

# Stabilization of Clayey Soil Using Bagasse Ash as a Stabilizing Material

<sup>1</sup>Nancy Missan, <sup>2</sup>Nitisha, <sup>3</sup>Hemlata Sharma, <sup>4</sup>Navdeep Mor

<sup>1,2,3</sup>Assistant Professor, Department of Civil Engineering, CGCTC Mohali-140307, India

<sup>4</sup>Research Scholar, Department of Civil Engineering, NITTTR, Chandigarh-160019

**Abstract :** Most of the structure collapse due to lack of geotechnical properties present in clayey soil which covers a most part of our country. So to avoid these types of failures in our structure we have to use a suitable and locally available material such as waste products as a admixture to improve soil properties. There is large number of sugar mills in our country which produces plethora of waste product in form of bagasse. This Waste of sugarcane can be used as admixture because it has fibrous properties with silica (SiO<sub>2</sub>) present in it which helps in stabilizing the clayey soil. In our study, we analyze the change in stabilization in clayey soil by adding different percentage of bagasse ash by experiments like CBR test, Atterberg's limit, SPT. After analysis, it was found that increasing percentage of sugarcane bagasse waste in clayey soil upto 12% increases the compaction and strength properties of the soil.

**Keywords -** Bagasse ash, soil stabilization, SPT, CBR, Atterberg's limit.

## I. INTRODUCTION

To achieve the higher strength of pavement structure its underlying soil must have higher stability properties. But some type of soils such as expansive soil which has tendency to create deep cracks and other failure which results in a weaken the structure. To improve its property of stabilization we have to use some admixture which is easily available and cost effective also. By improving the stabilization of the soil we can get a strong foundation to our structure which can be economical also.

Soil is the basic material in any construction work, so it should have safe bearing capacity to hold the structure firmly. Clayey soil have minimum tendency to hold the structure so that there are minimum possibilities to create any structure on clayey soil

There are many industrial wastes in our country which creates environmental problems like pollute our rivers, damages our agricultural land and spread diseases in animals and human beings. To reduce these effects we can use these waste products according to their chemical properties in our construction materials because they have tendency to enhance the engineering properties of the material. Such as bagasse ash which is a byproduct of Sugar mills produces in large amount of SiO<sub>2</sub> (62.43%) and some fibrous properties also. Which helps in improving then soil stability.

## 2. Objectives of the Study

1. To study basic properties of Soil
2. To determine the basic properties of Bagasse ash
3. To study effect of varying percentage of bagasse ash with variation in percentage on optimized soil sample.
4. To analyze the results.

## 3 Methodology of the research work

Step 1: Study various research papers on Sugar cane bagasse ash for strengthening of soil.

Step 2: Stabilization of Soil.

Step 3: collection of material

Step 4: Preparation of soil samples

Step 5: Testing of samples.

Step 6: Analysis and evaluation of results

Step 7: Findings and conclusion

## EXPERIMENTAL WORK

Experimental work involves various tests performed on the mixture bagasse ash in different percentages (0%,3%,6%,9% & 12%) and clayey soil. Various tests performed on the mixture are:

- i) Specific gravity test
- ii) Atterberg's Test
- iii) Standard proctor test
- iv) CBR test

### EXPERIMENTAL PROCEDURE

Soil samples are prepared with/without admixtures (bagaase ash) as per Indian standard procedure for the tests. Samples are oven dried at temperature 100-1050C and mix with water of different proportions. Take a mould of 150mm diameter and 175mm height with detachable perforated base plate. Oven dried soil sample of about 5kg in different proportion of bagasse ash (0%,3%,6%,9% & 12%) before adding the water. Different tests are performed to check the soil properties and strength of the soil mixture (clayey soil+ bagaase ash).

- i) To check the liquid limit, plastic limit, shrinkage limit and consistency of soil with/without admixtures we perform atterberg’s test.
- ii) In order to obtain the optimum moisture contents and maximum dry densities of prepared samples, we will perform California Bearing Ratio Test.

