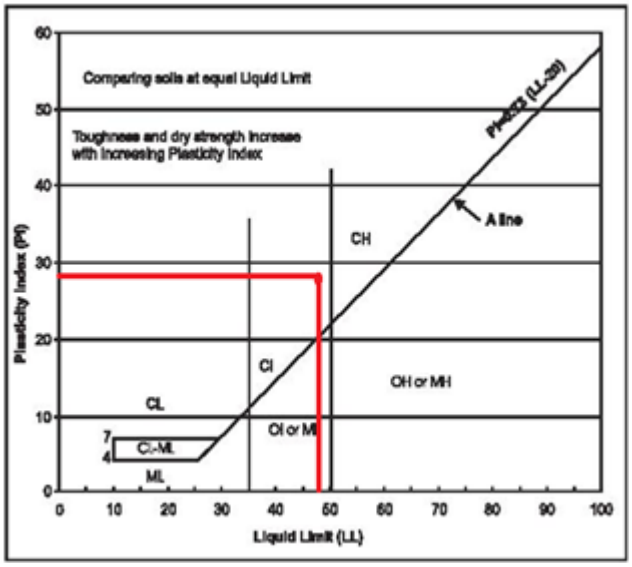


Figure 1: Plasticity Chart for Classification of Fine Graded Soil

From the obtained values of Plastic Limit and Liquid Limit of soil, soil is classified as "CI" which is inorganic clay with medium plasticity per above fig. 1.

4.2 Recron-3s

Use of Recron-3S as a reinforcing material is to increase the performance in terms of strength of soil also it enhances flexibility in operation, easy to use and reduces permeability. It is micro fibers with a unique "Triangular" cross-section. The physical parameters of it are shown.

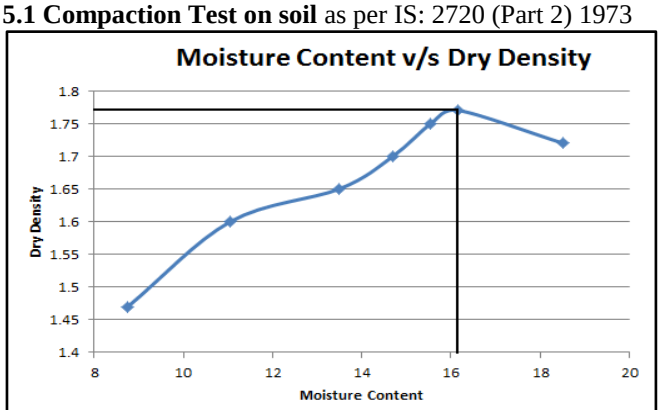
4.2.2 Properties of Recron – 3s

Property	*Value*
Cutting Length	6 mm or 12 mm
Shape of Fiber	Special for improved holding of cement aggregate
Tensile Strength	4000-6000 kg/cm^2
Melting Point	> 250 Degree Centigrade
Dosage Rate	Concrete Use CT 2024 (12 mm) at 125 g/cement bag 1:4 cement/sand ratio optimize as per application
Color	White
Unit Weight	0.91 g/cm3
Average Diameter	0.034 mm
Modulus of Elasticity	3500 Mpa
Fusion Point	165 Degree
Burning Point	590 degree
Acid and Alkali Resistance	Very Good
Dispensability	Excellent

5. Test Results

Compaction tests were carried out for different soil with and without fibers in suitable dosages to determine the maximum dry density (MDD) and optimum moisture content (OMC). Further tests are conducted as per the relevant code practice for CBR tests and UCS.

5.1 Compaction Test on soil as per IS: 2720 (Part 2) 1973

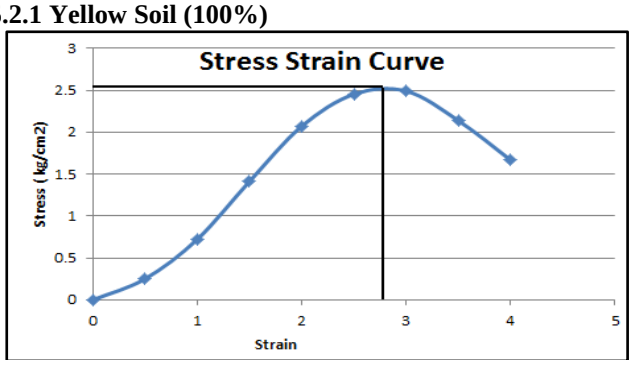


The modified compaction test is applied to determine the maximum dry density for soil. The natural soil has the maximum dry density of 1.77 g/cm3 at O.M.C of 16.15%.

