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STABILIZATION OF BLACK COTTON SOIL USING RECRON 3S FIBRE

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Abstract : Due to its expansive character, black cotton soil presents a serious obstacle to engineering projects, which frequently end in failure. In this paper the black cotton soil by employing RECRON 3S FIBER, providing a viable substitute for conventional techniques. The study assesses the efficiency of various fiber percentages in stabilizing the soil using a range of tests, such as index and engineering tests, and offers insightful information for engineers working on projects in areas with black cotton soil.

Recron 3S fiber is a cutting-edge reinforcing material that is utilized to improve construction quality and boost strength in a range of applications, including automobile batteries, paper, filtration fabrics, asbestos, cement sheets, and precast goods based on cement.

Index Terms- Index Properties, Recron 3s Fiber, UCS, MDD

I. INTRODUCTION

Black cotton soil, known for its high clay content, expansive properties, and low shear strength, presents significant challenges in construction projects. When exposed to moisture, it swells, and when dry, it contracts, leading to severe structural instability and damages like cracking, heaving, and buckling in pavements, foundations, and other structures.
To address these challenges, stabilization techniques are employed to improve the soil's mechanical properties, reduce expansion, and enhance durability. One innovative method involves the use of Recron 3S fiber, a synthetic polyester fiber known for its reinforcing and stabilizing capabilities. This approach aims to increase soil strength, reduce shrinkage, and minimize cracking.

Recron 3s fiber stabilization of black cotton soil provides an answer to the problems presented by this expansive soil type, which is prone to large volume variations as a result of moisture fluctuations. Black cotton soil, which is frequently found in tropical and subtropical areas, can result in structural instability, which can cause issues with roads and foundations like swelling, shrinking, and cracking. Recron 3s fiber is a polyester-based reinforcement material that is well-known for increasing the load-bearing capacity, decreasing cracking, and increasing soil tensile strength.

The primary goal of the experiment is to evaluate how Recron 3s fiber affects the strength and stability of black cotton soil. First, the qualities of the soil are thoroughly analyzed. Next, the fiber is mixed with the soil in different proportions to start the stabilizing process. Recron 3s is a type of polyester fiber designed for reinforcement applications in construction and soil stabilization. Its unique properties make it a valuable additive to enhance the strength and durability of materials like concrete and soil.
In concrete, Recron 3s fibers help reduce shrinkage cracks, improve tensile strength, and increase toughness. They are often used to reinforce concrete structures, providing a more robust and durable composition.

Recron 3s is also used to stabilize soils, especially expansive types like black cotton soil. The fibers are mixed with soil to improve its tensile strength, reduce the risk of cracking, and enhance overall stability. This can lead to better load-bearing capacity and reduced swelling and shrinking caused by moisture changes

II. LITERATURE REVIEW

1. **UNNAM ANIL, S.DURGA PRASAD** After conducting several laboratory studies, it was discovered that tile waste containing up to 1.5% recron 3s fibers may be used to stabilize expansive soil and save a significant amount of money on construction.
2. **K. SATISH KUMAR AND P.V. KOTESWARAO** The addition of CKD results in a 23% decrease in the mixture's liquid limit and a 41% increase in its plastic limit. The mix's plasticity index has dropped by 57%. The sample's plasticity index decreases as CKD (cement kiln dust) content rises, offering high workability.
3. **BABITA SINGH, AMRENDRA KUMAR, AND DR. RAVI KUMAR SHARMA** The clay-foundry sand combination with a 60:40 ratio achieves the highest maximum dry density value, with subsequent proportions following suit. This

happens because, at lower sand contents, clay particles occupy the spaces between the foundry sand particles, but at higher sand contents, the particles are segregated and the maximum dry density decreases.

2. MATERIAL

A. Black Cotton Soil

The expansive nature of black cotton soil is attributed to its high clay concentration, which causes notable variations in volume based on moisture levels. This type of soil is typically found in tropical and subtropical locations. Its organic matter and clay minerals give it a dark tint that can range from deep brown to black. Black cotton soil's propensity to expand when wet and shrink when dry is one of its main characteristics, which can cause significant problems for infrastructure and construction projects. This expanding nature presents a problem for engineers and builders because it can result in uneven settling, structural damage, and cracks in the foundation.

