ANALYSIS OF SOIL CHARACTERISTICS USING WASTE MATERIALS

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ABSTRACT

This paper investigates the use of industrial and agricultural wastes in soil for improving its engineering behavior. Before considering engineering characteristics, it is important to know the usual nature of soil and fitting it for strong nature is the remedy for weak soil. Various behaviors like CBR, OMC and MDD, UCC , plasticity index are plotted and described which confirm their engineering characteristics. The stabilized soil after stabilization will be used as substitute for deep foundation in future works and hence the wastes are disposed in an effective manner.

INTRODUCTION:

Soil around a structure plays vital role in stability. In some consideration it is impossible to meet actual nature because of its weak characteristics. Does to meet the design standards it is possible to adopt a method called “stabilization technique”. this technique is a cost effective technique and used in modern times. This paper aims at investigative the use bagasse ash and bottom ash in soil when combined both and concluded the result.

One of the industrial byproducts is “BOTTOM ASH”. Bottom ash as an additive helps to enhance the nature of soil as this contains several chemical compounds. As said by researchers it is an inexpensive material which increase the bearing capacity of the soil when mixed with soil alone and also as an admixture.

Agricultural waste product like “BAGASSE ASH” used in this project is a disposal material obtained from cane industry. This disposal may cause series health and environmental problem and so it is taken in to consideration for stabilization technique alone with BOTTOM ASH. Bagasse ash being a pozzolanic material helps in exchanging chemical reactions.

MATERIALS USED

CLAY SOIL: The soil was picked along a soil profile at a depth of 1.5m. Appearance shows that it is grayish black in colour and enough plasticity.

BOTTOM ASH: Bottom ash is generated from the burning of coal during the production of cement clinker. Plant operations which includes the raw feed, operation type and type of fuel used decides the property of bottom ash. Bottom ash mainly consists of 58.11% of silicon-di oxide and about 21% of aluminium oxide.

BAGASSE ASH

The Bagasse is the fibrous waste produced after the extraction of the sugar juice from cane mills. Bagasse ash is the residue obtained from the incineration of bagasse in sugar producing factories. Bagasse is rich in amorphous silica indicated that it has pozzolanic properties. Collected from nearby sugar factory. some minerals compostion of bagasse ash.

METHODOLOGY

The laboratory investigations made are: determination of index properties, compaction test (1).optimum moisture content (2).maximum dry density, unconfined compression strength test ,California bearing ratio test(1)soaked (2) unsoaked.

DETAILS OF SAMPLES ARE AS FOLLOWING

SAMPLE1: Clay Soil

SAMPLE2: Clay Soil And 15% Of Bagasse Ash And 5% Of Bottom Ash

SAMPLE3: Clay Soil And 10% Of Bagasse Ash And 10% Of Bottom Ash

PROPERTIES OF MATERIALS

Bagasse ash

Mineral Composition	Bagasse ash (%)
Silica (SiO_2)	77.34
Alumina (Al_2O_3)	9.55
Iron Oxide (Fe_2O_3)	3.61
Calcium Oxide(CaO)	2.15
Manganese Oxide (MnO)	0.13
Potassium Oxide (K_2O)	3.46
Sodium Oxide (Na_2O)	0.12
Titanium Oxide (TiO_2)	0.50
Loss of Ignition(LOI)	0.42
Phosphorous (P_2O_5)	1.07
Barium Oxide (BaO)	0.16

Bottom ash

PHYSICAL PROPERTIES

PROPERTIES	BOTTOM ASH
Specific gravity	2.32
pH value	5.5
Fineness modulus	3.37
Permeability	5.76×10^{-5} cm/s

CHEMICAL PROPERTIES

COMPOUND	% OF BOTTOM ASH
SiO_2	58.11
Cao	7.64
Al_2O_3	21.01
Fe_2O_3	10.01
Mgo	1.34
Na_2O_3	0.65
K_2O	0.89
Ti_2O_5	0.35

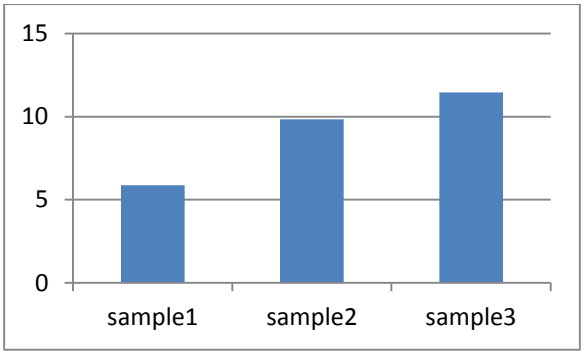
CLAY SOIL

PROPERTIES	**RESULTS**
Natural moisture content %	13.54%
Specific gravity	2.66
Sand%	24.7
Silt%	23.5
Clay	51.8
Atterberg limit soil Classification	CH
Liquid limit%	66
Plastic limit%	23
Plasticity index%	43
Compaction test:Optimum moisture content%	16
Maximum dry density	1.52
Unconfined compressive strength	0.201N/MM^2
CBR unsoaked	5.88%
CBR soaked	2.24%

TEST RESULTS

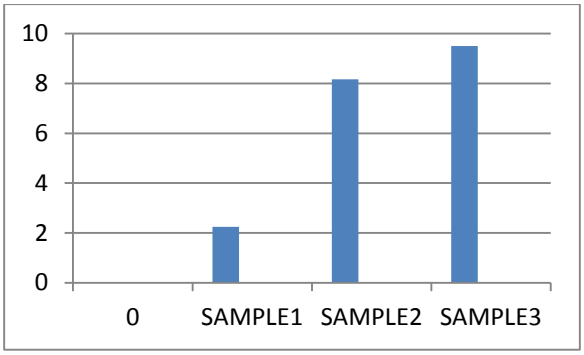
California bearing ratio test: From the compaction tests made,CBR tests were conducted on compacted specimen at optimum moisture content. CBR tests on both soaked & unsoaked are done. The increasing in CBR value for both soaked& unsoaked is due to hydration and pozzolanic rection between soil and bottom ash bagasse ash.