### RESULT & ANALYSIS

#### i) Compaction Test:

Standard Proctor Test was carried out with different percentage of Sugarcane bagasse ash and the values of MDD as well OMC obtained. Table shows the different values of OMC and MDD for different proportion of sugarcane bagasse ash replaced with soil. It is found that the dry density decreases with increase in the SCBA content. This decrease in dry density is due to the fact that the soil bagasse mixture becomes soft because of small density of Sugarcane Bagasse Ash.

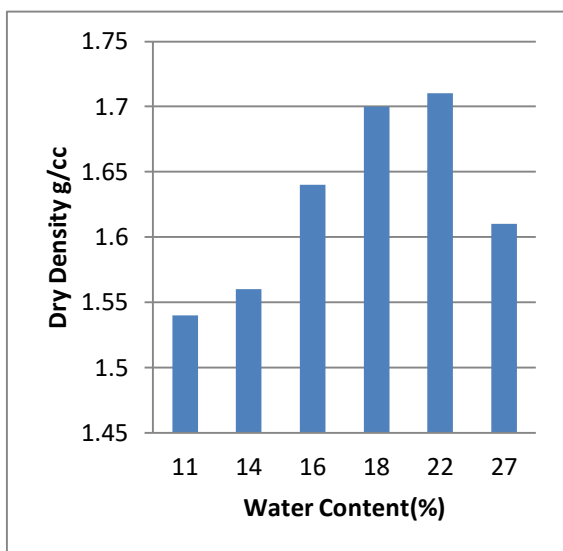


Fig.1 For sample 1 SCBA 0%

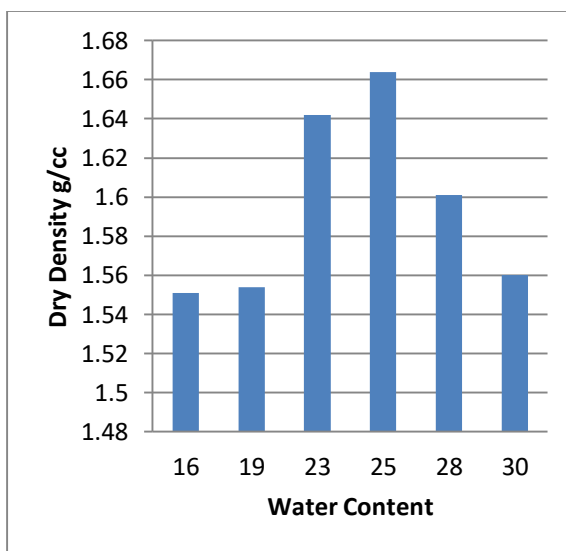


Fig.2 For sample 2 SCBA 3%

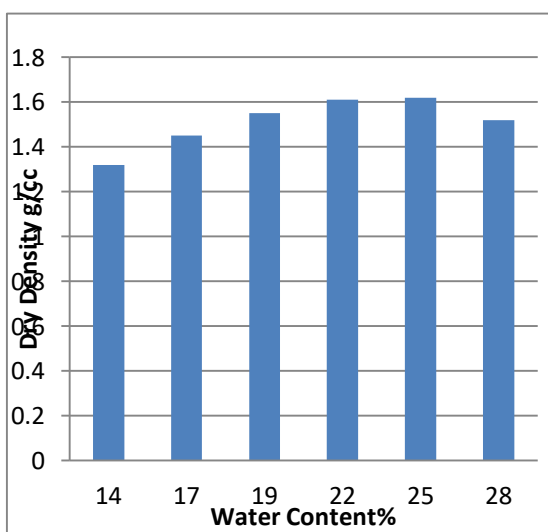


Fig.3 For sample 2 SCBA 6%