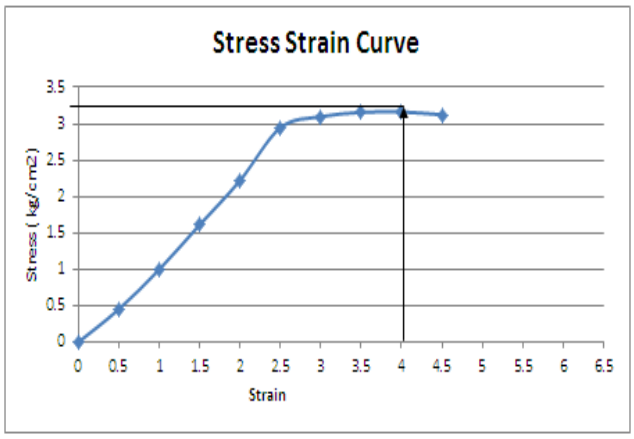
5.2 Unconfined Compressive Strength Test with and without additive as per IS: 2720 (Part 10) 1991

Unconfined compressive strength (UCS) test is the measure of the resistance of the composites to external loading and is a must considered for stabilization of soil. The samples for UCS test of height 7.6 cm and diameter 3.8 cm were prepared by statically compacting the mixtures in the mould to their respective dry density at corresponding optimum moisture content.

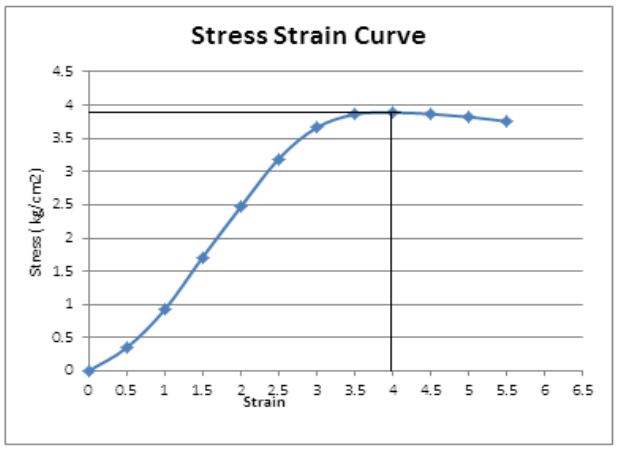
5.2.1 Yellow Soil (100%)



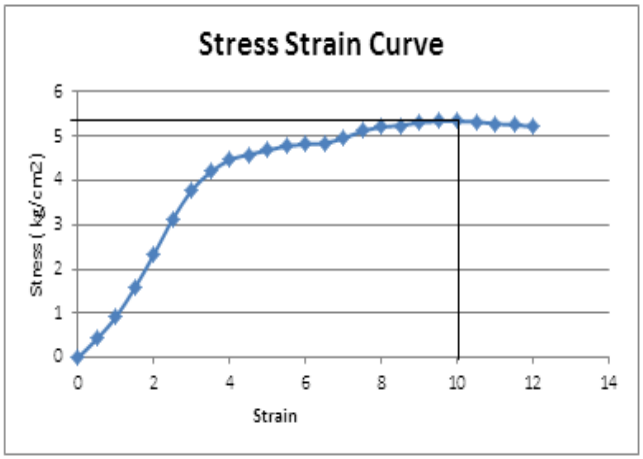
5.2.2 Yellow Soil (99.5%) + Recron–3s (0.5%)



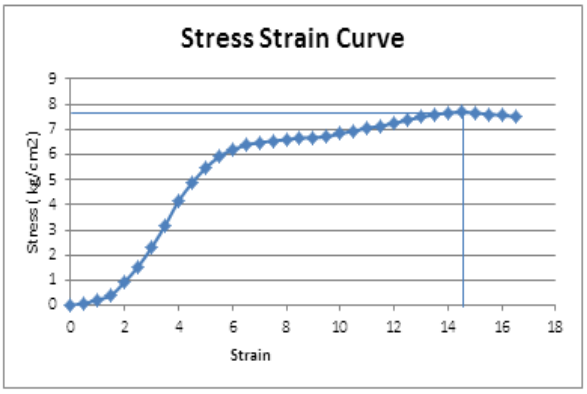
5.2.3 Yellow Soil (99%) + Recron–3s(1%)



