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Experimental Study on Black Cotton Soil to be used as Filling Material by Strengthning with Bagasse Ash and Brick Dust

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Abstract:- Soil stabilization deals with physical, physic-chemical and chemical methods to ensure that the stabilized soil service its intended purpose as a pavement component material. Soil stabilization is the process of altering the qualities of soil (Index & Engineering) in order to improve its performance. The black cotton soil various civil engineering application will be for example pavement designs, structural designs, structural buildings likewise. The black cotton soil is an expansive soil. That is the reason it can observe water and change the volume. Not only changing volume, it can also show swelling and shrinkage. This is the reason structures will damage. The failure due to settlement of soil, if soil settles foundation support will be sinking, the structure will be fail. In this present experimentation is with Bagasse Ash (BA) and Brick Dust (BD). The experimentation focused on physical properties of soil, compressive strength test, unconfined compressive strength test, California bearing ratio test and free swell test. In this experimentation with and without adding additives, compare with those two randomly adding percentages 5%, 10%, 15% and 20% brick dust. Bagasse ash is contently 4%. These experimentations shows clearly difference of the strength of soil. And this experiments result concludes bagasse ash and brick dust is good stabilization materials for black cotton soil.

Keywords:- *BC soil, SCBA, Brick Dust, compressive strength.*

I. INTRODUCTION

Soil stabilisation entails the use of controlled compaction, allowing, and the use of appropriate admixtures or stabilizers to improve the soil stability or bearing capacity. Because many areas lack adequate soil, soil stabilization and cement stabilisation are required, which can be replaced with BA and BD for cost savings. In this work, a stabilisation approach using bagasse ash and brick dust was used to try to better the qualities of B C soil subgrade Various tests, such as plastic limit and CBR test, were conducted in this inquiry to determine the influence of bagasse ash and brick dust when combined individually and in mixture with B C soil. In foundation engineering for bridges, highways, buildings, and embankments, BC soils are an example of weak soil. During the rainy season, the swelling occurs, and during the summer, the swelling occurs. This swelling and shrinkage is also influenced by the soil's tension and suction history, resulting in deformation that is substantially larger than elastic deformation and which cannot be anticipated using traditional elastic or plastic theories.

II. LITERATURE REVIEW

Kiran R. G and Kiran. L,(2013): In this research, used materials are B C soil + Bagasse Ash. Test is carried out: Compaction, CBR and UCS are all examples of Atterberg's limit. This paper was based on a study of the behavior of B C soil stabilised with bagasse ash and additions. In this work, laboratory experiments are carried out with varied %of bagasse ash (4, 8, & 12 %) and additive mix amounts. The adding of bagasse ash to BC soil did not result in any substantial changes in density. However, the addition of 8% bagasse ash increases the CBR and UCS values. The use of bagasse ash likely increased strength values, but combining it with cement and lime increased strength even more. As a result, 8% bagasse ash can be mixed with BC soil to improve its toughness.

Suresh Reddy & Prasad (2017) Conducted geotechnical reinvestigation work on B C soil is combined with ash from sugarcane straw (10%, 15%, 20% and 25%) and polypropylene fibres (0.5%, 1.0% and 1.5%). The OMC, UCS, and CBR Test were all performed. It starts with the addition of 20% sugarcane straw ash and 1% polypropylene fibres, which raises the UCS and CBR values.

Madurwar et.al (2013): This investigation entails, the B C soil with varying percentages of RBI 81 Grade such as 2,4,6 with period of curing of 7,14,28 days. At B.C.soil+6%RBI 81Grade with period of curing of 28 days, the CBR (%) value increases and even UCS (kg/sq.cm) value increases. Similarly, B.C.Soil with varying percent of sodium silicate such as 3, 4.5,6 with period of curing of 7, 14, 28 days. At B.C.Soil+3% Sodium silicate with period of curing of 7 days, the CBR (%) value increases and even UCS (kg/sq.cm) value increases.

Mr.Toshnil H.Boraste et.al (2017): In this investigation they have taken firstly laterite soil with 3% of glass and 20% of flyash,5% of glass and 20% of fly ash,7% of glass and 15% of fly ash then at the percent of 5% of glass and 20% of fly ash in this OMC and MDD values increases. Similarly, when we used B.C Soil also at the percent of 5 of glass and 20 of fly ash in this OMC and MDD increases.

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III. OBJECTIVES

To identify the optimum percent of bagasse ash and brick dust by adjusting the percent of bagasse ash and brick dust in tests such as LL, PL &PI. Using bagasse ash and brick dust, investigate the behavior of BC soil. The purpose of this study was to establish the CBR of BC soil combined with various % of bagasse ash and brick dust. To determine the suitable mixed that can be used in the stabilization of B C soil.To reduce the volume change behavior by stabilizing the B C soil using bagasse ash and brick dust.

IV. MATERIALS AND METHOD

Black Cotton Soil: B C soil is one of the varieties of expansive soil.Because of the iron and alumina soil is brown, black and dark in color meaning. Is a clay or soil that experiences considerable volume fluctuations (swelling or shrinking) as a result of small changes in water content. Soils rich in expansive minerals, such as montmorillonite and bentonite.

