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Behaviour Of Expansive Soil Stabilized With SCBA And Coir Fibre

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Abstract:- The amount of garbage in the world today is growing every year, making it difficult to dispose of significant amounts of agricultural waste, such as coconut shells, rice husks, and sugarcane bagasse ash. This research examines the impacts of Sugarcane Bagasse Ash(SCBA) and Core Fibre on liquid limit, plastic limit, compaction characteristics and California Bearing Ratio on Expansive Soil. Engineers face a difficult problem when designing and building civil engineering projects on and with expansive soils, It aims to evaluate the improvement in the strength and stability qualities in soft sub-grade soil by stabilising it with sugarcane bagasse ash and then reinforcing it with core fibre.

Keywords: CBR, Liquid Limit, SPT, Expansive Soil.

I. INTRODUCTION

Expansive soils are inorganic, medium- to high-compressibility soils that make up a true soil ecosystem in India. Expansive soil absorbs water quickly during the rainy season, which causes swelling and soil softening. A decrease in water content over the summer causes this to shrink and develop fractures. Due to the presence of the clay mineral known as montmorillonite, these soils have poor characteristics. Construction is highly challenging since typical soil behaviour leads to structural failure in the form of settlement fractures, etc. By adding various admixtures and waste products, several scientists and research projects have attempted to enhance the qualities of expansive soil. According to an experimental investigation by **T. Sudesh Reddy** and colleagues, using rural waste to replace nearby soil can somewhat improve its qualities. Sugarcane bagasse ash residue can be used to replace nearby soil as far as is practical. The results that follow are based on the laboratory tests that were conducted during their investigation. They discovered that expanding soil had better engineering qualities when 20% sugarcane bagasse ash was added. Also, they varied the amount of fibre from 0% to 1.5% while mixing Expansive Soil with 20% sugarcane bagasse ash. The CBR value is likewise rising in both cases of combination, according to test data.

D. S. V. Prasad (2010) In his research, he created a model of flexible pavement made up of an expansive soil subgrade of 0.5 m at the base compressed in 10 layers and gravel sub-base laid in 2 layers each of 0.07 m compressed thickness using a stratum of varying reinforcing material such as geogrid, bitumen coated chicken mesh, bitumen coated bamboo mesh for reinforcement with waste plastic and waste tier rubber was mixed uniformly throughout. 2 layers of WBM-II, each 0.075 m compacted thick, were put on top of the sub-base material. Cyclic plate load tests were conducted in order to identify a superior replacement for reinforcement in flexible pavement. It was concluded that providing changing reinforcing material reduces the total and elastic deformation values of flexible pavement systems. The reinforcement achieved by the geogrid has a higher maximum load bearing capacity and a lower rebound deflection value than any other reinforcement offered.

II. Experimental Investigations

For determination and study the behaviour of black cotton soil with different percentage of sugarcane bagasse ash following tests were performed.

2.1 Liquid Limit and Plastic Limit Test

The liquid limit is the water content at which the soil changes from the liquid state to plastic state and plastic limit is the water content below which the soil stop behaving as a plastic material. These tests were performed according IS 2720 (Part – 5) – 1985. The liquid limit and plastic limit test were conducted for Expansive Soil and mix specimen of different percentageof SCBA.

