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Improvement in Geotechnical Properties of Expansive Soil using Different Grain Size of Bagasse Ash, Lime and Quarry Dust

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ABSTRACT

The time period soil stabilization method improving the engineering houses of soil by means of synthetic method and increasing the solidity or bearing ability of any sort of soil via the use of managed proportioning, its compaction and the addition of a stabilizing agent. In soil stabilization, one of a kind methods are used to modify and enhance the houses of a soil so that it can be stabilized. The cost of creation of the pavement is considerably decreases if domestically to be had low cost substances are used in the production of sub base, sub grade and so on. The design of pavement is based on the minimum specified structural strength and bearing quality of the soil that will be achieved for each and every layer of material. This study investigated the stabilization of black cotton soil when stabilized by bagasse ash, lime and combination of different grain size of bagasse ash, lime and quarry dust. In this research various laboratory tests like atterberg limits, proctor test and CBR i.e California bearing ratio test is performed.California Bearing Ratio of the soil increases with the increase of Grain size of Bagasse ash.

Keywords*:-Bagasse ash, CBR, grain size, stabilization*

INTRODUCTION

Soil stabilization is the method of enhancement of strength or bearing capacity of the BC soil. Stabilization is done by the use of strained compaction, its proper proportioning and the addition of any stabilizing agent. It deals with the substantial and physio chemical methods to make the soil stabilize. Bagasse ash is a waste product available from sugarcane after crushing and burning the by-product. Bagasse ash can be advantageously used not only in the pavement construction work, but also provides an economic and useful avenue for disposal of bagasse ash, which is now recognized by as a national environmental problem. Due to lack of suitable soil at many places it need for soil stabilization. The common soil stabilized methods are lime stabilization and cement stabilization, which many be replaced by bagasse ash for economy. This reduces its disposal volume. Stabilization is used for an assortment of engineering works in which most common relevance being in the construction of both rigid & flexible and air field pavements to increase the bearing capacity of soil. Methods of stabilization may be grouped under two main types. a. Alteration or enhancement of various soil properties of the existing BC soil without any admixture or chemical change to improve bearing capacity of soil. b. Amendment of the properties with the help of any admixtures. The ideology of the soil stabilization are used for controlling the grading and size of aggregates and soils in the construction of bases and sub bases of the airport runways and highways pavements. In the present study an attempt has been made to improve the properties of Black cotton soil by addition of various materials like bagasse ash, lime & quarry dust. In this

investigation various Laboratory assessments have been carried to recognize the impact of bagasse ash, lime & quarry dust which mixed in mixture with Black cotton soil by accomplishing diverse exams together with plastic restrict, liquid limit and CBR assessments.

Meron Wubshet and Samuel Tadesse (2015) The Expansive soil accumulated from Addis Ababa, Bole sub metropolis, categorized as an A-7-5 soil on the AASHTO category became stabilized the usage of three% lime, 15% bagasse ash and 15% bagasse ash in mixture with three % lime through dry weight of the soil. The effect of the components on the soil became investigated with respect to plastcity, compaction and California bearing ratio (CBR) checks. The effects obtained imply an boom in optimum moisture content (OMC) and CBR fee; and a lower in maximum dry density (MDD) and plasticity of the soil for all components. But there was also a high-quality improvement within the CBR value when the soil is stabilized with a aggregate of lime and bagasse ash. This indicates a potential of the usage of bagasse ash as admixture in lime stabilized expansive soil.

Patrick Khaoya Barasa, Dr. Too , Kiptanui Jonah , S. M. Mulei (2015) First, particles size distribution was determined from grading test, secondly varying percentages (4%, 5%, and 6%) of lime was used to stabilize clay soil and then plasticity and CBR were determined. The same procedure was repeated for bagasse ash and finally the varying mix ratios of lime and ash 1:4, 2:3, 3:2 and 4:1 were used on the sample. The PI of the stabilized clay soil decreased with increase in the quantity of lime, ash and ratio lime to ash in all the samples.