Fig. 1: Black Cotton Soil

Bagasse Ash: Bagasse ash is the result of the burning of bagasse, a sugarcane waste product. Bagasse is currently used as a fuel in sugar plants to power boilers. This bagasse ash is typically dispersed throughout farms and dumped in ash ponds, causing pollution in the environment. Figure 1.2 depicts a sample bagasse ash used in this experimental analysis

Fig. 2: Bagasse Ash

SL .NO	PROPERTIES	VALUES
1	color	Black
2	Specific gravity	1.92
3	Sio2	62.43%
4	Al2o3	4.38%
5	Fe2o3	6.98%
6	CaO	11.80%
7	MgO	2.51%
8	SO3	1.48%
9	K2O	3.53%
10	Loss of ignition	4.73%

Table 1: Properties of SCBA

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- **Brick Dust:**

Fig. 2: Brick Dust

CHEMICALS	PERCENTAGE (%)
silica	50-60%
alumina	20-30%
lime	10%
magnesia	< 1% (< 20%)
Ferric oxide	<7% (<20%)
alkalis	< 10% (<20%)
Carbon dioxide	Very small %
Sulphur trioxide	Very small %
water	Very small %

Table 2: Properties of Brick Dust

V. METHODOLOGY

The B C soil, bagasse ash, and brick dust were collected, and preliminary tests were accomplished on the materials in accordance with IS standards and specifications. The plain B C soil was first tested for its physical properties, and then it was tested for engineering properties using compaction and direct shear testing. By compaction and direct shear test, the percentages of BA and BD are varied to determine the features of strength variation.To test the toughness of BC soil with various quantities of BA and brick dust mining waste.Adding admixtures to better the engineering qualities of BC soil and make it acceptable for constructions.To determine the effects of bagasse ash and brick dust as stabilizing agents on BC soil.

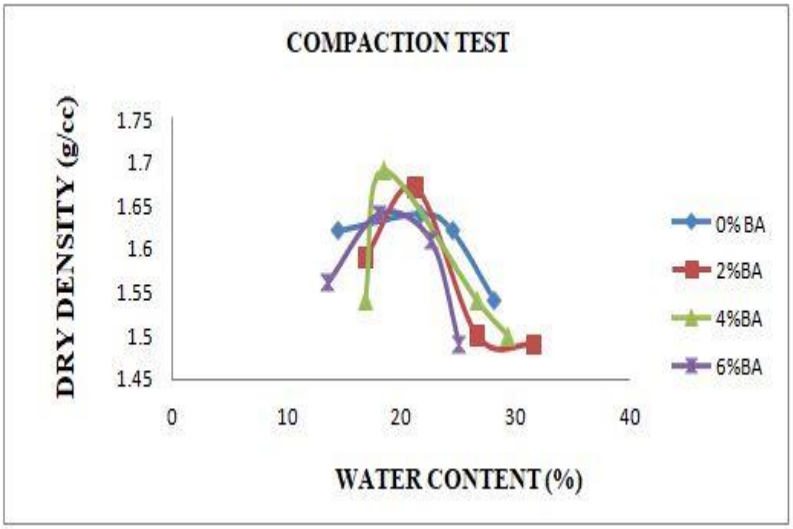

Fig. 3: variation of dry density v/s water content for BC soil fortified with varying % of bagasse ash

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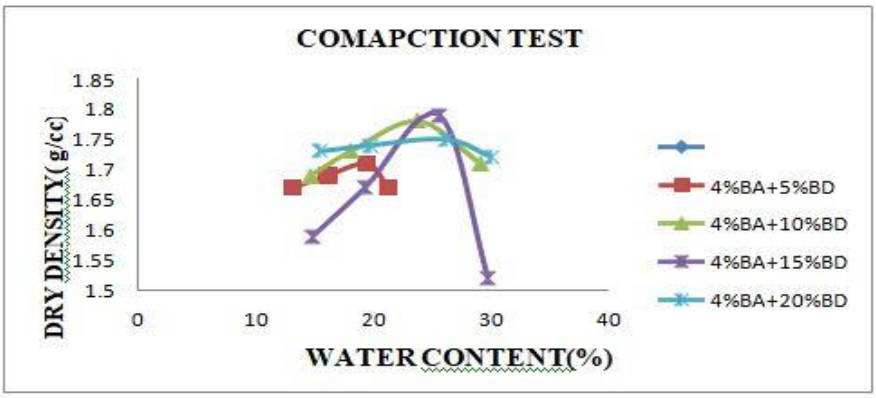

Fig. 4: variation of dry density v/s water content for BC soil with bagasse ashby varying different % brick dust