5.2.4 Yellow Soil (98.5%) + Recron–3s(1.5%)

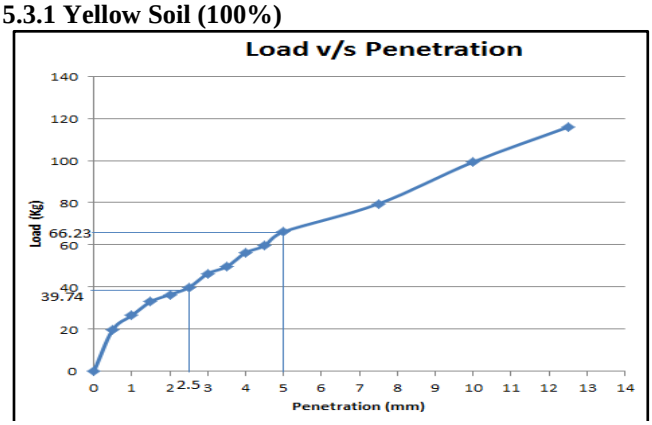


5.2.5 Yellow Soil (98%) + Recron–3s (2%)



5.3 CBR Test with and without additive IS 2720 (Part 16, 1987)

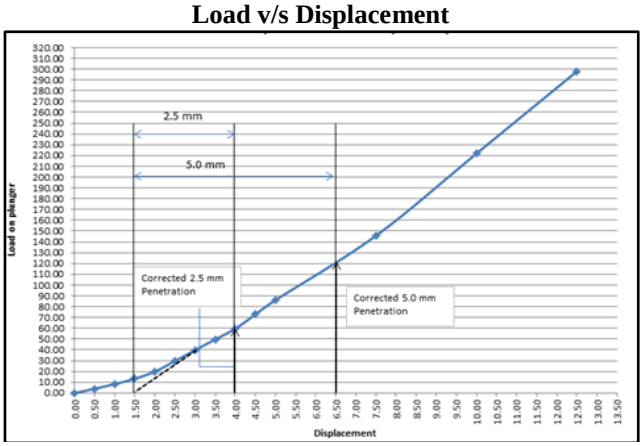
5.3.1 Yellow Soil (100%)



Penetration Depth (mm)	*Standard Load (kg)*	*Load On Plunger (kg)*	*CBR value*
2.5	1370.00	39.74	2.90
5.0	2055.00	66.23	3.22

5.3.1 Yellow Soil (99.5%) + Recron–3s (0.5%)

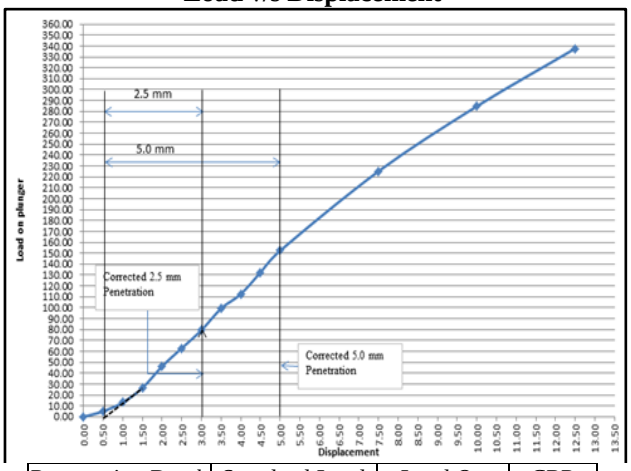
Load v/s Displacement



Penetration Depth (mm)	*Standard Load (kg)*	*Load On Plunger (kg)*	*CBR value*
2.5	1370.00	59.60	4.35
5.0	2055.00	121.85	5.93

5.3.3 Yellow Soil (99%) + Recron–3s (1%)

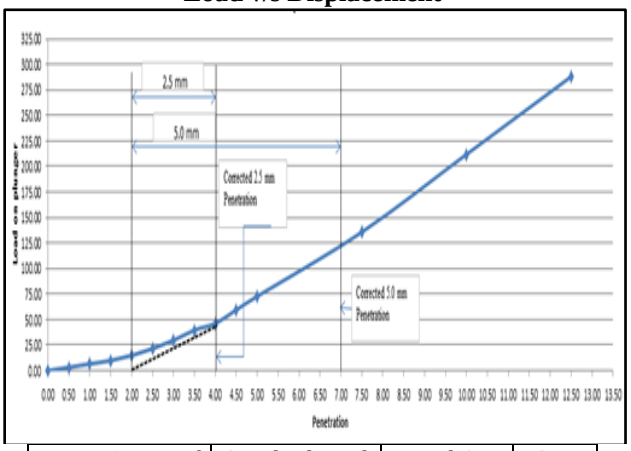
Load v/s Displacement



Penetration Depth (mm)	*Standard Load (kg)*	*Load On Plunger (kg)*	*CBR value*
2.5	1370.00	79.47	5.80
5.0	2055.00	152.32	7.41