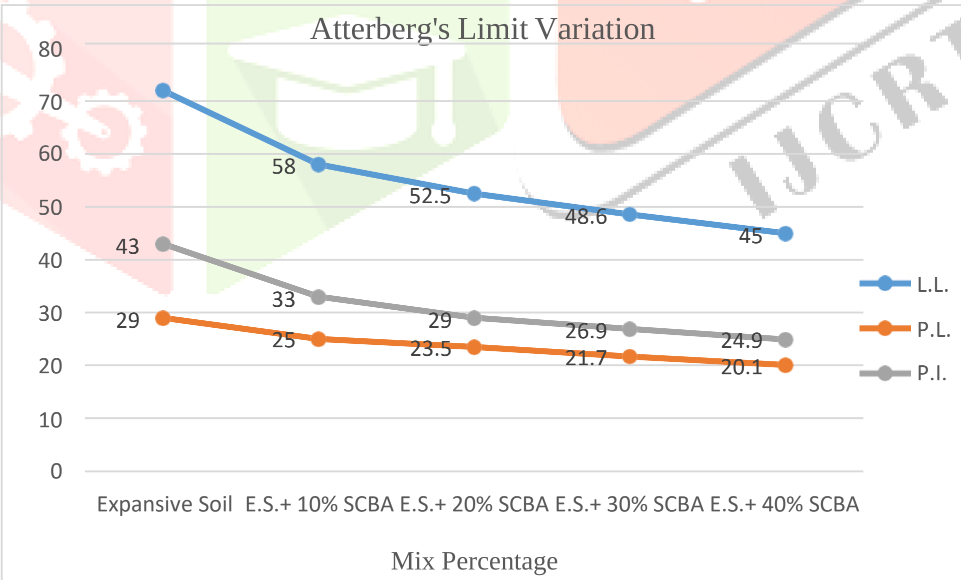

Fig.1 Atterberg's Limit Variation

2.2 Standard Proctor Test:-

This test is used for determining the maximum dry density and optimum moisture content in soil sample. This test was performed according IS 2720 (Part – 9) – 1971. The test results areshown in Table No. 1

TABLE1 – PROCTOR TEST RESULTS FOR EXPANSIVE SOILAND WITH DIFFERENTPERCETNAGE OF SCBA

Particulars	MDD (gm/cc)	OMC (%)
Expansive Soil	1.6	18.40
10% SCBA + Expansive Soil	1.8	15.9
20% SCBA + Expansive Soil	1.86	16.83
30% SCBA + Expansive Soil	1.83	17.43
40% SCBA + Expansive Soil	1.81	17.88

From the experiments results it is established that initially when raw Expansive Soil undergoes the compaction test, MDD value achieved is 1.6 gm/cm^3 at an optimal moisture content of 18.40 %. When SCBA is mixed with clayey soil, MDD of treated soil gets enhanced and comes in range of 1.8 - 1.86 gm/cc at OMC of range 15.9 - 17.88 % and also there is reduction in OMC of soil. The optimum percentage of Mix is 20% SCBA with Expansive Soil.

It is also observed that in case of 60 aspect ratio fibre, when 20% SCBA is mixed with 0.75% coir fibre in Expansive Soil, the MDD is increased and that is 1.92 gm/cc at 16.85%. If the percentage of the fibre increases from 0.75%, the MDD decreases and OMC increases.

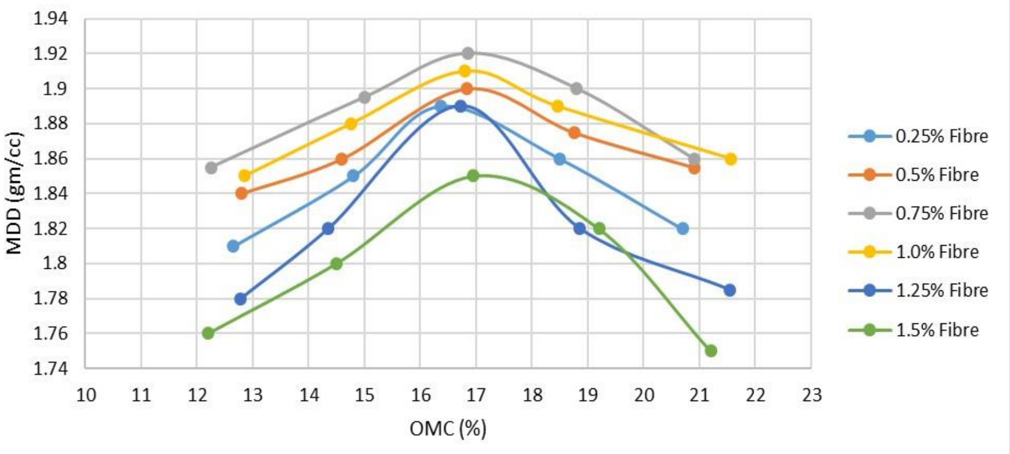

Fig. No. 2 SPT For Mix Specimen Of 20% SCBA And EXPANSIVE SOIL With Fibre (AR – 60)

Same as in case 80 aspect ratio fibre, when 20% SCBA is mixed with 0.75% coir fibre inExpansive Soil, the maximum MDD is determined 1.90 gm/cc at 16.71% OMC.

