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Stabilization of Expansive Soil using Bagasse ash and Bamboo Fiber as Reinforcement

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Abstract - *Expansive soils in India are the major concern for the foundation failure, as these soils show differences in behaviour with varying weather conditions. These soils have a tendency of losing the bearing capacity and result in shear failure and cracks owing to compaction. Expansive soil or expansive clay is prone to high change in volume which is related to change in the content of moisture. Construction on these types of soil can only be done by treating or stabilizing the physical and chemical properties of soil. In this study there are few techniques and additives used for stabilizing the expansive soil. The combination of a natural fiber and a cementitious product helps in regaining the soil strength to the maximum level. Industrial waste such as bagasse ash and natural fiber such as bamboo fiber are two of the assets which have the characteristics of stabilizing the soil*

Key Words: **Expansive Soil, Bagasse Ash, Bamboo fiber, Direct Shear Test, Shear strength**

1. INTRODUCTION

Development of establishment for structures on any expansive soil is exceptionally hazardous on geotechnical ground. Because of urbanization and industrialization, soil improvement and adjustment has been a zone of significant worry in the field of development. The nature of soil has enormous effect on kind of structure and the plan. The expansive soils are instances of feeble soils, which experienced in establishment designing for spans, expressways, structures, dikes and so forth. Expansive soil experiences changes in the volume when they interact with water as they show substitute growing in the shrinkage properties. It swells during wet season and recoil during warm season. The conduct of soil fortified with natural fiber has increased wide acknowledgment in the course of the most recent decades and it has been set up that fiber strengthened soil incredibly improves the general designing exhibition of soil. Broad examination has been done on the adjustment of expansive soils utilizing different added substances, for example, lime, cement, fly ash, modern waste items etc.

As of late, different wastes are produced in the society which isn't beneficial for us and prompts destructive impact on human just as some other animals of the society. So in this research we used the two waste i.e. bagasse and bamboo. However the utilization of geo synthetic materials includes significant expenses particularly for moderate tasks that incited to go after different materials including those from common fibers like coir and bamboo. One of the essential advantages of haphazardly distributed fiber is the nonappearance of potential planes of shortcoming that can create corresponding to arranged support and furthermore Sugarcane bagasse ash remains is the waste aftereffect of the start of bagasse ash for imperativeness in sugar industries. Sugarcane bagasse ash remains is disposed of in landfills and is by and by transforming into a characteristic weight. Utilization of waste material and natural fiber for improving soil property is invaluable on the grounds that they are modest, locally accessible and eco-accommodating. In this study, the balancing out impact of bamboo fiber on soil properties will be contemplated

2. LITERATURE REVIEW

Akansha & Mittal (2018) studied to enhance the properties of black cotton soil by utilizing bagasse ash and coir fiber. Tests were made utilizing various rates of bagasse ash of virgin soil were checked and CBR test were performed for both soaked and unsoaked soil tests. It is observed that addition of 10% sugarcane debris and 4% coir fiber in natural soil gave the maximum bearing capacity and strength in the specimen. Similarly CBR value rise the new CBR value of the test specimen in 2.5 mm penetration in submerged and un-submerged soil is 6.31 and 14.93 respectively. The percentage increase in new CBR value for 2.5 mm penetration in submerged and un-submerged is recorded as 52.42% and 159.65%.

Kumar et al. (2017) Attempted to improve the quality of the clay soil by making a soil bagasse ash- lime blend. Nineteen samples were set up to explore the properties of soil by including 5%, 10%, 15%, 20%, 25% and 30% of Bagasse ash with the specimen alongside 0%, 5% and 10% lime of the above samples. Standard proctor test and unconfined compressive strength test were directed to break down the OMC, MDD and compressive strength of soil blend. In Standard Procter Test, the dry density increments with increment in Bagasse ash rate up to 20% and from there on has a decreasing pattern. In spite of the

fact that a reduction in OMC has been seen with increment in Bagasse ash rate and there was marginal increment in MDD with the expansion in the percentage of lime, however a decline in OMC has been seen with increment in the percentage of lime content

Hasan et al. (2016) did his research on bagasse ash. Bagasse ash is a fibrous material which consists of high amount of silica. which is considered as pozzolanic material having non-reactive nature and can possibly be utilized for stabilizing the road subgrade. So as to exhibit the potential capacity of bagasse ash in reducing the unfriendly impacts of expansive soils on roads, an cluster of exploratory tests utilizing bagasse ash were directed. In their investigation bagasse ash & hydrated lime was utilized and mixed in with black soil tests, gathered from Queensland, Australia. Test specimens were made by utilizing various % of bagasse ash and hydrated lime i.e. 0%, 06%, 10%, 18% & 25% by the dry mass of soil, at a proportion of 3:1 respectively. The outcomes of UCS test, CBR test and FSR test were introduced for untreated and treated soil samples after different curing period of 3days, 7days and 28 days. The results of these tests obviously showed that adjustment of expansive soils utilizing hydrated lime and bagasse ash improves the quality as well as encourages adapting to ecological worries through decrease of sugar industry squander material.

Reddy et al. (2017) Led geotechnical test take a shot at black cotton soil mixed with sugarcane bagasse ash(10%, 15%, 20% and 25%) and polypropylene fibers (0.5%, 1.0% and 1.5%). The tests conducted were OMC, UCS, and CB ratio Test. It is discovered that 20 % of sugarcane bagasse ash and 1% of polypropylene fiber expands the UCS and CBR esteems.