Sabat and Bose (2017) carried out investigation to study the improvement in geotechnical properties of an expansive soil stabilized with fly ash and quarry dust, along with the effect of molding water content on CBR of fly ash-quarry dust stabilized expansive soil and economy of fly ash-quarry dust stabilization. It was concluded that the MDD goes on increasing and the OMC goes on decreasing and CBR got increased with increase in percentage of addition of fly ash –quarry dust mixes. The maximum value of UCS is achieved, when the percentage of fly ash-quarry dust mix is 45%, further addition of fly ash-quarry dust mixes decreased the UCS. The cohesion goes on decreasing and the angle of internal friction goes on increasing with the increase in percentage of addition of fly ash-quarry dust mixes. The optimum percentage of fly ash-quarry dust mix for improvement in geotechnical properties of the expansive soil is found to be 45%. 8) From the economic analysis it is found that, a substantial save in cost of construction is possible, if the two industrial wastes fly ash and quarry dust can be utilized up to 45% in the proportion of 1:2 to strengthen the expansive soil subgrade for construction of flexible pavements.

From the study of various research paper and literature review following objectives has been taken into consideration. To find out the optimal percentage of various materials like bagasse ash, lime & quarry dust by conducting various tests such as liquid limit, plastic limit and plasticity index by altering the different percentage of same materials. To study the performance of different soil using bagasse ash, lime & quarry dust. To determine the optimum moisture content and maximum dry density by conducting the proctor compaction test. To determine the California bearing ratio (CBR) value of black cotton soil mixed with different percentages of bagasse ash, lime and quarry dust. To reduce the cost of construction of the pavement over black cotton soil by soil stabilization technique with the help of soil stabilizing agent like bagasse ash, lime etc.

To utilize the waste materials available in the agro-industries.

MATERIALS AND METHODOLOGY

Various material used in this study are bagasses ash, quarry dust and lime. The burning of bagasse which a waste of sugarcane produces bagasse ash. Presently in sugar factories bagasse is burnt as a gas as a way to run their boilers. This bagasse ash is typically spread over farms and unload in ash pond which reasons environmental troubles additionally research states that Workplace exposure to dusts from the processing of bagasse can purpose the continual lung situation pulmonary fibrosis, more mainly referred to as bagassosis. So there may be excellent want for its reuse, also it is observed that bagasse ash is excessive in silica and is determined to have pozollinic belongings so it is able to be used as alternative to creation material. Baggase Ash has been taken in four grain size

- Less than 50micron.
- 50micron – 100 micron
- Greater than 100 micron

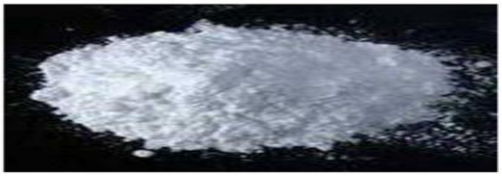

Fig.1: *Baggase ash*

Crushed quarry dust became acquired from the nearby crusher flowers. Quarry dust is a waste product produced throughout the crushing manner that's used to extract stone. It is rock debris. When massive rocks brake in too small elements for the development in quarries. It is like sand but typically grey in coloration.

Fig.2: *Quarry Dust*

The lime is an ancient cementing material. It has been used from early days to be a good building material in construction works. It is not available in nature in free state but it is produced by burning limestones. Shells of sea animals, kankars are also used in the manufacture of lime.

Fig.3: *Lime*

It is defined as a natural aggregate of mineral grains with or without natural matter constitutes and that can be alienated

Liquid Limit

The Casagrande's tool cuts a groove of size 2mm wide at the bottom and 11 mm wide at the top and 8 mm high. The number of blows used for the two soil samples to come in contact is noted down. Graph is plotted taking number of blows on a logarithmic scale on the abscissa and water content on the ordinate. Liquid limit corresponds to 25 blows from the graph.

Plastic Limit

This is determined by rolling out soil till its diameter reaches approximately 3 mm and measuring water content for the soil which crumbles on reaching this diameter. lasticity index (Ip) was also calculated with the help of liquid limit and plastic limit.