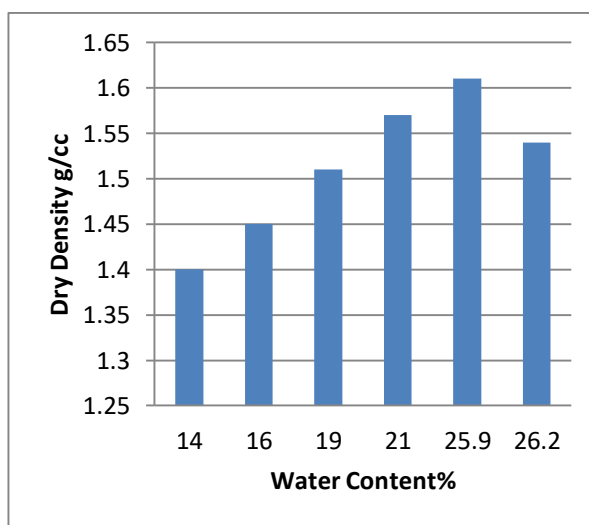


Fig.4 For sample 2 SCBA 9%

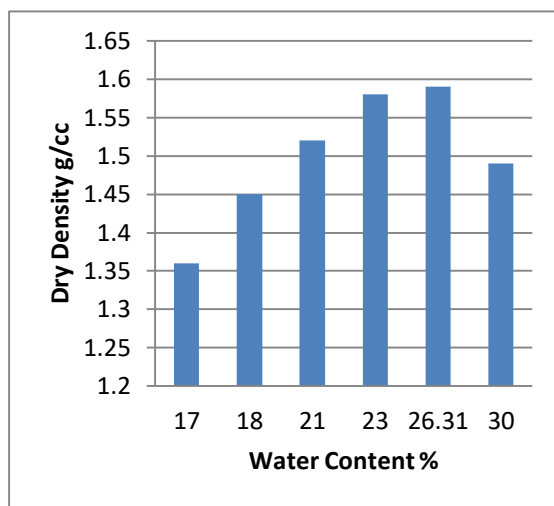


Fig.5 For sample 2 SCBA 12%

**COMPARITIVE STUDY**

Figure 4 is showing the comparison for the different mix proportion and the compaction curve of each. From comparison curve it is clear that as the percentage of sugarcane bagasse ash is increasing in mix proportion the maximum dry density (MDD) is decreasing. This decrease in dry density is due to the fact that the soil bagasse mixture becomes soft because of small density of Sugarcane Bagasse Ash. Waste.

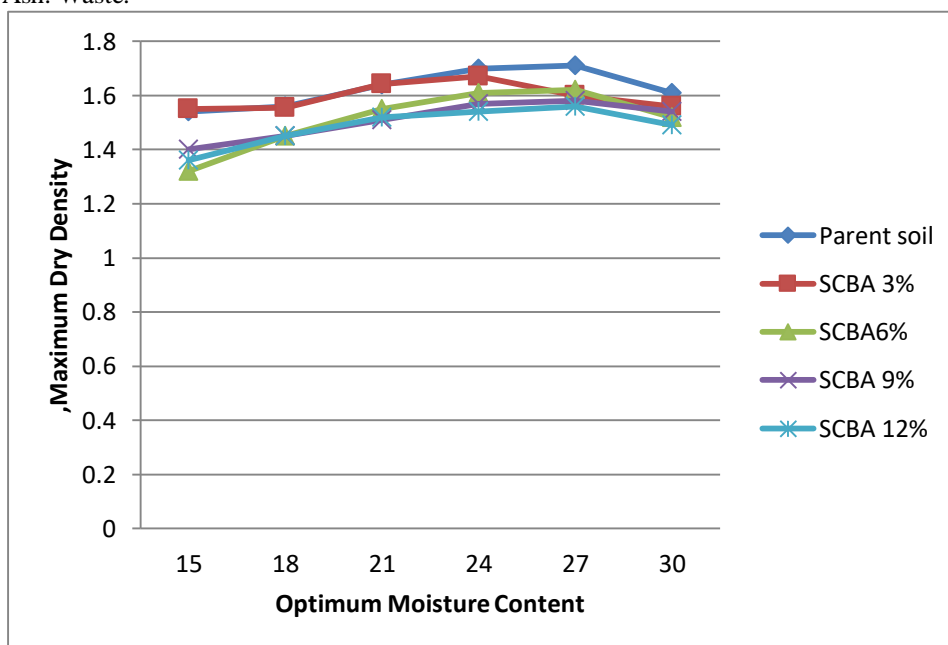


Fig.6 Dry Density vs Moisture Content for various mix proportions of sugarcane bagasse ash and clayey soil.

