TO EXAMINE THE BEHAVIOUR OF SOIL BY ADDITION OF DIFFERENT PROPORTIONS OF CEMENT AND BAGASSE ASH

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ABSTRACT

Soil is a homogeneous mixture of grain particles which is used as base of structure, which helps to bear the load induced by super structure. The quality of soil is one of the biggest factors on which types of structure and their and their plan is determined. In many cases soil in its occurring state lack in different geotechnical properties which are to be required in civil engineering works. Due to different properties different soils behave differently. The clayey soil due to high void ratio, small particle size and presence of high montmorillonite mineral in it undergo shear failure. To vanquish these properties, soil must be enhanced by unnatural means, which is termed as soil stabilization. The soil stabilization can be achieved by altering the mineralogy of soil up to an extent by adding components with enhanced mineralogy like cement, fly ash, bagasse ash etc. This research seeks to explore possibility of SCBA (Sugarcane Bagasse Ash) for the stabilization of soil. The waste produced by sugar industries after wrenching of sugarcane by machines. The waste is then burnt; the final outcome of ash is termed as bagasse ash. Soil is served with partial replacement of cement and bagasse ash (0%, 2%, 4%, 6%and 8%) which affects the OMC and MDD up to an optimal percentage.

INTRODUCTION

For any super structure to be constructed the foundation is very indispensable and on the other side it needs to be strong enough to support the whole super structure. In continuation for the underpinning (under structure) to be strong, the soil around it has a very crucial role. We should have proper facts about their characteristics, which affect their behaviour without knowing this we will not be able to cope up with soil. The required properties in a soil needed for the construction need can be attained by process of soil stabilization. Transforming from old to new constructions materials to suit different trades and site conditions for economicality and safe design constructions. Efficacious utilization of weak soils by relaying additional strength using stabilizers enables reduction in construction and improves the fulfilment required by the structures. Due to presence of high montmorillonite content in clayey soil it exhibits high swelling and shrinkage causing differential settlement of the structure resulting in severe damage. Soil enlarge in rainy season period and shrinks in summer seasons.

In this research, stabilization of soil is done with the assistance of Bagasse Ash (SCBA), the burning of bagasse in industries which produce sugar provides us with organic waste. The residue obtained from grinding sugarcane is bagasse (cane fiber) in which the leftover liquid (juice) and the dampness from the uprooting process remain. The sugar industries face a barrier in handling this waste due to the massive quantity. Amorphous silica is present in reasonable amount, which specifies the presence of pozzolanic properties, responsible in interacting the soil grains together resulting in greater shear strength. The use of bagasse ash as stabilizer for clayey soil can be verified under various experiments.

Literature Review

Use of Agricultural (farming) wastes as stabilizers for soil. This research was done by **M Chittaranjan, M. Vijay, D. Keerthi.** In their research of stabilization of the loose sub grade of underneath soil usage of farming (agricultural) wastes like groundnut shell ash, rice husk ash and bagasse was there. Values such as 0%, 3%, 6%, 9%, 12%and 15% were used in different proportions in the experiments and CBR test was performed for each proportion of these wastes. In the outcomes of these tests it was noticed that CBR value was improvised with increment in waste proportion.

'**Akwuete lateritic soil and bagasse ash**' was acquired from the approximate depth of 1.8 meters of soil. This research was performed under the supervision of **Ken C. Onyelowe.** Stabilization of soil was done using 4% and 6% proportions of cement with different proportions of bagasse ash varying from 0%(control), 2%, 4%, 6%, 8%, and 10% by weight of the dry soil. The CBR, OMC and MDD tests were performed in the labs. It was found that as the researcher raised the bagasse ash content there was increment in OMC.