Black cotton soil presents certain obstacles, yet it is nonetheless utilized in construction with certain safety measures. Because the earth is expansive, engineering solutions like as deep foundations and under-reamed piles are used. Stabilization techniques including chemical treatment with lime or cement and physical reinforcement with materials like Recron 3s fiber are frequently used to increase stability. Improving the soil's ability to support more weight and reducing edema are the main objectives.

Properties	Values
Free Swell Index	90%
Specific Gravity	2.82
Liquid Limit	37%
Plastic Limit	22%
Plasticity Index	15%
Shrinkage Limit	12.06%
MDD	1.63KN/gm/cc
OMC	8%
UCS	4.81KN/CM^2

Table:2.1 Properties of Soil without Recron fiber

B. Recron 3S Fibre

Recron 3s is a synthetic fiber with multiple uses that is made from high-quality polyester. It is widely used in civil engineering and construction to strengthen and prolong soil and concrete. The fine, consistently distributed fibers enhance the performance and durability of these materials in several ways when they are added. In concrete applications, Recron 3s increases resilience to shock and stress, reduces shrinkage cracks, and increases toughness..

Recron 3s has shown to be particularly helpful in stabilizing expansive soils, such as black cotton soil, which can expand when wet and contract when dry, causing structural problems. Engineers can increase the tensile strength of soil and lessen deformation and breaking by combining recron 3s with the soil

Properties	Values
Specific Gravity	0.91
Shape	Round
Diameter	17.3±5%
Length	6± 1.5 mm
Melting Point	160°C
Class	Ia
Water Absorption	<1%
Molecules Shape	Triangular

Table 2.2: Properties of Recron 3s fibre

C. laboratory studies

The experimental work has been done to investigate the influence of fiber content on the unconfined compression strength of clayey soil. Unconfined compressive strength test is one of the cheapest and fastest methods of measuring the compressive strength of cohesive soils. For this purpose various percentages of recron fiber (0,1,2,3 and 4%) were randomly mixed with the clayey soil. Compaction test were carried out by adopting IS heavu compaction method as specified as in IS 2720(Part VIII-1983)Here it is shown how to style a subsection and sub sub-section also.

3. RESULTS AND GRAPH

3.1. Results:

The influence of fiber content on OMC and dry density are in below table . From the table it can be observed that the addition of fibers

percentage of fines	OMC (%)	MDD (gm/cc)
1	17.64%	1.72
2	20.34%	1.83
3	29.40%	1.48
4	25.87%	1.33

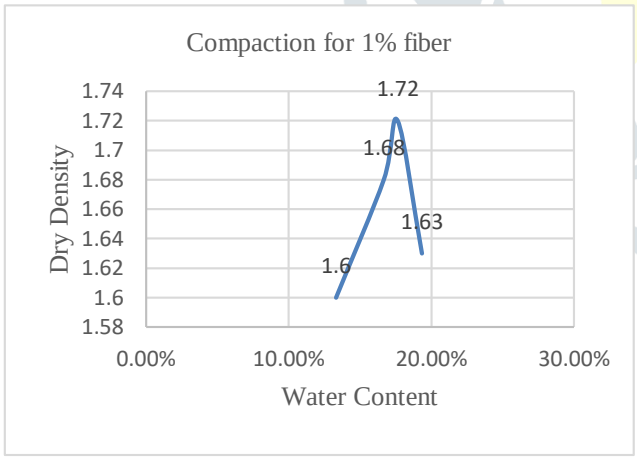
Table 3.1.1 OMC & MDD of soil with different recron %

Percentage of Fines	Uniconfined compressive strength (KN/CM^2)	Cohesion
1% fibre	7.831	3.911
2% fibre	8.108	4.504
3% fibre	5.894	2.947
4% fibre	5.63	2.815

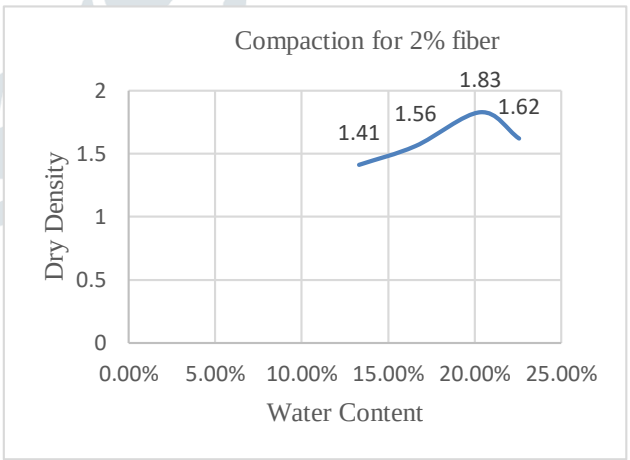
Table 3.1.2 Unconfined compressive Results