**ii) CBR Test**

We have graphically represented the variations in C.B.R. values in the graphs below for soaked conditions. On the fig.8, we take abscissa (x-axis) as penetration in mm and on ordinance (y axis) as load on plunger in kg. C.B.R. values of mix compositions of sugarcane bagasse wastage passing 75µ and clayey soil with percentage varying 3%, 6%, 9% and 12%. From graphs it can be seen that on increment of sugarcane bagasse waste percentage, the C.B.R. value of the mix composition increases. Subsequently it tends to be inferred that to utilize the mix compositions in base and sub base development.

Table:1 Variation of CBR values with SCBA %

S.No.	Percentage of SCBA	CBR Values
1	0%	3.45
2	3%	5.38
3	6%	5.80
4	9%	6.14
5	12%	9.50
6	15%	6.39

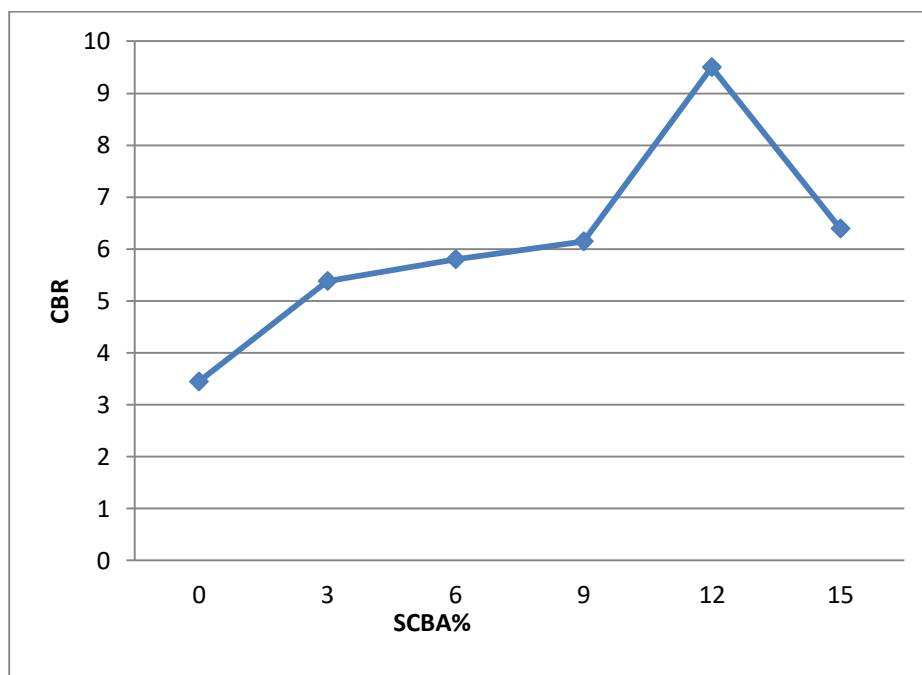


Fig.7 CBR soaked values with varying mix proportions of sugarcane bagasse ash

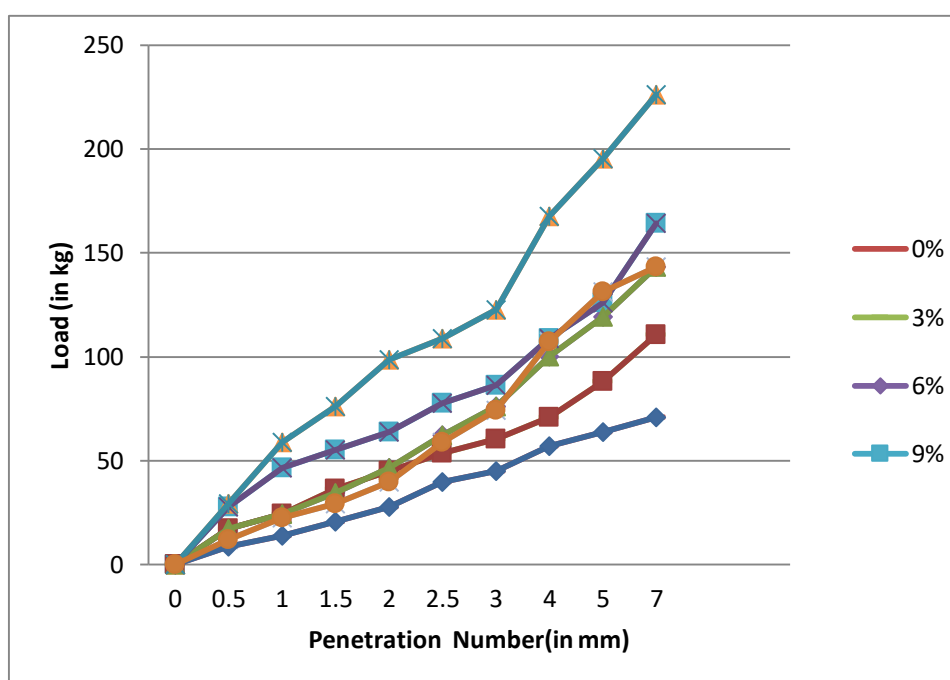


Fig.8 CBR soaked values with varying mix proportions of sugarcane bagasse ash

**DISCUSSION**

In the present paper, we determine the effect of sugarcane bagaase waste in the compaction properties of clayey soil with the help of modified proctor test and after analysis the all test result it was observed that OMC is increased and as well as MDD have been slightly increased for various mix proportion. After a rigorous literature review and analysis of the results we can conclude that .the presence of clay minerals in sugarcane bagaase waste increase absorption of water by clayey soil which increases optimum moisture content(OMC) as well as maximum dry density(MDD) Slight increase in maximum dry density (MDD) with increase in mix proportions is due to greater specific gravity of sugarcane