CBR TESTS: UNSOAKED



SOIL	**CBR UNSOAKED**
SAMPLE1	5.88
SAMPLE2	9.85
SAMPLE3	11.45

CBR SOAKED

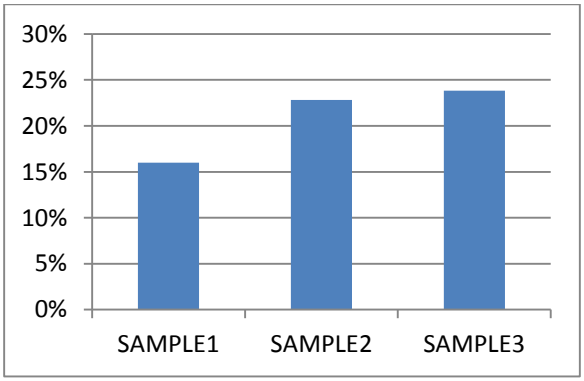


SOIL	CBR SOAKED
SAMPLE1	2.24
SAMPLE2	8.16
SAMPLE3	9.50

PROCTOR COMPACTION TEST

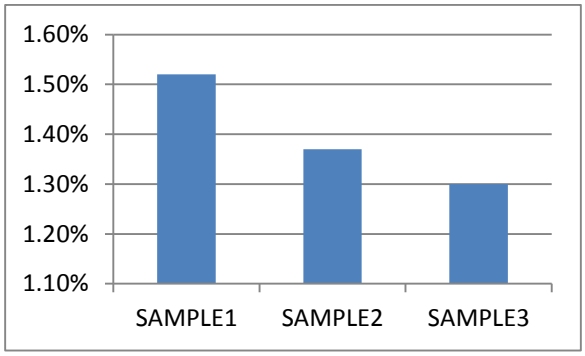
Compaction test: The air from the voids are driven out in this process. At relatively high moisture content the soil is compacted and so the air is driven out. hence MDD is achieved and this moisture content is called OMC. The increase of OMC is due to the porous nature and pozzolanic reactions of bagasse ash. The decrease of MDD is due to the varying value of specific gravity of bagasse ash and bottom ash when compared with soil.

OMC



SOIL	OMC
SAMPLE1	16%
SAMPLE2	22.82%
SAMPLE3	23.83%

MDD VALUES

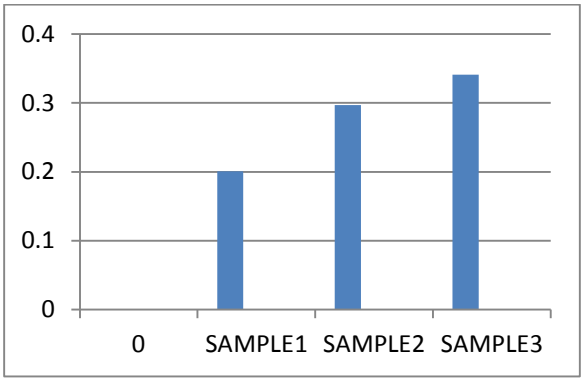


SOIL	MDD
SAMPLE1	1.52%
SAMPLE2	1.37%
SAMPLE3	1.30%

UNCONFIND COMPRESSIVE TEST

This test is used to determine shear strength of soil. The cylindrical sample in this experiment fails under vertical loading as stated by scientific researchers, the mineral consistents in bottom ash are responsible the increase in USC value.

UCC VALUES

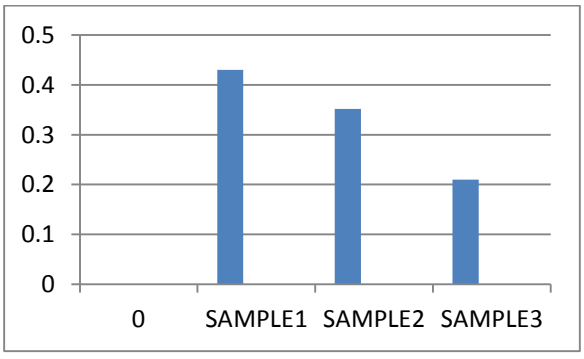


SOIL	UCC VALUES N/mm^2
SAMPLE1	0.201
SAMPLE2	0.297
SAMPLE3	0.341

PLASTICITY INDEX

INDEX PROPERTY(PLASTICITY):

Plastic limit is the crumble of soil when rolled into a thread of 3mm dia whereas liquid limit shows small shearing strength against following plasticity index is the difference between liquid limit & plastic limit.



SAMPLE	PLASTICITY INDEX
SAMPLE 1	43%
SAMPLE 2	35.2%
SAMPLE 3	21%

CONCLUSION :

1) The plasticity index got decreased under equal propostions.
2) Increase in OMC and decrease in MDD under equal propostions are the points to be noted.since increase in bagasse ash content can effectively reduce the OMC &so MDD increase.
3) The UCS test proved that there is an considerable increase in equal proportion when compared with another proportion .
4) CBR value got changed from its actual value to higher value in both in proportion. But equal proportion of advisable.
5) From the above conclusions it is noted that there is a great increase in equal proportions compared to another proportion .because increase bagase ash showed variations in strength which may lead to failure like settlement.
6) Another important point to be taken is, bagasse ash alone cannot be used an effective stabilizer. Inclusion of additives show better performance.

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