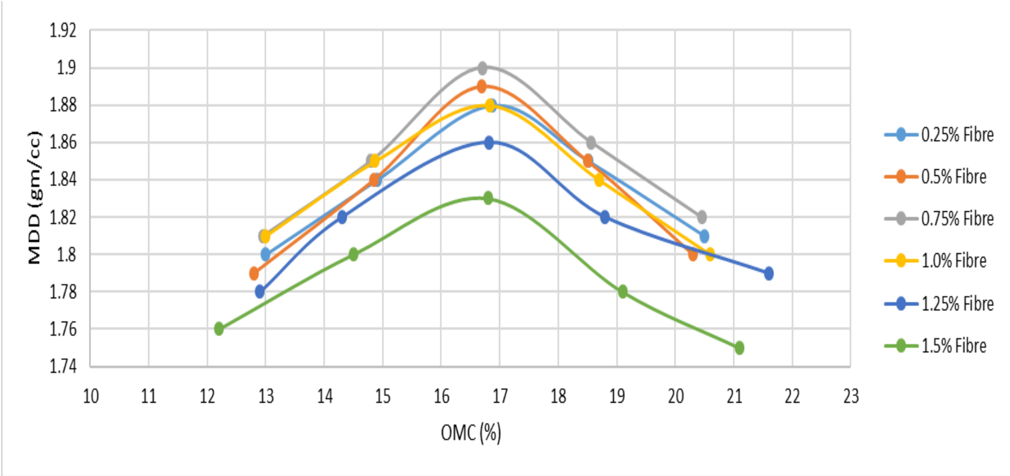

Fig. no. 3 – SPT for mix specimen of 20% SCBA and Expansive Soil with Fibre (AR-80)

2.3 California Bearing Ratio (CBR) Test

To evaluate the CBR Value for subgrade soil and soil that might be stabilised with different percentages of SCBA, California Bearing Ratio (CBR) tests were conducted, and Soil- SCBA mix with different fibre (Core Fibre) ratio and altered fibre percentages.

The CBR Tests were executed out on clayey soil (Expansive Soil), Clayey Soil treated with altered percentages of SCBA ranges from 10 % to 40 %.

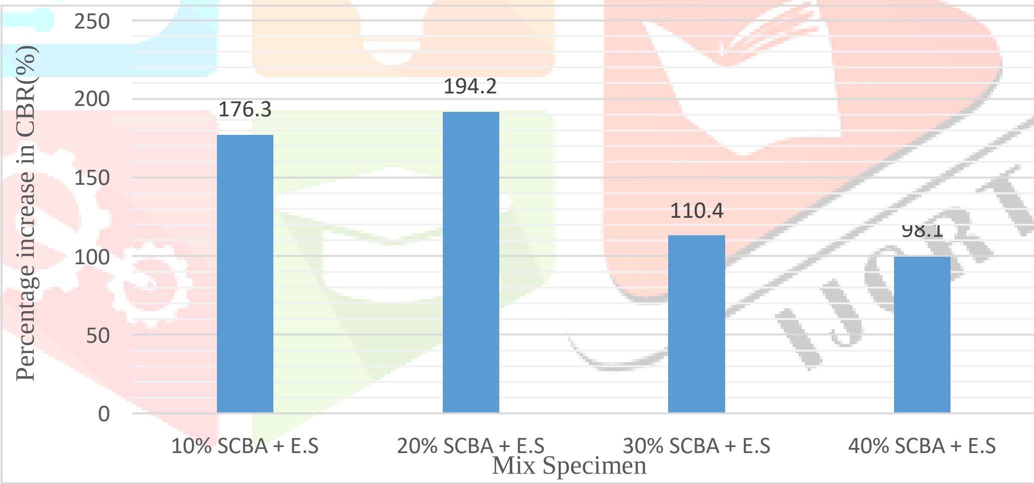

Fig. no. 4 Expansive soil with varying percentage SCBA

It is observed that when the coir fibre (aspect ratio – 60) is mixed in 20% SCBA and Expansive Soil, the CBR value increases to 0.75% fibre mix specimen which is 6.93% but after further increasing the percentage of fibre it decreases to 6.5% CBR value.