bagaase waste than the sand. The CBR values obtained from above Result were increased as the sugarcane bagaase waste particles acts as grains like that of sand particle which upon mixing increases the strength by filling up the voids between sand particles.

**CONCLUSIONS**

Various experiments were conducted on mix compositions of clayey soil with sugarcane bagaase wastage as additive and it was found that with increasing percentage of sugarcane bagaase waste with clayey soil increases the compaction and strength properties.

**REFERENCES**

- [1] Kanchan Lata Singh and S M Ali Jawaid. 2013. Geotechnical Properties of Soil Stabilized with Bagasse Ash. IJBSTR RESEARCH PAPER. 33(3): 120-124.
- [2] Prakash Chavan and Dr.M.S.Nagakumar, 2014. Studies on Soil Stabilization by using Bagasse Ash. IJSRET, 11(3): 2278-0882.
- [3] Amit S. Kharade, Vishal V. Suryavanshi, Bhikaji S. Gujar, Rohankit R. Deshmukh. 2014. Waste Product Bagasse Ash from Sugar Industry can be used as Stabilizing Material for Expansive Soils. 3(3): 100-105.
- [4] K.S. Gandhi. 2012. Expansive Soil Stabilization Using Bagasse Ash”, IJERT, 1(5): 105-111.
- [5] K.R. Arora “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi.
- [6] A.V.Narasimha Rao. 2011. Applications of agriculture and domestic waste in geotechnical Applications. Journal of Environmental Research and Development. 5(3): 673-678.
- [7] M.Chittaranjan, M.Vijay. 2011. Agriculture waste as soil stabilizers. International Journal of Earth Science and Engineering. 4(3): 50-51.
- [8] V.S. Aigbodion, S.B. Hassan, T. Ause and G.B.Nyior. 2010. Potential Utilization of Solid Waste (Bagasse Ash). Journal of Minerals and Martials Characterization and Engineering, 9(2): 67-77.