In 2012 research was done by **Gandhi** to improve expansive nature of poor and loose soil with the usage of bagasse ash. The dry density of the soil with extensive nature got an increment so to make the soil suitable and fit for varying conditions. In extensive soils the property (nature) of swelling is decreased by replacing some proportion of bagasse ash as admixture. Various tests like Swelling Pressure, Plastic Limit, Liquid Limit, Plasticity Index, Shrinkage Limit, and Swell Index were performed with different proportions of Bagasse ash such as 0 %, 3%, 5%, 7%and

10% respectively. From the conducted research, he reached at a conclusion that with the increment in proportion of bagasse ash there is a decrement in all the properties.

Objectives of the study:

1. To examine the change occurring in characteristics of clayey soil using bagasse ash as an admixture.
2. To enquire the contraction properties of clayey soil with cement and bagasse ash.
3. Analyzing the change in values of standard proctor test (SPT)
4. For investigating that bagasse ash can be use as a stabilizer and to reduce the problem of disposing this.
5. To review the difference in properties of compaction of Bagasse Ash treated soil with and soil which is untreated.
6. To study the strength parameters of clayey soil treated with different percentages of bagasse ash such as 2%, 4%, 6%, 8%
7. To study the change in other properties of treated and untreated soil.

Benefits:

The characteristics of soil differ in great proportion. The bearing capacity of soil plays a vital role in construction of structures. Hence, the requirement of the soil underneath the superstructure to be stabilized is necessary as it will help to decrease the degree of settlement in soil afterward implementing the load on the soil. While working with soils it is important to keep in mind that the different soils behave differently and have a different grade. There is a great difference between well graded and uniformly graded soil. If a soil is uniformly graded it is also termed as poorly graded soil which is not a requirement of construction. We require well graded soil so to acquire minimum number of voids. Hence, it is better to use different types of soils merged together in varying proportions to enhance the strength of soil as it provides strength to the soil. On the contrary it is not economical to replace the whole soil so here admixtures come into role as they also play vital role in increasing the bearing capacity of soil.

- It is favourable both in terms of cost and energy so to enhance the bearing capacity of the underneath soil instead of using different types of footings.

- In hilly areas stability of slopes is a major aspect so to overcome these soil stabilizers can introduced over there.
- Prevention of Soil erosion can also be done, which is convenient in varying weather conditions.
- Waterproofing can be done with the help of soil stabilization which prevents the soil strength parameters.
- It prevents the decrement in volumetric change in soil caused by temperature change or water content.

MATERIAL

1. Clayey soil

Manual labour method was used for the collection of soil. Bigger size lumps were broken down with pick axes and rammers. The lumps were broken and then it was oven dried for 24 hours at 105°c to 110°c

A clayey soil, though distinguished by the colour which it bears, namely black, white, yellow and red, differs from all other soils, being tough, wet, and cold, and consequently requiring a good deal of labour from the husbandman before it can be sufficiently pulverized, or placed in a state for bearing artificial crops of corn or grass.

In a dry summer, clay cracks and shows a surface full of small chinks, or openings. If ploughed in a wet state, it sticks to the plough like mortar, and in a dry summer, the plough turns it up in great clods, scarcely to be broken or separated by the heaviest roller.

2. Bagasse Ash

The admixture used in the research was obtained from Sugarcane mill in “Morinda of District Mohali, Punjab”. After inspecting the admixture (bagasse ash) discernibly it was observed that it has greyish black texture and the nature of ash is fibrous. Production of fibrous waste after

grinding sugarcane in mill and the juice of sugarcane is extricated form the cane. The waste left is burnt over and the by product obtained is Bagasse ash. Dumping this waste product is massive problem to tackle with hence using it as an admixture is an ideal way right now. Presence of amorphous silica content is quite high in this and it reflects some pozzolanic properties. To preserve the environment from getting disturbed by this waste material a continuous study is always in process.

METHODOLOGY

Different set of readings were collected from the stabilized soil sample by performing various lab tests on each sample. The following tests were performed on a soil to get a output result on basic properties of sample of underneath soil for improvising the strength parameters of soil.