5.3.4 Yellow Soil (98.5%) + Recron–3s (1.5%)

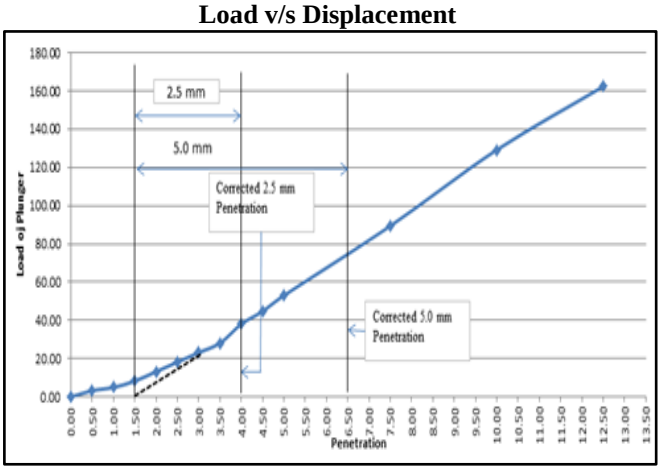
Load v/s Displacement



Penetration Depth (mm)	*Standard Load (kg)*	*Load On Plunger (kg)*	*CBR value*
2.5	1370.00	46.36	3.38
5.0	2055.00	122.98	5.98

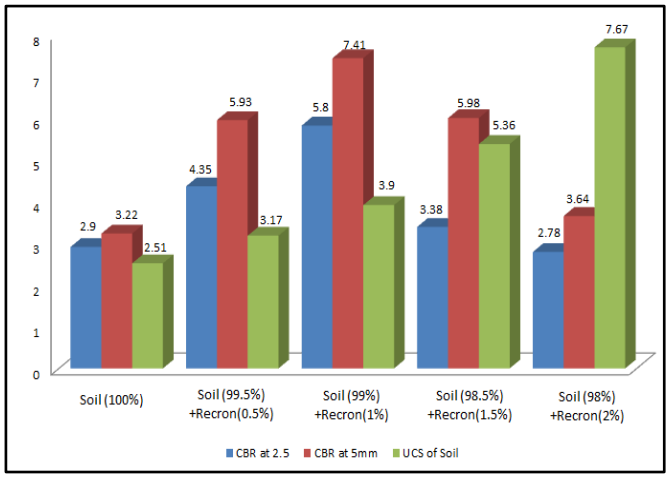
5.3.5 Yellow Soil(98%) + Recron–3s(2%)

Load v/s Displacement



Penetration Depth (mm)	*Standard Load (kg)*	*Load On Plunger (kg)*	*CBR value*
2.5	1370.00	38.08	2.78
5.0	2055.00	74.73	3.64

5.4 Comparative Graph of Yellow Soil with and Without Additive showing CBR and UCS values



6. Conclusion

The key findings are as shown below

The soil used is classified as CI type of soil as per IS (1498-1970) from the values of Liquid Li1mit = 49.16, Plastic Limit = 27.23, Plasticity Index = 21.93. Maximum Dry Density and Optimum Moisture Content of the soil is MDD = 1.77 g/cc and OMC = 16.15 %.

The use of Recron-3s as additive material is advisable to be utilized by pavement engineers and road contractors as the improvement in the strength of soil in terms of CBR value and UCS value is noted. As per the result shown, the value of CBR of sample increases with increase in addition of Recron-3s up to 1%, and further increase in Recron-3s results in to decrement in CBR value.

Optimum dose of Recron -3s is found 1% of dry weight of soil. The CBR value at this dose is = 7.41 %. The UCS value at this dose is = 3.9 kg/cm2. The value of CBR for Natural Soil without recron-3s at 5 mm penetration is 3.24 %. It is evident that by adopting Recron-3s the rising CBR value is more than two times that of natural soil i.e. 7.41 %. This indicates, by using Recron-3s the thickness of pavement can be reduced which will prove more economical and will also increase load carrying capacity.

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