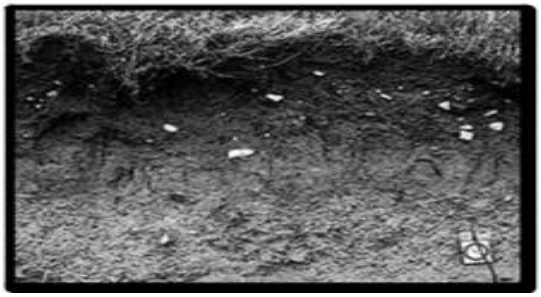

Fig.4: *Black Cotton Soil*

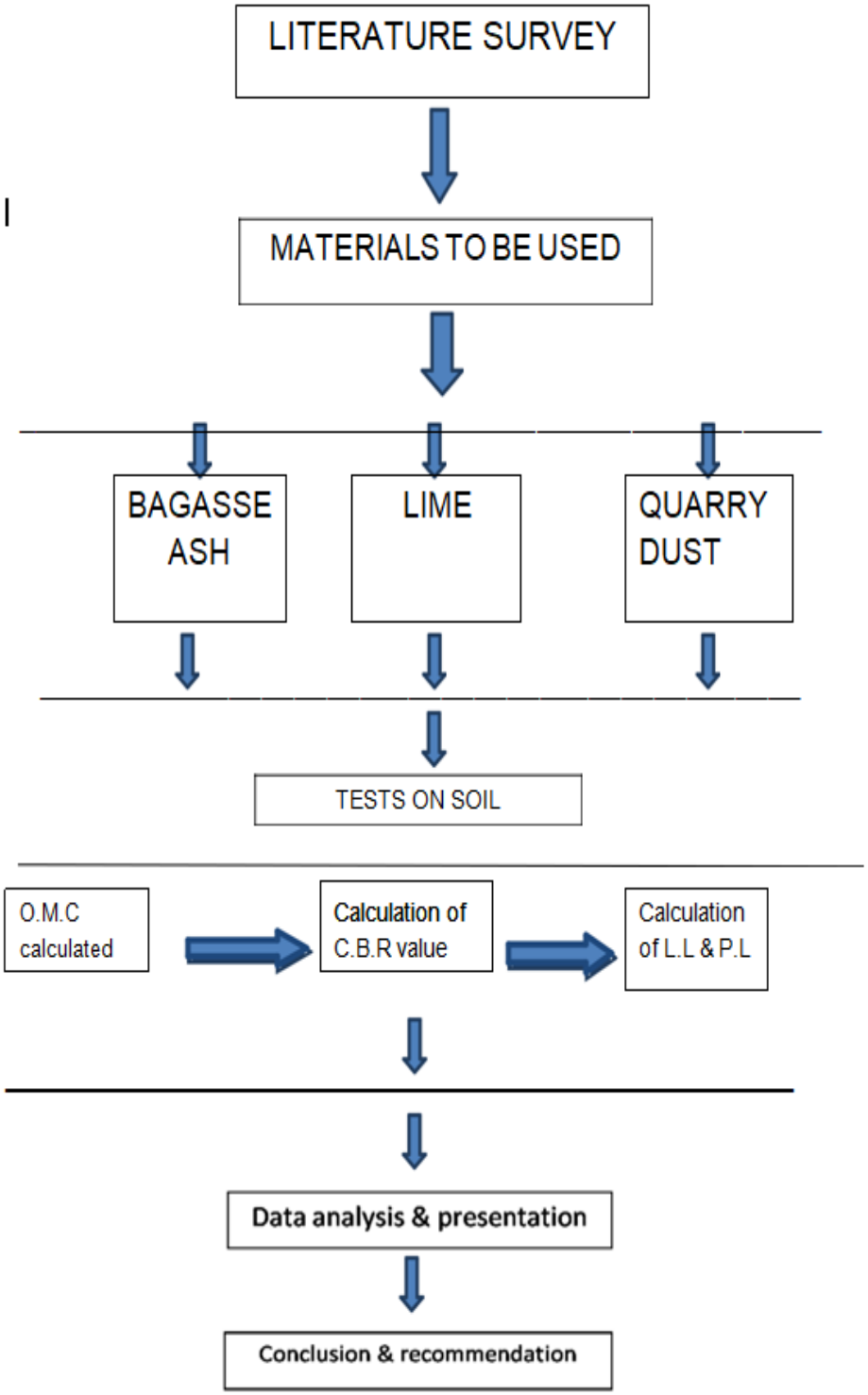

Fig.5: *Flow chart of Methodology*

Proctor Compaction Test

This experiment gives a clear relationship between the dry density of the soil and the moisture content of the soil. The experimental setup consists of (i) cylindrical metal mould (internal diameter-10.15 cm and internal height-11.7 cm), (ii) detachable base plate, (iii) collar (5 cm effective height), (iv) rammer (2.5 kg). Compaction process helps in increasing the bulk density by driving out the air from the voids.

The theory used in the test is that for any compactive attempt, the dry density depends upon the moisture content inside the soil. The maximum dry density (MDD) is done when the soil is compacted at exceedingly high moisture content and almost all of the air is driven out, this moisture content is referred to as highest quality moisture content material (OMC).After plotting the statistics from the experiment with water content because the abscissa and dry density because the ordinate, we are able to attain the OMC and MDD.

CBR Test