- Moisture Content (By Oven dry method)
- Plastic Limit (By Thread method)
- Sieve Analysis (By Dry grain size analysis)
- Specific Gravity (By Pycnometer)
- Liquid Limit (By Casagrande's apparatus)
- Standard Proctor Test (By Proctor's apparatus)

Table1.a

Engineering Properties of Soil		
S. No.	Properties	Typical Value
1.	I. S. Classification	C I
2.	Liquid limit	22-23
3.	MDD g/cc	1.85
4.	OMC %	14
5.	Specific Gravity	2.07

RESULT AND DISCUSSION

Water content in given soil sample

Table 2

Wt. of container (g)	47	47
Wt. of container + wet soil (g)	150	154
Wt. of container + dry soil (g)	140	144
Wt. of water (gm)	10	10
Moisture content (%)	10.7	10.3

The natural moisture content of soil sample is 10.55

Specific Gravity

Table 3

Weight in (g)	Specimen 1	Specimen 2	Specimen 3
Weight of empty pycnometer (M1)	633gm	633gm	633gm
Weight of dry soil with pycnometer (M2)	828gm	828gm	828gm
Weight of soil, pycnometer and water (M3)	1506gm	1502gm	1508gm
Weight of pycnometer filled with water (M4)	1405gm	1402gm	1406gm
Specific gravity	2.07	2.05	2.09

Result: Mean specific gravity of given soil is 2.07

Particle Size Distribution

Table 4

Sieve Size (mm)	Weight (gm) Retained	%age retained	Cumulative %age	%age finer
4.75	152	15.20	15.20	84.80
2.36	178	17.80	33.00	67.00
1.18	200	20.00	53.00	47.00
0.6	166	16.60	69.60	30.40
0.3	161	16.10	85.70	11.50
0.15	138	13.80	99.50	.50
0.075	5	.50	100.00	.00
Sum 1000				

6.4 Liquid Limit

Table 5

Wt. of container (gm)	44.9	46	44.6
Wt. of container + wet soil (gm)	78.3	81.3	76.8
Wt. of container + dry soil (gm)	70	75.30	74.10
Wt. of water (gm)	8.3	6	2.7
Moisture content (%)	33.07	20.30	10
No. of blows	17	26	34

From Graph, At 25 Number of blows Moisture content is 22%

Therefore Liquid Limit is equal to 22%

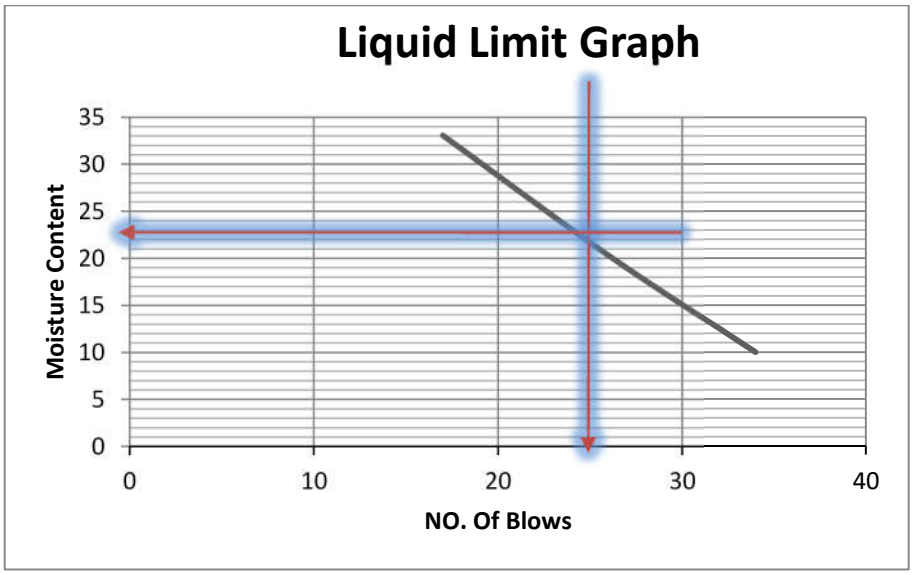

Liquid Limit Graph
Moisture Content
35
30
25
20
15
10
5
0
0
10
20
30
40
NO. Of Blows