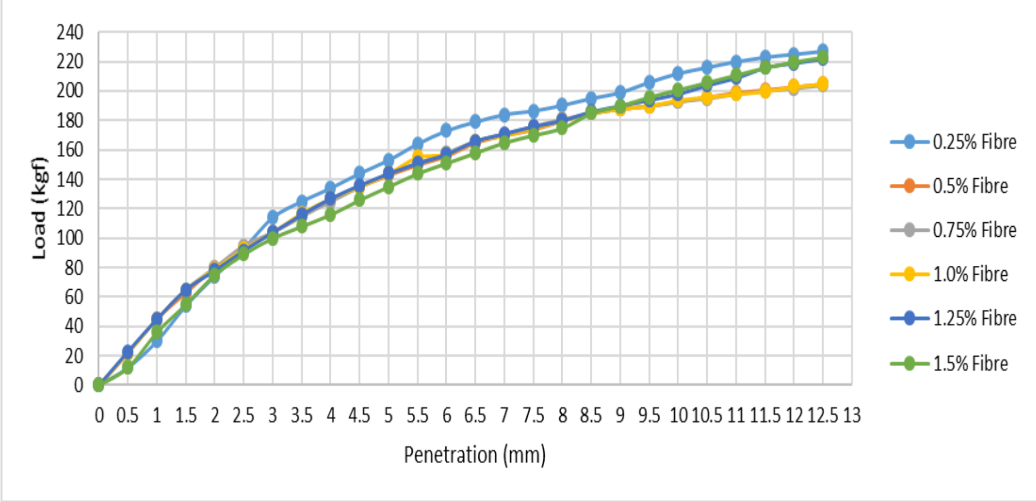

Fig. 5 – CBR for mix specimen of 20% SCBA and EXPANSIVE SOIL with Fibre (AR – 60)

Same as in case of 80 aspect ratio coir fibre, the CBR value increases to 0.75% fibre mix specimen.

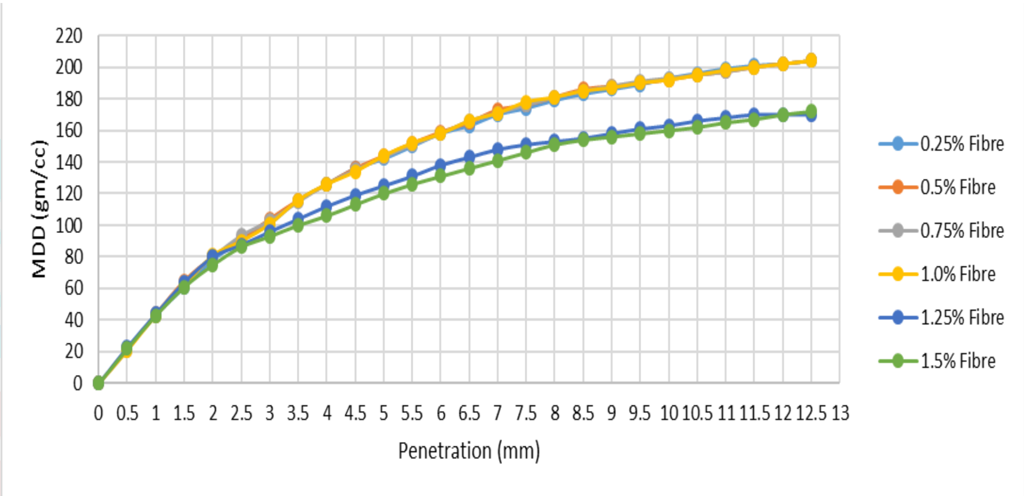

Fig. 6 – CBR for mix specimen of 20% SCBA and Expansive Soil with Fibre (AR – 80)

III. Conclusion

With increasing the quantity of SCBA in Expansive Soil, the resulting mixture turned gradually high plasticity clay (CH) to medium plasticity clay(CI). It is observed that when SCBA mixes in the Expansive Soil, the compactive parameters also increases. The MDD of untreated soil is determined as 1.6 gm/cc at 18.40% OMC. Which is increased to 1.86 gm/cc at 16.83% OMC when 20% SCBA mixed. Further increasing the percentage of SCBA the MDD decreases and OMC increases.

It is also observed that in case of 60 aspect ratio fibre, when 20% SCBA is mixed with 0.75% coir fibre in Expansive Soil, the MDD is increased and that is 1.92 gm/cc at 16.85%. If the percentage of the fibre increases from 0.75%, the MDD decreases and OMC increases. Same as in case 80 aspect ratio fibre, when 20% SCBA is mixed with 0.75% coir fibre in Expansive Soil, the maximum MDD is determined 1.90 gm/cc at 16.71% OMC.

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