The laboratory CBR apparatus consists of mould 150mm diameter with a base plate and a collar, a loading frame and dial gauges for measuring the penetration values and growth soaking.The specimen within the mould is soaked in water for four days and the swelling and water absorption values are cited. The surcharge weight is located at the top of the specimen inside the mould and the assembly is underneath the positioned plunger of the loading frame.Load is applied on the sample by using a popular plunger with dia of fifty mm on the price of one.25mm.A load penetration curve drawn. The load values on standard crushed stones are 1370 kg and 2055 kg at 2.5mm and 5.0 penetrations respectively. CBR = (load carries by standard specimen)* 100

ANALYSIS AND RESULT

Table.1: *Details of Material Composition*

rial no.	Bagasse ash		Lime (%)	Quarry dust(%)
	(%)	GRAIN SIZE		
1	1	Less than 50 micron	4	1
2	2	Less than 50 micron	3	1
3	3	Less than 50 micron	2	1
4	4	Less than 50 micron	1	1
5	1	50 micron-100 micron	4	1
6	2	50 micron-100 micron	3	1
7	3	50 micron-100 micron	2	1
8	4	50 micron-100 micron	1	1
9	1	Greater than 100 micron	4	1
10	2	Greater than 100 micron	3	1
11	3	Greater than 100 micron	2	1
12	4	Greater than 100 micron	1	1