With the fiber content increasing from 1% to 2% resulted in the increase of dry density and the same OMC. This may happen due to the reduction of the voids in the fiber soil matrix. Further increasing the fiber content (4%) OMC and dry density decreased. A reasonable explanation for the decrease of dry density was that fibers presenting in the matrix stuck together to form lumps which caused pockets of low density in the matrix (Prabakar and Sridhar, 2002). Besides, the water absorption of fiber is less than 1% and makes the OMC same.

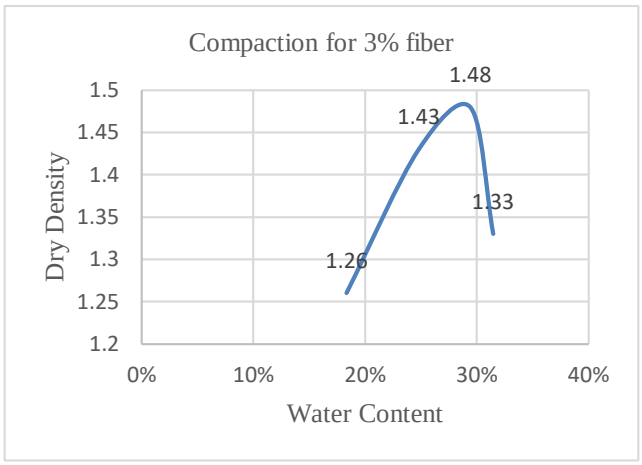
3.2 Graphs:



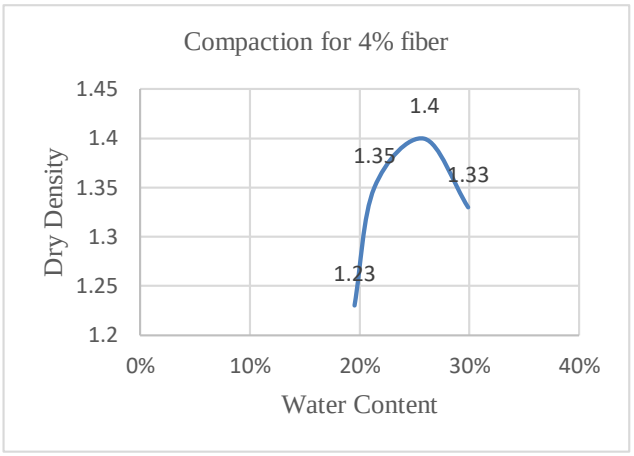
3.2.1 Fig: Relation b/w D.D and Water content



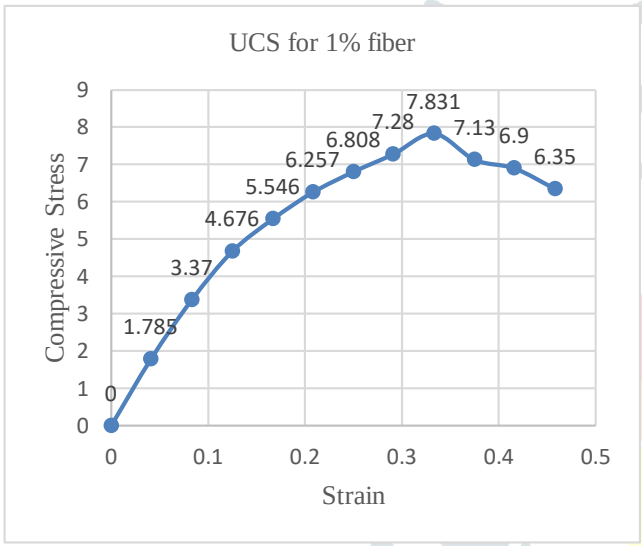
3.2.2 Fig: Relation b/w D.D and Water content