Verma et al. (2017) worked on the effect of bamboo grid reinforcement utilizing soil bagasse ash blend. Three bamboo grids (1*1, 2*2, 3*3) were made and lay them in three distinct depths of bagasse ash treated soil sample (1/3,2/3, ½) . The test performed are CBR test and they found that the utilization of bamboo reinforcement of the grid layer on the soil will increase the CBR by 51% for one layer of bamboo reinforcement, 48% for two-layer of bamboo support and 47% for 3 layers of bamboo fortification. As indicated by CBR results, when they blend bagasse ash with CBR in various extents they found that the most extreme quality addition is done when soil is mixed with 20% bagasse ash at the depth 2/3 in aperture size 2x2.

Kharade et al.(2014) researched that expansive soil can be stabilized by using bagasse ash. Various experiments were done on samples during this research. For stabilizing expansive (black cotton) soil, The partial replacement of soil with bagasse ash at the rate 3%, 6%, 9% and 12% is done. At 06% of replacement of soil with bagasse ash without any addition of chemicals and binding material showed very high rise in properties of black cotton soil. For getting the optimum value at which soil stabilized, standard proctor test and UCS test were conducted.

Chittaranjan et al. (2011) examined the 'agricultural squanders as soil stabilizers'. Wastes i.e. sugarcane ash, groundnut shell ash and rice husk ash are utilized to improve the weak subgrade soil. The subgrade soil which is not stabilized is treated with over three wastes independently at 0%, 03%, 06%, 09%, 12% and 15% and CBR test is done for each percent . Increase in the percentage of agricultural waste in soil showed increase in CBR value of test samples.

Onyelowe (2012) had done the study on Akwuete Lateritic Soil stabilized with cement and Bagasse Ash that was taken from 1.5m below the top layer of soil. In this study soil was stabilized by adding 4% and 6% of cement with the addition of bagasse ash in varying percentage at the rate 0%, 02%,04%, 06%, 08% and 10% by weight of dry soil. After utilization of admixture of bagasse ash and cement in soil various tests were performed i.e. OMC, MDD and CBR. Eventually it is concluded that with the increase in bagasse ash, OMC also increased. It was observed that the addition of bagasse ash improved the CBR value in comparison to natural soil. Maximum dry density reduced at the 4% of cement with bagasse ash in soil where as maximum dry density increased at 6% of cement content with the increase in the actual percentage of bagasse ash.

Kiran & Kiran (2013) investigates the strength Qualities of Expansive (black Cotton) Soil Utilizing Bagasse ash and Added substances as for a Stabilizer". In this research, Expansive (black cotton) soil is taken from a village Harihara of Davanagere, Karnataka. Different tests were formed at the various rate of bagasse ash i.e. 4%, 8% and 12% and added substance blend extent. CBR, UCS tests were performed on the samples. It was observed that the above mix proportion showed the change in thickness, CBR and UCD values. For 8% of bagasse ash with 8% cement showed expansion of thickness from 15.16 KN/m^2 to 16.5 KN/m^2. At 4% bagasse ash with 08% cement, the CBR values were expanded from 2.13 to 5.43. Similarly UCS values expanded to 174.91 KN/m^2 at 08% bagasse ash with 08% cement as earlier it was 84.92 KN/m^2.

Moses and Osinubi (2013) done their research on "Compaction Efforts of Bagasse Ash-cement Treatment on Expansive (Black Cotton) Soil". Dark greyish soil was utilized in this research and collected from Gombe state. Index properties were checked on natural soil as well as on treated soil. Cement of varying percentage i.e. 0%,2%,4%,6% and 8% were added with bagasse ash at the rate 0%,2%,4%,6% and 8% by weight of soil in expansive black cotton soil. All the tests i.e. moisture density relationship, CBR, UCS were performed on the treated soil. The most favorable blend is 4% BA/ 8% OPC was suggested for the treatment of expansive (black cotton) soil and can be used as a sub-base material.

Paul and Sneha (2016) taken a shot at the impact of random inclusion of the bamboo fiber on quality conduct of fly ash treated black cotton soil This paper depicts the compaction and quality conduct of fly dash treated Expansive soil fortified with bamboo fiber. The ideal level of fly ash was seen as 20% by load of soil. Bamboo fiber of normal width 0.45 mm and 25 mm length is utilized. It was arbitrarily included into the fly ash treated soil at four unique rates of fiber content. The fortified soil tests were exposed to unconfined pressure test and compaction tests. It is discovered that quality properties of ideal mix of BC soil-fly ash with bamboo filaments is considerably better than untreated BC soil. An ideal fiber substance of 1% (by weight) is prescribed for fortifying fly ash treated BC soil.

3. CONCLUSION

Extraordinary relative examinations of the current researches shows that using various waste admixtures can improvise the geotechnical properties of expansive soil. It is also concluded that utilizing industrial waste can help in both the circumstances i.e. "waste management and soil subgrade treatment." Inclusion of natural fiber (bamboo fiber) can results in a subsequent increase in the physical and chemical properties of expansive soil. In the context of the reviews it is also concluded that using the combination of an agricultural waste and a natural fiber ended in providing both shear and compressive strength of the soil subgrade.

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