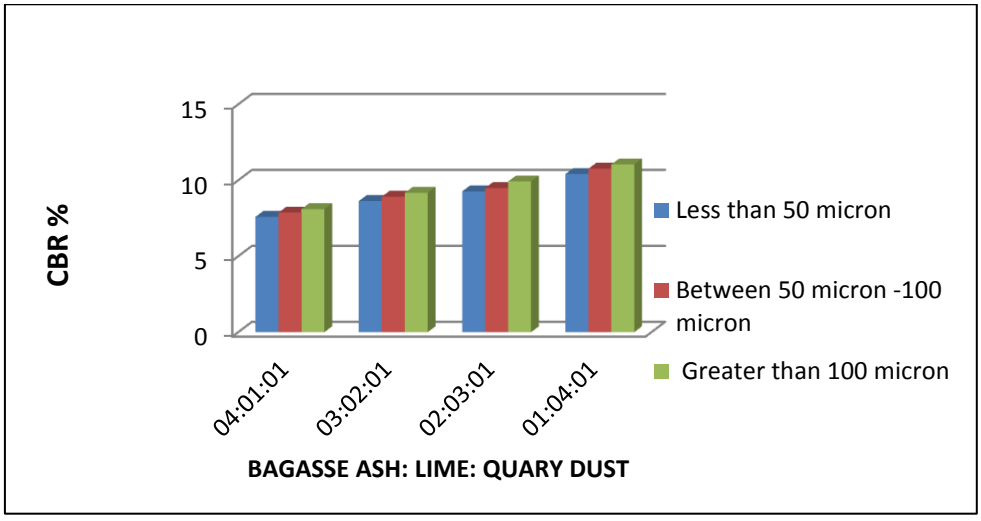

Fig.6: *CBR % Grain size of Bagasse Ash*

Table.2: *CBR test results using L*

	BAGASSE ASH: LIME: QUARY DUST			
Grain size	**04:01:01**	**03:02:01**	**02:03:01**	**01:04:01**
Less than 50 micron	7.59	8.63	9.27	10.41
Between 50 micron -100 micron	7.87	8.92	9.49	10.76
Greater than 100 micron	8.1	9.17	9.92	11.04

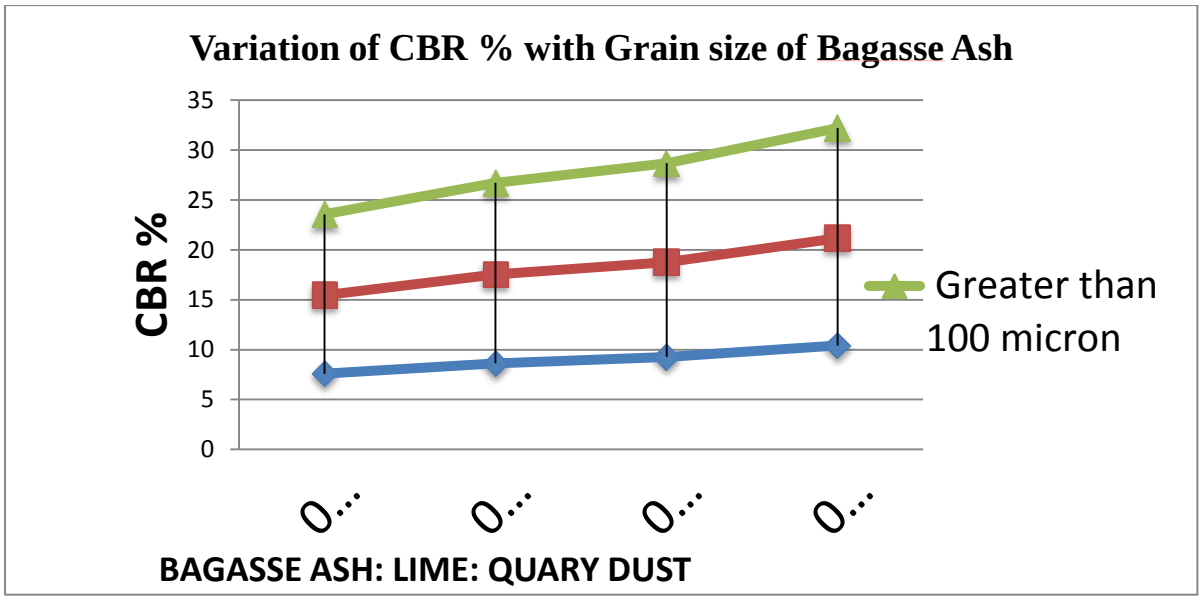

Fig.7: *Graph showing variation of CBR with grain size of bagasse ash*

CONCLUSION

The CBR test conducted for different grain sizes of Bagasse ash mixed with lime and quary dust in the proportion of 04:01:01, 03:02:01, 02:03:01 and 01:04:01. In all the result it was observe that the CBR value is maximum in the proportion of 01:04:01. It was also found that the CBR value is maximum for the grain size of Bagasse ash greater than 100 micron which is 11.04 percent. The plasticity index reduced with increased in content of bagasse ash and lime.

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