Figure 5.1

Plastic limit

Table no. 6

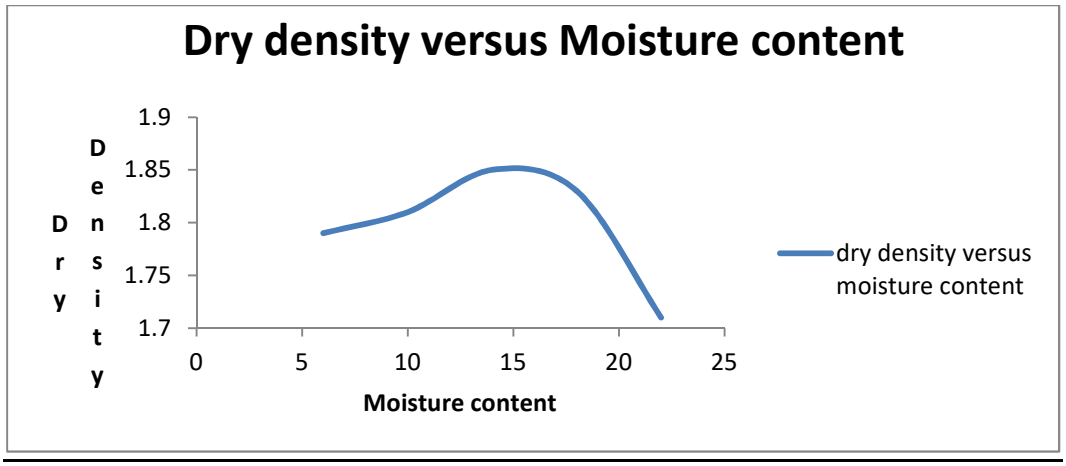
	Specimen 1	Specimen 2	Specimen 3
Wt. of container with lid	52	52	52
Wt. of container + wet soil	60	66	68.5
Wt. of container + dry soil	59	64	66
Wt. of water	1	2	2.5
Wt. of dry soil	7	12	14
Moisture content	14.28	16.66	17.85
Mean Value (Plastic limit)	16.26		

Plastic limit: 16.26% Plasticity index:31.98%

Standard Proctor Test

Table 7

UNSTABILIZED SOIL (U1)					
Water Content taken initially	6%	10%	14%	18%	22%
Dry density (g/cc)	1.79	1.81	1.85	1.83	1.71



X-Axis – Moisture Content Y-Axis – Dry Density

Figure 7.1

Proctor Compaction test for soil and cement:-

Table 8

Water Content taken initially	6%	11%	16%	21%	26%	31%
Dry Density at 3%	1.68	1.879	1.821	1.71		
Dry Density at 6%	1.68	1.90	1.75	1.70		
Dry Density at 9%	1.63	1.69	1.74	1.75	1.71	1.63
Dry Density at 12%	1.60	1.67	1.67	1.62		