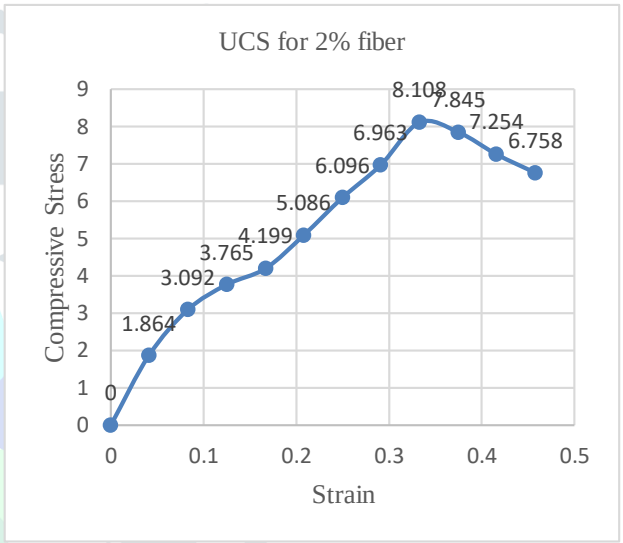
3.2.3 Fig: Relation b/w D.D and Water content



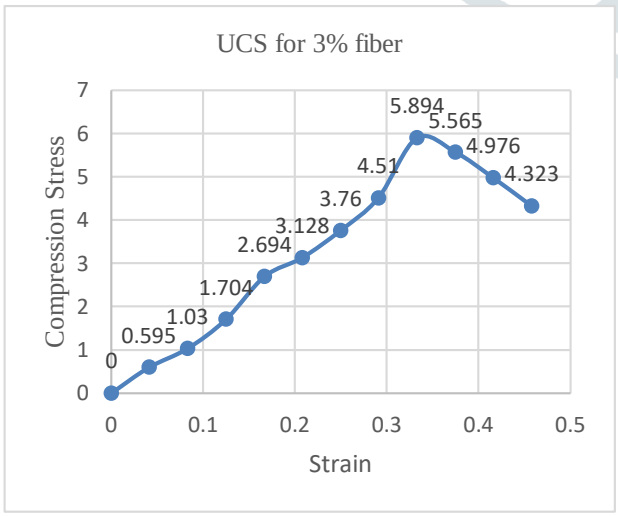
3.2.4 Fig: Relation b/w D.D and Water content



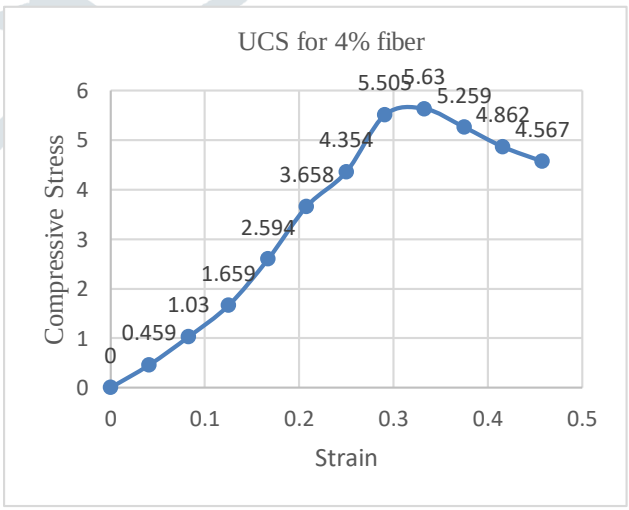
3.2.5 Fig: Relation b/w Stress and strain (UCS Test)



3.2.6 Fig: Relation b/w Stress and strain (UCS Test)



3.2.7 Fig: Relation b/w Stress and strain (UCS Test)



3.2.8 Fig: Relation b/w Stress and strain (UCS Test)

4. CONCLUSION

The geotechnical properties of clay reinforced with Recron fiber were investigated by conducting compaction test and unconfined compression test. The following conclusions were drawn from the experimental results:

- The soil's MDD displays an interesting trend with the addition of fibre. MDD rises with increasing fibre content, peaks at roughly 2%, and then falls. This suggests that the optimal fibre dose for compaction is around 2%, at which point the soil reaches its maximum density.

- The amount of fibre in the soil matrix has a considerable effect on soil strength. The soil's strength rises with the addition of fibre, culminating at roughly 2% fibre concentration. However, after this stage, soil strength falls. This shows that there is an optimal fibre content (about 2%) for maximum UCS .

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