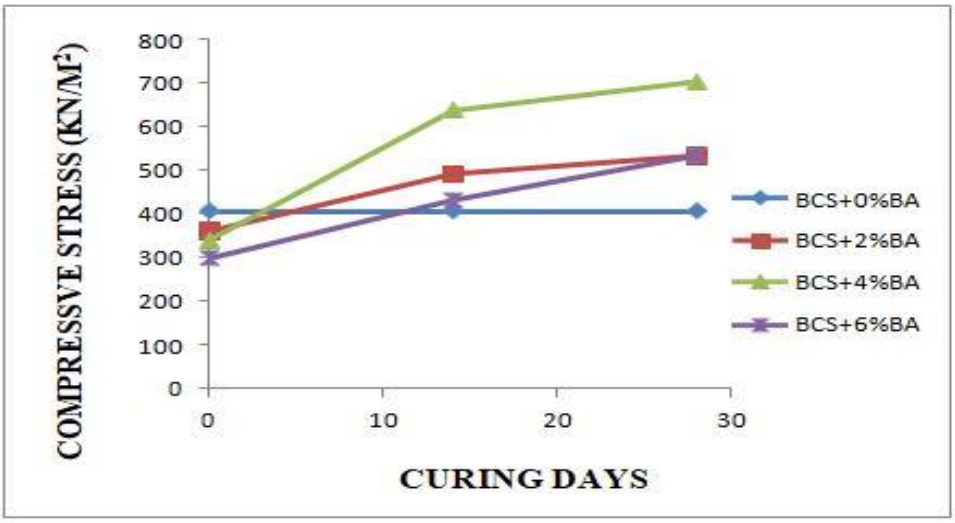

Fig. 5: variations of stress to various curing period

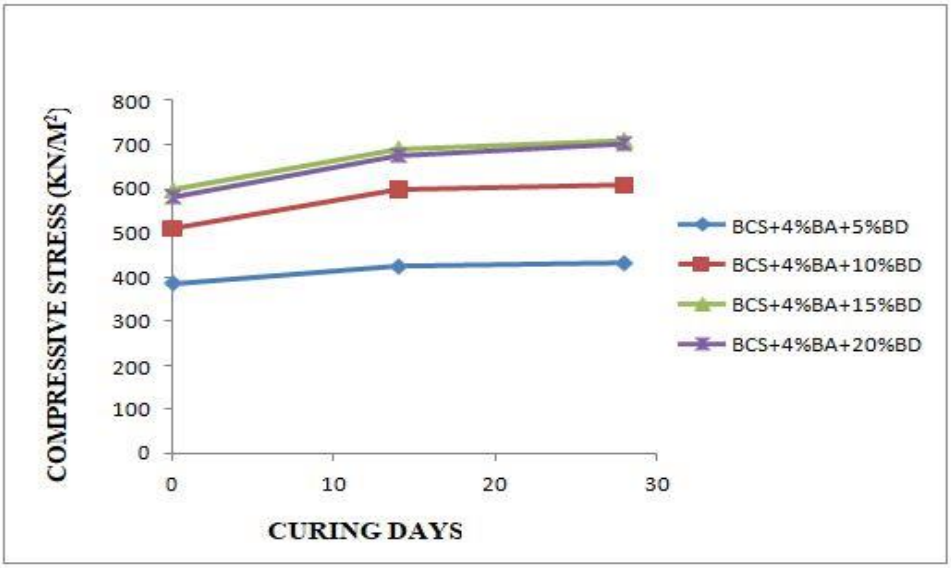

Fig. 6: unconfined compressive strength of BCS with bagasse ash by varyingdifferent %brick dust at different curing period

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VI. CONCLUSIONS

By employing waste materials such as bagasse ash and brick dust, this study presents an effective way for improving the qualities of B C soil. The stability test, on the other hand, involves increasing the levels while adding additives. Increases in BA decrease the LL,PL & PIThe use of bagasse ash brick dust in conjunction with soil improves the strength qualities. Bagasse ash and brick dust are both inexpensive and readily available. All of the fundamental tests show that expansive BCS with 4% BA is the best.On test with both immediate and varied curing periods, bagasse ash with black cotton soil fortified with 15% brick dust showed stronger strength than BC soil alone as well as other percentages of brick dust combination. This combination will induce ideal black cotton soil with greater soil brick dust matrix indices than other percent of fibre combination to the black cotton soil, as shown above. As a result, they are determined to be the best combination. Bagasse ash with black cotton soil supplemented with 15% brick dust is observed to be greater for both immediate testing and with varied curing periods, according to the UCS test. The unconfined compressive test revealed this. According to the UCS test, bagasse ash with black cotton soil supplemented with 15% brick dust is superior in both immediate testing and with various curing durations. This was found by the unconfined compressive test.Based on the results of the experiments, it was concluded that the admixtures brick dust is superior to the standard brick dust, and that the qualities of soil can be improved by addition of waste material from bagasse ash.

VII. SCOPE OF THE STUDY

According to the findings, the adding of BA and brick dust improves the geotechnical qualities of B C soil to a greater extent. The further studies could be done on: With increasing percentages of bagasse ash and brick dust, the consolidation characteristics of B C soil may be determined. Other soils, such as silt and clay-silt combinations, can be subjected to similar experimental investigation. The comparative investigation of various waste materials' effectiveness in enhancing B C soil. Other types of soils can be studied as well. Study can be taken u for prolonged curing periods. Variations in the percentages of bagasse ash and brick dust can be used to enhancethe research.

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