Y-Axis – Dry Density X-Axis- Moisture Content

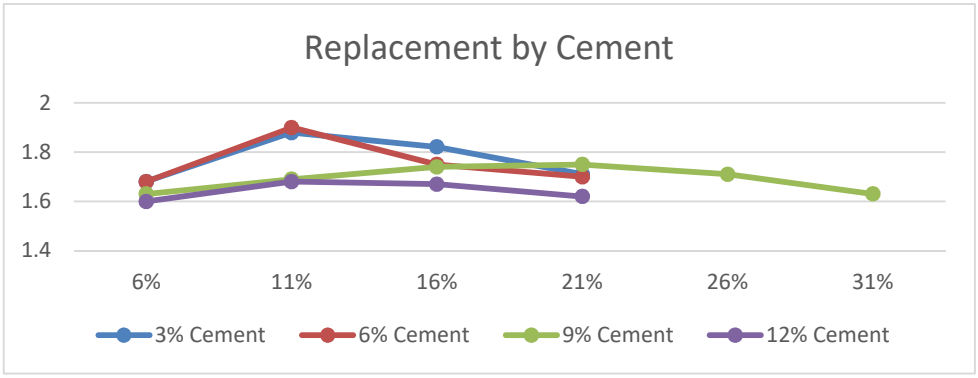
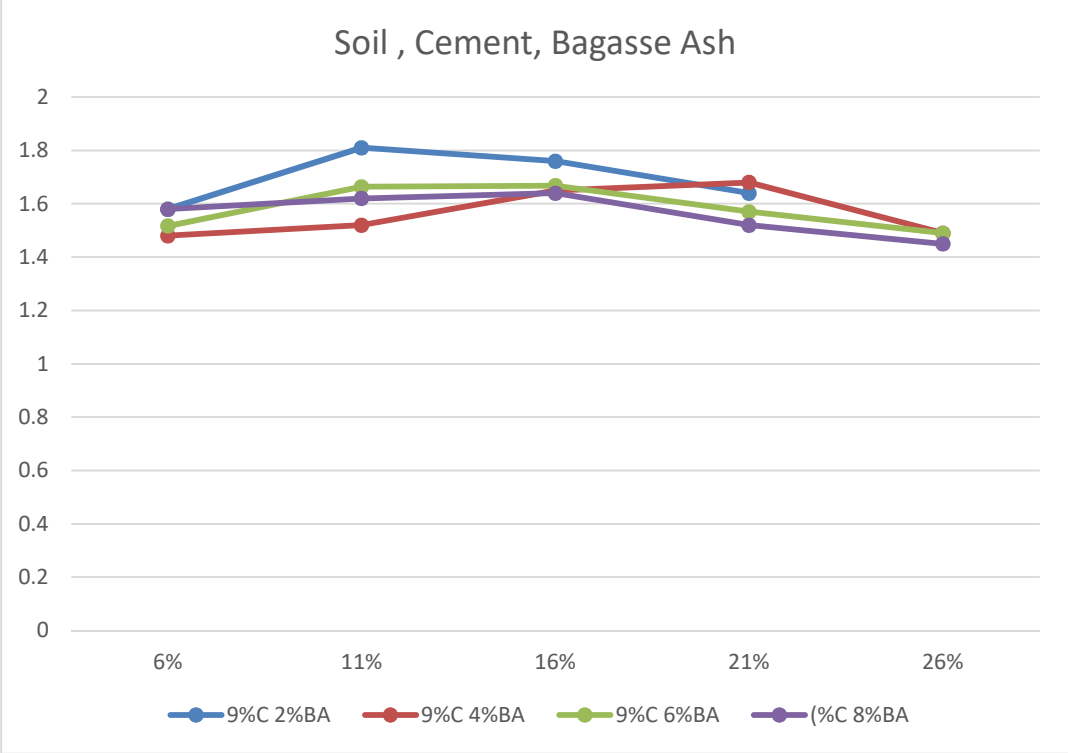


Figure 8.1

Proctor compaction test for soil, cement, bagasse ash

Table 9

Water Content taken initially	6%	11%	16%	21%	26%
Dry Density 9% C 2% BA	1.58	1.81	1.76	1.64	
Dry Density 9% C 4% BA	1.48	1.52	1.65	1.68	1.49
Dry Density 9% C 6% BA	1.517	1.664	1.668	1.57	1.49
Dry Density 9% C 8% BA	1.58	1.62	1.64	1.52	1.45



Y-Axis – Dry Density X-Axis- Moisture Content

Figure 9.1

CONCLUSION

- The addition of bagasse ash enhances some properties of clayey soil and hence within certain limits it can be used in clayey soil. In construction field it can be used in inferior constructions like village roads etc. As these constructions will provide sufficient time to deal with its further sustainable use and disposal.
- With the increment in quantity of bagasse ash a certain decrease in density and a certain increase in OMC was observed but within a limit, after which they showed anomalous behaviour.
- On addition of SCBA there is a decrement in dry density due to its light in weight.
- On addition of cement content the dry density increases in 3%, 6% and decreases in 9%, 12%.

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